

**Year 1 of 5 Monitoring Report  
Heath Dairy Road Stream Restoration Site  
Randolph County, NC**

**SCO Project Number 040633101  
NCDENR Division of Mitigation Services Project Number 170  
NCDENR D06017S  
USACE Action Item # SAW 2008 02860**



**Prepared for:**

**NCDENR Division of Mitigation Services  
1652 Mail Service Center  
Raleigh, NC 27699-1652**

**Construction Completed: August 2013  
Data Collection: November 2014  
Submitted: March 2015**

**Heath Dairy Road Stream Restoration  
Randolph County, NC**

**Year 1 of 5 Monitoring Report**

**SCO Project Number 040633101  
NCDENR Division of Mitigation Services Project Number 170  
NCDENR D06017S  
USACE Action Item # SAW 2008 02860**

**Prepared by:**



701 Corporate Center Drive  
Suite 475  
Raleigh, NC, 27607  
Phone: 919-854-6200  
Fax: 919-854-6259

Project Manager:  
Richard Prosser, PE  
Phone: 919-760-4000  
e-mail: Rick.Prosser@aecom.com

## Table of Contents

1.0 EXECUTIVE SUMMARY .....	3
2.0 METHODOLOGY .....	5
2.1 Vegetation .....	6
2.2 Stream Assessment .....	6
2.3 Visual Assessment .....	7
2.4 Digital Photos .....	7
2.5 Hydrology .....	8
2.6 Other Parameters .....	8
3.0 REFERENCES .....	8

## APPENDICES

### **Appendix A – Project Vicinity Map and Background Tables**

Figure 1 – Vicinity Map

Table 1 – Project Restoration Components

Table 2 – Project Activity and Reporting History

Table 3 – Project Contacts

Table 4 – Project Attributes

## **Appendix B – Visual Assessment Data**

Figure 2 – Current Condition Plan View

Table 5 – Visual Stream Morphology Stability Assessment Table

Table 6 – Vegetation Condition Assessment Table

Photos – Vegetation Plot Photos

Photos – Photo Points

## **Appendix C – Vegetative Data**

Table 7 – Vegetation Plot Data

CVS Output Tables

February 2014 Replanting Data (Figure and species table)

## **Appendix D – Stream Survey Data**

Cross-section Plots with annual overlays and photos

Longitudinal Profile Plot with annual overlay

Pebble Count Plots

Table 8 – Baseline Stream Data Summary

Table 9a – Monitoring – Cross-Section Morphology Data Table

Table 9b – Monitoring Stream Reach Morphology Data Table

## **Appendix E – Hydrologic Data**

Table 10 – Verification of Bankfull Events

Monthly Rainfall Data

Precipitation and Water Level Plots

Table 11 – Wetland Hydrology Criteria Attainment

## 1.0 EXECUTIVE SUMMARY

The Heath Dairy Road Stream Restoration site was identified by the North Carolina Department of Transportation (NCDOT) as a degraded reach of Back Creek and several unnamed tributaries, in Randolph County, North Carolina. The project was transferred to the North Carolina NCDENR Division of Mitigation Services (DMS) in 2005. The Heath Dairy Road Restoration Site encompasses approximately 7,708 linear feet of degraded channels.

The site is located in the Back Creek watershed of the Yadkin-Pee Dee River Basin, United States Geological Survey (USGS) Hydrologic Unit Code 03040103050050, within the North Carolina Division of Water Quality (NCDWQ) sub-basin 03-07-09. Back Creek drains into the Back Creek (Lucas) Lake and then into the Uwharrie River approximately eleven miles downstream of the site. Historic land use of the site has consisted primarily of agriculture and livestock grazing. The streams within the project area were accessible to livestock, resulting in local disturbances to stream banks and wetland soil surfaces. Additional land use practices including the maintenance and removal of riparian vegetation, and relocating, dredging, and straightening of on-site streams all contribute to the degraded water quality and unstable channel characteristics.

Restoration goals identified in the 2009 Yadkin Pee Dee RBRP Plan include protection of wildlife resources, improved management of stormwater runoff, and mitigation of impacts resulting from urbanization in the area. Within the Back Creek watershed, 26% of streams are lacking riparian buffer. The following goals were established to guide the restoration process for the project:

- Improve local water quality within the restored channel reaches as well as the downstream watercourses by reducing channel and off-site sediment loads, reducing nutrient loads from adjacent agricultural fields, and reducing water temperatures.
- Improve local aquatic and terrestrial habitat and diversity within the restored channels and their vicinity.
- Preclude the construction of additional infrastructure and the combination of agricultural practices including cattle grazing and the application of pesticides and fertilizer within the riparian buffer area by providing a permanent conservation easement.

The project's measurable objectives are:

- Restore natural stable channel morphology and proper sediment transport capacity;
- Create and/or improve bed form diversity and improve aquatic and benthic macroinvertebrate habitat;
- Construct a floodplain (or local bankfull bench) that is accessible at the proposed bankfull channel elevation;
- Improve channel and stream bank stabilization by integrating in-stream structures and native bank vegetation;

- Restore 7,781 linear feet of stream through Priority I and II restoration from the existing 6,748 linear feet of stream;
- Enhance 960 linear feet of stream from the existing 960 linear feet of stream;
- Preserve 636 linear feet of stream;
- Enhance 0.6 acres of wetlands from the existing 0.6 acres of wetlands (all are riparian non-riverine wetlands);
- Preserve 1.18 acres of wetlands (all are riparian non-riverine wetlands, except Wetland J which is a riparian riverine wetland consisting of 0.090 acres of preservation); and,
- Restore approximately 30 acres of riparian buffer by establishing a native forested and herbaceous riparian buffer plant community.

During Year 1 (2014) monitoring 26 vegetation plots were evaluated. Vegetation from all 26 plots averaged 228 stems-per-acre. Eight of the 26 plots met or exceeded the success criteria of 320 planted stems-per-acre (minimum stem count after 3 years). Some stem mortality was likely due to the dense herbaceous growth that occurred during the summer. Additionally, one plot (Veg Plot 20) is in an area with standing water.

The DMS exercised a warranty clause of the vegetation installation contract and on 2/10/2015 – 2/12/2015 an additional 10,500 stems were installed to address the low density reported above. A species list and planting zone map are included in Appendix C of this document.

Planted woody vegetation throughout the site is somewhat sparse due to competition from herbaceous plants and fescue. Herbaceous vegetation is well established within the riparian areas. Live stakes (willows and silky dogwood) planted along the streambanks are growing well.

Visual assessment and geomorphic surveys completed for the site indicate that project reaches are currently performing within established success criteria ranges shown in Table 8a Appendix D. Several areas of concern were observed along stream monitoring reaches within the sites. The table below describes the issues and each area is identified on Figure 2 (Appendix B).

**Stream Areas of Concern**

<b>Map Identifier</b>	<b>Feature/Issue</b>
Stream Area of Concern #1	Slumping on left bank (outside of meander bend) / Log vane exposed not functioning
Stream Area of Concern #2	Slumping on left bank of pool /Short steep riffle leading to pool
Stream Area of Concern #3	Wide pool with some slumping on left bank
Stream Area of Concern #4	Transverse riffle formed
Stream Area of Concern #5	Log vane appears to have failed several short steep riffles

Back Creek and North Branch do exhibit some shortening and steepening of the riffles along with a lengthening of the pools in some locations. Back Creek design riffle slope was 0.0095 ft/ft. The As-built slope was 0.01 ft/ft while after Year 1 the average slope is now 0.018 ft/ft. The North Branch shows an average steepening of the riffles from 0.0035 ft/ft (design and As-built) to 0.015 ft/ft in Year 1. The Year 1 riffle slopes are actually quite close to the reference

reach riffle slopes of 0.013 ft/ft. No remedial action is proposed at this time, however, these reaches should be monitored closely and a remedial action plan developed if they do not stabilize over the next few years. West and East Branch appear quite stable.

Pebble count data indicates fining of many of the riffle sections. Significant vegetation growth (*Murdannia keisak*) was observed in many of the riffles. The *Murdannia* appears to have trapped and held a large amount of silt covering the coarser material below. The pebble counts reflect these silt deposits. It is likely that as the streambank vegetation develops the *Murdannia* will be shaded out and the silts should wash on through the system. The coarser material placed during construction of the riffles will become more evident once the silts have washed through the system.

Four groundwater gauges have been installed across the site. Gauges 1 through 3 were installed and monitored by DMS while gauge 4 was installed and monitored by AECOM. Wetland hydrology success criteria will be satisfied in restored wetland areas when saturated soil conditions occur within 12 inches of the ground's surface for a minimum of 12.5% (29 days) of the growing season (March 24 to Nov 13) during average climatic conditions.

All three DMS addendum wetland gauges exceeded the minimum wetland hydrology criterion of groundwater within 12 inches of the ground surface for a minimum of 5% of the growing season; however two gauges fell short of meeting the project established 12.5% performance standard. Gauges 1, 2, and 3 exhibited water levels within 12 inches of the ground surface for 20%, 5.5% and 9% of the growing season respectively. This data does not represent a complete growing season as the gauges malfunctioned in August of 2014. Please refer to gauge data summary and gauge location map included in appendix E. Gauge 4 exceeded the 12.5% performance standard with water levels within 12 inches of the ground surface for 38% of the growing season.

Other portions of the site appear to be quite wet and installation of groundwater gauges in these areas might indicate that wetland hydrology is present. The largest of these areas is the floodplain to the west of North Branch. There are also several smaller pocket wetland areas on both sides of the lower portion of West Branch.

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

## **2.0 METHODOLOGY**

Vegetation survival, channel stability, and wetland hydrology were monitored on the project site. Post restoration monitoring will occur for a minimum of five years or until success criteria are met.

## 2.1 Vegetation

Twenty-six vegetation plots were established and assessed for the baseline vegetation monitoring. The Carolina Vegetation Survey (CVS) Protocol Level 2 methodology (Lee et al. 2006, <http://cvs.bio.unc.edu/methods.htm>) was used to sample vegetation on October 2 and November 20, 2014.

## 2.2 Stream Assessment

Twenty-eight permanent monitoring cross-sections have been established on the site as follows:

- Back Creek, 16 cross-sections
- West Branch, 5 cross-sections
- UT to West Branch, 1 cross-section
- North Branch, 3 cross-sections
- East Branch, 3 cross-sections

Reach	Monitoring XS No.	Feature	Pebble Count
Back Creek	XS-1	Pool	Yes
Back Creek	XS-2	Riffle	Yes
Back Creek	XS-3	Riffle	Yes
Back Creek	XS-4	Pool	Yes
Back Creek	XS-5	Pool	No
Back Creek	XS-6	Riffle	Yes
Back Creek	XS-7	Pool	No
Back Creek	XS-8	Riffle	Yes
Back Creek	XS-9	Pool	Yes
Back Creek	XS-10	Riffle	Yes
Back Creek	XS-11	Pool	No
Back Creek	XS-12	Riffle	Yes
Back Creek	XS-13	Pool	No
Back Creek	XS-14	Riffle	Yes
Back Creek	XS-15	Pool	No
Back Creek	XS-16	Pool	Yes
West Branch	XS-17	Riffle	No
West Branch	XS-18	Pool	No
West Branch	XS-19	Riffle	Yes
West Branch	XS-20	Riffle	Yes
West Branch	XS-21	Pool	Yes
UT to West Branch	XS-22	Riffle	Yes
North Branch	XS-23	Pool	No
North Branch	XS-24	Riffle	Yes
North Branch	XS-25	Riffle	Yes
East Branch	XS-26	Pool	Yes
East Branch	XS-27	Riffle	Yes



Reach	Monitoring XS No.	Feature	Pebble Count
East Branch	XS-28	Riffle	Yes

The restored length of Back Creek is 5,300 feet in length. Three, 1,000-foot segments were surveyed. Each segment is as follows:

- 14+15 to 24+15
- 26+80 to 40+28
- 51+42 to 62+22

Multiple parameters were located including top of bank, thalweg, and water surface. Pool and riffle features were called out to calculate feature slopes and lengths. Note that for West Branch, water surface features were not surveyed at many points as no flowing water was present in the upper portion of the reach at the time of the survey. The lack of flowing water is not unexpected as the upper reaches were documented as ephemeral to intermittent in the 2009 Restoration Plan. The survey was performed with a survey grade GPS (Trimble R8 GNSS RTK survey unit). Due to tree cover preventing satellite reception, the upper 1,800 feet of the West Branch was surveyed using standard transit and level equipment and methods.

The entire length of West Branch, East Branch and North Branch was surveyed. The small UT to West Branch was not surveyed due to its short length.

Wolman pebble counts were conducted at 20 of the 28 permanent cross-sections and used to calculate the sediment distribution at the cross-sections and the D50 and D84 at each location. Particle sizes less than 2.0 mm were determined by touch using the following guidelines:

- Silt – Smooth feeling (not gritty)
- Fine sand – Slightly gritty texture
- Coarse sand – Very gritty texture

### 2.3 Visual Assessment

A visual assessment of the stream was performed to assess the bank (lateral stability), bed (vertical stability), the easement boundary, and site vegetation.

### 2.4 Digital Photos

Four permanent photo stations have been established as part of the baseline monitoring. Starting in the first monitoring year, these photos will be taken in late October / early November, so that vegetative conditions are similar at the site between monitoring years. The photos will be used to make a qualitative assessment of channel aggradation or degradation, bank erosion, success of riparian vegetation, effectiveness of erosion control measures, and the presence or absence of developing in-stream bars. Any significant changes from the as-built conditions will be

discussed and highlighted in the report. Additional photo points will be established if problem areas arise.

Digital photos of each of the vegetation plots were also taken.

## **2.5 Hydrology**

Four monitoring gauges were installed in or around wetland enhancement areas to monitor site hydrology. Gauges 1 through 3 were installed and monitored by DMS while Gauge 4 was monitored by AECOM.

Two crest gauges were installed; however the bottoms filled with silt and they did not function properly. Silt was removed in the base so that water could enter the gauge. If the gauges continue to clog with silt they should be relocated or repositioned in the channel.

## **2.6 Other Parameters**

No obvious areas of encroachment onto the easement were noted. It did not appear the Heath Dairy Farm owners were utilizing the easement across West Branch as it was quite overgrown. No beaver activity was noted.

## **3.0 REFERENCES**

Lee, M.T., R.K. Peet, S.D. Roberts, T.R. Wentworth. 2006. *CVS-EEP Protocol for Recording Vegetation Version 4.0.*

## **Appendix A – General Figures and Tables**

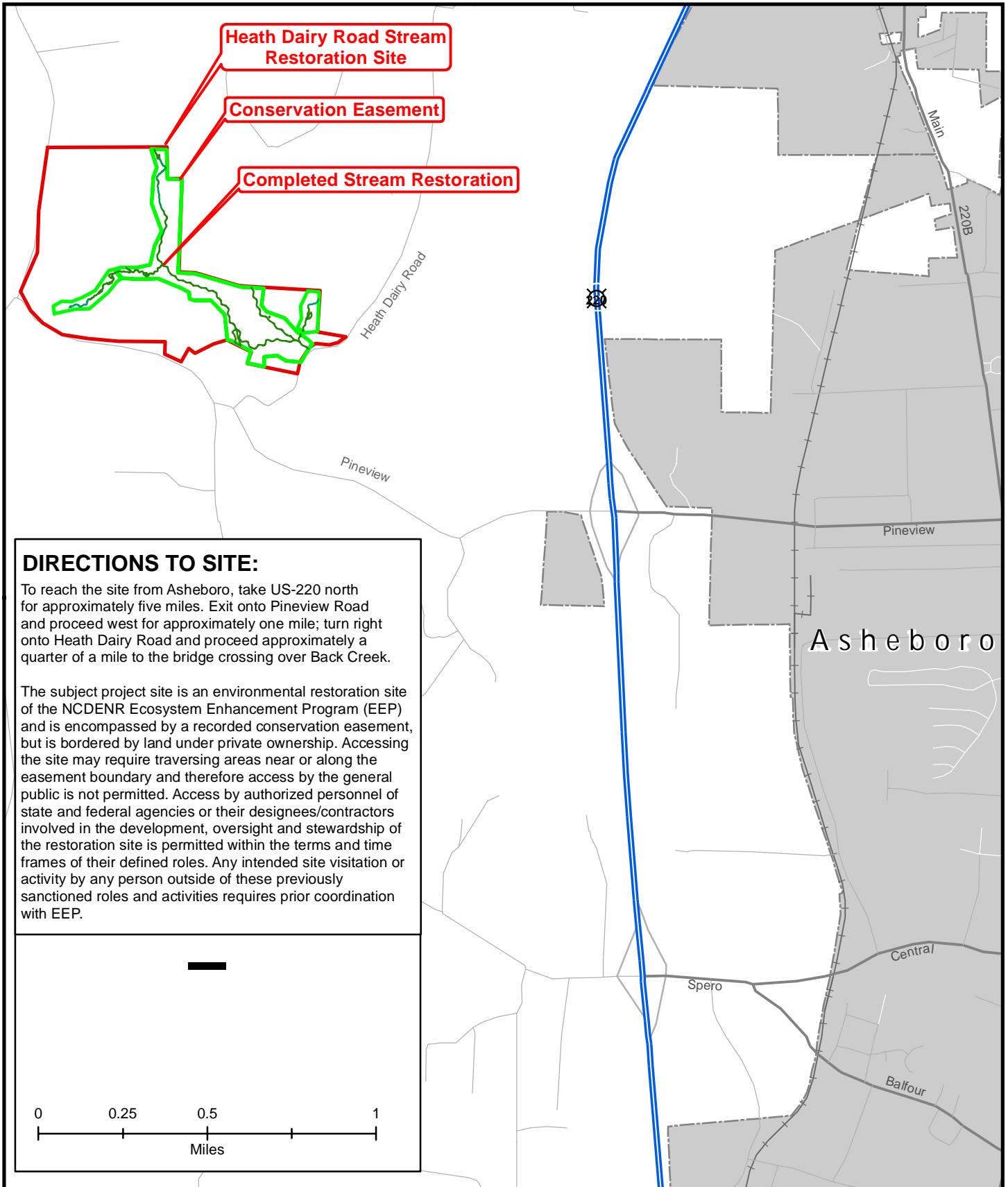
Figure 1 – Vicinity Map

Table 1 – Project Restoration Components

Table 2 – Project Activity and Reporting History

Table 3 – Project Contacts

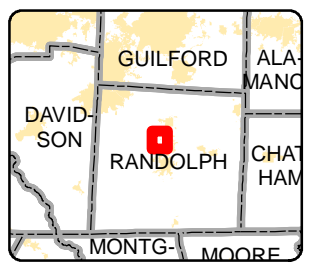
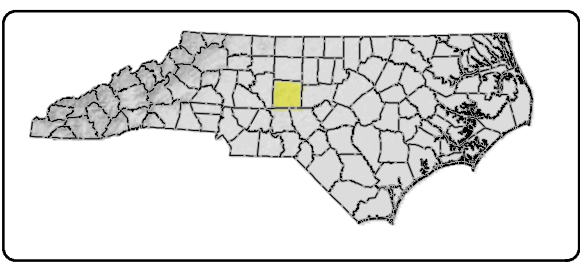
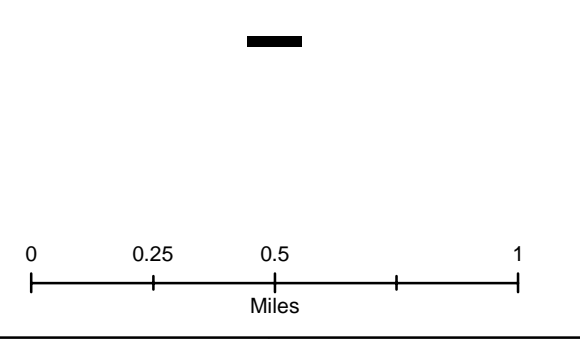
Table 4 – Project Attributes



**DIRECTIONS TO SITE:**

To reach the site from Asheboro, take US-220 north for approximately five miles. Exit onto Pineview Road and proceed west for approximately one mile; turn right onto Heath Dairy Road and proceed approximately a quarter of a mile to the bridge crossing over Back Creek.

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



**1. Vicinity Map**  
 Heath Dairy Road Stream Restoration Site  
 Randolph County, NC  
 Project #: 60183329

**Table 1. Project Restoration Components and Mitigation Credits  
Heath Dairy Road Stream Restoration/ DMS No. 170**

Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Offset	Phosphorous Offset
Type	R	RE	R	RE	R	RE			
Totals	8431	127	1.4	0.54					
Project Components									
Project Component	Stationing/Location		Existing Footage or Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio		
Back Creek 1	10+00 – 11+55		149 LF	P2	Restoration	155 LF	1:1		
Back Creek 2	11+55 – 16+25		470 LF	E1	Enhancement	470 LF	1.5:1		
Back Creek 3	16+25 – 17+00		75 LF	P1	Restoration	75 LF	1:1		
Back Creek 4	17+00 – 20+90		390 LF	E1	Enhancement	390 LF	1.5:1		
Back Creek 5	20+90 – 24+60		374 LF	P1	Restoration	370 LF	1:1		
Back Creek 6	24+60 – 25+60		100 LF	E1	Enhancement	100 LF	1.5:1		
Back Creek 7	25+60 – 63+45		3450 LF	P1, P2	Restoration	3785 LF	1:1		
West Preserve	14+58 - 18+75		417 LF	NA	Preservation	417 LF	5:1		
West Branch 1	10+00 – 26+12		1523 LF	P1	Restoration	1590 LF*	1:1		
North Branch 1	10+30 – 21+97		495 LF	P2	Restoration	1167 LF	1:1		
East Preserve	5+01 - 7+20		219 LF	NA	Preservation	219 LF	5:1		
East Branch 1	9+96 – 15+93		580 LF	P1	Restoration	547 LF*	1:1		
UT to West Br.	10+36 – 11+38		102 LF	P1	Restoration	102 LF	1:1		
Wetland A1	NA		1.075 AC	NA	Preservation	1.075 AC	5:1		
Wetland A2	NA		0.136AC	NA	Enhancement	0.136 AC	2:1		
Wetland B	NA		0.307 AC	NA	Enhancement	0.307 AC	2:1		
Wetland C	NA		0.104 AC	NA	Enhancement	0.104 AC	2:1		
Wetland E	NA		0.010 AC	NA	Enhancement	0.010 AC	2:1		
Wetland F	NA		0.036 AC	NA	Enhancement	0.036 AC	2:1		
Wetland I	NA		0.007 AC	NA	Preservation	0.007 AC	5:1		
Wetland J	NA		0.090 AC	NA	Preservation	0.090 AC	5:1		
Wetland K	NA		0.010 AC	NA	Enhancement	0.010 AC	2:1		
Wetland L	NA		0.007 AC	NA	Preservation	0.007 AC	5:1		
Wetland M	NA		1.4 AC	NA	Restoration	1.4 AC	1:1		
Component Summation									
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)			
		Riverine	Non-Riverine						
Restoration	7791		1.4			30			
Enhancement			0.60						
Enhancement I	960								
Enhancement II									
Creation									
Preservation	636		1.18						
High Quality Preservation									

\*Liner footage for the ford (22 ft) and egress (50 ft) easements areas have been removed from West and East Branch respectively.

**Table 2. Project Activity and Reporting History  
Heath Dairy Road Stream Restoration/ DMS No. 170**

<b>Activity or Report</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Restoration Plan	April 2009	May 2009
CLOMR	June 2010	March 2011
LOMR	April 2014	Under Review
Final Design – Construction Plans	NA	June 2011
Construction	NA	August 2013
Permanent seed applied to entire site	NA	August 2013
Plantings for entire site	NA	February 2014
Mitigation Plan (Year 0 Monitoring – baseline)	April 2014	May 2014
Year 1 Monitoring	November 2014	March 2015
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

**Table 3. Project Contact Table  
Heath Dairy Road Stream Restoration/ DMS No. 170**

<p><b>Owner</b>  NCDENR Division of Mitigation Services.</p>	<p>Melonie Allen 217 W. Jones Street Suite 300A Raleigh NC 27603 919-368-9352</p>
<p><b>Designer</b>  AECOM of North Carolina, Inc.</p>	<p>Tammie Tucker 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 919-760-4025</p>
<p><b>Landowner</b>  Mr. Phillip Ridge   Dr. Edward Shackelford</p>	<p>3562 Plainfield Road Sophia, NC 27350 336-861-4555  203 Shannon Road Asheboro, NC 27203 336-625-6222</p>
<p><b>Construction Contractor</b></p>	<p>Backwater Environmental 515 S. Kennedy Avenue Eden, NC 27288</p>
<p><b>Planting Contractor</b></p>	<p>Carolina Silvics, Inc. 908 Indian Trail Road Edenton, NC 27932</p>
<p><b>Seeding Contractor</b></p>	<p>Backwater Environmental 515 S. Kennedy Avenue Eden, NC 27288</p>
<p><b>Monitoring Performer</b>  AECOM of North Carolina, Inc.</p>	<p>Tammie Tucker 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 919-760-4025</p>

**Table 4. Project Baseline Information and Attributes  
Heath Dairy Road Stream Restoration/ DMS No. 170**

<b>Project Information</b>					
Project Name	Heath Dairy Farm Road Stream Restoration				
Project County	Randolph				
Project Area (acres)	56.8				
Project Coordinates (lat/long)	35°46'47.85"N / 79°50'51.50"W				
<b>Project Watershed Summary</b>					
Physiographic Province	Piedmont				
Project River Basin	Yadkin				
USGS HUC for Project	03040103050050				
NCDWQ Sub-basin for Project	03-07-09				
Project Drainage Area (acres)	1722				
Project Drainage Area Percentage of Impervious Area	< 2%				
CGIA Land Use Classification	Agricultural Land – Cropland and Pasture				
<b>Reach Summary Information (Pre-restoration)</b>					
<b>Parameters</b>	<b>Back Creek</b>	<b>West Branch</b>	<b>North Branch</b>	<b>East Branch</b>	<b>UT to West Branch</b>
Length of Reach (feet)	5008	1940	495	799	102
Valley Classification	VIII	II	II	II	II
Drainage area (acres)	1722	90	730	160	32
NCDWQ Stream ID Score	NA	NA	NA	NA	NA
NCDWQ Water Quality Classification	WS-II, HQW	WS-II, HQW	WS-II, HQW	WS-II, HQW	WS-II, HQW
Morphological Description	G4, E4	G4	E4	G4	G4
Evolutionary Trend	NA	NA	NA	NA	NA
Underlying Mapped Soils	(DoB) Dogue and (BtC2) Badin-Tarrus Complex				
Drainage Class	Well Drained to Moderately Well Drained				
Soil Hydric Status	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric
Slope					
FEMA Classification	Detail Study	None	Detail Study	None	None
Native Vegetation	Mesic Mixed Hardwood Forest (Piedmont Subtype)				
Percent Composition of Exotic Invasive Vegetation	20%	20%	20%	20%	20%
<b>Wetland Summary Information</b>					
<b>Parameters</b>	<b>Wetland A</b>	<b>Wetland B</b>	<b>Wetland C</b>	<b>Wetland E - L</b>	
Size of Wetland (acres)	1.21	0.31	0.10	0.26	
Wetland Type	Riparian	Riparian	Riparian	Riparian	
Mapped Soil Series	(BtC2) Badin-Tarrus Complex				
Drainage Class	Moderately Well Drained				
Soil Hydric Series	Soil series not hydric but soils exhibited low-chroma colors and mottling				



Source of Hydrology	Surface drainage	Surface drainage	Toe of slope seepage	Toe of slope seepage
Hydrologic Impairment	No	No	No	No
Native Vegetation	Piedmont Bottomland Forest / Piedmont Alluvial Forest			
Percent Composition of Exotic Invasive Vegetation	20%	20%	20%	20%
<b>Regulatory Considerations</b>				
<b>Regulation</b>	<b>Applicable</b>	<b>Resolved</b>	<b>Supporting Documentation</b>	
Waters of the US – Section 404	Yes	Yes		
Waters of the US – Section 401	Yes	Yes		
Endangered Species Act	Yes	Yes		
Historic Preservation Act	Yes	Yes	2/1/2007 Concurrence letter from SHPO	
CZMA/CAMA	No	NA		
FEMA Floodplain Compliance	Yes	Yes		
Essential Fisheries Habitat	No	NA		

## **Appendix B – Visual Assessment Data**

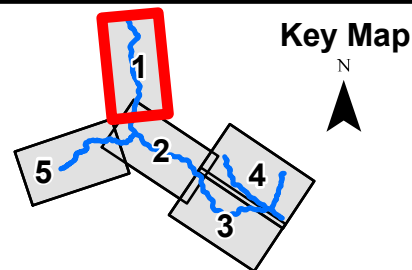
Figure 2 – Current Condition Plan View

Table 5 – Visual Stream Morphology Stability Assessment Table

Table 6 – Vegetation Condition Assessment Table

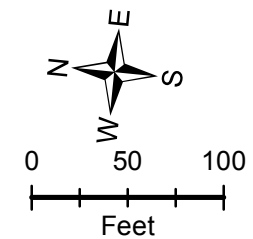
Photos – Vegetation Plot Photos

Photos – Photo Points



**Legend**

- |                      |              |                          |
|----------------------|--------------|--------------------------|
| Vegetation Plots     | Photo Points | Vegetation Problem Areas |
| Cross Sections       | Cross Vanes  | Stream Problem Area      |
| Crest Gauge          | Log Vanes    | Easement Boundary        |
| GW Monitoring Gauges | Log Sills    | Utility Easement         |



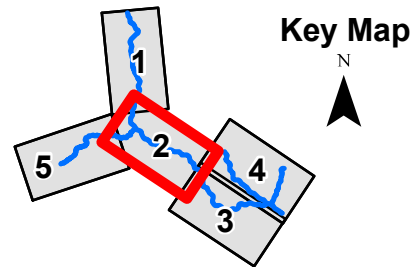
**2. Current Condition Plan View**

Heath Dairy Road Stream Restoration Site  
Randolph County, NC  
Project #: 60183329

**SHEET**  
**1**



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swis User Community

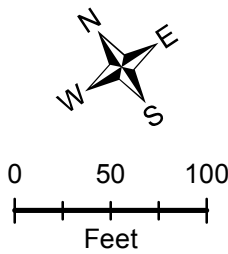


Key Map



**Legend**

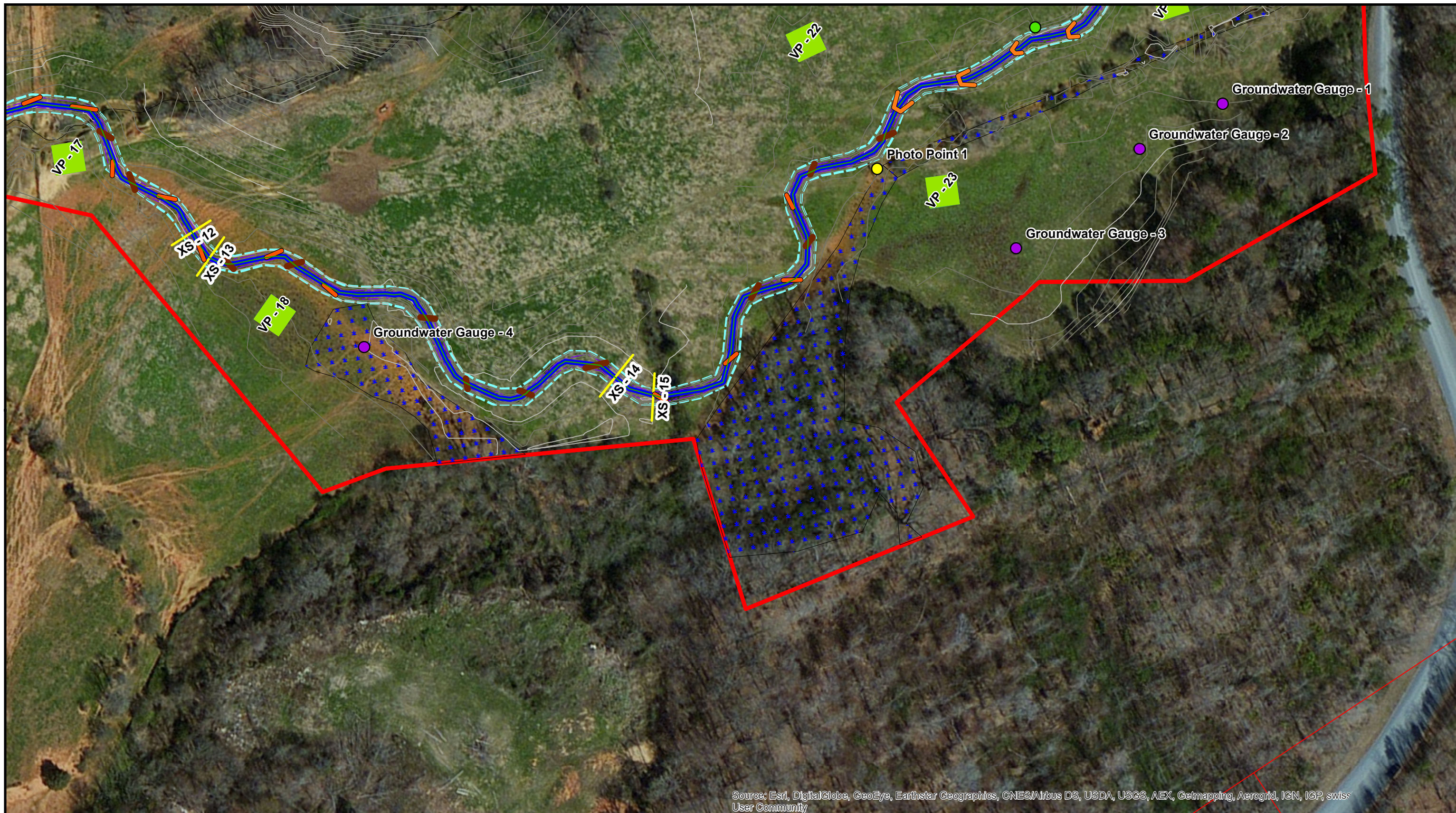
- |                      |              |                          |
|----------------------|--------------|--------------------------|
| Vegetation Plots     | Photo Points | Vegetation Problem Areas |
| Cross Sections       | Cross Vanes  | Stream Problem Area      |
| Crest Gauge          | Log Vanes    | Easement Boundary        |
| GW Monitoring Gauges | Log Sills    | Utility Easement         |



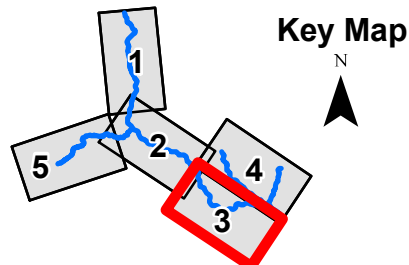
**2. Current Condition Plan View**

Heath Dairy Road Stream Restoration Site  
Randolph County, NC  
Project #: 60183329

**SHEET**  
**2**



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swis User Community

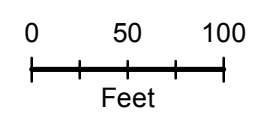


Key Map



**Legend**

- |                      |              |                          |
|----------------------|--------------|--------------------------|
| Vegetation Plots     | Photo Points | Vegetation Problem Areas |
| Cross Sections       | Cross Vanes  | Stream Problem Area      |
| Crest Gauge          | Log Vanes    | Easement Boundary        |
| GW Monitoring Gauges | Log Sills    | Utility Easement         |



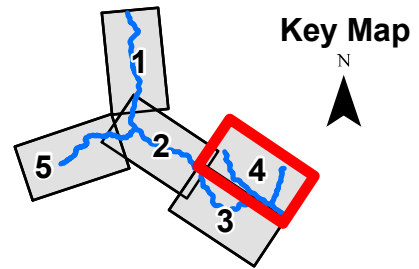
**2. Current Condition Plan View**

Heath Dairy Road Stream Restoration Site  
 Randolph County, NC  
 Project #: 60183329

**SHEET**  
**3**



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swis User Community

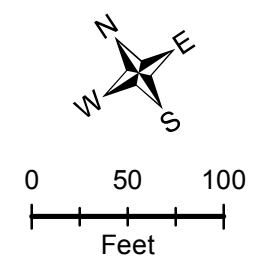


Key Map



**Legend**

- |                      |              |                          |
|----------------------|--------------|--------------------------|
| Vegetation Plots     | Photo Points | Vegetation Problem Areas |
| Cross Sections       | Cross Vanes  | Stream Problem Area      |
| Crest Gauge          | Log Vanes    | Easement Boundary        |
| GW Monitoring Gauges | Log Sills    | Utility Easement         |



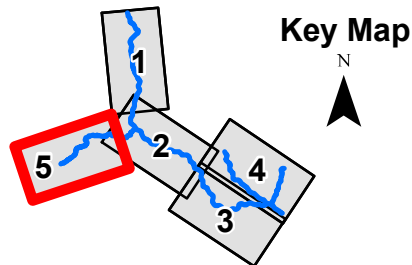
**2. Current Condition Plan View**

Heath Dairy Road Stream Restoration Site  
 Randolph County, NC  
 Project #: 60183329

**SHEET**  
**4**



Source: Esri, DigitalGlobe, User Community

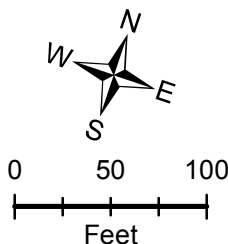


Key Map



**Legend**

- |                      |              |                          |
|----------------------|--------------|--------------------------|
| Vegetation Plots     | Photo Points | Vegetation Problem Areas |
| Cross Sections       | Cross Vanes  | Stream Problem Area      |
| Crest Gauge          | Log Vanes    | Easement Boundary        |
| GW Monitoring Gauges | Log Sills    | Utility Easement         |



**2. Current Condition Plan View**

Heath Dairy Road Stream Restoration Site  
 Randolph County, NC  
 Project #: 60183329

**SHEET**  
**5**

**Table 5A. Visual Stream Morphology Stability Assessment (Back Creek)  
Heath Dairy Road Stream Restoration/ DMS No. 170**

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
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)	50	76	1	25	99
		2. Degradation - Evidence of downcutting			2	100	99
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	50	76			65
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth/Mean Bankfull Depth >1.5)	76	76			100
		2. Length Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	60	76			79
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	70	76			92
		2. Thalweg centering at downstream of meander bend (Glide)	76	76		100	
2. Bank	1. Scouring/Eroding	Bank lacks vegetative cover due to active scour and erosion			0	0	100
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected.			0	0	100
	3. Mass Wasting	Bank slumping, caving, or collapse			3	80	98
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	102	104			98
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	42	43			99
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	40	43			96
	3. Bank Protection	Bank erosion within the structures extent or influence does not exceed 15%.	43	43			100
	4. Habitat	Pool forming structures maintaining Max Pool Depth/Mean Bankfull Depth ratio >1.5. Rootwads/logs providing some cover at low flow	104	104			100

Note: 60 log vanes, 1 rock vane, 34 log sills, 9 rock cross-vanes



**Table 5B. Visual Stream Morphology Stability Assessment (West Branch to Back Breek)  
Heath Dairy Road Stream Restoration/ DMS No. 170**

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
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)	52	52	0	0	100
		2. Degradation - Evidence of downcutting			0	0	100
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	52	52	0	0	100
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth/Mean Bankfull Depth >1.5)	52	52			100
		2. Length Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	52	52			100
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	52	52			100
		2. Thalweg centering at downstream of meander bend (Glide)	52	52	100		
	2. Bank	1. Scouring/Eroding	Bank lacks vegetative cover due to active scour and erosion	52	52	0	0
2. Undercut		Banks undercut/overhanging to the extent that mass wasting is expected.	0			0	100
3. Mass Wasting		Bank slumping, caving, or collapse	0			0	100
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	84	84	0	0	100
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	84	84			100
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	83	84			99
	3. Bank Protection	Bank erosion within the structures extent or influence does not exceed 15%.	84	84			100
	4. Habitat	Pool forming structures maintaining Max Pool Depth/Mean Bankfull Depth ratio >1.5. Rootwads/logs providing some cover at low flow	84	84			100

Note: 32 log sills and 54 rock cross-vanes

**Table 5C. Visual Stream Morphology Stability Assessment (North Branch to Back Creek)  
Heath Dairy Road Stream Restoration/ DMS No. 170**

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
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100
		2. Degradation - Evidence of downcutting			0	0	100
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	7	14		50	
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth/Mean Bankfull Depth >1.5)	14	14		100	
		2. Length Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	14	14		100	
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	14	14		100	
		2. Thalweg centering at downstream of meander bend (Glide)	14	14		100	
2. Bank	1. Scouring/Eroding	Bank lacks vegetative cover due to active scour and erosion			0	0	100
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected.			0	0	100
	3. Mass Wasting	Bank slumping, caving, or collapse			0	0	100
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	15	15		100	
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	5	5		100	
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	15	15		100	
	3. Bank Protection	Bank erosion within the structures extent or influence does not exceed 15%.	15	15		100	
	4. Habitat	Pool forming structures maintaining Max Pool Depth/Mean Bankfull Depth ratio >1.5. Rootwads/logs providing some cover at low flow	15	15		100	

Note: 10 log vanes and 5 rock cross-vanes

**Table 5D. Visual Stream Morphology Stability Assessment (East Branch to Back Creek)  
Heath Dairy Road Stream Restoration/ DMS No. 170**

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
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)	8	14	0	0	100
		2. Degradation - Evidence of downcutting			0	0	100
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	8	14			57
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth/Mean Bankfull Depth >1.5)	14	14			100
		2. Length Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	14	14			100
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	14	14			100
		2. Thalweg centering at downstream of meander bend (Glide)	14	14			100
2. Bank	1. Scouring/Eroding	Bank lacks vegetative cover due to active scour and erosion			0	0	100
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected.			0	0	100
	3. Mass Wasting	Bank slumping, caving, or collapse			0	0	100
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	17	17			100
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	11	11			100
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	17	17			100
	3. Bank Protection	Bank erosion within the structures extent or influence does not exceed 15%.	17	17			100
	4. Habitat	Pool forming structures maintaining Max Pool Depth/Mean Bankfull Depth ratio >1.5. Rootwads/logs providing some cover at low flow	17	17			100

Note: 6 log vanes, 5 log sills, and 6 rock cross-vanes

**Table 6. Vegetation Condition Assessment  
Heath Dairy Road Stream Restoration/ DMS No. 170**

Planted Acreage		32 Acres				
<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Area</b>
1. Bare Areas	Very limited cover of both woody and herbaceous material	0.1 acres		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		1		70%
Total						
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems a size class that are obviously small given the monitoring year	0.25 acres				
Cumulative Total						
Easement Acreage		56.8 Acres				
Vegetation Category						
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons a map scale)	1000 SF		2	0.01	< 1%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons a map scale)	None		0	0	0



Vegetation Monitoring Plot 1 – 10/2/14



Vegetation Monitoring Plot 4 – 10/2/14



Vegetation Monitoring Plot 2 – 10/2/14



Vegetation Monitoring Plot 5 – 10/2/14



Vegetation Monitoring Plot 3 – 10/2/14



Vegetation Monitoring Plot 6 – 11/20/14



Vegetation Monitoring Plot 7 – 10/2/14



Vegetation Monitoring Plot 10 – 11/20/14



Vegetation Monitoring Plot 8 – 10/2/14



Vegetation Monitoring Plot 11 – 11/20/14



Vegetation Monitoring Plot 9 – 11/20/14



Vegetation Monitoring Plot 12 – 11/20/14



Vegetation Monitoring Plot 13 – 11/20/14



Vegetation Monitoring Plot 16 – 11/20/14



Vegetation Monitoring Plot 14 – 11/20/14



Vegetation Monitoring Plot 17 – 11/20/14



Vegetation Monitoring Plot 15 – 11/20/14



Vegetation Monitoring Plot 18 – 11/20/14



Vegetation Monitoring Plot 19 – 11/20/14



Vegetation Monitoring Plot 22 – 11/20/14



Vegetation Monitoring Plot 20 – 11/20/14



Vegetation Monitoring Plot 23 – 11/20/14



Vegetation Monitoring Plot 21 – 11/20/14



Vegetation Monitoring Plot 24 – 11/20/14





Vegetation Monitoring Plot 25 – 11/20/14



Photo Point 1 downstream – 3/4/15



Vegetation Monitoring Plot 26 – 11/20/14



Photo Point 1 – 3/4/15



Photo Point 1 upstream – 3/4/15



Photo Point 2 downstream – 11/20/14



Photo Point 2 upstream – 11/20/14



Photo Point 3 downstream – 11/20/14



Photo Point 2 West Branch – 11/20/14



Photo Point 4 – 11/20/14



Photo Point 3 upstream – 11/20/14

## **Appendix C – Vegetative Data**

Table 7 – Vegetation Plot Data  
CVS Output Tables  
February 2014 Replanting Data (Figure and species table)



Report Prepared By	Ron Johnson
Date Prepared	2/19/2015 13:18
database name	cvs-eep-entrytool-v2.3.1.mdb
database location	E:\Work\Temporary Working Files\Heath Dairy Farm
computer name	USRAL3LT109
file size	76120064

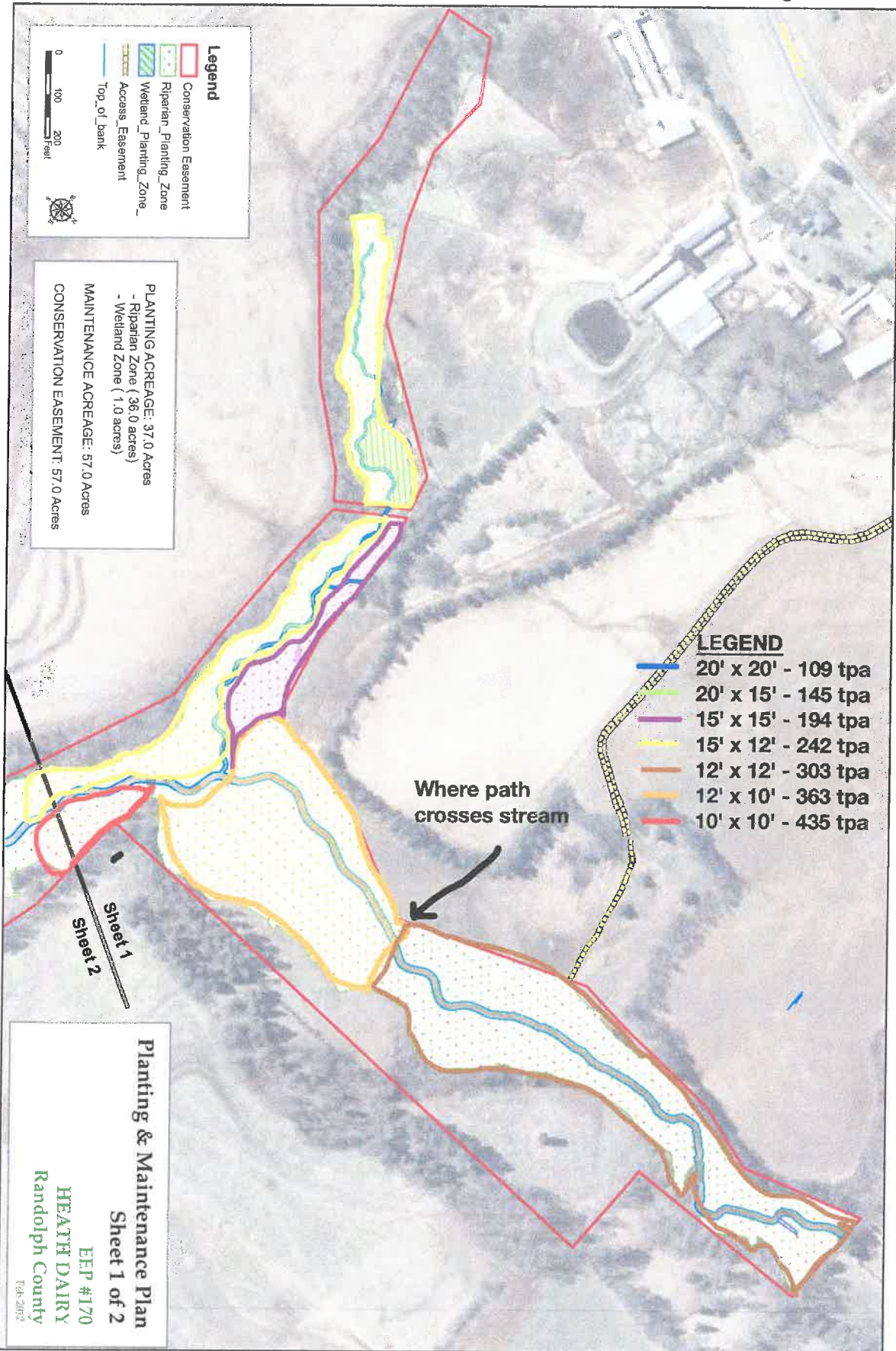
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----

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.

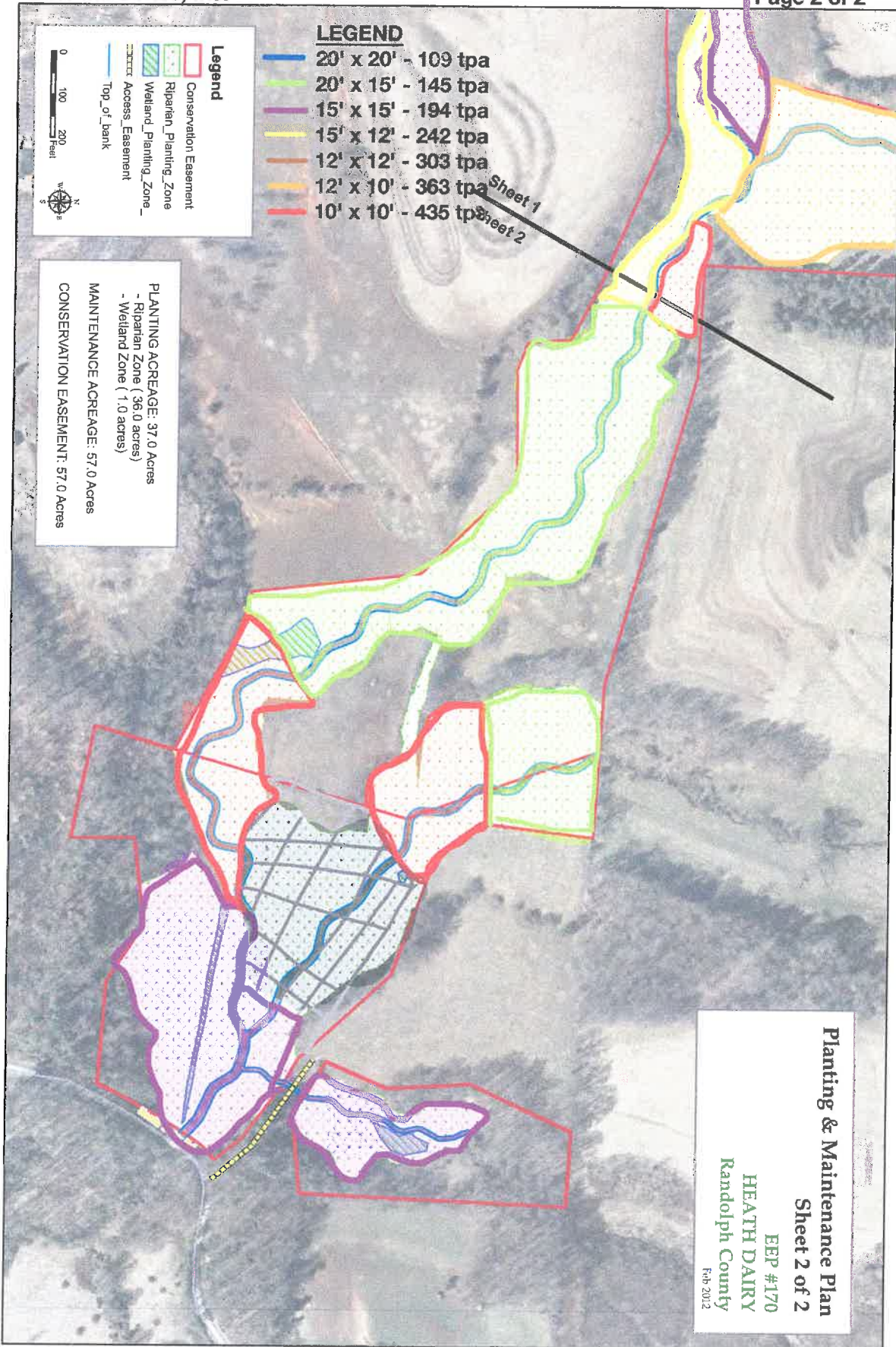
PROJECT SUMMARY-----

Project Code	170
project Name	Heath Dairy Road
Description	Stream and wetland restoration
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	26

plot	Plot Level	Year	Latitude/Northing	Longitude/Easting	Zone	Datum	Date Sampled	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
170-01-0001-year:1	2	1	35°47'16.1"N	79°51'9.056"W		NAD83/WGS84	10/2/2014	7	7	2	0	7	7						2
170-01-0002-year:1	2	1	35°47'12.03"N°	79°51'8.817"W°		NAD83/WGS84	10/2/2014	8	8	0	0	8	8						4
170-01-0003-year:1	2	1	35°47'9.893"N°	79°51'9.535"W°		NAD83/WGS84	10/2/2014	2	2	5	0	2	2						2
170-01-0004-year:1	2	1	35°47'9.142"N	79°51'8.564"W		NAD83/WGS84	10/2/2014	1	1	5	0	1	1						1
170-01-0005-year:1	2	1	35°47'7.084"N°	79°51'7.472"W		NAD83/WGS84	10/2/2014	1	1	3	0	1	1						1
170-01-0006-year:1	2	1	35°47'4.251"N	79°51'7.368"W		NAD83/WGS84	11/20/2014	1	1	3	0	1	1						1
170-01-0007-year:1	2	1	35°47'0.877"N	79°51'7.515"W		NAD83/WGS84	11/20/2014	3	3	4	0	3	3						3
170-01-0008-year:1	2	1	35°46'57.921"N	79°51'7.457"W		NAD83/WGS84	2/10/2014	4	4	1	0	4	4						3
170-01-0009-year:1	2	1	35°46'54.086"N	79°51'20.927"W		NAD83/WGS84	11/20/2014	2	2	4	0	2	2						2
170-01-0010-year:1	2	1	35°46'55.316"N	79°51'18.943"W		NAD83/WGS84	11/20/2014	4	4	1	0	4	4	161.8742572	161.8742572	0	161.8742572	161.8742572	3
170-01-0011-year:1	2	1	35°46'57.213"N	79°51'16.806"W		NAD83/WGS84	11/20/2014	5	5	1	0	5	5						3
170-01-0012-year:1	2	1	35°46'58.12"N	79°51'12.849"W		NAD83/WGS84	11/20/2014	3	3	7	0	3	3						1
170-01-0013-year:1	2	1	35°46'58.015"N	79°51'10.894"W		NAD83/WGS84	11/20/2014	3	3	3	0	3	3						2
170-01-0014-year:1	2	1	35°46'55.984"N°	79°51'4.243"W°		NAD83/WGS84	11/20/2014	0	0	5	0	0	0						0
170-01-0015-year:1	2	1	35°46'54.621"N	79°50'59.681"W		NAD83/WGS84	11/20/2014	2	2	4	0	2	2						2
170-01-0016-year:1	2	1	35°46'53.439"N°	79°50'57.846"W°		NAD83/WGS84	11/20/2014	6	6	3	0	6	6						5
170-01-0017-year:1	2	1	35°46'51.869"N°	79°50'56.274"W°		NAD83/WGS84	11/20/2014	7	7	2	0	7	7						5
170-01-0018-year:1	2	1	35°46'49.093"N°	79°50'54.964"W°		NAD83/WGS84	11/20/2014	8	8	1	0	8	8						2
170-01-0019-year:1	2	1	35°46'53.925"N°	79°50'51.469"W°		NAD83/WGS84	11/20/2014	3	3	8	0	3	3						2
170-01-0020-year:1	2	1	35°46'51.631"N°	79°50'50.563"W°		NAD83/WGS84		0	0	0	0	0	0						0
170-01-0021-year:1	2	1	35°46'50.202"N°	79°50'46.716"W°		NAD83/WGS84	11/20/2014	3	3	5	0	3	3						2
170-01-0022-year:1	2	1	35°46'48.456"N°	79°50'46.777"W°		NAD83/WGS84	11/20/2014	2	2	4	0	2	2						2
170-01-0023-year:1	2	1	35°46'46.26"N°	79°50'46.414"W°		NAD83/WGS84	11/20/2014	5	5	1	0	5	5						3
170-01-0024-year:1	2	1	35°46'46.648"N°	79°50'42.45"W°		NAD83/WGS84	11/20/2014	5	5	2	0	5	5						4
170-01-0025-year:1	2	1	35°46'47.812"N	79°50'42.626"W		NAD83/WGS84	11/20/2014	3	3	3	0	3	3						3
170-01-0026-year:1	2	1	35°46'50.298"N°	79°50'40.661"W°		NAD83/WGS84	10/2/2014	2	2	4	0	2	2	80.9371286	80.9371286	0	80.9371286	80.9371286	2



**Approximate Spacing and Location of Warranty Replant Stems**  
**February 2015**  
**Carolina Silvics, Inc.**





Heath Dairy (EEP 170) Replants

Species	Type	Qty	%	Nursery
<i>Betula nigra</i>	bare roots	1,100	10%	Superior Trees
<i>Fraxinus pennsylvanica</i>	bare roots	1,100	10%	AborGen
<i>Liriodendron tulipifera</i>	bare roots	1,100	10%	AborGen
<i>Nyssa sylvatica</i>	bare roots	1,100	10%	AborGen
<i>Platanus occidentalis</i>	bare roots	1,100	10%	AborGen
<i>Quercus falcata</i> var. <i>pagodaefolia</i>	bare roots	1,000	10%	AborGen
<i>Quercus michauxii</i>	bare roots	1,000	10%	AborGen
<i>Quercus phellos</i>	bare roots	1,000	10%	AborGen
<i>Quercus rubra</i>	bare roots	1,000	10%	AborGen
<i>Quercus shumardii</i>	bare roots	1,000	10%	AborGen
		10,500	100%	

## **Appendix D – Stream Survey Data**

Cross-section Plots with annual overlays and photos

Longitudinal Profile Plot with annual overlay

Pebble Count Plots

Table 8 – Baseline Stream Data Summary

Table 9a – Monitoring – Cross-Section Morphology Data Table

Table 9b – Monitoring Stream Reach Morphology Data Table

# Cross-section Plot Exhibit

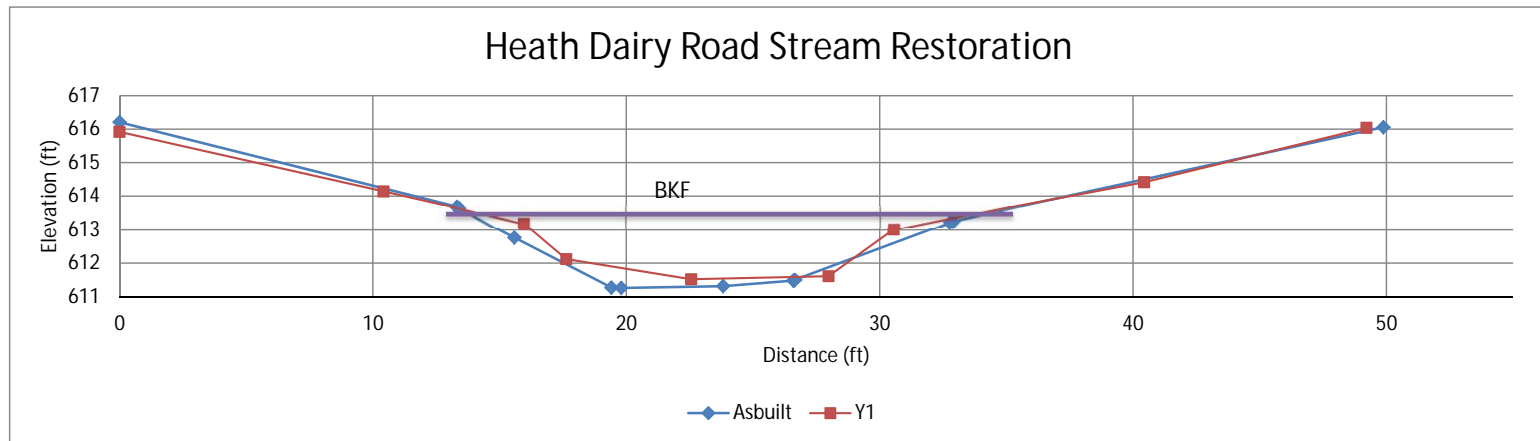
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	1
Feature	Pool
Drainage Area (sq mi)	2.70
Date	12/2/2014
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.00	615.918
10.42	614.14
15.98	613.174
17.63	612.118
22.56	611.519
27.98	611.607
30.55	613.014 BKF
40.44	614.416
49.21	616.039

Summary Data	
Bankfull Elevation	613.01
Bankfull Width (ft)	14.31
Floodprone Width (ft)	32
Bankfull Mean Depth (ft)	1.13
Bankfull Max Depth (ft)	1.49
Bankfull Cross Sectional Area (ft <sup>2</sup> )	16.14
Bankfull Width/Depth Ratio	12.66
Bankfull Entrenchment Ratio	2.28



Photo: Cross-section 1 looking downstream



# Cross-section Plot Exhibit

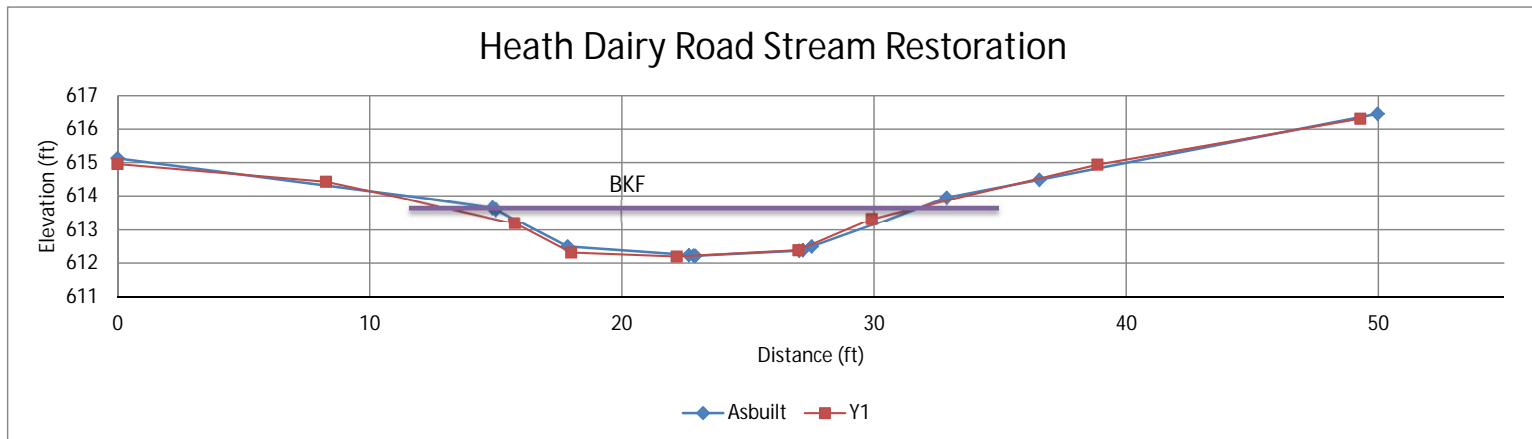
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	2
Feature	Riffle
Drainage Area (sq mi)	2.70
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.00	614.96
8.27	614.43
15.76	613.21 BKF
17.99	612.32
22.17	612.20
27.00	612.39
29.91	613.33
38.86	614.94
49.28	616.31

Summary Data	
Bankfull Elevation	613.21
Bankfull Width (ft)	13.78
Floodprone Width (ft)	25.3
Bankfull Mean Depth (ft)	0.76
Bankfull Max Depth (ft)	1.01
Bankfull Cross Sectional Area (ft <sup>2</sup> )	10.42
Bankfull Width/Depth Ratio	18.13
Bankfull Entrenchment Ratio	1.84



Photo: Cross-section 2 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	3
Feature	Riffle
Drainage Area (sq mi)	2.70
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

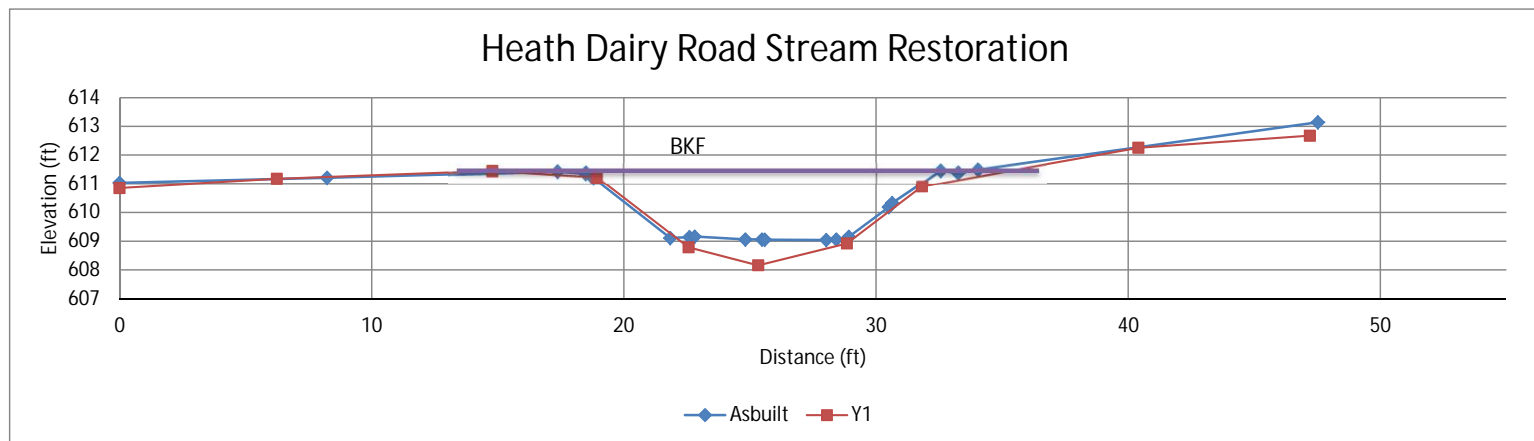
Station	Elevation
0.00	610.85
6.24	611.17
14.81	611.45
18.94	611.23
22.57	608.79
25.33	608.16
28.84	608.92
31.82	610.91 BKF
40.41	612.26
47.20	612.68

### Summary Data

Bankfull Elevation	610.91
Bankfull Width (ft)	13.57
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.58
Bankfull Max Depth (ft)	2.75
Bankfull Cross Sectional Area (ft <sup>2</sup> )	21.38
Bankfull Width/Depth Ratio	8.59
Bankfull Entrenchment Ratio	7.3



Photo: Cross-section 3 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	4
Feature	Pool
Drainage Area (sq mi)	2.70
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

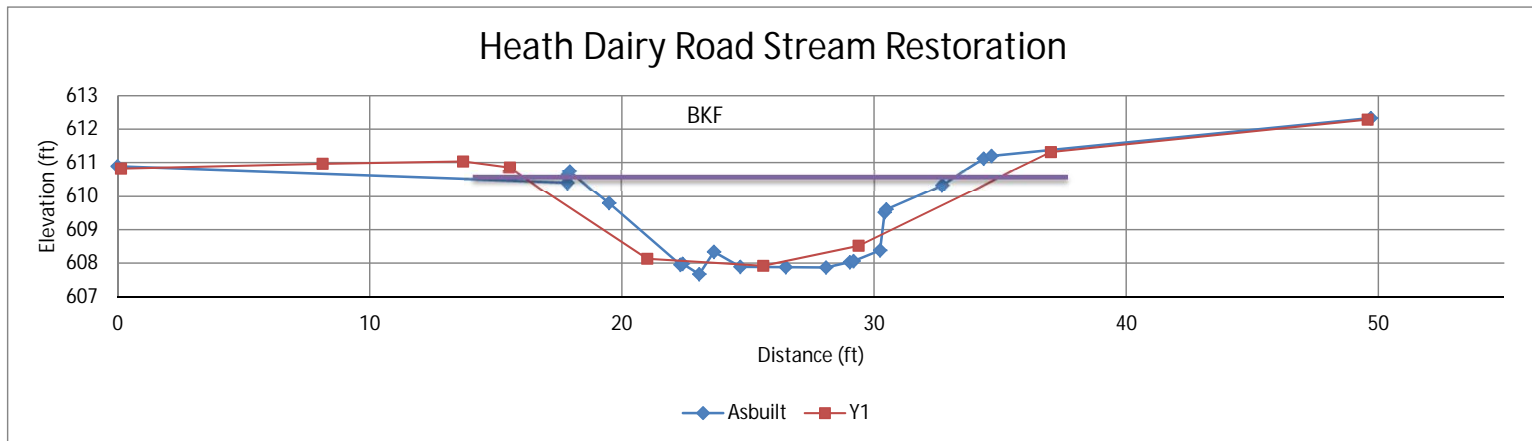
Station	Elevation
0.14	610.82
8.14	610.96
13.71	611.03
15.56	610.85 BKF
21.01	608.13
25.61	607.92
29.39	608.52
37.01	611.32
49.58	612.29

### Summary Data

Bankfull Elevation	610.82
Bankfull Width (ft)	20.17
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.87
Bankfull Max Depth (ft)	2.93
Bankfull Cross Sectional Area (ft <sup>2</sup> )	37.74
Bankfull Width/Depth Ratio	10.79
Bankfull Entrenchment Ratio	4.96



Photo: Cross-section 4 looking downstream



# Cross-section Plot Exhibit

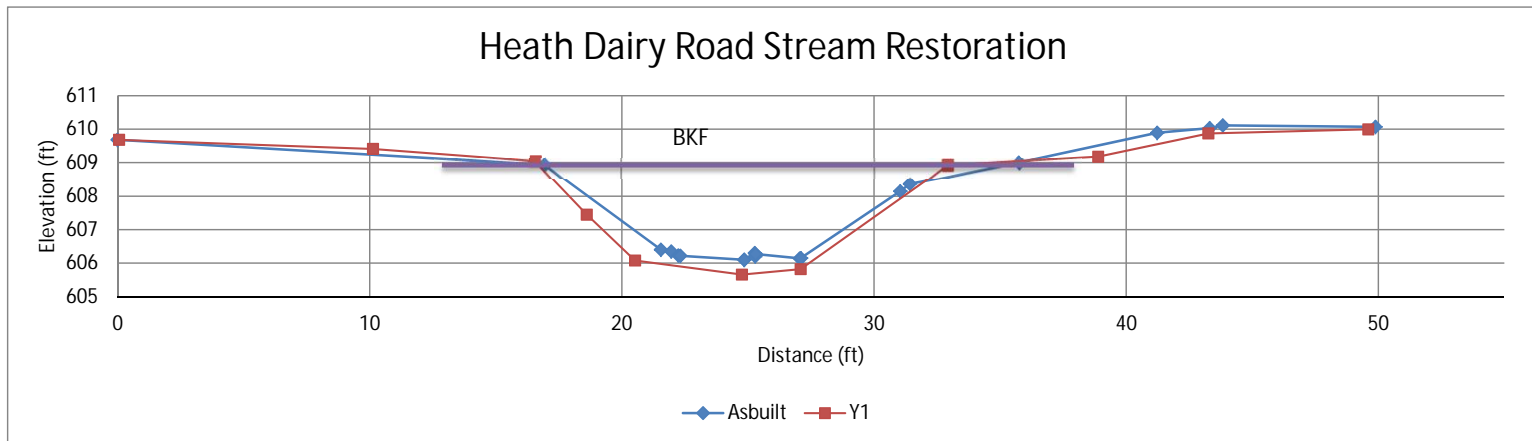
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	5
Feature	Pool
Drainage Area (sq mi)	2.70
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.06	609.68
10.13	609.41
16.59	609.04
18.61	607.45
20.52	606.08
24.77	605.66
27.09	605.82
32.91	608.92 BKF
38.89	609.18
43.26	609.87
49.60	609.99

Summary Data	
Bankfull Elevation	609.18
Bankfull Width (ft)	16.17
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	2.16
Bankfull Max Depth (ft)	3.26
Bankfull Cross Sectional Area (ft <sup>2</sup> )	34.85
Bankfull Width/Depth Ratio	7.49
Bankfull Entrenchment Ratio	8.2



Photo: Cross-section 5 looking downstream



# Cross-section Plot Exhibit

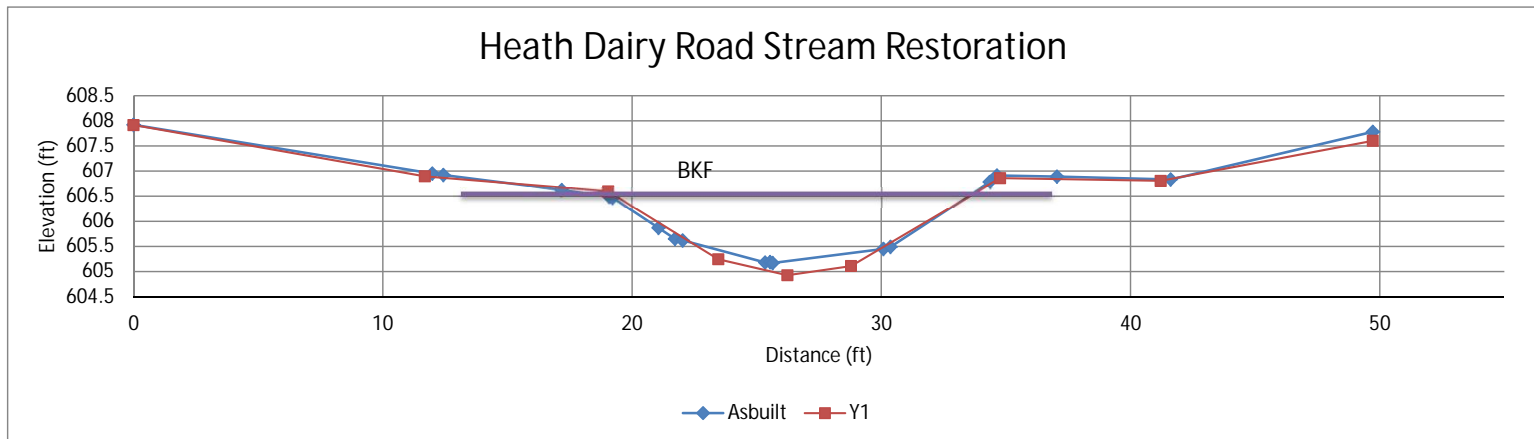
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	6
Feature	Riffle
Drainage Area (sq mi)	2.70
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.00	607.92
11.69	606.90
19.05	606.59 BKF
23.46	605.24
26.23	604.93
28.78	605.11
34.76	606.86
41.21	606.80
49.72	607.60

Summary Data	
Bankfull Elevation	606.59
Bankfull Width (ft)	14.79
Floodprone Width (ft)	75
Bankfull Mean Depth (ft)	1.01
Bankfull Max Depth (ft)	1.66
Bankfull Cross Sectional Area (ft <sup>2</sup> )	14.89
Bankfull Width/Depth Ratio	14.64
Bankfull Entrenchment Ratio	5



Photo: Cross-section 6 looking downstream





# Cross-section Plot Exhibit

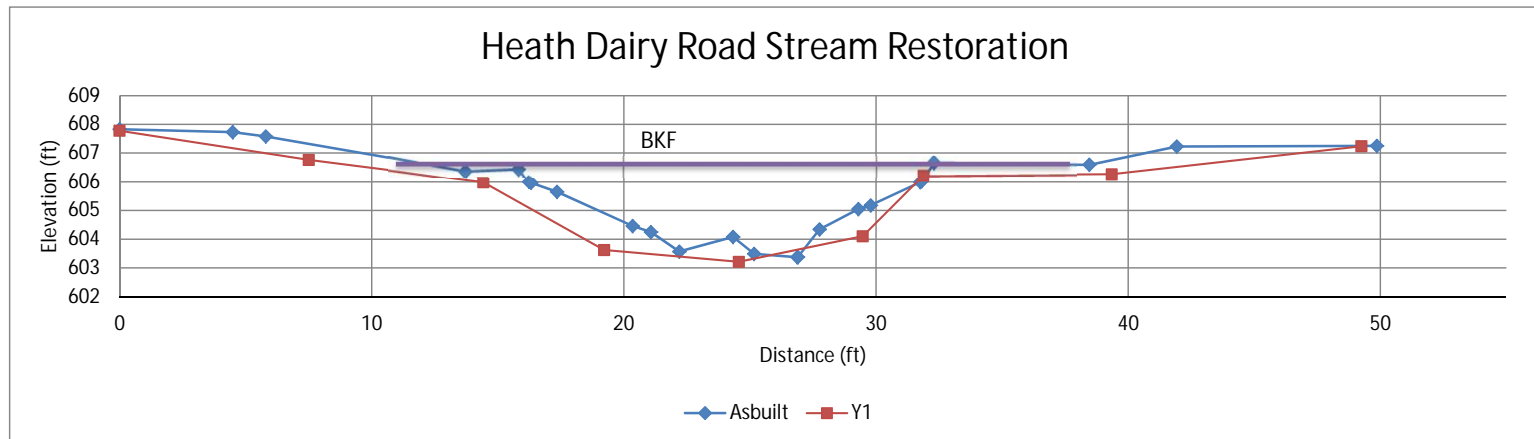
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	7
Feature	Pool
Dranage Area (sq mi)	
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.00	607.78
7.51	606.76
14.43	605.99
19.22	603.62
24.56	603.21
29.48	604.10
31.87	606.22 BKF
39.35	606.26
49.25	607.24

Summary Data	
Bankfull Elevation	606.22
Bankfull Width (ft)	19.51
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.9
Bankfull Max Depth (ft)	3.01
Bankfull Cross Sectional Area (ft <sup>2</sup> )	37.15
Bankfull Width/Depth Ratio	10.27
Bankfull Entrenchment Ratio	5.1



Photo: Cross-section 7 looking downstream



# Cross-section Plot Exhibit

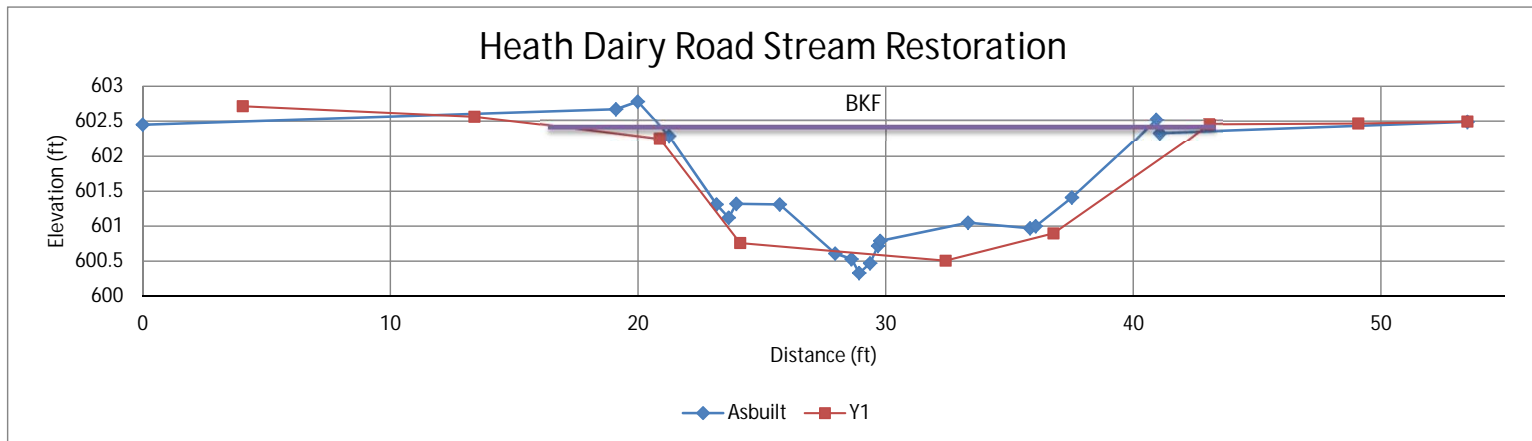
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	8
Feature	Riffle
Drainage Area (sq mi)	2.70
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
4.04	602.71
13.39	602.56
20.88	602.25 BKF
24.13	600.76
32.42	600.51
36.78	600.90
43.06	602.46
49.08	602.47
53.49	602.49

Summary Data	
Bankfull Elevation	602.25
Bankfull Width (ft)	21.33
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.23
Bankfull Max Depth (ft)	1.74
Bankfull Cross Sectional Area (ft <sup>2</sup> )	26.21
Bankfull Width/Depth Ratio	17.34
Bankfull Entrenchment Ratio	4.68



Photo: Cross-section 8 looking downstream



# Cross-section Plot Exhibit

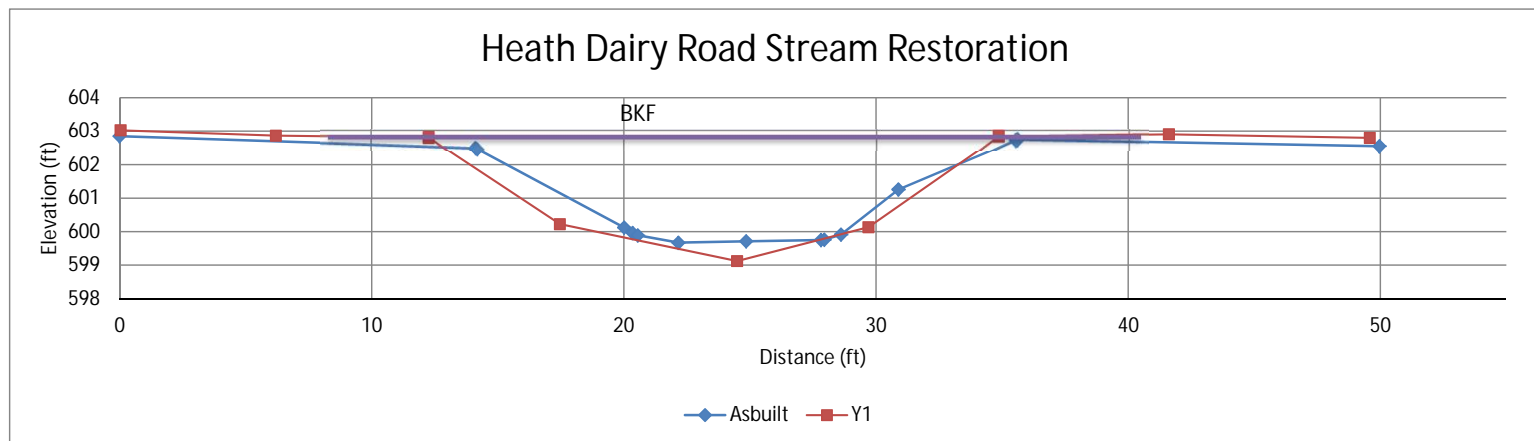
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	9
Feature	Pool
Drainage Area (sq mi)	2.70
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.04	603.02
6.20	602.87
12.28	602.81 BKF
17.47	600.22
24.49	599.12
29.70	600.13
34.84	602.84
41.62	602.91
49.58	602.80

Summary Data	
Bankfull Elevation	602.81
Bankfull Width (ft)	22.5
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	2.32
Bankfull Max Depth (ft)	3.69
Bankfull Cross Sectional Area (ft <sup>2</sup> )	52.17
Bankfull Width/Depth Ratio	9.7
Bankfull Entrenchment Ratio	4.4



Photo: Cross-section 9 looking downstream



# Cross-section Plot Exhibit

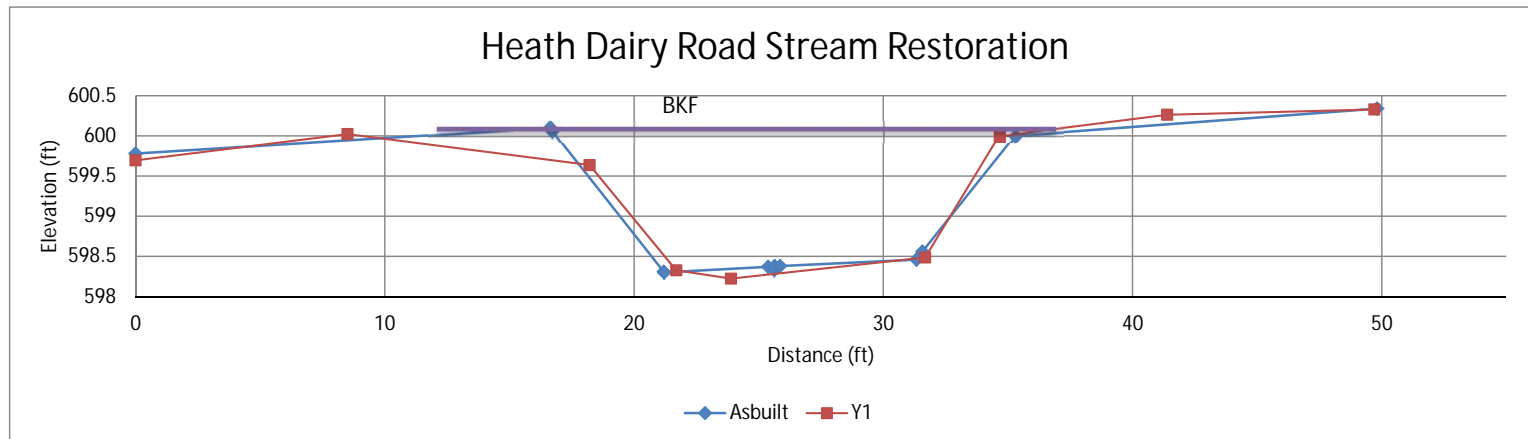
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	10
Feature	Riffle
Drainage Area (sq mi)	2.84
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.00	599.70
8.50	600.02
18.22	599.64 BKF
21.69	598.33
23.89	598.22
31.68	598.49
34.64	600.00
41.39	600.26
49.70	600.33

Summary Data	
Bankfull Elevation	599.64
Bankfull Width (ft)	15.71
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.06
Bankfull Max Depth (ft)	1.42
Bankfull Cross Sectional Area (ft <sup>2</sup> )	16.58
Bankfull Width/Depth Ratio	14.82
Bankfull Entrenchment Ratio	6.4



Photo: Cross-section 10 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	11
Feature	Pool
Drainage Area (sq mi)	2.84
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.00	600.12
8.21	600.13
14.78	599.64 BKF
18.69	597.56
23.40	596.70
26.87	597.73
31.27	599.57
37.62	600.51
49.49	600.55

Summary Data	
Bankfull Elevation	599.64
Bankfull Width (ft)	16.96
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.69
Bankfull Max Depth (ft)	2.94
Bankfull Cross Sectional Area (ft <sup>2</sup> )	28.68
Bankfull Width/Depth Ratio	10.04
Bankfull Entrenchment Ratio	5.9

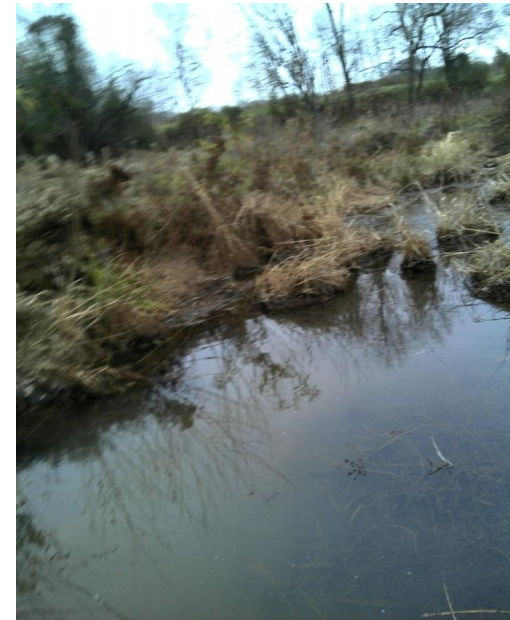
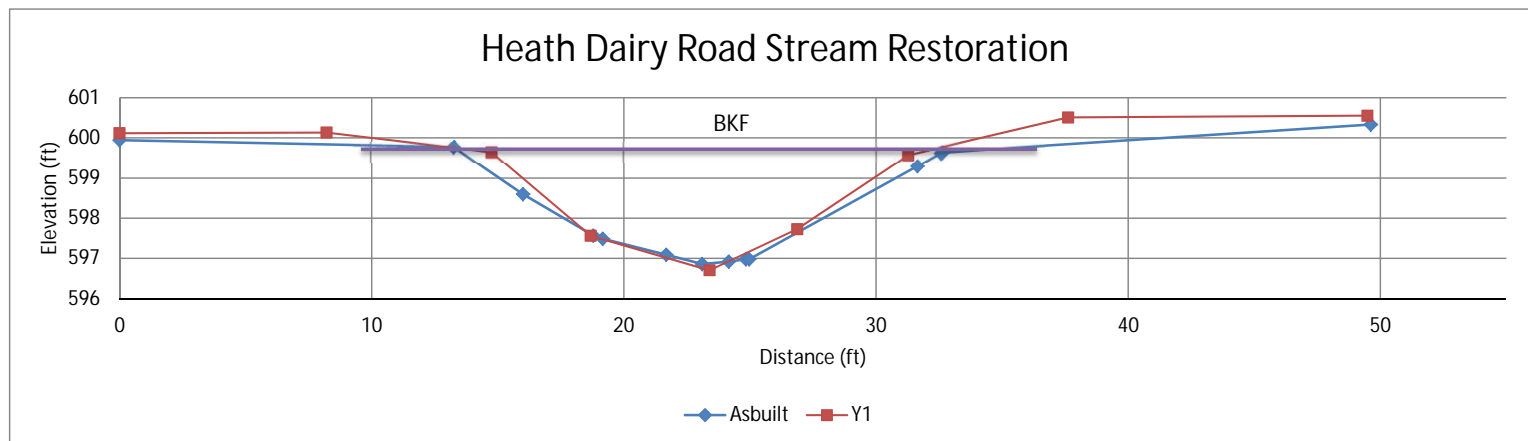


Photo: Cross-section 11 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	12
Feature	Riffle
Drainage Area (sq mi)	2.84
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

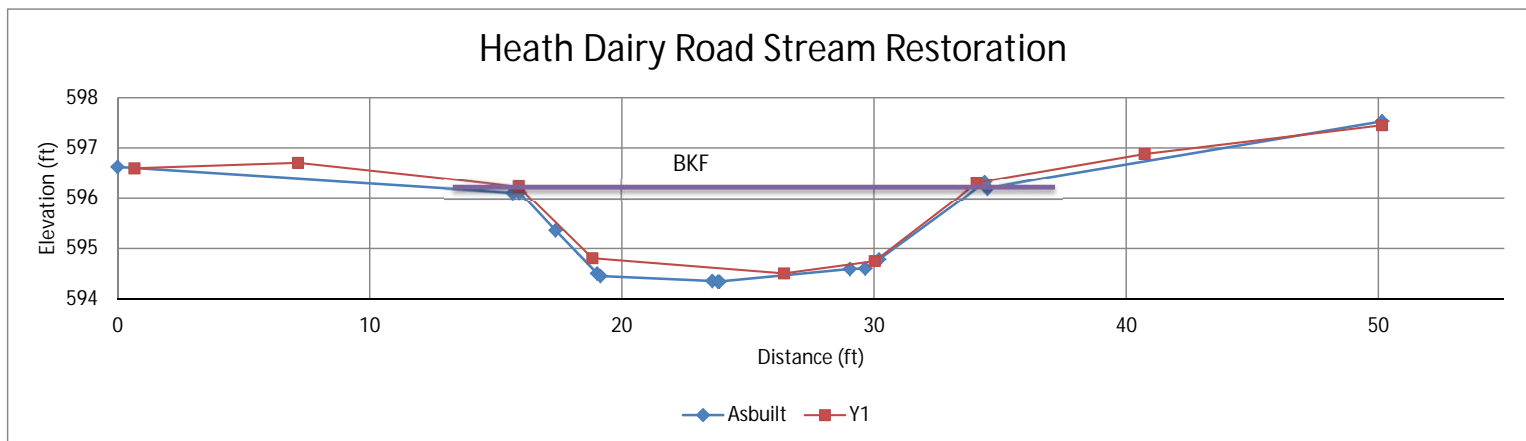
Station	Elevation
0.67	596.59
7.16	596.70
15.94	596.23 BKF
18.84	594.80
26.43	594.50
30.03	594.75
34.06	596.30
40.73	596.88
50.15	597.45

### Summary Data

Bankfull Elevation	596.23
Bankfull Width (ft)	17.94
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.26
Bankfull Max Depth (ft)	1.73
Bankfull Cross Sectional Area (ft <sup>2</sup> )	22.69
Bankfull Width/Depth Ratio	14.24
Bankfull Entrenchment Ratio	5.6



Photo: Cross-section 12 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	13
Feature	Pool
Drainage Area (sq mi)	2.84
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.69	596.54
9.60	596.59
15.18	596.27
20.21	595.84 BKF
23.58	593.42
28.64	593.03
33.36	593.76
35.94	595.71
39.16	596.32
44.57	596.53
44.87	597.30

### Summary Data

Bankfull Elevation	595.54
Bankfull Width (ft)	16.42
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.93
Bankfull Max Depth (ft)	2.81
Bankfull Cross Sectional Area (ft <sup>2</sup> )	31.75
Bankfull Width/Depth Ratio	8.51
Bankfull Entrenchment Ratio	6

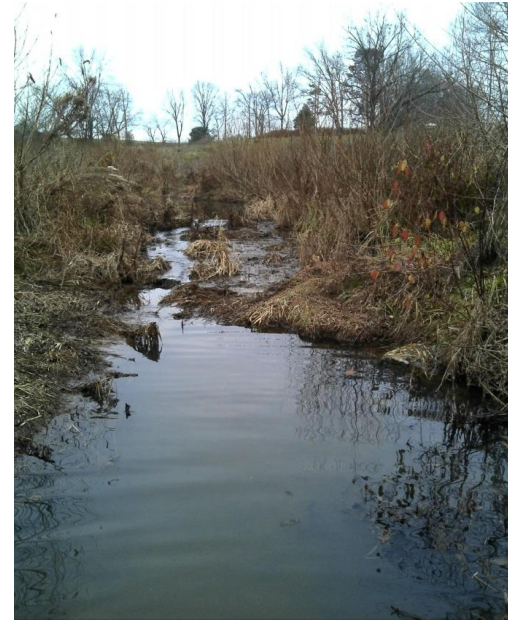
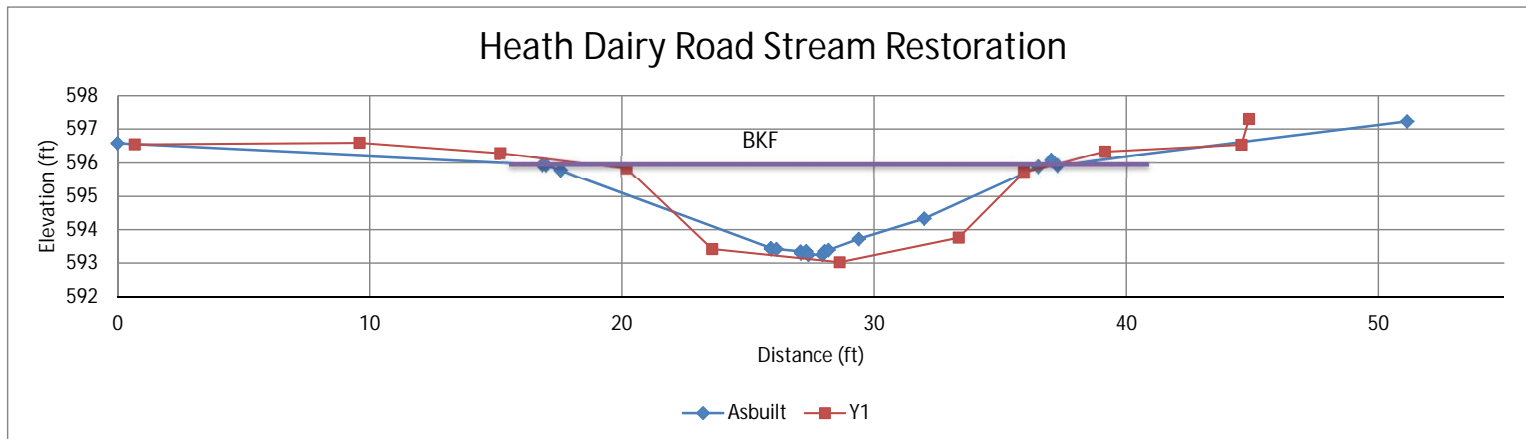


Photo: Cross-section 13 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	14
Feature	Riffle
Drainage Area (sq mi)	2.84
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

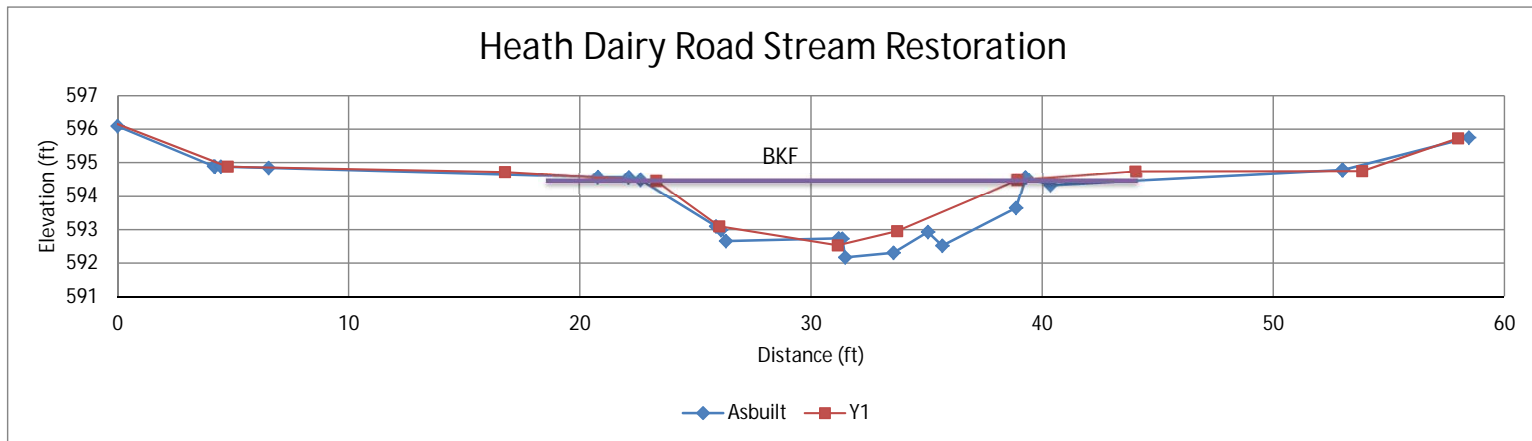
Station	Elevation
0.00	596.15
4.77	594.88
16.76	594.72
23.32	594.45 BKF
26.03	593.10
31.16	592.53
33.73	592.96
38.90	594.48
44.04	594.73
53.85	594.75
58.00	595.73

### Summary Data

Bankfull Elevation	595.45
Bankfull Width (ft)	15.48
Floodprone Width (ft)	70
Bankfull Mean Depth (ft)	1.19
Bankfull Max Depth (ft)	1.92
Bankfull Cross Sectional Area (ft <sup>2</sup> )	18.37
Bankfull Width/Depth Ratio	13.01
Bankfull Entrenchment Ratio	4.5



Photo: Cross-section 14 looking downstream





# Cross-section Plot Exhibit

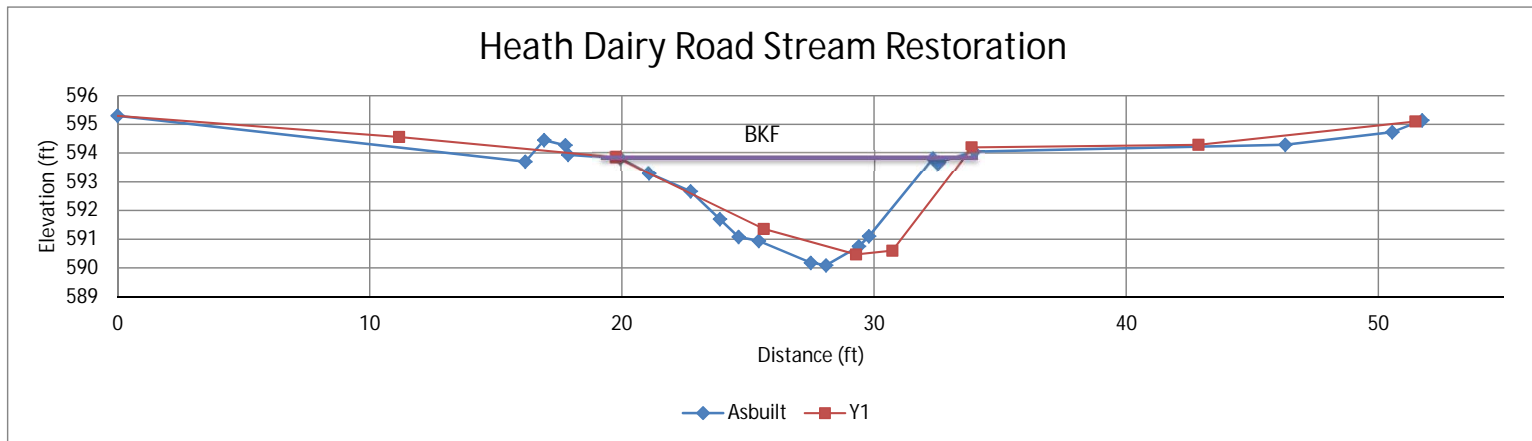
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	15
Feature	Pool
Drainage Area (sq mi)	2.84
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.00	595.30
11.17	594.56
19.80	593.85 BKF
25.62	591.36
29.29	590.47
30.73	590.60
33.87	594.20
42.87	594.29
51.47	595.10

Summary Data	
Bankfull Elevation	593.85
Bankfull Width (ft)	13.76
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.99
Bankfull Max Depth (ft)	3.38
Bankfull Cross Sectional Area (ft <sup>2</sup> )	27.4
Bankfull Width/Depth Ratio	6.91
Bankfull Entrenchment Ratio	7.3



Photo: Cross-section 15 looking downstream



# Cross-section Plot Exhibit

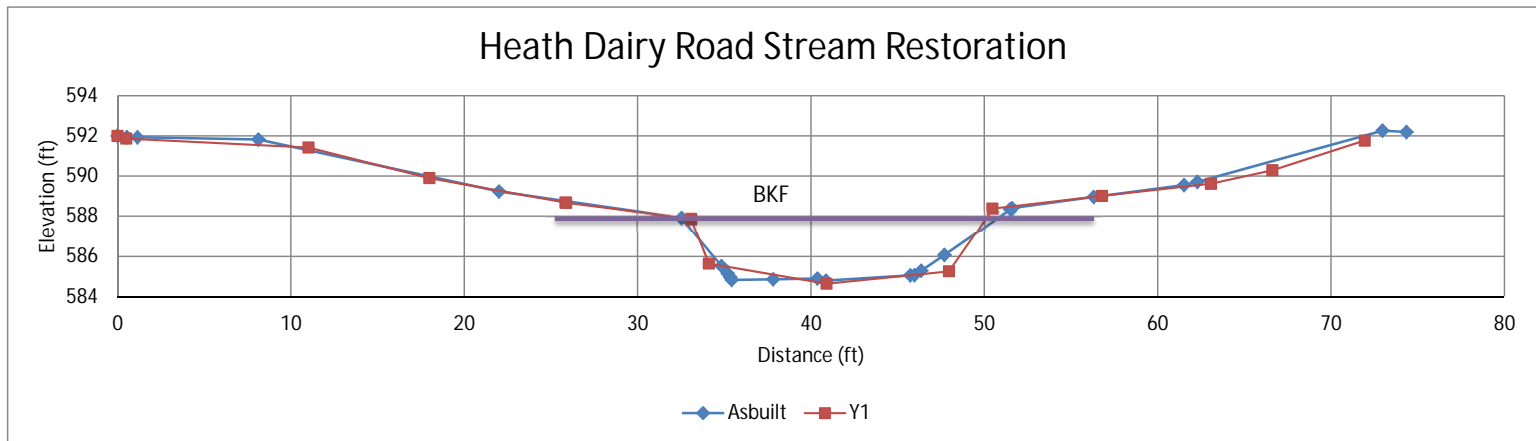
River Basin	Yadkin-Pee Dee
Watershed	Back Creek
X-Sec ID	16
Feature	Pool
Drainage Area (sq mi)	4.23
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.00	592.00
0.51	591.86
11.02	591.42
17.98	589.90
25.83	588.68
25.88	588.67
33.10	587.86 BKF
34.11	585.64
40.90	584.64
47.96	585.26
50.47	588.38
56.79	589.01
63.07	589.62
66.61	590.29
71.94	591.77

Summary Data	
Bankfull Elevation	587.86
Bankfull Width (ft)	16.95
Floodprone Width (ft)	57
Bankfull Mean Depth (ft)	2.53
Bankfull Max Depth (ft)	3.22
Bankfull Cross Sectional Area (ft <sup>2</sup> )	42.85
Bankfull Width/Depth Ratio	6.7
Bankfull Entrenchment Ratio	3.4



Photo: Cross-section 16 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	West Branch Back Creek
X-Sec ID	17
Feature	Pool
Drainage Area (sq mi)	0.14 (90 acres)
Date	Jan-15
Field Crew	Steven Pires, Ron Johnson

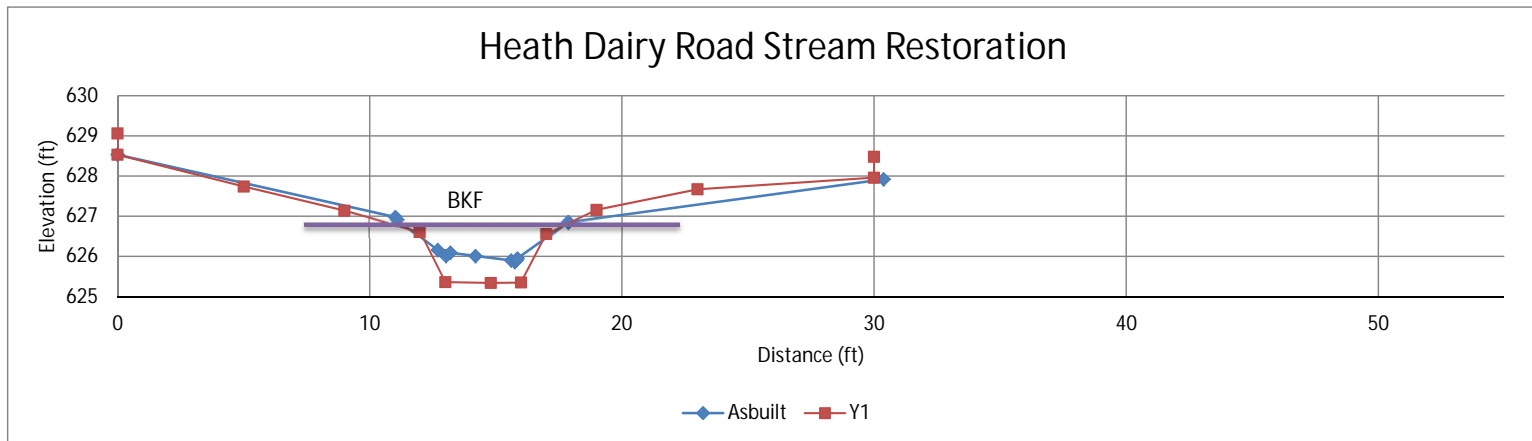
Station	Elevation
0	629.06
0	628.53
5	627.74
9	627.14
12	626.61
13	625.36
14.8	625.34
16	625.35
17	626.56 BKF
19	627.16
23	627.67
30	627.96
30	628.48

### Summary Data

Bankfull Elevation	626.56
Bankfull Width (ft)	4.96
Floodprone Width (ft)	20
Bankfull Mean Depth (ft)	0.97
Bankfull Max Depth (ft)	1.22
Bankfull Cross Sectional Area (ft <sup>2</sup> )	4.82
Bankfull Width/Depth Ratio	5.1
Bankfull Entrenchment Ratio	4.22



Photo: Cross-section 17 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	West Branch Back Creek
X-Sec ID	18
Feature	Riffle
Drainage Area (sq mi)	0.14 (90 acres)
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

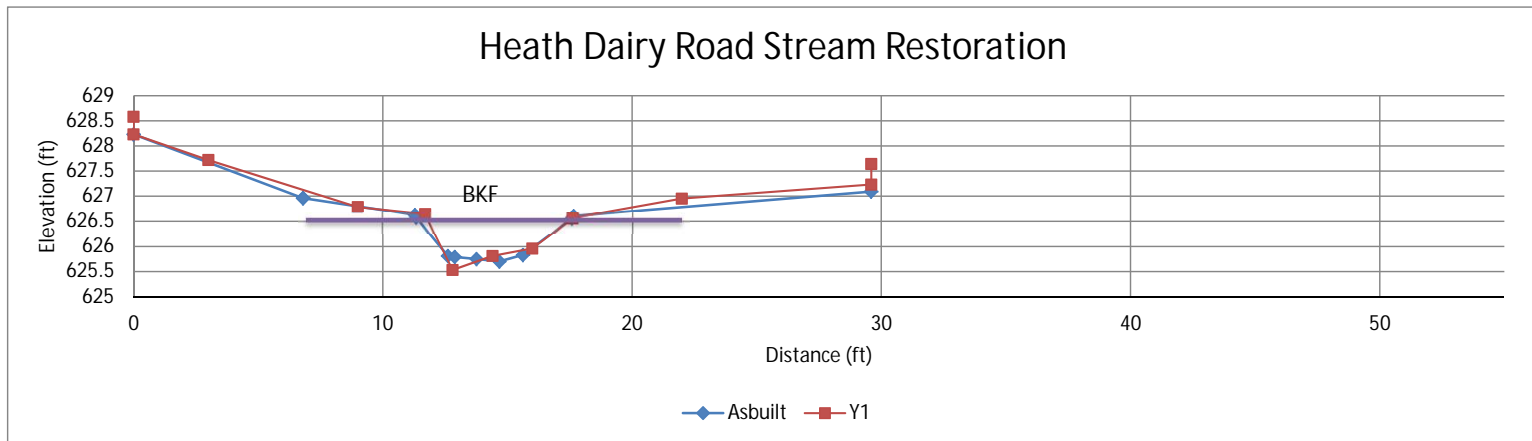
Station	Elevation
0	628.58
0	628.23
3	627.72
9	626.78
11.7	626.64
12.8	625.53
14.4	625.81
16	625.96
17.6	626.56 BKF
22	626.95
29.6	627.23
29.6	627.64

### Summary Data

Bankfull Elevation	626.56
Bankfull Width (ft)	5.82
Floodprone Width (ft)	26
Bankfull Mean Depth (ft)	0.6
Bankfull Max Depth (ft)	1.03
Bankfull Cross Sectional Area (ft <sup>2</sup> )	3.51
Bankfull Width/Depth Ratio	9.7
Bankfull Entrenchment Ratio	4.43



Photo: Cross-section 18 looking downstream



# Cross-section Plot Exhibit

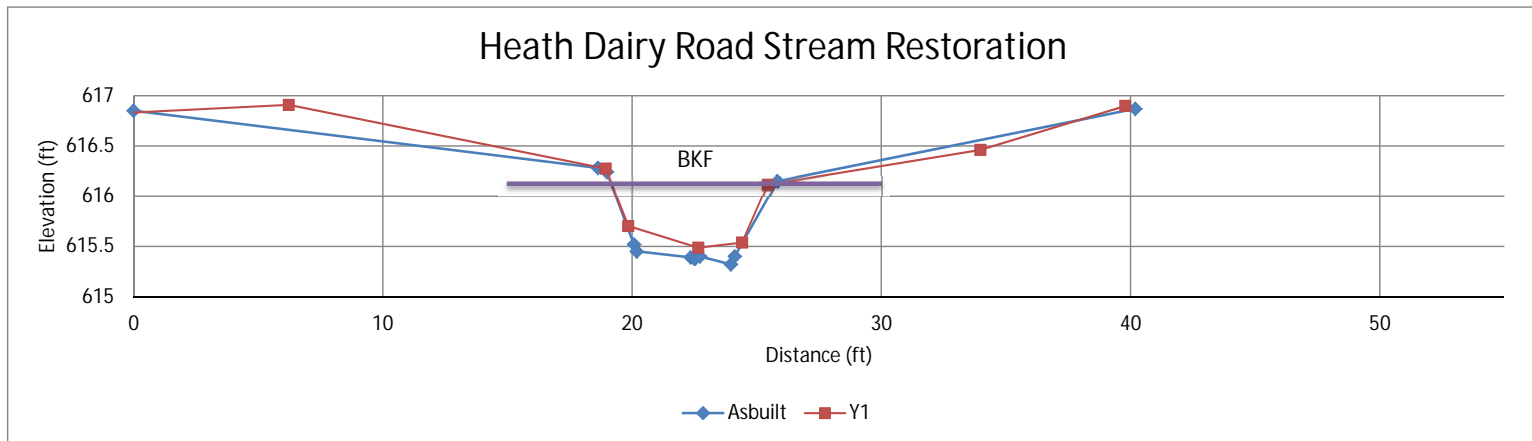
River Basin	Yadkin-Pee Dee
Watershed	West Branch Back Creek
X-Sec ID	19
Feature	Riffle
Dranage Area (sq mi)	0.14 (90 acres)
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.00	616.83
6.23	616.91
18.94	616.27
19.85	615.70
22.66	615.49
24.41	615.54
25.43	616.11 BKF
33.97	616.46
39.79	616.90

Summary Data	
Bankfull Elevation	616.11
Bankfull Width (ft)	6.23
Floodprone Width (ft)	27.7
Bankfull Mean Depth (ft)	0.47
Bankfull Max Depth (ft)	0.62
Bankfull Cross Sectional Area (ft <sup>2</sup> )	2.91
Bankfull Width/Depth Ratio	13.26
Bankfull Entrenchment Ratio	4.45



Photo: Cross-section 19 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	West Branch Back Creek
X-Sec ID	20
Feature	Riffle
Drainage Area (sq mi)	0.14 (90 acres)
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

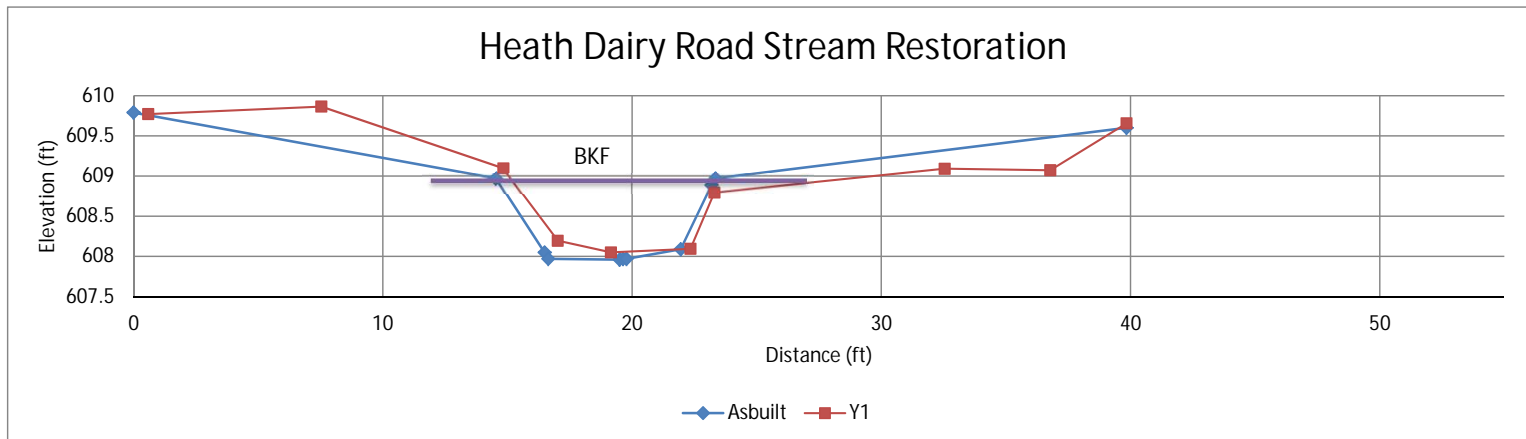
Station	Elevation
0.59	609.77
7.54	609.86
14.84	609.10
17.02	608.20
19.16	608.05
22.34	608.10
23.31	608.80 BKF
32.54	609.09
36.78	609.07
39.84	609.66

### Summary Data

Bankfull Elevation	608.8
Bankfull Width (ft)	7.74
Floodprone Width (ft)	29
Bankfull Mean Depth (ft)	0.58
Bankfull Max Depth (ft)	0.75
Bankfull Cross Sectional Area (ft <sup>2</sup> )	4.53
Bankfull Width/Depth Ratio	13.34
Bankfull Entrenchment Ratio	3.71



Photo: Cross-section 20 looking downstream



# Cross-section Plot Exhibit

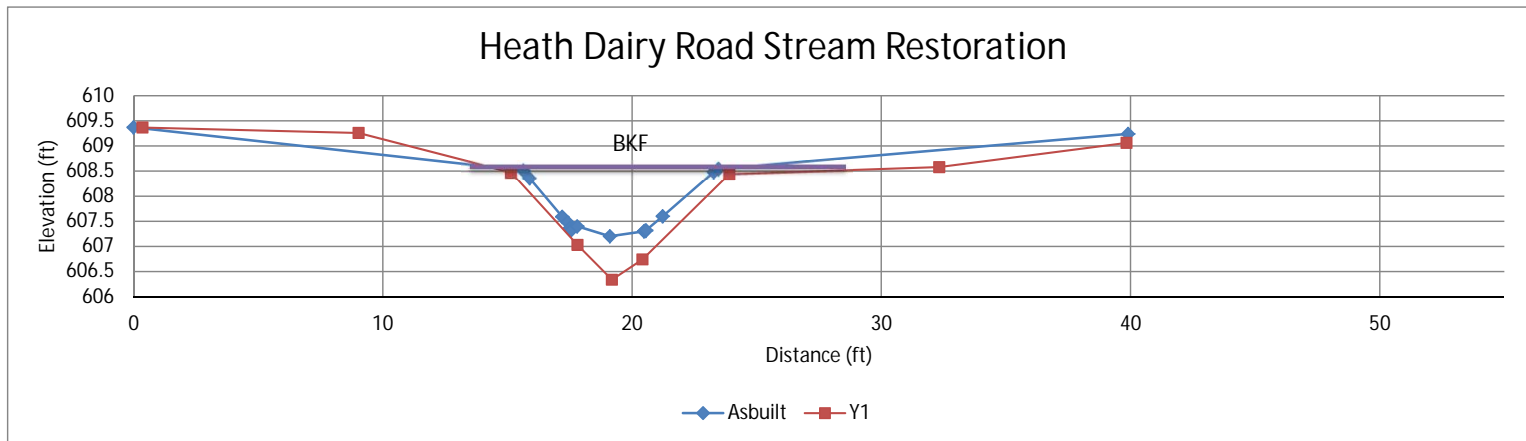
River Basin	Yadkin-Pee Dee
Watershed	West Branch Back Creek
X-Sec ID	21
Feature	Pool
Drainage Area (sq mi)	0.14 (90 acres)
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.36	609.37
9.03	609.26
15.16	608.47 BKF
17.81	607.03
19.19	606.34
20.42	606.74
23.90	608.44
32.32	608.58
39.84	609.06

Summary Data	
Bankfull Elevation	608.47
Bankfull Width (ft)	10.54
Floodprone Width (ft)	40
Bankfull Mean Depth (ft)	0.93
Bankfull Max Depth (ft)	2.13
Bankfull Cross Sectional Area (ft <sup>2</sup> )	9.83
Bankfull Width/Depth Ratio	11.33
Bankfull Entrenchment Ratio	3.74



Photo: Cross-section 21 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	West Branch Back Creek
X-Sec ID	22
Feature	Riffle
Dranage Area (sq mi)	0.14 (90 acres)
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

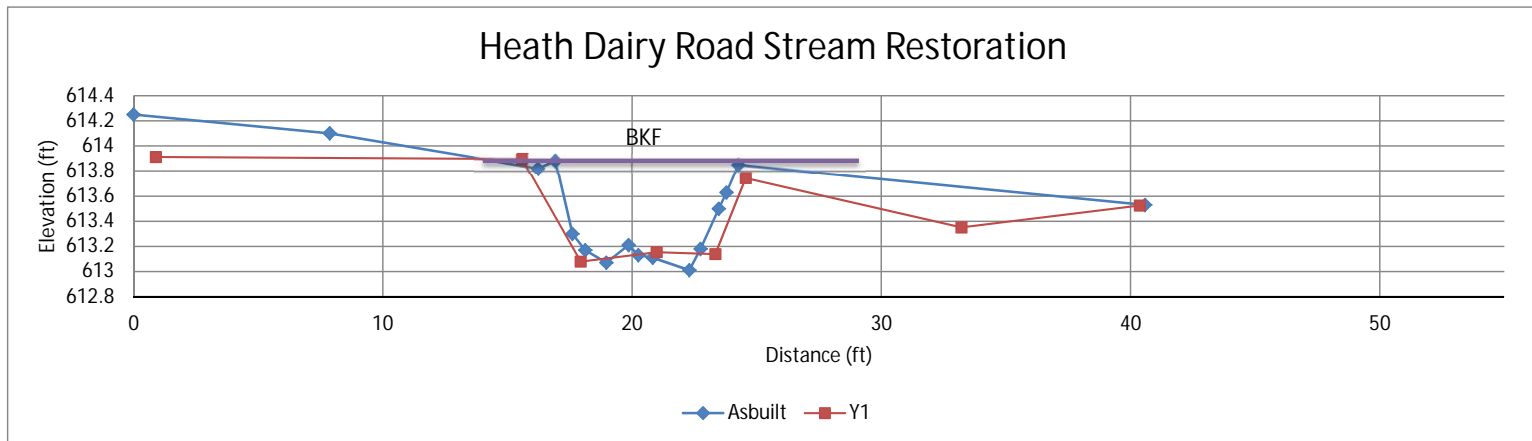
Station	Elevation
0.90	613.91
15.61	613.90
17.94	613.08
20.99	613.15
23.34	613.14
24.56	613.75 BKF
33.22	613.35
40.38	613.53

### Summary Data

Bankfull Elevation	613.91
Bankfull Width (ft)	8.52
Floodprone Width (ft)	75
Bankfull Mean Depth (ft)	0.51
Bankfull Max Depth (ft)	0.67
Bankfull Cross Sectional Area (ft <sup>2</sup> )	4.37
Bankfull Width/Depth Ratio	16.71
Bankfull Entrenchment Ratio	8.52



Photo: Cross-section 22 looking downstream





# Cross-section Plot Exhibit

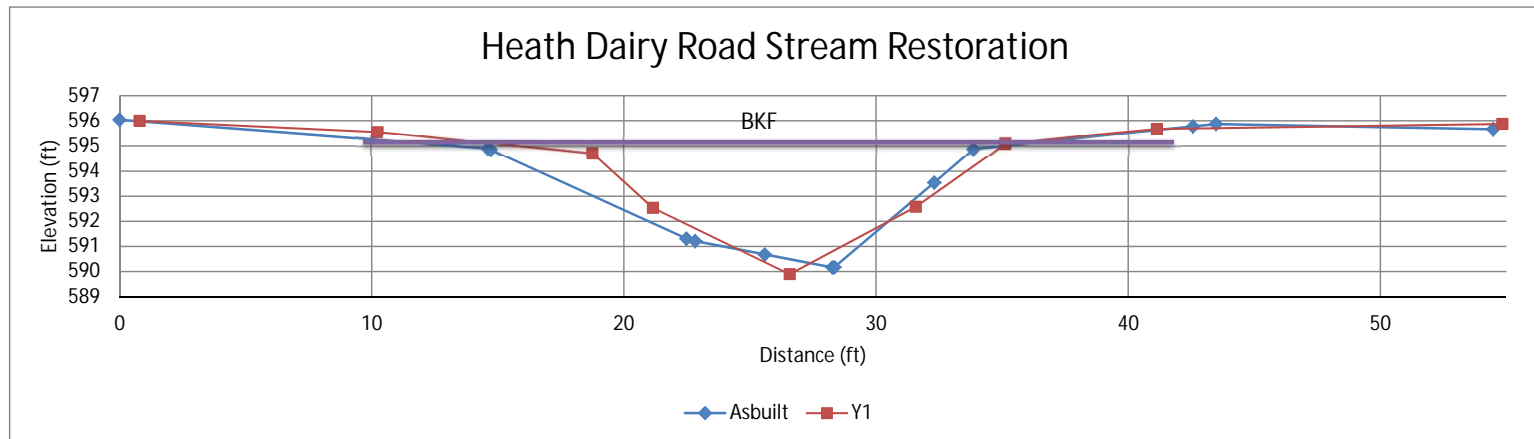
River Basin	Yadkin-Pee Dee
Watershed	North Branch Back Creek
X-Sec ID	23
Feature	Pool
Drainage Area (sq mi)	1.14
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.80	595.99
10.24	595.54
18.76	594.72 BKF
21.15	592.53
26.57	589.89
31.58	592.58
35.11	595.09
41.14	595.67
54.84	595.87

Summary Data	
Bankfull Elevation	594.72
Bankfull Width (ft)	15.83
Floodprone Width (ft)	200
Bankfull Mean Depth (ft)	2.67
Bankfull Max Depth (ft)	4.83
Bankfull Cross Sectional Area (ft <sup>2</sup> )	42.32
Bankfull Width/Depth Ratio	5.93
Bankfull Entrenchment Ratio	12.63



Photo: Cross-section 23 looking downstream



# Cross-section Plot Exhibit

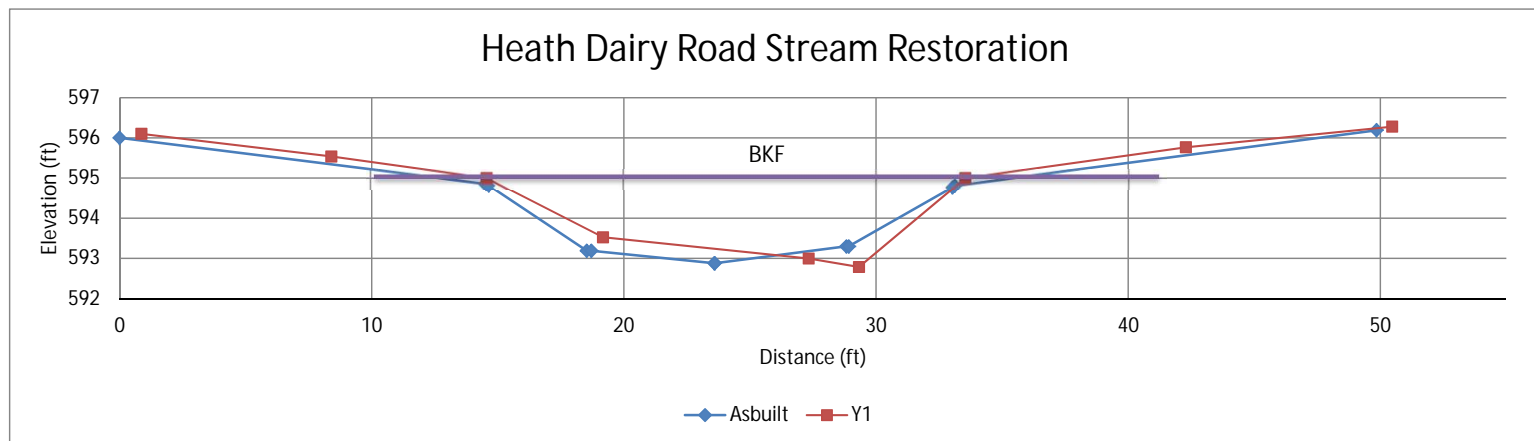
River Basin	Yadkin-Pee Dee
Watershed	North Branch Back Creek
X-Sec ID	24
Feature	Riffle
Drainage Area (sq mi)	1.14
Date	Dec-14
Field Crew	Steven Pires, Kevin Lapp

Station	Elevation
0.87	596.10
8.40	595.54
14.59	595.00 BKF
19.17	593.53
27.33	593.00
29.33	592.79
33.53	595.00
42.29	595.77
50.47	596.28

Summary Data	
Bankfull Elevation	595
Bankfull Width (ft)	18.94
Floodprone Width (ft)	200
Bankfull Mean Depth (ft)	1.39
Bankfull Max Depth (ft)	2.21
Bankfull Cross Sectional Area (ft <sup>2</sup> )	26.37
Bankfull Width/Depth Ratio	13.63
Bankfull Entrenchment Ratio	10.56



Photo: Cross-section 24 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	North Branch Back Creek
X-Sec ID	25
Feature	Riffle
Drainage Area (sq mi)	1.14
Date	Dec-14
Field Crew	Steven Pires, Ron Johnson

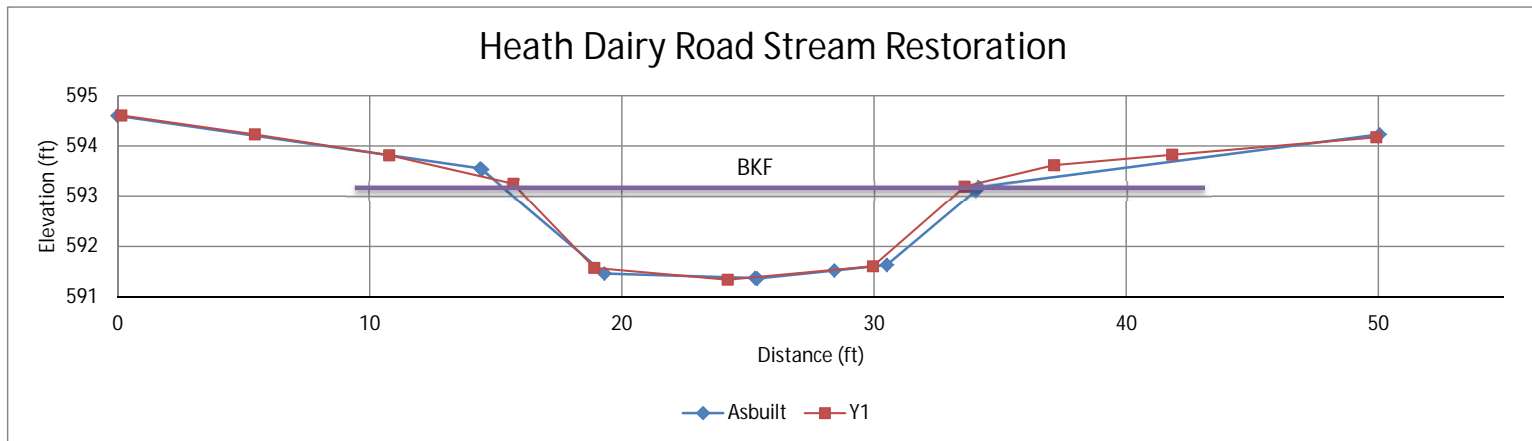
Station	Elevation
0.15	594.61
5.45	594.23
10.77	593.81
15.70	593.25
18.91	591.57
24.20	591.34
29.96	591.60
33.57	593.19 BKF
37.14	593.62
41.83	593.83
49.92	594.17

### Summary Data

Bankfull Elevation	593.19
Bankfull Width (ft)	17.76
Floodprone Width (ft)	100
Bankfull Mean Depth (ft)	1.38
Bankfull Max Depth (ft)	1.85
Bankfull Cross Sectional Area (ft <sup>2</sup> )	24.46
Bankfull Width/Depth Ratio	12.87
Bankfull Entrenchment Ratio	5.63



Photo: Cross-section 25 looking downstream



# Cross-section Plot Exhibit

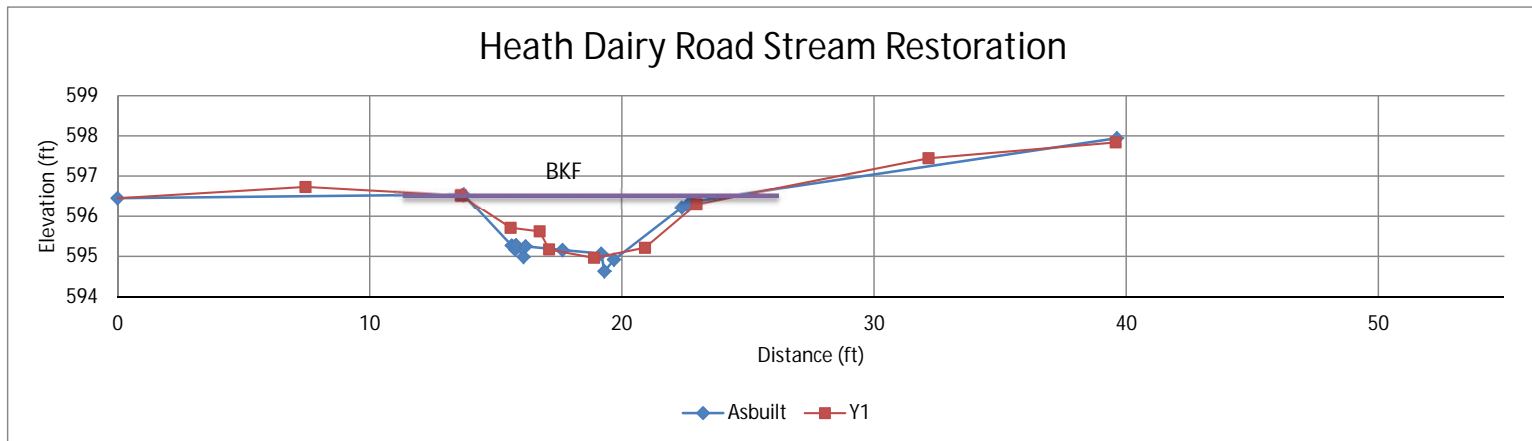
River Basin	Yadkin-Pee Dee
Watershed	East Branch Back Creek
X-Sec ID	26
Feature	Pool
Dranage Area (sq mi)	0.25
Date	Dec-14
Field Crew	Steven Pires, Ron Johnson

Station	Elevation
0.00	596.45
7.46	596.73
13.65	596.52
15.59	595.71
16.74	595.62
17.11	595.17
18.90	594.96
20.92	595.22
22.96	596.30 BKF
32.16	597.44
39.58	597.84

Summary Data	
Bankfull Elevation	596.3
Bankfull Width (ft)	8.78
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.82
Bankfull Max Depth (ft)	1.34
Bankfull Cross Sectional Area (ft <sup>2</sup> )	7.24
Bankfull Width/Depth Ratio	10.71
Bankfull Entrenchment Ratio	5.69



Photo: Cross-section 26 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	East Branch Back Creek
X-Sec ID	27
Feature	Riffle
Drainage Area (sq mi)	0.25
Date	Dec-14
Field Crew	Steven Pires, Ron Johnson

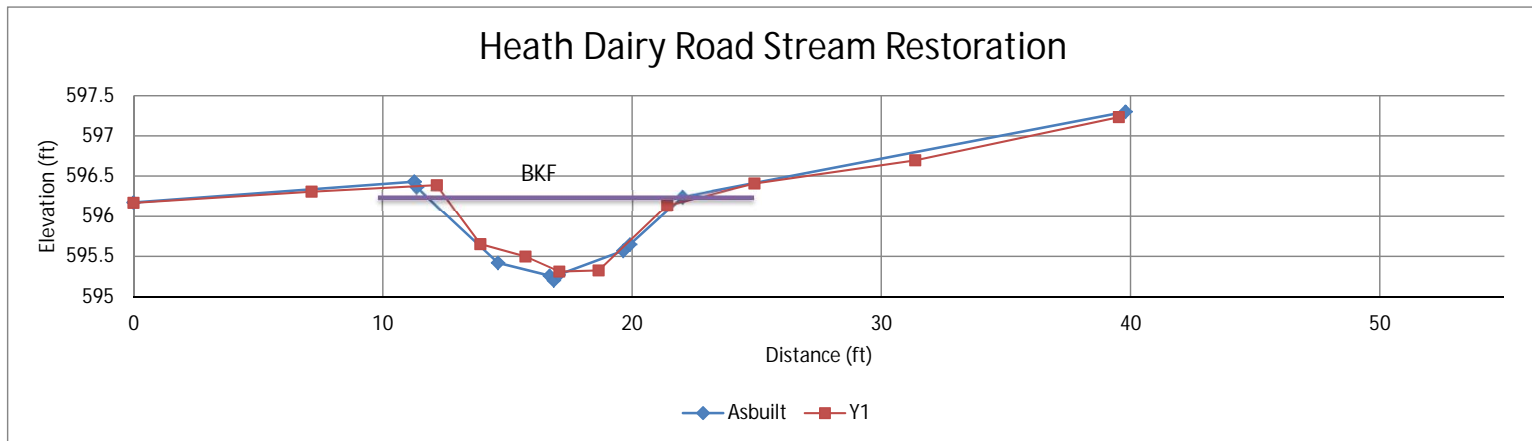
Station	Elevation
0.00	596.17
7.15	596.31
12.17	596.39
13.92	595.65
15.73	595.50
17.09	595.31
18.66	595.33
21.40	596.14 BKF
24.91	596.41
31.36	596.70
39.53	597.23

### Summary Data

Bankfull Elevation	596.14
Bankfull Width (ft)	8.64
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.54
Bankfull Max Depth (ft)	0.83
Bankfull Cross Sectional Area (ft <sup>2</sup> )	4.7
Bankfull Width/Depth Ratio	16
Bankfull Entrenchment Ratio	5.78



Photo: Cross-section 27 looking downstream



# Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	East Branch Back Creek
X-Sec ID	28
Feature	Riffle
Drainage Area (sq mi)	0.25
Date	Dec-14
Field Crew	Steven Pires, Ron Johnson

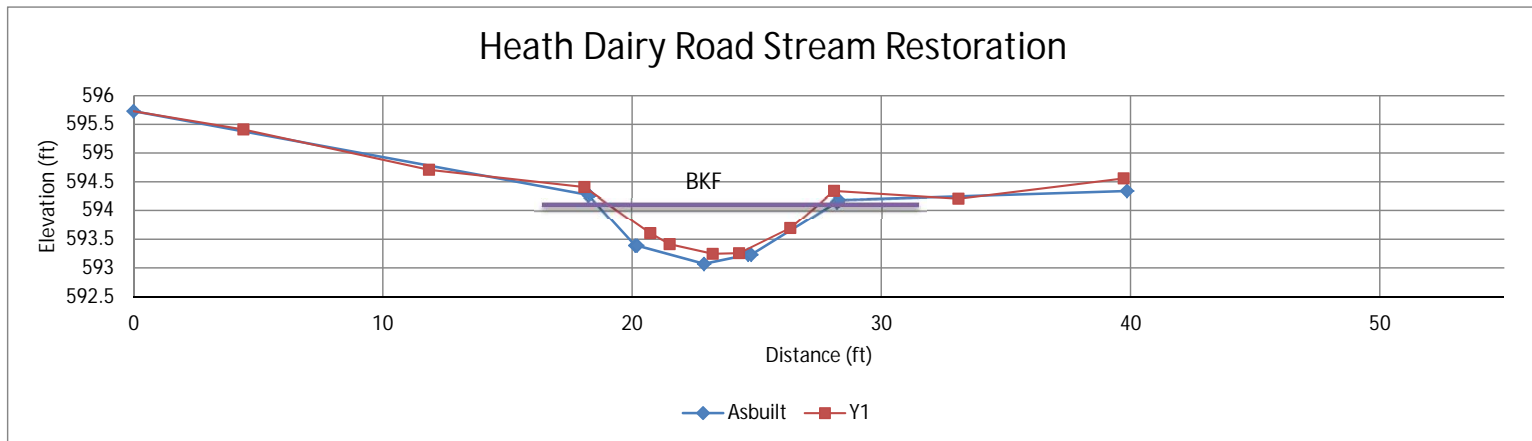
Station	Elevation
0.00	595.73
4.40	595.41
11.85	594.71
18.09	594.41
20.73	593.61
21.51	593.41
23.24	593.25
24.30	593.26
26.34	593.70
28.10	594.34 BKF
33.10	594.21
39.72	594.56

### Summary Data

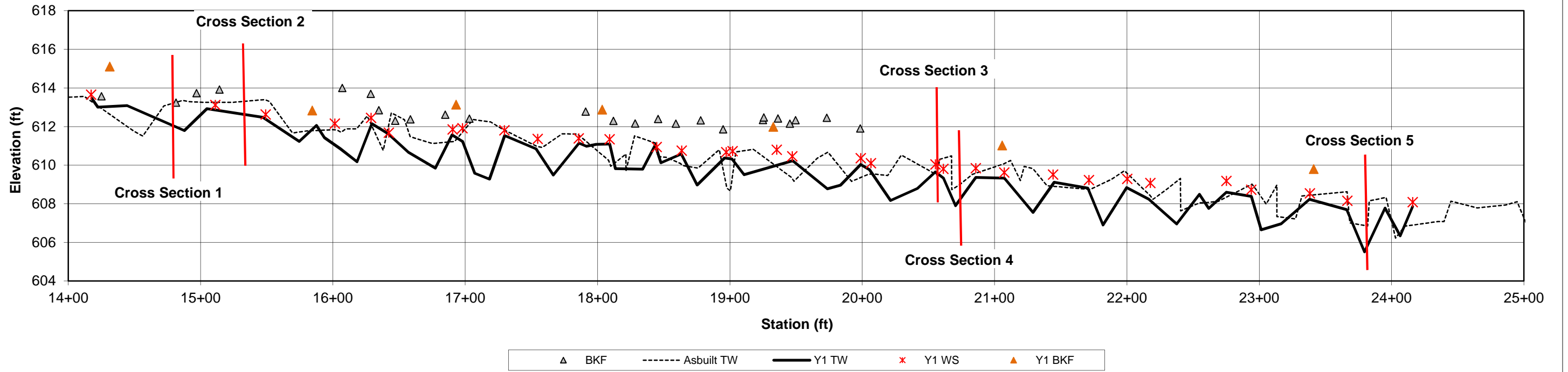
Bankfull Elevation	594.34
Bankfull Width (ft)	9.88
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.68
Bankfull Max Depth (ft)	1.09
Bankfull Cross Sectional Area (ft <sup>2</sup> )	6.74
Bankfull Width/Depth Ratio	14.53
Bankfull Entrenchment Ratio	5.06



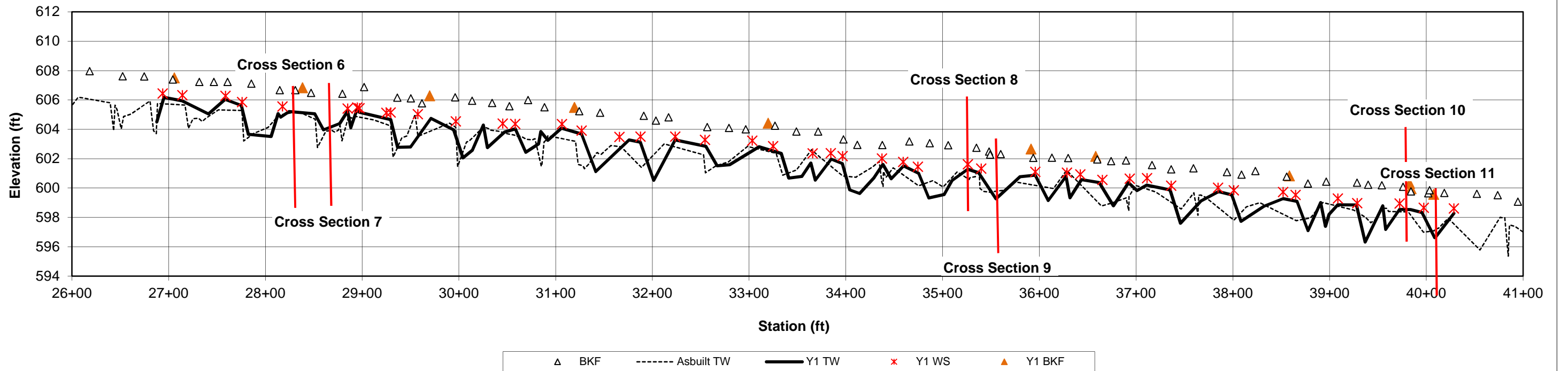
Photo: Cross-section 28 looking downstream



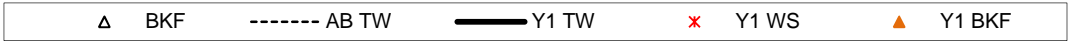
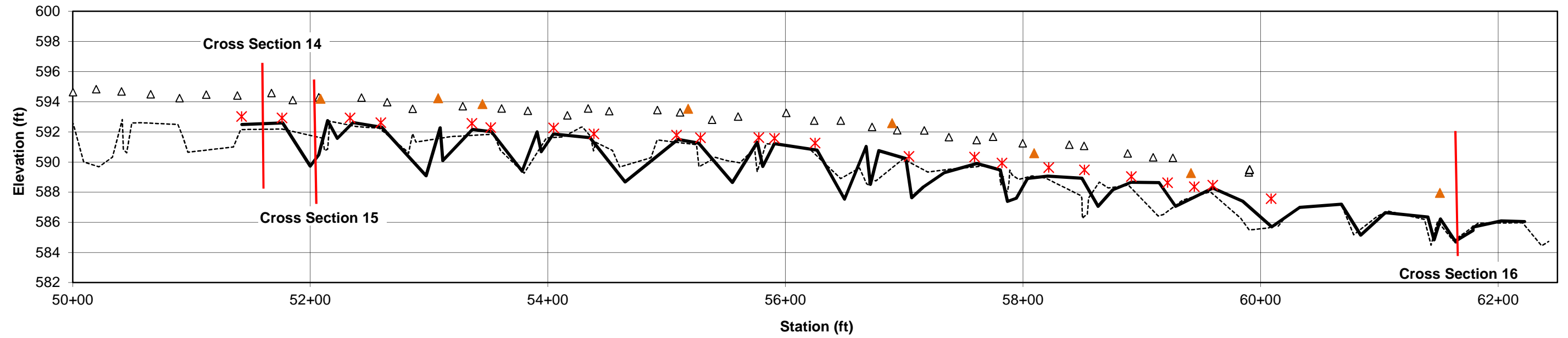
Back Creek Long Profile



Back Creek Long Profile

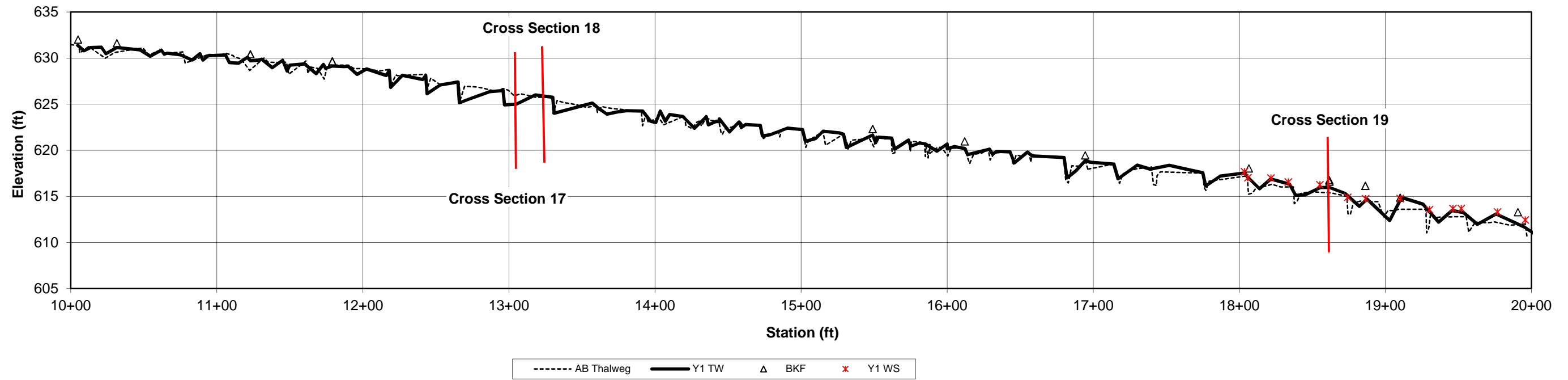


### Back Creek Long Profile

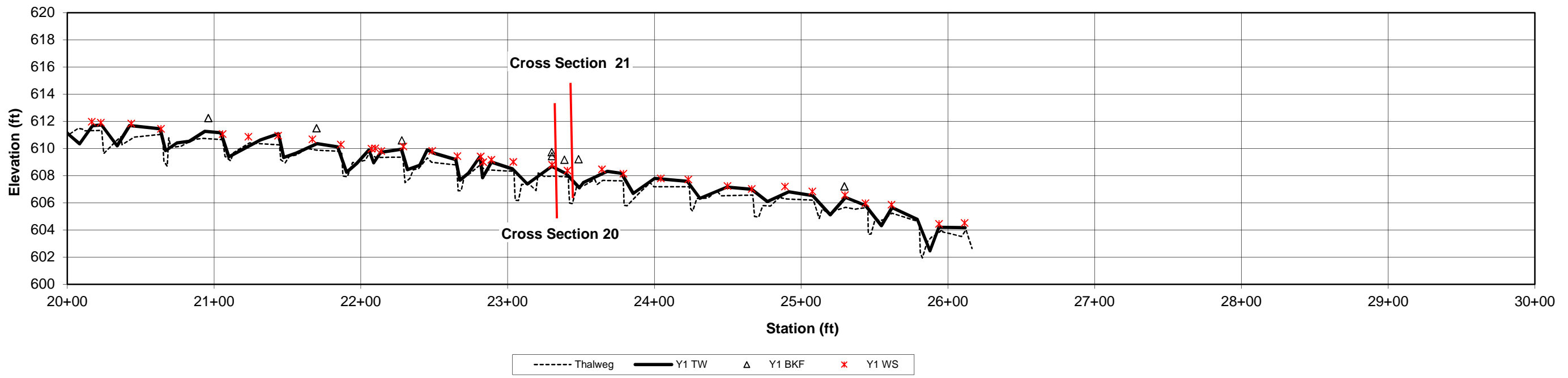




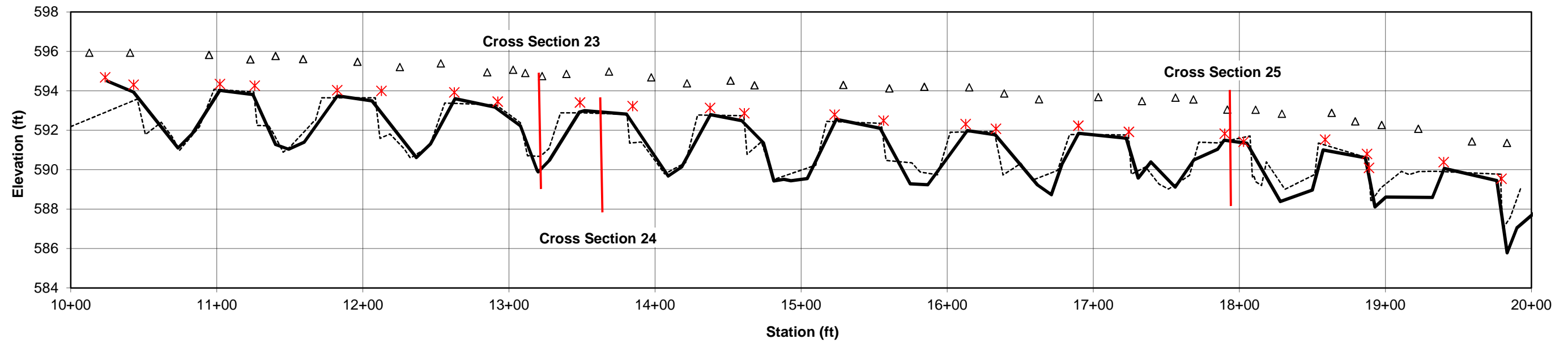
### West Branch Long Profile



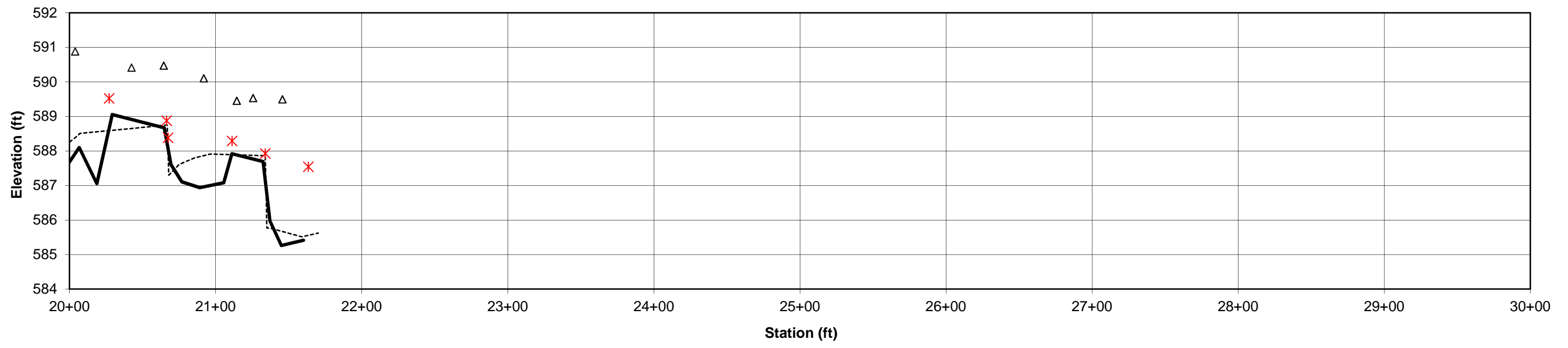
### West Branch Long Profile



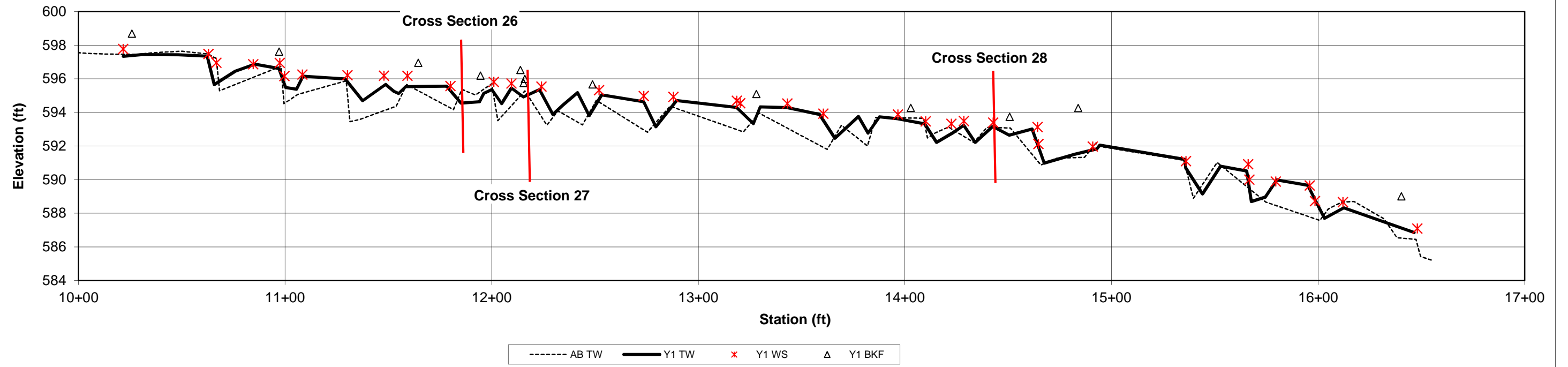
North Branch Long Profile



North Branch Long Profile



### East Branch Long Profile

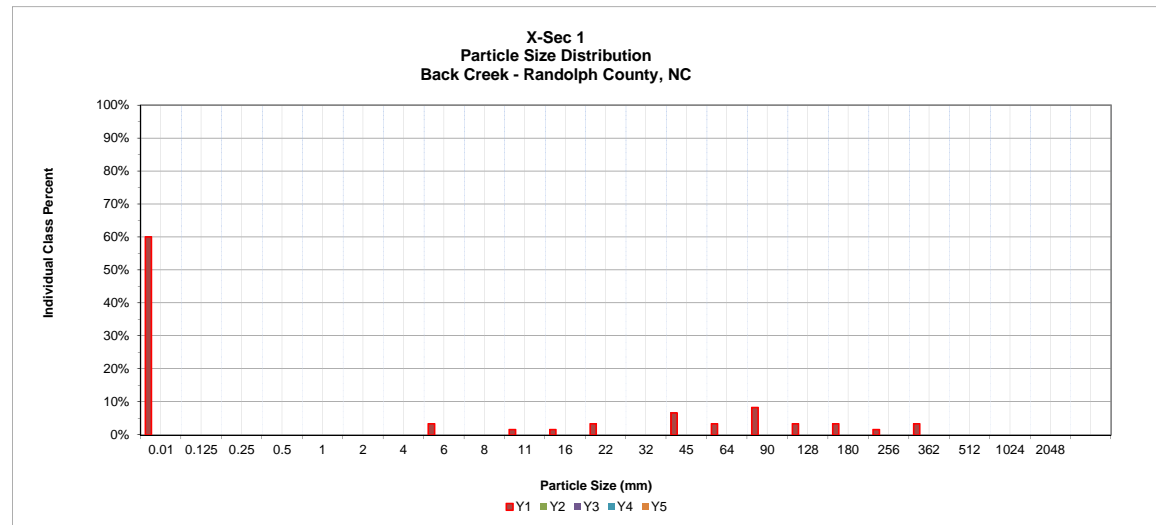
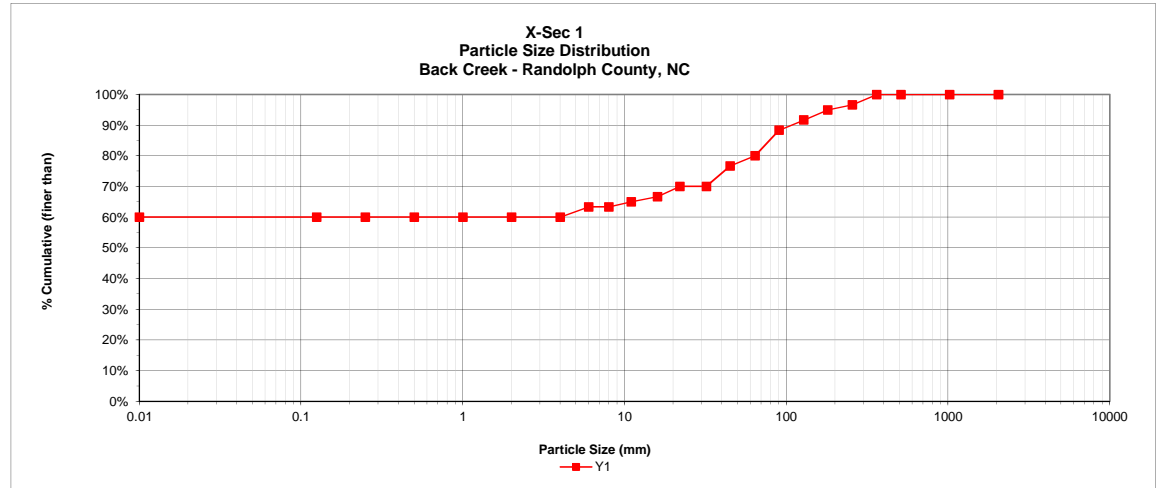


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 1  
 Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	36	60%	60%
<b>S A N D</b>	Very Fine	.062 - .125	0	0%	60%
	Fine	.125 - .25	0	0%	60%
	Medium	.25 - .50	0	0%	60%
	Coarse	.50 - 1.0	0	0%	60%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	60%
<b>G R A V E L S</b>	Very Fine	2.0 - 4.0	0	0%	60%
	Fine	4.0 - 5.7	2	3%	63%
	Fine	5.7 - 8.0	0	0%	63%
	Medium	8.0 - 11.3	1	2%	65%
	Medium	11.3 - 16.0	1	2%	67%
	Coarse	16.0 - 22.6	2	3%	70%
	Coarse	22.6 - 32.0	0	0%	70%
	Very Coarse	32.0 - 45.0	4	7%	77%
	Very Coarse	45.0 - 64.0	2	3%	80%
<b>C O B L</b>	Small	64 - 90	5	8%	88%
	Small	90 - 128	2	3%	92%
	Large	128 - 180	2	3%	95%
<b>L</b>	Large	180 - 256	1	2%	97%
<b>B L</b>	Small	256 - 362	2	3%	100%
	Small	362 - 512	0	0%	100%
<b>D R</b>	Medium	512 - 1024	0	0%	100%
	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	0.05
D84	76
D95	180

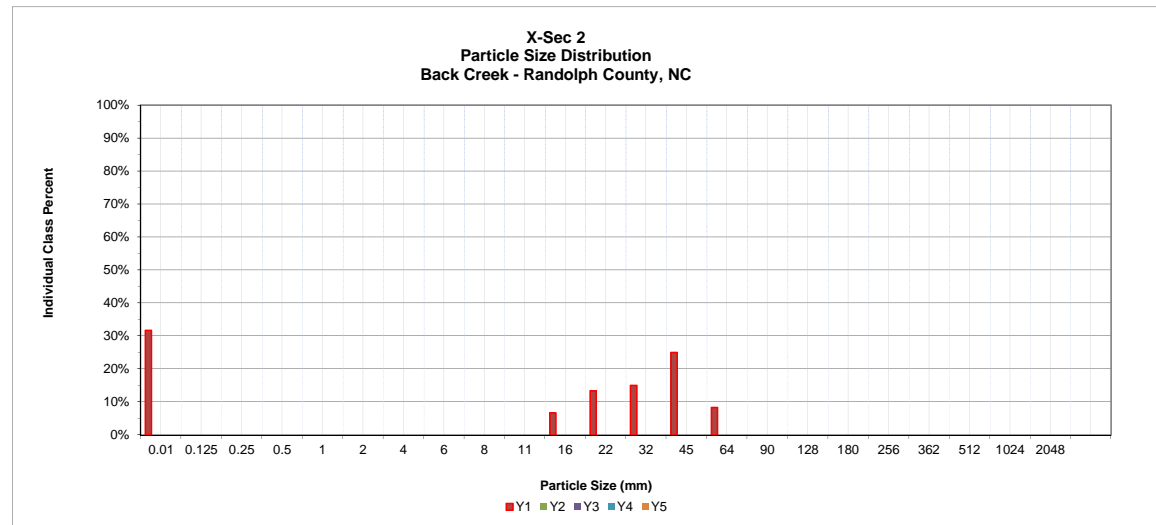
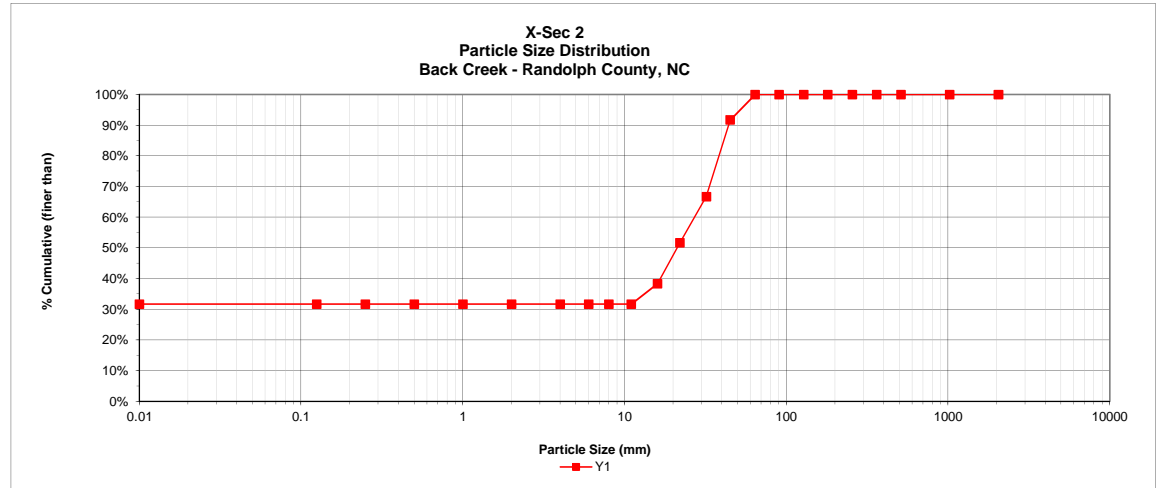


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 2  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	19	32%	32%
<b>S A N D</b>	Very Fine	.062 - .125	0	0%	32%
	Fine	.125 - .25	0	0%	32%
	Medium	.25 - .50	0	0%	32%
	Coarse	.50 - 1.0	0	0%	32%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	32%
<b>G R A V E L S</b>	Very Fine	2.0 - 4.0	0	0%	32%
	Fine	4.0 - 5.7	0	0%	32%
	Fine	5.7 - 8.0	0	0%	32%
	Medium	8.0 - 11.3	0	0%	32%
	Medium	11.3 - 16.0	4	7%	38%
	Coarse	16.0 - 22.6	8	13%	52%
<b>L</b>	Coarse	22.6 - 32.0	9	15%	67%
<b>S</b>	Very Coarse	32.0 - 45.0	15	25%	92%
	Very Coarse	45.0 - 64.0	5	8%	100%
<b>C O B L E</b>	Small	64 - 90	0	0%	100%
	Small	90 - 128	0	0%	100%
<b>B L O C K</b>	Large	128 - 180	0	0%	100%
	Large	180 - 256	0	0%	100%
<b>B L O C K</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>D R Y</b>	Medium	512 - 1024	0	0%	100%
	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	30.8
D84	58
D95	74

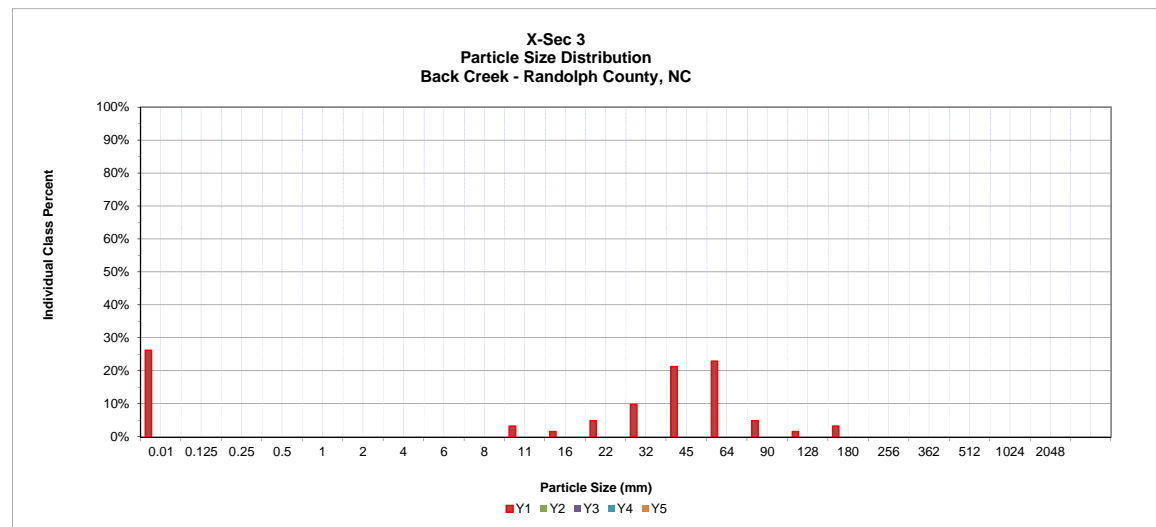
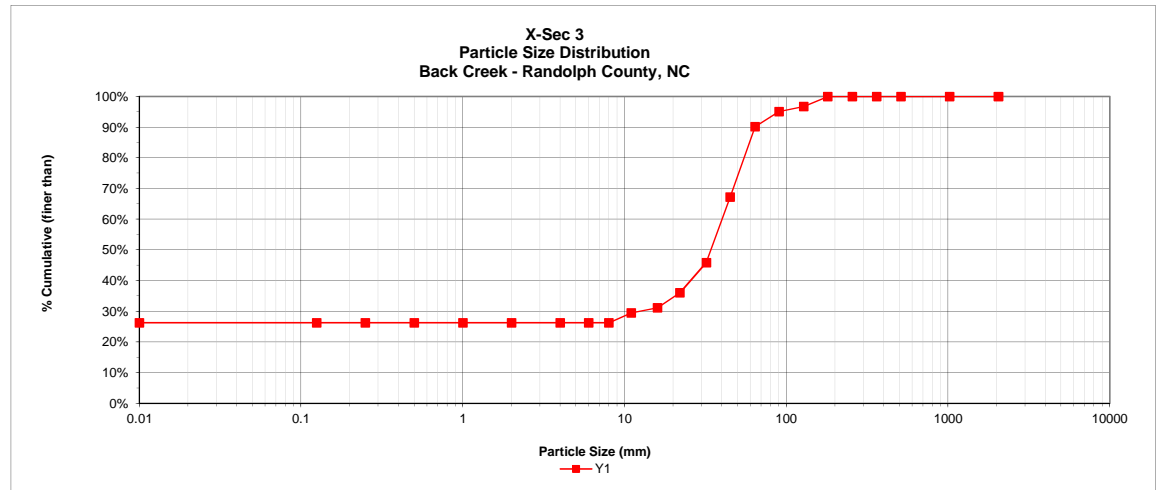


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 3  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	16	26%	26%
<b>S</b>	Very Fine	.062 - .125	0	0%	26%
	Fine	.125 - .25	0	0%	26%
	Medium	.25 - .50	0	0%	26%
	Coarse	.50 - 1.0	0	0%	26%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	26%
<b>G</b>	Very Fine	2.0 - 4.0	0	0%	26%
	Fine	4.0 - 5.7	0	0%	26%
<b>R</b>	Fine	5.7 - 8.0	0	0%	26%
<b>A</b>	Medium	8.0 - 11.3	2	3%	30%
<b>V</b>	Medium	11.3 - 16.0	1	2%	31%
<b>E</b>	Coarse	16.0 - 22.6	3	5%	36%
<b>L</b>	Coarse	22.6 - 32.0	6	10%	46%
<b>S</b>	Very Coarse	32.0 - 45.0	13	21%	67%
	Very Coarse	45.0 - 64.0	14	23%	90%
<b>C</b>	Small	64 - 90	3	5%	95%
	Small	90 - 128	1	2%	97%
<b>B</b>	Large	128 - 180	2	3%	100%
<b>L</b>	Large	180 - 256	0	0%	100%
<b>B</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			61	100%	

Summary Data	
D50	34.5
D84	59
D95	90

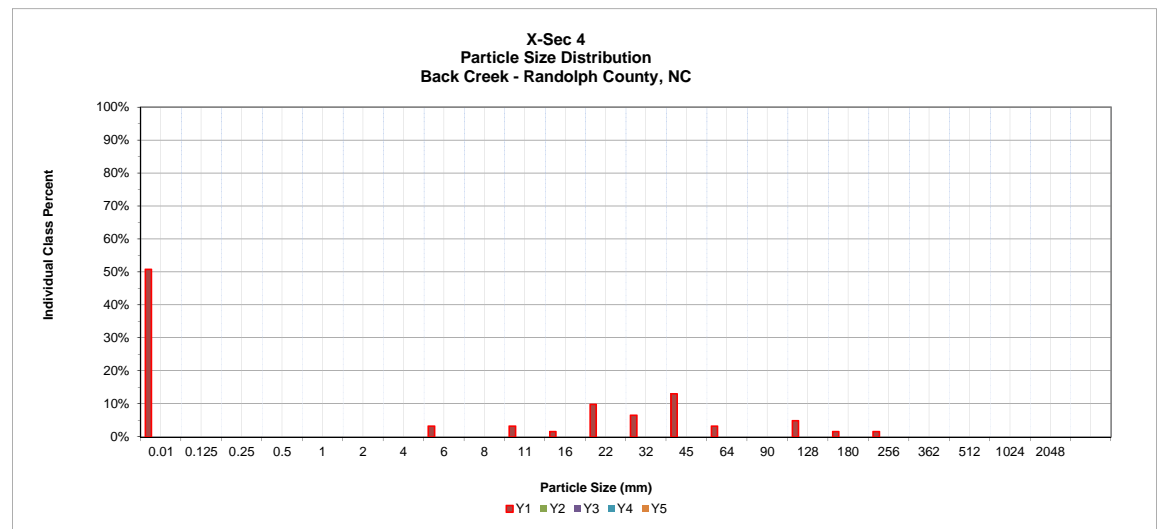
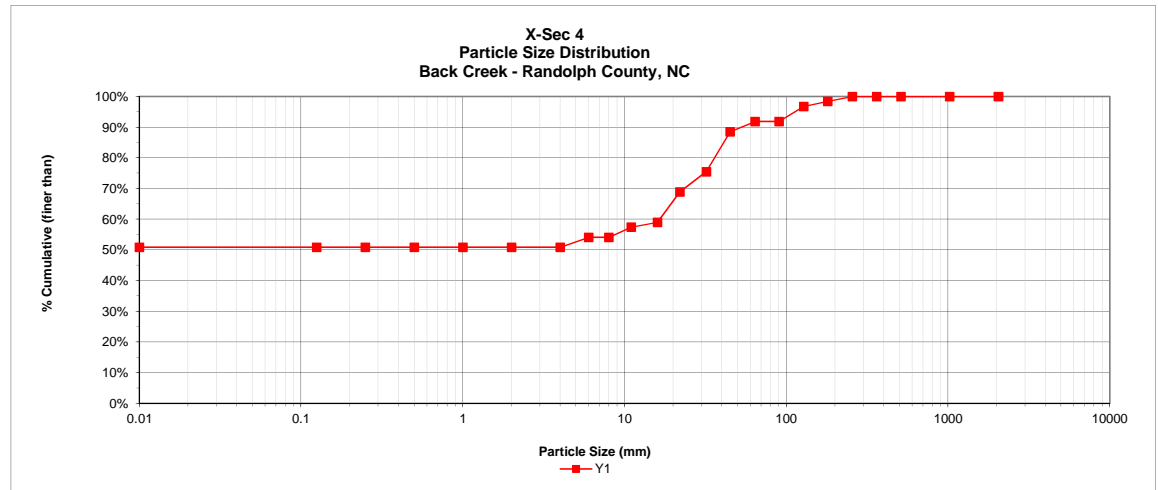


# Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 4  
 Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	31	51%	51%
<b>S A N D</b>	Very Fine	.062 - .125	0	0%	51%
	Fine	.125 - .25	0	0%	51%
	Medium	.25 - .50	0	0%	51%
	Coarse	.50 - 1.0	0	0%	51%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	51%
<b>G R A V E L S</b>	Very Fine	2.0 - 4.0	0	0%	51%
	Fine	4.0 - 5.7	2	3%	54%
	Fine	5.7 - 8.0	0	0%	54%
	Medium	8.0 - 11.3	2	3%	57%
	Medium	11.3 - 16.0	1	2%	59%
	Coarse	16.0 - 22.6	6	10%	69%
	Coarse	22.6 - 32.0	4	7%	75%
<b>S</b>	Very Coarse	32.0 - 45.0	8	13%	89%
	Very Coarse	45.0 - 64.0	2	3%	92%
<b>C O B L E</b>	Small	64 - 90	0	0%	92%
	Small	90 - 128	3	5%	97%
	Large	128 - 180	1	2%	98%
<b>L</b>	Large	180 - 256	1	2%	100%
<b>B L O C K</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>D I S T R I B U T I O N</b>	Medium	512 - 1024	0	0%	100%
	Lrg - Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			61	100%	

Summary Data	
D50	0.06
D84	40
D95	114

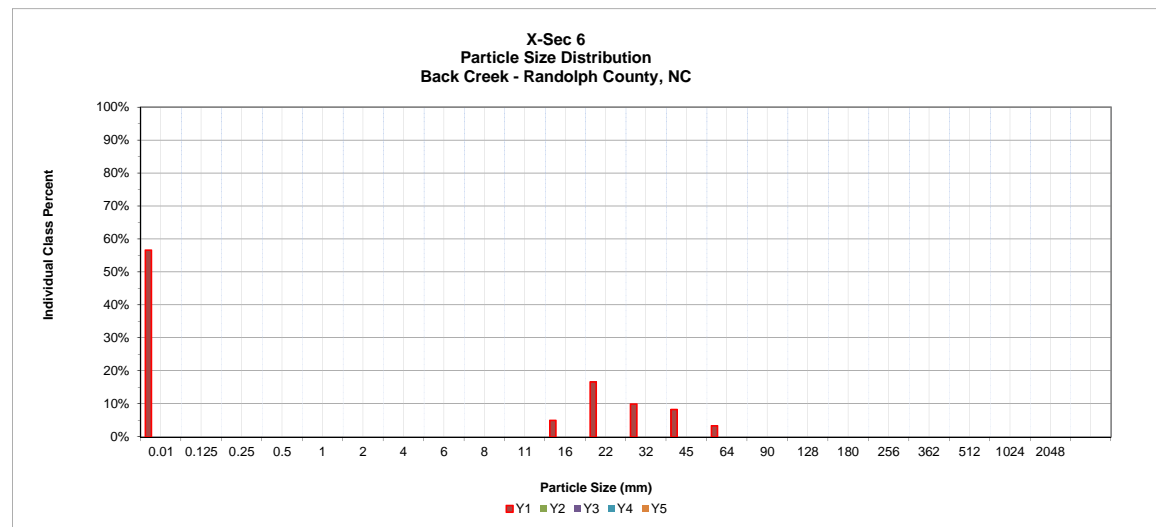
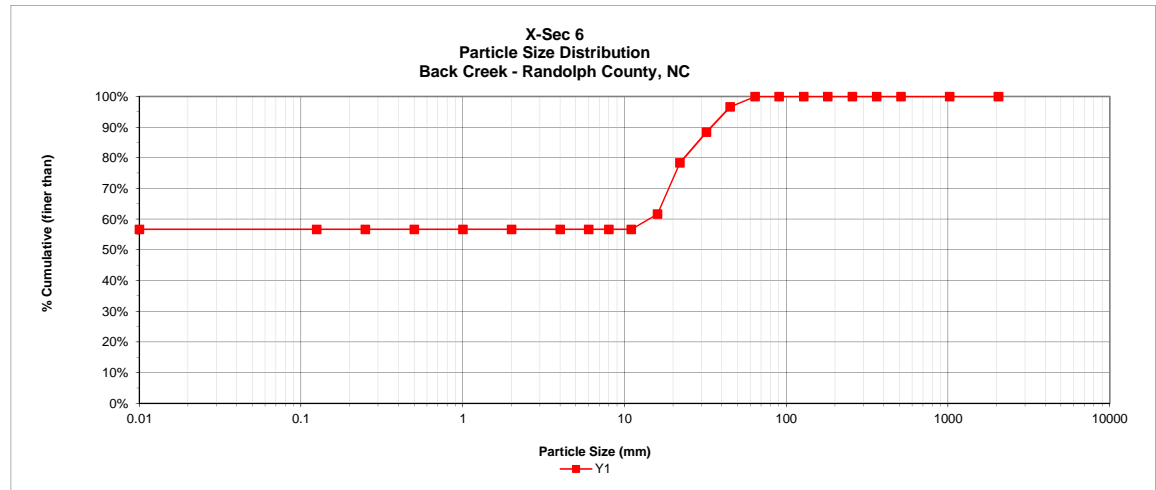


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 6  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	34	57%	57%
<b>S A N D</b>	Very Fine	.062 - .125	0	0%	57%
	Fine	.125 - .25	0	0%	57%
	Medium	.25 - .50	0	0%	57%
	Coarse	.50 - 1.0	0	0%	57%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	57%
<b>G R A V E L S</b>	Very Fine	2.0 - 4.0	0	0%	57%
	Fine	4.0 - 5.7	0	0%	57%
	Fine	5.7 - 8.0	0	0%	57%
	Medium	8.0 - 11.3	0	0%	57%
	Medium	11.3 - 16.0	3	5%	62%
	Coarse	16.0 - 22.6	10	17%	78%
<b>L</b>	Coarse	22.6 - 32.0	6	10%	88%
<b>S</b>	Very Coarse	32.0 - 45.0	5	8%	97%
	Very Coarse	45.0 - 64.0	2	3%	100%
<b>C O B B L E</b>	Small	64 - 90	0	0%	100%
	Small	90 - 128	0	0%	100%
<b>B L O C K</b>	Large	128 - 180	0	0%	100%
	Large	180 - 256	0	0%	100%
<b>B L O C K</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>D R Y R O C K</b>	Medium	512 - 1024	0	0%	100%
	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	0.05
D84	28
D95	42



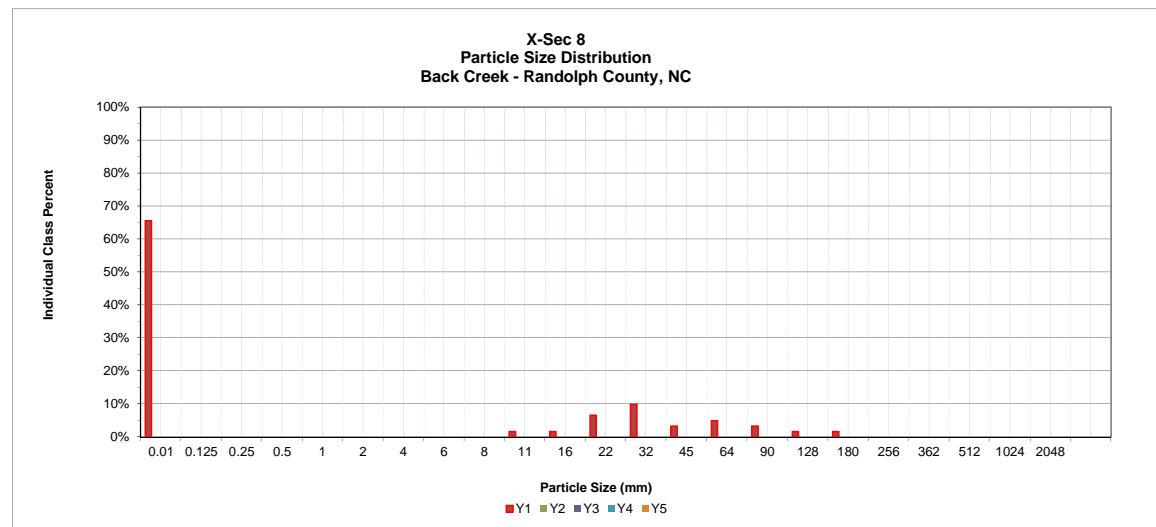
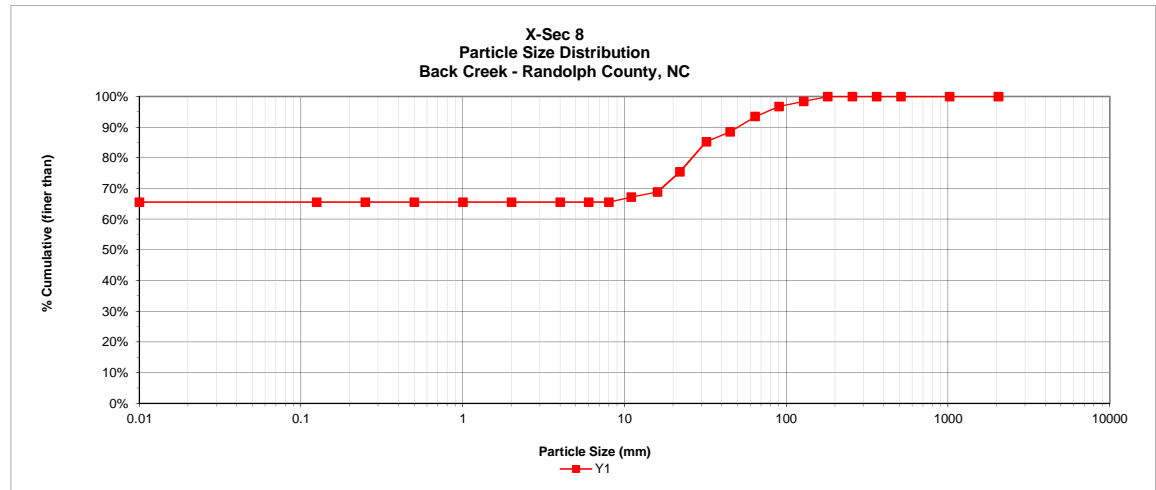


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 8  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	40	66%	66%
<b>S A N D</b>	Very Fine	.062 - .125	0	0%	66%
	Fine	.125 - .25	0	0%	66%
	Medium	.25 - .50	0	0%	66%
	Coarse	.50 - 1.0	0	0%	66%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	66%
<b>G R A V E L S</b>	Very Fine	2.0 - 4.0	0	0%	66%
	Fine	4.0 - 5.7	0	0%	66%
	Fine	5.7 - 8.0	0	0%	66%
	Medium	8.0 - 11.3	1	2%	67%
	Medium	11.3 - 16.0	1	2%	69%
	Coarse	16.0 - 22.6	4	7%	75%
	Coarse	22.6 - 32.0	6	10%	85%
	Very Coarse	32.0 - 45.0	2	3%	89%
	Very Coarse	45.0 - 64.0	3	5%	93%
<b>C O B L E</b>	Small	64 - 90	2	3%	97%
	Small	90 - 128	1	2%	98%
	Large	128 - 180	1	2%	100%
<b>L</b>	Large	180 - 256	0	0%	100%
<b>B L O C K</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>D R Y</b>	Medium	512 - 1024	0	0%	100%
	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			61	100%	

Summary Data	
D50	0.05
D84	31
D95	76

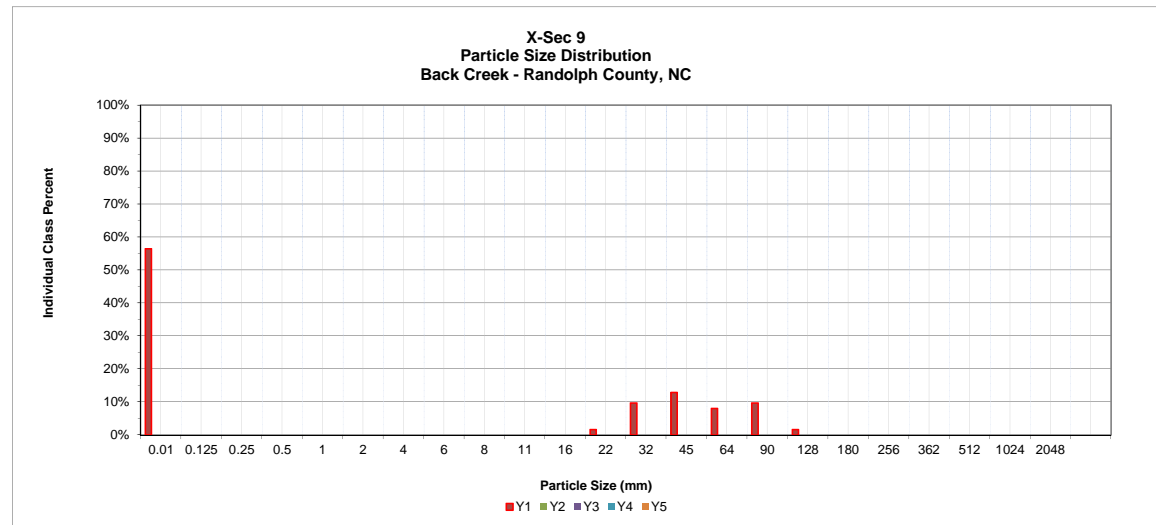
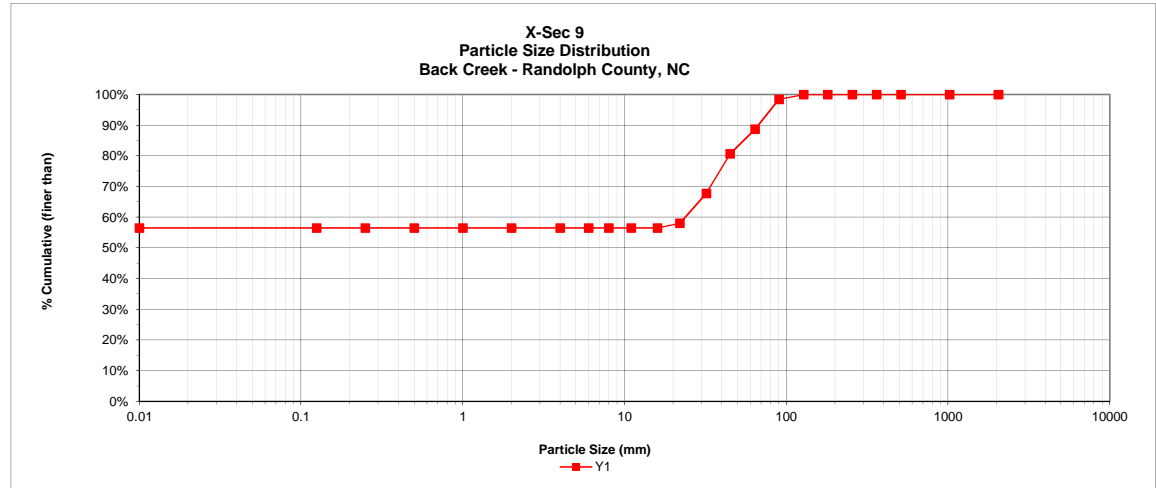


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 9  
 Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	35	56%	56%
<b>S A N D</b>	Very Fine	.062 - .125	0	0%	56%
	Fine	.125 - .25	0	0%	56%
	Medium	.25 - .50	0	0%	56%
	Coarse	.50 - 1.0	0	0%	56%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	56%
<b>G R A V E L S</b>	Very Fine	2.0 - 4.0	0	0%	56%
	Fine	4.0 - 5.7	0	0%	56%
	Fine	5.7 - 8.0	0	0%	56%
	Medium	8.0 - 11.3	0	0%	56%
	Medium	11.3 - 16.0	0	0%	56%
	Coarse	16.0 - 22.6	1	2%	58%
<b>L S</b>	Coarse	22.6 - 32.0	6	10%	68%
	Very Coarse	32.0 - 45.0	8	13%	81%
	Very Coarse	45.0 - 64.0	5	8%	89%
<b>C O B L E</b>	Small	64 - 90	6	10%	98%
	Small	90 - 128	1	2%	100%
<b>B L O C K</b>	Large	128 - 180	0	0%	100%
	Large	180 - 256	0	0%	100%
<b>B L O C K</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>D R Y</b>	Medium	512 - 1024	0	0%	100%
	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			62	100%	

Summary Data	
D50	0.06
D84	53
D95	81

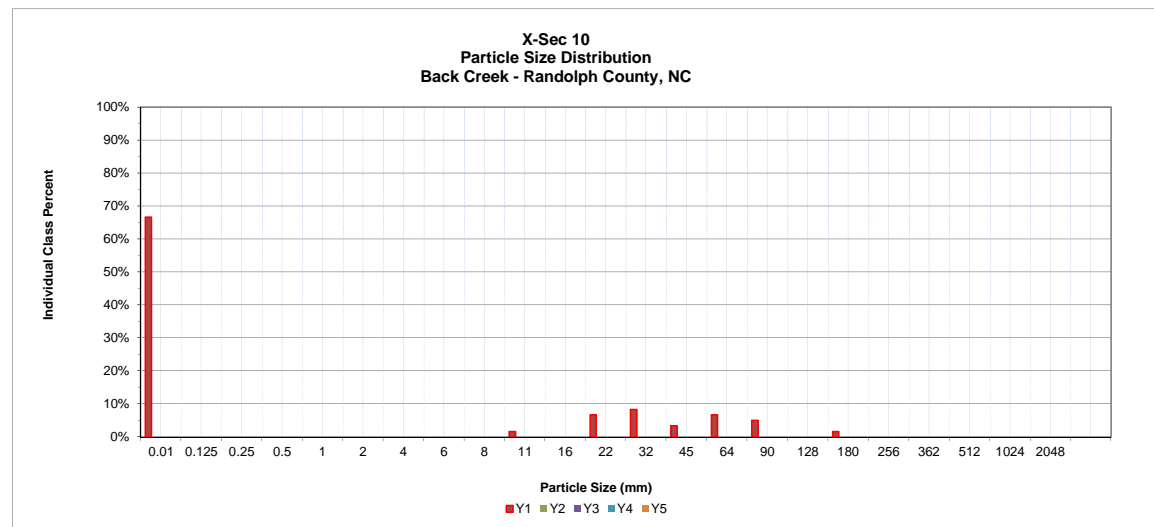
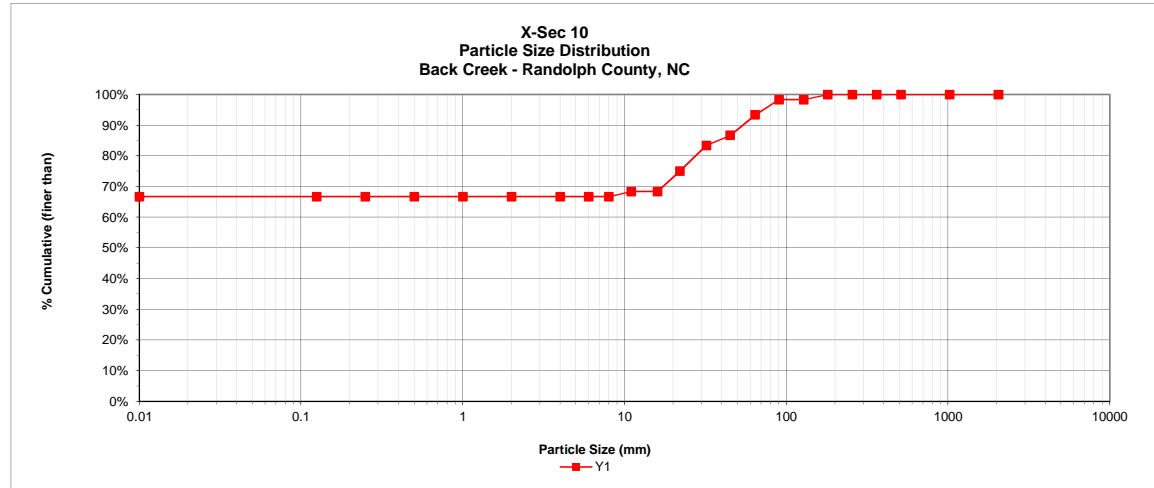


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 10  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	40	67%	67%
<b>S</b>	Very Fine	.062 - .125	0	0%	67%
	Fine	.125 - .25	0	0%	67%
<b>A</b>	Medium	.25 - .50	0	0%	67%
<b>N</b>	Coarse	.50 - 1.0	0	0%	67%
<b>D</b>	Very Coarse	1.0 - 2.0	0	0%	67%
<b>G</b>	Very Fine	2.0 - 4.0	0	0%	67%
	Fine	4.0 - 5.7	0	0%	67%
<b>R</b>	Fine	5.7 - 8.0	0	0%	67%
<b>A</b>	Medium	8.0 - 11.3	1	2%	68%
<b>V</b>	Medium	11.3 - 16.0	0	0%	68%
<b>E</b>	Coarse	16.0 - 22.6	4	7%	75%
<b>L</b>	Coarse	22.6 - 32.0	5	8%	83%
<b>S</b>	Very Coarse	32.0 - 45.0	2	3%	87%
	Very Coarse	45.0 - 64.0	4	7%	93%
<b>C</b>	Small	64 - 90	3	5%	98%
	Small	90 - 128	0	0%	98%
<b>B</b>	Large	128 - 180	1	2%	100%
<b>L</b>	Large	180 - 256	0	0%	100%
<b>B</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>L</b>	Small	362 - 512	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	0.05
D84	35
D95	73

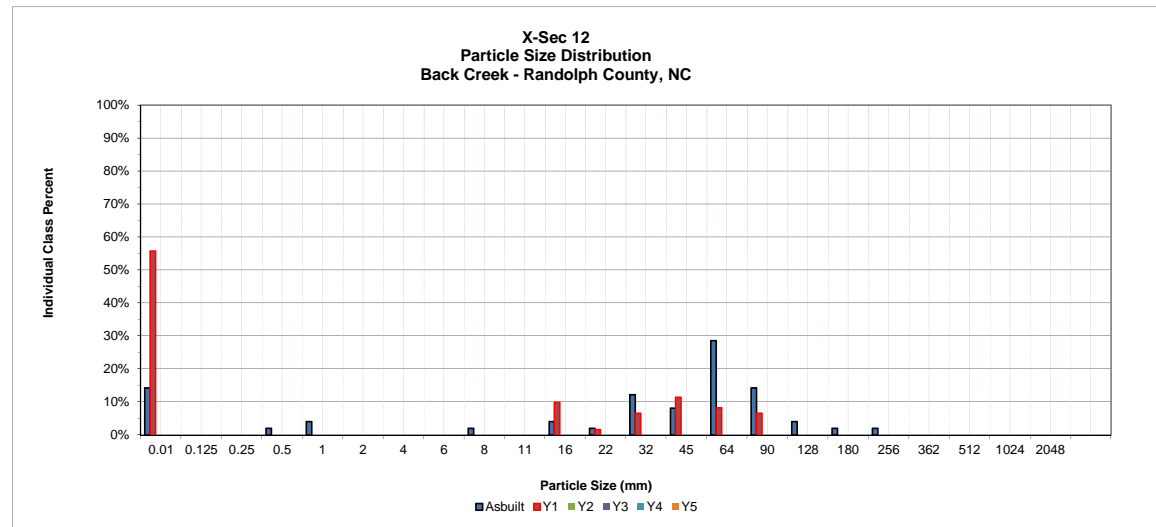
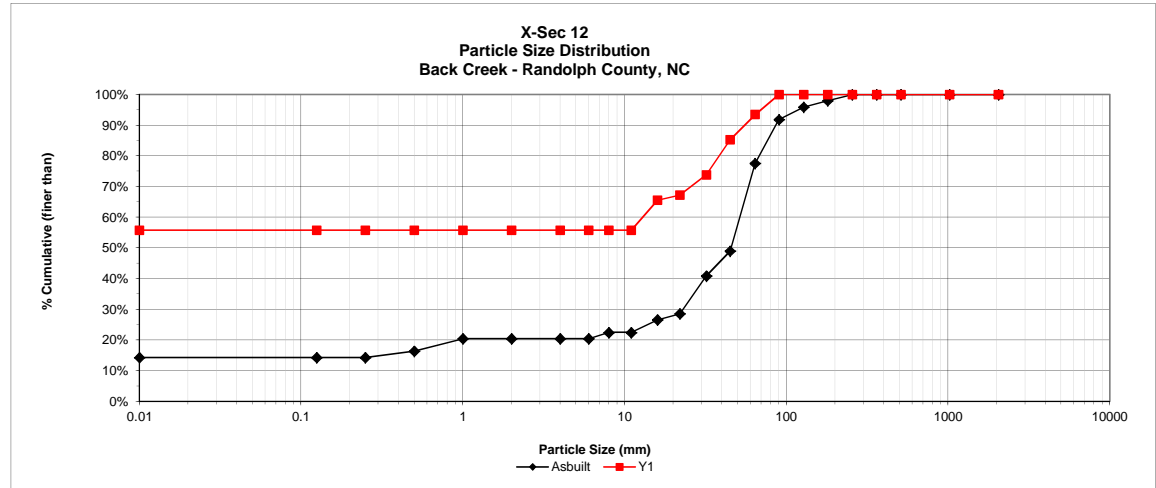


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 12  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	34	56%	56%
<b>S</b>	Very Fine	.062 - .125	0	0%	56%
	Fine	.125 - .25	0	0%	56%
	Medium	.25 - .50	0	0%	56%
	Coarse	.50 - 1.0	0	0%	56%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	56%
<b>G</b>	Very Fine	2.0 - 4.0	0	0%	56%
	Fine	4.0 - 5.7	0	0%	56%
<b>R</b>	Fine	5.7 - 8.0	0	0%	56%
<b>A</b>	Medium	8.0 - 11.3	0	0%	56%
<b>V</b>	Medium	11.3 - 16.0	6	10%	66%
<b>E</b>	Coarse	16.0 - 22.6	1	2%	67%
<b>L</b>	Coarse	22.6 - 32.0	4	7%	74%
<b>S</b>	Very Coarse	32.0 - 45.0	7	11%	85%
	Very Coarse	45.0 - 64.0	5	8%	93%
<b>C</b>	Small	64 - 90	4	7%	100%
	Small	90 - 128	0	0%	100%
<b>O</b>	Small	128 - 180	0	0%	100%
<b>B</b>	Large	128 - 180	0	0%	100%
<b>L</b>	Large	180 - 256	0	0%	100%
<b>B</b>	Small	256 - 362	0	0%	100%
<b>L</b>	Small	362 - 512	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			61	100%	

Summary Data	
D50	0.06
D84	44
D95	70

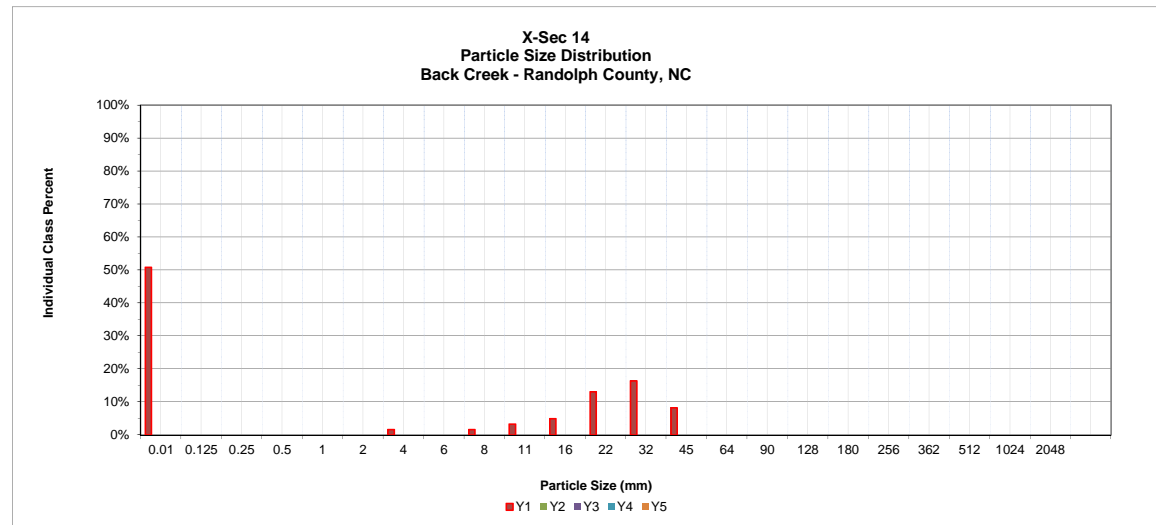
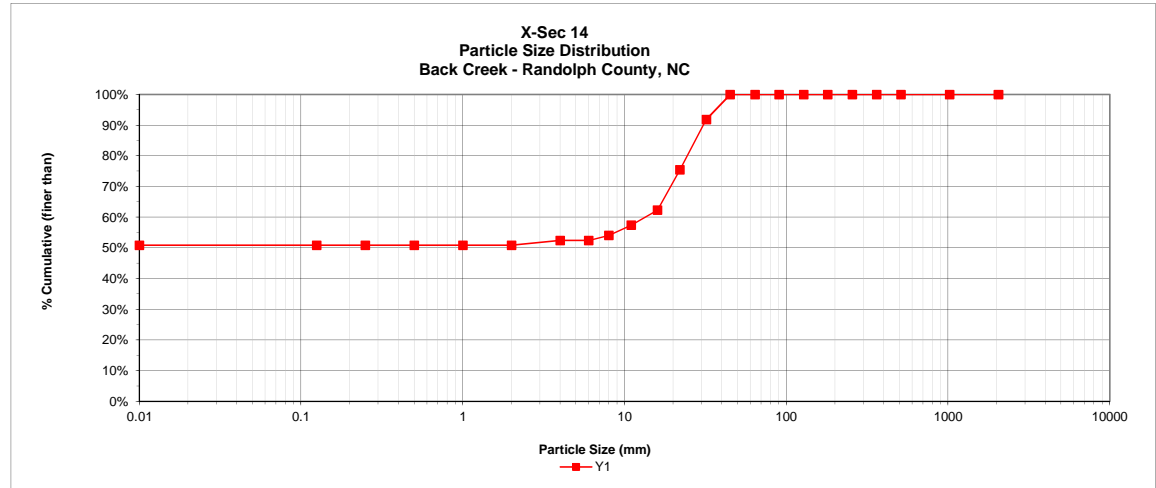


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 14  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	31	51%	51%
<b>S</b>	Very Fine	.062 - .125	0	0%	51%
	Fine	.125 - .25	0	0%	51%
<b>A</b>	Medium	.25 - .50	0	0%	51%
<b>N</b>	Coarse	.50 - 1.0	0	0%	51%
<b>D</b>	Very Coarse	1.0 - 2.0	0	0%	51%
<b>G</b>	Very Fine	2.0 - 4.0	1	2%	52%
	Fine	4.0 - 5.7	0	0%	52%
<b>R</b>	Fine	5.7 - 8.0	1	2%	54%
<b>A</b>	Medium	8.0 - 11.3	2	3%	57%
<b>V</b>	Medium	11.3 - 16.0	3	5%	62%
<b>E</b>	Coarse	16.0 - 22.6	8	13%	75%
<b>L</b>	Coarse	22.6 - 32.0	10	16%	92%
<b>S</b>	Very Coarse	32.0 - 45.0	5	8%	100%
	Very Coarse	45.0 - 64.0	0	0%	100%
<b>C</b>	Small	64 - 90	0	0%	100%
	Small	90 - 128	0	0%	100%
<b>O</b>	Large	128 - 180	0	0%	100%
<b>B</b>	Large	180 - 256	0	0%	100%
<b>L</b>	Small	256 - 362	0	0%	100%
<b>L</b>	Small	362 - 512	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			61	100%	

Summary Data	
D50	0.06
D84	28
D95	37

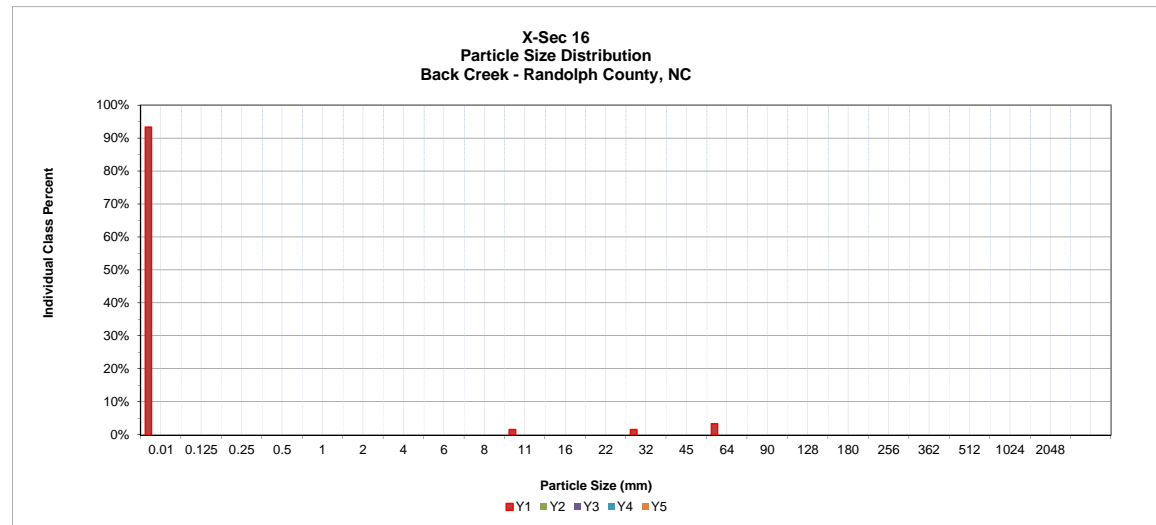
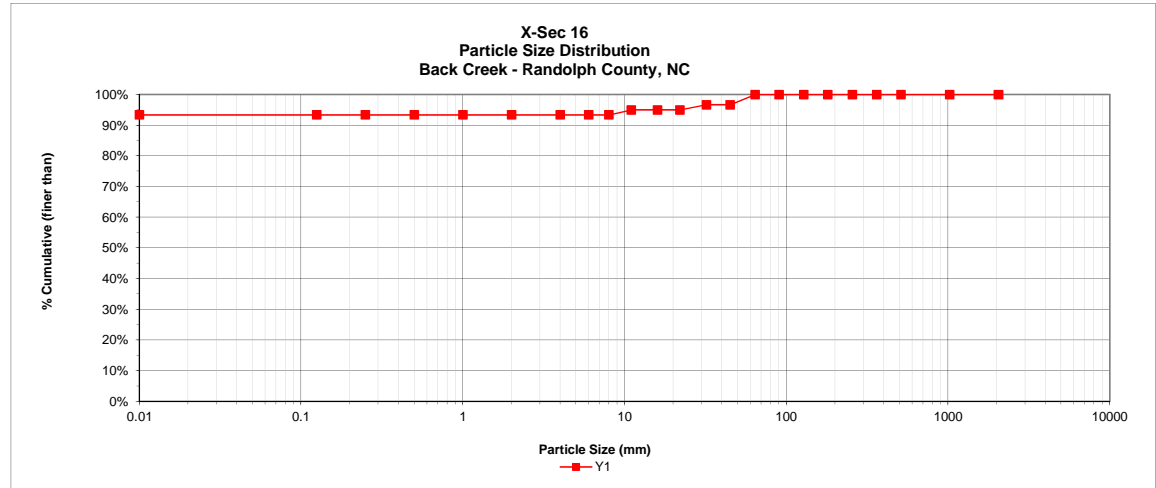


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 16  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	56	93%	93%
<b>S</b>	Very Fine	.062 - .125	0	0%	93%
	Fine	.125 - .25	0	0%	93%
<b>A</b>	Medium	.25 - .50	0	0%	93%
<b>N</b>	Coarse	.50 - 1.0	0	0%	93%
<b>D</b>	Very Coarse	1.0 - 2.0	0	0%	93%
<b>G</b>	Very Fine	2.0 - 4.0	0	0%	93%
	Fine	4.0 - 5.7	0	0%	93%
<b>R</b>	Fine	5.7 - 8.0	0	0%	93%
<b>A</b>	Medium	8.0 - 11.3	1	2%	95%
<b>V</b>	Medium	11.3 - 16.0	0	0%	95%
<b>E</b>	Coarse	16.0 - 22.6	0	0%	95%
<b>L</b>	Coarse	22.6 - 32.0	1	2%	97%
<b>S</b>	Very Coarse	32.0 - 45.0	0	0%	97%
	Very Coarse	45.0 - 64.0	2	3%	100%
<b>C</b>	Small	64 - 90	0	0%	100%
	Small	90 - 128	0	0%	100%
<b>O</b>	Large	128 - 180	0	0%	100%
<b>B</b>	Large	180 - 256	0	0%	100%
<b>L</b>	Small	256 - 362	0	0%	100%
<b>B</b>	Small	362 - 512	0	0%	100%
<b>L</b>	Medium	512 - 1024	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	0.03
D84	0.06
D95	11

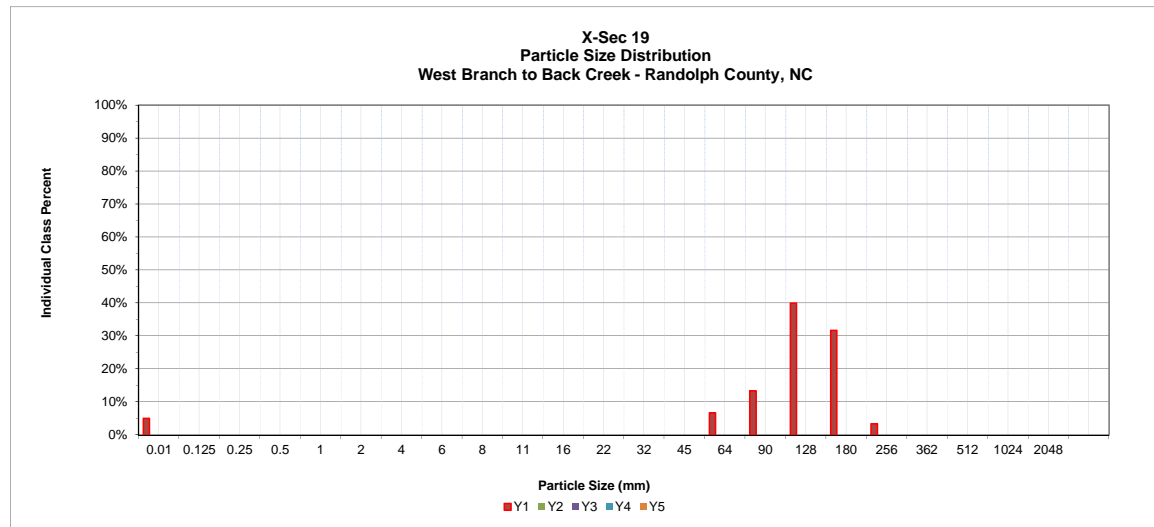
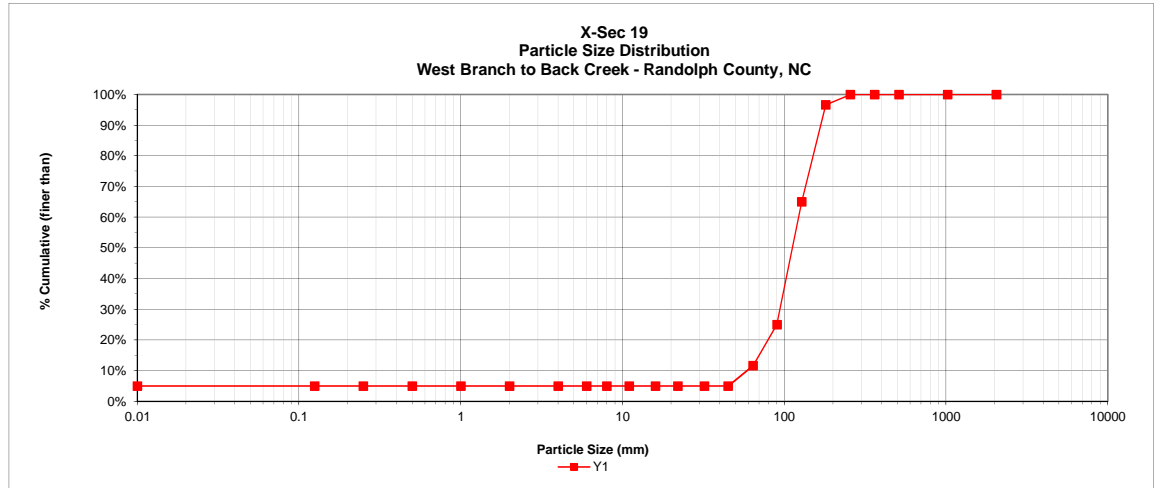


# Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 19  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	3	5%	5%
<b>S A N D</b>	Very Fine	.062 - .125	0	0%	5%
	Fine	.125 - .25	0	0%	5%
	Medium	.25 - .50	0	0%	5%
	Coarse	.50 - 1.0	0	0%	5%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	5%
<b>G R A V E L S</b>	Very Fine	2.0 - 4.0	0	0%	5%
	Fine	4.0 - 5.7	0	0%	5%
	Fine	5.7 - 8.0	0	0%	5%
	Medium	8.0 - 11.3	0	0%	5%
	Medium	11.3 - 16.0	0	0%	5%
	Coarse	16.0 - 22.6	0	0%	5%
	Coarse	22.6 - 32.0	0	0%	5%
	Very Coarse	32.0 - 45.0	0	0%	5%
	Very Coarse	45.0 - 64.0	4	7%	12%
<b>C O B B L E</b>	Small	64 - 90	8	13%	25%
	Small	90 - 128	24	40%	65%
<b>B L O C K</b>	Large	128 - 180	19	32%	97%
	Large	180 - 256	2	3%	100%
<b>B L O C K</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>D R Y</b>	Medium	512 - 1024	0	0%	100%
	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	113
D84	159
D95	177

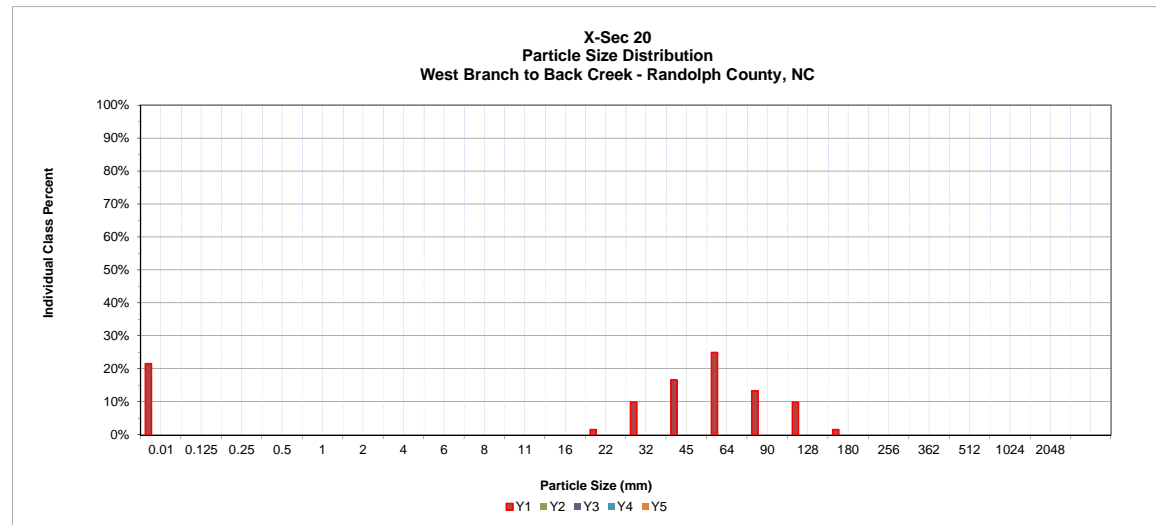
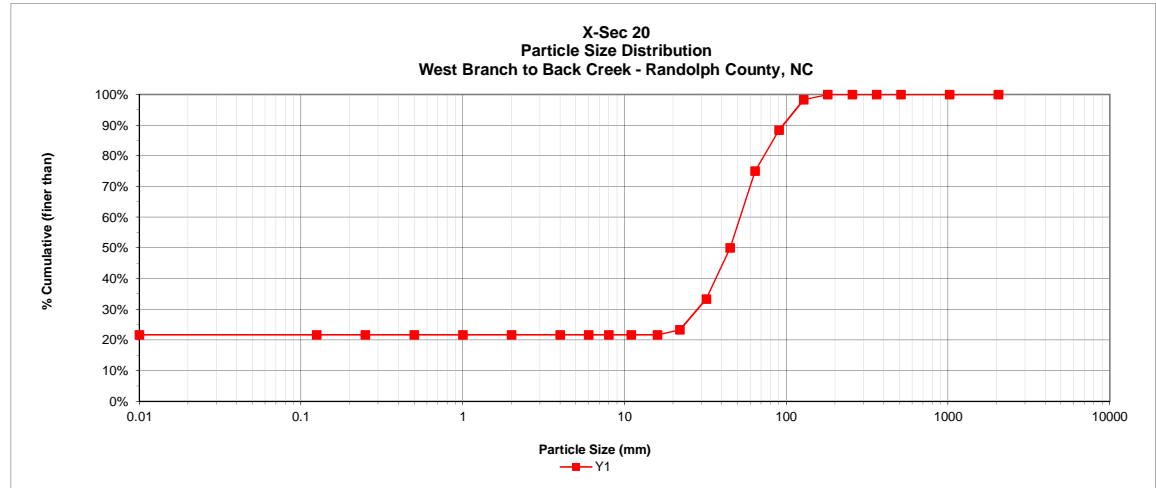


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 20  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	13	22%	22%
<b>S A N D</b>	Very Fine	.062 - .125	0	0%	22%
	Fine	.125 - .25	0	0%	22%
	Medium	.25 - .50	0	0%	22%
	Coarse	.50 - 1.0	0	0%	22%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	22%
<b>G R A V E L S</b>	Very Fine	2.0 - 4.0	0	0%	22%
	Fine	4.0 - 5.7	0	0%	22%
	Fine	5.7 - 8.0	0	0%	22%
	Medium	8.0 - 11.3	0	0%	22%
	Medium	11.3 - 16.0	0	0%	22%
	Coarse	16.0 - 22.6	1	2%	23%
	Coarse	22.6 - 32.0	6	10%	33%
	Very Coarse	32.0 - 45.0	10	17%	50%
<b>C O B L E</b>	Very Coarse	45.0 - 64.0	15	25%	75%
	Small	64 - 90	8	13%	88%
	Small	90 - 128	6	10%	98%
<b>B L O C K</b>	Large	128 - 180	1	2%	100%
	Large	180 - 256	0	0%	100%
<b>B L O C K</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>D R Y</b>	Medium	512 - 1024	0	0%	100%
	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	45
D84	82
D95	115



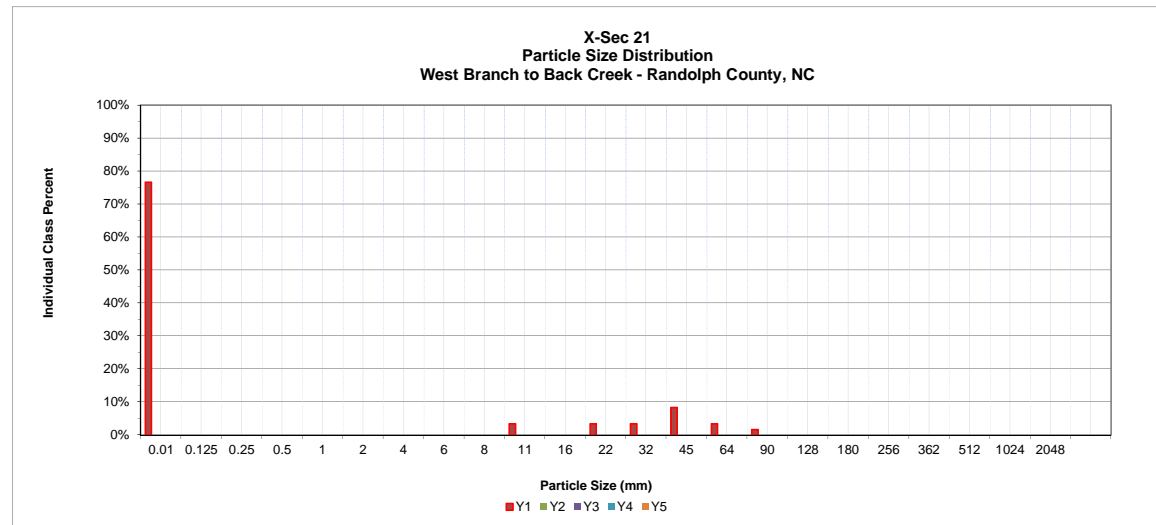
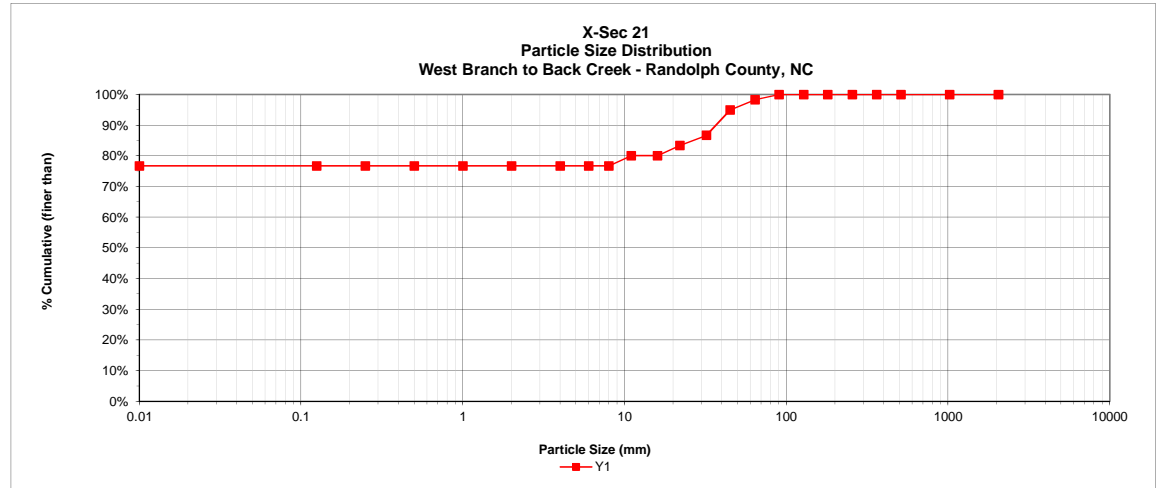


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 21  
 Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	46	77%	77%
<b>S A N D</b>	Very Fine	.062 - .125	0	0%	77%
	Fine	.125 - .25	0	0%	77%
	Medium	.25 - .50	0	0%	77%
	Coarse	.50 - 1.0	0	0%	77%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	77%
<b>G R A V E L S</b>	Very Fine	2.0 - 4.0	0	0%	77%
	Fine	4.0 - 5.7	0	0%	77%
	Fine	5.7 - 8.0	0	0%	77%
	Medium	8.0 - 11.3	2	3%	80%
	Medium	11.3 - 16.0	0	0%	80%
	Coarse	16.0 - 22.6	2	3%	83%
	Coarse	22.6 - 32.0	2	3%	87%
	Very Coarse	32.0 - 45.0	5	8%	95%
	Very Coarse	45.0 - 64.0	2	3%	98%
<b>C O B L</b>	Small	64 - 90	1	2%	100%
	Small	90 - 128	0	0%	100%
	Large	128 - 180	0	0%	100%
<b>L</b>	Large	180 - 256	0	0%	100%
<b>B L</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>D R</b>	Medium	512 - 1024	0	0%	100%
	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	0.04
D84	25
D95	45

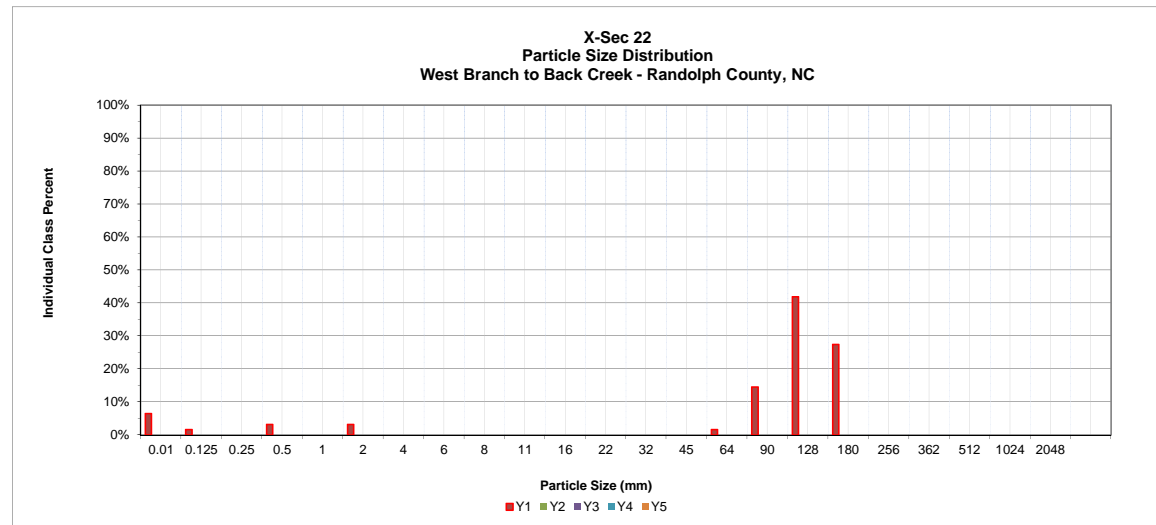
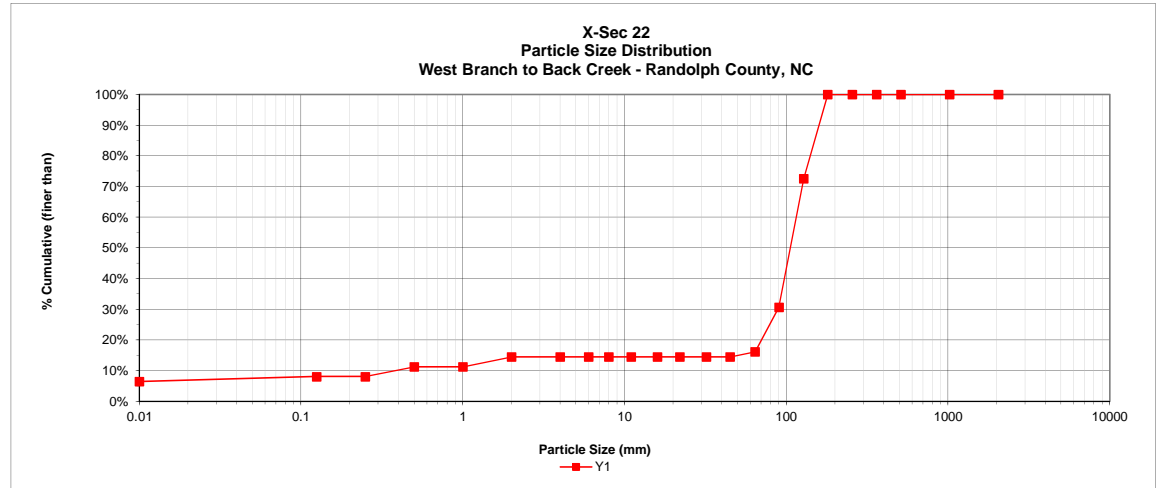


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 22  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	4	6%	6%
<b>S</b>	Very Fine	.062 - .125	1	2%	8%
	Fine	.125 - .25	0	0%	8%
<b>A</b>	Medium	.25 - .50	2	3%	11%
<b>N</b>	Coarse	.50 - 1.0	0	0%	11%
<b>D</b>	Very Coarse	1.0 - 2.0	2	3%	15%
<b>G</b>	Very Fine	2.0 - 4.0	0	0%	15%
	Fine	4.0 - 5.7	0	0%	15%
<b>R</b>	Fine	5.7 - 8.0	0	0%	15%
<b>A</b>	Medium	8.0 - 11.3	0	0%	15%
<b>V</b>	Medium	11.3 - 16.0	0	0%	15%
<b>E</b>	Coarse	16.0 - 22.6	0	0%	15%
<b>L</b>	Coarse	22.6 - 32.0	0	0%	15%
<b>S</b>	Very Coarse	32.0 - 45.0	0	0%	15%
	Very Coarse	45.0 - 64.0	1	2%	16%
<b>C</b>	Small	64 - 90	9	15%	31%
	Small	90 - 128	26	42%	73%
<b>O</b>	Large	128 - 180	17	27%	100%
<b>B</b>	Large	180 - 256	0	0%	100%
<b>L</b>	Large	180 - 256	0	0%	100%
<b>B</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>L</b>	Small	362 - 512	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			62	100%	

Summary Data	
D50	108
D84	150
D95	171

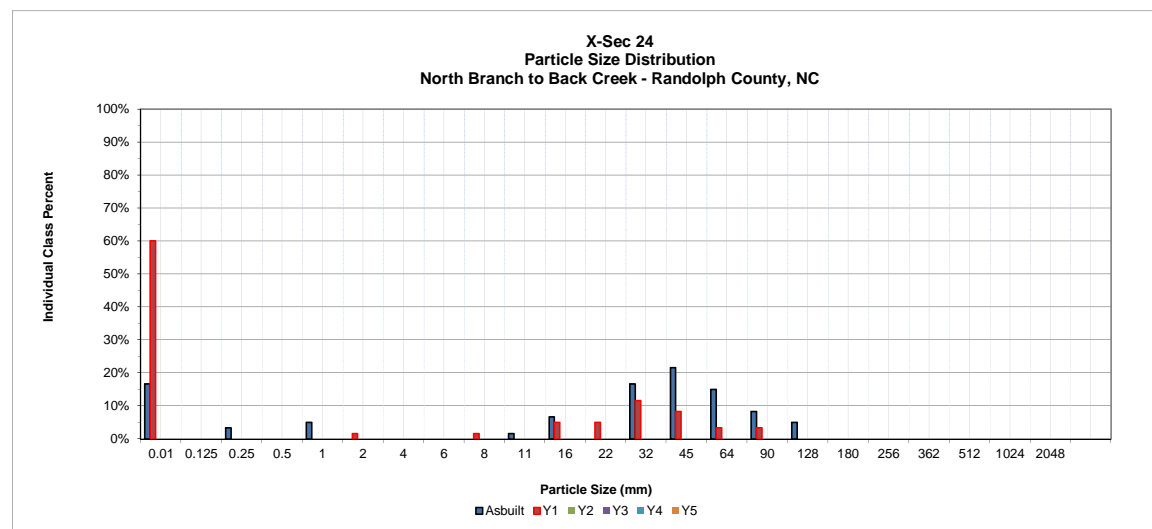
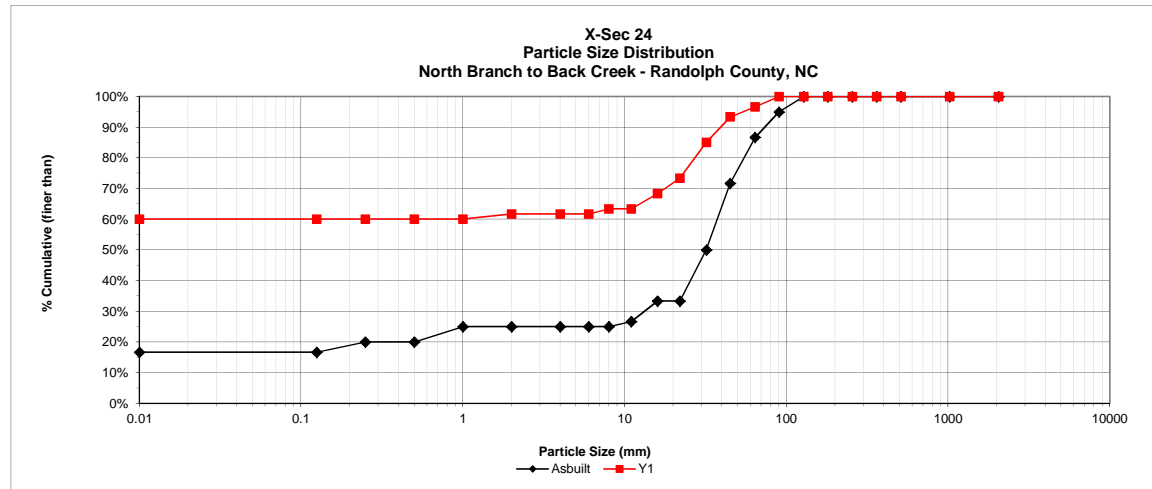


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 24  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	36	60%	60%
<b>S</b>	Very Fine	.062 - .125	0	0%	60%
	Fine	.125 - .25	0	0%	60%
<b>A</b>	Medium	.25 - .50	0	0%	60%
<b>N</b>	Coarse	.50 - 1.0	0	0%	60%
<b>D</b>	Very Coarse	1.0 - 2.0	1	2%	62%
<b>G</b>	Very Fine	2.0 - 4.0	0	0%	62%
	Fine	4.0 - 5.7	0	0%	62%
<b>R</b>	Fine	5.7 - 8.0	1	2%	63%
<b>A</b>	Medium	8.0 - 11.3	0	0%	63%
<b>V</b>	Medium	11.3 - 16.0	3	5%	68%
<b>E</b>	Coarse	16.0 - 22.6	3	5%	73%
<b>L</b>	Coarse	22.6 - 32.0	7	12%	85%
<b>S</b>	Very Coarse	32.0 - 45.0	5	8%	93%
	Very Coarse	45.0 - 64.0	2	3%	97%
<b>C</b>	Small	64 - 90	2	3%	100%
	Small	90 - 128	0	0%	100%
<b>O</b>	Large	128 - 180	0	0%	100%
<b>B</b>	Large	180 - 256	0	0%	100%
<b>L</b>	Small	256 - 362	0	0%	100%
<b>L</b>	Small	362 - 512	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	0.05
D84	31
D95	55

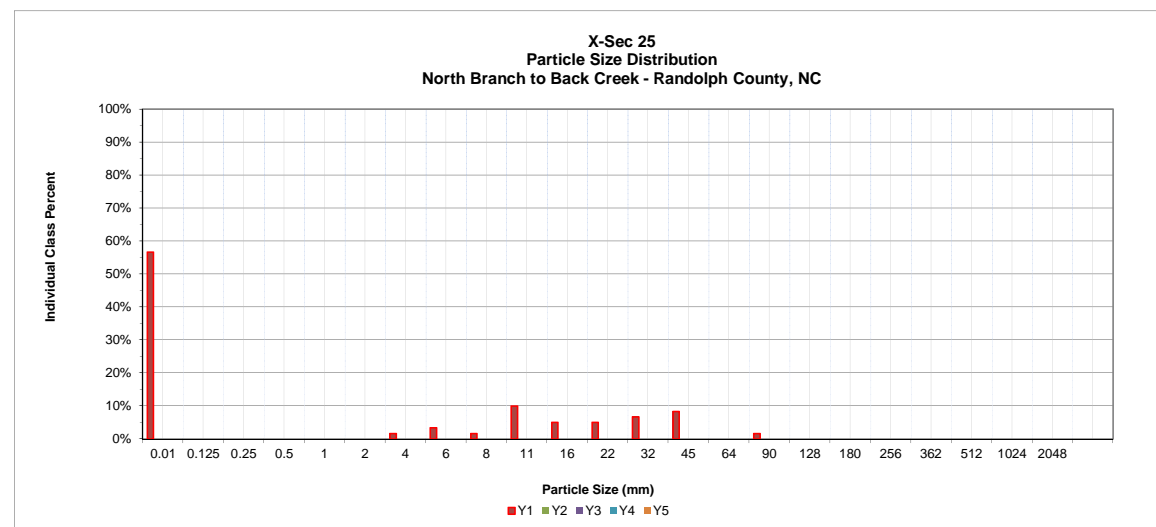
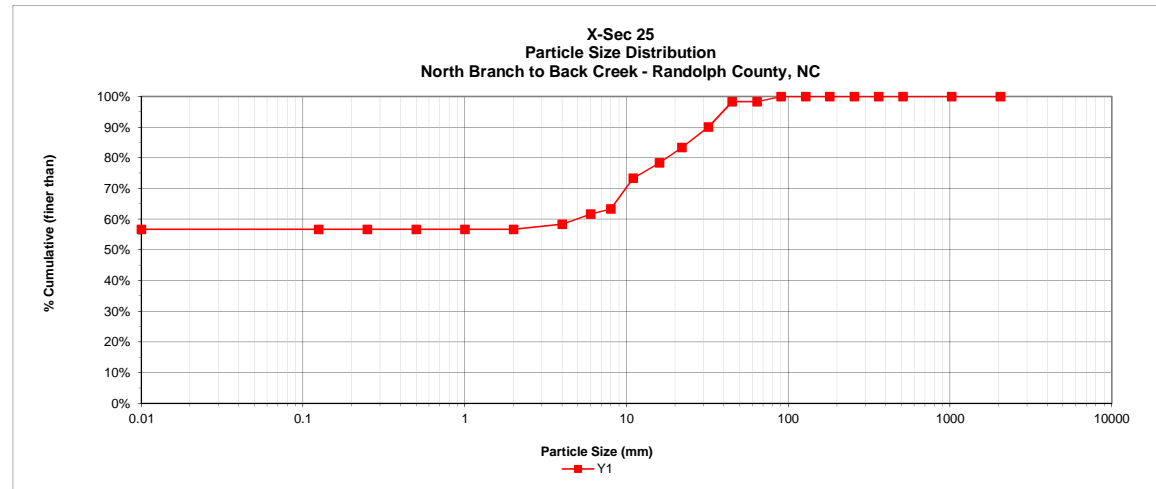


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 25  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	34	57%	57%
<b>S</b>	Very Fine	.062 - .125	0	0%	57%
	Fine	.125 - .25	0	0%	57%
<b>A</b>	Medium	.25 - .50	0	0%	57%
<b>N</b>	Coarse	.50 - 1.0	0	0%	57%
<b>D</b>	Very Coarse	1.0 - 2.0	0	0%	57%
<b>G</b>	Very Fine	2.0 - 4.0	1	2%	58%
	Fine	4.0 - 5.7	2	3%	62%
<b>R</b>	Fine	5.7 - 8.0	1	2%	63%
<b>A</b>	Medium	8.0 - 11.3	6	10%	73%
<b>V</b>	Medium	11.3 - 16.0	3	5%	78%
<b>E</b>	Coarse	16.0 - 22.6	3	5%	83%
<b>L</b>	Coarse	22.6 - 32.0	4	7%	90%
<b>S</b>	Very Coarse	32.0 - 45.0	5	8%	98%
	Very Coarse	45.0 - 64.0	0	0%	98%
<b>C</b>	Small	64 - 90	1	2%	100%
	Small	90 - 128	0	0%	100%
<b>O</b>	Large	128 - 180	0	0%	100%
<b>B</b>	Large	180 - 256	0	0%	100%
<b>L</b>	Large	180 - 256	0	0%	100%
<b>B</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>L</b>	Small	362 - 512	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	0.05
D84	24
D95	40



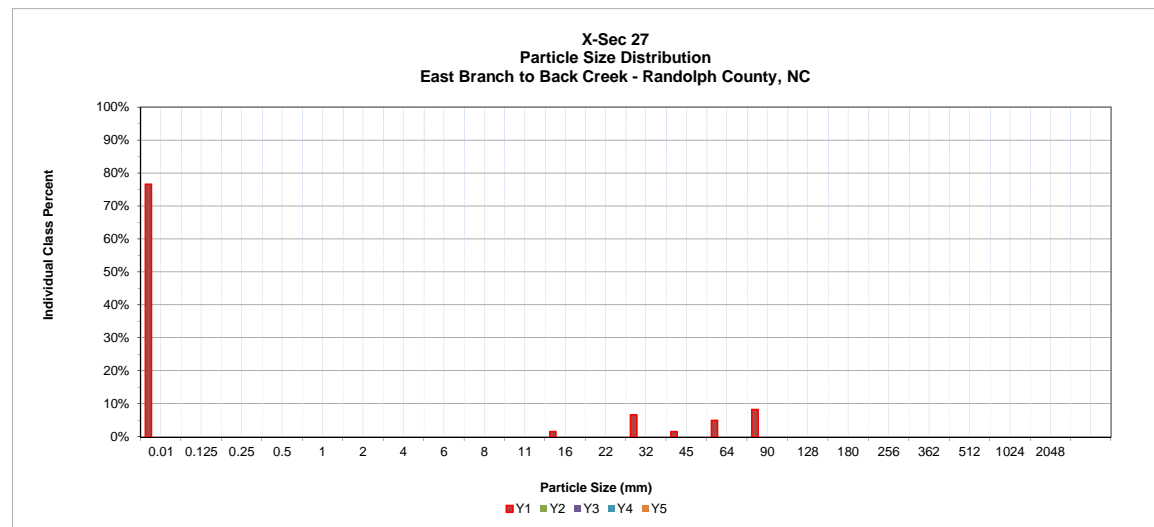
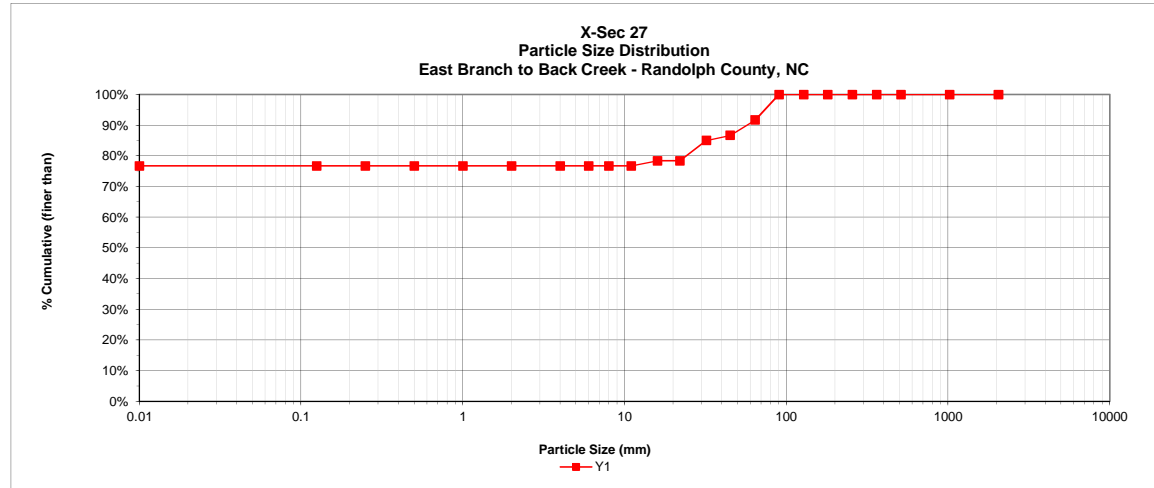


## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 27  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	46	77%	77%
<b>S</b>	Very Fine	.062 - .125	0	0%	77%
	Fine	.125 - .25	0	0%	77%
<b>A</b>	Medium	.25 - .50	0	0%	77%
<b>N</b>	Coarse	.50 - 1.0	0	0%	77%
<b>D</b>	Very Coarse	1.0 - 2.0	0	0%	77%
<b>G</b>	Very Fine	2.0 - 4.0	0	0%	77%
	Fine	4.0 - 5.7	0	0%	77%
<b>R</b>	Medium	5.7 - 8.0	0	0%	77%
<b>A</b>	Medium	8.0 - 11.3	0	0%	77%
<b>V</b>	Medium	11.3 - 16.0	1	2%	78%
<b>E</b>	Coarse	16.0 - 22.6	0	0%	78%
<b>L</b>	Coarse	22.6 - 32.0	4	7%	85%
<b>S</b>	Very Coarse	32.0 - 45.0	1	2%	87%
	Very Coarse	45.0 - 64.0	3	5%	92%
<b>C</b>	Small	64 - 90	5	8%	100%
	Small	90 - 128	0	0%	100%
<b>O</b>	Large	128 - 180	0	0%	100%
<b>B</b>	Large	180 - 256	0	0%	100%
<b>L</b>	Large	180 - 256	0	0%	100%
<b>B</b>	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
<b>L</b>	Small	362 - 512	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	0.04
D84	31
D95	74



## Cross - Section Pebble Count

Project Name : Heath Dairy Farm  
 Cross Section: 28  
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
<b>S/C</b>	Silt/Clay	< 0.062	34	57%	57%
<b>S</b>	Very Fine	.062 - .125	1	2%	58%
	Fine	.125 - .25	0	0%	58%
<b>N</b>	Medium	.25 - .50	0	0%	58%
<b>D</b>	Coarse	.50 - 1.0	0	0%	58%
<b>S</b>	Very Coarse	1.0 - 2.0	0	0%	58%
<b>G</b>	Very Fine	2.0 - 4.0	0	0%	58%
	Fine	4.0 - 5.7	0	0%	58%
<b>R</b>	Fine	5.7 - 8.0	0	0%	58%
<b>A</b>	Medium	8.0 - 11.3	0	0%	58%
<b>V</b>	Medium	11.3 - 16.0	0	0%	58%
<b>E</b>	Coarse	16.0 - 22.6	1	2%	60%
<b>L</b>	Coarse	22.6 - 32.0	7	12%	72%
<b>S</b>	Very Coarse	32.0 - 45.0	8	13%	85%
	Very Coarse	45.0 - 64.0	3	5%	90%
<b>C</b>	Small	64 - 90	5	8%	98%
	Small	90 - 128	1	2%	100%
<b>B</b>	Large	128 - 180	0	0%	100%
<b>L</b>	Large	180 - 256	0	0%	100%
<b>B</b>	Small	256 - 362	0	0%	100%
<b>L</b>	Small	362 - 512	0	0%	100%
<b>D</b>	Medium	512 - 1024	0	0%	100%
<b>R</b>	Lrg- Very Lrg	1024 - 2048	0	0%	100%
<b>BDRK</b>	Bedrock		0	0%	100%
<b>Totals</b>			60	100%	

Summary Data	
D50	0.05
D84	44
D95	80

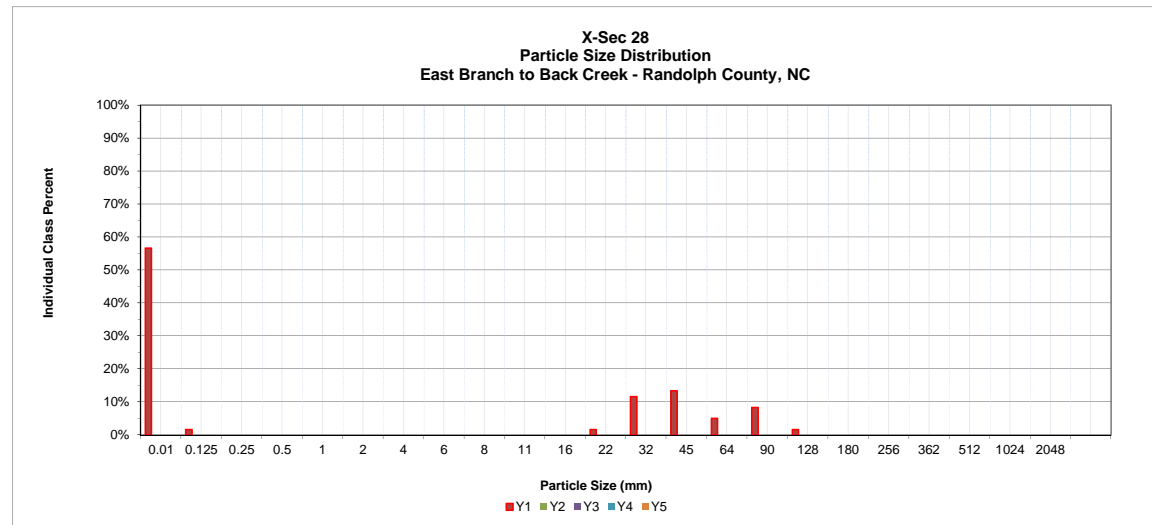
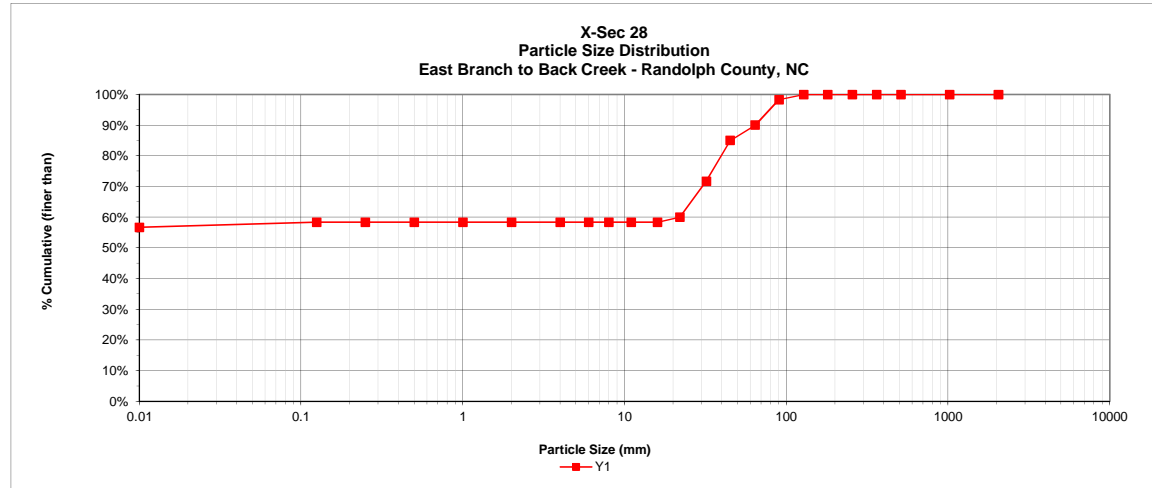


Table 8a. Baseline Stream Data Summary Heath Dairy Road Stream Restoration/ DMS No. 170																						
	Existing Conditions	Reference Reach	Design			Existing Conditions	Reference Reach	Design	Reference Reach	Design		Existing Conditions	Reference Reach	Design	Existing Conditions	Reference Reach	Design	Existing Conditions	Reference Reach	Design		
Stream Reach	Back Creek Upper	Fork Creek	Back Cr. Reach 1*	Back Cr. Reach 2*	Back Cr. Reach 3*	Back Creek Lower	UT to Polecat Cr.	Back Creek Reach 4*	Fork Creek	Back Cr. Reach 4b*	Back Cr. Reach 5*	North Branch	Fork Creek	North Branch	East Branch	Fork Creek	East Branch	West Branch	Fork Creek	West Branch Reach 1*	West Branch Reach 2*	West Branch Reach 3*
Stream Type	G4	B4c	B4c	B4c	B4c	E4	E4	E4	B4c	B4c	B4c	E4	B4c	B4c	G4	B4c	B4c	G4	B4c	B4c	B4c	B4c
Drainage Area (mi <sup>2</sup> )	0.94	2.2	1.04	1.08	1.22	2.5	0.4	1.3	2.2	1.34	2.69	2.5	2.2	1.14	0.05	2.2	0.25	0.05	2.2	0.05	0.06	0.14
Bankfull Width (ft)	10.1	20.1	16.5	16.6	17.5	13.8	9.4	16.5	20.1	17.5	22.5	13.8	20.1	16.5	5	20.1	10	5	20.1	5.8	6.2	8.2
Mean Depth (ft)	1.68	1.73	1.2	1.2	1.3	3.07	1.13	1.4	1.73	1.2	1.6	3.07	1.73	1.2	0.62	1.73	0.7	0.62	1.73	0.4	0.44	0.6
Bankfull XS <sub>AREA</sub> (ft <sup>2</sup> )	17	34.8	19	19	22	42.3	10.6	23	34.8	22	36	42.3	34.8	20	3.1	34.8	7	3.1	34.8	2.4	2.7	4.7
Bankfull Discharge (cfs)	75	163	86	88	101	167	37.4	101	163	101	174	167	163	92	8.5	163	30	8.5	163	9	10	19
Bkf Mean Velocity (ft/s)	4.4	4.7	4.5	4.5	4.5	3.9	3.5	3	4.7	3	4.5	3.9	4.7	4.5	2.7	4.7	4.5	2.7	4.7	4.5	4.5	4.5
Width/Depth Ratio	6	12	14	14	14	4.5	8.3	12	12	14	14	4.5	12	13	8	12	14	8	12	14	14	14
Max. Riffle Depth (ft)	2.4	2	1.6	1.6	1.7	4.1	1.6	2	2	1.7	2.2	4.1	2	1.7	0.8	2	1	0.8	2	0.55	0.6	0.8
Riffle Depth Ratio	1.4	1.2	1.3	1.3	1.3	1.3	1.4	1.45	1.2	1.4	1.4	1.3	1.2	1.4	1.3	1.2	1.4	1.3	1.2	1.38	1.36	1.36
Max. Pool Depth (ft)	2.8	2.6	2.4	2.5	2.6	5	1.6	3.5	2.6	2.6	3.3	5	2.6	2.6	1.4	2.6	1.5	1.4	2.6	0.8	0.9	1
Pool Depth Ratio	1.7	1.5	2	2	2	1.6	1.8	2.2	1.5	2.1	2.1	1.6	1.5	2.1	2.3	1.5	2.1	2.3	1.5	2	2	2
Flood Prone Width (ft)	29	63	30 – 45	28 – 77	34 – 120	200	50	200	63	35	45	200	63	40 – 57	5.8	63	26 – 42	5.8	63	12 – 22	12 – 30	16
Entrenchment Ratio	1.4 – 4.5	2.7 – 3.1	1.9 – 2.9	1.7 – 4.8	2.0 – 7.0	14.5	5.3	12.5	2.7 – 3.1	2	2	14.5	2.7 – 3.1	2.4 – 3.4	1.2	2.7 – 3.1	2.7 – 4.4	1.2	2.7 – 3.1	2.0 – 3.8	2.0 – 4.8	2
Bank Height Ratio	1.4 – 2.3	1.2	1	1	1	1.5	1.2	1	1.2	1	1	1.5	1.2	1	2.6	1.2	1	2.6	1.2	1	1	1
Meander Length (ft)	190	37 – 172	110 – 120	125 – 145	130 – 145	160	56 – 85	135 – 155	37 – 172	115	145	55	37 – 172	150 – 160	80	37 – 172	90	60 – 120	37 – 172	50 – 55	50 – 60	60 – 70
Meander Length Ratio	19	1.8 – 8.6	7.1 – 7.7	7.8 – 9.1	7.6 – 8.5	12	6 – 9	8.4 – 9.7	1.8 – 8.6	6.6	6.6	4	1.8 – 8.6	9.1 – 9.7	16	1.8 – 8.6	9.5	12 – 24	1.8 – 8.6	8.6 – 9.5	8.1 – 9.7	7.3 – 8.5
Radius of Curvature (ft)	18	47 – 318	31 – 46	32 – 48	34 – 51	15	19 – 50	32 – 48	47 – 318	35 – 52	44 – 66	13	47 – 318	33 – 49	9 – 43	47 – 318	21 – 31	9 – 43	47 – 318	12 – 17	12 – 19	16 – 25
Rc Ratio	1.8	2.3 – 16	2 – 3	2 – 3	2 – 3	1.1	2.0 – 5.3	2 – 3	2.3 – 16	2 – 3	2 – 3	1	2.3 – 16	2 – 3	1.8 – 8.6	2.3 – 16	2 – 3	1.8 – 8.6	2.3 – 16	2 – 3	2 – 3	2 – 3
Belt Width (ft)	25	33 – 40	30 – 35	40 – 50	45 – 60	23	28 – 50	90	33 – 40	40	60	35	33 – 40	40 – 50	16	33 – 40	25	20	33 – 40	15 – 20	15 – 20	25 – 30
Meander Width Ratio	2.5	1.6 – 2.0	1.9 – 2.2	2.5 – 3.1	2.6 – 3.5	1.7	3.0 – 5.3	5.6	1.6 – 2.0	2.3	2.7	2.5	1.6 – 2.0	2.4 – 3.0	3.2	1.6 – 2.0	2.6	4	1.6 – 2.0	2.6 – 3.4	2.4 – 3.2	3.1 – 3.7
Sinuosity	1	1.05	1.1	1.1	1.1	1	1.4	1.3	1.05	1.1	1.1	1	1.05	1.1	1.05	1.05	1.1	1.07	1.05	1.1	1.2	1.1
Channel Slope (ft/ft)	0.0087	0.0079	0.006	0.0062	0.0062	0.0045	0.012	0.0023	0.0079	0.0095	0.0095	0.0045	0.0079	0.0036	0.011	0.0079	0.008	0.011	0.0079	0.0128	0.0174	0.00108
Valley Slope (ft/ft)	0.0087	0.0083	0.0066	0.0068	0.0068	0.0045	0.017	0.003	0.0083	0.0105	0.0105	0.0045	0.0083	0.004	0.012	0.0083	0.0088	0.019	0.0083	0.0141	0.0209	0.00119
Riffle Slope (ft/ft)	0.023	0.013	0.006	0.0062	0.0062	0.0037	0.027	0.0023	0.013	0.0095	0.0095	0.0037	0.013	0.0036	0.31	0.013	0.008	0.31	0.013	0.0128	0.0174	0.0108
Riffle Slope Ratio	2.6	0.1	1	1	1	0.8	2.3	1	0.1	1	1	0.8	0.1	1	28	0.1	1	28	0.1	1	1	1
Pool Slope (ft/ft)	0	0.001	0	0	0	0	0.017	0	0.001	0	0	0	0.001	0	0	0.001	0	0	0.001	0	0	0
Pool Slope Ratio	0	0.1	0	0	0	0	1.4	0	0.1	0	0	0	0.1	0	0	0.1	0	0	0.1	0	0	0
Pool Width (ft)	7.8	19.9	18.1	18.3	19.2	13.4	7.1	18.1	19.9	19.2	24.7	13.4	19.9	16.5	4.4	19.9	11	4.4	19.9	6.4	6.8	9
Pool Width Ratio	0.8	1	1.1	1.1	1.1	1	0.8	1.1	1	1.1	1.1	1	1	1	0.9	1	1.1	0.9	1	1.1	1.1	1.1
Pool Spacing (ft)	57.6	71 – 134	66 – 99	66 – 99	70 – 105	43	34 – 52	66 – 99	71 – 134	70 – 105	90 – 135	43	71 – 134	66 – 99	9 – 45	71 – 134	40 – 60	9 – 45	71 – 134	23 – 35	25 – 37	32 – 49
Pool Spacing Ratio	5.7	3.5 – 6.7	6-Apr	4 – 6	4 – 6	3.1	3.6 – 5.5	4 – 6	3.5 – 6.7	4 – 6	4 – 6	3.1	3.5 – 6.7	4 – 6	2 – 9	3.5 – 6.7	4 – 6	2 – 9	3.5 – 6.7	4 – 6	4 – 6	4 – 6
D <sub>50</sub> (mm)	25	28	25	25	25	25	15	25	28	25	25	25	28	25	9	28	25	9	28	9	9	9
D <sub>84</sub> (mm)	63	81	63	63	63	81	91	81	81	81	81	81	81	81	19	81	81	19	81	19	19	19





**Exhibit Table 9A. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)**

**Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: Back Creek XS1 - 10**

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Pool)						
	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+
<b>Based on fixed baseline bankfull elevation</b>																																			
Bankfull Width (ft)	21.75	14.31						16.91	13.78						15.25	13.57						14.97	20.17						18.29	16.17					
Floodprone Width (ft)	32	32						26	25.3						100	100						100	100						50	50					
Bankfull Mean Depth (ft)	1.47	1.13						1.01	0.76						1.61	1.58						1.69	1.87						1.6	2.16					
Bankfull Max Depth (ft)	2.37	1.49						1.44	1.01						2.39	2.75						2.73	2.93						2.83	3.26					
Bankfull Cross Sectional Area (ft <sup>2</sup> )	32.01	16.14						17	10.42						24.56	21.38						25.29	37.74						29.28	34.85					
Bankfull Width/Depth Ratio	14.8	12.66						16.74	18.13						9.47	8.59						8.86	10.79						11.43	7.49					
Bankfull Entrenchment Ratio	2.23	2.28						2.39	1.84						6.55	7.3						6.68	4.96						2.73	8.2					
Bankfull Bank Height Ratio																																			
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )																																			
d50 (mm)		0.05							30.8							34.5							0.06							NA					
	Cross Section 6 (Riffle)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)							Cross Section 9 (Pool)							Cross Section 10 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Based on fixed baseline bankfull elevation</b>																																			
Bankfull Width (ft)	14.27	14.79						18.83	19.51						26.3	21.33						20.68	22.5						22.9	15.71					
Floodprone Width (ft)	75	75						100	100						100	100						100	100						100	100					
Bankfull Mean Depth (ft)	0.87	1.01						1.59	1.9						0.97	1.23						1.81	2.32						1.1	1.06					
Bankfull Max Depth (ft)	1.32	1.66						3.07	3.01						2.19	1.74						2.83	3.69						1.8	1.42					
Bankfull Cross Sectional Area (ft <sup>2</sup> )	12.41	14.89						29.94	37.15						25.6	26.21						37.43	52.17						25.14	16.58					
Bankfull Width/Depth Ratio	16.4	14.64						11.84	10.27						27.3	17.34						11.43	9.7						20.82	14.82					
Bankfull Entrenchment Ratio	5.25	5						5.31	5.1						3.80	4.68						4.84	4.4						4.36	6.4					
Bankfull Bank Height Ratio																																			
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )																																			
d50 (mm)		0.05							NA							0.05							0.06							0.05					

**Exhibit Table 9B. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)**

**Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: Back Creek XS11-16; West Branch XS17-20**

	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Pool)							Cross Section 14 (Riffle)							Cross Section 15 (Pool)						
	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+
<b>Based on fixed baseline bankfull elevation</b>																																			
Bankfull Width (ft)	22.55	16.96						18.44	17.94						20.02	16.42						17.3	15.48						16.12	13.76					
Floodprone Width (ft)	100	100						100	100						100	100						70	70						100	100					
Bankfull Mean Depth (ft)	1.51	1.69						1.28	1.26						1.43	1.93						1.54	1.19						1.81	1.99					
Bankfull Max Depth (ft)	2.91	2.94						1.78	1.73						2.69	2.81						2.39	1.92						3.96	3.38					
Bankfull Cross Sectional Area (ft <sup>2</sup> )	34.05	28.68						23.57	22.69						28.58	31.75						26.6	18.37						29.14	27.4					
Bankfull Width/Depth Ratio	14.93	10.04						14.41	14.24						14	8.51						11.23	13.01						8.91	6.91					
Bankfull Entrenchment Ratio	4.43	5.9						5.42	5.6						4.99	6						4.00	4.5						6.20	7.3					
Bankfull Bank Height Ratio																																			
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )																																			
d50 (mm)		NA							0.06							NA							0.06							NA					
	Cross Section 16 (Pool)							Cross Section 17 (Riffle)							Cross Section 18 (Pool)							Cross Section 19 (Riffle)							Cross Section 20 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Based on fixed baseline bankfull elevation</b>																																			
Bankfull Width (ft)	18.22	16.95						6.65	4.96						6.86	5.82						6.7	6.23						8.79	7.74					
Floodprone Width (ft)	57	57						20	20						26	26							27.7							29					
Bankfull Mean Depth (ft)	2.34	2.53						0.62	0.97						0.58	0.6						0.59	0.47						0.78	0.58					
Bankfull Max Depth (ft)	3.12	3.22						0.99	1.22						0.92	1.03						0.83	0.62						1.01	0.75					
Bankfull Cross Sectional Area (ft <sup>2</sup> )	42.73	42.85						4.11	4.82						3.97	3.51						3.98	2.91						6.83	4.53					
Bankfull Width/Depth Ratio	7.79	6.7						10.73	5.1						11.83	9.7						11.36	13.26						11.27	13.34					
Bankfull Entrenchment Ratio	3.13	3.4						3.69	4.22						3.78	4.43						6.00	4.45						4.53	3.71					
Bankfull Bank Height Ratio																																			
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )																																			
d50 (mm)		0.03							NA							NA							113							45					

**Exhibit Table 9C. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)**

**Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: West Branch XS21, UT to West Branch XS22-25; North Branch XS23-25; East Branch XS26-28**

	Cross Section 21 (Pool)							Cross Section 22 (Riffle)							Cross Section 23 (Pool)							Cross Section 24 (Riffle)							Cross Section 25 (Riffle)							
<b>Based on fixed baseline bankfull elevation</b>	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+	
Bankfull Width (ft)	7.72	10.54						8.59	8.52						19.17	15.83							18.46	18.94						18.86	17.76					
Floodprone Width (ft)	40	40						75	75						200	200							200	200						100	100					
Bankfull Mean Depth (ft)	0.83	0.93						0.52	0.51						2.68	2.67							1.32	1.39						1.36	1.38					
Bankfull Max Depth (ft)	1.31	2.13						0.84	0.67						4.72	4.83							1.93	2.21						1.82	1.85					
Bankfull Cross Sectional Area (ft <sup>2</sup> )	6.44	9.83						4.46	4.37						51.38	42.32							24.43	26.37						25.68	24.46					
Bankfull Width/Depth Ratio	9.3	11.33						16.52	16.71						7.15	5.93							13.98	13.63						13.87	12.87					
Bankfull Entrenchment Ratio	5.17	3.74						8.50	8.52						10.43	12.63							10.83	10.56						5.30	5.63					
Bankfull Bank Height Ratio																																				
<b>Based on current/developing bankfull feature</b>																																				
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Bankfull Bank Height Ratio																																				
Cross Sectional Area between end pins (ft <sup>2</sup> )																																				
d50 (mm)		0.04							108							NA								0.05							0.05					
	Cross Section 26 (Pool)							Cross Section 27 (Riffle)							Cross Section 28 (Riffle)							Cross Section xxx (Pool)							Cross Section xxx (Riffle)							
<b>Based on fixed baseline bankfull elevation</b>	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+	
Bankfull Width (ft)	8.75	8.78						10.23	8.64						9.84	9.88																				
Floodprone Width (ft)	50	50						50	50						50	50																				
Bankfull Mean Depth (ft)	0.93	0.82						0.62	0.54						0.69	0.68																				
Bankfull Max Depth (ft)	1.73	1.34						1.04	0.83						1.11	1.09																				
Bankfull Cross Sectional Area (ft <sup>2</sup> )	8.1	7.24						6.31	4.7						6.83	6.74																				
Bankfull Width/Depth Ratio	9.41	10.71						16.5	16						14.26	14.53																				
Bankfull Entrenchment Ratio	5.71	5.69						4.88	5.78						5.08	5.06																				
Bankfull Bank Height Ratio																																				
<b>Based on current/developing bankfull feature</b>																																				
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Bankfull Bank Height Ratio																																				
Cross Sectional Area between end pins (ft <sup>2</sup> )																																				
d50 (mm)		0.04							0.04							0.05																				



## **Appendix E – Hydrologic Data**

Table 10 – Verification of Bankfull Events

Monthly Rainfall Data

Precipitation and Water Level Plots

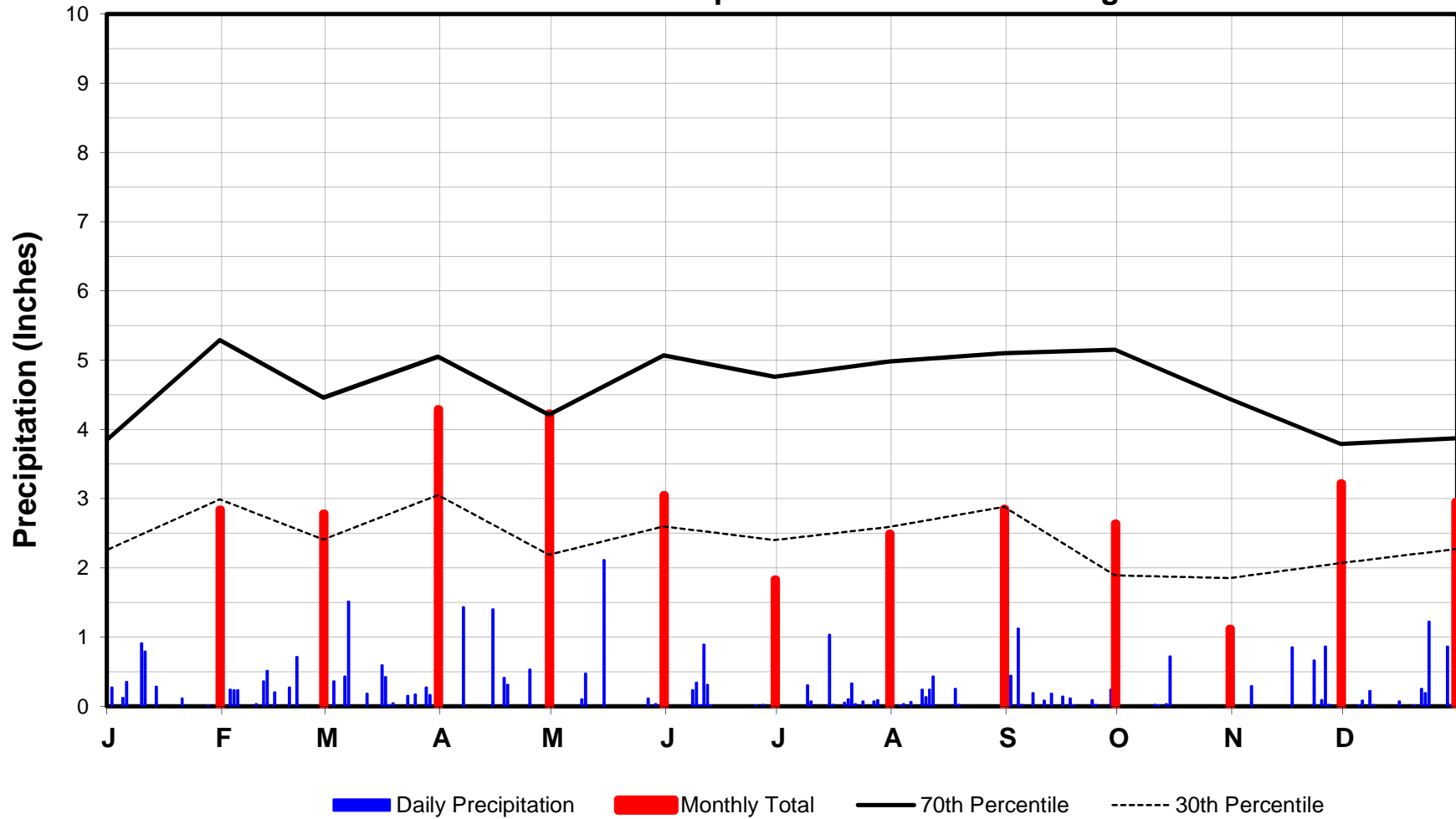
Table 11 – Wetland Hydrology Criteria Attainment

**Table 10. Verifictioin of Bankfull Event  
Heath Dairy Road Stream Restoration/ DMS No. 170**

<b>Date of Data Collection</b>	<b>Date of Occurrence</b>	<b>Method</b>	<b>Photo #</b>
A bankfull event was observed in 2013 following construction but not documented		Rack lines in vegetation	

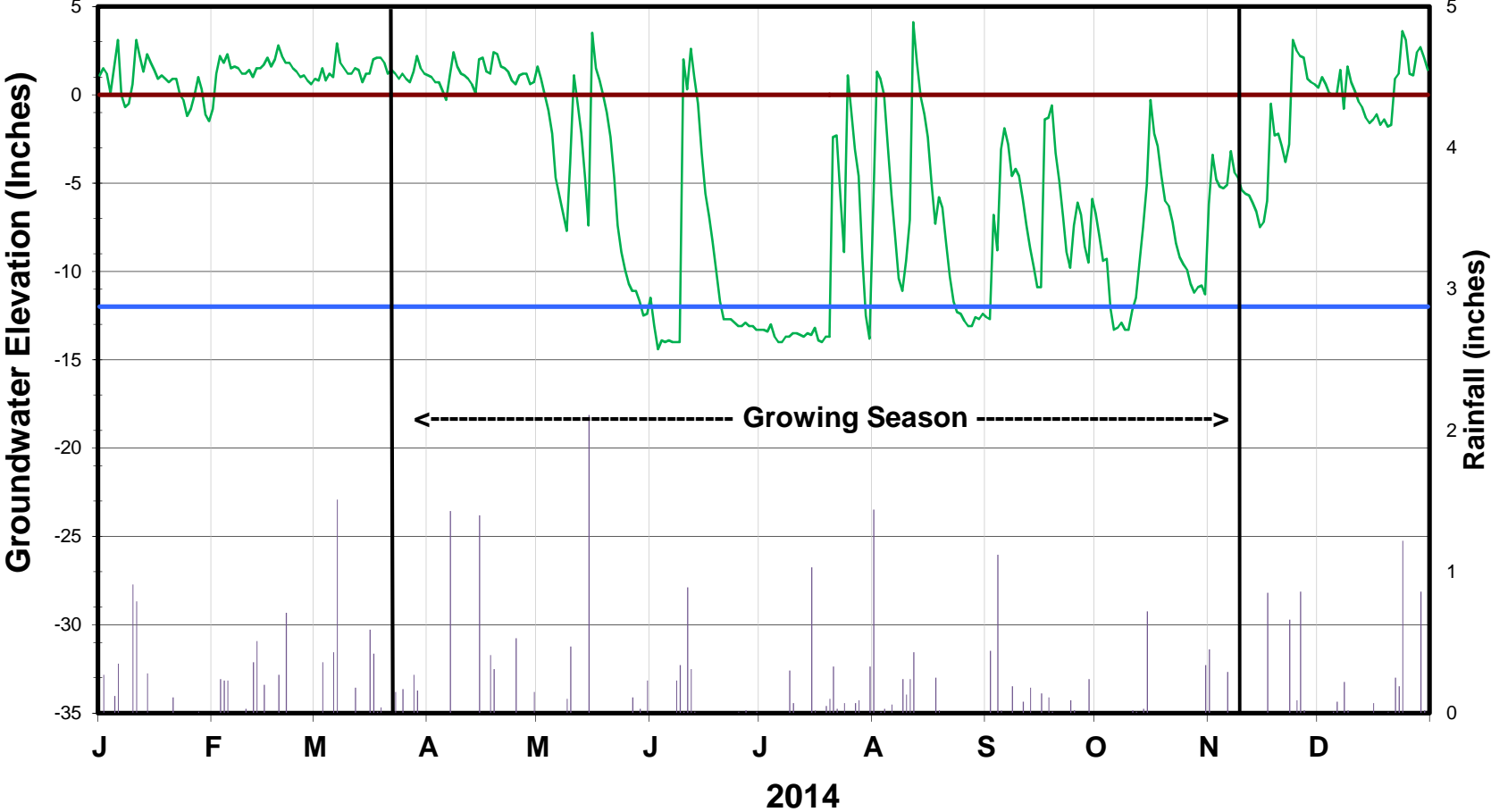
Note: Installed crest gauges clogged with silt and did not function properly during 2014

Heath Dairy Road  
Randolph County, NC  
2014 Precipitation Data Y1 Monitoring

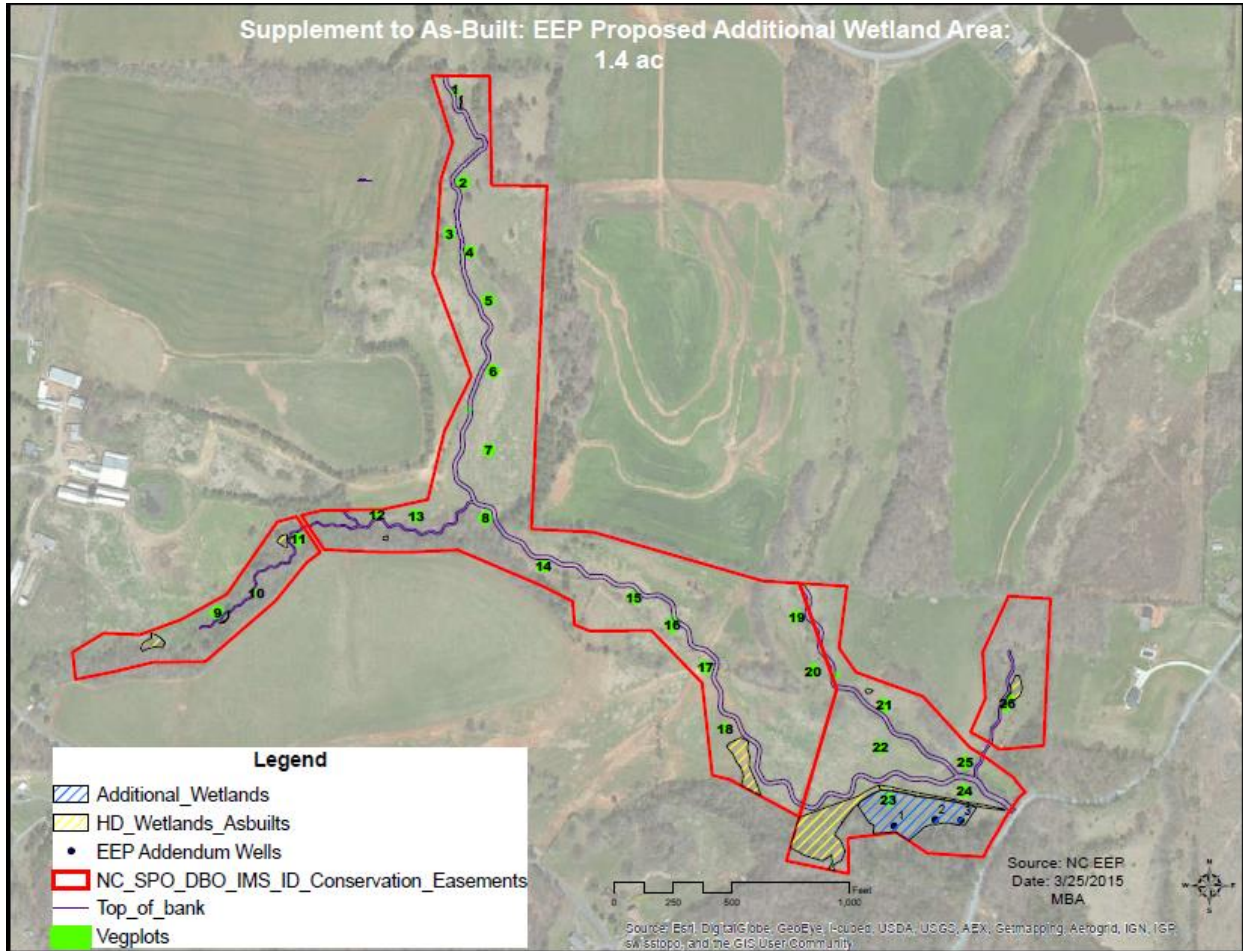




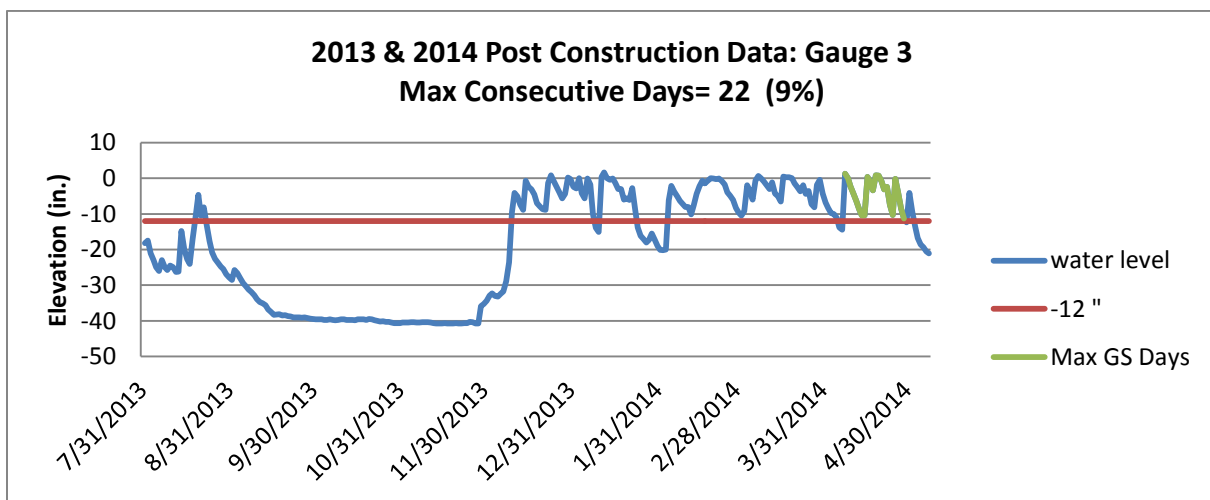
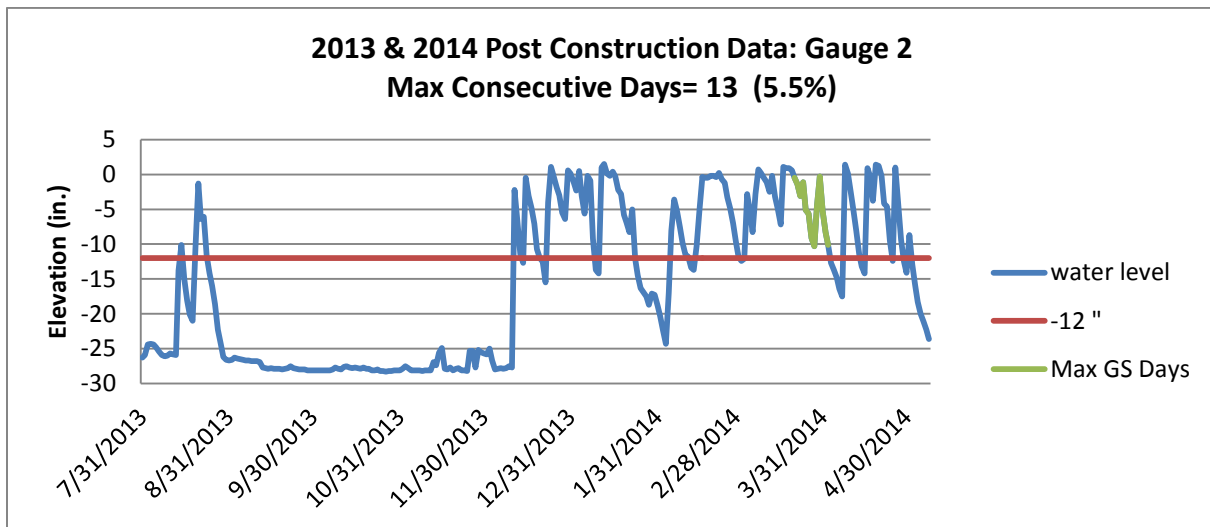
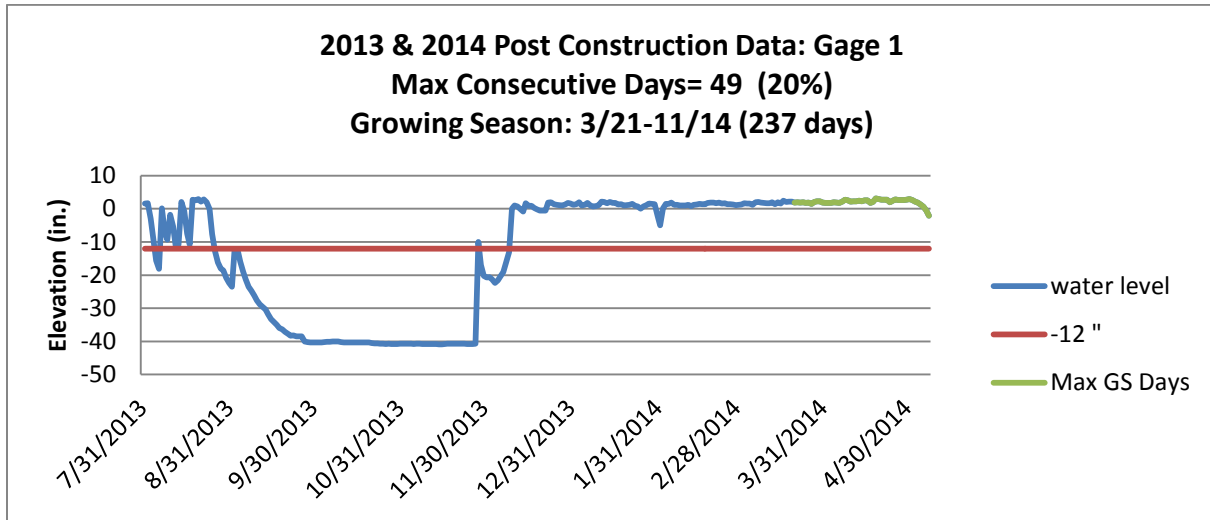
# Heath Dairy Road Groundwater Gauges



# EEP Supplemental Wetland Gauge Location Map and Year 1 Post Construction Gauge Data Summary



Post Construction Gauge Data Year 1:



**Table 11. Summary of Groundwater Gauge Results  
Heath Dairy Road Stream Restoration/ DMS No. 170**

<b>Success Criteria Achieved/Max Consecutive Days During Growing Season</b>					
<b>Gauge</b>	<b>Year 1 (2014)</b>	<b>Year 2 (2015)</b>	<b>Year 3 (2016)</b>	<b>Year 4 (2017)</b>	<b>Year 5 (2018)</b>
GW 1	Yes/49 days (20%)				
GW 2	No/13 days (5.5%)				
GW 3	No/22 days (9%)				
GW 4	Yes/67 days (28%)				