Newtown Stream and Wetland Restoration Project

Union County, North Carolina

EEP Project #94150

Contract No. 002025

MY-03 Monitoring Report-Final

Data Collected: September 2013
Submitted: November 2013

Prepared for:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
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APPENDICES

I. Executive Summary

The Newtown Stream and Wetland Restoration Site is located within the sub-basin 03-08-38 of the Catawba River Basin in Union County, North Carolina and contains Underwood Creek and one Unnamed Tributary (UT) to Underwood Creek. The restoration lengths of Underwood Creek (Main Channel) and UT to Underwood Creek (Tributary) are 1,273 and 4,075 feet, respectively, for a total project length of 5,348 feet (Figure 1). The project included restoration of 3.38 acres of riparian wetland and protection of an existing 0.15 acres of jurisdictional wetlands. The project site is owned by one property owner Mr. Frank W. Howey, Jr. The project is located within the HUC 03050103030020 (Lower Catawba Basin) of the South Atlantic-Gulf Region. NCDWQ classifies Underwood Creek (DWQ Stream Index Number 11-138-2-3-1) as class C. The 1.5 square mile watershed contributing drainage to the stream restoration segment is located in a rural setting. The land adjacent to the project streams is primarily used for agricultural practices and single family development. The floodplain is more confined in the upper reach of the project and opens up to a broad width for the majority of the project length. Vegetation typical of a Piedmont Alluvial Forest was planted throughout the conservation easement.

Project Goals:

- Improve water quality with the construction of stable stream banks and the establishment of a vegetated buffer
- Improve the stream function and habitat with the connection of the channelized and incised stream back to its floodplain
- Improve wetland hydrology with the functional uplift of the proposed channel
- Restore long-term stability with the restoration of channel pattern, profile and dimension
- Improve in-stream habitat with the installation of brush toes, root wads, constructed riffles, log vanes and rock cross vanes to enhance pool depths

Project Objectives:

- The restoration of 4,690 linear feet of Priority I, 558 feet of Priority II and 100 feet of Enhancement II in order to raise the stream bed elevation, reconnect the stream to its floodplain, restore pattern, and re-establish channel dimension on Underwood Creek and UT to Underwood Creek
- Restoration of 3.38 acres of wetlands through the functional uplift of the stream to improve wetland hydrology and the removal of depositional sediment from the wetland surface due to agricultural field soil wash
- Establish a minimum of 50 feet of riparian buffer along both sides of the entire stream length

Thirteen (13) vegetation plots were monitored using Level II of the CVS-EEP vegetation monitoring protocol (Version 4.2) which accounts for planted and natural stems. Counting only planted stems and excluding livestakes, there are 407 stems/acre. Counting both natural and planted stems, excluding live stakes, there are 859 stems/acre.

The success criterion for planted woody species is 320 stems/acre after MY-03. A mortality rate of ten percent will be allowed after MY-04 (288 stems/acre), with another ten percent allowed after MY-05 (260 stems/acre). While all the vegetation plots combined meet the criteria for total planted stems, planted stem counts for plots 4, 6, 7, 8, and 11 were below the threshold requirements of 320 stems (Table 7). Plots 4, 7, and 8 exceeded the stem density requirements when including natural stems. Volunteers observed within the plot 4 and 7 were eastern cottonwood (*Populus deltoides*) trees. The eastern cottonwood is very abundant throughout the vicinity of the stream confluence and is sporadically abundant throughout the stream buffer corridor as in the vicinity of plot 7. Volunteers observed within plot 8 include eastern silverling (*Baccharus halimifolia*) and common elderberry (*Sambucus canadensis*). Other volunteer species observed within the conservation easement were black willow (*Salix nigra*), eastern sugarberry (*Celtis laevigata*), winged sumac (*Rhus copallinum*), and slippery elm (*Ulmus rubra*). Volunteer species densities are low within plots 6 and 11. Wetland hydrology is present and the herbaceous layer is dominant within the vicinity of Plot 6. Some planting may have been smothered by the herbaceous layer resulting in the low stem density. Planted species surviving within Plot 6 are river birch (*Betula nigra*), button bush (*Cephalanthus occidentalis*), green ash (*Fraxinus pennsylvanica*), and swamp chestnut oak (*Quercus michauxii*). Plot 11 is located within an area where the herbaceous layer is relatively sparse and wetland hydrology is absent. Planted species surviving are persimmon (*Diospyros virginiana*), green ash, swamp chestnut oak, and willow oak. The vegetation problem areas consist of areas with low stem densities and invasive exotic vegetation. Low stem densities were observed in the vicinity of plots 6 and 11 and in areas of the floodplain bench where herbaceous vegetation diversity was low and sparse. Some of these areas corresponds to areas where excavation of the new stream floodplain occurred. Soil compactness and nutrient deficiency may be a factor in the survival rate of woody stems in these particular areas of low stem densities. Five species of invasive exotics were observed in the conservation easement include Tree-of-heaven (*Ailanthus altissima*), Japanese stiltgrass (*Microstegium vimineum*), Chinese privet (Ligustrum *sinense*), Johnson grass (*Sorghum halapense*), and Asian dayflower (*Murdania keisak*). Chinese privet and Johnson grass stands within the conservation easement were treated with a foliar herbicidal spray during the MY-03 period resulting in individual stems of Chinese privet exhibiting defoliation with little new growth. Johnson grass was dying in most of the areas treated. Some areas of Johnson grass along the conservation easement limits still persist. Some living individual stems of Chinese privet were observed in and around the wetland reference site and along the margins of the adjacent woodlands beyond the conservation easement limits. The tree-of-heaven stands previously noted observed along the conservation easement boundary just northeast of plot 8 were dead with some re-sprouts in the immediate vicinity. Although these invasive exotic species are given different ranks of severity, the functionality of the project is not expected to be impaired significantly. These species will continue to be observed and treated as necessary.

MY-03Vegetation Problem Areas			
VPA #	**Station Number**	**Suspected Cause**	**Proposed Remedial Action**
1	See CCPV	Chinese privet is scattered in forested areas that were present during pre-construction.	Chinese privet has been treated throughout the CE. Persistence will be monitored and treated again if deemed necessary.
2	See CCPV	Johnson grass is scattered in small patches and along the conservation easement boundary. The CCPV depicts areas where it is concentrated.	Johnson grass has been treated throughout the CE. Persistence will be monitored and treated again if deemed necessary.
3	See CCPV	Japanese stiltgrass is concentrated in an area adjacent to woodlands where it escaped.	Japanese stiltgrass persistence will be monitored and treated if deemed necessary.
5	See CCPV	Low stem densities were observed in patches throughout the conservation easement in areas where planted and natural stem densities were low.	Areas of low stem densities will be replanted in 2014

Eight Remote Data Systems (RDS) groundwater monitoring gauges are located throughout the riparian wetlands within the conservation easement. There are a total of 3.38 acres of riparian wetland restoration and 0.15 acres of wetland preservation. According to the wetland groundwater gauges on site for MY-03, Gauges 1 through 8 met wetland hydrology criteria (Table 13). During the MY-04 period an additional three ground water monitoring gauges will be installed in select wetland restoration areas near the conservation easement boundary.

The monitoring reach of Underwood Creek is stable with little change to the stream pattern and profile. There was a much larger presence of water in the channel during MY-03 compared to MY-02. The months of June and July in 2013 had higher than normal rainfall. The cross sections for MY-03 compare well to the MY-02 cross section data. Pebble counts in the riffle cross sections show coursing of particle size. Some riffles surveyed in the longitudinal profile continue to adjust however no instability of the steam profile has occurred. The rills noted in the Current Condition Plan View (CCPV) occurred shortly after construction. They are currently not showing any further degradation and vegetation has begun to grow in this area. Beaver activity is present from the confluence of the tributary approximately 200 feet upstream. A beaver dam at station 18+20 was knocked down by monitoring personnel. The dams are causing back water and the submergence of the step grade control structures near the confluence. Beaver trapping is scheduled to occur before November 28, 2013.

The monitoring reach of UT to Underwood Creek also displays little change to pattern, profile or dimension. Along this 3,000 linear monitoring reach, 97 percent of the riffles are holding grade, a 2% increase from MY-02. Flowing water was not evident in the upper portion of the reach however water was present in some of the pools from station 9+50 to 11+25. The reach has been dryer during our surveys over the past two years

which may be due to the data collection timing. The watershed will be investigated to determine if there has been an upstream impact that may be impacting the project site. No significant changes in the stream location or elevation was preformed with the restoration from station 1+00 through 8+00 that would have affected the stream hydrology. The channel from station 8+00 through 12+00 was relocated and elevated through a series of step structures. The soils will be evaluated in the relic channel location through this area in MY-04 to evaluate the post project soil hydrology. Flow will be documented in the channel next year at various times. EBX will install a minimum of two continuous flow devices prior to the start of the MY-04 growing season. There is no vegetation growing in the channel through the wooded enhancement area. Once the stream exits the wooded area and the tree canopy reduces the stream bank herbaceous vegetation is very dense. The vegetation has fallen into the channel forming mats in the channel bottom in areas. The vegetation is rooted to the bank and is easily pulled back out of the channel. Following station 11+25, water was present throughout the remainder of the stream to the confluence.

A comparison of the cross section data shows little change in geometry between MY-02 and MY-03 for all sections but section 4. Cross section 4, a pool, has narrowed. The signification amount of vegetation present at the time of monitoring may have affected the data collected. The tree adjacent to cross section 1 has fallen and the root ball is partially exposed. This tree was mentioned in MY-02 as it was leaning on an adjacent tree. The root ball is in the floodplain and therefore is not compromising the channel banks at this time. The photo below shows the root ball of the fallen tree. Bank erosion was observed in two locations as noted in the MY-02 report. Four riffles showed signs of additional degradation in this monitoring year. The locations are noted on the CCPV. The overall longitudinal profile of the stream is stable. Beaver dams were present at three locations in the area from the confluence with Underwood Creek to a distance approximately 200 feet upstream. The beaver dams were broken down by monitoring personnel. The beaver dams are causing water to pond upstream of the channel.

MY-03 Stream Problem Areas			
PA	**Station**	**Suspected Cause**	**Proposed Remedial Action**
1	See CCPV	Bank erosion	Observe in MY-04 to see if stabilizes
2	See CCPV	Point Bar Riling within the floodplain-occurred after construction	Not degrading further some vegetation has come into the area
3	See CCPV	Degradation of some riffles from the previous monitoring year	Observe in MY-04 not causing any stream instability
4	At confluence of streams – area of influence extends approximately 200 feet upstream both streams	Beaver activity – construction of beaver dams	Beaver removal

Summary information/data related to the occurrence of items such as beaver or encroachment, and statistics related to performance of various project and monitoring elements, can be found in the tables and figures in the report appendices. Narrative background and supporting information formally found in these reports can be found in the mitigation and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

II. Methodology

Methodologies follow EEP monitoring report template Version 1.3 (01/15/10) and CVS vegetation monitoring protocol Version 4.2 (Lee et al 2008). Photos were taken with a digital camera. A Trimble Geo XT handheld unit with sub-meter accuracy was used to collect groundwater gauge locations, vegetation monitoring plot origins, and problem area locations. Cross sectional and longitudinal surveys were conducted using total station survey equipment. Data was entered into AutoCAD Civil3D to obtain dimensions of the cross sections and parameters applicable to the longitudinal profile. Reports were then generated to display summaries of the stream survey.

A. Vegetation Methodologies

Level II of the EEP/CVS protocol (Version 4.2) was used to collect data for MY-03. Data collected for these plots are in Appendix C.

B. Wetland Methodologies

Seven RDS groundwater monitoring gauges (1-3; 5-8) were installed in April of 2011. Gauge 4, the wetland reference gauge, was installed in February 2010. Gauges are downloaded bi- monthly to ensure proper function throughout the growing season. Data is provided in an Excel spreadsheet along with incorporation of local rainfall data provided by the NC State Climate Office.

C. Stream Methodologies

Stream profile and cross-sections were surveyed using total station equipment and methods, and plotted using AutoCAD Civil3D. The longitudinal profile was generated using the MY-00 alignment. Cross sectional data was extracted based on a linear alignment between the end pins. Cross section bankfull elevations for yearly comparisons are based on the baseline bankfull elevation established for each cross section.

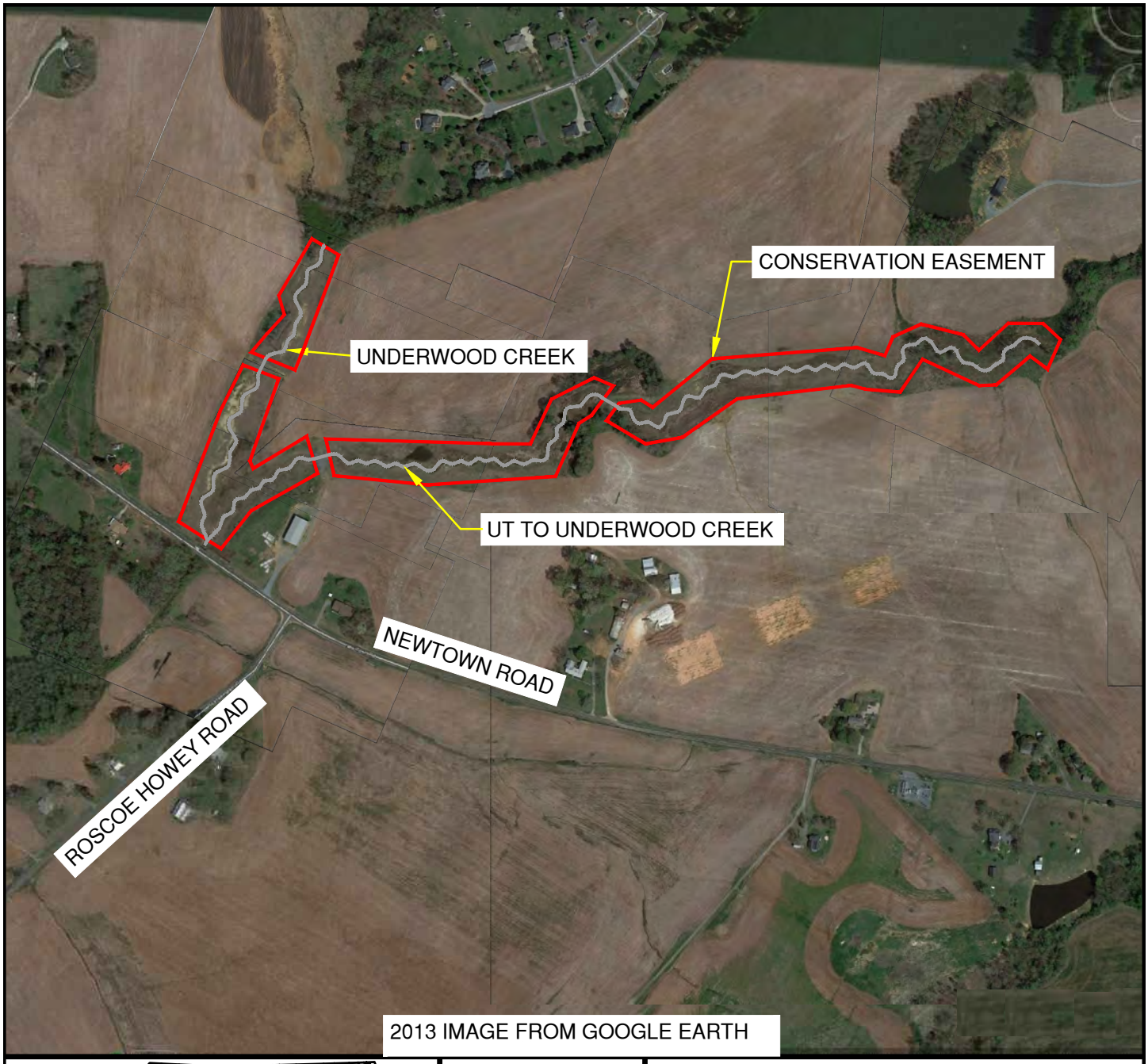
III. References

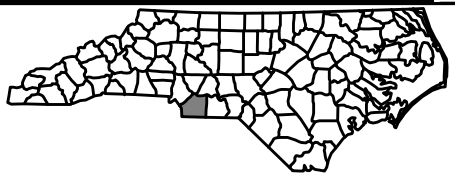
Lee, Michael T. Peet, Robert K. Roberts, Steven D., Wentworth, Thomas R. (2008). *CVS-EEP Protocol for Recording Vegetation Version 4.2.*

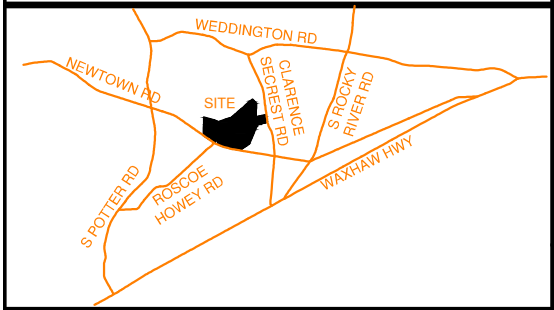
Weakley, Alan (2007). *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas*. http://www.herbarium.unc.edu/flora.htm.

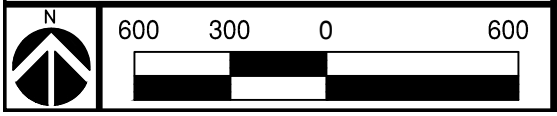
Wolman, M.G., 1954. A Method of Sampling Coarse River-Bed Material, Transactions of American Geophysical Union 35:951-956.

Appendix A. Project Vicinity Map and Background Tables









Ecosystem Enhancement PROGRAM

North Carolina - Ecosystem Enhancement Program

Newtown Stream and Wetland Restoration Site
Union County, North Carolina

FIGURE 1
NEWTOWN STREAM AND WETLAND RESTORATION AERIAL VICINITY MAP

DATE: January 7, 2014

WARD CONSULTING ENGINEERS, PC

4805 Green Road Suite 100
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Table 1. Project Components Newtown Stream and Wetland Restoration									
Project Component or Reach ID	Existing Feet/Acres	Restoration Level	Approach	Footage or Acreage	Stationing	Mitigation Ratio	Mitigation Units	BMP Elements1	Comment
Underwood Creek	520	R	P2	558	5+00 - 10+58	1:1	558		
Underwood Creek	625	R	P1	715	11+16 - 19+06	1:1	715		58 LF easement exclusion for Stream Crossing
UT to Underwood Creek	3923	R	P1	3975	2+00 - 43+07	1:1	3975		125 LF easement exclusion for two (2) Stream Crossings
UT to Underwood Creek	100	E2		100	1+00 - 2+00	2.5:1	40		
Wetland	3.38	R	-	3.38		1:1	3.38		
Wetland	0.15	P	-	0.15		1:1	0.15		Preservation

1 = BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; Grassed Swale = S; LS = Level Spreader; NI = Natural Infiltration Area, O = Other; CF = Cattle Fencing; WS = Watering System; CH = Livestock Housing

Table 1b. Component Summations Newtown - EEP# 94150							
Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	5248	3.38					
Enhancement							
Enhancement I							
Enhancement II	100						
Creation							
Preservation		0.15					
HQ Preservation							
Totals (Feet/Acres)	**5348**	**3.53**					
MU Totals	**5288**	**3.53**					
	Non-Applicable						

Table 2. Project Activity and Reporting History

Newtown Stream and Wetland Restoration

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	June 2010	June 2010
Final Design – Construction Plans	July 2010	July 2010
Construction	-	April 2011
Bare root and livestake planting	-	April 2011
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	April 2011	May 2011
Year 1 Monitoring	October 2011	December 2011
Year 2 Monitoring	November 2012	November 2012
Year 3 Monitoring	September 2013	November 2013
Year 4 Monitoring		
Year 5 Monitoring		

Bolded items are examples of those items that are not standard, but may come up and should be included. Non-bolded items represent events that are standard components over the course of a typical project.

Table 3. Project Contacts Table Newtown Stream and Wetland Restoration	
Designer Primary project design POC	Ward Consulting Engineers, P.C. 4805 Green Road, Suite 100 Raleigh, NC 27616 Becky Ward 919-870-0526
Construction Contractor Construction contractor POC	RFG Construction 1907 Cambridge Dr Kinston, NC 28504 Robert Grady 252-559-6954
Survey Contractor Survey contractor POC	R.B. Pharr & Associates 420 Hawthorne Ln Charlotte, NC 28204 Justin Cloninger 704-376-2186
Planting Contractor Planting contractor POC	New Forest Services P.O. Box 255 Manistee, MI 49660 Brian Jarvinen 910-512-6754
Seeding Contractor Contractor point of contact	RFG Construction 1907 Cambridge Dr Kinston, NC 28504 Robert Grady 252-559-6954
Seed Mix Sources	Evergreen Seed - Fuquay Varina, NC 919-567-1333
Nursery Stock Suppliers	Arbor Gen - Blenheim, SC - South Carolina SuperTree Nursery 800-222-1290
Monitoring Performers	Ward Consulting Engineers, P.C. 4805 Green Road, Suite 100 Raleigh, NC 27616
Stream Monitoring POC	Becky Ward 919-870-0526
Vegetation Monitoring POC	Chris Sheats - The Catena Group - 919-732-1300
Wetland Monitoring POC	Chris Sheats - The Catena Group - 919-732-1300

Table 4. Project Attribute Table Newtown Stream and Wetland Restoration		
Project County	Union	
Physiographic Region	Piedmont	
Ecoregion	Carolina Slate Belt	
Project River Basin	Catawba River Basin	
USGS HUC for Project (14 digit)	3050103030020	
NCDWQ Sub-basin for Project	03-08-38	
Within extent of EEP Watershed Plan?	No	
WRC Hab Class (Warm, Cool, Cold)	-	
% of project easement fenced or demarcated	100%	
Beaver activity observed during design phase?	No	
Restoration Component Attribute Table		
	Underwood Creek	**UT to Underwood Creek**
Drainage area	0.72 sq mi	0.74 sq mi
Stream order	-	-
Restored length (feet)	1273	3975
Perennial or Intermittent	Perennial	Perennial
Watershed type (Rural, Urban, Developing etc.)	Rural	Rural
Watershed LULC Distribution (e.g.)		
Residential	14%	
Ag-Row Crop	66%	
Ag-Livestock	-	
Forested	20%	
Etc.	-	
Watershed impervious cover (%)	-	
NCDWQ AU/Index number	11-138-2-3-1	N/A
NCDWQ classification	C	N/A
303d listed?	N	N
Upstream of a 303d listed segment?	N	N
Reasons for 303d listing or stressor	N/A	N/A
Total acreage of easement	16.43 Ac	
Total vegetated acreage within the easement	0.17 Ac	0.53 Ac
Total planted acreage as part of the restoration	14.3 Ac	
Rosgen classification of pre-existing	incised C4/E4	incised C4/E4 w/sections of G4
Rosgen classification of As-built	C4	C4
Valley type		
Valley slope	0.64%	0.63%
Valley side slope range (e.g. 2-3.%)	-	-
Valley toe slope range (e.g. 2-3.%)	-	-
Cowardin classification	-	-
Trout waters designation	N	N
Species of concern, endangered etc.? (Y/N)	N	N
Dominant soil series and characteristics		
Series	Chewacla	Chewacla
Depth	-	-
Clay%	-	-
K	-	-
T	-	-

Use N/A for items that may not apply. Use "-" for items that are unavailable and "U" for items that are unknown

Appendix B. Visual Assessment Data

Vegetation Plot Origins		
Plot Name	Northing	Easting
VP 1	448672.01	1507128.22
VP 2	448460.02	1506909.61
VP 3	448157.84	1506800.79
VP 4	447966.78	1506832.95
VP 5	448153.74	1507081.53
VP 6	448228.13	1507543.37
VP 7	448179.64	1507841.68
VP 8	448266.41	1508086.78
VP 9	448359.76	1508550.13
VP 10	448446.72	1508742.00
VP 11	448583.68	1508973.48
VP 12	448521.15	1509214.17
VP 13	448603.80	1509481.71

Cross Sections Underwood Creek				
	Left Pin		Right Pin	
	Northing	Easting	Northing	Easting
XS 1	448791.94	1507187.43	448790.30	1507136.44
XS 2	448657.90	1507124.68	448677.45	1507078.39
XS 3	448366.02	1506907.39	448404.06	1506885.52
XS 4	448140.89	1506841.37	448163.68	1506800.24
XS 5	448053.24	1506800.42	448089.27	1506775.75

Cross Sections UT to Underwood Creek				
	Left Pin		Right Pin	
	Northing	Easting	Northing	Easting
XS 1	448628.47	1509726.46	448682.84	1509702.58
XS 2	448532.49	1509448.30	448573.02	1509463.20
XS 3	448538.35	1509071.04	448597.67	1509099.72
XS 4	448538.71	1508911.29	448578.60	1508914.82
XS 5	448367.87	1508633.33	448431.03	1508619.55
XS 6	448264.34	1508171.97	448307.14	1508136.96
XS 7	448182.29	1508003.67	448221.68	1507995.64
XS 8	448177.18	1507786.94	448232.42	1507767.15
XS 9	448179.84	1507395.62	448237.37	1507413.75
XS 10	448103.36	1507024.96	448125.71	1506988.19

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch = 200 ft.

2013 Aerial from Google Earth

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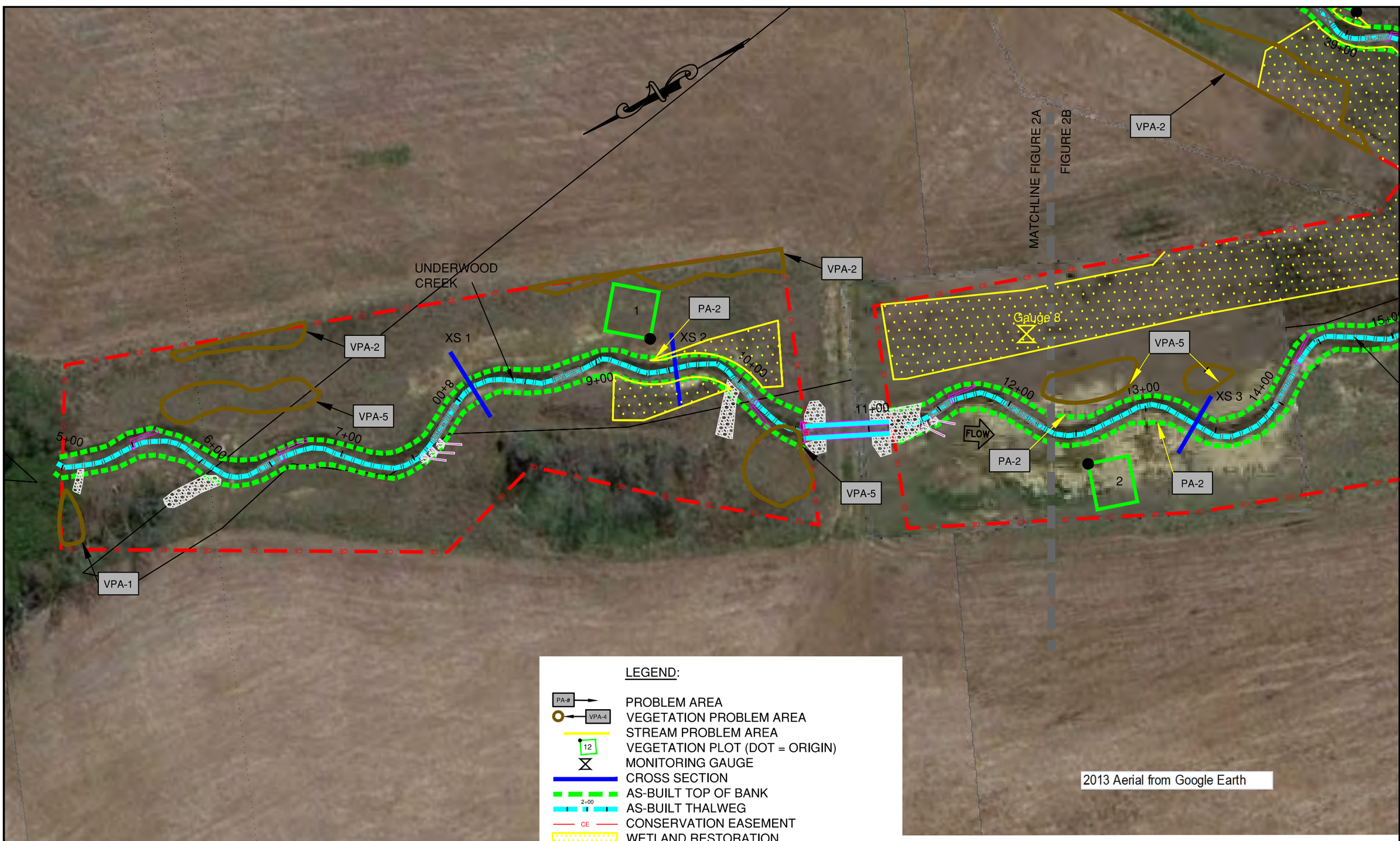
Ecosystem Enhancement Program

NEWTOWN EEP# 94150
OVERALL CURRENT CONDITIONS PLAN VIEW
UNION COUNTY, NORTH CAROLINA

DATE: 7 January 2014
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: CCPV
SCALE: 1" = 200
CURRENT CONDITIONS PLAN VIEW
SHEET NO.
FIGURE 2



LEGEND:

- PA-# — PROBLEM AREA
- VPA-4 — VEGETATION PROBLEM AREA
- STREAM PROBLEM AREA
- 12 — VEGETATION PLOT (DOT = ORIGIN)
- MONITORING GAUGE
- CROSS SECTION
- AS-BUILT TOP OF BANK
- 2+00 — AS-BUILT THALWEG
- CE — CONSERVATION EASEMENT
- WETLAND RESTORATION
- EXISTING WETLAND
- AS-BUILT STRUCTURE
- AS-BUILT CONSTRUCTED RIFFLE
- AS-BUILT GRADE TRANSITION STRUCTURE
- ROOT WADS
- ROCK TOE
- BRUSH TOE
- RIP RAP PROTECTION

GRAPHIC SCALE

60 0 30 60 120 180

(IN FEET)
1 inch = 60 ft.

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Ecosystem Enhancement PROGRAM

NEWTOWN
UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 7 January 2014

REVISIONS:

PROJECT NAME: EBX NEWTOWN

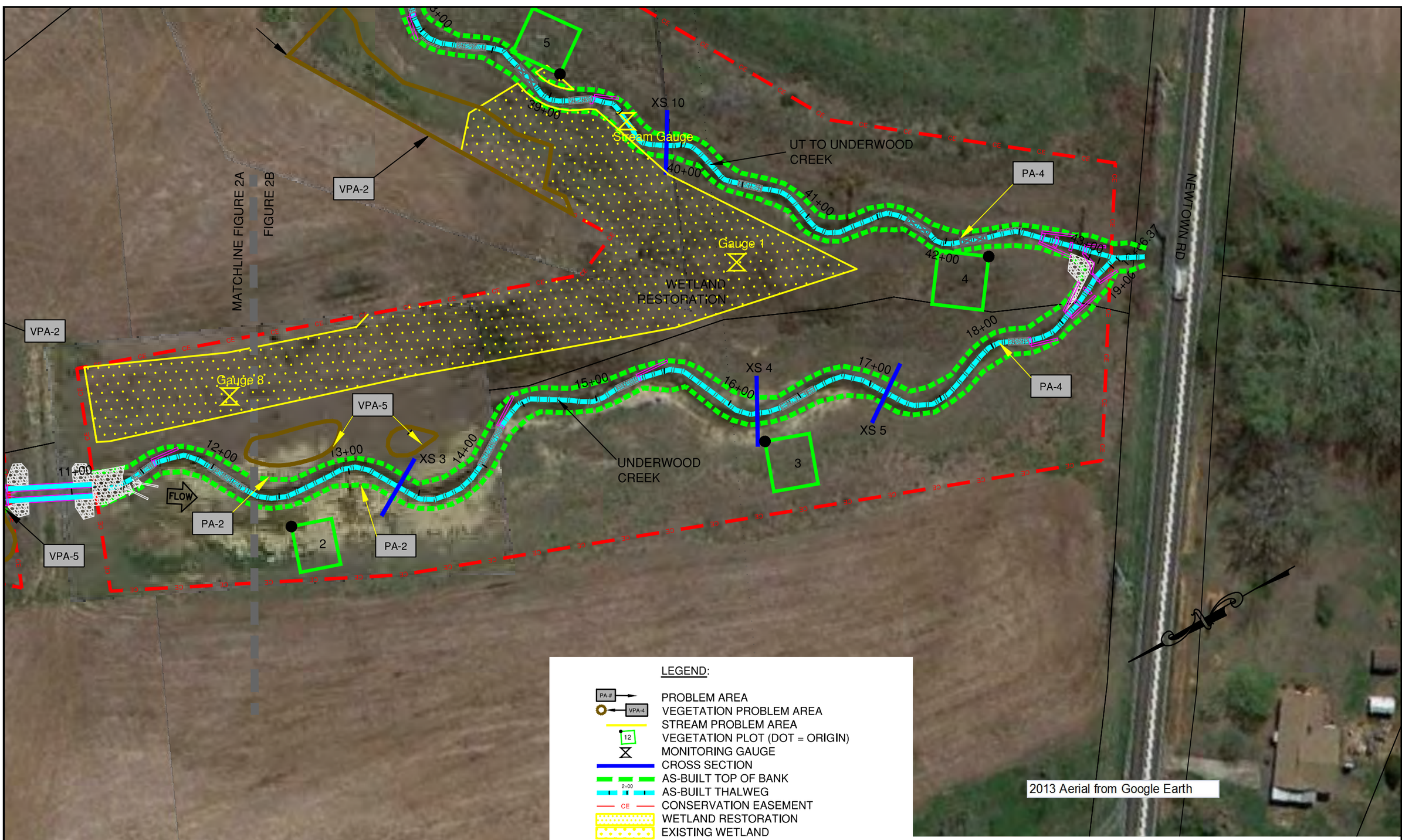
DWG NAME: CCPV

SCALE: 1" = 60'

CURRENT CONDITIONS PLAN VIEW

SHEET NO.

FIGURE 2A



LEGEND:

- PA-# — PROBLEM AREA
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- AS-BUILT CONSTRUCTED RIFFLE
- AS-BUILT GRADE TRANSITION STRUCTURE
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- ROCK TOE
- BRUSH TOE
- RIP RAP PROTECTION

2013 Aerial from Google Earth

GRAPHIC SCALE

60 0 30 60 120 180

(IN FEET)
1 inch = 60 ft.

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Ecosystem Enhancement PROGRAM

NEWTOWN
UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 7 January 2014

REVISIONS:

PROJECT NAME: EBX NEWTOWN

DWG NAME: CCPV

SCALE: 1" = 60'

CURRENT CONDITIONS PLAN VIEW

SHEET NO.

FIGURE 2B

LEGEND:

- PA-# — PROBLEM AREA
- VPA-4 — VEGETATION PROBLEM AREA
- STREAM PROBLEM AREA
- 12 — VEGETATION PLOT (DOT = ORIGIN)
- MONITORING GAUGE
- CROSS SECTION
- AS-BUILT TOP OF BANK
- 2+00 — AS-BUILT THALWEG
- CE — CONSERVATION EASEMENT
- WETLAND RESTORATION
- EXISTING WETLAND
- AS-BUILT STRUCTURE
- AS-BUILT CONSTRUCTED RIFFLE
- AS-BUILT GRADE TRANSITION STRUCTURE
- ROOT WADS
- ROCK TOE
- BRUSH TOE
- RIP RAP PROTECTION

VPA-2
VPA-5
UT TO UNDERWOOD CREEK
WETLAND RESTORATION
XS 1
XS 2
13
Gauge 5
MATCHLINE FIGURE 2C
FIGURE 2D
0+47.52
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00

2013 Aerial from Google Earth

GRAPHIC SCALE

60 0 30 60 120 180

(IN FEET)
1 inch = 60 ft.

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Ecosystem Enhancement PROGRAM

NEWTOWN
UT to UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 7 January 2014
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: CCPV
SCALE: 1" = 60'

CURRENT CONDITIONS PLAN VIEW

SHEET NO.
FIGURE 2C

LEGEND:

PA-# PROBLEM AREA
VPA-4 VEGETATION PROBLEM AREA
STREAM PROBLEM AREA
12 VEGETATION PLOT (DOT = ORIGIN)
MONITORING GAUGE
CROSS SECTION
AS-BUILT TOP OF BANK
2+00 AS-BUILT THALWEG
CE CONSERVATION EASEMENT
WETLAND RESTORATION
EXISTING WETLAND
AS-BUILT STRUCTURE
AS-BUILT CONSTRUCTED RIFFLE
AS-BUILT GRADE TRANSITION STRUCTURE
ROOT WADS
ROCK TOE
BRUSH TOE
RIP RAP PROTECTION

MATCHLINE FIGURE 2C
FIGURE 2D
MATCHLINE FIGURE 2D
FIGURE 2E
PA-3
PA-1
VPA-5
VPA-4
Gauge 7
Gauge 6
XS 5
XS 4
XS 3
UT TO UNDERWOOD CREEK
WETLAND RESTORATION
WETLAND RESTORATION
WETLAND RESTORATION
9
10
11
12
13+00
14+00
15+00
16+00
17+00
18+00
19+00
20+00
21+00
22+00
23+00
2013 Aerial from Google Earth

GRAPHIC SCALE
60 0 30 60 120 180
(IN FEET)
1 inch = 60 ft.

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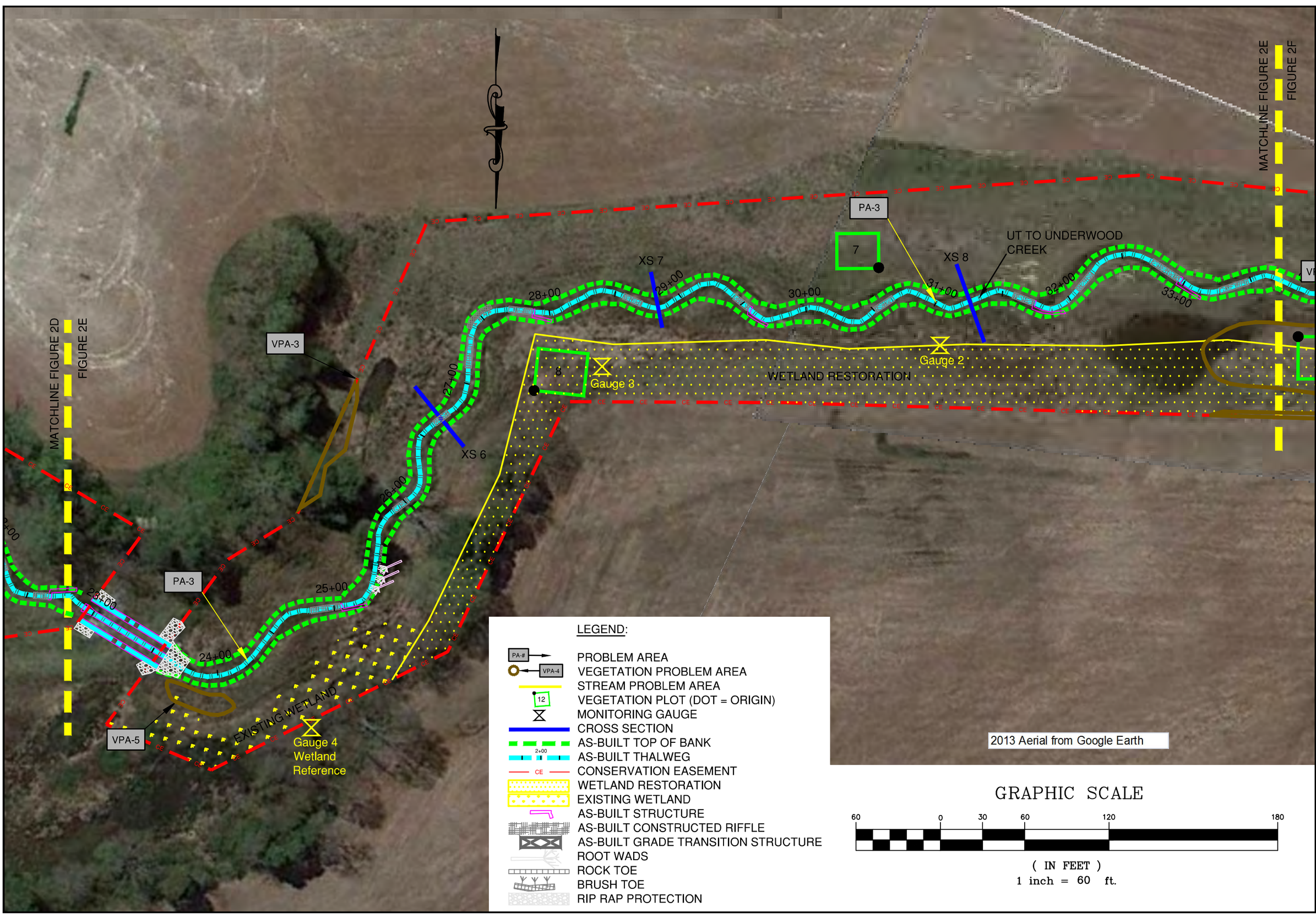
CURRENT CONDITIONS PLAN VIEW

SHEET NO.
FIGURE 2D



LEGEND:

- PA-# / VPA-4 — PROBLEM AREA
- VEGETATION PROBLEM AREA
- STREAM PROBLEM AREA
- 12 — VEGETATION PLOT (DOT = ORIGIN)
- MONITORING GAUGE
- CROSS SECTION
- AS-BUILT TOP OF BANK
- 2+00 — AS-BUILT THALWEG
- CE — CONSERVATION EASEMENT
- WETLAND RESTORATION
- EXISTING WETLAND
- AS-BUILT STRUCTURE
- AS-BUILT CONSTRUCTED RIFFLE
- AS-BUILT GRADE TRANSITION STRUCTURE
- ROOT WADS
- ROCK TOE
- BRUSH TOE
- RIP RAP PROTECTION

GRAPHIC SCALE

60 0 30 60 120 180

(IN FEET)
1 inch = 60 ft.

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UNION COUNTY, NORTH CAROLINA

DATE: 7 January 2014
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: CCPV
SCALE: 1" = 60'

CURRENT CONDITIONS PLAN VIEW

SHEET NO.
FIGURE 2E

LEGEND:

- PA-# / VPA-4 — PROBLEM AREA / VEGETATION PROBLEM AREA
- STREAM PROBLEM AREA
- 12 — VEGETATION PLOT (DOT = ORIGIN)
- MONITORING GAUGE
- CROSS SECTION
- AS-BUILT TOP OF BANK
- 2+00 — AS-BUILT THALWEG
- CE — CONSERVATION EASEMENT
- WETLAND RESTORATION
- EXISTING WETLAND
- AS-BUILT STRUCTURE
- AS-BUILT CONSTRUCTED RIFFLE
- AS-BUILT GRADE TRANSITION STRUCTURE
- ROOT WADS
- ROCK TOE
- BRUSH TOE
- RIP RAP PROTECTION

MATCHLINE FIGURE 2E

FIGURE 2F

NEWTOWN RD

PA-4

PA-4

VPA-2

VPA-5

VPA-5

VPA-2

PA-2

XS 10

XS 9

XS 5

XS 4

Gauge 1

Stream Gauge

Rain Gauge

Gauge 8

UT TO UNDERWOOD CREEK

UNDERWOOD CREEK

WETLAND RESTORATION

WETLAND RESTORATION

43+00

42+00

41+00

40+00

39+00

38+00

37+00

36+00

35+00

18+00

17+00

16+00

15+00

14+00

13+00

1

3

4

5

6

GRAPHIC SCALE

60 0 30 60 120 180

(IN FEET)

1 inch = 60 ft.

2013 Aerial from Google Earth

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Ecosystem Enhancement PROGRAM

NEWTOWN
UT to UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 7 January 2014

REVISIONS:

PROJECT NAME: EBX NEWTOWN

DWG NAME: CCPV

SCALE: 1" = 60'

CURRENT CONDITIONS PLAN VIEW

SHEET NO.

FIGURE 2F

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **Underwood Creek**
Assessed Length **1273**

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		100%			
		2. Degradation - Evidence of downcutting			0		100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	18	22			82%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	24	24			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	24	24			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	22	22			100%			
		2. Thalweg centering at downstream of meander (Glide)	22	22			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0		100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0		100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0		100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	6	6			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%. (See guidance for this table in EEP monitoring guidance document)	6	6			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%			

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **UT to Underwood Creek**
Assessed Length **3000**

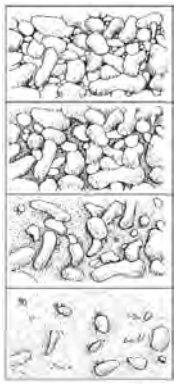
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing 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			4	80	97%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	44	65			68%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	65	65			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	65	65			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	65	65			100%			
		2. Thalweg centering at downstream of meander (Glide)	60	63			95%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	19	19			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	18	18			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	18	18			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	17	17			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	16	16			100%			

Criteria, Definitions and Thresholds for Visual Stream Morphology Assessments

Major Channel Category	Channel Sub-Category	Metric	Definitions	Cataloging Threshold	CCPV Depiction
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)	"Aggradation refers to at least moderate increases in reach stored sediment. It is NOT simply constituted by minor fining of riffles or filling of pools at or below baseflow elevations. An aggrading reach is often characterized by sand or gravel bar formation/growth with associated fining of reach substrate and smoothing of the reach long profile. Bars/aggraded areas significant enough to deflect flow against banks should be catalogued. Repeat channel photopoints are a key tool in assessing project aggradation. (See photo exhibit 1 below for range of example bar development/aggradation)	Catalog only if feature has most of the characteristics described to the left (cell E11) and is at least 15 feet in length or 20% of the riffle/run length, whichever is less.	NA
		2. Degradation - Number and size of evident downcuts within Riffle/Run units.	Where projects have regularly-spaced engineered grade control, degredation/downcutting is expected only in short, discreet lengths. "Indicators include perched sill structures, channel bed "steps" in clay-rich parent material, evidence of bed retreat at the bank toe (parent material may be exposed); mobilization of coarse riffle substrate in to pools downstream, and perhaps riffles with run morphology. Long-profile surveys should support an assessment of bed degradation where the visual assessment and survey overlap.	Catalog only if feature has most of the characteristics described to the left (cell E12) and is at least 15 feet in length or 20% of the riffle/run length, whichever is less.	Dark Red or Purple Color to be certain to distinguish from Mass Wasting Color Code
	2. Riffle Condition	1. Texture	Riffles should maintain a coarseness similar to the design distribution. Significant fining of the riffle surface indicates non-attainment for the riffle. Repeat pebble counts should support an assessment of riffle fining where overlap occurs (see exhibit graphic 2 below describing embedding for gravel-cobble systems).	NA	NA
	3. **Meander Pool Condition**	1. Depth Sufficient?	This metric is used to assess meander pools and also step-pools along a Rosgen B-type channel reaches. For stepped reaches the pools will be evaluated and tallied here and under the Habitat Sub-Category below. The max pool bankfull depth should be 1.6 times the mean bankfull depth (Max Pool Depth : Mean Bankfull Depth > 1.6). The mean bankfull depth from the As-built/baseline survey can be utilized to make this determination. Exhibit 3 provides residual pool depths using the 1.6 multiplier for a range of mean channel riffle depths that typify restoration projects.	NA	NA
		2. Length appropriate?	This metric will only be applied to meander pools. The meander pool length should be >30% of the ~ linear centerline distance between the tail of the upstream riffle and the head of the downstream rifle.	NA	NA
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)?	This metric is used to characterize flow paths along riffle-run-pool transitions. The thalweg is expected to be against the outer bank in the bend apex, but vectors oriented towards the outer bank too far above the bend apex may indicate the potential for increased bank erosion. Similarly, the pool-glide-riffle transition is also expected to demonstrate flow path centering (Metric 4.2 below). The current-year thalweg rendered on the CCPV figure can assist in this assessment.	NA	NA
		2. Thalweg centering at downstream of meander bend (Glide)?	See Metric 4.1 above	NA	NA
2. Bank	**1. Scoured/Eroding Bank**	In order to better assess continued bank erosion risk, tallied bank segments are also characterized with respect to the proximity and integrated extent of stabilizing vegetation. Continued erosion risk for a given bank instability object is essentially adjusted downwards by adjacent mature vegetation and/or stabilizing roots. One or more mature trees in close proximity (e.g. 10 feet or less) or obvious integration of root mass within the bank failure are characteristics that would prompt the tallying of a given bank object into the additional sub-category related to risk of further instability (columns J-L of the actual data table). Essentially, the vegetative elements of rooting density and depth (e.g. from a BEHI assessment) need to be considered here.	Banks with evident scour /erosion	<table><tr><th>Bank Height</th><th>Minimum Length</th></tr><tr><td>>6</td><td>6</td></tr><tr><td>3-6</td><td>8</td></tr><tr><td><3</td><td>10</td></tr></table> See Footnote/Exhibit 5 below also This table provides a guide for working thresholds for bank erosion cataloging/mapping based on bank height. For the bank height ranges above, the minimum length of bank to be mapped and tallied is specified. For example, where banks are <3 feet high, only map an unstable segment if it is ≥ 10 feet.[5]	Yellow.
	2. Undercut		Banks undercut/overhanging to the extent that mass wasting appears likely? Does NOT include undercuts that modest, appear sustainable/stable and are providing habitat.		Orange.
	3. Mass Wasting		Bank slumping/calving/collapse?		Red.
3. Structures	**1. Overall Integrity**	The assessment of engineered structure performance should include all structures that provide grade control, bank protection, or habitat functions. These include Vanes, J-hooks, and rootwads, etc.	Bulk of structure physically intact with no dislodged boulders or logs?		Using callouts or some other means to maintain legibility, annotate structure with red **"S"** if structural failure has occurred
	2. Grade Control		Bed grade control maintained across the sill structure? No evident loss of bed elevation immediately upstream of structure? Some piping alone will not constitute a loss of grade control.		Using callouts or some other means to maintain legibility, annotate structure with red **"G"** if structure has lost grade control
	2a. Piping		Catalog structures lacking any substantial flow underneath sills or around arms?		Using callouts or some other means to maintain legibility, annotate structure with red **"P"** if significant piping has occurred
	3. Bank Protection		See exhibit 4 below for determining structural sphere of influence. If the amount of bank that is deemed to be actively eroding within the structures sphere of influence exceeds 15% of the total bank footage within the structures sphere of influence, then the structure should be classified as not providing adequate bank protection in the data table.		Using callouts or some other means to maintain legibility, annotate structure with red **"B"** if structure has failed to provide bank protection
	4. Habitat		Are pools maintained @ ~ Max Pool Depth : Mean Bankfull Depth > 1.6? For rootwads, habitat provision means interacting with baseflow and providing cover.		Using callouts or some other means to maintain legibility, annotate structure with red **"H"** if structure is not providing habitat

Exhibit 1. Examples of bar features warranting concerning related to cataloging item 1.1.1 of the assessment

Exhibit 2. Graphic depicting embedding of riffles with fine material



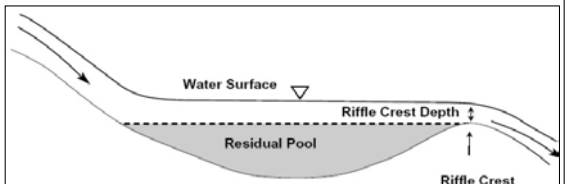
Progressing from top to bottom, the series of graphics to the left depicts the fining of interstial spaces between coarser particles. This describes increasing levels of embededness in riffles. The observer must have an understanding of the intended substrate distributions/texture of the bed for the projects riffles when assessing this. However, as a guideline for streams in the coarse gravel to cobble range, the 2nd panel from the top represents a visual guideline for the condition that would begin to elicit concern for this parameter, but still contains a good deal of coarse material. Progressing from that state to the conditions depicted in the the 3rd and 4th panel represents a visual que for significant emdedding.

From USEPA (EPA 841-B-97-003 - Nov 1997)

Exhibit 3. Residual Pool Depth Table - Relating 1.6 criterion for typical mean riffle depths to residual pool depths

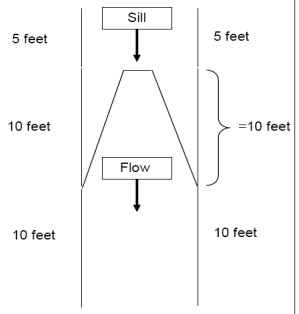
This residual pool table was provided in the event the tracking of bankfull at each pool feature to estimate a Dmax was inconvenient. Estimating the residual pool depth by measuring the max pool depth to water surface and subtracting the water depth at the riffle head may provide a more convenient way under certain circumstances to estimate in the field. For this reason the exhibit table provides a relationship between the 1.6 criterion applied to mean riffle depth for the site and the resulting residual pool depths.

Mean Riffle Depth D_{bkf}	Multiplier	Target Bankfull Pool Max	Residual Pool Depth
1.0	1.6	1.6	0.6
1.5	1.6	2.4	0.9
2.0	1.6	3.2	1.2
2.5	1.6	4.0	1.5
3.0	1.6	4.8	1.8
3.5	1.6	5.6	2.1
4.0	1.6	6.4	2.4
4.5	1.6	7.2	2.7
5.0	1.6	8.0	3.0



From: Hilton and Lisle, 1993

Exhibit 4. Extent of Structural Influence for Bank Protection



The drawing is a guideline for the extent of influence vane arms exert on stream banks. The bracketed segment (10ft) immediately adjacent to the vane arm is multiplied by 5 to determine the total length of bank influenced by a cross vane. This includes the bank length adjacent to each vane arm, 1 length (10 feet) below each van arm, and ½ length (5 feet) on each bank above the uppermost structural element (in this case the vane sill), yielding 50 feet in this example case. In this example a single arm vane or j-hook would only influence 25ft of bank.

If the amount of recent bank erosion observed within the extent of influence exceeds 15% then the structure is deemed not to be providing adequate bank protection. In the above examples this would amount to ~ 8 and 4 feet, respectively.

If in an earlier assessment the structure failed the 15% bank protection criteria but the erosion has subsequently stabilized, then the observer can use best professional judgment to determine if the structure is currently meeting the bank protection criteria.

5 = The above was developed because of the need to have a threshold given the large number of performers and to avoid spending time trying to catalog and map small objects that if excluded would have minimal overall impacts on the performance percentages. It is a guide that tries to strike a balance between the obvious need to have a threshold, yet provide confidence that the site conditions are accurately represented. For example, a scenario where 1 object nearly exceeding the threshold were to occur every 100 feet of bank height (which would be a high frequency and unlikely) with a bank height of 5 feet, would yield an error of ~3%. However, if the observer is encountering a truly high number of objects just below the threshold in the above table (e.g. > 1 per 100 feet of bank channel on average) and is concerned that the exclsuion of such objects is going to misrepresent the site conditions, then judgement should be applied and objects below the threshold may be cataloged. If a rare condition as described does occur and the thresholds are not utilized then a table footnote explaining this should be included.

Lastly, given the increase in overall area and the implications to stability, greater banks heights required smaller threshold minimums.

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **14.3**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	10	0.54	3.8%
			Total	10	0.54	3.8%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	10	0.54	3.8%

Easement Acreage[2] **16.43**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	100 SF	Brown Line	13	0.33	2.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Brown Line	0	0.00	0.0%

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

2 = The acreage within the easement boundaries.

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

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

High Concern:				Low/Moderate Concern:	
Vines	**Genus/Species**	**Shrubs/Herbs**	**Genus/Species**	**Shrubs/Herbs**	**Genus/Species**
Kudzu	*Pueraria lobata*	Japanese Knotweed	Polygonum cuspidatum	Japanese Privet	Ligustrum Japonicum
Porcelain Berry	Ampelopsis brevipeduncul	Oriental Bittersweet	Celastrus orbiculatus	Glossy Privet	Ligustrum lucidum
Japanese Honeysuckle	Lonicera japonica	Multiflora Rose	Rosa multiflora	Fescue	Festuca spp.
Japanese Hops	Humulus japonicus	Russian olive	Elaeagnus angustifolia	English Ivy	Hedera helix
Wisterias	Wisteria spp.	Chinese Privet	Ligustrum sinense	Microstegium	Microstegium vimineum
Winter Creeper	Euonymus fortunei	Chinese Silvergrass	Miscanthus sinensis	Burning Bush	Euonymus alatus
Bush Killer (Watch List)	Cayratia japonica	Phragmites	Phragmites australis	Johnson Grass	Sorghum halepense
		Bamboos	Phyllostachys spp	Bush Honeysuckles	Lonicera, spp.
Trees		Sericea Lespedeza	Sericea Lespedeza	Periwinkles	Vinca minor
Tree of Heaven	Ailanthus altissima	Garlic Mustard (Watch List)	Alliaria petiolata	Morning Glories	Morning Glories
Mimosa	Albizia julibrissin	Cogon Grass (Watch List)	Imperata cylindrica	Bicolor Lespedeza (Watch List)	Lespedeza bicolor
Princess Tree	Paulownia tomentosa	Giant Reed (Watch List)	Arundo donax	Chinese Yams (Watch List)	Dioscorea oppositifolia
China Berry	Melia azedarach	Tropical Soda Apple (Watch List)	Solanum viarum	Air Potato (Watch List)	Dioscorea bulbifera
Callery Pear	Pyrus calleryana	Japanese Spirea (Watch List)	Spiraea japonica	Japanese Climbing Fern (Watch List)	Lygodium japonicum
White Mulberry	Morus alba	Japanese Barberry (Watch List)	Berberis thunbergii		
Tallow Tree (Watch List)	Triadica sebifera				

Stream Station Photos

Photo 1. Looking downstream at Underwood Creek XS-1

Photo 2. Looking downstream at Underwood Creek XS-2

Photo 3. Looking downstream at Underwood Creek XS-3

Photo 4. Looking downstream at Underwood Creek XS-4

Photo 5. Looking downstream at Underwood Creek XS-5


Photo 6. Looking downstream at UT to Underwood Creek XS-1

Photo 7. Looking downstream at UT to Underwood Creek XS-2

Photo 8. Looking downstream at UT to Underwood Creek XS-3

Photo 9. Looking downstream at UT to Underwood Creek XS-4

Photo 10. Looking downstream at UT to Underwood Creek XS-5

Photo 11. Looking downstream at UT to Underwood Creek XS-6

Photo 12. Looking downstream at UT to Underwood Creek XS-7

Photo 13. Looking downstream at UT to Underwood Creek XS-8

Photo 14. Looking downstream at UT to Underwood Creek XS-9

Photo 15. Looking downstream at UT to Underwood Creek XS-10

MY-00 Vegetation Plot Photos
April 22, 2011

Veg Plot 1

Veg Plot 2

Veg Plot 3

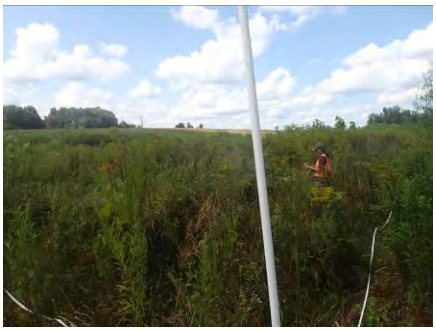
Veg Plot 4

MY-03 Vegetation Plot Photos
August 22-23, 2013

Veg Plot 1

Veg Plot 2

Veg Plot 3



Veg Plot 4

Veg Plot 5

Veg Plot 5

Veg Plot 6

Veg Plot 6

Veg Plot 7

Veg Plot 7

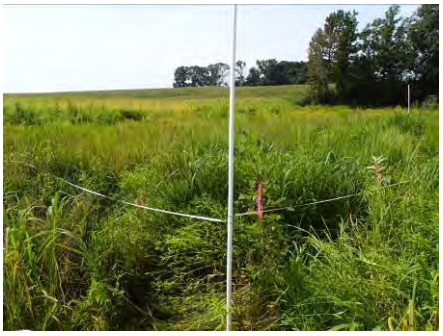
Veg Plot 8

Veg Plot 8

Veg Plot 9

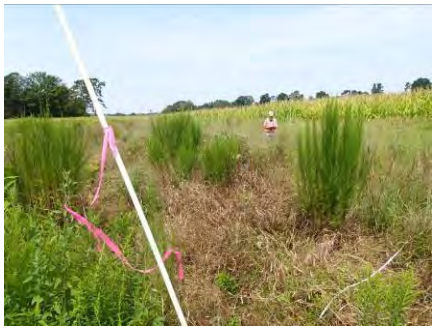
Veg Plot 9

Veg Plot 10



Veg Plot 10

Veg Plot 11



Veg Plot 11

Veg Plot 12

Veg Plot 12

Veg Plot 13

Veg Plot 13

Appendix C. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment		
Vegetation Plot ID	**Vegetation Survival Threshold Met?**	**Tract Mean**
VP1	Yes	100%
VP2	Yes	
VP3	Yes	
VP4	No	
VP5	Yes	
VP6	No	
VP7	No	
VP8	No	
VP9	Yes	
VP10	Yes	
VP11	No	
VP12	Yes	
VP13	Yes	

CVS Metadata

Report Prepared By Chris Sheats
Date Prepared 10/23/2013 14:22

database name	TheCatenaGroup-2012-D.mdb
database location	\\SERVER\RedirectedFolders\csheats\Desktop
computer name	HARNETT
file size	37228544

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	94150
project Name	Newtown Stream and Wetland Restoration
Description	Underwood Creek Stream Restoration in Union County southwest of Monroe, NC.
River Basin	Catawba
length(ft)	5317
stream-to-edge width (ft)	50
area (sq m)	49391.55
Required Plots (calculated)	13
Sampled Plots	13

Table 9. Density per Plot
EEP Project Code 94150. Project Name: Newtown Stream and Wetland Restoration

Current Plot Data (MY3 2013)

Scientific Name	Common Name	Species Type	E94150-01-0001			E94150-01-0002			E94150-01-0003			E94150-01-0004			E94150-01-0005		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Asimina triloba	pawpaw	Tree															
Baccharis halimifolia	eastern baccharis	Shrub						1			4			3			
Betula nigra	river birch	Tree	7	7	7	3	3	3	4	4	4						
Carpinus caroliniana	American hornbeam	Tree															
Carpinus caroliniana var. caroliniana	Coastal American Hornbeam	Tree															
Carya	hickory	Tree															
Celtis laevigata	sugarberry	Tree										1	1	1			
Cephalanthus occidentalis	common buttonbush	Shrub															
Cornus amomum	silky dogwood	Shrub															
Diospyros virginiana	common persimmon	Tree															
Fraxinus pennsylvanica	green ash	Tree							1	1	1			1			
Ligustrum sinense	Chinese privet	Exotic															1
Liquidambar styraciflua	sweetgum	Tree									1						
Platanus occidentalis	American sycamore	Tree				3	3	3				2	2	2			
Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	Tree													16	16	16
Populus deltoides	eastern cottonwood	Tree															
Populus deltoides var. deltoides	eastern cottonwood				5			1			6			31			20
Quercus	oak	Tree				1	1	1									
Quercus michauxii	swamp chestnut oak	Tree	7	7	7	8	8	8	5	5	5	2	2	2	1	1	1
Quercus phellos	willow oak	Tree							2	2	2				3	3	3
Rhus copallinum	flameleaf sumac	shrub															
Rhus copallinum var. copallinum	flameleaf sumac	shrub			1												
Rosa multiflora	multiflora rose	Exotic															
Rosa palustris	swamp rose	Shrub															
Salix nigra	black willow	Tree												2			
Sambucus canadensis	Common Elderberry	Shrub															3
Ulmus alata	winged elm	Tree															
Ulmus rubra	slippery elm	Tree															
Unknown		Shrub or Tree															
Color for Density		Stem Count	14	14	20	15	15	17	12	12	23	5	5	42	20	20	44
Exceeds requirements by 10%		size (ares)	1			1			1			1			1		
Exceeds requirements, but by less than 10%		size (ACRES)	0.02			0.02			0.02			0.02			0.02		
Fails to meet requirements, by less than 10%		Species count	2	2	4	4	4	6	4	4	7	3	3	7	3	3	6
Fails to meet requirements by more than 10%		Stems per ACRE	566.5599	566.5599	809.3713	607.0285	607.0285	687.9656	485.6228	485.6228	930.777	202.3428	202.3428	1699.68	809.3713	809.3713	1780.617

Scientific Name	E94150-01-0006			E94150-01-0007			E94150-01-0008			E94150-01-0009			E94150-01-0010		
	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Asimina triloba							1	1	1						
Baccharis halimifolia									18			4			
Betula nigra	1	1	1	1	1	1									
Carpinus caroliniana															
Carpinus caroliniana var. caroliniana				1	1	1									
Carya															
Celtis laevigata															
Cephalanthus occidentalis	1	1	2												
Cornus amomum															
Diospyros virginiana										1	1	1	2	2	2
Fraxinus pennsylvanica	2	2	2	3	3	3	1	1	1	3	3	3	2	2	3
Ligustrum sinense															
Liquidambar styraciflua												7			
Platanus occidentalis															
Platanus occidentalis var. occidentalis				1	1	1	1	1	1	2	2	2			
Populus deltoides															
Populus deltoides var. deltoides						16						6			
Quercus													2	2	2
Quercus michauxii	1	1	1				1	1	1	5	5	5			
Quercus phellos				1	1	1				2	2	2	3	3	3
Rhus copallinum															
Rhus copallinum var. copallinum															
Rosa multiflora						1									
Rosa palustris															
Salix nigra															
Sambucus canadensis															
Ulmus alata												5			
Ulmus rubra															
Unknown															
Stem Count	5	5	6	7	7	24	4	4	22	13	13	35	9	9	10
size (ares)	1			1			1			1			1		
size (ACRES)	0.02			0.02			0.02			0.02			0.02		
Species count	4	4	4	5	5	7	4	4	5	5	5	9	4	4	4
Stems per ACRE	202.3428	202.3428	242.8114	283.2799	283.2799	971.2455	161.8743	161.8743	890.3084	526.0913	526.0913	1416.4	364.2171	364.2171	404.6856

Scientific Name	E94150-01-0011			E94150-01-0012			E94150-01-0013		
	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Asimina triloba									
Baccharis halimifolia									
Betula nigra							1	1	1
Carpinus caroliniana									
Carpinus caroliniana var. caroliniana									
Carya									
Celtis laevigata				1	1	1			
Cephalanthus occidentalis									
Cornus amomum	2	2	2				1	1	1
Diospyros virginiana	1	1	1	1	1	1	5	5	5
Fraxinus pennsylvanica				2	2	2	2	2	2
Ligustrum sinense									
Liquidambar styraciflua									
Platanus occidentalis									
Platanus occidentalis var. occidentalis									
Populus deltoides									
Populus deltoides var. deltoides									6
Quercus									
Quercus michauxii	3	3	3	6	6	6			
Quercus phellos	1	1	1				1	1	1
Rhus copallinum									
Rhus copallinum var. copallinum									
Rosa multiflora									
Rosa palustris									
Salix nigra									
Sambucus canadensis									
Ulmus alata									
Ulmus rubra									
Unknown									
Stem Count	7	7	7	10	10	10	10	10	16
size (ares)	1			1			1		
size (ACRES)	0.02			0.02			0.02		
Species count	4	4	4	4	4	4	5	5	6
Stems per ACRE	283.2799	283.2799	283.2799	404.6856	404.6856	404.6856	404.6856	404.6856	647.497

Annual Means

Scientific Name	MY3 (2013)			MY2 (2012)			MY1 (2011)			MY0 (2011)		
	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Asimina triloba	1	1	1	4	4	4	14	14	14	16	16	16
Baccharis halimifolia			30			34						
Betula nigra	17	17	17	17	17	17	20	20	20	24	24	24
Carpinus caroliniana										2	2	2
Carpinus caroliniana var. caroliniana	1	1	1	1	1	1	2	2	2	6	6	6
Carya										2	2	2
Celtis laevigata	2	2	2	4	4	5	9	9	9	5	5	5
Cephalanthus occidentalis	1	1	2	1	1	1						
Cornus amomum	3	3	3	3	3	3	4	4	4	3	3	3
Diospyros virginiana	10	10	10	11	11	11	19	19	19	26	26	26
Fraxinus pennsylvanica	16	16	18	17	17	19	17	17	17	20	20	20
Ligustrum sinense			1			1						
Liquidambar styraciflua			8			2						
Platanus occidentalis	5	5	5	5	5	5	6	6	6	7	7	7
Platanus occidentalis var. occidentalis	20	20	20	20	20	20	21	21	21	21	21	21
Populus deltoides						90						
Populus deltoides var. deltoides			91									
Quercus	3	3	3	3	3	3	8	8	8	65	65	65
Quercus michauxii	39	39	39	41	41	41	41	41	41	1	1	1
Quercus phellos	13	13	13	14	14	14	12	12	12			
Rhus copallinum						2						
Rhus copallinum var. copallinum			1									
Rosa multiflora			1			1						
Rosa palustris						5						
Salix nigra			2									
Sambucus canadensis			3			13						
Ulmus alata			5									
Ulmus rubra						5						
Unknown										10	10	10
Stem Count	131	131	276	141	141	297	173	173	173	208	208	208
size (ares)	13			13			13			13		
size (ACRES)	0.32			0.32			0.32			0.32		
Species count	13	13	22	13	13	22	12	12	12	14	14	14
Stems per ACRE	407.7986	407.7986	859.1787	438.9283	438.9283	924.551	538.5432	538.5432	538.5432	647.497	647.497	647.497

Appendix D. Stream Survey Data

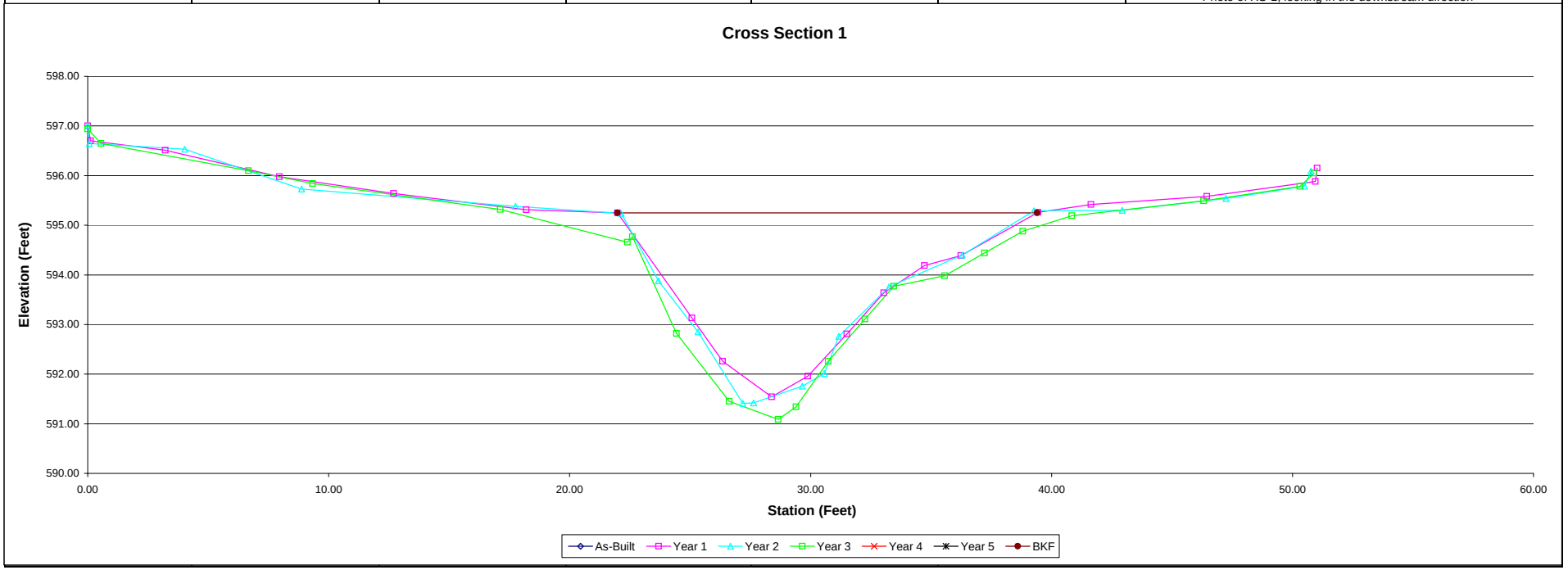
Project:	Underwood Creek
Cross Section:	Cross Section 1 (New for MY-01)
Feature	Pool
Station:	8+13
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)		31.4	33.0	33.4		
W (BKF)		17.4	17.3	16.2		
Max d		3.7	3.8	4.0		
Mean d	#DIV/0!	1.8	1.9	2.1		
W/D	#DIV/0!	9.7	9.1	7.9		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			MY	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	El
			0.00	597.00	LPIN	0.00	597.00	LPIN	0.00	596.94	LPIN		
			0.12	596.70		0.07	596.65		0.55	596.65			
			3.22	596.51		4.02	596.53		6.67	596.1			
			7.95	595.98		8.88	595.73		9.33	595.84			
			12.70	595.64		17.76	595.38		17.12	595.32			
			18.20	595.31		22.14	595.24	3L Bankfull	22.4	594.66			
			21.99	595.25	BANKFULL	23.68	593.88		22.61	594.77	TOBL bankfull left		
			25.08	593.13	TOE L	25.33	592.85		24.43	592.82	TOE L		
			26.35	592.26		27.19	591.41	TOE L	26.62	591.45			
			28.38	591.54	TW	27.63	591.42	TW	28.66	591.09	TW		
			29.89	591.96		29.66	591.76		29.4	591.34			
			31.51	592.81	TOE R	30.57	592.01	TOE R	30.73	592.26			
			33.04	593.64		31.17	592.76		32.26	593.11	TOE R		
			34.73	594.19		33.26	593.76		33.45	593.77	TOBR Bankfull right		
			36.24	594.39		36.29	594.40		35.57	593.98			
			39.44	595.26	R Bankfull F	39.26	595.29	R Bankfull F	37.22	594.44			
			41.64	595.42		42.93	595.30		38.81	594.88			
			46.44	595.58		47.24	595.54		40.84	595.19			
			50.95	595.88		50.50	595.79		46.31	595.49			
			51.02	596.15	RPIN	50.76	596.09	RPIN	50.31	595.78			
									50.89	596.05	RPIN		

Photo of XS-1, looking in the downstream direction



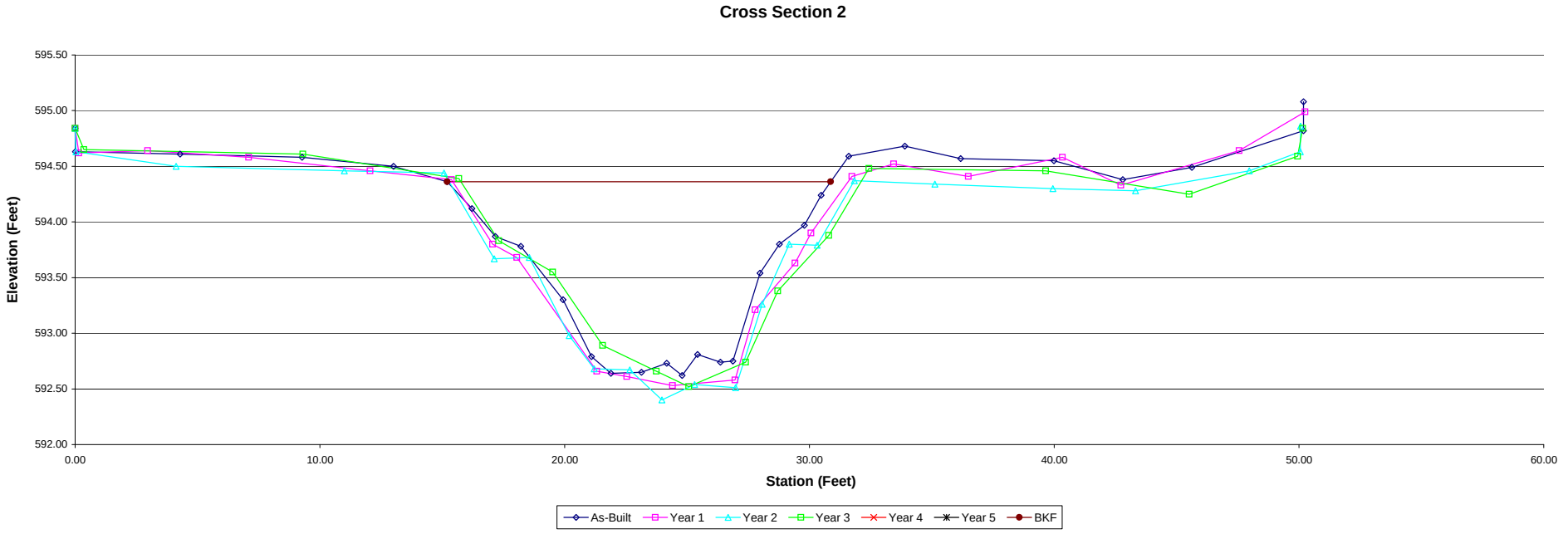
Project:	Underwood Creek
Cross Section:	Cross Section 2 (CS-1 in MY-00)
Feature	Riffle
Station:	9+54
Date:	9/10/13
Crew:	SV,CC,BW p

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	16.1	18.3	18.4	17.7		
W (BKF)	15.7	16.1	16.5	16.8		
Max d	1.7	1.8	2.0	1.8		
Mean d	1.0	1.1	1.1	1.1		
W/D	15.2	14.2	14.9	15.9		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
0.00	594.84	LPIN	0.00	594.84	LPIN	0.00	594.84	LPIN	0.00	594.84	LPIN	
0.01	594.63		0.15	594.62		0.03	594.63		0.36	594.65		
4.29	594.61		2.96	594.64		4.13	594.50		9.31	594.61		
9.27	594.58		7.09	594.58		11.00	594.46		15.68	594.39	3L Bankfull Left	
13.01	594.50		12.05	594.46		15.07	594.44	3L Bankfull	17.31	593.83		
15.20	594.36	BANKFULL	15.38	594.38	BANKFULL	17.12	593.67		19.51	593.55		
16.21	594.12		17.06	593.80		18.56	593.68		21.55	592.89	TOEL	
17.17	593.87		18.05	593.68		20.19	592.98		23.75	592.66		
18.21	593.78		21.31	592.66	TOE L	21.21	592.68	TOE L	25.07	592.52	TW	
19.94	593.30		22.54	592.61		22.66	592.67		27.39	592.74	TOER	
21.10	592.79	TOE L	24.41	592.53	TW	23.97	592.40		28.71	593.38		
21.89	592.64		26.96	592.58	TOE R	25.31	592.54	TW	30.79	593.88		
23.14	592.65		27.79	593.21		26.98	592.51	TOE R	32.43	594.48	R Bankfull Right	
24.17	592.73		29.41	593.63		28.07	593.26		39.65	594.46		
24.80	592.62	TW	30.07	593.90		29.17	593.80		45.52	594.25		
25.43	592.81		31.74	594.41	BANKFULL	30.31	593.79		49.95	594.59		
26.36	592.74		33.44	594.52		31.83	594.37	R Bankfull F	50.15	594.84	RPIN	
26.87	592.75	TOE R	36.49	594.41		35.13	594.34					
27.98	593.54		40.34	594.58		39.95	594.30					
28.77	593.80		42.73	594.33		43.32	594.28					
29.79	593.97		47.56	594.64		47.97	594.46					
30.48	594.24		50.25	594.99	RPIN	50.05	594.63					
31.61	594.59	BANKFULL RIGHT				50.07	594.86	RPIN				
33.90	594.68											
36.18	594.57											
39.99	594.55											
42.80	594.38											
45.62	594.49											
50.18	594.82											
50.19	595.08	RPIN										

Photo of XS-2, looking in the downstream direction



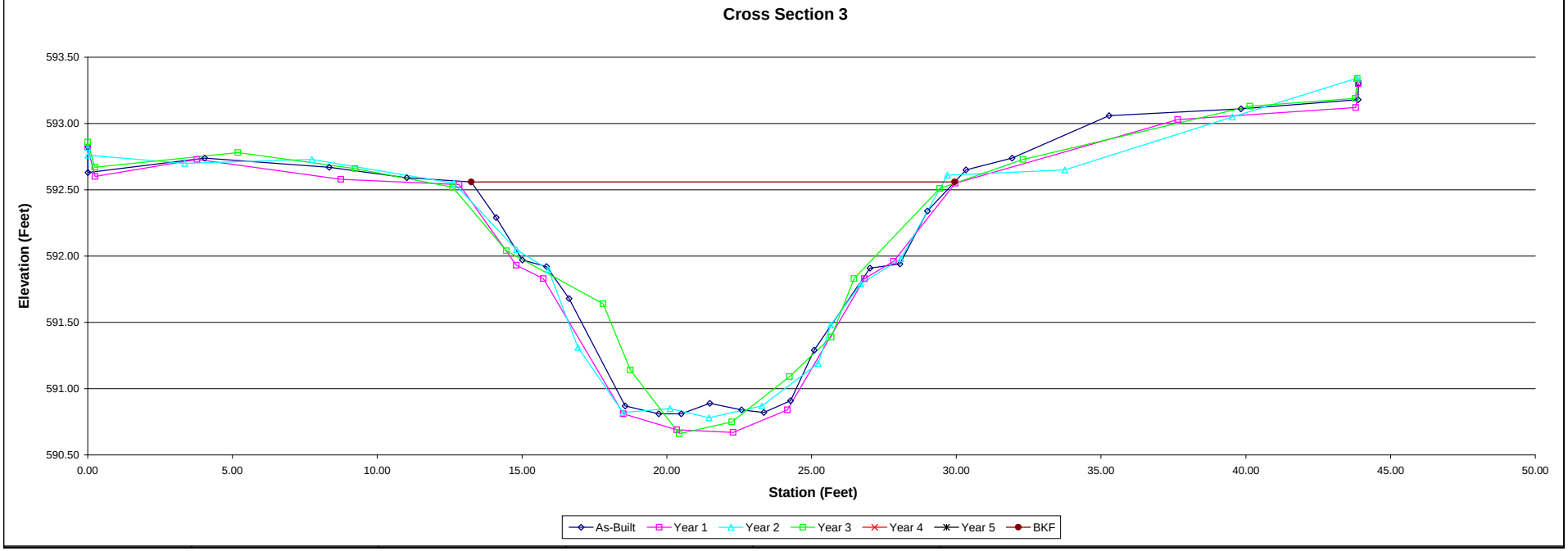
Project:	Underwood Creek
Cross Section:	Cross Section 3 (CS-2 in MY-00)
Feature	Riffle
Station:	13+36
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	18.1	20.3	18.7	17.2		
W (BKF)	16.7	19.3	17.2	16.8		
Max d	1.8	1.9	1.8	1.9		
Mean d	1.1	1.0	1.1	1.0		
W/D	15.4	18.4	15.8	16.5		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			Statio
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	
0.00	592.82	LPIN	0.00	592.82	LPIN	0.00	592.82	LPIN	0.00	592.86	LPIN	
0.01	592.63		0.25	592.60		0.01	592.76		0.24	592.67		
4.04	592.74		3.78	592.73		3.35	592.70		5.19	592.78		
8.34	592.67		8.75	592.58		7.74	592.73		9.24	592.66		
11.02	592.59		12.83	592.54	BANKFULL	12.65	592.55	3L Bankfull	12.60	592.52	3L Bankfull Left	
13.25	592.56	BANKFULL	14.80	591.93		14.80	592.05		14.46	592.04		
14.11	592.29		15.74	591.83		15.91	591.90		17.80	591.64		
15.01	591.97		18.50	590.81	TOE L	16.93	591.31		18.74	591.14	TOEL	
15.85	591.92		20.35	590.69	TW	18.49	590.82	TOE L	20.43	590.66	TW	
16.62	591.68		22.29	590.67		20.11	590.85	TW	22.25	590.75		
18.56	590.87	TOE L	24.17	590.84	TOE R	21.46	590.78		24.24	591.09	TOER	
19.72	590.81		26.83	591.83		23.29	590.87		25.68	591.39		
20.50	590.81	TW	27.83	591.96		25.23	591.19	TOE R	26.47	591.83		
21.49	590.89		29.96	592.55	BANKFULL	25.66	591.48		29.43	592.51	R Bankfull Right	
22.58	590.84		37.65	593.03		26.70	591.79		32.31	592.73		
23.35	590.82		43.80	593.12		28.09	591.98		40.14	593.13		
24.28	590.91	TOE R	43.89	593.30	RPIN	29.69	592.61	R Bankfull F	43.78	593.19		
25.09	591.29					33.75	592.65		43.85	593.34	RPIN	
27.02	591.91					39.53	593.05					
28.05	591.94					43.82	593.34					
29.00	592.34					43.84	593.34	RPIN				
30.33	592.65	BANKFULL RIGHT										
31.93	592.74											
35.28	593.06											
39.83	593.11											
43.88	593.18											
43.89	593.30	RPIN										

Photo of XS-3 looking in the downstream direction



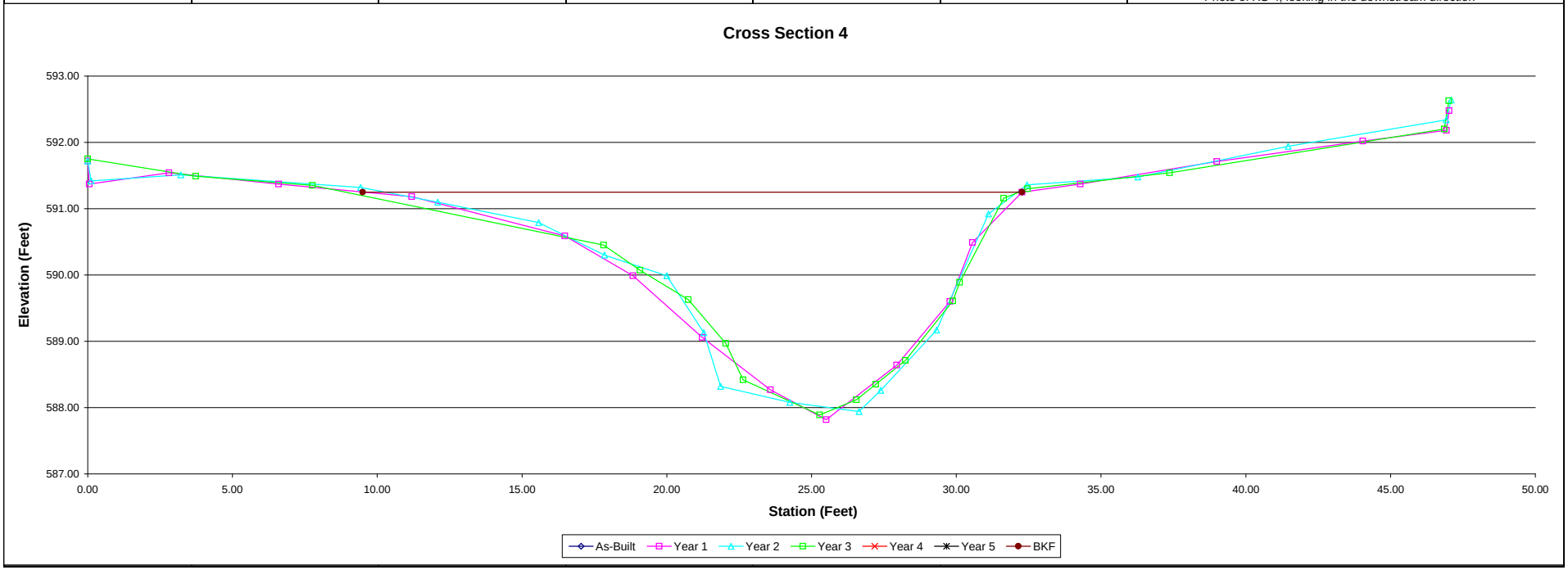
Project:	Underwood Creek
Cross Section:	Cross Section 4 (New for MY-01)
Feature	Pool
Station:	16+19
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)		33.8	33.4	33.6		
W (BKF)		22.8	21.8	23.9		
Max d		3.4	3.3	3.4		
Mean d	#DIV/0!	1.5	1.5	1.4		
W/D	#DIV/0!	15.3	14.3	17.0		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			M
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
			0.00	591.72	LPIN	0.00	591.72	LPIN	0.00	591.75	LPIN	
			0.05	591.37		0.12	591.42		3.73	591.49		
			2.81	591.54		3.21	591.51		7.76	591.35	BL Bankfull Left	
			6.59	591.37		9.43	591.32	BL Bankfull	17.82	590.45		
			11.19	591.18	BL Bankfull	12.09	591.10		19.08	590.07		
			16.48	590.59		15.57	590.79		20.74	589.63		
			18.83	589.99		17.85	590.30		22.04	588.97		
			21.22	589.06	TOE L	20.00	589.99		22.64	588.42	TOE L	
			23.58	588.27		21.28	589.13		25.28	587.89	TW	
			25.51	587.82	TW	21.86	588.32	TOE L	26.55	588.12		
			27.94	588.64		24.25	588.08		27.22	588.35	TOE R	
			29.78	589.60	TOE R	26.64	587.94	TW	28.24	588.71		
			30.56	590.49		27.39	588.26	TOE R	29.88	589.61		
			32.27	591.25	BANKFULL	29.32	589.17		30.12	589.89		
			34.28	591.37		31.11	590.92		31.64	591.16	R Bankfull Right	
			39.00	591.71		32.44	591.36	R Bankfull R	32.46	591.30		
			44.04	592.02		36.27	591.48		37.37	591.54		
			46.93	592.18		41.46	591.94		46.86	592.20		
			47.02	592.48	RPIN	46.92	592.34		47.01	592.63	RPIN	
						47.09	592.64	RPIN				

Photo of XS-4, looking in the downstream direction



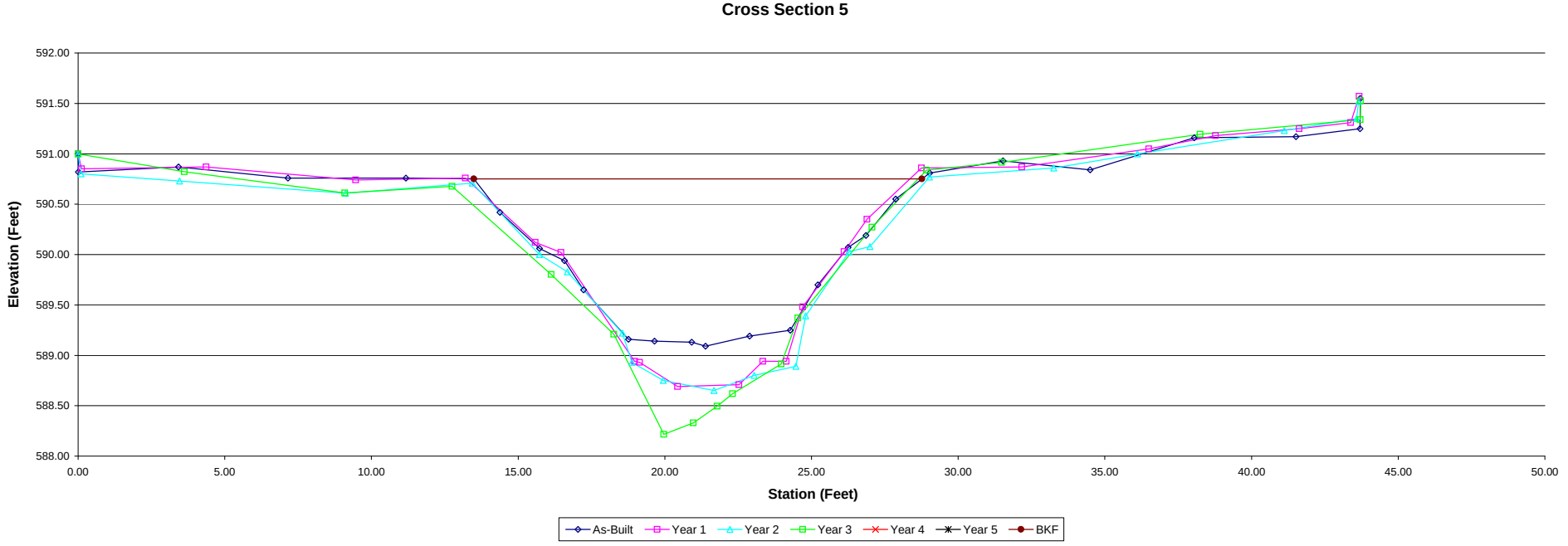
Project:	Underwood Creek
Cross Section:	Cross Section 5 (CS-3 in MY-00)
Feature	Riffle
Station:	17+13
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	15.9	17.5	19.7	20.3		
W (BKF)	15.3	15.1	26.5	16.2		
Max d	1.7	2.1	2.1	2.5		
Mean d	1.0	1.2	0.7	1.3		
W/D	14.7	13.1	35.6	12.9		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
0.00	591.00	LPIN	0.00	591.00	LPIN	0.00	591.00	LPIN	0.00	591	LPIN	
0.01	590.82		0.12	590.85		0.10	590.80		3.62	590.821		
3.42	590.87		4.36	590.87		3.46	590.73		9.09	590.612		
7.15	590.76		9.46	590.74		9.12	590.61		12.75	590.676	L Bankfull Left	
11.17	590.76		13.20	590.76	BANKFULL	13.44	590.71	BL Bankfull	16.13	589.802		
13.49	590.75	BANKFULL	15.58	590.12		15.73	590.00		18.26	589.209	TOE L	
14.38	590.42		16.46	590.02		16.68	589.83		19.97	588.215	TW	
15.73	590.06		18.97	588.94	TOE L	18.55	589.22		20.97	588.33		
16.58	589.94		19.14	588.93		18.88	588.93	TOE L	21.79	588.495		
17.23	589.65		20.44	588.69	TW	19.95	588.75		22.31	588.619		
18.76	589.16	TOE L	22.53	588.71		21.68	588.65	TW	23.97	588.914	TOE R	
19.65	589.14		23.34	588.94		23.04	588.80		24.54	589.37		
20.92	589.13		24.14	588.94	TOE R	24.47	588.89	TOE R	27.06	590.271		
21.39	589.09	TW	24.70	589.48		24.80	589.39		28.92	590.839	R Bankfull Right	
22.89	589.19		26.11	590.03		26.29	590.03		31.48	590.914		
24.28	589.25	TOE R	26.89	590.35		26.99	590.08		38.25	591.194		
25.22	589.70		28.75	590.86	BANKFULL	29.02	590.77	R Bankfull	43.71	591.339		
26.25	590.07		32.17	590.87		33.26	590.86		43.72	591.527	RPIN	
26.86	590.19		36.50	591.05		36.11	591.00					
27.87	590.55		38.77	591.18		41.12	591.23					
29.03	590.81	BANKFULL	41.62	591.25		43.58	591.35					
31.53	590.93		43.38	591.31		43.65	591.52	RPIN				
34.50	590.84		43.67	591.57	RPIN							
38.05	591.16											
41.52	591.17											
43.70	591.25											
43.71	591.55	RPIN										

Photo of XS-5, looking in the downstream direction



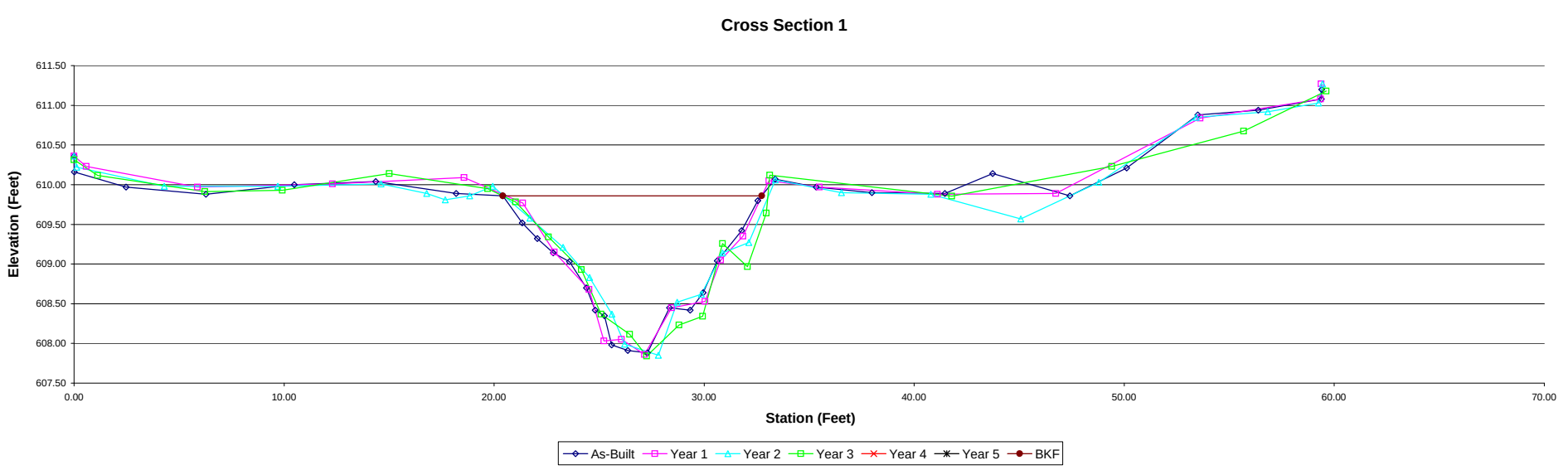
Project:	UT to Underwood Creek
Cross Section:	Cross Section 1 (Same as MY-00)
Feature	Riffle
Station:	6+40
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	13.1	13.2	12.5	12.5		
W (BKF)	12.3	12.2	12.6	12.0		
Max d	2.0	2.0	2.0	1.9		
Mean d	1.1	1.1	1.0	1.0		
W/D	11.6	11.3	12.7	11.5		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			M
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
	610.36	LPIN		610.36	LPIN	0.00	610.36	LPIN		610.31	X1 LP	
0.01	610.16		0.58	610.23		0.13	610.22		1.12	610.12		
2.48	609.97		5.87	609.97		4.30	609.98		6.23	609.91		
6.28	609.88		12.30	610.01		9.70	609.98		9.92	609.93		
10.49	610.00		18.57	610.09		14.62	610.01		15.01	610.14		
14.36	610.04		21.36	609.77	BANKFULL	16.79	609.89		19.70	609.95		
18.19	609.89		22.86	609.15		17.67	609.81		21.02	609.78	L BANKFULL LEFT	
20.42	609.86	BANKFULL	24.52	608.68		18.83	609.86		22.59	609.34		
21.34	609.52		25.23	608.03	TOE L	19.93	609.98	3L Bankfull	24.16	608.93		
22.06	609.32		26.06	608.05		21.70	609.58		25.09	608.37	TOE L	
22.82	609.14		27.16	607.86	TW	23.28	609.21		26.45	608.12		
23.59	609.03		28.45	608.45		24.54	608.83		27.26	607.84	X1 TW	
24.39	608.70		30.04	608.53	TOE R	25.61	608.37	TOE L	28.80	608.23		
24.81	608.42	TOE L	30.79	609.05		26.21	607.99		29.93	608.34	TOE R	
25.25	608.35		31.85	609.35		27.82	607.85	TW	30.87	609.26		
25.59	607.98		33.09	610.05	BANKFULL	28.71	608.52		32.06	608.97		
26.36	607.91	TW	35.49	609.97		29.87	608.62	TOE R	32.96	609.64		
27.30	607.88		41.11	609.88		30.88	609.14		33.13	610.12	R BANKFULL RIGHT	
28.35	608.45		46.74	609.89		32.13	609.27		41.79	609.86		
29.33	608.42		53.62	610.84		33.39	610.06	R Bankfull R	49.41	610.23		
29.95	608.64	TOE R	59.35	611.08		36.54	609.90		55.69	610.68		
30.62	609.04		59.38	611.27	RPIN	40.79	609.88		59.62	611.18	X1 RP	
31.79	609.42					45.07	609.57					
32.56	609.80					48.79	610.03					
33.38	610.07	BANKFULL RIGHT				53.43	610.85					
35.33	609.97					56.84	610.92					
37.99	609.90					59.25	611.03					
41.46	609.89					59.44	611.27	RPIN				
43.74	610.14											
47.41	609.86											
50.12	610.21											
53.50	610.88											
56.38	610.94											
59.39	611.08											
59.40	611.20	RPIN										

Photo of XS-1, looking in the downstream direction



Project:	UT to Underwood Creek
Cross Section:	Cross Section 2 (New for MY-01)
Feature	Pool
Station:	10+32
Date:	9/10/13
Crew:	SV,CC,BW

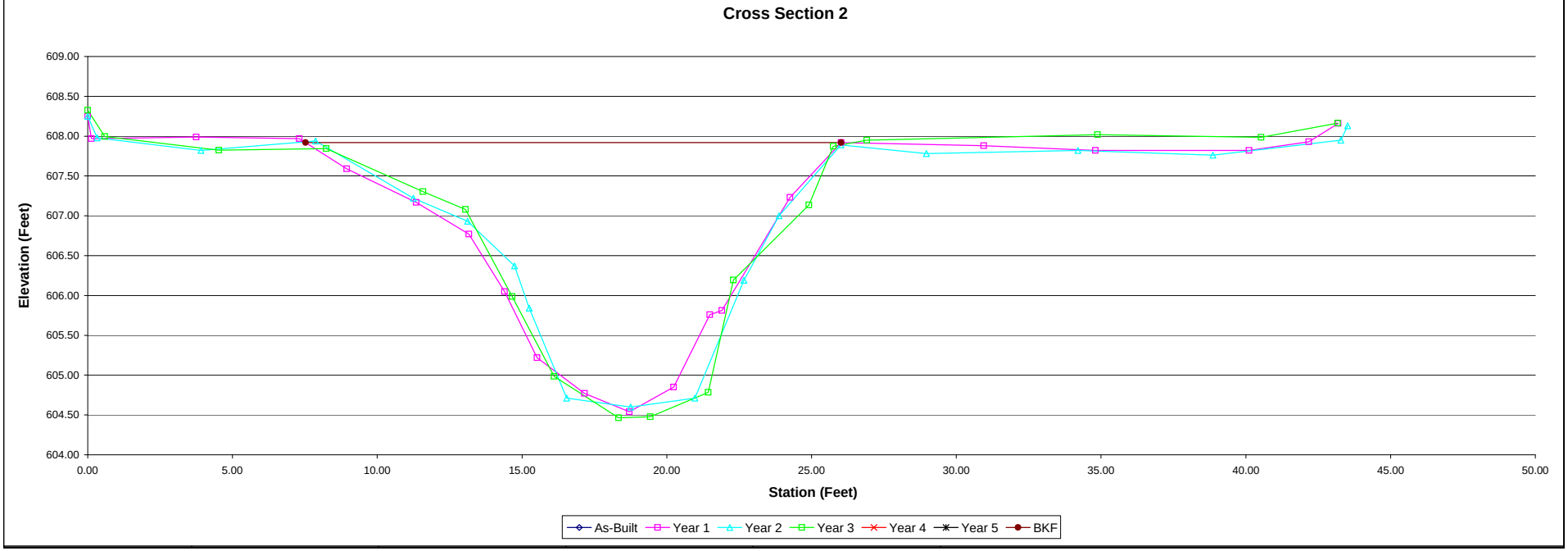
Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)		30.4	32.0	31.4		
W (BKF)		18.5	34.6	24.1		
Max d		3.4	3.3	3.5		
Mean d	#DIV/0!	1.6	0.9	1.3		
W/D	#DIV/0!	11.2	37.5	18.5		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
				608.25	LPIN	0.00	608.25	LPIN		608.33	LPIN	
			0.13	607.97		0.33	607.98		0.59	608.00		
			3.75	607.99		3.91	607.82		4.53	607.83		
			7.31	607.97	BANKFULL	7.87	607.94	3L Bankfull	8.24	607.85	3L Bankfull Left	
			8.95	607.59		11.25	607.22		11.58	607.30		
			11.35	607.17		13.12	606.93		13.05	607.08		
			13.17	606.77		14.74	606.37		14.66	605.99		
			14.40	606.05		15.25	605.84		16.11	604.99	TOEL	
			15.52	605.22	TOE L	16.54	604.71	TOE L	18.34	604.47	CP	
			17.16	604.77		18.75	604.60	TW	19.43	604.48	TW	
			18.71	604.54	TW	20.97	604.71	TOE R	21.43	604.78	TOER	
			20.24	604.85		22.66	606.19		22.30	606.20		
			21.49	605.76		23.88	607.00		24.91	607.14		
			21.90	605.81	TOE R	26.01	607.89	R Bankfull F	25.75	607.87	R Bankfull Right	
			24.26	607.23		28.97	607.78		26.91	607.95		
			26.02	607.92	BANKFULL	34.20	607.82		34.88	608.02		
			30.95	607.88		38.86	607.76		40.53	607.98		
			34.81	607.82		43.28	607.95		43.17	608.16	RPIN	
			40.11	607.82		43.52	608.13	RPIN				
			42.18	607.93								
			43.19	608.16	RPIN							

Photo of XS-2, looking in the downstream direction

Photo of XS-2, looking in the downstream direction



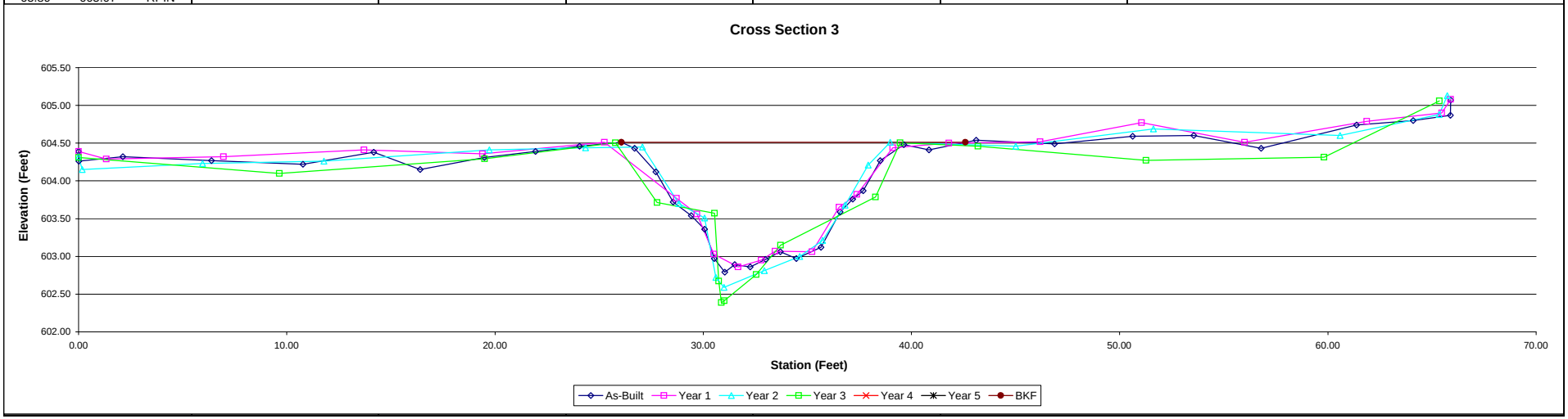
Project:	UT to Underwood Creek
Cross Section:	Cross Section 3 (CS-2 in MY-00)
Feature	Riffle
Station:	14+45
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	13.4	13.2	13.0	11.6		
W (BKF)	16.5	18.7	11.9	13.7		
Max d	1.7	1.6	1.9	2.1		
Mean d	0.8	0.7	1.1	0.9		
W/D	20.4	26.6	10.9	16.0		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Stati
0.00	604.39	LPIN	0.00	604.39	LPIN	0.00	604.32	LPIN	0.00	604.31	LPIN	
0.01	604.26		1.33	604.29		0.18	604.15		9.65	604.10		
2.13	604.32		6.96	604.32		5.95	604.23		19.50	604.29		
6.38	604.27		13.71	604.41		11.79	604.26		25.79	604.51	3L Bankfull Left	
10.78	604.22		19.40	604.36		19.73	604.41		27.78	603.71		
14.17	604.38		25.26	604.51	BANKFULL	24.35	604.44		30.54	603.57	TOE L	
16.41	604.15		28.72	603.77		27.08	604.45	3L Bankfull	30.75	602.67		
19.49	604.31		29.70	603.56		28.83	603.70		30.87	602.39	tw	
21.94	604.39		30.51	603.03	TOE L	30.06	603.51		31.01	602.41		
24.06	604.46		31.68	602.86	TW	30.61	602.72	TOE L	32.55	602.76		
26.07	604.51	BANKFULL	32.79	602.95		31.00	602.59	TW	33.71	603.15	TOE R	
26.70	604.43		33.45	603.07		32.94	602.81		38.27	603.79		
27.72	604.12		35.23	603.06	TOE R	34.64	603.00		39.46	604.51	R Bankfull Right	
28.56	603.72		36.52	603.65		35.73	603.21	TOE R	43.19	604.46		
29.42	603.54		37.38	603.82		36.81	603.68		51.27	604.27		
30.07	603.36		39.10	604.44	BANKFULL	37.92	604.21		59.82	604.31		
30.53	602.97	TOE L	41.80	604.50		38.98	604.51	R Bankfull F	65.35	605.06	RPIN	
31.04	602.79		46.18	604.52		45.01	604.46					
31.51	602.89		51.05	604.77		51.62	604.69					
32.26	602.86	TW	56.00	604.51		60.58	604.60					
33.00	602.96		61.87	604.79		65.34	604.88					
33.70	603.06		65.47	604.90		65.73	605.13	RPIN				
34.47	602.97		65.89	605.08	RPIN							
35.66	603.12	TOE R										
36.57	603.59											
37.18	603.76											
37.68	603.87											
38.50	604.27											
39.63	604.48	BANKFULL RIGHT										
40.84	604.41											
43.11	604.54											
46.87	604.49											
50.62	604.59											
53.56	604.60											
56.79	604.43											
61.38	604.74											
64.10	604.80											
65.88	604.87											
65.89	605.07	RPIN										

Photo of XS-3 looking in the downstream direction



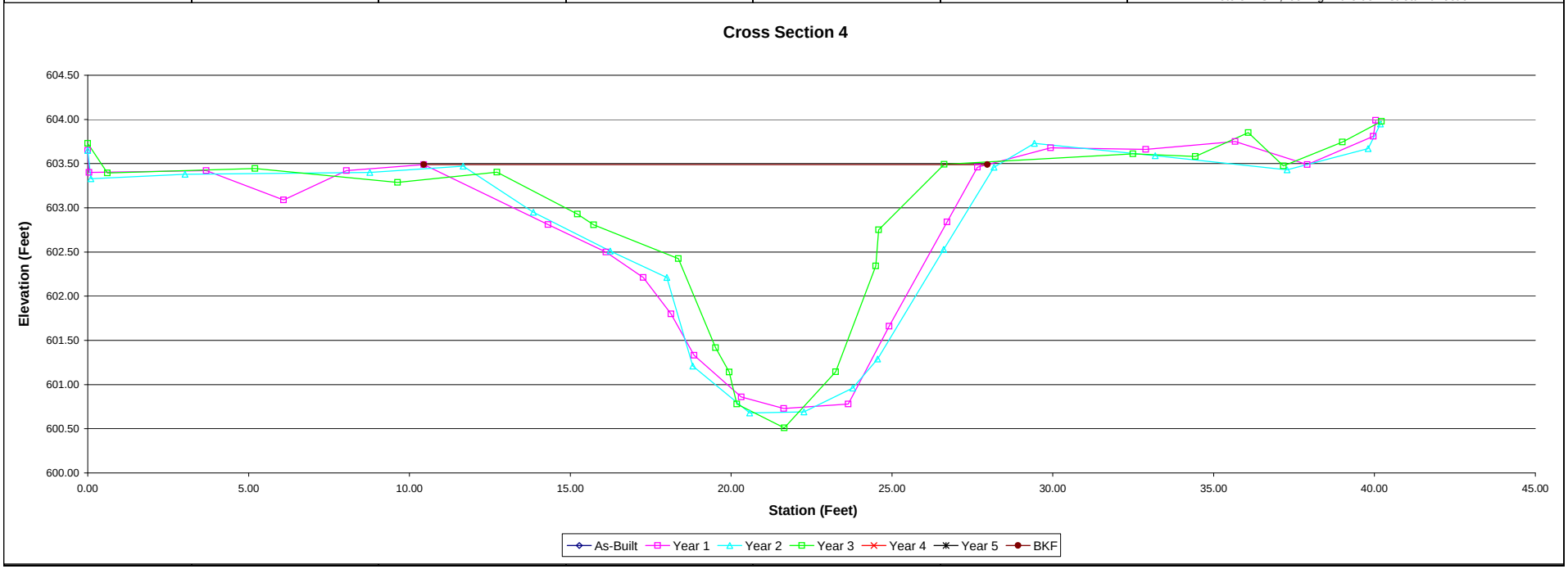
Project:	UT to Underwood Creek
Cross Section:	Cross Section 4 (New for MY-01)
Feature	Pool
Station:	16+30
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)		24.8	25.0	18.1		
W (BKF)		17.5	16.6	13.9		
Max d		2.8	2.8	3.0		
Mean d	#DIV/0!	1.4	1.5	1.3		
W/D	#DIV/0!	12.4	11.1	10.6		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
				603.65	LPIN	0.00	603.65	LPIN	0.00	603.73	LPIN	
			0.04	603.40		0.10	603.33		0.61	603.39		
			3.68	603.42		3.02	603.38		5.20	603.45		
			6.09	603.09		8.77	603.40		9.63	603.29		
			8.04	603.42		11.67	603.47	3L Bankfull	12.72	603.40	Bankfull Left	
			10.45	603.49	BANKFULL	13.85	602.95		15.22	602.93		
			14.31	602.81		16.24	602.51		15.73	602.81		
			16.11	602.50		18.00	602.21		18.36	602.43		
			17.27	602.21		18.81	601.21	TOE L	19.52	601.42		
			18.13	601.80		20.58	600.68		19.94	601.14	TOEL	
			18.85	601.33	TOE L	22.26	600.69	TW	20.18	600.78		
			20.32	600.86		23.78	600.96		21.65	600.51	TW	
			21.64	600.73	TW	24.55	601.29	TOE R	23.25	601.14	TOER	
			23.64	600.78		26.61	602.53		24.50	602.34		
			24.91	601.66	TOE R	28.17	603.46	R Bankfull F	24.59	602.75		
			26.71	602.84		29.43	603.73		26.62	603.49	R Bankfull Right	
			27.66	603.46	BANKFULL	33.18	603.59		32.49	603.61		
			29.93	603.68		37.28	603.43		34.43	603.58		
			32.89	603.66		39.80	603.67		36.08	603.85		
			35.67	603.75		40.18	603.95	RPIN	37.17	603.48		
			37.91	603.49					39.00	603.75		
			39.96	603.81					40.22	603.98	RPIN	
			40.04	603.99	RPIN							

Photo of XS-4, looking in the downstream direction



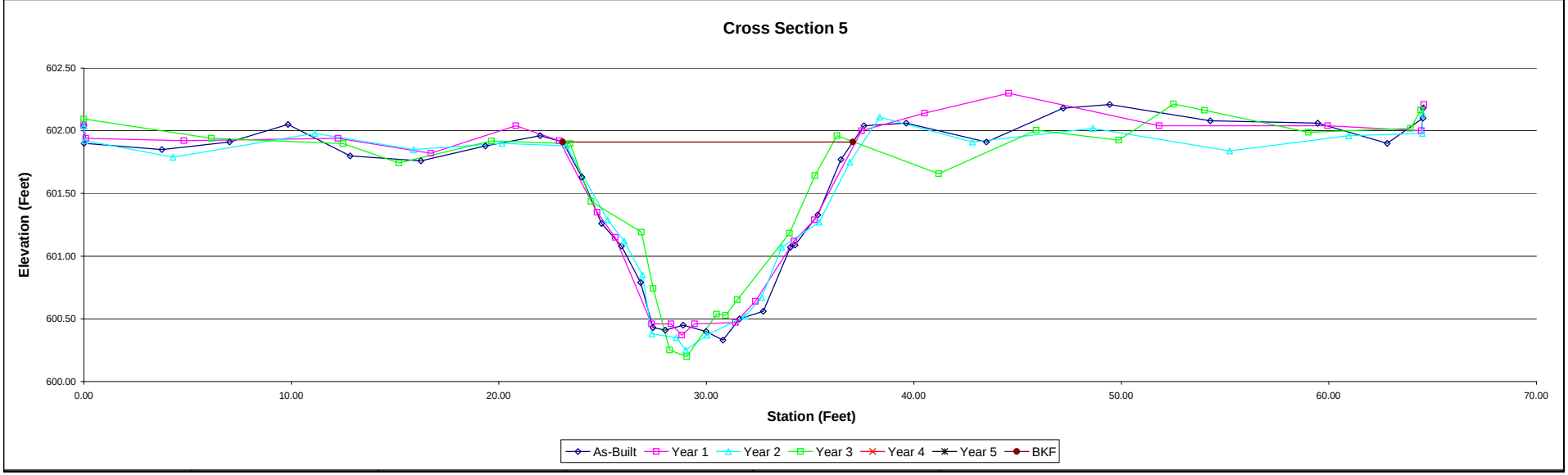
Project:	UT to Underwood Creek
Cross Section:	Cross Section 5 (CS-3 in MY-00)
Feature	Riffle
Station:	20+04
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	13.6	13.4	13.5	12.0		
W (BKF)	14.0	14.2	14.3	14.9		
Max d	1.6	1.5	1.7	1.7		
Mean d	1.0	0.9	0.9	0.8		
W/D	14.4	15.2	15.1	18.5		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			M
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station E
	602.04	LPIN		602.04	LPIN	0.00	602.04	LPIN	0.00	602.10	LPIN	
0.01	601.90		0.10	601.94		0.05	601.92		6.15	601.94		
3.76	601.85		4.82	601.92		4.29	601.79		12.49	601.90		
7.03	601.91		12.25	601.94		11.13	601.98		15.19	601.74		
9.84	602.05		16.72	601.82		15.89	601.85		19.64	601.92		
12.83	601.80		20.82	602.04		20.15	601.90		23.43	601.90	3L Bankfull Left	
16.24	601.76		22.92	601.92	BANKFULL	23.26	601.88	3L Bankfull	24.45	601.44		
19.36	601.88		24.74	601.35		25.24	601.29		26.87	601.19		
21.99	601.96		25.61	601.15		26.04	601.12		27.44	600.74		
23.08	601.91	BANKFULL	27.36	600.46	TOE L	26.92	600.85		28.23	600.25	TOEL	
24.00	601.63		28.30	600.46		27.38	600.38	TOE L	29.05	600.20	TW	
24.95	601.26		28.81	600.37	TW	28.55	600.35		30.49	600.54	TOER	
25.91	601.08		29.43	600.46		29.01	600.25	TW	30.93	600.53		
26.83	600.79		31.40	600.47		30.03	600.37		31.49	600.65		
27.43	600.43	TOE L	32.37	600.64	TOE R	31.86	600.52		34.01	601.18		
28.02	600.41		34.22	601.12		32.67	600.67	TOE R	35.24	601.64		
28.88	600.45		35.21	601.29		33.63	601.07		36.29	601.96	R Bankfull Right	
29.99	600.40		37.48	602.00	BANKFULL	35.44	601.27		41.20	601.66		
30.80	600.33	TW	40.52	602.14		36.92	601.75		45.89	602.00		
31.59	600.50		44.57	602.30		38.35	602.11	R Bankfull F	49.88	601.93		
32.75	600.56	TOE R	51.82	602.04		42.83	601.91		52.51	602.21		
34.04	601.07		59.94	602.04		48.63	602.02		54.01	602.16		
34.27	601.09		64.45	602.00		55.22	601.84		59.01	601.99		
35.37	601.33		64.58	602.21	RPIN	60.95	601.96		63.94	602.02		
36.49	601.77					64.50	601.98		64.43	602.17	RPIN	
37.60	602.04	BANKFULL RIGHT				64.51	602.14	RPIN				
39.63	602.06											
43.50	601.91											
47.20	602.18											
49.43	602.21											
54.28	602.08											
59.47	602.06											
62.81	601.90											
64.53	602.10											
64.54	602.18	RPIN										

Photo of XS-5, looking in the downstream direction



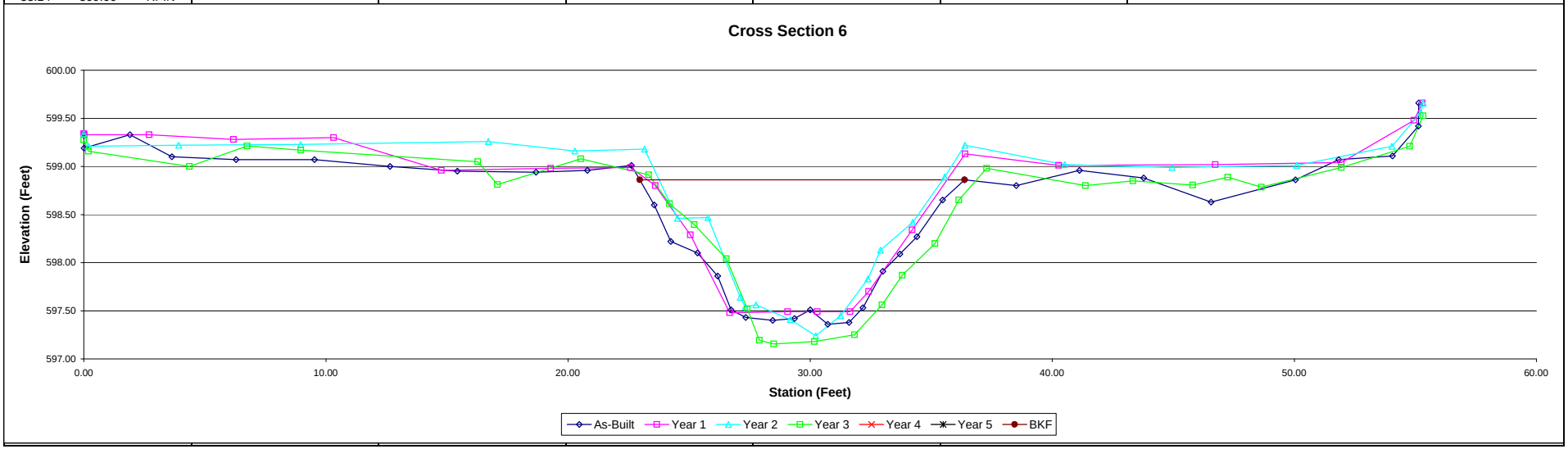
Project:	UT to Underwood Creek
Cross Section:	Cross Section 6 (CS-4 in MY-00)
Feature	Riffle
Station:	26+68
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	12.9	11.8	10.3	13.9		
W (BKF)	13.4	12.4	11.7	13.4		
Max d	1.5	1.4	1.6	1.7		
Mean d	1.0	1.0	0.9	1.0		
W/D	13.9	13.0	13.3	12.8		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			MY04-2014		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	
0.00	599.34	LPIN	0.00	599.34	LPIN	0.00	599.34	LPIN		599.28	LPIN			
0.01	599.19		0.02	599.33		0.19	599.21		0.19	599.16				
1.91	599.33		2.70	599.33		3.92	599.22		4.36	599.00				
3.64	599.10		6.18	599.28		8.95	599.23		6.75	599.21				
6.29	599.07		10.32	599.30		16.71	599.26		8.97	599.17				
9.53	599.07		14.77	598.96		20.28	599.16		16.28	599.05				
12.65	599.00		19.29	598.98		23.16	599.18	3L Bankfull	17.09	598.81				
15.43	598.95		22.58	598.99	BANKFULL	24.52	598.46		20.53	599.08				
18.68	598.94		23.61	598.80		25.78	598.47		23.34	598.91	3L Bankfull Left			
20.80	598.96		25.06	598.29		27.11	597.64		24.19	598.61				
22.62	599.01	BANKFULL	26.68	597.48	TOE L	27.32	597.54	TOE L	25.22	598.40				
23.56	598.60		29.07	597.49	TW	27.76	597.56		26.54	598.04				
24.24	598.22		30.30	597.49		29.18	597.41		27.41	597.52	TOEL			
25.35	598.10		31.65	597.49		30.23	597.24	TW	27.91	597.19				
26.18	597.86		32.42	597.70	TOE R	31.26	597.45		28.50	597.16	TW			
26.73	597.51	TOE L	34.22	598.34		32.39	597.83	TOE R	30.18	597.18				
27.34	597.43		36.41	599.13	BANKFULL	32.91	598.13		31.84	597.25				
28.46	597.40		40.27	599.01		34.24	598.42		32.97	597.56	TOER			
29.36	597.42		46.73	599.02		35.56	598.89		33.81	597.87				
30.01	597.51		51.94	599.04		36.39	599.22	R Bankfull F	35.16	598.20				
30.73	597.36	TW	54.94	599.48		40.52	599.02		36.14	598.65				
31.61	597.38		55.29	599.66	RPIN	44.95	598.99		37.29	598.98	R Bankfull Right			
32.18	597.53	TOE R				50.10	599.01		41.38	598.80				
33.00	597.91					54.03	599.21		43.34	598.85				
33.71	598.09					55.22	599.56		45.80	598.81				
34.41	598.27					55.32	599.66	RPIN	47.25	598.89				
35.47	598.65								48.64	598.79				
36.38	598.86	BANKFULL RIGHT							51.94	598.99				
38.52	598.80								54.77	599.21				
41.13	598.96								55.32	599.53	RPIN			
43.78	598.88													
46.56	598.63													
50.05	598.86													
51.84	599.07													
54.06	599.11													
55.13	599.42													
55.14	599.66	RPIN												

Photo of XS-6, looking in the downstream direction



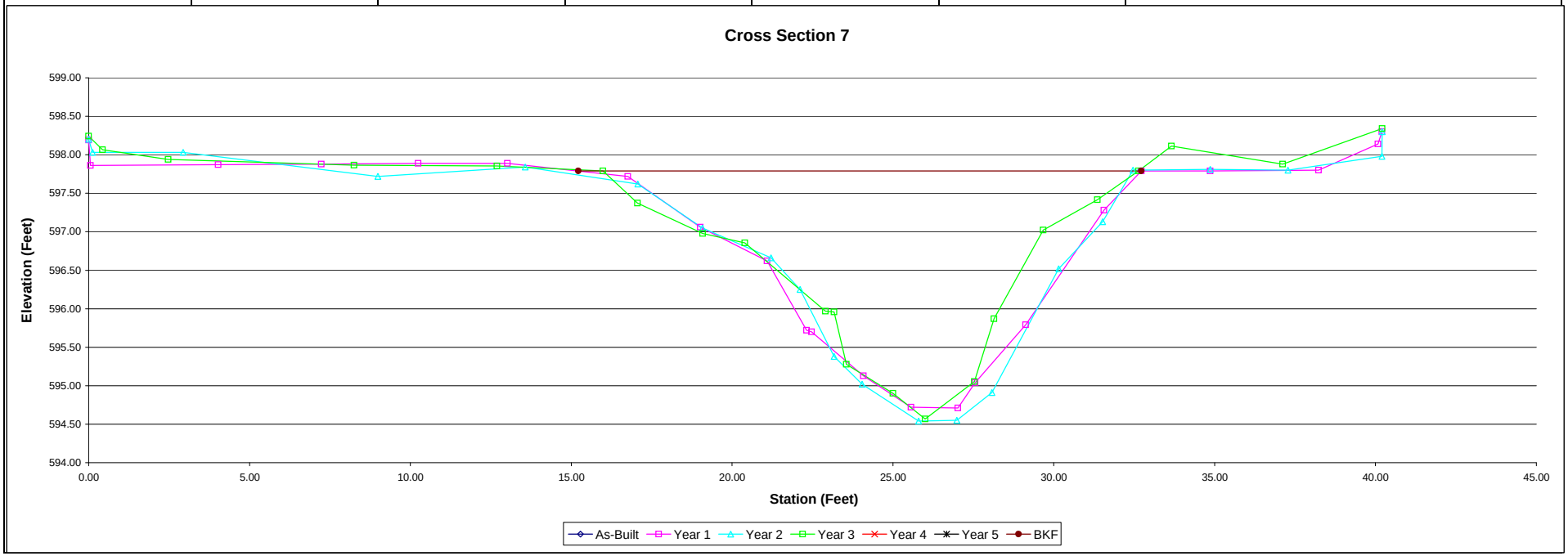
Project:	UT to Underwood Creek
Cross Section:	Cross Section 7 (New for MY-01)
Feature	Pool
Station:	28+82
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)		26.9	27.7	27.4		
W (BKF)		17.5	18.1	17.7		
Max d		3.1	3.3	3.4		
Mean d		1.5	1.5	1.6		
W/D		11.4	11.8	11.4		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
			0.00	598.19	LPIN	0.00	598.20	LPIN		598.24	LPIN	
			0.06	597.86		0.12	598.03		0.43	598.06		
			4.03	597.87		2.94	598.03		2.47	597.94		
			7.23	597.88		8.99	597.72		8.25	597.87		
			10.24	597.89		13.57	597.84		12.69	597.86		
			13.02	597.89		17.07	597.62	3L Bankfull	15.99	597.79	3L Bankfull Left	
			16.76	597.72	3L Bankfull	19.08	597.05		17.06	597.37		
			19.01	597.06		21.21	596.66		19.09	596.98		
			21.09	596.62		22.11	596.25		20.40	596.86		
			22.32	595.72	TOE L	23.17	595.38	TOE L	22.90	595.97		
			22.47	595.70		24.04	595.02		23.17	595.96	TOEL	
			24.08	595.13		25.80	594.54	TW	23.55	595.28		
			25.56	594.72		26.99	594.55		25.00	594.90		
			27.02	594.71	TW	28.08	594.91	TOE R	26.00	594.57	TW	
			27.56	595.04		30.15	596.52		27.53	595.05		
			29.13	595.79	TOE R	31.52	597.13		28.14	595.87	TOER	
			31.56	597.28		32.46	597.80	R Bankfull F	29.67	597.02		
			32.72	597.79	BANKFULL	34.86	597.81		31.36	597.42		
			34.86	597.79		37.28	597.80		32.63	597.79		
			38.23	597.80		40.20	597.98		33.66	598.11	R Bankfull Right	
			40.08	598.14		40.21	598.30	RPIN	37.12	597.88		
			40.20	598.30	RPIN				40.21	598.34	RPIN	

Photo of XS-7, looking in the downstream direction



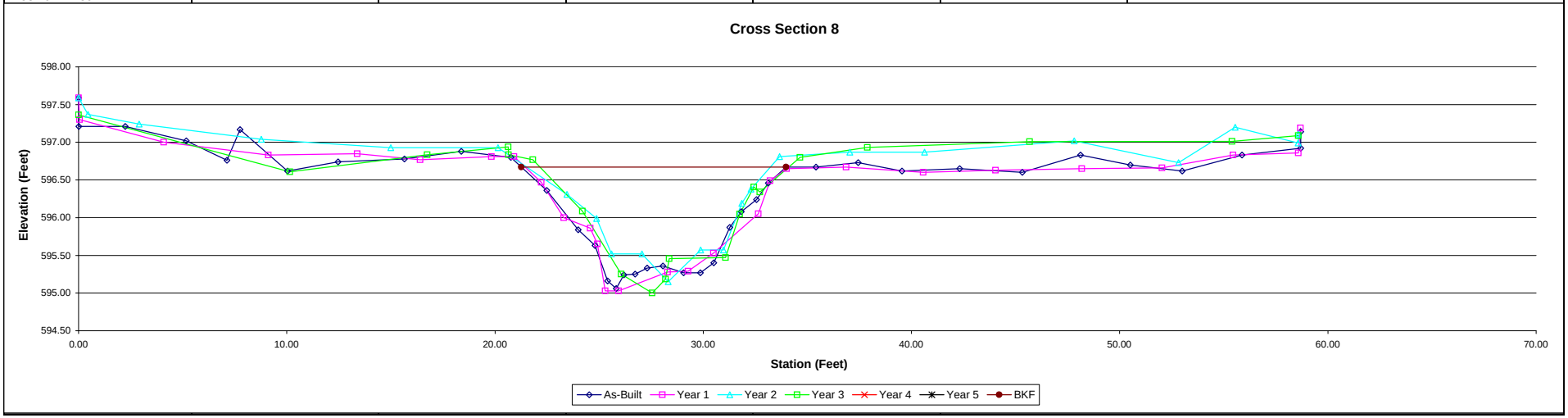
Project:	UT to Underwood Creek
Cross Section:	Cross Section 8 (CS-5 in MY-00)
Feature	Riffle
Station:	31+25
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	11.6	9.4	7.2	10.9		
W (BKF)	12.7	11.0	10.0	12.5		
Max d	1.6	1.4	1.3	1.7		
Mean d	0.9	0.9	0.7	0.9		
W/D	13.9	12.7	13.8	14.3		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
0.00	597.59	LPIN	0.00	597.59	LPIN	0.00	597.59	LPIN		597.36	LPIN	
0.01	597.21		0.05	597.30		0.45	597.37		10.15	596.61		
2.24	597.21		4.09	597.00		2.91	597.24		16.74	596.83		
5.17	597.02		9.12	596.83		8.78	597.04		20.64	596.94		
7.12	596.76		13.38	596.85		14.99	596.93		20.65	596.84	Bankfull left	
7.76	597.17		16.41	596.77		20.15	596.93	BL Bankfull	21.82	596.77		
10.04	596.62		19.83	596.81		23.46	596.31		24.20	596.09		
12.46	596.74		20.91	596.81	BANKFULL	24.88	595.99		26.06	595.25	TOE L	
15.65	596.78		22.22	596.47		25.60	595.52	TOE L	27.55	595.00	TW	
18.38	596.88		23.31	596.00		27.05	595.52		28.19	595.19		
20.76	596.80	BANKFULL	24.58	595.86		28.31	595.15	TW	28.36	595.46	TOE R	
22.48	596.36		24.91	595.65		29.87	595.57		31.07	595.47		
24.00	595.84		25.29	595.03	TOE L	30.97	595.57	TOE R	31.75	596.05		
24.80	595.63		25.94	595.03	TW	31.85	596.19		32.43	596.41	ankfull Right	
25.41	595.16	TOE L	28.29	595.28		32.29	596.38		32.72	596.34		
25.82	595.06	TW	29.27	595.29		33.67	596.81	R Bankfull F	34.65	596.80		
26.19	595.24		30.49	595.53	TOE R	37.04	596.87		37.88	596.93		
26.73	595.25		32.64	596.05		40.63	596.87		45.68	597.01		
27.31	595.33		33.21	596.49		47.82	597.02		55.39	597.01		
28.06	595.36		34.00	596.65	BANKFULL	52.83	596.73		58.58	597.09	RPIN	
29.06	595.27		36.86	596.67		55.55	597.20					
29.86	595.27		40.57	596.60		58.57	596.99					
30.51	595.40	TOE R	44.04	596.63		58.58	597.11	RPIN				
31.27	595.87		48.18	596.65								
31.83	596.08		52.03	596.66								
32.56	596.24		55.45	596.83								
33.12	596.46		58.58	596.86								
33.98	596.67	BANKFULL	58.68	597.19	RPIN							
35.42	596.67											
37.44	596.73											
39.55	596.62											
42.32	596.65											
45.33	596.60											
48.12	596.83											
50.51	596.70											
53.00	596.62											
55.88	596.83											
58.69	596.92											
58.70	597.14	RPIN										

Photo of XS-8, looking in the downstream direction



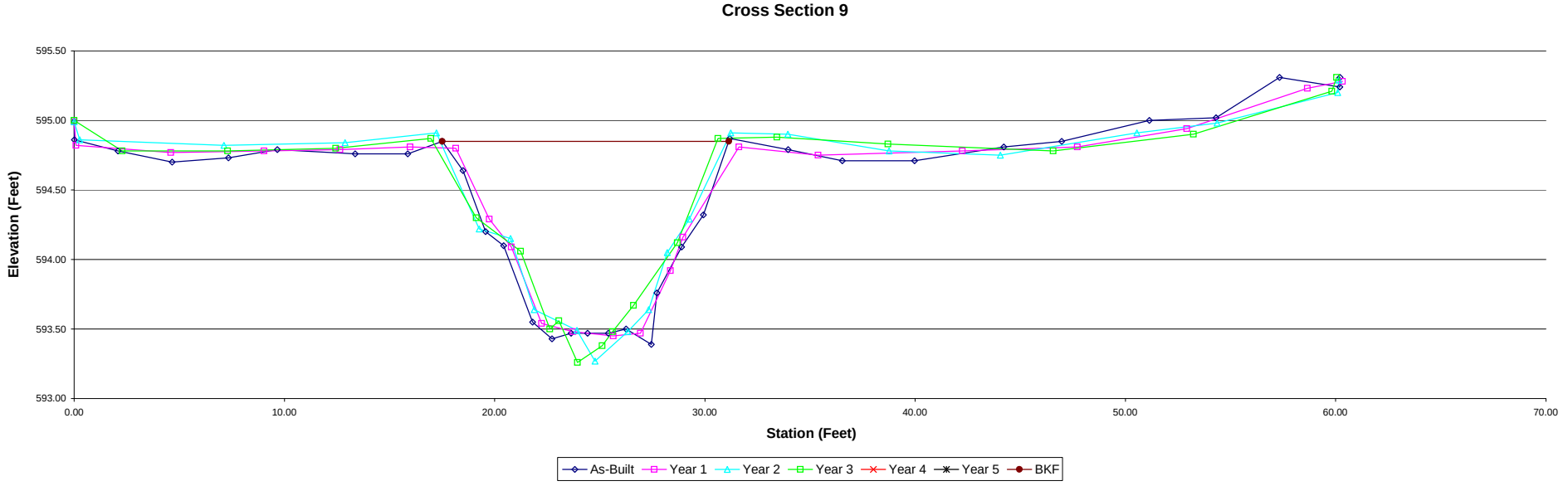
Project:	UT to Underwood Creek
Cross Section:	Cross Section 9 (CS-6 in MY-00)
Feature	Riffle
Station:	35+34
Date:	9/10/13
Crew:	SV,CC,BW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	12.8	12.1	11.8	11.4		
W (BKF)	13.6	13.5	13.6	13.5		
Max d	1.5	1.4	1.6	1.6		
Mean d	0.9	0.9	0.9	0.8		
W/D	14.5	15.0	15.7	16.0		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Static
	594.99	LPIN		594.99	LPIN	0.00	594.99	LPIN		595.00	LPIN	
0.01	594.86		0.09	594.82		0.26	594.86		2.29	594.78		
2.08	594.78		4.60	594.77		7.13	594.82		7.30	594.78		
4.66	594.70		9.03	594.78		12.89	594.84		12.44	594.80		
7.34	594.73		12.65	594.79		17.23	594.91	3L Bankfull	16.96	594.87	NKFULL LEFT	
9.67	594.79		15.98	594.81		19.27	594.22		19.13	594.30		
13.36	594.76		18.15	594.80	BANKFULL	20.76	594.15		21.24	594.06		
15.87	594.76		19.75	594.29		21.88	593.64	TOE L	22.62	593.50	TOE L	
17.51	594.85	BANKFULL	20.79	594.09		23.91	593.49		23.05	593.56		
18.49	594.64		22.23	593.54	TOE L	24.77	593.27	TW	23.94	593.26	TW	
19.57	594.20		23.72	593.48	TW	26.33	593.48		25.11	593.38		
20.43	594.10		25.65	593.45		27.32	593.64	TOE R	25.61	593.48		
21.80	593.55	TOE L	26.94	593.47	TOE R	28.21	594.05		26.61	593.67	TOE R	
22.73	593.43		28.36	593.92		29.26	594.29		28.69	594.12		
23.64	593.47		28.96	594.16		31.23	594.91	R Bankfull F	30.62	594.87	NKFULL RIGHT	
24.42	593.47	TW	31.62	594.81	BANKFULL	33.94	594.90		33.43	594.88		
25.40	593.47		35.38	594.75		38.76	594.78		38.71	594.83		
26.25	593.50		42.24	594.78		44.05	594.75		46.57	594.78		
27.45	593.39	TOE R	47.72	594.81		50.54	594.91		53.23	594.90		
27.72	593.76		52.92	594.94		54.36	594.98		59.82	595.21		
28.89	594.09		58.65	595.23		60.09	595.20		60.05	595.31	RPIN	
29.93	594.32		60.32	595.28	RPIN	60.15	595.29	RPIN				
31.18	594.87	BANKFULL RIGHT										
33.96	594.79											
36.54	594.71											
39.97	594.71											
44.21	594.81											
46.97	594.85											
51.14	595.00											
54.31	595.02											
57.33	595.31											
60.20	595.24											
60.21	595.31	RPIN										

Photo of XS-9, looking in the downstream direction



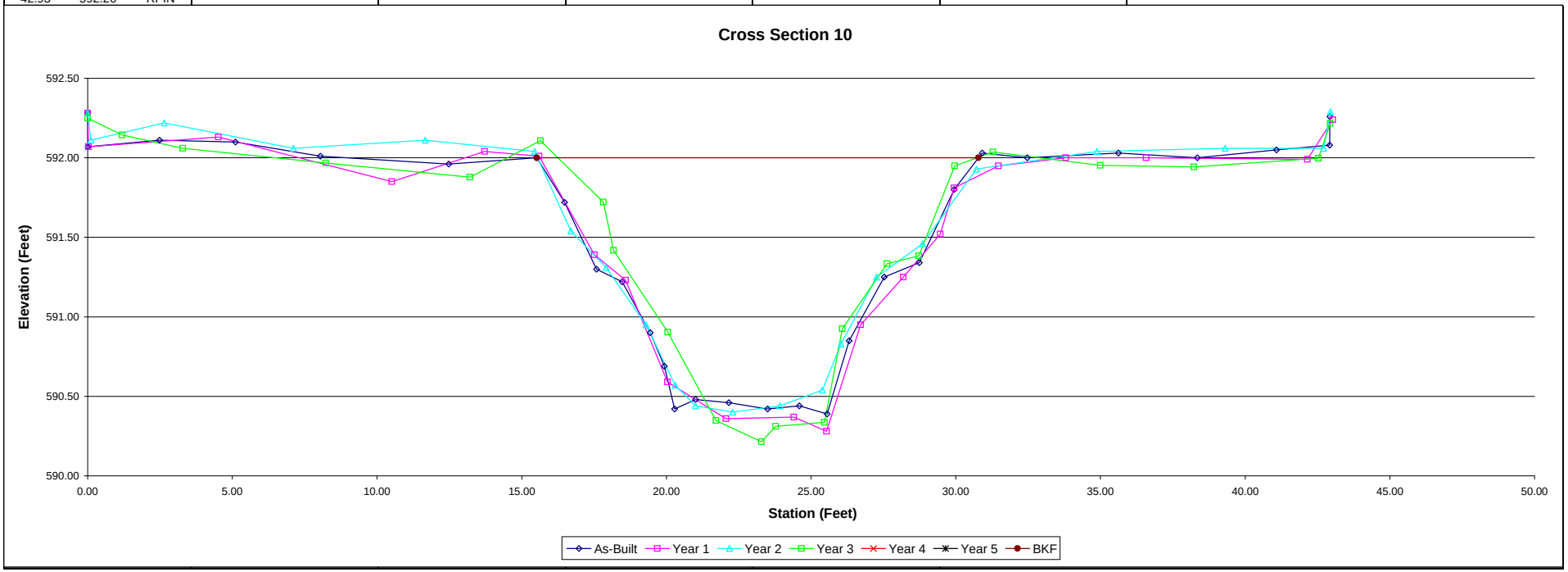
Project:	UT to Underwood Creek
Cross Section:	Cross Section 10 (CS-7 in MY-00)
Feature	Riffle
Station:	39+90
Date:	9/10/13
Crew:	SV,CC,BW

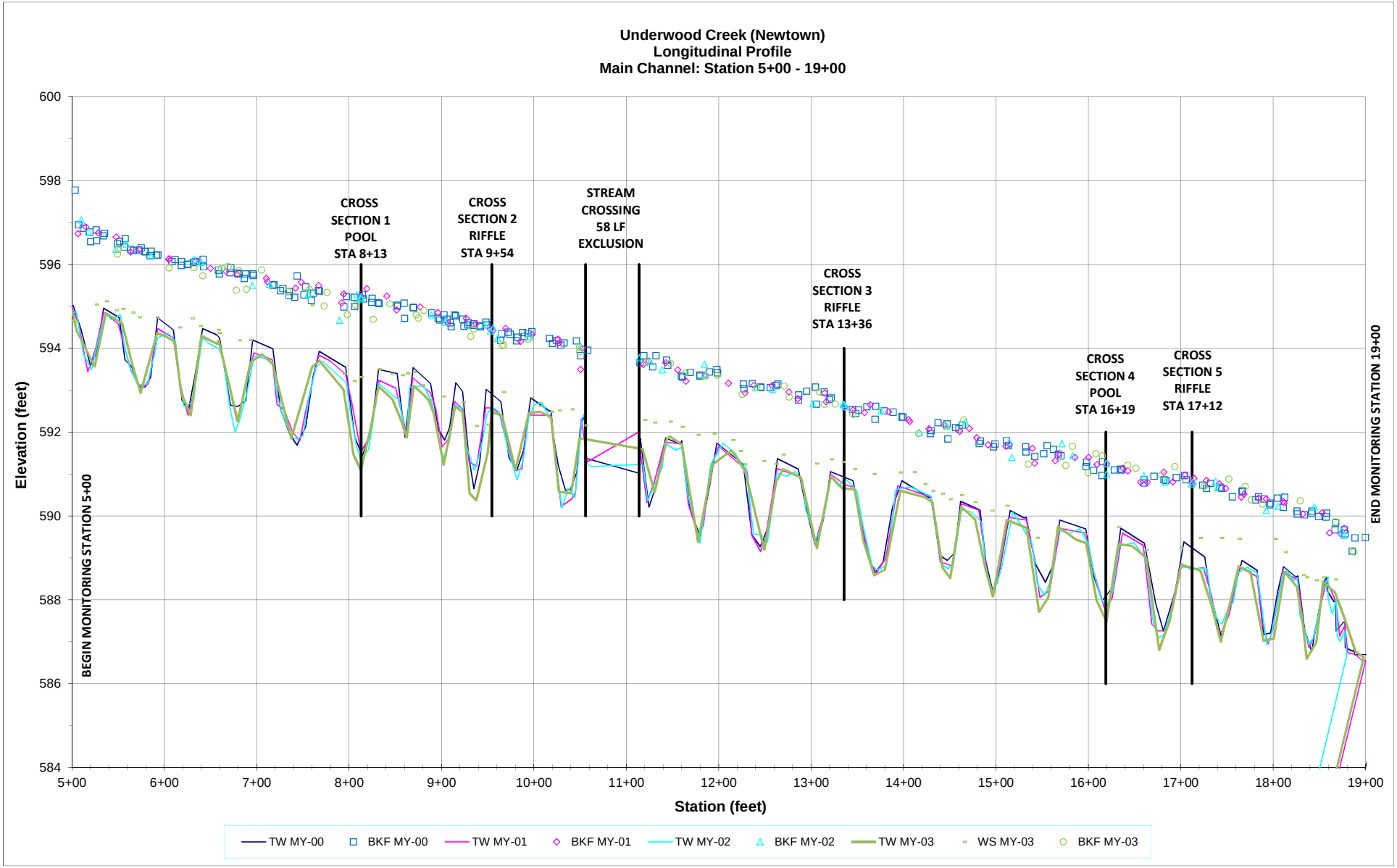
Summary (bankfull)

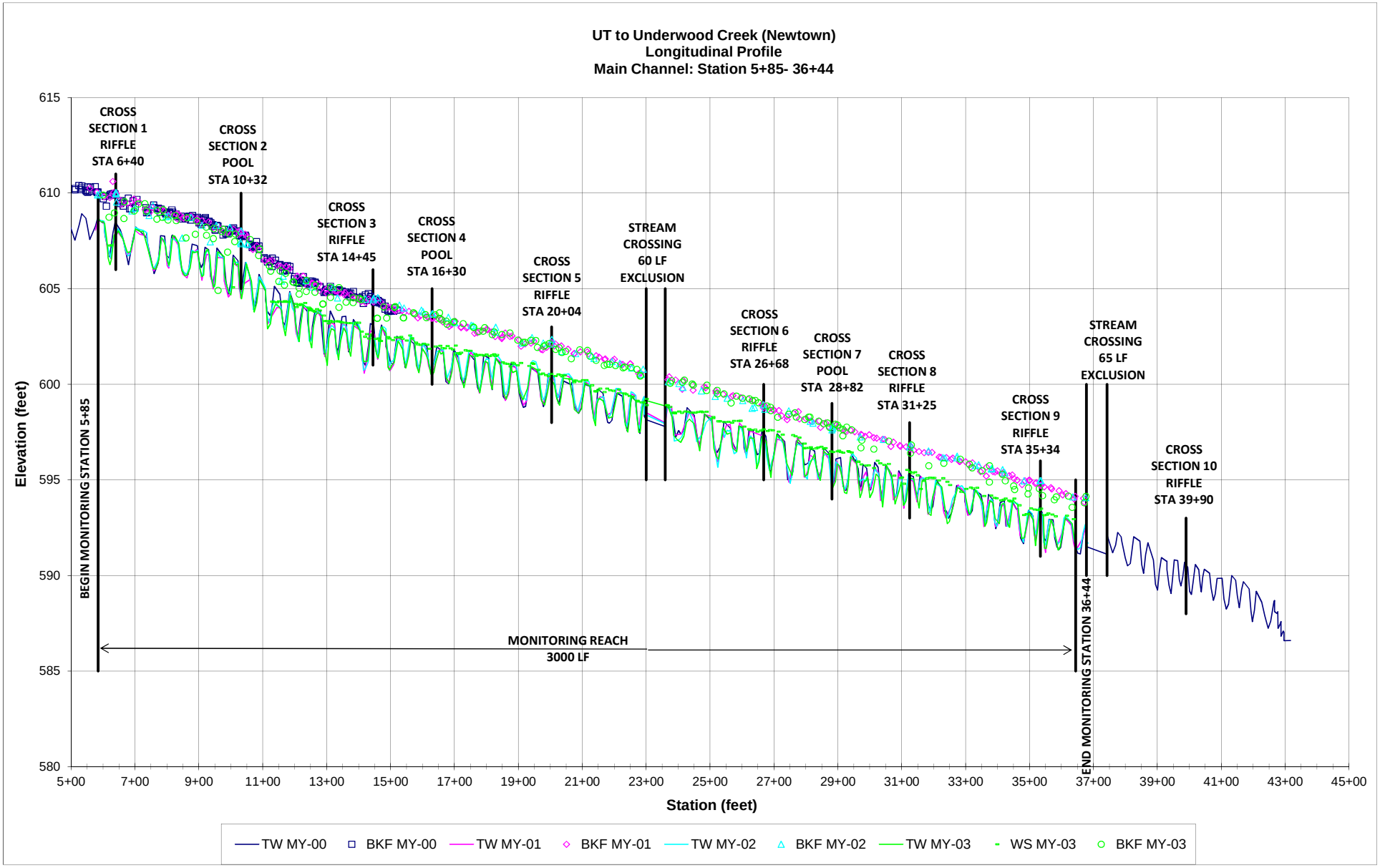
	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	15.2	14.1	13.3	12.7		
W (BKF)	15.3	15.0	14.8	14.3		
Max d	1.6	1.6	1.5	1.7		
Mean d	1.0	0.9	0.9	0.9		
W/D	15.3	15.9	16.5	16.1		

MY00-2011			MY01-2011			MY02-2012			MY03-2013			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
	592.28	LPIN		592.28	LPIN	0.00	592.28	LPIN		592.25	LPIN	
0.01	592.07		0.03	592.07		0.11	592.11		1.19	592.14		
2.48	592.11		4.52	592.13		2.64	592.22		3.29	592.06		
5.11	592.10		10.51	591.85		7.11	592.06		8.23	591.97		
8.04	592.01		13.72	592.04		11.66	592.11		13.21	591.88		
12.48	591.96		15.60	592.01	BANKFULL	15.45	592.04	BL Bankfull	15.65	592.11	Bankfull Left	
15.52	592.00	BANKFULL	17.51	591.39		16.70	591.54		17.82	591.72		
16.48	591.72		18.59	591.23		17.92	591.31		18.17	591.42		
17.58	591.30		20.04	590.59	TOE L	19.30	590.95		20.05	590.90		
18.47	591.22		22.06	590.36	TW	20.30	590.57	TOE L	21.71	590.35	TOE L	
19.44	590.90		24.40	590.37		21.01	590.44		23.28	590.21	TW	
19.93	590.69		25.53	590.28	TOE R	22.29	590.40	TW	23.78	590.31		
20.28	590.42	TOE L	26.71	590.95		23.92	590.44		25.46	590.34	TOE R	
21.01	590.48		28.19	591.25		25.39	590.54	TOE R	26.08	590.93		
22.16	590.46		29.46	591.52		26.03	590.83		27.63	591.33		
23.50	590.42	TW	29.94	591.81		27.26	591.25		28.72	591.38		
24.59	590.44		31.47	591.95	BANKFULL	28.85	591.46		29.96	591.95	ankfull Right	
25.55	590.39	TOE R	33.80	592.00		30.71	591.93	R Bankfull	31.28	592.04		
26.31	590.85		36.58	592.00		34.88	592.04		35.00	591.95		
27.53	591.25		42.15	591.99		39.31	592.06		38.23	591.94		
28.74	591.34		43.03	592.24	RPIN	42.71	592.06		42.53	592.00		
29.94	591.80					42.95	592.29	RPIN	42.94	592.22	RPIN	
30.91	592.03	BANKFULL RIGHT										
32.47	592.00											
35.62	592.03											
38.35	592.00											
41.08	592.05											
42.92	592.08											
42.93	592.26	RPIN										

Photo of XS-10, looking in the downstream direction

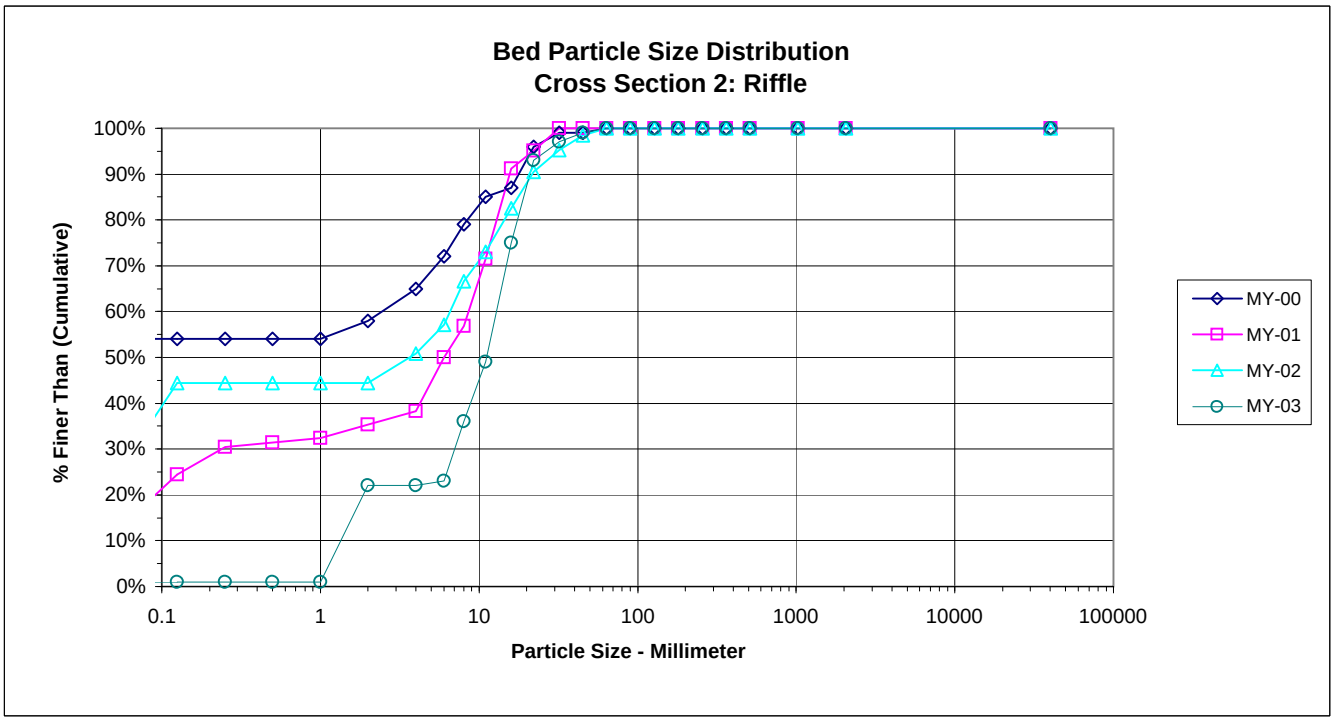



Underwood Creek (Newtown)
Longitudinal Profile
Main Channel: Station 5+00 - 19+00
Elevation (feet)
Station (feet)
600
598
596
594
592
590
588
586
584
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
19+00
BEGIN MONITORING STATION 5+00
END MONITORING STATION 19+00
CROSS SECTION 1 POOL STA 8+13
CROSS SECTION 2 RIFFLE STA 9+54
STREAM CROSSING 58 LF EXCLUSION
CROSS SECTION 3 RIFFLE STA 13+36
CROSS SECTION 4 POOL STA 16+19
CROSS SECTION 5 RIFFLE STA 17+12
TW MY-00
BKF MY-00
TW MY-01
BKF MY-01
TW MY-02
BKF MY-02
TW MY-03
WS MY-03
BKF MY-03


UT to Underwood Creek (Newtown)
Longitudinal Profile
Main Channel: Station 5+85- 36+44
Elevation (feet)
Station (feet)
615
610
605
600
595
590
585
580
5+00
7+00
9+00
11+00
13+00
15+00
17+00
19+00
21+00
23+00
25+00
27+00
29+00
31+00
33+00
35+00
37+00
39+00
41+00
43+00
45+00
CROSS SECTION 1 RIFFLE STA 6+40
CROSS SECTION 2 POOL STA 10+32
CROSS SECTION 3 RIFFLE STA 14+45
CROSS SECTION 4 POOL STA 16+30
CROSS SECTION 5 RIFFLE STA 20+04
STREAM CROSSING 60 LF EXCLUSION
CROSS SECTION 6 RIFFLE STA 26+68
CROSS SECTION 7 POOL STA 28+82
CROSS SECTION 8 RIFFLE STA 31+25
CROSS SECTION 9 RIFFLE STA 35+34
STREAM CROSSING 65 LF EXCLUSION
CROSS SECTION 10 RIFFLE STA 39+90
BEGIN MONITORING STATION 5+85
END MONITORING STATION 36+44
MONITORING REACH 3000 LF
TW MY-00
BKF MY-00
TW MY-01
BKF MY-01
TW MY-02
BKF MY-02
TW MY-03
WS MY-03
BKF MY-03

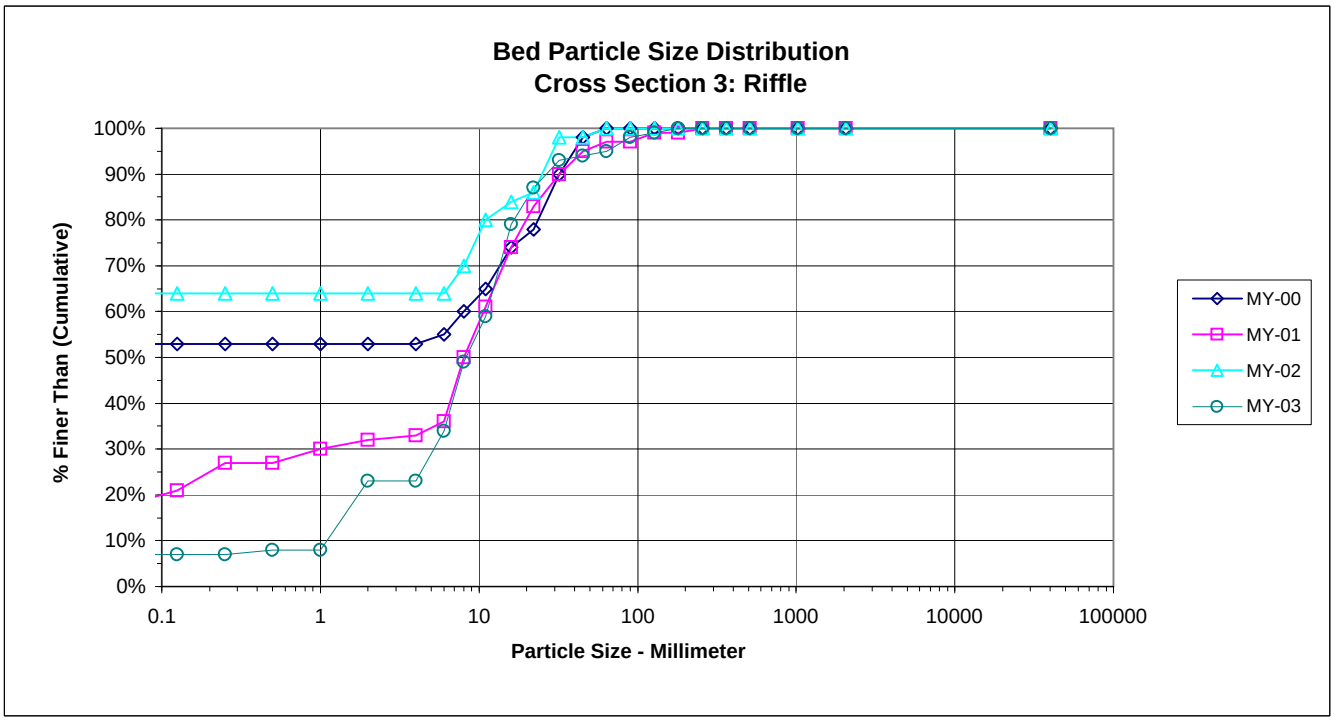
PEBBLE COUNT								
Project:	Underwood Creek					**Date:**	9/10/2013	
Location:	Cross Section #2							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	1	0	1	1%	1%
	Very Fine	.062 - .125	S		0	0	0%	1%
	Fine	.125 - .25	A		0	0	0%	1%
	Medium	.25 - .50	N		0	0	0%	1%
	Coarse	.50 - 1.0	D		0	0	0%	1%
.04 -.08	Very Coarse	1.0 - 2.0	S	21	0	21	21%	22%
.08 - .16	Very Fine	2.0 - 4.0			0	0	0%	22%
.16 - .22	Fine	4.0 - 5.7	G	1	0	1	1%	23%
.22 - .31	Fine	5.7 - 8.0	R	13	0	13	13%	36%
.31 - .44	Medium	8.0 - 11.3	A	13	0	13	13%	49%
.44 - .63	Medium	11.3 - 16.0	V	26	0	26	26%	75%
.63 - .89	Coarse	16.0 - 22.6	E	18	0	18	18%	93%
.89 - 1.26	Coarse	22.6 - 32.0	L	4	0	4	4%	97%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	2	0	2	2%	99%
1.77 - 2.5	Very Coarse	45.0 - 64.0		1	0	1	1%	100%
2.5 - 3.5	Small	64 - 90	C		0	0	0%	100%
3.5 - 5.0	Small	90 - 128	O		0	0	0%	100%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	100%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**100**	**0**	**100**	**100%**	**100%**

d16	d35	d50	d84	d95
1.7	7.8	11.2	19.0	27.0



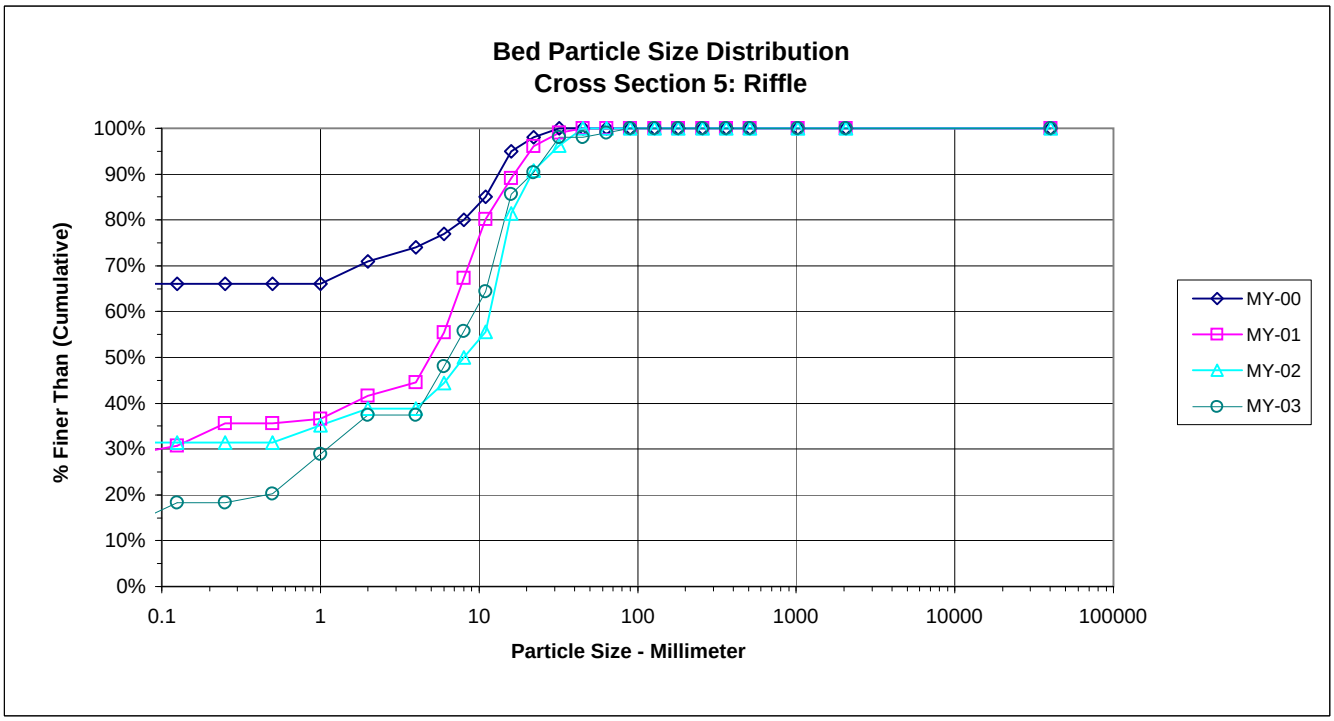
PEBBLE COUNT								
Project:	Underwood Creek					**Date:**	9/10/2013	
Location:	Cross Section #3							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	7	0	7	7%	7%
	Very Fine	.062 - .125	S		0	0	0%	7%
	Fine	.125 - .25	A		0	0	0%	7%
	Medium	.25 - .50	N	1	0	1	1%	8%
	Coarse	.50 - 1.0	D		0	0	0%	8%
.04 -.08	Very Coarse	1.0 - 2.0	S	15	0	15	15%	23%
.08 - .16	Very Fine	2.0 - 4.0			0	0	0%	23%
.16 - .22	Fine	4.0 - 5.7	G	11	0	11	11%	34%
.22 - .31	Fine	5.7 - 8.0	R	15	0	15	15%	49%
.31 - .44	Medium	8.0 - 11.3	A	10	0	10	10%	59%
.44 - .63	Medium	11.3 - 16.0	V	20	0	20	20%	79%
.63 - .89	Coarse	16.0 - 22.6	E	8	0	8	8%	87%
.89 - 1.26	Coarse	22.6 - 32.0	L	6	0	6	6%	93%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	1	0	1	1%	94%
1.77 - 2.5	Very Coarse	45.0 - 64.0		1	0	1	1%	95%
2.5 - 3.5	Small	64 - 90	C	3	0	3	3%	98%
3.5 - 5.0	Small	90 - 128	O	1	0	1	1%	99%
5.0 - 7.1	Large	128 - 180	B	1	0	1	1%	100%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**100**	**0**	**100**	**100%**	**100%**

d16	d35	d50	d84	d95
1.5	6.1	8.3	19.8	64.0



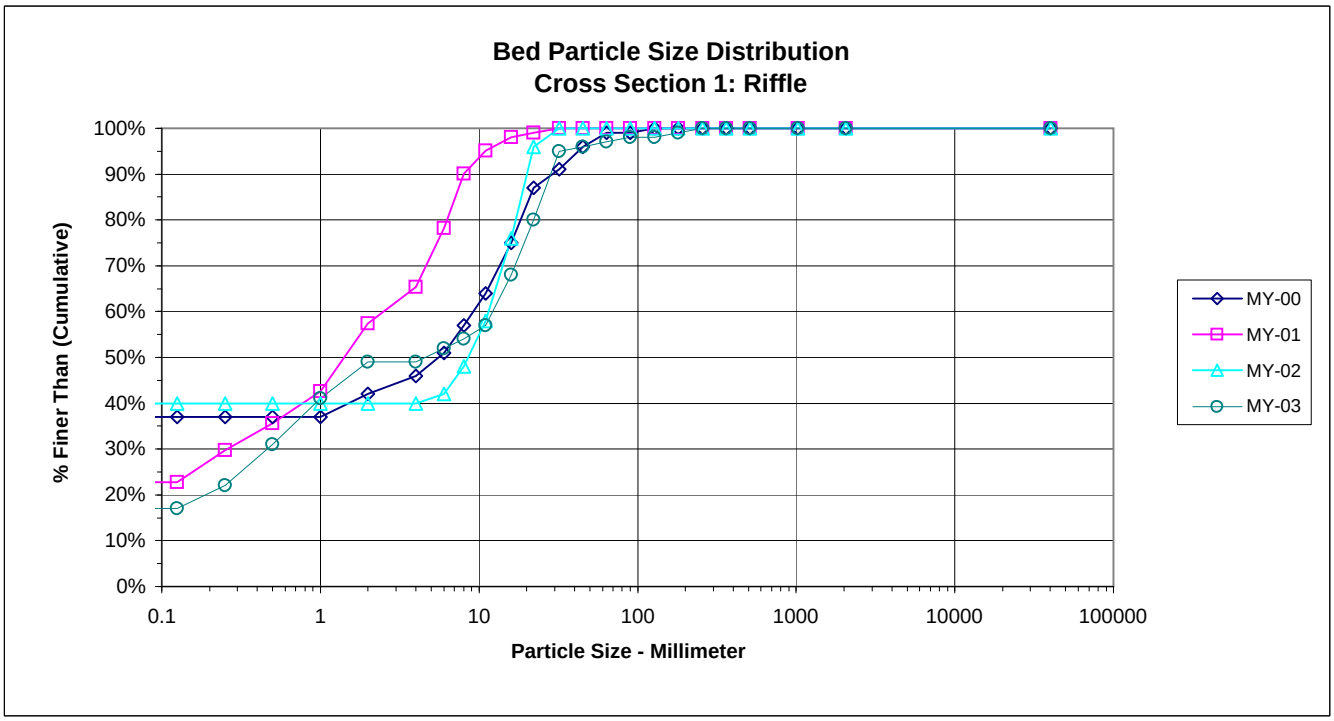
PEBBLE COUNT								
Project:	Underwood Creek					**Date:**	9/10/2013	
Location:	Cross Section #5							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	14	0	14	13%	13%
	Very Fine	.062 - .125	S	5	0	5	5%	18%
	Fine	.125 - .25	A		0	0	0%	18%
	Medium	.25 - .50	N	2	0	2	2%	20%
	Coarse	.50 - 1.0	D	9	0	9	9%	29%
.04 -.08	Very Coarse	1.0 - 2.0	S	9	0	9	9%	38%
.08 - .16	Very Fine	2.0 - 4.0			0	0	0%	38%
.16 - .22	Fine	4.0 - 5.7	G	11	0	11	11%	48%
.22 - .31	Fine	5.7 - 8.0	R	8	0	8	8%	56%
.31 - .44	Medium	8.0 - 11.3	A	9	0	9	9%	64%
.44 - .63	Medium	11.3 - 16.0	V	22	0	22	21%	86%
.63 - .89	Coarse	16.0 - 22.6	E	5	0	5	5%	90%
.89 - 1.26	Coarse	22.6 - 32.0	L	8	0	8	8%	98%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S		0	0	0%	98%
1.77 - 2.5	Very Coarse	45.0 - 64.0		1	0	1	1%	99%
2.5 - 3.5	Small	64 - 90	C	1	0	1	1%	100%
3.5 - 5.0	Small	90 - 128	O		0	0	0%	100%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	100%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**104**	**0**	**104**	**100%**	**100%**

d16	d35	d50	d84	d95
0.1	1.7	6.5	15.6	28.0



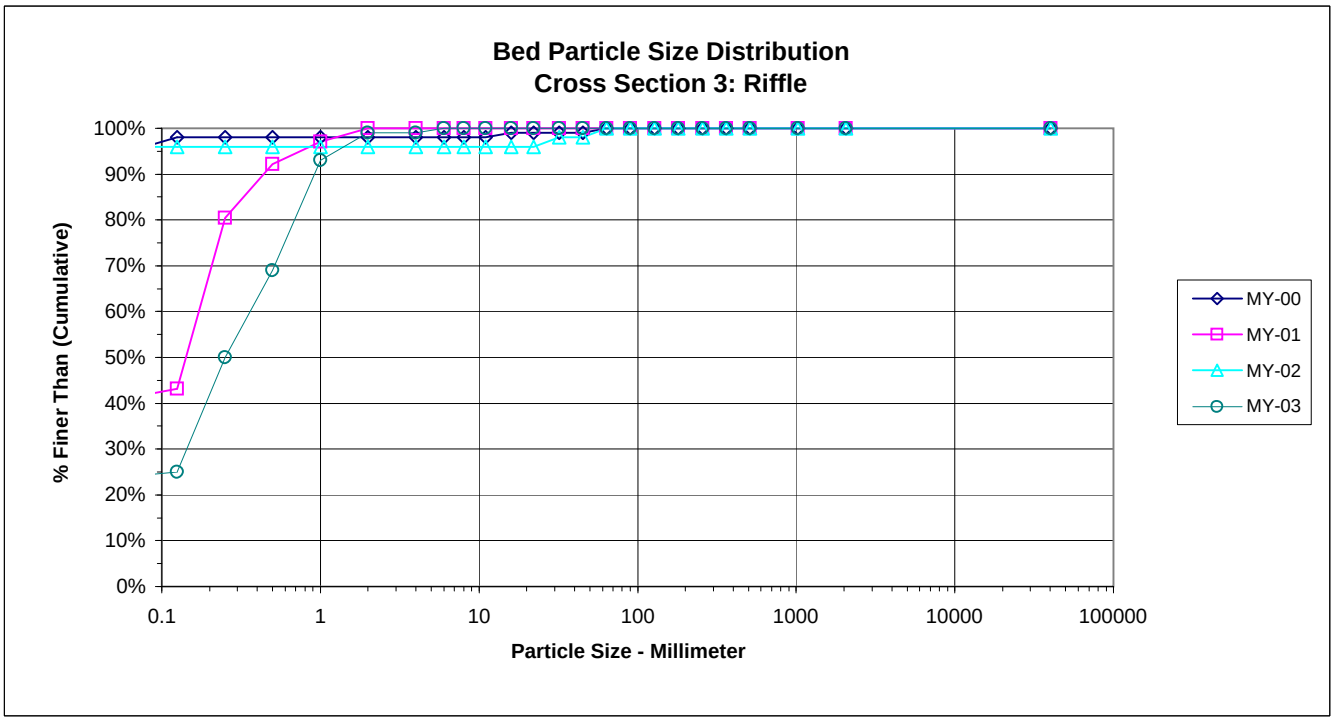
PEBBLE COUNT								
Project:	UT to Underwood Creek				**Date:**	9/10/2013		
Location:	Cross Section #1							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	17	0	17	17%	17%
	Very Fine	.062 - .125	S		0	0	0%	17%
	Fine	.125 - .25	A	5	0	5	5%	22%
	Medium	.25 - .50	N	9	0	9	9%	31%
	Coarse	.50 - 1.0	D	10	0	10	10%	41%
.04 -.08	Very Coarse	1.0 - 2.0	S	8	0	8	8%	49%
.08 - .16	Very Fine	2.0 - 4.0			0	0	0%	49%
.16 - .22	Fine	4.0 - 5.7	G	3	0	3	3%	52%
.22 - .31	Fine	5.7 - 8.0	R	2	0	2	2%	54%
.31 - .44	Medium	8.0 - 11.3	A	3	0	3	3%	57%
.44 - .63	Medium	11.3 - 16.0	V	11	0	11	11%	68%
.63 - .89	Coarse	16.0 - 22.6	E	12	0	12	12%	80%
.89 - 1.26	Coarse	22.6 - 32.0	L	15	0	15	15%	95%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	1	0	1	1%	96%
1.77 - 2.5	Very Coarse	45.0 - 64.0		1	0	1	1%	97%
2.5 - 3.5	Small	64 - 90	C	1	0	1	1%	98%
3.5 - 5.0	Small	90 - 128	O		0	0	0%	98%
5.0 - 7.1	Large	128 - 180	B	1	0	1	1%	99%
7.1 - 10.1	Large	180 - 256	L	1	0	1	1%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**100**	**0**	**100**	**100%**	**100%**

d16	d35	d50	d84	d95
0.1	0.7	4.7	24.7	32.0



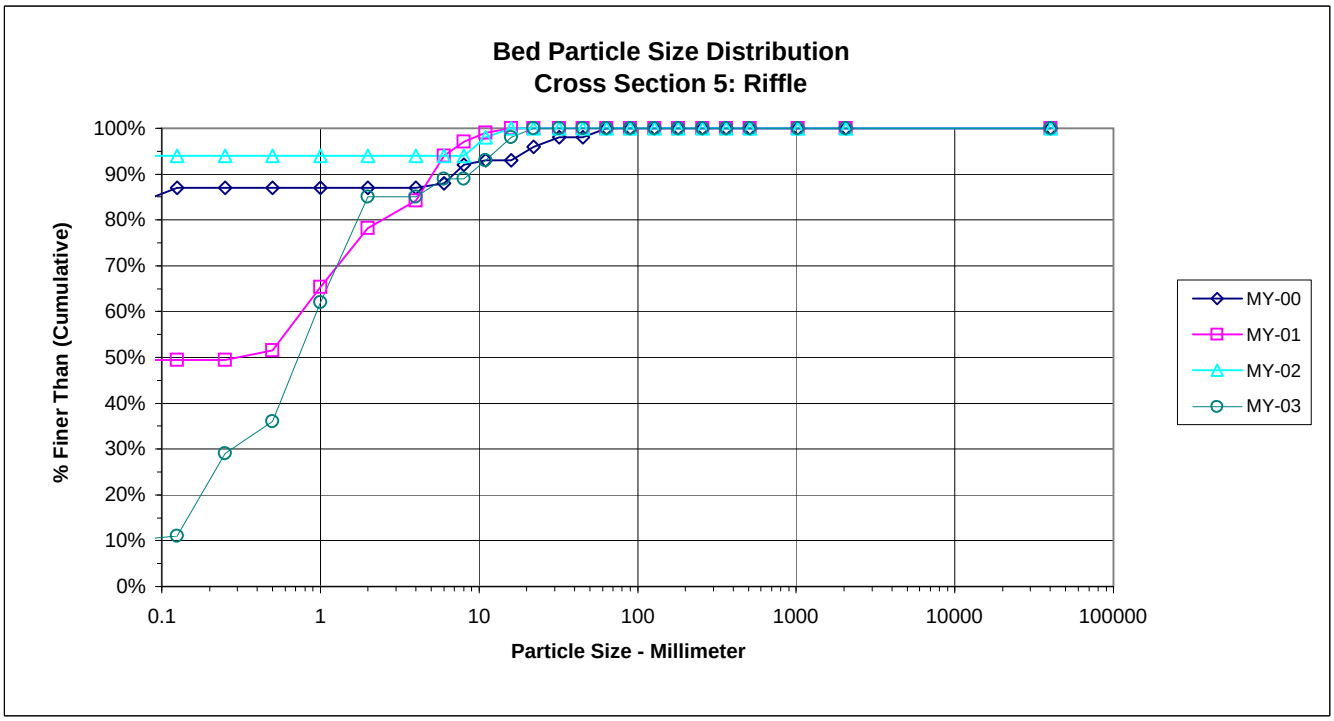
PEBBLE COUNT								
Project:	UT to Underwood Creek				**Date:**	9/10/2013		
Location:	Cross Section #3							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	24	0	24	24%	24%
	Very Fine	.062 - .125	S	1	0	1	1%	25%
	Fine	.125 - .25	A	25	0	25	25%	50%
	Medium	.25 - .50	N	19	0	19	19%	69%
	Coarse	.50 - 1.0	D	24	0	24	24%	93%
.04 -.08	Very Coarse	1.0 - 2.0	S	6	0	6	6%	99%
.08 - .16	Very Fine	2.0 - 4.0			0	0	0%	99%
.16 - .22	Fine	4.0 - 5.7	G	1	0	1	1%	100%
.22 - .31	Fine	5.7 - 8.0	R		0	0	0%	100%
.31 - .44	Medium	8.0 - 11.3	A		0	0	0%	100%
.44 - .63	Medium	11.3 - 16.0	V		0	0	0%	100%
.63 - .89	Coarse	16.0 - 22.6	E		0	0	0%	100%
.89 - 1.26	Coarse	22.6 - 32.0	L		0	0	0%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S		0	0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0			0	0	0%	100%
2.5 - 3.5	Small	64 - 90	C		0	0	0%	100%
3.5 - 5.0	Small	90 - 128	O		0	0	0%	100%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	100%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**100**	**0**	**100**	**100%**	**100%**

d16	d35	d50	d84	d95
0.1	0.0	0.3	0.8	1.3



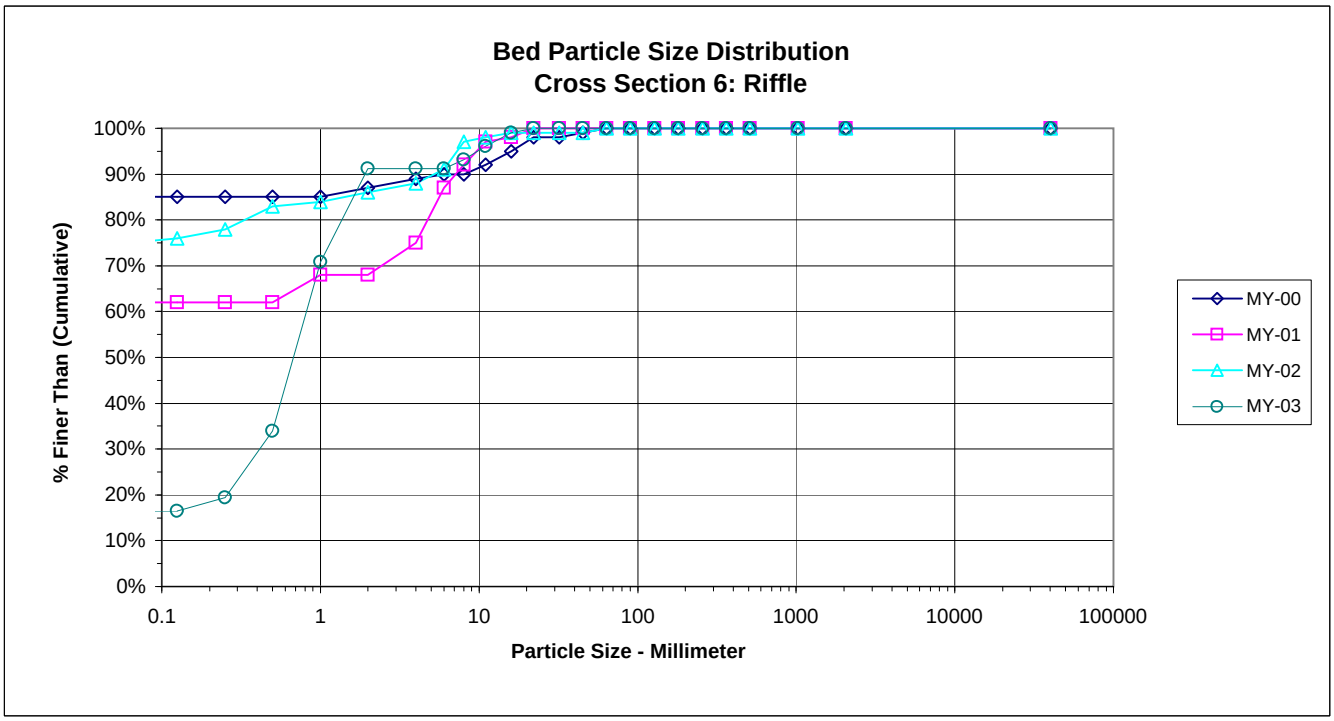
PEBBLE COUNT								
Project:	UT to Underwood Creek				**Date:**	9/10/2013		
Location:	Cross Section #5							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	10	0	10	10%	10%
	Very Fine	.062 - .125	S	1	0	1	1%	11%
	Fine	.125 - .25	A	18	0	18	18%	29%
	Medium	.25 - .50	N	7	0	7	7%	36%
	Coarse	.50 - 1.0	D	26	0	26	26%	62%
.04 -.08	Very Coarse	1.0 - 2.0	S	23	0	23	23%	85%
.08 - .16	Very Fine	2.0 - 4.0			0	0	0%	85%
.16 - .22	Fine	4.0 - 5.7	G	4	0	4	4%	89%
.22 - .31	Fine	5.7 - 8.0	R		0	0	0%	89%
.31 - .44	Medium	8.0 - 11.3	A	4	0	4	4%	93%
.44 - .63	Medium	11.3 - 16.0	V	5	0	5	5%	98%
.63 - .89	Coarse	16.0 - 22.6	E	2	0	2	2%	100%
.89 - 1.26	Coarse	22.6 - 32.0	L		0	0	0%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S		0	0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0			0	0	0%	100%
2.5 - 3.5	Small	64 - 90	C		0	0	0%	100%
3.5 - 5.0	Small	90 - 128	O		0	0	0%	100%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	100%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**100**	**0**	**100**	**100%**	**100%**

d16	d35	d50	d84	d95
Silt/Clay	0.5	0.8	2.0	13.0



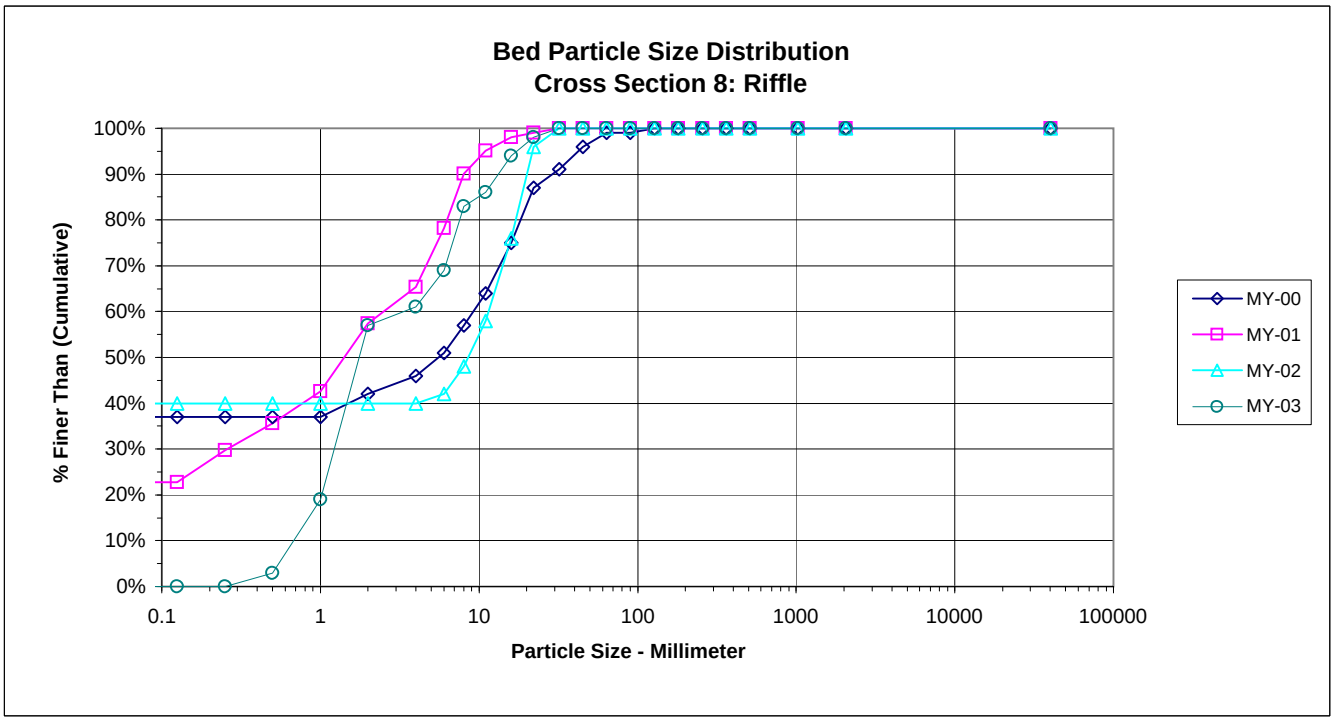
PEBBLE COUNT								
Project:	UT to Underwood Creek				**Date:**	9/10/2013		
Location:	Cross Section #6							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	17	0	17	17%	17%
	Very Fine	.062 - .125	S		0	0	0%	17%
	Fine	.125 - .25	A	3	0	3	3%	19%
	Medium	.25 - .50	N	15	0	15	15%	34%
	Coarse	.50 - 1.0	D	38	0	38	37%	71%
.04 -.08	Very Coarse	1.0 - 2.0	S	21	0	21	20%	91%
.08 - .16	Very Fine	2.0 - 4.0			0	0	0%	91%
.16 - .22	Fine	4.0 - 5.7	G		0	0	0%	91%
.22 - .31	Fine	5.7 - 8.0	R	2	0	2	2%	93%
.31 - .44	Medium	8.0 - 11.3	A	3	0	3	3%	96%
.44 - .63	Medium	11.3 - 16.0	V	3	0	3	3%	99%
.63 - .89	Coarse	16.0 - 22.6	E	1	0	1	1%	100%
.89 - 1.26	Coarse	22.6 - 32.0	L		0	0	0%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S		0	0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0			0	0	0%	100%
2.5 - 3.5	Small	64 - 90	C		0	0	0%	100%
3.5 - 5.0	Small	90 - 128	O		0	0	0%	100%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	100%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**103**	**0**	**103**	**100%**	**100%**

d16	d35	d50	d84	d95
0.1	0.5	0.7	1.6	9.8



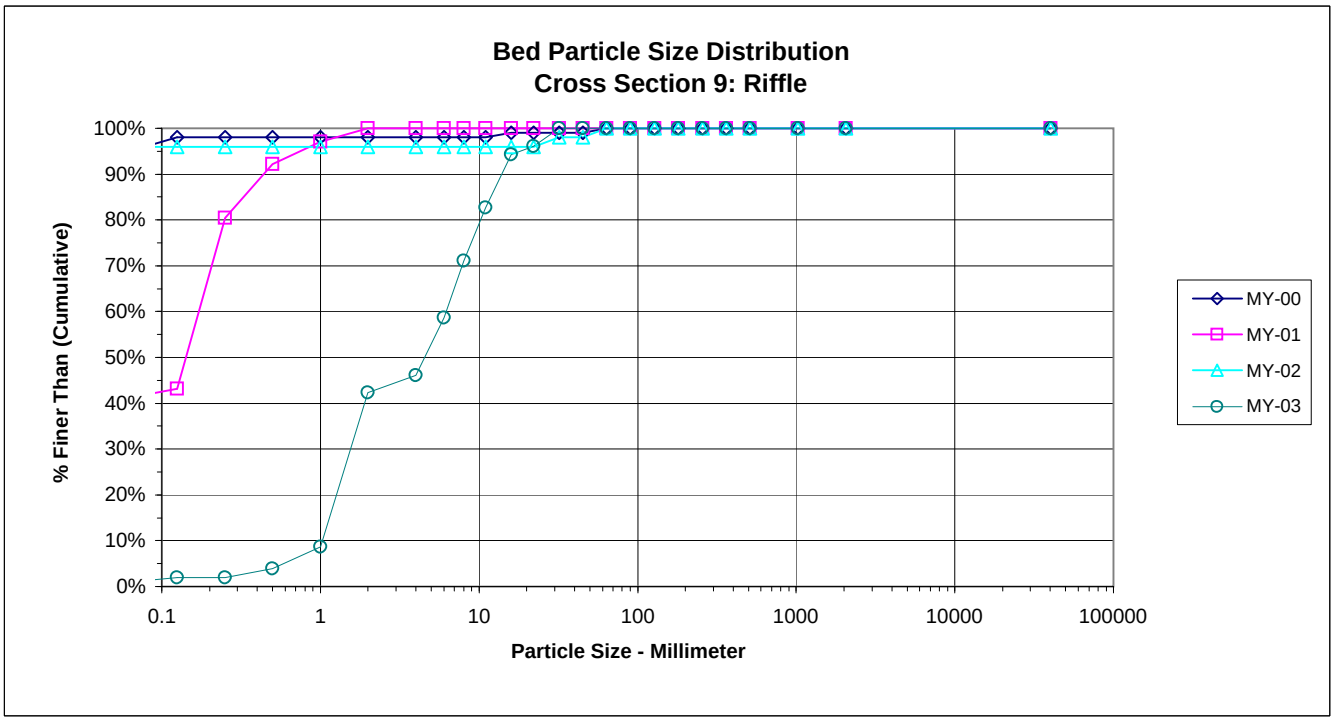
PEBBLE COUNT								
Project:	UT to Underwood Creek				**Date:**	9/10/2013		
Location:	Cross Section #8							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C		0	0	0%	0%
	Very Fine	.062 - .125	S		0	0	0%	0%
	Fine	.125 - .25	A		0	0	0%	0%
	Medium	.25 - .50	N	3	0	3	3%	3%
	Coarse	.50 - 1.0	D	16	0	16	16%	19%
.04 -.08	Very Coarse	1.0 - 2.0	S	38	0	38	38%	57%
.08 - .16	Very Fine	2.0 - 4.0		4	0	4	4%	61%
.16 - .22	Fine	4.0 - 5.7	G	8	0	8	8%	69%
.22 - .31	Fine	5.7 - 8.0	R	14	0	14	14%	83%
.31 - .44	Medium	8.0 - 11.3	A	3	0	3	3%	86%
.44 - .63	Medium	11.3 - 16.0	V	8	0	8	8%	94%
.63 - .89	Coarse	16.0 - 22.6	E	4	0	4	4%	98%
.89 - 1.26	Coarse	22.6 - 32.0	L	2	0	2	2%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S		0	0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0			0	0	0%	100%
2.5 - 3.5	Small	64 - 90	C		0	0	0%	100%
3.5 - 5.0	Small	90 - 128	O		0	0	0%	100%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	100%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**100**	**0**	**100**	**100%**	**100%**

d16	d35	d50	d84	d95
0.9	1.4	1.8	9.0	17.5



PEBBLE COUNT								
Project:	UT to Underwood Creek					**Date:**	9/10/2013	
Location:	Cross Section #9							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	1	0	1	1%	1%
	Very Fine	.062 - .125	S	1	0	1	1%	2%
	Fine	.125 - .25	A		0	0	0%	2%
	Medium	.25 - .50	N	2	0	2	2%	4%
	Coarse	.50 - 1.0	D	5	0	5	5%	9%
.04 -.08	Very Coarse	1.0 - 2.0	S	35	0	35	34%	42%
.08 - .16	Very Fine	2.0 - 4.0		4	0	4	4%	46%
.16 - .22	Fine	4.0 - 5.7	G	13	0	13	13%	59%
.22 - .31	Fine	5.7 - 8.0	R	13	0	13	13%	71%
.31 - .44	Medium	8.0 - 11.3	A	12	0	12	12%	83%
.44 - .63	Medium	11.3 - 16.0	V	12	0	12	12%	94%
.63 - .89	Coarse	16.0 - 22.6	E	2	0	2	2%	96%
.89 - 1.26	Coarse	22.6 - 32.0	L	4	0	4	4%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S		0	0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0			0	0	0%	100%
2.5 - 3.5	Small	64 - 90	C		0	0	0%	100%
3.5 - 5.0	Small	90 - 128	O		0	0	0%	100%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	100%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**104**	**0**	**104**	**100%**	**100%**

d16	d35	d50	d84	d95
1.2	1.8	4.6	11.6	18.4



PEBBLE COUNT								
Project:	UT to Underwood Creek					**Date:**	9/10/2013	
Location:	Cross Section #10							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	2	0	2	2%	2%
	Very Fine	.062 - .125	S	0	0	0	0%	2%
	Fine	.125 - .25	A	2	0	2	2%	4%
	Medium	.25 - .50	N	5	0	5	5%	9%
	Coarse	.50 - 1.0	D	10	0	10	10%	19%
.04 -.08	Very Coarse	1.0 - 2.0	S	6	0	6	6%	25%
.08 - .16	Very Fine	2.0 - 4.0			0	0	0%	25%
.16 - .22	Fine	4.0 - 5.7	G	7	0	7	7%	32%
.22 - .31	Fine	5.7 - 8.0	R	13	0	13	13%	45%
.31 - .44	Medium	8.0 - 11.3	A	10	0	10	10%	54%
.44 - .63	Medium	11.3 - 16.0	V	17	0	17	17%	71%
.63 - .89	Coarse	16.0 - 22.6	E	15	0	15	15%	86%
.89 - 1.26	Coarse	22.6 - 32.0	L	13	0	13	13%	99%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	1	0	1	1%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0			0	0	0%	100%
2.5 - 3.5	Small	64 - 90	C		0	0	0%	100%
3.5 - 5.0	Small	90 - 128	O		0	0	0%	100%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	100%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	100%
14.3 - 20	Small	362 - 512	L		0	0	0%	100%
20 - 40	Medium	512 - 1024	D		0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	100%
	Bedrock		BDRK		0	0	0%	100%
			Totals	**101**	**0**	**101**	**100%**	**100%**

d16	d35	d50	d84	d95
0.9	6.5	9.7	21.1	28.9

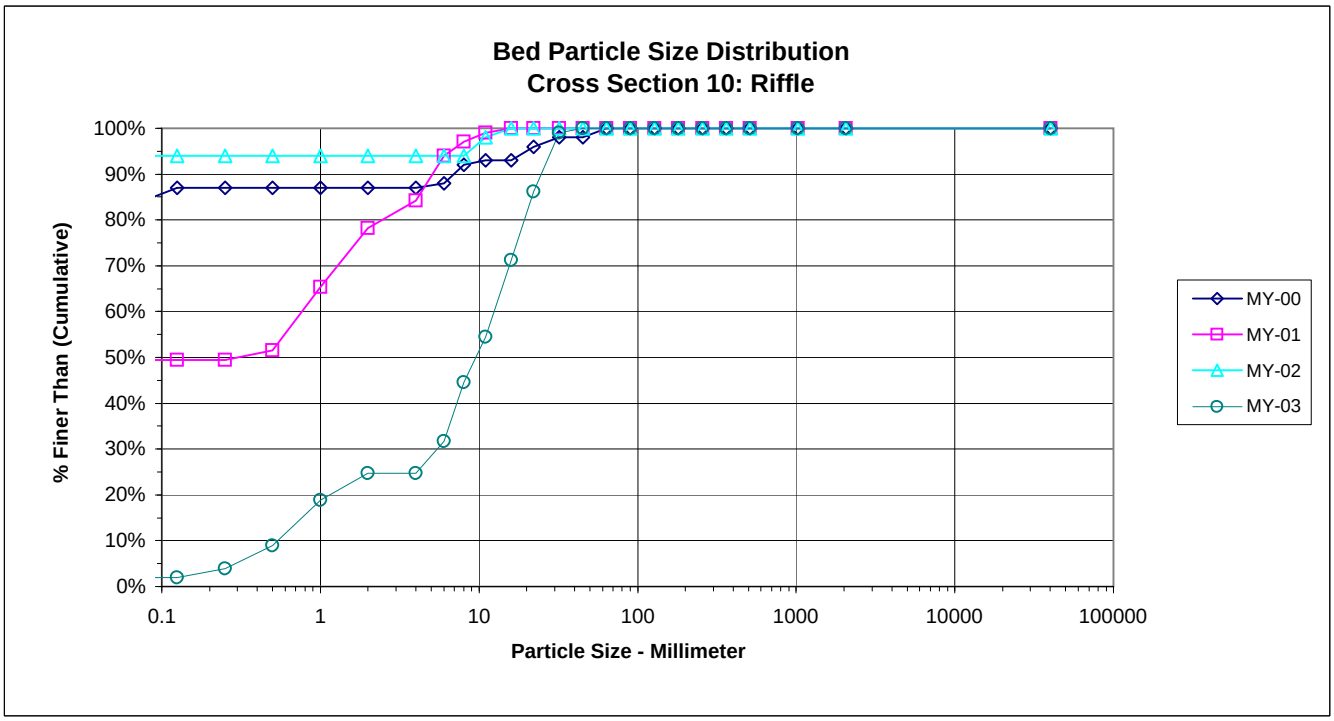


Table 10a. Baseline Stream Data Summary
Newtown - EEP# 94150 - Underwood Creek: 1273 feet

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					8.3	11.72		16.3			10	12.2		14.3				16		15.272	15.878	15.667	16.694	0.7338	3
Floodprone Width (ft)					12	58		107									130	140	250	110	158.33	140	225	59.652	3
Bankfull Mean Depth (ft)					0.93	1.16		1.29			0.92	1.12		1.34				1.06		1.0281	1.0491	1.0349	1.0842	0.0306	3
[1]Bankfull Max Depth (ft)					1.02	1.58		2.05										1.6		1.66	1.7167	1.74	1.75	0.0493	3
Bankfull Cross Sectional Area (ft^2)					10.5	13.3		19.6			12.2	13		13.4				17		15.806	16.671	16.108	18.099	1.2459	3
Width/Depth Ratio					6.5	10.42		16.8			7.7	11.3		15.6				15		14.757	15.131	15.238	15.398	0.3337	3
Entrenchment Ratio					1.47	4.65		7.71			2.9	6.5		8.6			8	9	16	7.2026	9.8721	8.9357	13.478	3.2408	3
[1]Bank Height Ratio					1.61	1.83		2.28			0.9	1		1.2				1		1	1	1	1	0	3
Profile																									
Riffle Length (ft)					6.33	37.84		106.87			4.03	14.18		23.61			10	21.696	58	7.36	20.808	20.505	31.54	5.5775	22
Riffle Slope (ft/ft)					0.0001	0.0537		0.2384			0	0.0202		0.0815			0.0069	0.0125	0.0171	0.0034	0.0132	0.0135	0.0285	0.0054	22
Pool Length (ft)					19.07	55.73		119.93			18.51	32.11		58.03			19	35.957	54	17.45	34.809	34.925	52.82	7.6111	24
Pool Max depth (ft)					2	2.31		3.1			1.7	2.47		3.1			2.4	3.5	4.5	2.76	3.4017	3.43	4.04	0.374	24
Pool Spacing (ft)					34	91		245			29	48		84			37	63	110	31.47	55.969	54.565	78.46	10.484	22
Pattern																									
Channel Beltwidth (ft)					35	47.8		56			25	40		65			34	53	86	34		53	86		
Radius of Curvature (ft)					7	47		173			20	31		122			26	41	59	26		41	59		
Rc:Bankfull width (ft/ft)					0.06	0.04		0.148			0.016	0.0255		0.037			0.016	0.0255	0.037	0.016		0.0255	0.037		
Meander Wavelength (ft)					55	113.57		245			62	85.5		99			82	112	130	82		112	130		
Meander Width Ratio					1.84	2.52		2.95			2.1	3.3		5.4			2.1	3.3	5.4	2.1		3.3	5.4		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2						0.45												0.43			0.43				
Max part size (mm) mobilized at bankfull																		60			60				
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification						incised C4/E4						E4/C4						C4			C4				
Bankfull Velocity (fps)						4.05												3.3			3.3				
Bankfull Discharge (cfs)						55																			
Valley length (ft)						1110						542													
Channel Thalweg length (ft)						1149						650						1331			1331				
Sinuosity (ft)						1.04						1.2						1.3			1.3				
Water Surface Slope (Channel) (ft/ft)						0.006						0.0065						0.0048			0.0048				
BF slope (ft/ft)						0.0071						0.0114						0.0048			0.0048				
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

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

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

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

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

Table 10a. Baseline Stream Data Summary
Newtown - EEP# 94150 - UT to Underwood Creek: 3000 feet

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					6.3	11.75		16			10	12.2		14.3				14		12.322	13.977	13.625	16.516	1.4652	7
Floodprone Width (ft)					19	109		352									95	160	220	95	172.86	135	280	76.095	7
Bankfull Mean Depth (ft)					0.73	1.12		1.56			0.92	1.12		1.34				0.98		0.8103	0.9506	0.963	1.0596	0.0775	7
[1]Bankfull Max Depth (ft)					1.1	1.92		2.6										1.4		1.46	1.6371	1.61	1.98	0.1729	7
Bankfull Cross Sectional Area (ft^2)					7.3	12.9		18.8			12.2	13		13.4				13.7		11.585	13.225	13.057	15.215	1.0894	7
Width/Depth Ratio					5.4	11.21		19.8			7.7	11.3		15.6				14.3		11.629	14.868	14.373	20.383	2.6834	7
Entrenchment Ratio					2	9.04		29.3			2.9	6.5		8.6			6.8	11	16	6.9727	12.435	8.8446	22.723	5.7683	7
[1]Bank Height Ratio					1.26	1.31		1.99			0.9	1		1.2				1		0.9419	0.979	0.9848	1	0.0254	7
Profile																									
Riffle Length (ft)					1.64	38.85		289.95			4.03	14.18		23.61			10	16.45	80	9.19	16.294	15.51	34.04	4.4599	64
Riffle Slope (ft/ft)					0.0002	0.021		0.121			0	0.0202		0.0815			0.0074	0.0158	0.057	0.0008	0.0175	0.0156	0.0556	0.011	60
Pool Length (ft)					8.87	54.34		435			18.51	32.11		58.03			14	30.242	53	19.68	30.254	28.74	51.91	7.7476	65
Pool Max depth (ft)					1.3	2.57		4.8			1.7	2.47		3.1			2.1	2.8	3.9	2.42	2.9651	2.92	3.68	0.2746	65
Pool Spacing (ft)					8.5	105		752			29	48		84			32	55	97	31.79	46.166	44.57	80.51	9.6963	63
Pattern																									
Channel Beltwidth (ft)					40	43.75		51			25	40		65			30	46	76	30		46	76		
Radius of Curvature (ft)					2.4	23		169			20	31		122			23	36	52	23		36	52		
Rc:Bankfull width (ft/ft)					0.002	0.0197		0.144			0.016	0.0255		0.037			0.016	0.0255	0.037	0.016		0.0255	0.037		
Meander Wavelength (ft)					80	126.5		190			62	85.5		99			72	98	113	72		98	113		
Meander Width Ratio					7.71	1.87		2.18			2.1	3.3		5.4			2.1	3.3	5.4	2.1		3.3	5.4		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2						0.41												0.28			0.28				
Max part size (mm) mobilized at bankfull																		38			38				
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification						incised C4/E4 w/sections of G4						E4/C4						C4			C4				
Bankfull Velocity (fps)						3.19												3.07			3.07				
Bankfull Discharge (cfs)						42																			
Valley length (ft)						3506						542													
Channel Thalweg length (ft)						4097						650						4100			4100				
Sinuosity (ft)						1.17						1.2						1.3			1.3				
Water Surface Slope (Channel) (ft/ft)						0.0054						0.0065						0.0048			0.0048				
BF slope (ft/ft)						0.0063						0.0114						0.0048			0.0048				
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

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

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

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

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

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Newtown - EEP# 94150 - Underwood Creek: 1273 feet

Parameter	Pre-Existing Condition							Reference Reach(es) Data						
[1]Ri% / Ru% / P% / G% / S%	38%	6%	48%	8%				28%	4%	60%	8%			
[1]SC% / Sa% / G% / C% / B% / Be%	2.16%	4.95%	81.62%	9.12%	0.43%	1.72%		0.91%	3%	81.59%	14%	0%	0.50%	
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	8.15	19.25	27.75	58.65	105.10			11.59	20.73	29.25	60.76	82.68		
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10														
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0														

Parameter	Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	36%		59%		2%			24%		43%		2%		
[1]SC% / Sa% / G% / C% / B% / Be%														
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)														
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10														
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0														

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

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary. The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions. ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design survey), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-constrution distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section surveys and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a m

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Newtown - EEP# 94150 - UT to Underwood Creek: 3000 feet

Parameter	Pre-Existing Condition							Reference Reach(es) Data						
[1]Ri% / Ru% / P% / G% / S%	39%	2%	53%	4%				28%	4%	60%	8%			
[1]SC% / Sa% / G% / C% / B% / Be%	0%	2%	92.81%	4.72%	0.47%	0%		0.9%	3%	81.6%	14.0%	0%	0.5%	
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	12.70	19.80	24.50	43.05	60.50			11.59	20.73	29.25	60.76	82.68		
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10														
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0														

Parameter	Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	34%		64%		1%			34%		64%		1%		
[1]SC% / Sa% / G% / C% / B% / Be%														
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)														
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10														
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0														

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

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosely built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary. The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions. ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design survey), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-constrution distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section surveys and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Newtown - EEP# 94150 - Underwood Creek: 1273 feet

	Cross Section 1 (Pool) [New for MY-01]							Cross Section 2 (Riffle) [CS-1 in MY-00]							Cross Section 3 (Riffle) [CS-2 in MY-00]						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	N/A	595.25	595.25	595.25				594.36	594.36	594.36	594.36				592.56	592.56	592.56	592.56			
Bankfull Width (ft)	N/A	17.4132	17.2994	16.20				15.67	16.1383	16.5208	16.75				16.69	19.3302	17.1858	16.83			
Floodprone Width (ft)	N/A	205	205	205				140	140	140	140				225	225	225	225			
Bankfull Mean Depth (ft)	N/A	1.80387	1.90705	2.06				1.03	1.13501	1.11225	1.06				1.08	1.04954	1.08934	1.02			
Bankfull Max Depth (ft)	N/A	3.71	3.84	3.98				1.74	1.83	1.96	1.84				1.75	1.89	1.78	1.9			
Bankfull Cross Sectional Area (ft^2)	N/A	31.4112	32.9907	33.40				16.11	18.3172	18.3753	17.70				18.10	20.2878	18.7211	17.16			
Bankfull Width/Depth Ratio	N/A	9.65324	9.07129	7.86				15.24	14.2187	14.8535	15.85				15.40	18.4178	15.7764	16.5			
Bankfull Entrenchment Ratio	N/A	11.7727	11.8501	12.65				8.94	8.67499	8.47416	8.36				13.48	11.6398	13.0922	13.37			
Bankfull Bank Height Ratio	N/A	1	0.99479	0.93				1.00	1.01093	0.93367	1.02				1.00	0.97884	0.95506	0.97			
Cross Sectional Area between end pins (ft^2)	N/A	82.7397	83.8882	88.73				39.17	40.6695	41.3709	37.31				33.48	36.1303	36.2383	34.73			
d50 (mm)	N/A	N/A	N/A	N/A				Silt	6	3.8	11.2				Silt	8	0.1	8.3			

	Cross Section 4 (Pool) [New for MY-01]							Cross Section 5 (Riffle) [CS-3 in MY-00]						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	N/A	591.25	591.25	591.25				590.75	590.75	590.75	590.75			
Bankfull Width (ft)	N/A	22.7747	21.8311	23.88				15.27	15.1116	26.4612	16.19			
Floodprone Width (ft)	N/A	180	180	180				110	110	110	110			
Bankfull Mean Depth (ft)	N/A	1.48487	1.53167	1.41				1.04	1.15674	0.74409	1.25			
Bankfull Max Depth (ft)	N/A	3.43	3.31	3.36				1.66	2.06	2.1	2.53			
Bankfull Cross Sectional Area (ft^2)	N/A	33.8175	33.4381	33.57				15.88	17.4802	19.6896	20.27			
Bankfull Width/Depth Ratio	N/A	15.3379	14.2532	16.99				14.69	13.064	35.5616	12.93			
Bankfull Entrenchment Ratio	N/A	7.90349	8.2451	7.54				7.20	7.27916	4.15704	6.79			
Bankfull Bank Height Ratio	N/A	0.97959	1.02115	0.97				1.00	1.00485	0.98095	0.955			
Cross Sectional Area between end pins (ft^2)	N/A	65.0698	68.305	68.55				34.16	35.7582	38.1268	37.96			
d50 (mm)	N/A	N/A	N/A	N/A				Silt	5	8	6.5			

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

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Newtown - EEP# 94150 - UT to Underwood Creek: 3000 feet

	Cross Section 1 (Riffle) [CS-1 in MY-00]							Cross Section 2 (Pool) [New for MY-01]							Cross Section 3 (Riffle) [CS-2 in MY-00]							Cross Section 4 (Pool) [New for MY-01]							Cross Section 5 (Riffle) [CS-3 in MY-00]						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	609.86	609.86	609.86	609.78				N/A	607.92	607.92	607.92				604.51	604.51	604.51	604.51				N/A	603.49	603.49	603.49				601.91	601.91	601.91	601.91			
Bankfull Width (ft)	12.32	12.1781	12.61	11.99				N/A	18.4942	34.6182	24.13				16.52	17.1657	11.9	13.67				N/A	17.5195	16.64	13.89				13.99	14.2403	14.2956	14.93			
Floodprone Width (ft)	280	280	280	280				N/A	190	190	190				245	245	245	245				N/A	190	190	190				230	230	230	230			
Bankfull Mean Depth (ft)	1.06	1.08101	0.99345	1.04				N/A	1.64521	0.92427	1.3				0.81	0.76829	1.09414	0.85				N/A	1.41475	1.49962	1.3				0.97	0.93924	0.94396	0.81			
Bankfull Max Depth (ft)	1.98	2	2.01	1.94				N/A	3.38	3.32	3.45				1.72	1.65	1.92	2.12				N/A	2.76	2.81	2.98				1.58	1.54	1.66	1.71			
Bankfull Cross Sectional Area (ft^2)	13.06	13.1646	12.5275	12.5				N/A	30.4269	31.9966	31.42				13.38	13.1883	13.0203	11.64				N/A	24.7857	24.9536	18.13				13.61	13.3751	13.4945	12.05			
Bankfull Width/Depth Ratio	11.63	11.2655	12.6931	11.5				N/A	11.2412	37.4546	18.53				20.38	22.3426	10.8761	16.05				N/A	12.3835	11.0962	10.65				14.37	15.1615	15.1442	18.51			
Bankfull Entrenchment Ratio	22.72	22.9921	22.2046	23.35				N/A	10.2735	5.48844	7.87				14.83	14.2726	20.5882	17.92				N/A	10.845	11.4183	13.68				16.45	16.1513	16.0889	15.4			
Bankfull Bank Height Ratio	0.98	0.955	1.0597	1				N/A	1	0.99096	0.97				0.94	0.96	0.96875	1				N/A	0.98913	0.98577	0.97				1.00	1.00649	0.98193	0.99			
Cross Sectional Area between end pins (ft^2)	57.18	57.0575	59.3436	54.42				N/A	43.2436	44.0703	44.07				31.77	30.81	30.7878	36.31				N/A	37.4425	37.4902	32.5				24.19	24.079	24.7074	24.62			
d50 (mm)	5.60	1.5	8.6	4.7				N/A	N/A	N/A	N/A				Silt	0.10	0.1	0.3				N/A	N/A	N/A	N/A				Silt	0.3	0.1	0.8			
	Cross Section 6 (Riffle) [CS-4 in MY-00]							**Cross Section 7 (Pool) [New for MY-01]**							**Cross Section 8 (Riffle) [CS-5 in MY-00]**							**Cross Section 9 (Riffle) [CS-6 in MY-00]**							**Cross Section 10 (Riffle-NOT in Monitoring Reach) [CS-7 in MY-00]**						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	598.86	598.86	598.86	598.86	598.86	598.86		N/A	597.79	597.79	597.79				596.67	596.67	596.67	596.67				594.85	594.85	594.85	594.85				592.00	592	592	592			
Bankfull Width (ft)	13.42	12.3768	11.7113	13.38				N/A	17.5	18.0805	17.67				12.71	10.9641	9.97303	12.49				13.62	13.47	13.632	13.53				15.26	17.8611	14.7913	14.31			
Floodprone Width (ft)	115	115	115	115				N/A	180	180	180				110	110	110	110				95	95	95	95				135	135	135	135			
Bankfull Mean Depth (ft)	0.96	0.95074	0.881	1.04				N/A	1.53518	1.53213	1.55				0.91	0.88145	0.72229	0.87				0.94	0.90062	0.86565	0.84				1.00	0.85914	0.89803	0.89			
Bankfull Max Depth (ft)	1.50	1.38	1.62	1.7				N/A	3.08	3.25	3.38				1.61	1.44	1.32	1.67				1.46	1.4	1.58	1.59				1.61	1.72	1.5	1.69			
Bankfull Cross Sectional Area (ft^2)	12.92	11.7671	10.3176	13.94				N/A	26.8657	27.7017	27.39				11.59	9.66431	7.2034	10.9				12.80	12.1313	11.8005	11.43				15.22	15.3453	13.283	12.71			
Bankfull Width/Depth Ratio	13.93	13.018	13.2933	12.84				N/A	11.3993	11.8009	11.4				13.95	12.4387	13.8075	14.31				14.50	14.9564	15.7476	16.02				15.31	20.7895	16.4708	16.11			
Bankfull Entrenchment Ratio	8.57	9.29159	9.81958	8.6				N/A	10.2857	9.95547	10.19				8.65	10.0328	11.0297	8.81				6.97	7.05271	6.96892	7.02				8.84	7.55831	9.127	9.43			
Bankfull Bank Height Ratio	1.00	1.08696	1.19753	1.03				N/A	0.97727	0.94769	1.05				1.00	1.125	1.25758	1.08				0.95	0.94286	1.03797	1.01				0.98	0.92442	1.02	0.98			
Cross Sectional Area between end pins (ft^2)	43.35	36.1685	33.3235	38.48				N/A	43.0746	44.0268	39.66				46.57	38.0631	34.7665	32.28				31.80	30.4305	28.7662	30				25.97	24.7681	25.0001	24.08			
d50 (mm)	Silt	0.1	0.1	0.7				N/A	N/A	N/A	N/A				Silt	4.4	1.4	1.8				Silt	2	7.4	4.6				Silt	4.8	0.7	9.7			

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

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Newtown - EEP# 94150 - Underwood Creek: 1273 feet

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	15.272	15.878	15.667	16.694	0.7338	3	15.112	16.86	16.138	19.33	2.1999	3	16.521	20.056	17.186	26.461	5.5571	3	16.19	16.59	16.75	16.83	0.35	3												
Floodprone Width (ft)	110	158.33	140	225	59.652	3	110	158.33	140	225	59.652	3	110	158.33	140	225	59.652	3	110	158.3	140	225	59.65	3												
Bankfull Mean Depth (ft)	1.0281	1.0491	1.0349	1.0842	0.0306	3	1.0495	1.1138	1.135	1.1567	0.0567	3	0.7441	0.9819	1.0893	1.1123	0.2063	3	1.02	1.11	1.06	1.25	0.12	3												
[1]Bankfull Max Depth (ft)	1.66	1.7167	1.74	1.75	0.0493	3	1.83	1.9267	1.89	2.06	0.1193	3	1.78	1.9467	1.96	2.1	0.1604	3	1.84	2.09	1.9	2.53	0.39	3												
Bankfull Cross Sectional Area (ft^2)	15.806	16.671	16.108	18.099	1.2459	3	17.48	18.695	18.317	20.288	1.4414	3	18.375	18.929	18.721	19.69	0.6813	3	17.16	18.38	17.7	20.27	1.66	3												
Width/Depth Ratio	14.757	15.131	15.238	15.398	0.3337	3	13.064	15.233	14.219	18.418	2.8175	3	14.853	22.064	15.776	35.562	11.699	3	12.93	15.1	15.85	16.5	1.9	3												
Entrenchment Ratio	7.2026	9.8721	8.9357	13.478	3.2408	3	7.2792	9.198	8.675	11.64	2.2269	3	4.157	8.5745	8.4742	13.092	4.4684	3	6.79	9.51	8.36	13.37	3.43	3												
[1]Bank Height Ratio	1	1	1	1	0	3	0.9788	0.9982	1.0049	1.0109	0.017	3	0.9337	0.9566	0.9551	0.981	0.0237	3	0.950	0.980	0.970	1.020	0.030	3												
Profile																																				
Riffle Length (ft)	7.36	20.808	20.505	31.54	5.5775	22	8.58	21.4	19.56	35.95	6.1111	22	7.34	22.884	22.73	38.3	7.2336	21	8.09	19.46739	18.64	34.57	6.742777	23												
Riffle Slope (ft/ft)	0.0034	0.0132	0.0135	0.0285	0.0054	22	0.0004	0.0112	0.0100	0.0284	0.0068	22	0.0005	0.0095	0.0101	0.0349	0.0075	21	0.00459	0.014253	0.01208	0.03393	0.00754	23												
Pool Length (ft)	17.45	34.809	34.925	52.82	7.6111	24	18.27	34.33	32.865	50.34	7.2143	24	11.35	33.02	33.105	46.16	7.1733	24	23.11	35.23042	34.185	53.41	7.629916	24												
Pool Max depth (ft)	2.76	3.4017	3.43	4.04	0.374	24	2.91	3.5154	3.515	3.94	0.2514	24	2.95	5.68	3.72	52.99	10.08	24	2.86	3.604167	3.57	4.21	0.366368	24												
Pool Spacing (ft)	31.47	55.969	54.565	78.46	10.484	22	37.01	57.451	55.8	92.83	13.993	23	33.03	56.567	53.365	92.77	13.478	22	35.5	57.02826	53.96	90.26	13.98921	23												
Pattern																																				
Channel Beltwidth (ft)	34		53	86																																
Radius of Curvature (ft)	26		41	59																																
Rc:Bankfull width (ft/ft)	0.016		0.0255	0.037																																
Meander Wavelength (ft)	82		112	130																																
Meander Width Ratio	2.1		3.3	5.4																																

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

Additional Reach Parameters																																				
Rosgen Classification	C4						C4						C4						C4																	
Channel Thalweg length (ft)	1331						1331						1331						1331																	
Sinuosity (ft)	1.3						1.3						1.3						1.3																	
Water Surface Slope (Channel) (ft/ft)	0.0048						0.00485						0.00418						0.0048																	
BF slope (ft/ft)	0.0048						0.00522						0.00550						0.0047																	
[3]Ri% / Ru% / P% / G% / S%	24%		43%		2%		36%		64%		2%		38%		62%				**34%**		**64%**		**0%**													
[3]SC% / Sa% / G% / C% / B% / Be%													41%	8%	51%	0%	0%	0%	**7%**	**20%**	**71%**	**2%**	**0%**	**0%**												
[3]d16 / d35 / d50 / d84 / d95 /													0.0855	0.3944	3.9537	16.912	30.222		**1.12**	**5.23**	**8.66**	**18.13**	**39.67**													
[2]% of Reach with Eroding Banks	0						3%						0%						0%																	
Channel Stability or Habitat Metric																																				
Biological or Other																																				

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

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Newtown - EEP# 94150 - UT to Underwood Creek: 3000 feet

Parameter	Baseline*						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	12.322	13.977	13.625	16.516	1.4652	7	10.964	13.399	12.923	17.166	2.1617	6	9.973	12.354	12.255	14.296	1.5334	6	11.99	13.33	13.46	14.93	1.02	6												
Floodprone Width (ft)	95	172.86	135	280	76.095	7	95	179.17	172.5	280	81.328	6	95	179.17	172.5	280	81.328	6	95	179.2	172.5	280	81.33	6												
Bankfull Mean Depth (ft)	0.8103	0.9506	0.963	1.0596	0.0775	7	0.7683	0.9202	0.9199	1.081	0.1021	6	0.7223	0.9167	0.9125	1.0941	0.1263	6	0.81	0.91	0.86	1.04	0.1	6												
[1]Bankfull Max Depth (ft)	1.46	1.6371	1.61	1.98	0.1729	7	1.38	1.5683	1.49	2	0.2341	6	1.32	1.685	1.64	2.01	0.249	6	1.59	1.79	1.71	2.12	0.2	6												
Bankfull Cross Sectional Area (ft^2)	11.585	13.225	13.057	15.215	1.0894	7	9.6643	12.215	12.648	13.375	1.4077	6	7.2034	11.394	12.164	13.494	2.3335	6	10.9	12.08	11.85	13.94	1.06	6												
Width/Depth Ratio	11.629	14.868	14.373	20.383	2.6834	7	11.266	14.864	13.987	22.343	3.9564	6	10.876	13.594	13.55	15.748	1.7536	6	11.5	14.87	15.16	18.5	2.52	6												
Entrenchment Ratio	6.9727	12.435	8.8446	22.723	5.7683	7	7.0527	13.299	12.153	22.992	5.81	6	6.9689	14.45	13.559	22.205	6.158	6	7.02	13.52	12.1	23.35	6.45	6												
[1]Bank Height Ratio	0.9419	0.979	0.9848	1	0.0254	7	0.9429	1.0123	0.982	1.125	0.0767	6	0.9688	1.0839	1.0488	1.2576	0.1178	6	0.99	1.02	1.01	1.08	0.03	6												
Profile																																				
Riffle Length (ft)	9.19	16.294	15.51	34.04	4.4599	64	6.49	15.282	13.945	47.85	6.6304	64	4	17.062	16.56	36.16	4.8838	64	6.84	15.21	15.21	24.78	4.64	64												
Riffle Slope (ft/ft)	0.0008	0.0175	0.0156	0.0556	0.0110	60	0.0017	0.0178	0.0170	0.0586	0.0116	58	0.0014	0.0174	0.0147	0.0673	0.0132	51	0.0017	0.0197	0.0166	0.0607	0.0130	59												
Pool Length (ft)	19.68	30.254	28.74	51.91	7.7476	65	16.33	31.91	29.535	55.66	8.3181	64	18.59	30.179	28.3	58.78	8.9824	64	19.09	13.35	28.89	57.33	8.09	64												
Pool Max depth (ft)	2.42	2.9651	2.92	3.68	0.2746	65	2.6	3.2741	3.1675	12.61	1.2177	64	0.38	2.99	2.94	4.57	0.50	64	1.63	3.05	2.95	12.09	1.28	64												
Pool Spacing (ft)	31.79	46.166	44.57	80.51	9.6963	63	24.26	46.85	45.795	85.42	11.441	62	29.23	47.102	43.685	81.57	11.346	62	26.16	47.11	43.59	131.26	15.35	63												
Pattern																																				
Channel Beltwidth (ft)	30		46	76																																
Radius of Curvature (ft)	23		36	52																																
Rc:Bankfull width (ft/ft)	0.016		0.0255	0.037																																
Meander Wavelength (ft)	72		98	113																																
Meander Width Ratio	2.1		3.3	5.4																																

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

Additional Reach Parameters																																				
Rosgen Classification	C4						C4						C4						C4																	
Channel Thalweg length (ft)	4100*						3000						3000						3000																	
Sinuosity (ft)	1.3						1.3						1.3						1.3																	
Water Surface Slope (Channel) (ft/ft)	0.0048						0.00529						0.00492						0.0045																	
BF slope (ft/ft)	0.0048						0.00528						0.00512						0.005																	
[3]Ri% / Ru% / P% / G% / S%	34%		64%		1%		33%		67%				36%		64%				33%		67%															
[3]SC% / Sa% / G% / C% / B% / Be%													59%	7%	34%	0%	0%	0%	11%	59%	29%	0%	0%													
[3]d16 / d35 / d50 / d84 / d95 /													0.2974	0.9642	2.9522	7.4625	12.125		0.41	0.81	2.14	8.27	15.35													
[2]% of Reach with Eroding Banks	0						0						0%						0%																	
Channel Stability or Habitat Metric																																				
Biological or Other																																				

* - The Baseline calculations were performed for the entire restoration length and includes Cross Section 10 (CS-7 in MY-00) which is not in the monitoring Reach for UT to Underwood Creek

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

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.

2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

4. = Of value/needed only if the n exceeds 3

Appendix E. Hydrologic Data

Table 12. Verification of Bankfull Events			
Newtown - EEP# 94150			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo Number**
25-Oct-11	N/A	Site Visit observing visible wrack lines	MY-01 29-30
23-Aug-13	30-June-13	Gauge data	N/A
23-Aug-13	07-July-13	Gauge data	N/A
09-Oct-13	21-Sept-13	Gauge data	N/A

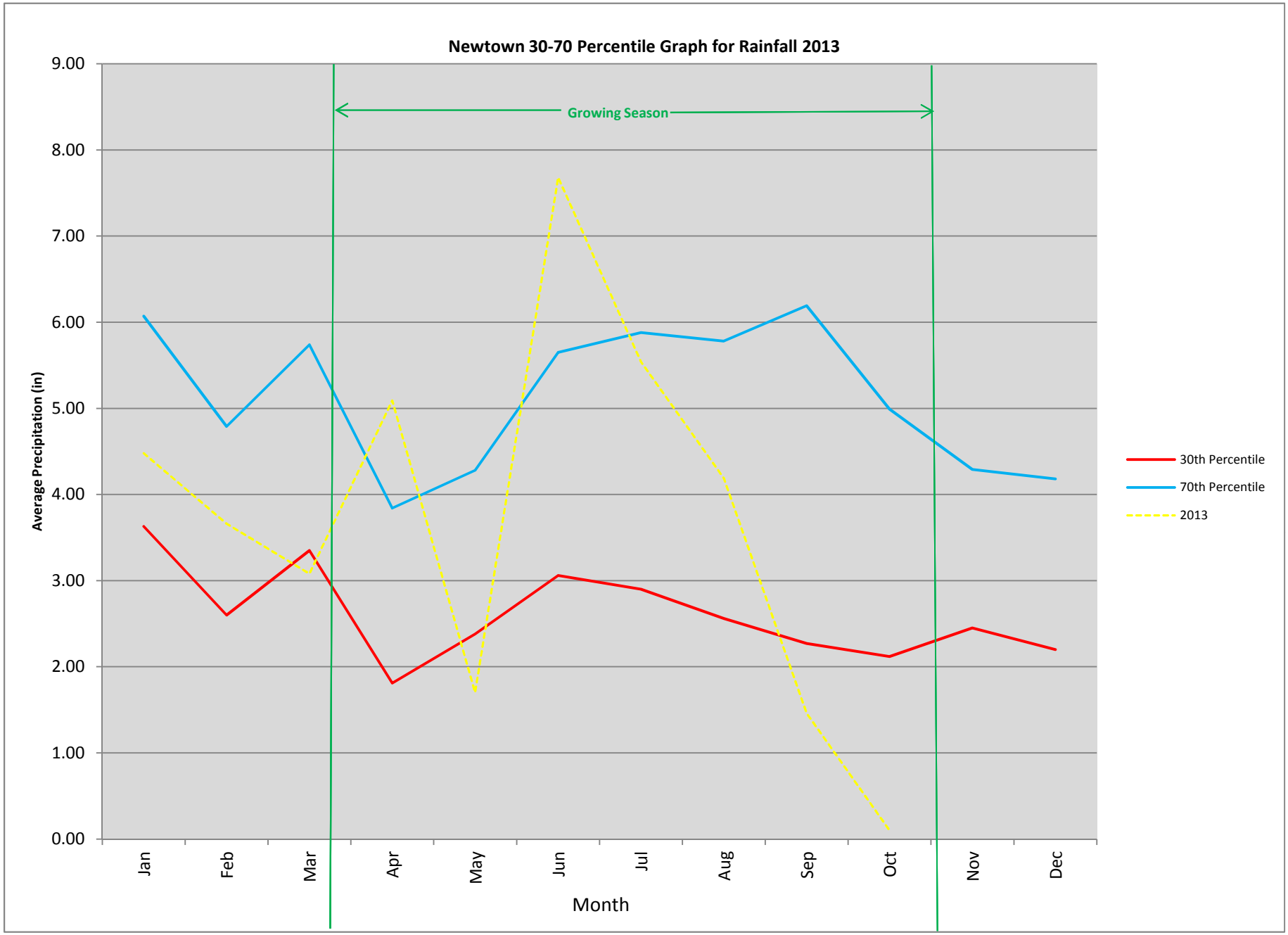
Table 13. Wetland Criteria Attainment 2010-2013

	MY01 - 2011			MY02 - 2012		
Gauge Number	**Maximum Number of Consecutive Days**	**Percent of Growing Season**	**Success Criteria Attained**	**Maximum Number of Consecutive Days**	**Percent of Growing Season**	**Success Criteria Attained**
1	59[a]	26	Yes	79[f]	35	Yes
2	197[b]	86	Yes	223[f]	98	Yes
3	197[b]	86	Yes	223[f]	98	Yes
4	77[c]	34	Yes	75[g]	33	Yes
5	92 [b]	40	Yes	105[h]	46	Yes
6	111 [b]	49	Yes	223[f]	98	Yes
7	27[d]	12	Yes	64[f]	28	Yes
8	7[e]	3	**No**	5[f]	2	**No**
	MY03 – 2013			**MY04 – 2014**		
1	168[i]	74	Yes			
2	209[i]	92	Yes			
3	209[i]	92	Yes			
4	209[i]	92	Yes			
5	179[i]	79	Yes			
6	209[i]	92	Yes			
7	209[i]	92	Yes			
8	22[j]	9	Yes			

a – Gauge installed April 23, 2011 –197 days of growing season monitored
b - Gauge installed April 22, 2011 –198 days of growing season monitored
c – Gauge installed February 20, 2010; Data missing due to gauge failure - 217 days of growing season monitored
d – Gauge installed May 24, 2011 – 166 days of growing season monitored
e – Gauge installed August 13, 2011 –85 days of growing season monitored
f – Report produced prior to end of growing season –223 days of 2012 growing season monitored
g – Data missing due to gauge failure; 219 days of growing season monitored
h - Data missing due to gauge failure; 181 days of growing season monitored
i - Report produced proper to end of growing season - 209 days of 2013 growing season monitored
j - Data missing due to gauge failure; 130 days of growing season monitored

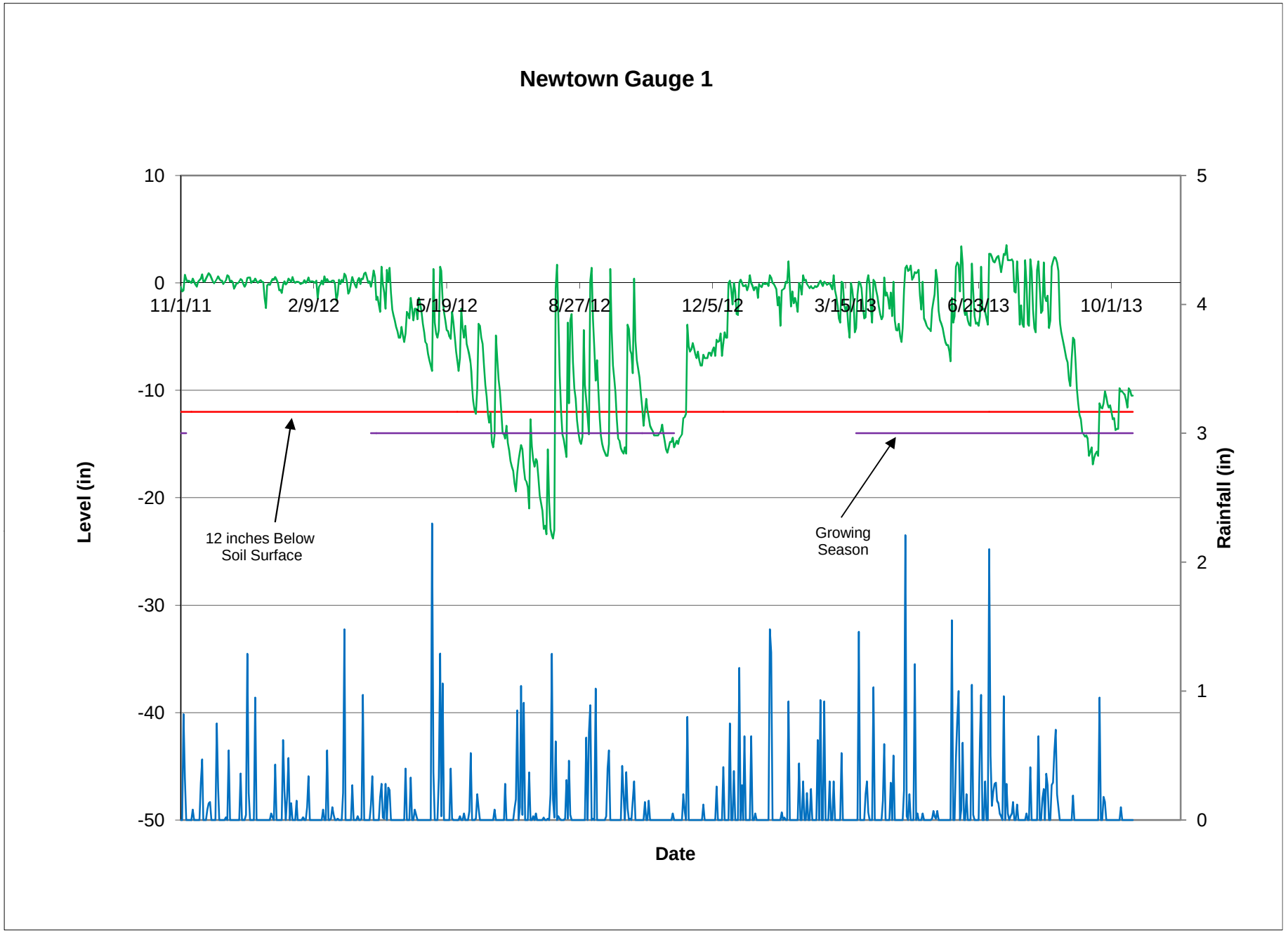
Growing Season: March 23 to November 6 (source: http://www.wcc.nrcs.usda.gov/cgibin/state.pl?state=nc)

Groundwater levels should be within 12 inches of the surface for at least 6.3% of the growing season to meet wetland hydrology success criteria. Union County has a growing season of 221 days (March 23-October 6). Therefore groundwater levels must be within 12 inches of the soil surface for a minimum of 14 consecutive days within the growing season to meet wetland hydrology success criteria. All of the wetland groundwater gauges exhibit hydroperiod criterion that exceeds the minimum 6.3% as described in the Baseline Monitoring Document and As-Built Baseline Report.



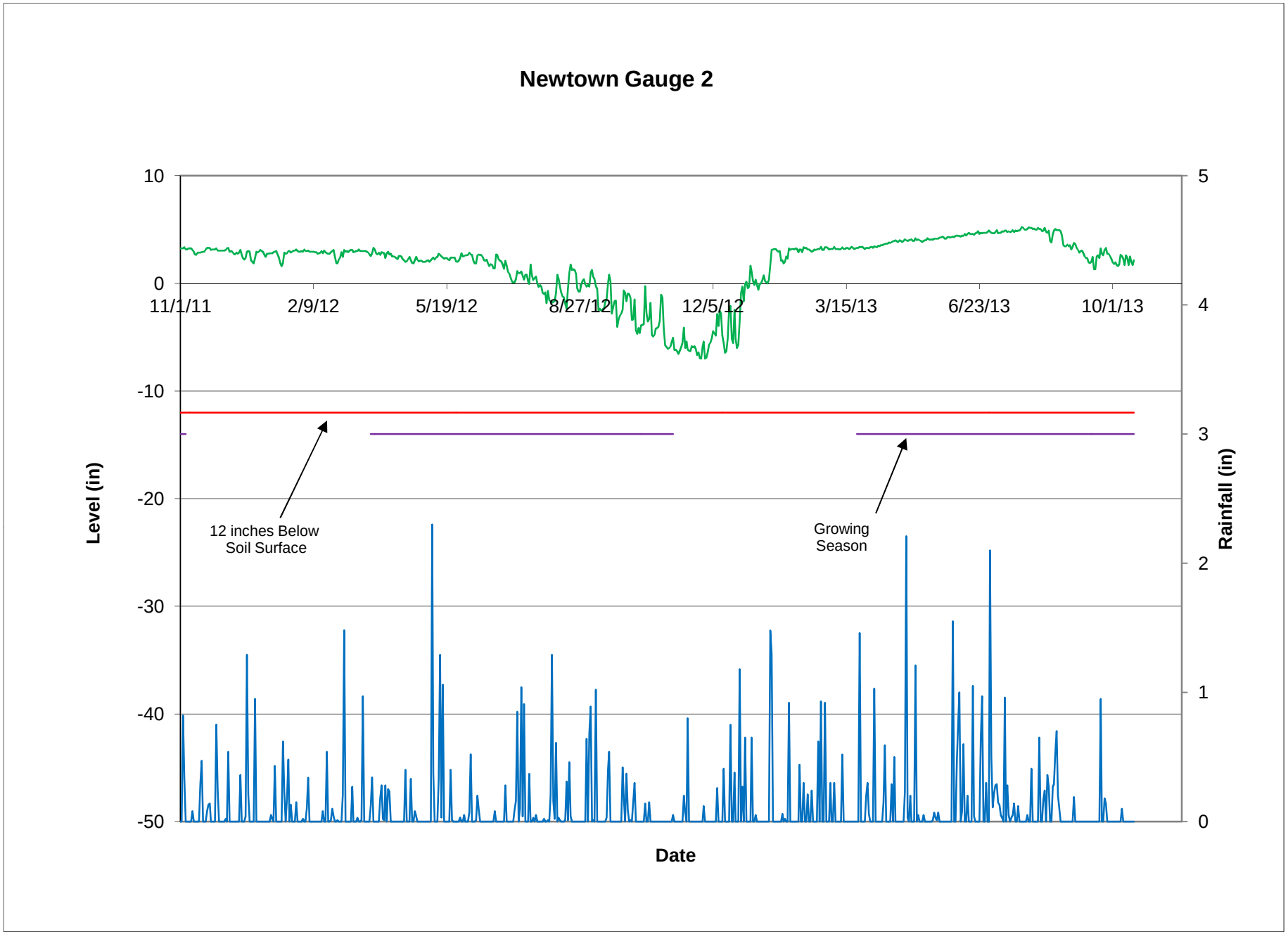
Growing Season: March 23 to November 6 (228 days)
(http://www.wcc.nrcs.usda.gov/cgibin/sate.pl?state=nc)

2013 Rain Data: Station KCLT
(http://www.nc-climate.ncsu.edu/services/request.php)



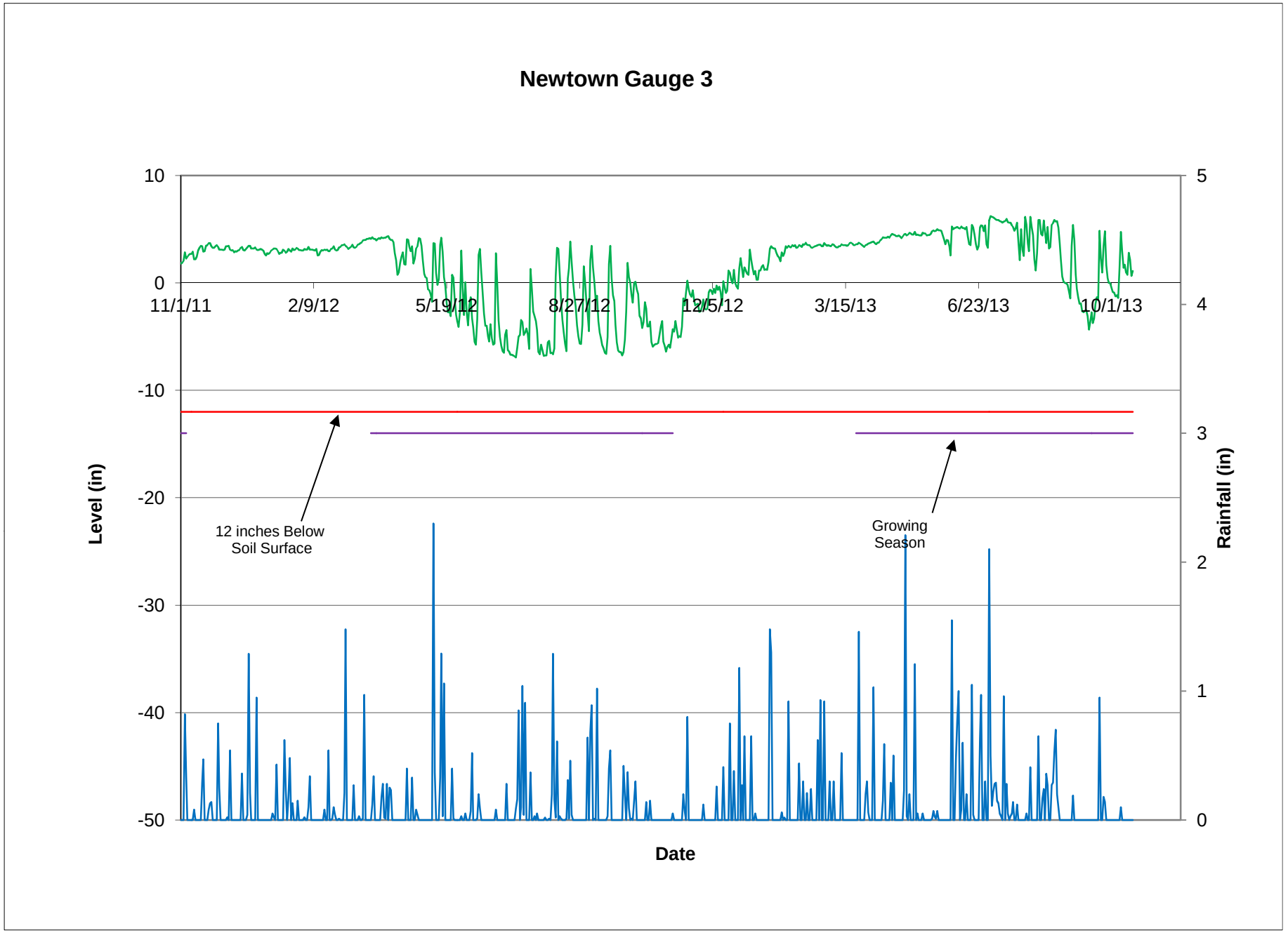
Growing Season: March 23 to November 6 (228 days)
(http://www.wcc.nrcs.usda.gov/cgibin/sate.pl?state=nc)

2011-2013 Rain Data: Station KCLT
(http://www.nc-climate.ncsu.edu/services/request.php)



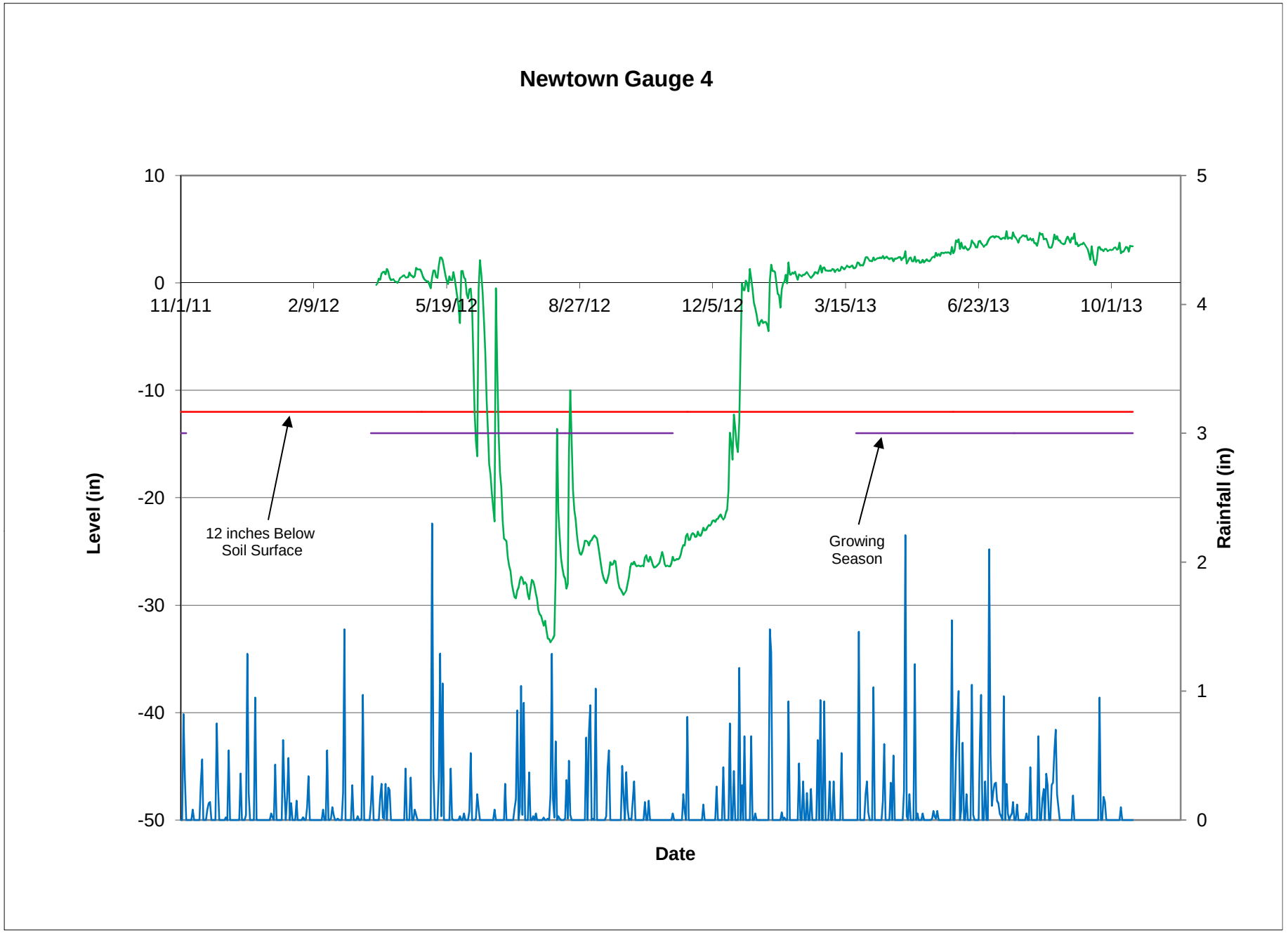
Growing Season: March 23 to November 6 (228 days)
(http://www.wcc.nrcs.usda.gov/cgibin/sate.pl?state=nc)

2011-2013 Rain Data: Station KCLT
(http://www.nc-climate.ncsu.edu/services/request.php)



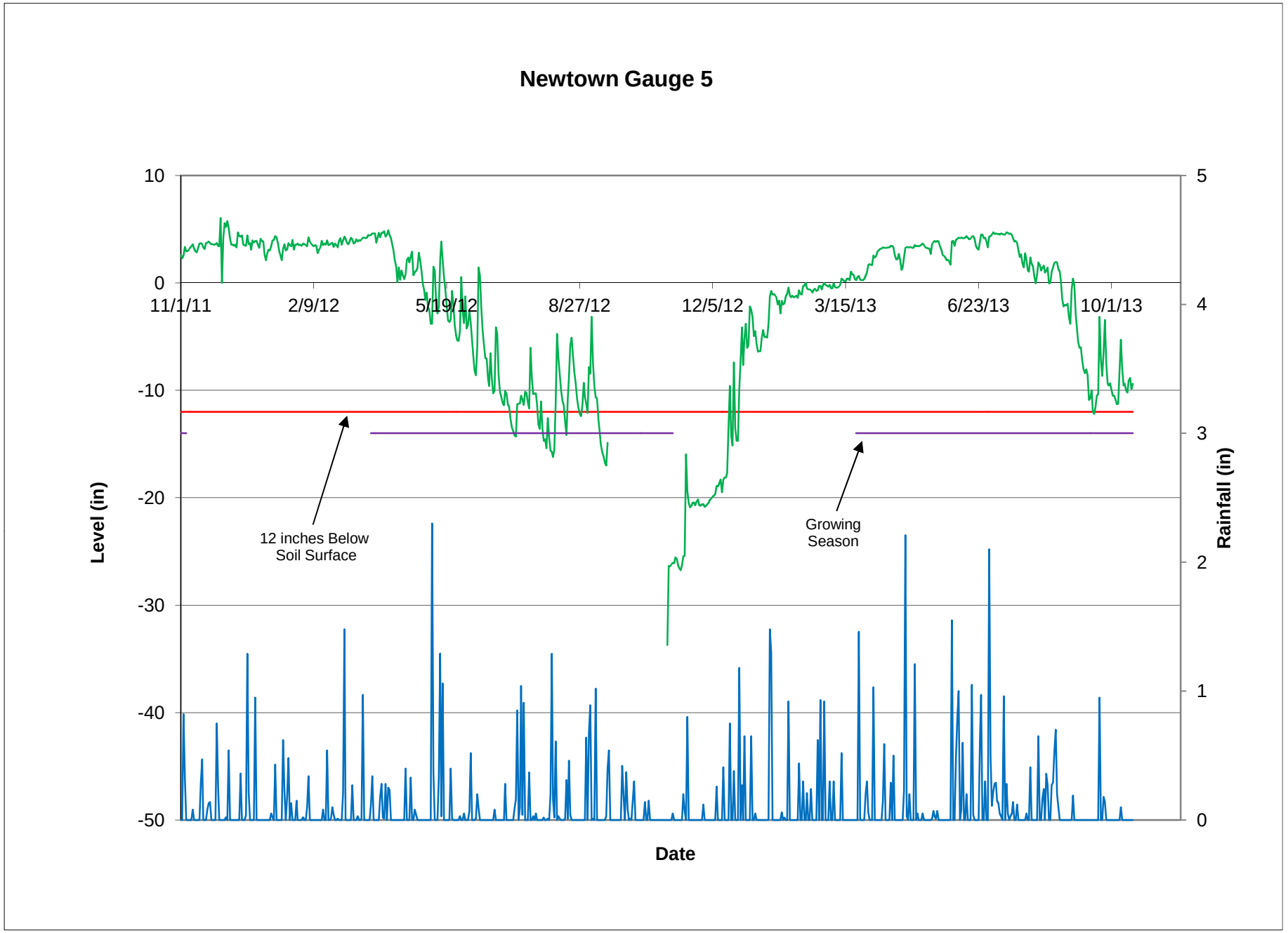
Growing Season: March 23 to November 6 (228 days)
(http://www.wcc.nrcs.usda.gov/cgibin/sate.pl?state=nc)

2011-2013 Rain Data: Station KCLT
(http://www.nc-climate.ncsu.edu/services/request.php)



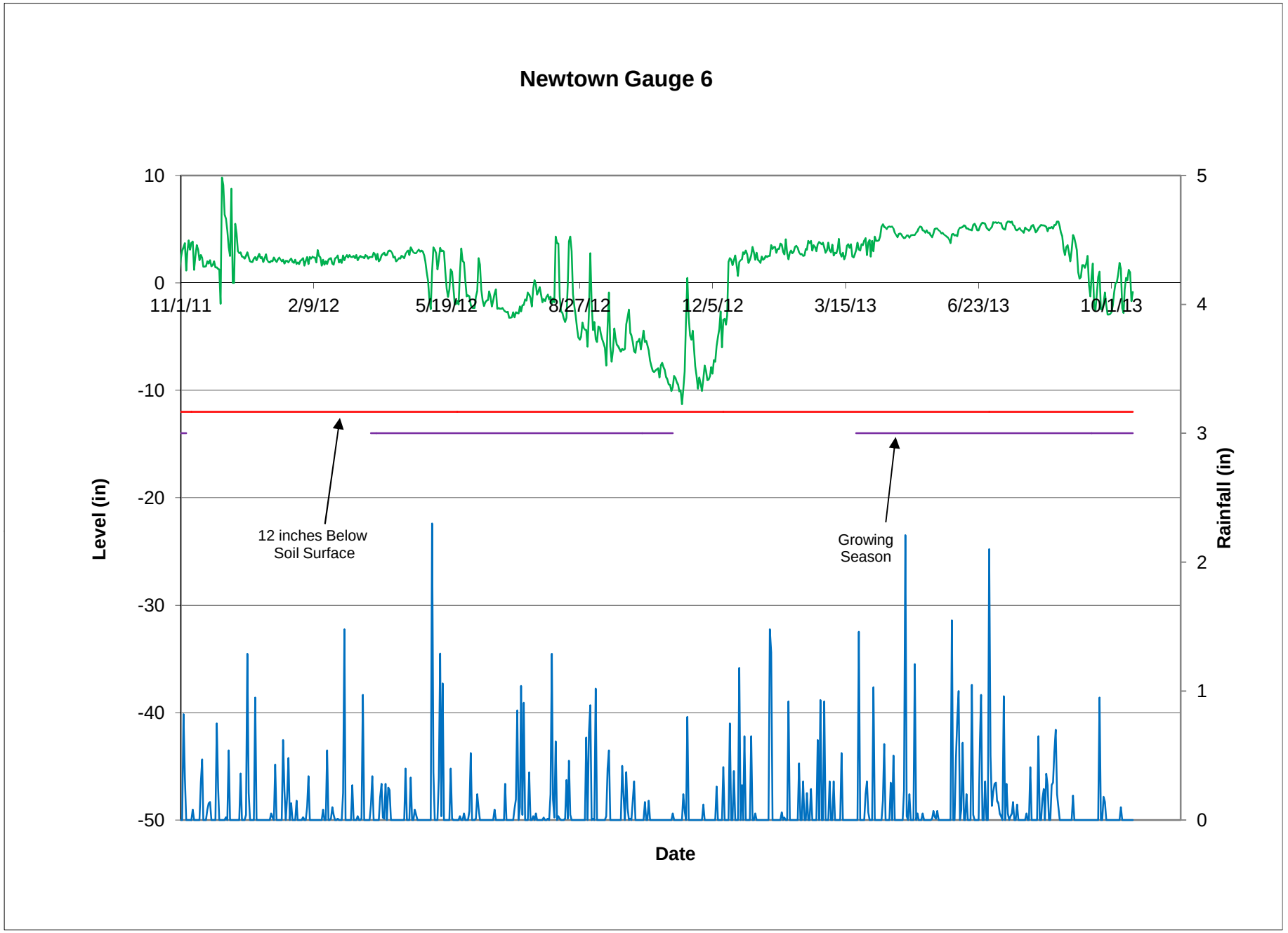
Growing Season: March 23 to November 6 (228 days)
(http://www.wcc.nrcs.usda.gov/cgibin/sate.pl?state=nc)

2011-2013 Rain Data: Station KCLT
(http://www.nc-climate.ncsu.edu/services/request.php)



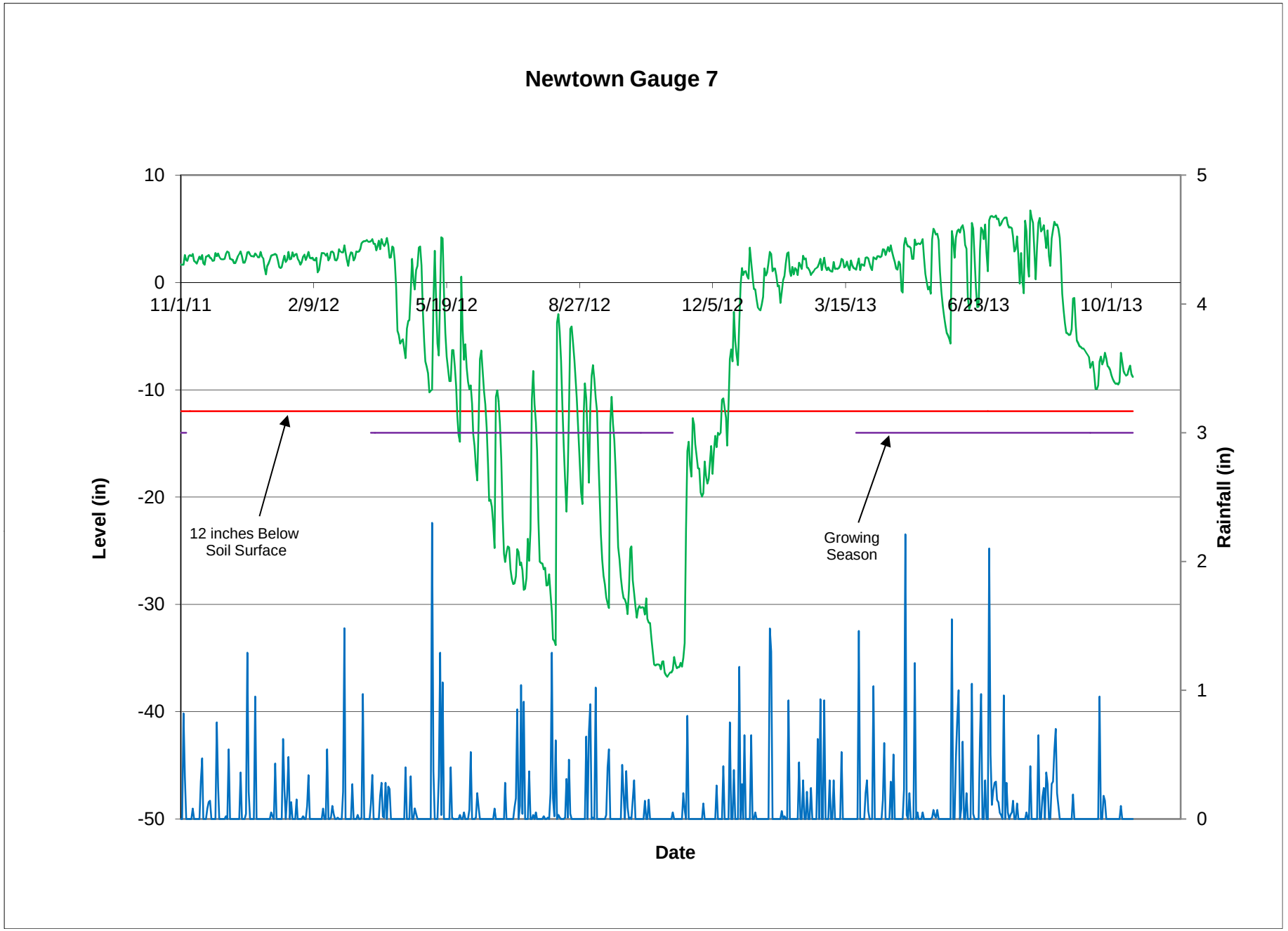
Growing Season: March 23 to November 6 (228 days)
(http://www.wcc.nrcs.usda.gov/cgibin/sate.pl?state=nc)

2011-2013 Rain Data: Station KCLT
(http://www.nc-climate.ncsu.edu/services/request.php)



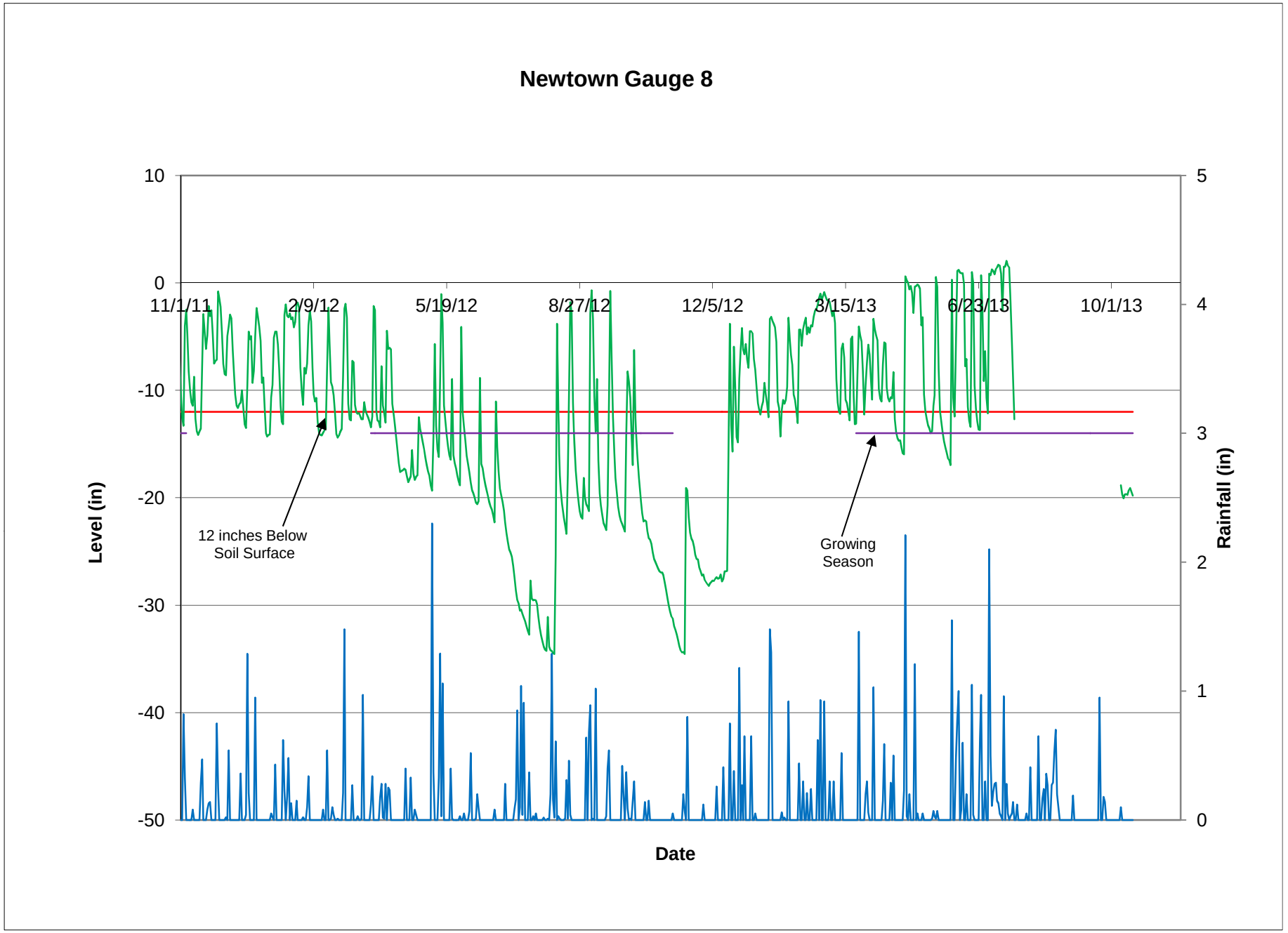
Growing Season: March 23 to November 6 (228 days)
(http://www.wcc.nrcs.usda.gov/cgibin/sate.pl?state=nc)

2011-2013 Rain Data: Station KCLT
(http://www.nc-climate.ncsu.edu/services/request.php)



Growing Season: March 23 to November 6 (228 days)
(http://www.wcc.nrcs.usda.gov/cgibin/sate.pl?state=nc)

2011-2013 Rain Data: Station KCLT
(http://www.nc-climate.ncsu.edu/services/request.php)



Growing Season: March 23 to November 6 (228 days)
(http://www.wcc.nrcs.usda.gov/cgibin/sate.pl?state=nc)

2011-2013 Rain Data: Station KCLT
(http://www.nc-climate.ncsu.edu/services/request.php)