BISHOP SITE STREAM AND WETLAND RESTORATION

2007 Annual Monitoring Report (Year 1) (FINAL)

Anson County
EEP Project No. D05010S
Design Firm: EcoScience Corporation

April 2008

Prepared for: NCDENR/ ECOSYSTEM ENHANCEMENT PROGRAM
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1.0 EXECUTIVE SUMMARY

EcoScience Corporation (ESC) was retained by the North Carolina Ecosystem Enhancement Program (EEP) to provide stream and wetland restoration/enhancement design services for the Bishop Site Stream and Wetland Restoration (hereafter referred to as the Site). The Site, which is in the Yadkin River Basin (Cataloguing Units 03040104 and 03040105), is located north of Wadesboro in Anson County, North Carolina (Figure 1). It is just northwest (upstream) of the Rocky River's confluence with the Pee Dee River. Three separate construction areas, each confined within a North Carolina Department of Transportation (NCDOT)-owned conservation easement, comprise the approximate 200-acre Site: Camp Branch (Site A, 94.9 acres), Dula Thoroughfare (Site B, 70.8 acres), and the Unnamed Tributary (UT) to Dula Thoroughfare (Site C, 33.7 acres).

The following report summarizes first year (Year 1) monitoring activities at the Site. Site construction began in May 2006 and was completed in February 2007 when the Site was planted (grading activities were completed in October 2006). As-built surveys for the Site were performed in May 2007. First year monitoring was conducted in October 2007. In order to be considered successful, the Site must achieve vegetative, groundwater, and stream channel success criteria for a minimum of five years (or until success criteria are achieved).

Vegetation Monitoring

Vegetation monitoring for Year 1 was performed based on the Carolina Vegetation Survey (CVS)-EEP Protocol for Recording Vegetation Version 4.0 [Lee et al. 2006]). Vegetation success criteria for Site vegetation is based on a minimum survival of 260 stems per acre of planted species at the end of monitoring Year 5. Based on the first year surveys, the average count of the surviving planted species across the Site is 850 stems per acre (1047 stems per acre at Camp Branch, 842 stems per acre at Dula Thoroughfare, and 310 stems per acre at UT to Dula Thoroughfare). Although planted stem survivability exceeds the required average of 260 stems/acre, planted bare root survivability at UT to Dula Thoroughfare was observed to significantly less than that observed at the other two Site restoration areas (Camp Branch and Dula Thoroughfare). Thus, supplemental plantings may be warranted within planted areas at UT to Dula Thoroughfare.

Stream Monitoring

As stated in the project's Mitigation Report (EEP 2007), success criteria for on-Site stream reaches will include 1) successful classification of the reach as a functioning system (Rosgen 1996), and 2) channel stability indicative of a stable stream system. Longitudinal profile and cross-sectional surveys (including modified Wolman pebble counts at each) were conducted along Site stream reaches at their locations as specified in the Site monitoring plan. Crest gauges were also installed to monitor for the occurrence of bankfull events.

Stream channel stability within each of the three Site restoration areas was observed to be good to excellent. Based on observations since grading activities were completed, Camp Branch (Site A) continues to narrow its width-to-depth ratio towards values characteristic of E-type streams (it was designed as a low width-to-depth ratio C channel with the intention of a gradual geomorphic shift towards an E channel).

Due to exceptional drought conditions throughout the first project monitoring year, none of the stream reaches held any water at the time of monitoring activities. Furthermore, crest gauges did not indicate the occurrence of any bankfull events for this monitoring year (it should be noted that at least three bankfull events occurred immediately following Site grading activities before the installation of Site crest gauges).

Wetland Hydrology Monitoring

Wetland groundwater monitoring gauges were installed within the proposed wetland restoration areas adjacent to Dula Thoroughfare. A total of three gauges were installed: two remain in their original locations and one was relocated to better reflect representative groundwater levels within the excavated floodplain. Data from the gauges indicate that hydrologic success criteria was achieved in the first year of project monitoring despite exceptional drought conditions across much of the State (including Anson County).

2.0 PROJECT BACKGROUND

2.1 LOCATION AND SETTING

The Site is located north of Wadesboro in Anson County, NC, just upstream of the confluence of the Rocky and Yadkin Rivers (Figure 1, Appendix A). In order to access the Site, from Wadesboro, take North Carolina Highway 52 (NC 52) north. Approximately 1.3 miles south of NC 52's crossing over the Rocky River, turn east onto Carpenter Road (a gravel road). Follow Carpenter Road to the east. Gated access points to the Site (one for Camp Branch, one for Dula Thoroughfare and UT to Dula Thoroughfare) abut Carpenter Road from the east.

2.2 PROJECT STRUCTURE AND OBJECTIVES

Prior to restoration activities, land use at the Site was primarily agricultural. Many Site drainage features and wetland areas were dredged, straightened, and filled in some locations to accommodate row crop cultivation and other agrarian activities. Stream channel instability and loss of wetland functions resulted within impacted areas.

Primary Site restoration goals included the restoration of stable dimension, pattern, and profile for impacted on-Site stream reaches including Camp Branch, the UT to Camp Branch, Dula Thoroughfare, and the UT to Dula Thoroughfare. A second primary project goal was the restoration of riparian wetlands adjacent to Dula Thoroughfare.

Secondary Site restoration goals included stream channel enhancement and preservation as well as wetland enhancement and preservation. These goals were achieved via site planting with bare root seedlings to recreate pre-disturbance vegetative communities within their appropriate landscape contexts.

At Camp Branch (Site A), specific Site restoration goals included:

- Priority II stream restoration (including all attendant benefits outlined in Rosgen 1996) via excavation of approximately 1,767 linear feet of a designed E/C-type stream of the main Camp Branch channel on new location, including adjacent floodplain excavation to achieve an entrenchment ratio characteristic of E/C-type streams;
- Priority I stream restoration (including all attendant benefits outlined in Rosgen 1996) of approximately 403 linear feet and Priority II restoration of approximately 143 linear feet of a designed E/C-type stream of a UT to Camp Branch, including floodplain excavation along the UT upstream of Camp Branch to achieve a stable confluence;
- Level II stream enhancement of approximately 945 linear feet of Camp Branch upstream of its confluence with the UT via riparian plantings adjacent to the Camp Branch stream banks; and
- Re-establishment of the characteristic, pre-disturbance Piedmont Bottomland Forest (Schafale and Weakley 1990) community adjacent to restoration reaches using bare root seedling plantings.

At Dula Thoroughfare (Site B), specific Site restoration goals included:

- Priority II stream restoration via excavation of approximately 2,730 linear feet of a designed E-type stream of Dula Thoroughfare (including an associated tributary), including adjacent floodplain excavation to achieve and entrenchment ratio characteristic of E-type streams;

- Restoration of approximately 3.1 acres of riverine wetlands adjacent to Dula Thoroughfare via floodplain excavation in previously identified hydric soil areas, thereby re-establishing jurisdictional wetland hydrology;
- Aquatic habitat creation via excavation of vernal pools within floodplain cut areas; and
- Re-establishment of the characteristic, pre-disturbance Piedmont Bottomland Forest (Schafale and Weakley 1990) community adjacent to restoration reaches using bare root seedling plantings.

At UT to Dula Thoroughare (Site C), specific Site restoration goals included:

- Level I enhancement of approximately 1,871 linear feet of stream via backfill of straightened and ditched portions of the existing watercourse, thereby re-establishing characteristic stream dimension and pattern by reintroducing flow into adjacent relic channel areas;
- Level II enhancement of approximately 480 linear feet of stream via riparian plantings adjacent to the UT to Dula Thoroughfare stream banks; and
- Re-vegetation of open areas adjacent to the UT to Dula Thoroughfare via plantings of characteristic, pre-disturbance community types described by Schafale and Weakley (1990) using bare root seedling plantings.

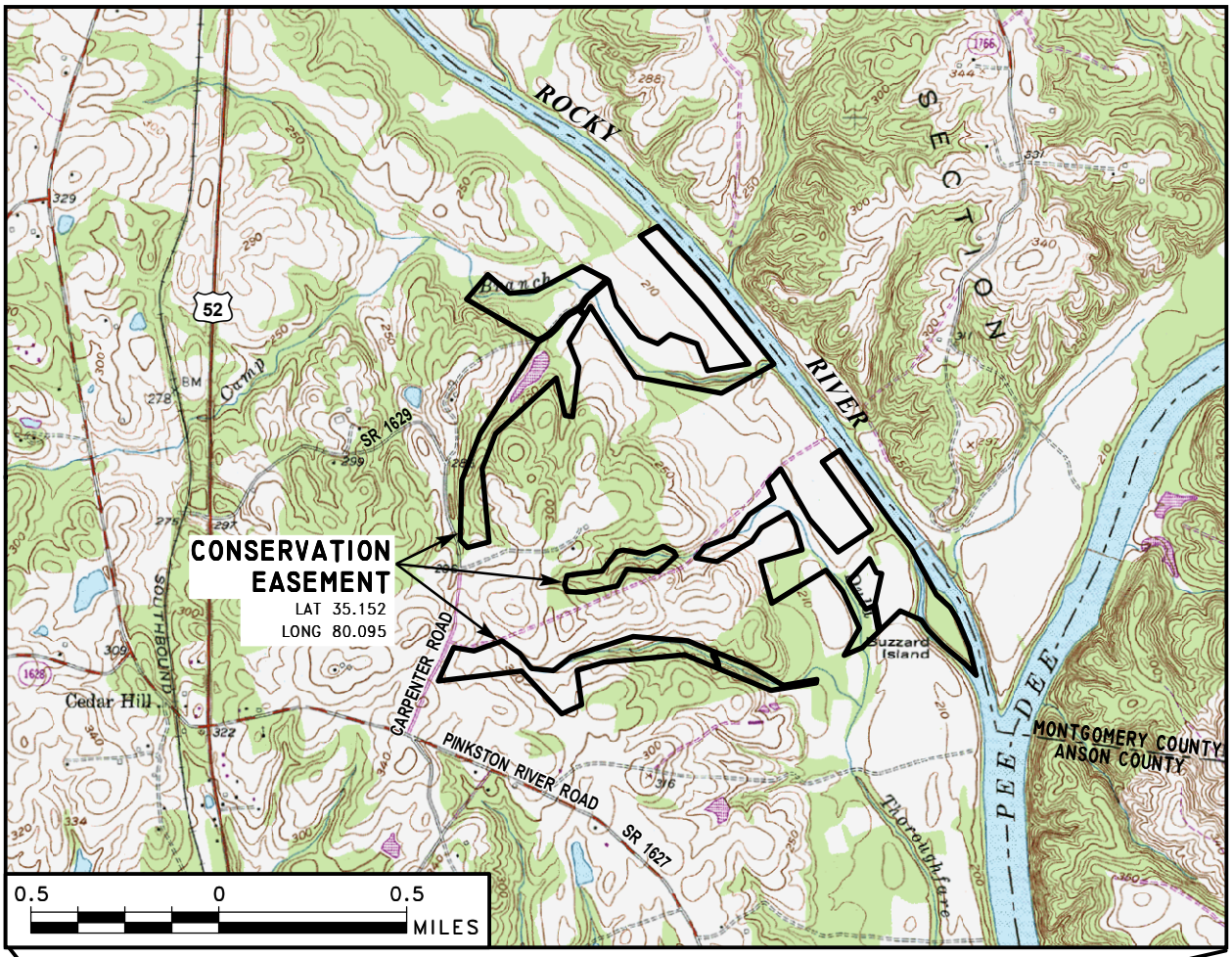
Prior to restoration activities, each of the on-Site drainage features listed above had been impacted to accommodate agricultural land usage (primarily row crop cultivation). In the classic scenario, stream channels are traditionally relocated to the toe of the adjacent valley slope, straightened, and dredged in an attempt to decrease flooding and increase the size of the cultivatable areas within the floodplain. Field evidence suggests this was the case with Camp Branch, while Dula Thoroughfare and the UT to Dula Thoroughfare were straightened and ditched along their existing locations. The straightening and ditching of Dula Thoroughfare likely drained adjacent riverine wetlands with the exception of those along the fringe of the channel.

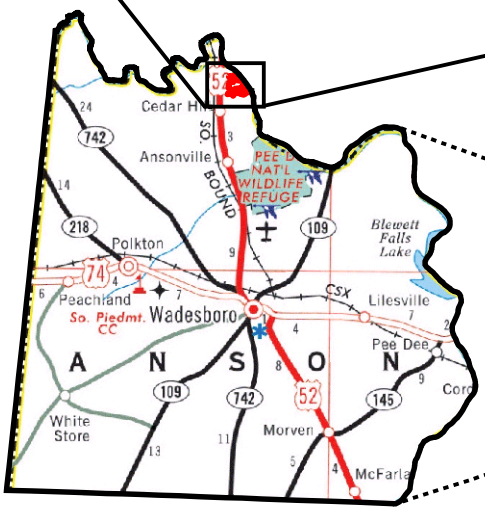
Table 1: Project Components Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S							
Project Component or Reach ID	**Pre-Existing Feet/Acres[1]**	**Restoration Level**	**Approach**	**Footage or Acreage**	**Stationing**	**Buffer Acres**	**Comment**
Reach 1	1,500 lf	R	P2	1,767 lf	0+00 – 17+94	N/A	Total includes 27 LF gap in easement at channel ford
Reach 2	945 lf	E2	N/A	945 lf	N/A	N/A	Enhancement reaches not stationed
Reach 3	220 lf (total)	R	P1	403 lf	0+00 – 4+33	N/A	Total includes 30 LF gap in easement at channel ford
Reach 4	See above	R	P2	143 lf	4+33 – 5+76	N/A	
Reach 5	1,840 lf	R	P2	2,025 lf	0+00 – 20+25	N/A	
Reach 6	540 lf	R	P2	705 lf	0+00 – 7+05	N/A	
Reach 7	1,871 lf	E1	N/A	1,871 lf	N/A	N/A	Enhancement reaches not stationed
Reach 8	480 lf	E2	N/A	480lf	N/A	N/A	Enhancement reaches not stationed
Stream Preservation	12,918 lf	P	N/A	12,918 lf	N/A	N/A	
Riparian Wetland Restoration	N/A	R	N/A	3.1 ac	N/A	N/A	
Riparian Wetland Enhancement	1.0 ac	WE	N/A	1.0 ac	N/A	N/A	
Riparian Wetland Preservation	7.5 ac	P	N/A	7.5 ac	N/A	N/A	

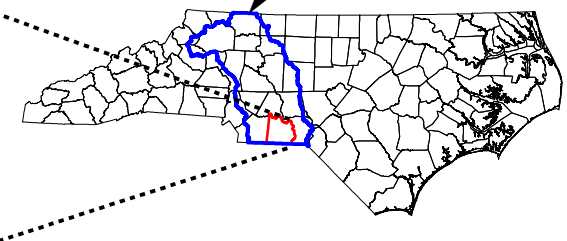
Component Summations

Restoration Level	**Stream (lf)**	**Wetland (Ac)**		**Upland (Ac)**	**Buffer (Ac)**	**BMP**
		Riparian	**Non-Riparian**			
Restoration	5,043	3.1	N/A	N/A	N/A	N/A
Enhancement	N/A	1.0	N/A	N/A	N/A	N/A
Enhancement I	1,871	N/A	N/A	N/A	N/A	N/A
Enhancement II	1,425	N/A	N/A	N/A	N/A	N/A
Creation	N/A	N/A	N/A	N/A	N/A	N/A
Preservation	12,918	7.5	N/A	N/A	N/A	N/A
HQ Preservation	N/A	N/A	N/A	N/A	N/A	N/A
Totals	**21,257**	**11.6**	**N/A**	**N/A**	**N/A**	**N/A**

[1]Values are approximate
*N/A — Not applicable







YADKIN-PEE DEE RIVER BASIN
(CU 03040105 & 03040104)

NAD 83

EcoScience Corporation
Raleigh, North Carolina

Ecosystem Enhancement Program

SITE LOCATION

EEP BISHOP SITE STREAM AND WETLAND RESTORATION

EEP Project No. D05010S

ANSON COUNTY, NORTH CAROLINA

Dwn By:	DGJ
Ckd By:	JDC
Date:	JAN 2008
ESC Project:	04-212.00

FIGURE

1

2.3 PROJECT HISTORY AND BACKGROUND

Table 2. Project Activity and Reporting History Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S		
Activity Report	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	August 2004	September 2004
Final Design (90%)	March 2005	June 2005
Construction	N/A*	February 2007
Temporary S&E mix applied to entire project area	N/A	Throughout construction
Permanent seed mix applied to reach/segments	N/A	October 2006
Bare Root Seedling Installation	N/A	February 2007
Mitigation Plan	June 2007	October 2007
Final Report	June 2007	October 2007
Year 1 Vegetation Monitoring	October 2007	October 2007
Year 1 Stream Monitoring	October 2007	October 2007
Year 1 Wetland Monitoring	December 2007	December 2007

*N/A – Not applicable

Table 3. Project Contacts Bishop Site Stream and Wetland Restoration / EEP Project No. D05010S	
Designer EcoScience Corporation	Jim Cooper (Designer) 1101 Haynes Street, Suite 101 Raleigh, NC 27604 (919) 828-3433
Construction Contractor Vaughn Contruction, Inc.	Tommy Vaughn and Spencer Walker (Foremen) P.O. Box 796 Wadesboro, NC 28170 (704) 694-6450
Planting Contractor Kiker Forestry and Realty	Jason Kiker (Consulting Forester) P.O. Box 933 Wadesboro, NC 28170 (704) 694-6436
Seeding Contactor NA*	NA
Seed Mix Sources	NA
Nursery Stock Suppliers	International Paper Supertree Nursery
Monitoring Performers EcoScience Corporation	1101 Haynes Street, Suite 101 Raleigh, NC 27604 (919) 828-3433
Stream Monitoring POC	Jim Cooper
Vegetation Monitoring POC	Jens Geratz
Wetland Monitoring POC	Justin Wright

*NA – Not available

Table 4. Project Background Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S	
Project County	Anson
Drainage Areas: Camp Branch Dula Thoroughfare UT to Dula Thoroughfare	 2.9 square miles 0.36 square miles 0.23 square miles
Impervious cover estimate (%)	<1 percent for all streams
Stream Orders (per USGS): Camp Branch Dula Thoroughfare UT to Dula Thoroughfare	 2nd 1st 1st
Physiographic Region	Piedmont
Ecoregion (Griffith and Omernik)	Triassic Basins
Rosgen Classifications of As-built: Camp Branch UT to Camp Branch Dula Thoroughfare UT to Dula Thoroughfare	 C4 E/C4 E5 E/D5
Cowardin Classification	Streams: R3US1/R3US2 Wetlands: PFO1
Dominant soil types	Badin Channery Silt Loam (BaB, BaC) Badin-Goldston Complex (BgD) McQueen (MrB) Shellbluff (ShA) Tetotum (ToA) Chewacla (ChA)
Reference Site ID	N/A* (reference areas established on-Site)
USGS HUCs for Project and Reference	03040104 (Dula Thoroughfare, UT to Dula Thoroughfare) 03040105 (Camp Branch)
NCDWQ Sub-basins for Project and Reference	03-07-10 (Dula Thoroughfare, UT to Dula Thoroughfare) 03-07-14 (Camp Branch)
NCDWQ classification for Project and Reference	**C** (all Site waterways)
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	N/A
Percent of project easement fenced	No fencing along easement

*N/A – Not applicable

NAD 83

CAMP BRANCH - SHEET 2A, 3A

CONSERVATION EASEMENT

DULA THOROUGHFARE SHEET 2B, 3B

CONSERVATION EASEMENT

CONSERVATION EASEMENT

UT TO DULA THOROUGHFARE - SHEET 2C, 3C

TO NC 52

SR 1629

CARPENTER ROAD

PINKSTON RIVER ROAD

SR 1627

ROCKY

RIVER

POND

POND

POND

MITIGATION LEGEND

STREAM RESTORATION (PRIORITY 1)	403 ln. ft.
STREAM RESTORATION (PRIORITY 2)	4,640 ln. ft.
STREAM ENHANCEMENT (LEVEL 1)	1,871 ln. ft.
STREAM ENHANCEMENT (LEVEL 2)	1,425 ln. ft.
STREAM PRESERVATION	12,918 ln. ft.
WETLAND RESTORATION	3.1 acres
WETLAND ENHANCEMENT	1.0 acres
WETLAND PRESERVATION	7.5 acres

800 0 800 FEET

EcoScience Corporation
Raleigh, North Carolina

REVISIONS

CLIENT:
Ecosystem Enhancement Program

PROJECT:

EEP BISHOP SITE STREAM AND WETLAND RESTORATION

EEP Project No. D05010S
ANSON COUNTY, NORTH CAROLINA

TITLE:

MONITORING PLAN VIEW SHEET INDEX

DWN BY: DGJ	DATE: JAN 2008
CKD BY: JDC	SCALE: 1" = 800'

ESC PROJECT NO.: 04-212.00

FIGURE
2

MONITORING LEGEND

- STREAM CROSS-SECTION LOCATION (XS)
- LONGITUDINAL PROFILE REACH
- STREAM CREST GAUGE (CG)
- VP1 VEGETATION MONITORING PLOT
- ESC BENCHMARK (BM)

LEGEND

- STREAM TOP OF BANK
- WETLAND PRESERVATION
- FLOODPLAIN GRADING
- FORD

ROCKY RIVER

C/E

VP1 VP2 VP3 VP4 VP5 VP6 VP7

XS1 XS2 XS3 XS4 XS5 XS6 XS7 XS8

CG1 CG2

BM1 BM2 BM3

FLOW

POND

CONSERVATION EASEMENT

NAD 83

300 0 300 FEET

EcoScience Corporation
Raleigh, North Carolina

REVISIONS

CLIENT: Ecosystem Enhancement Program

PROJECT:

EEP BISHOP SITE STREAM AND WETLAND RESTORATION

EEP Project No. D05010S
ANSON COUNTY, NORTH CAROLINA

TITLE:

MONITORING PLAN VIEW

CAMP BRANCH (SITE A)

DWN BY:	DATE:
DGJ	JAN 2008
CKD BY:	SCALE:
JDC	1" = 300'

ESC PROJECT NO.: 04-212.00

FIGURE

2A

MONITORING LEGEND

- STREAM CROSS-SECTION LOCATION (XS)
- STREAM CREST GAUGE (CG)
- GROUNDWATER MONITORING GAUGE (GW)
- VP1 VEGETATION MONITORING PLOT
- ESC BENCHMARK (BM)

LEGEND

- STREAM TOP OF BANK
- WETLAND RESTORATION
- WETLAND PRESERVATION
- FLOODPLAIN GRADING
- FLOODPLAIN POOL

BM4 XS9 VP9 VP8 XS10 BM5 CG3 GW3 XS11 VP10 BM6 GW2 VP11 XS12 VP12 GW1

C/E

ROCKY RIVER

RUN

CONSERVATION EASEMENT

NAD 83

300 0 300 FEET

EcoScience Corporation
Raleigh, North Carolina

REVISIONS

CLIENT: Ecosystem Enhancement Program

PROJECT:

EEP BISHOP SITE STREAM AND WETLAND RESTORATION

EEP Project No. D05010S
ANSON COUNTY, NORTH CAROLINA

TITLE:

MONITORING PLAN VIEW

DULA THOROUGHFARE (SITE B)

DWN BY:	DATE:
DGJ	JAN 2008
CKD BY:	SCALE:
JDC	1" = 300'

ESC PROJECT NO.: 04-212.00

FIGURE

2B

MONITORING LEGEND

- STREAM CROSS-SECTION LOCATION (XS)
- VP1 — VEGETATION MONITORING PLOT
- PHOTO POINT LOCATION (PP)

CONSERVATION EASEMENT

C/E

VP13 VP14 VP15

PP1 PP2 PP3 PP4

XS13 XS14 XS15

FLOW

NAD 83

300 0 300 FEET

LEGEND

- STREAM TOP OF BANK
- WETLAND ENHANCEMENT
- ROCK SILLS
- FORD

EcoScience Corporation
Raleigh, North Carolina

REVISIONS

CLIENT: Ecosystem Enhancement Program

PROJECT:

EEP BISHOP SITE STREAM AND WETLAND RESTORATION

EEP Project No. D05010S
ANSON COUNTY, NORTH CAROLINA

TITLE:

MONITORING PLAN VIEW

UT TO DULA THOROUGHFARE (SITE C)

DWN BY:	DATE:
DGJ	JAN 2008
CKD BY:	SCALE:
JDC	1" = 300'

ESC PROJECT No.: 04-212.00

FIGURE

2C

3.0 PROJECT CONDITION AND MONITORING RESULTS

3.1 VEGETATION ASSESSMENT

3.1.1 VEGETATION PLOT DATA

Vegetation plot locations are displayed on Figures 2A-C. Vegetation monitoring was conducted using the CVS-EEP Protocol for Recording Vegetation Version 4.0 (Lee et al. 2006). The taxonomic standard used for species identifications was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007). All plot data tables and photos are included in Appendix A.

Despite exceptional drought conditions in Anson County throughout most of the first year of project monitoring (2007), the total average density of planted stems per acre across the Site is 850 stems/acre. The average planted stem density at Camp Branch was 1087 stems/acre, 842 stems/acre at Dula Thoroughfare, and 310 stems/acre at the UT to Dula Thoroughfare. ESC believes that the lower survivability of planted stems at UT to Dula Thoroughfare may be attributable to dry soil conditions exacerbated by the steep valley slopes characteristic of this portion of the Site.

3.1.2 VEGETATION PROBLEM AREAS

Vegetation problem areas are displayed on Figures 3A-C. Table A-6 (Vegetation Problem Areas) and vegetation problem area photos are included in Appendix A.

3.2 STREAM ASSESSMENT

Longitudinal profiles were surveyed along the entire restored lengths of Camp Branch and UT to Camp Branch (Figure 2A). Stream channel cross-sections were surveyed along each of the restored stream reaches on-Site (Figures 2A-C).

3.2.1 STREAM MORPHOLOGICAL PARAMETERS

All tables summarizing stream channel morphological parameters, including longitudinal profile and cross-sectional survey data as well as visual assessment tables, are included in Appendix B. Please note that since passive enhancement was undertaken along UT to Dula Thoroughfare (Reach 7), a baseline morphology and hydraulic summary table was not prepared for this reach.

3.2.2 STREAM PROBLEM AREAS

Stream channel problem areas are displayed on Figures 3A-C. Stream channel problem area photos and Table B-1 (Stream Problem Areas) are included in Appendix B.

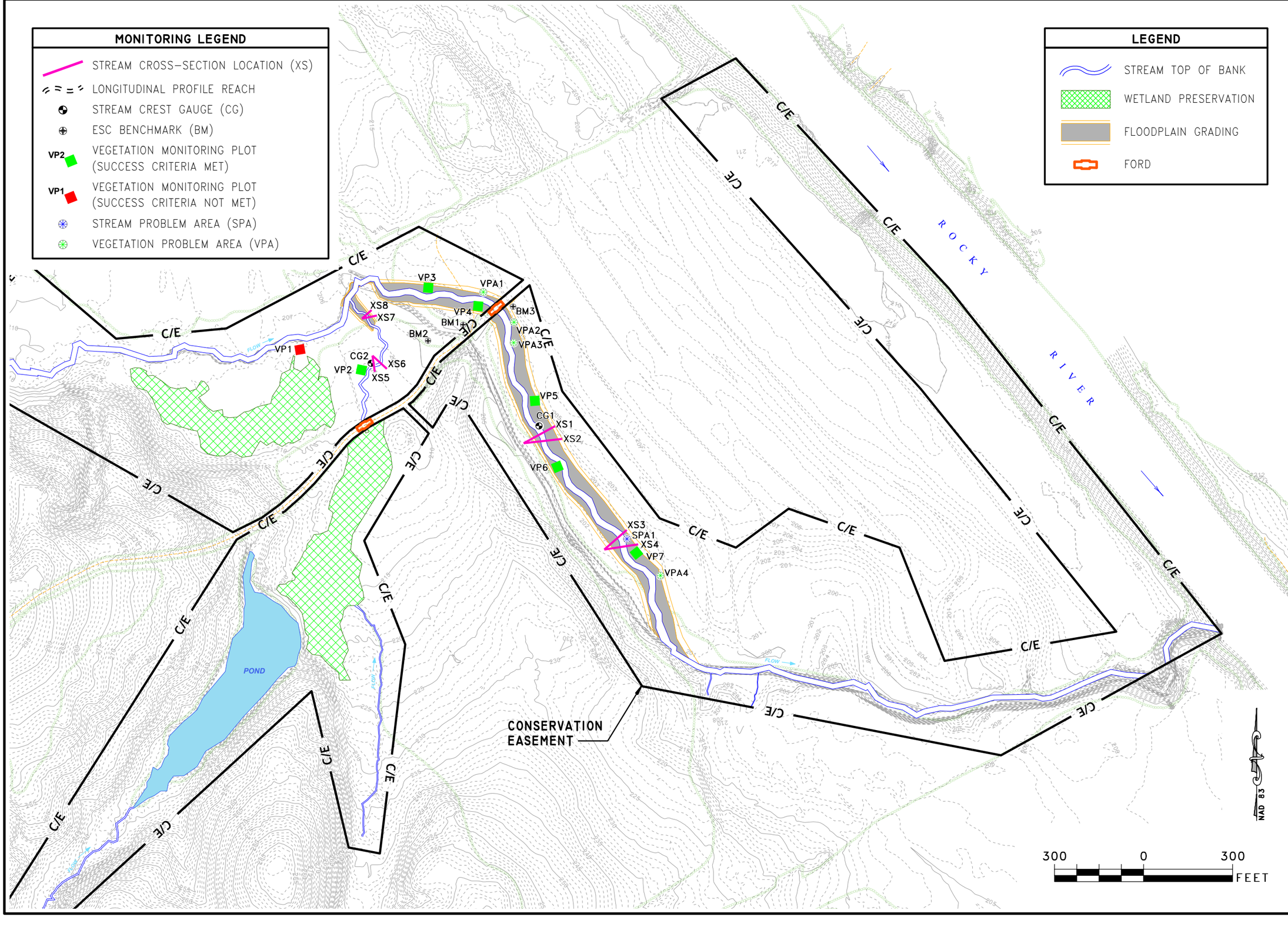
Generally, stream channel bed and bank stability was observed to be good to excellent across the Site in all restoration and enhancement reaches. It should be noted that although stream banks were generally stable, drought conditions likely inhibited herbaceous vegetation growth along stream banks, which greatly buffets stability. Very few areas of bank erosion were observed. Some channel bar formation has occurred within the upper reaches of Camp Branch (Reach 1, Figure 3A). ESC believes this is the result of the abrupt change in hydrodynamics as the Camp Branch floodplain substantially widens at the beginning of the restored reach, thereby lessening stream power. Thus, ESC does not believe this to be a stream problem area.

MONITORING LEGEND

- STREAM CROSS-SECTION LOCATION (XS)
- LONGITUDINAL PROFILE REACH
- STREAM CREST GAUGE (CG)
- ESC BENCHMARK (BM)
- VP2 — VEGETATION MONITORING PLOT (SUCCESS CRITERIA MET)
- VP1 — VEGETATION MONITORING PLOT (SUCCESS CRITERIA NOT MET)
- STREAM PROBLEM AREA (SPA)
- VEGETATION PROBLEM AREA (VPA)

LEGEND

- STREAM TOP OF BANK
- WETLAND PRESERVATION
- FLOODPLAIN GRADING
- FORD



EcoScience Corporation
Raleigh, North Carolina

REVISIONS

CLIENT: Ecosystem Enhancement Program

PROJECT:

EEP BISHOP SITE STREAM AND WETLAND RESTORATION

EEP Project No. D05010S
ANSON COUNTY, NORTH CAROLINA

TITLE:

INTEGRATED PROBLEM AREA PLAN VIEW

CAMP BRANCH (SITE A)

DWN BY:	DATE:
DGJ	JAN 2008
CKD BY:	SCALE:
JDC	1" = 300'

ESC PROJECT NO.: 04-212.00

FIGURE

3A

MONITORING LEGEND

- STREAM CROSS-SECTION LOCATION (XS)
- STREAM CREST GAUGE (CG)
- GROUNDWATER MONITORING GAUGE (GW)
- ESC BENCHMARK (BM)
- VP11 VEGETATION MONITORING PLOT (SUCCESS CRITERIA MET)
- VEGETATION PROBLEM AREA (VPA)

LEGEND

- STREAM TOP OF BANK
- WETLAND RESTORATION
- WETLAND PRESERVATION
- FLOODPLAIN GRADING
- FLOODPLAIN POOL

BM4 XS9 VP9 BM5 CG3 VRA5 XS11 GW3 VP10 VP8 XS10 BM6 GW2 VP11 XS12 VP12 GW1 VPA6 PP1 SPA2 C/E ROCKY RIVER FLOW CONSERVATION EASEMENT

300 0 300 FEET

NAD 83

EcoScience Corporation
Raleigh, North Carolina

REVISIONS

CLIENT: Ecosystem Enhancement Program

PROJECT:

EEP BISHOP SITE STREAM AND WETLAND RESTORATION

EEP Project No. D05010S
ANSON COUNTY, NORTH CAROLINA

TITLE:

INTEGRATED PROBLEM AREA PLAN VIEW

DULA THOROUGHFARE (SITE B)

DWN BY:	DATE:
DGJ	JAN 2008
CKD BY:	SCALE:
JDC	1" = 300'

ESC PROJECT NO.: 04-212.00

FIGURE

3B

MONITORING LEGEND

- STREAM CROSS-SECTION LOCATION (XS)
- PHOTO POINT LOCATION (PP)
- VP13 — VEGETATION MONITORING PLOT (SUCCESS CRITERIA MET)
- VP15 — VEGETATION MONITORING PLOT (SUCCESS CRITERIA NOT MET)
- STREAM PROBLEM AREA (SPA)
- VEGETATION PROBLEM AREA (VPA)
- ROCK SILLS (FUNCTIONING PROPERLY)
- ROCK SILLS (EXHIBITING MINOR PIPING/SCOUR)

CONSERVATION EASEMENT

C/E

VP13 VP14 VP15

PP1 PP2 PP3 PP4

XS13 XS14 XS15

VPA6 SPA2

FLOW

NAD 83

300 0 300 FEET

LEGEND

- STREAM TOP OF BANK
- WETLAND ENHANCEMENT
- FORD

EcoScience Corporation
Raleigh, North Carolina

REVISIONS

CLIENT: Ecosystem Enhancement Program

PROJECT:

EEP
BISHOP SITE
STREAM
AND
WETLAND
RESTORATION

EEP Project No. D05010S
ANSON COUNTY,
NORTH CAROLINA

TITLE:

INTEGRATED
PROBLEM AREA
PLAN VIEW

UT TO DULA
THOROUGHFARE
(SITE C)

DWN BY:	DATE:
DGJ	JAN 2008
CKD BY:	SCALE:
JDC	1" = 300'

ESC PROJECT No.: 04-212.00

FIGURE

3C

3.3 WETLAND ASSESSMENT

3.3.1 GROUNDWATER GAUGE DATA

Wetland restoration areas and groundwater monitoring gauge locations are displayed on Figure 2C. Monitoring gauge hydrographs and associated data tables are included in Appendix C.

A total of three groundwater monitoring gauges were installed within the lower (downstream) portions of Dula Thoroughfare (Figure 2B). The two upstream-most gauges (Gauges 2 and 3) have remained in their original locations throughout the monitoring period. Gauge 1 was moved in summer to better represent local groundwater conditions. According to the County Soil Survey (NRCS 2000), the Anson County growing season is 250 days long, extending from March 15 to November 19 (based on guidance provided in the United States Army Corps of Engineers' 2003 *Stream Mitigation Guidelines*). Gauges 2 and 3 recorded groundwater levels within the upper 12 inches of the soil surface for periods of 41 and 42 consecutive days, respectively, exceeding the 31.25 consecutive days that corresponds to 12.5 percent of the growing season. Thus, wetland hydrologic success was achieved in the first year of project monitoring.

4.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wenthworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc/edu/methods.htm)

Weakley, A.S. 2007. *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Working Draft of 11 January 2007). University of North Carolina at Chapel Hill: Chapel Hill, NC.

APPENDIX A: VEGETATION RAW DATA

VEGETATION RAW DATA

CVS VEGETATION DATA TABLES

Table A-1. Vegetation Metadata
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Report Prepared By	Jim Cooper
Date Prepared	1/16/2008 13:26
database name	CVS_EEP_EntryTool_v210.mdb
database location	C:\Documents and Settings\Graphics2\Desktop\EEP CVS DATA
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	This worksheet, which is a summary of the project and the project data.
Plots	List of plots surveyed.
Vigor	Frequency distribution of vigor classes.
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.
Stem Count by Plot and Spp	Count of living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	D05010S
project Name	Bishop Site Stream and Wetland Restoration
Description	Stream and wetland restoration/enhancement in Anson County
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	15

Table A-2. Vegetation Vigor by Species
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Species	4	3	2	1	0	Missing
Asimina triloba		2	3			
Betula nigra	28	48	8			
Carya ovata		1				
Celtis laevigata		11	2			
Cephalanthus occidentalis	8	10	15	1		
Cornus amomum	2	24	36			
Cornus florida		2				
Fraxinus pennsylvanica	7	9	2			
Nyssa biflora		2	2			
Quercus falcata	3	2				
Quercus michauxii	1	7	5			
Quercus pagoda	4	8	3			
Quercus phellos	6	12	1			
Fagus grandifolia		1	1			
Quercus rubra	2	4	2			
Platanus occidentalis	7	7	1			
Ulmus americana	2	10	3			
TOT: 17	**70**	**160**	**84**	**1**		

Table A-3. Vegetation Damage by Species
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Species	All Damage Categories	(no damage)	Deer	Insects
Asimina triloba	5	4		1
Betula nigra	84	77	7	
Carya ovata	1	1		
Celtis laevigata	13	13		
Cephalanthus occidentalis	34	32	2	
Cornus amomum	62	46	16	
Cornus florida	2	2		
Fagus grandifolia	2	2		
Fraxinus pennsylvanica	18	18		
Nyssa biflora	4	4		
Platanus occidentalis	15	15		
Quercus falcata	5	5		
Quercus michauxii	13	13		
Quercus pagoda	15	15		
Quercus phellos	19	19		
Quercus rubra	8	8		
Ulmus americana	15	14	1	
TOT: 17	**315**	**288**	**26**	**1**

Table A-4. Vegetation Damage by Plot
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Plot	All Damage Categories	(no damage)	Deer	Insects
1	4	3		1
2	36	27	9	
3	22	22		
4	33	24	9	
5	33	32	1	
6	27	26	1	
7	33	28	5	
8	16	16		
9	39	39		
10	29	29		
11	12	12		
12	8	7	1	
13	13	13		
14	3	3		
15	7	7		
TOT: 15	**315**	**288**	**26**	**1**

Table A-5. Stem Count by Plot and Species
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

	Species	Total Stems	# plots	avg# stems	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15
	Asimina triloba	5	3	1.67	3	1		1											
	Betula nigra	84	10	8.4		9		10	11	10	7	1	17	14	2	3			
	Carya ovata	1	1	1											1				
	Celtis laevigata	13	7	1.86	1	2	3			1	1			1			4		
	Cephalanthus occidentalis	34	9	3.78		5		2	7	2	6	1	5	3		3			
	Cornus amomum	62	9	6.89		5		12	9	8	12	3	9	3		1			
	Cornus florida	2	2	1														1	1
	Fagus grandifolia	2	2	1													1		1
	Fraxinus pennsylvanica	18	7	2.57		1	3	3		2		4		4	1				
	Nyssa biflora	4	4	1				1				1	1						1
	Platanus occidentalis	15	8	1.88		3	2	1	1	1	1		1		5				
	Quercus falcata	5	3	1.67													2	2	1
	Quercus michauxii	13	7	1.86		5	2		1		1	2		1	1				
	Quercus pagoda	15	9	1.67		3		2	1	1	3	2	1	1		1			
	Quercus phellos	19	10	1.9		2	5		3	1	1	2	2	1	1				1
	Quercus rubra	8	2	4													6		2
	Ulmus americana	15	7	2.14			7	1		1	1		3	1	1				
TOT:	**17**	**315**	**17**		**4**	**36**	**22**	**33**	**33**	**27**	**33**	**16**	**39**	**29**	**12**	**8**	**13**	**3**	**7**
	Average # of stems/acre				**162**	**1457**	**890**	**1335**	**1335**	**1093**	**1335**	**647**	**1578**	**1174**	**486**	**324**	**526**	**121**	**283**
Site Total: 850 trees/acre					**Camp Branch: 1087 trees/acre**							**Dula Thoroughfare: 842 trees/acre**					**UT to Dula Thoroughfare: 310 trees/acre**		

VEGETATION PROBLEM AREAS

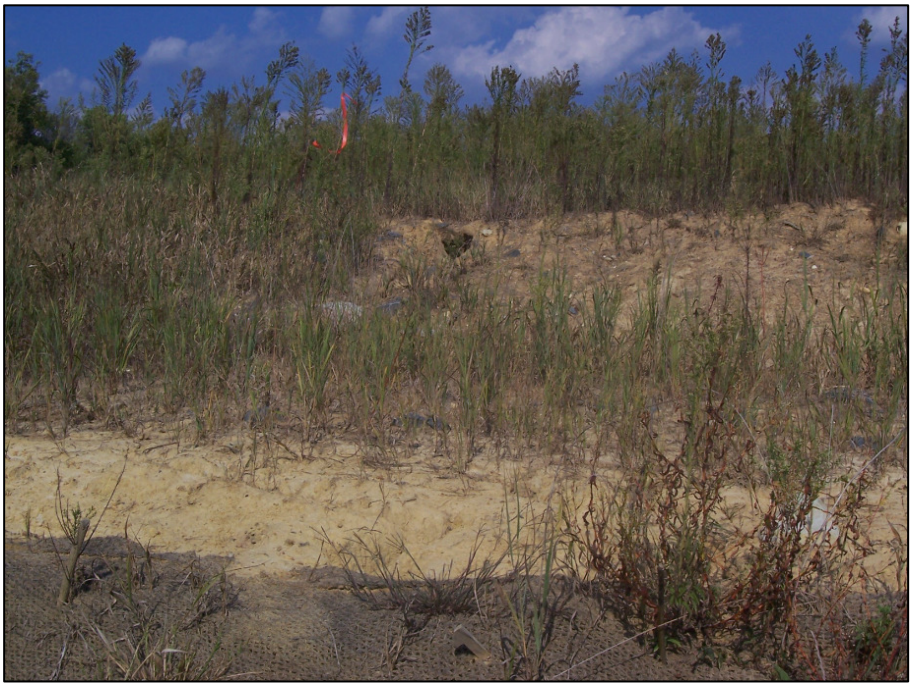
***EEP feature issue descriptions have been modified to best characterize identified problem areas**

Table A-6. Vegetation Problem Areas
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Feature Issue*	Station #/ Range	Probable Cause	Photo Number
Floodplain cut erosion/minor rill	Figure 3A	Drought conditions inhibiting herbaceous vegetation growth to buffet floodplain cut stability	VPA1
Floodplain cut erosion/minor rill	Figure 3A	Drought conditions inhibiting herbaceous vegetation growth to buffet floodplain cut stability	VPA2
Bare floodplain area	Figure 3A (30-40 ft. in length along channel)	Drought conditions inhibiting herbaceous and woody vegetation growth along floodplain; naturally rocky subsoil in this location	VPA3
Floodplain cut erosion/minor rill	Figure 3A	Drought conditions inhibiting herbaceous vegetation growth to buffet floodplain cut stability	VPA4
Floodplain cut erosion/minor rill	Figure 3B	Drought conditions inhibiting herbaceous vegetation growth to buffet floodplain cut stability	VPA5
Rill formation along valley slope	Figure 3C	Drought conditions inhibiting herbaceous vegetation growth to buffet floodplain cut stability; erosion from agricultural field upland from easement boundary	VPA6

VEGETATION PROBLEM AREA PHOTOS

VPA1: Rill erosion along floodplain cut (Camp Branch, Figure 3A)



VPA2: Rill erosion along floodplain cut (Camp Branch, Figure 3A)

VPA3: Bare floodplain area adjacent to Camp Branch (Camp Branch, Figure 3A)

VPA4: Rill erosion along floodplain cut (Camp Branch, Figure 3A)

VPA5: Rill erosion along floodplain cut (Dula Thoroughfare, Figure 3B)

VPA6: Rill erosion along valley slope (UT to Dula Thoroughfare, Figure 3C)

VEGETATION MONITORING PLOT PHOTOS

(Note: All plot photos were taken from the plot origin facing the opposite plot corner)

Plot 1 (Camp Branch)

Plot 2 (Camp Branch)

Plot 3 (Camp Branch)

Plot 4 (Camp Branch)

Plot 5 (Camp Branch)

Plot 6 (Camp Branch)

Plot 7 (Camp Branch)

Plot 8 (Dula Thoroughfare)

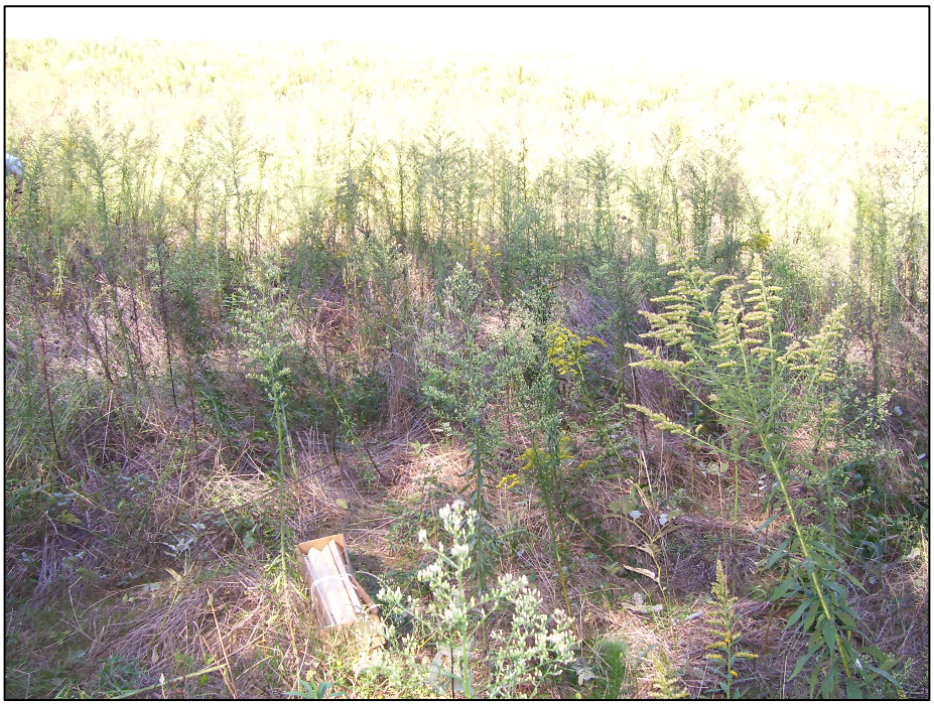
Plot 9 (Dula Thoroughfare)

Plot 10 (Dula Thoroughfare)

Plot 11 (Dula Thoroughfare)

Plot 12 (Dula Thoroughfare)

Plot 13 (UT to Dula Thoroughfare)



Plot 14 (UT to Dula Thoroughfare)

Plot 15 (UT to Dula Thoroughfare)

APPENDIX B: STREAM GEOMORPHIC RAW DATA

STREAM GEORMOPHIC RAW DATA

STREAM PROBLEM AREAS

Table B-1. Stream Problem Areas
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Feature Issue	Station Numbers	Suspected Cause	Photo Number
Minor left bank erosion (Camp Branch, Reach 1)	14+00 - 14+10	Drought conditions inhibiting herbaceous vegetation growth to buffet bank stability	SPA1
Piping within downstream-most rock sill set (UT to Dula Thoroughfare, Reach 7)	N/A*	Unknown	SPA2 (PP1)[1]

*N/A-not applicable (enhancement reaches not stationed)

[1]Due to dry channel conditions, dense herbaceous growth within the stream impeded photographing this problem area clearly

STREAM PROBLEM AREA PHOTOS

SPA1: Bank erosion on left bank of Camp Branch, Reach 1 (14+00-14+10)

SP2A: Piping within downstream-most rock sill set on UT to Dula Thoroughfare (Reach 7)

STREAM PHOTO POINT STATION PHOTOS

Photo Point 1: Looking upstream

Photo Point 1: Looking downstream

Photo Point 2: Looking upstream

Photo Point 2: Looking downstream

Photo Point 3: Looking upstream

Photo Point 3: Looking downstream

Photo Point 4: Looking upstream

Photo Point 4: Looking downstream

STREAM GEOMORPHIC RAW DATA

VERIFICATION OF BANKFULL EVENTS

Stream channel crest gauges were installed adjacent to Camp Branch, UT to Camp Branch, and Dula Thoroughfare (Figures 2A-B). Likely attributable to exceptional drought conditions in Anson County throughout the first year of project monitoring (2007), crest gauges did not indicate the occurrence of any bankfull events. However, it should be noted that at least two bankfull events occurred at Camp Branch, UT to Camp Branch, and Dula Thoroughfare shortly after the completion of Site grading activities in late 2006 before Site planting.

Table B-2. Verification of Bankfull Events
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Date of Data Collection	Date of Occurrence	Method	Photo Number
12/2007	N/A*[1]	Crest Gauge (one each at Camp Branch, UT to Camp Branch, and Dula Thoroughfare)	N/A

*N/A – Not applicable

[1] *No bankfull events were observed to have occurred during the Year-1 (2007) monitoring period*

Table B-3a. Categorical Stream Feature Visual Stability Assessment
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S
Segment/Reach: Camp Branch (Reach 1 [Table I])

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	100%	88%				
B. Pools	100%	79%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	95%				
F. Rock Vanes	N/A*	N/A				
G. Root Wads	N/A	N/A				

*N/A – Not applicable

Table B-3b. Categorical Stream Feature Visual Stability Assessment
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S
Segment/Reach: UT to Camp Branch (Reaches 3 and 4 [Table I])

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	100%	100%				
B. Pools	100%	100%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Rock Vanes	N/A*	N/A				
G. Root Wads	N/A	N/A				

*N/A – Not applicable

Table B-3c. Categorical Stream Feature Visual Stability Assessment Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S Segment/Reach: Dula Thoroughfare (Reaches 5 and 6 [Table I])						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles	N/A*[1]	N/A				
B. Pools	N/A	N/A				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Rock Vanes	N/A*	N/A				
G. Root Wads	N/A	N/A				

*N/A – Not applicable

[1]Riffles and pools were not differentiated in the design for Dula Thoroughfare-the channel has a consistent depth reach-wide

Table B-3d. Categorical Stream Feature Visual Stability Assessment Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S Segment/Reach: UT to Dula Thoroughfare (Reach 7 [Table I])						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles	N/A*[1]	N/A				
B. Pools	N/A	N/A				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Rock Vanes	100%	90%				
G. Root Wads	N/A	N/A				

*N/A – Not applicable

[1]Passive enhancement was performed on UT to Dula Thoroughfare; thus, riffles and pools were not differentiated

Table B-4a. Baseline Morphology and Hydraulic Summary
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S
Camp Branch: Reach 1 (1,810 linear feet [longitudinal profile monitoring reach length])

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built/Year-1[1]		
Dimension	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max
BF Width (ft)	N/A*	N/A	N/A	N/A	18.8	N/A	16.0	17.8	19.5	21.3	21.3	21.3	16.0	19.0	22.0	18.1	20.4	22.8
Floodprone Width (ft)	N/A	N/A	N/A	N/A	N/A	N/A	17.2	20.8	24.3	NA	NA	NA	70.0	90.0	300.0	91.3	95.2	99.9
BF Cross Sectional Area (ft^2)	N/A	N/A	N/A	N/A	44.2	N/A	42.0	42.0	42.0	38.7	38.7	38.7	30.0	30.0	30.0	24.0	27.8	31.6
BF Mean Depth (ft)	N/A	N/A	N/A	N/A	2.1	N/A	2.2	2.4	2.6	1.8	1.8	1.8	1.4	1.6	1.9	1.3	1.4	1.4
BF Max Depth (ft)	N/A	N/A	N/A	N/A	N/A	N/A	2.5	2.8	3.0	2.7	2.7	2.7	1.8	2.0	2.3	1.8	1.9	2.0
Width/Depth Ratio	N/A	N/A	N/A	N/A	9.0	N/A	6.2	7.6	8.9	11.8	11.8	11.8	10.0	11.9	13.8	13.6	14.9	16.3
Entrenchment Ratio	N/A	N/A	N/A	N/A	N/A	N/A	1.1	1.1	1.2	NA	NA	NA	3.7	4.7	15.8	4.5	4.7	4.9
Wetted Perimeter(ft)	N/A	N/A	N/A	N/A	23.0	N/A	20.8	22.6	24.3	24.9	24.9	24.9	21.8	22.2	22.8	23.0	23.2	23.2
Hydraulic radius (ft)	N/A	N/A	N/A	N/A	1.9	N/A	1.7	1.9	2.0	1.6	1.6	1.6	1.3	1.4	1.4	1.2	1.2	1.2
Pattern																		
Channel Beltwidth (ft)	N/A	N/A	N/A	N/A	N/A	N/A	19	37	79	NA	NA	NA	45.0	62.0	77.0	45.0	62.0	80.0
Radius of Curvature (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	40.0	51.1	76.0	40.0	51.1	76.0
Meander Wavelength (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	102.0	137.8	171.0	102.0	137.8	171.0
Meander Width ratio	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	2.4	3.3	4.1	2.2	3.0	3.9
Profile																		
Riffle length (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	9.0	21.9	37.0	10.2	23.4	43.3
Riffle slope (ft/ft)	N/A	N/A	N/A	N/A	N/A	N/A	0.001	0.01	0.06	0.008	NA	0.02	0.003	0.005	0.009	0	0.01	0.02
Pool length (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	23.0	29.5	38.0	11.6	23.0	37.0
Pool spacing (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	48.0	72.5	122.0	44.8	86.5	173.4
Substrate																		
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13.8	N/A	7.2	7.2	7.2	gravel	gravel	gravel	0.4	14.7	31.0
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	39.0	N/A	NA	NA	NA	gravel	gravel	gravel	16.0	31.5	45.0
Additional Reach Parameters																		
Valley Length (ft)	N/A			N/A			1,640			NA			1,640			1,640		
Channel Length (ft)	N/A			N/A			1,722			NA			1807			1,810		
Sinuosity	N/A			N/A			1.05			1.18			1.1			1.1		
Water Surface Slope (ft/ft)	N/A			N/A			0.0041			0.0029			N/A			N/A		
BF slope (ft/ft)	N/A			N/A			NA			0.0029			0.004 (0.0035-0.0055)			0.0034		
Rosgen Classification	N/A			N/A			G4			E/C4			C4			C4		

*N/A-Not Applicable, **NA-Historical project documents were unavailable at the time of report submission, [1]As-built data based on Year-1 survey

Table B-4b. Baseline Morphology and Hydraulic Summary
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S
UT to Camp Branch: Reaches 3 and 4 (556 linear feet [longitudinal profile monitoring reach length])

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built/Year-1[1]		
Dimension	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max
BF Width (ft)	N/A*	N/A	N/A	N/A	6.0	N/A	NA	NA	NA	NA	NA	NA	5.0	6.0	7.0	6.8	7.9	8.0
Floodprone Width (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	35.0	200.0	500.0	35.0	200.0	500.0
BF Cross Sectional Area (ft^2)	N/A	N/A	N/A	N/A	7.2	N/A	NA	NA	NA	NA	NA	NA	6.4	6.4	6.4	3.0	4.4	5.8
BF Mean Depth (ft)	N/A	N/A	N/A	N/A	0.9	N/A	NA	NA	NA	NA	NA	NA	0.5	0.6	0.7	0.4	0.6	0.7
BF Max Depth (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	0.7	0.8	1.0	0.6	0.8	1.0
Width/Depth Ratio	N/A	N/A	N/A	N/A	6.7	N/A	NA	NA	NA	NA	NA	NA	8.6	10.0	12.0	11.2	13.1	19.8
Entrenchment Ratio	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	5.8	33.0	83.0	4.4	25.3	63.3
Wetted Perimeter(ft)	N/A	N/A	N/A	N/A	7.8	N/A	NA	NA	NA	NA	NA	NA	7.0	7.2	7.4	8.7	9.1	9.3
Hydraulic radius (ft)	N/A	N/A	N/A	N/A	0.8	N/A	NA	NA	NA	NA	NA	NA	0.9	0.9	0.9	0.5	0.5	0.5
Pattern																		
Channel Beltwidth (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	32.0	37.0	42.0	32.0	37.0	42.0
Radius of Curvature (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	14.0	18.0	30.0	14.0	18.0	30.0
Meander Wavelength (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	59.0	60.6	62.0	59.0	60.6	62.0
Meander Width ratio	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	5.3	6.2	7.0	4.1	4.7	5.3
Profile																		
Riffle length (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	7.0	11.3	18.0	NA[2]	NA	NA
Riffle slope (ft/ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	0.007	0.01	0.02	NA	NA	NA
Pool length (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	8.0	14.8	24.0	NA	NA	NA
Pool spacing (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	21.0	37.2	46.8	NA	NA	NA
Substrate																		
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	gravel	gravel	gravel	0.4	21.2	69.0
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	gravel	gravel	gravel	0.5	45.7	110.0
Additional Reach Parameters																		
Valley Length (ft)	N/A			N/A			NA			NA			749			667		
Channel Length (ft)	N/A			N/A			NA			NA			624			556		
Sinuosity	N/A			N/A			NA			NA			1.2			1.2		
Water Surface Slope (ft/ft)	N/A			N/A			NA			NA			N/A			N/A		
BF slope (ft/ft)	N/A			N/A			NA			NA			0.01 (0.004-0.013)			0.01		
Rosgen Classification	N/A			N/A			NA			NA			E4/5			C4/5		

*N/A-Not Applicable, **NA-Historical project documents were unavailable at the time of report submission, [1]As-built data based on Year-1 survey , [2]Water was not present within the channel at the time of surveying. Thus, facet slopes and lengths were not feasible to calculate.

Table B-4c. Baseline Morphology and Hydraulic Summary
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S
Dula Thoroughfare: Reaches 5 and 6 (2,730 linear feet)

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built/Year-1[1]		
Dimension	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max
BF Width (ft)	N/A*	N/A	N/A	N/A	8.8	N/A	12.3	14.1	15.9	NA	NA	NA	6.0	6.0	6.0	4.9	7.4	9.6
Floodprone Width (ft)	N/A	N/A	N/A	N/A	N/A	N/A	35.0+	78.3+	150.0+	NA	NA	NA	90.0	120.0	150.0	84.0	120.0	125.0
BF Cross Sectional Area (ft^2)	N/A	N/A	N/A	N/A	10.7	N/A	5.7	6.6	8.4	NA	NA	NA	4.0	4.0	4.0	2.4	5.8	8.9
BF Mean Depth (ft)	N/A	N/A	N/A	N/A	1.1	N/A	0.4	0.5	0.6	NA	NA	NA	0.7	0.7	0.7	0.5	0.7	0.9
BF Max Depth (ft)	N/A	N/A	N/A	N/A	N/A	N/A	0.8	0.8	0.9	NA	NA	NA	1.0	1.0	1.0	0.6	1.1	1.5
Width/Depth Ratio	N/A	N/A	N/A	N/A	8.0	N/A	23.0	NA	40.0	NA	NA	NA	8.6	8.6	8.6	9.7	10.3	10.8
Entrenchment Ratio	N/A	N/A	N/A	N/A	N/A	N/A	23.5	28.2	35.3	NA	NA	NA	15.0	20.0	25.0	> 12.9	> 14.5	17.1
Wetted Perimeter(ft)	N/A	N/A	N/A	N/A	11.0	N/A	14.9	15.1	15.3	NA	NA	NA	7.4	7.4	7.4	8.4	8.8	9.2
Hydraulic radius (ft)	N/A	N/A	N/A	N/A	1.0	N/A	0.4	0.4	0.4	NA	NA	NA	0.8	0.8	0.8	0.6	0.7	0.7
Pattern																		
Channel Beltwidth (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	80.0	100.0	140.0	80.0	100.0	140.0
Radius of Curvature (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	19.6	36.6	80.0	19.6	36.6	80.0
Meander Wavelength (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Meander Width ratio	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	13.3	16.7	23.3	10.8	13.5	18.9
Profile																		
Riffle length (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA[2]	NA	NA
Riffle slope (ft/ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pool length (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pool spacing (ft)	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Substrate																		
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	silt	sand	sand	NA	NA	NA	silt	sand	sand	0.09	0.09	0.09
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	silt	sand	sand	NA	NA	NA	silt	sand	sand	0.11	0.11	0.11
Additional Reach Parameters																		
Valley Length (ft)	N/A			N/A			NA			NA			2,300			2,275		
Channel Length (ft)	N/A			N/A			NA			NA			2,790			2,730		
Sinuosity	N/A			N/A			1.01			NA			1.2			1.2		
Water Surface Slope (ft/ft)	N/A			N/A			0.0019			NA			N/A			NA		
BF slope (ft/ft)	N/A			N/A			0.0019			NA			0.001			NA		
Rosgen Classification	N/A			N/A			C5/6			NA			E5/6			E5/6		

*N/A-Not Applicable, **NA-Historical project documents were unavailable at the time of report submission, [1]As-built data based on Year-1 survey, [2] Per the Site Monitoring Plan, longitudinal profiles were not conducted along Dula Thoroughfare

Exhibit Table B-5a. Morphology and Hydraulic Monitoring Summary: Camp Branch (Reach 1)
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Parameter	Cross-Section 1 Pool						Cross-Section 2 Riffle						Cross-Section 3 Pool						Cross-Section 4 Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY	MY1	MY2	MY3	MY4	MY5	MY
BF Width (ft)	21.0						18.1						23.9						22.8					
Floodprone Width (ft)	97.2						99.9						85.2						91.3					
BF Cross Sectional Area (ft^2)	37.8						24.0						47.4						31.6					
BF Mean Depth (ft)	1.8						1.3						2.0						1.4					
BF Max Depth (ft)	2.5						1.8						3.3						2.0					
Width/Depth Ratio	11.6						13.6						12.0						16.3					
Entrenchment Ratio	4.6						5.5						3.6						4.0					
Wetted Perimeter(ft)	24.6						20.7						27.9						25.6					
Hydraulic radius (ft)	1.4						1.2						1.7						1.2					
Substrate																								
d50 (mm)	0.4						31.0						0.4						27.0					
d84 (mm)	16.0						45.0						20.0						45.0					

Parameter	MY-01 (2007)			MY-02 (2008)			MY-03 (2009)			MY-04 (2010)			MY-05 (2011)			MY+		
Pattern	Min	Med	Max	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	45.0	62.0	80.0															
Radius of Curvature (ft)	40.0	51.1	76.0															
Meander Wavelength (ft)	102.0	137.8	171.0															
Meander Width ratio	2.2	3.0	3.9															
Profile**																		
Riffle length (ft)	10.2	23.4	43.3															
Riffle slope (ft/ft)	0[1]	0.01	0.02															
Pool length (ft)	11.6	23.0	37.0															
Pool spacing (ft)	44.9	74.7	94.0															
Additional Reach Parameters																		
Valley Length (ft)	1,640																	
Channel Length (ft)	1,810																	
Sinuosity	1.1																	
Water Surface Slope (ft/ft)	NA*																	
BF slope (ft/ft)	0.0034																	
Rosgen Classification	C4																	

[1]Water was not present within the channel during Year-1 stream monitoring activities; thus, riffle slopes are based on thalweg survey elevations, *NA-not available

Exhibit Table B-5b. Morphology and Hydraulic Monitoring Summary: UT to Camp Branch (Reaches 3 and 4)
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Parameter	Cross-Section 5 Riffle						Cross-Section 6 Pool						Cross-Section 7 Riffle						Cross-Section 8 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY	MY1	MY2	MY3	MY4	MY5	MY
BF Width (ft)	8.0						6.8						7.9						5.9					
Floodprone Width (ft)	> 55						> 66						35.0						38.0					
BF Cross Sectional Area (ft^2)	5.8						5.9						3.0						3.5					
BF Mean Depth (ft)	0.7						0.9						0.4						0.6					
BF Max Depth (ft)	1.0						1.4						0.6						1.1					
Width/Depth Ratio	11.4						7.6						19.8						9.8					
Entrenchment Ratio	> 6.9						> 9.7						4.4						6.4					
Wetted Perimeter(ft)	9.4						8.6						8.7						7.1					
Hydraulic radius (ft)	0.6						0.7						0.3						0.5					
Substrate																								
d50 (mm)	69.0						0.4						15.0						0.4					
d84 (mm)	110.0						0.5						72.0						0.5					

Parameter	MY-01 (2007)			MY-02 (2008)			MY-03 (2009)			MY-04 (2010)			MY-05 (2011)			MY+		
Pattern	Min	Med	Max	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	32.0	37.0	42.0															
Radius of Curvature (ft)	14.0	18.0	30.0															
Meander Wavelength (ft)	59.0	60.6	62.0															
Meander Width ratio	4.1	4.7	5.3															
Profile**																		
Riffle length (ft)	NA*[1]	NA	NA															
Riffle slope (ft/ft)	NA	NA	NA															
Pool length (ft)	NA	NA	NA															
Pool spacing (ft)	NA	NA	NA															
Additional Reach Parameters																		
Valley Length (ft)	667																	
Channel Length (ft)	556																	
Sinuosity	1.2																	
Water Surface Slope (ft/ft)	NA																	
BF slope (ft/ft)	0.01																	
Rosgen Classification	C4																	

[1]Water was not present within the channel during Year-1 stream monitoring activities; thus, facet lengths and slopes are unavailable, *NA-not available

Exhibit Table B-5c. Morphology and Hydraulic Monitoring Summary: Dula Thoroughfare (Reaches 5 and 6)
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Parameter	Cross-Section 9						Cross-Section 10						Cross-Section 11						Cross-Section 12					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY	MY1	MY2	MY3	MY4	MY5	MY
BF Width (ft)	9.6						4.9						8.7						6.5					
Floodprone Width (ft)	>125						84.0						127						95.0					
BF Cross Sectional Area (ft^2)	8.9						2.4						8.2						3.8					
BF Mean Depth (ft)	0.9						0.5						0.9						0.6					
BF Max Depth (ft)	1.5						0.6						1.4						0.8					
Width/Depth Ratio	10.6						10.3						9.7						10.8					
Entrenchment Ratio	> 13						17.1						14.5						14.6					
Wetted Perimeter(ft)	11.4						5.9						10.5						7.7					
Hydraulic radius (ft)	0.8						0.4						0.8						0.5					
Substrate																								
d50 (mm)	0.09						0.09						0.09						0.09					
d84 (mm)	0.11						0.11						0.11						0.11					

Parameter	MY-01 (2007)			MY-02 (2008)			MY-03 (2009)			MY-04 (2010)			MY-05 (2011)			MY+		
Pattern	Min	Med	Max	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	80.0	100.0	140.0															
Radius of Curvature (ft)	19.6	36.6	80.0															
Meander Wavelength (ft)	NA*	NA	NA															
Meander Width ratio	10.8	13.5	18.9															
Profile**																		
Riffle length (ft)	NA[1]	NA	NA															
Riffle slope (ft/ft)	NA	NA	NA															
Pool length (ft)	NA	NA	NA															
Pool spacing (ft)	NA	NA	NA															
Additional Reach Parameters																		
Valley Length (ft)	2,275																	
Channel Length (ft)	2,730																	
Sinuosity	1.2																	
Water Surface Slope (ft/ft)	NA																	
BF slope (ft/ft)	NA																	
Rosgen Classification	E5/6																	

*NA-not available, [1]Per the Site Monitoring Plan, longitudinal profiles were not conducted along Dula Thoroughfare

Exhibit Table B-5d. Morphology and Hydraulic Monitoring Summary: UT to Dula Thoroughfare (Reach 7)
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Parameter	Cross-Section 13 Pool						Cross-Section 14 Riffle/Braided System						Cross-Section 15 Riffle											
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY	MY1	MY2	MY3	MY4	MY5	MY
BF Width (ft)	11.1						16.2						7.1											
Floodprone Width (ft)	>27						>70						>62											
BF Cross Sectional Area (ft^2)	8.6						4.3						2.6											
BF Mean Depth (ft)	0.8						0.3						0.4											
BF Max Depth (ft)	1.3						0.7						0.6											
Width/Depth Ratio	14.3						54.0						17.8											
Entrenchment Ratio	>2.4						> 4.3						> 8.7											
Wetted Perimeter(ft)	12.7						16.8						7.9											
Hydraulic radius (ft)	0.7						0.3						0.3											
Substrate																								
d50 (mm)	0.4						0.5						13.0											
d84 (mm)	0.4						0.5						20.0											

Parameter	MY-01 (2007)			MY-02 (2008)			MY-03 (2009)			MY-04 (2010)			MY-05 (2011)			MY+		
Pattern	Min	Med	Max	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	NA[1]*	NA	NA															
Radius of Curvature (ft)	NA	NA	NA															
Meander Wavelength (ft)	NA	NA	NA															
Meander Width ratio	NA	NA	NA															
Profile**	NA	NA	NA															
Riffle length (ft)	NA	NA	NA															
Riffle slope (ft/ft)	NA	NA	NA															
Pool length (ft)	NA	NA	NA															
Pool spacing (ft)	NA	NA	NA															
Additional Reach Parameters																		
Valley Length (ft)		NA																
Channel Length (ft)		1,871																
Sinuosity		NA																
Water Surface Slope (ft/ft)		NA																
BF slope (ft/ft)		NA																
Rosgen Classification		C/D4/5																

*NA-not available, [1]Per the Site Monitoring Plan, longitudinal profiles were not conducted along UT to Dula Thoroughfare

Table B-6a. Visual Morphological Stability Assessment[1]

Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Camp Branch (Reach 1) 1,810 linear feet

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform Mean or Total
A. Riffles	1. Present?	21	24	N/A*	88	
	2. Armor stable (e.g. no displacement)?	24	24	N/A	88	
	3. Facet grade appears stable?	21	24	N/A	88	
	4. Minimal evidence of embedding/fining?	21	24	N/A	88	
	5. Length appropriate?	21	24	N/A	88	**88%**
B. Pools	1. Present? (e.g not subject to severe aggrad. or migrat.?)	19	24	N/A	79	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	19	24	N/A	79	
	3. Length appropriate?	19	24	N/A	79	**79%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	N/A	N/A	N/A	100	
	2. Downstream of meander (glide/inflection) centering?	N/A	N/A	N/A	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	N/A	N/A	N/A	100	
	2. Of those eroding, # w/concomitant point bar formation?	N/A	N/A	N/A	100	
	3. Apparent Rc within spec?	N/A	N/A	N/A	100	
	4. Sufficient floodplain access and relief?	N/A	N/A	N/A	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	N/A	90	
	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	N/A	N/A	N/A	100	**95%**
F. Vanes	1. Free of back or arm scour?	N/A	N/A	N/A	N/A	
	2. Height appropriate?	N/A	N/A	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	N/A	N/A	N/A	
	4. Free of piping or other structural failures?[3]	N/A	N/A	N/A	N/A	**N/A**
G. Wads/ Boulders	1. Free of scour?	N/A	N/A	N/A	N/A	
	2. Footing stable?	N/A	N/A	N/A	N/A	**N/A**

[1]Visual Morphologic Stability Assessment Tables prepared for Camp Branch (Reach 1) and UT to Camp Branch (Reaches 3 and 4) only (longitudinal profiles were performed along these reaches only)

*N/A-Not applicable

Table B-6b. Visual Morphological Stability Assessment[1]

Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S
UT to Camp Branch (Reaches 3 and 4) 556 linear feet

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform Mean or Total
A. Riffles	1. Present?	16	16	N/A*	88	
	2. Armor stable (e.g. no displacement)?	16	16	N/A	88	
	3. Facet grade appears stable?	16	16	N/A	88	
	4. Minimal evidence of embedding/fining?	16	16	N/A	88	
	5. Length appropriate?	16	16	N/A	88	**100%**
B. Pools	1. Present? (e.g not subject to severe aggrad. or migrat.?)	17	17	N/A	79	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	17	17	N/A	79	
	3. Length appropriate?	17	17	N/A	79	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	N/A	N/A	N/A	100	
	2. Downstream of meander (glide/inflection) centering?	N/A	N/A	N/A	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	N/A	N/A	N/A	100	
	2. Of those eroding, # w/concomitant point bar formation?	N/A	N/A	N/A	100	
	3. Apparent Rc within spec?	N/A	N/A	N/A	100	
	4. Sufficient floodplain access and relief?	N/A	N/A	N/A	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	N/A	100	
	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	N/A	N/A	N/A	100	**100%**
F. Vanes	1. Free of back or arm scour?	N/A	N/A	N/A	N/A	
	2. Height appropriate?	N/A	N/A	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	N/A	N/A	N/A	
	4. Free of piping or other structural failures?[3]	N/A	N/A	N/A	N/A	**N/A**
G. Wads/ Boulders	1. Free of scour?	N/A	N/A	N/A	N/A	
	2. Footing stable?	N/A	N/A	N/A	N/A	**N/A**

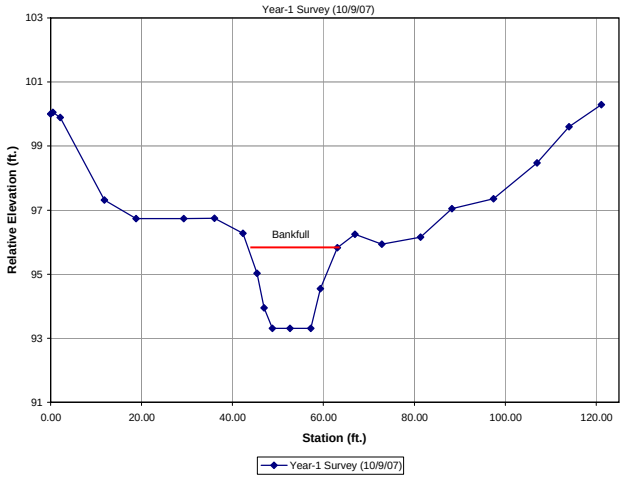
[1]Visual Morphologic Stability Assessment Tables prepared for Camp Branch (Reach 1) and UT to Camp Branch (Reaches 3 and 4) only (longitudinal profiles were performed along these reaches only)
*N/A-Not applicable

Survey Data			
Cross-Section 1: Pool			
Station		**Elevation**	**Feature**
0.00		100.00	LPIN
0.51		100.05	
2.11		99.89	
11.79		97.31	
18.76		96.74	
29.28		96.74	
36.01		96.75	
42.31		96.28	
45.40		95.03	
46.93		93.95	
48.78		93.31	
52.62		93.31	TW
57.19		93.31	
59.34		94.55	
63.09		95.83	
66.93		96.25	RBKF
72.87		95.94	
81.37		96.16	
88.24		97.04	
97.41		97.35	
106.98		98.47	
114.00		99.60	
121.11		100.29	RPIN

Summary Data	2007
Bankful Cross Sectional Area	37.8 sq. ft.
Bankfull Width	21.0 ft
Bankfull Mean Depth	1.8 ft
Bankful Max Depth	2.5 ft
Width/Depth Ratio	11.6
Entrenchment Ratio	4.6
Classification	E5

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 1, looking downstream

Cross-Section 1, looking upstream

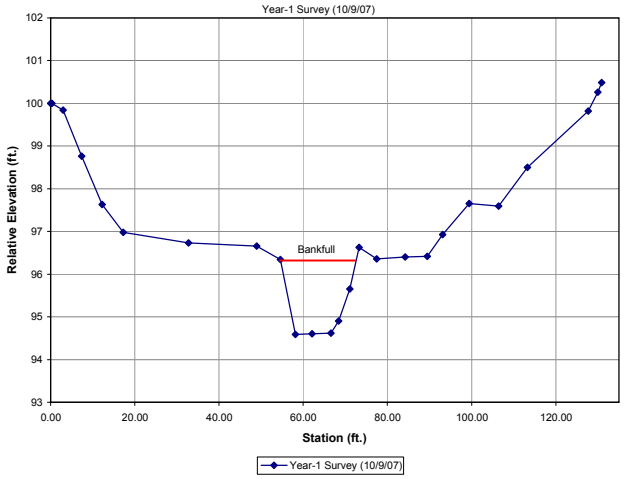
Title	**Cross-Section 1**		
Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**
10/9/07	Sunny	Jim Cooper, Michael Gloden	Station 9+09

Survey Data			
Cross-Section 2: Riffle			
Station		**Elevation**	**Feature**
0.00		100.00	LPIN
0.34		100.00	
2.93		99.84	
7.40		98.76	
12.25		97.63	
17.25		96.98	
32.75		96.73	
48.92		96.66	
54.60		96.34	LBKF
58.15		94.59	TW
62.12		94.60	
66.62		94.62	
68.41		94.90	
71.08		95.65	
73.31		96.63	
77.48		96.36	
84.26		96.40	
89.49		96.42	
93.15		96.93	
99.41		97.65	
106.41		97.59	
113.24		98.50	
127.70		99.82	
129.98		100.26	
130.86		100.49	RPIN

Summary Data	2007
Bankful Cross Sectional Area	24.0 sq. ft.
Bankfull Width	18.1 ft
Bankfull Mean Depth	1.3 ft
Bankful Max Depth	1.8 ft
Width/Depth Ratio	13.6
Entrenchment Ratio	5.5
Classification	C4

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 2, looking downstream

Cross-Section 2, looking upstream

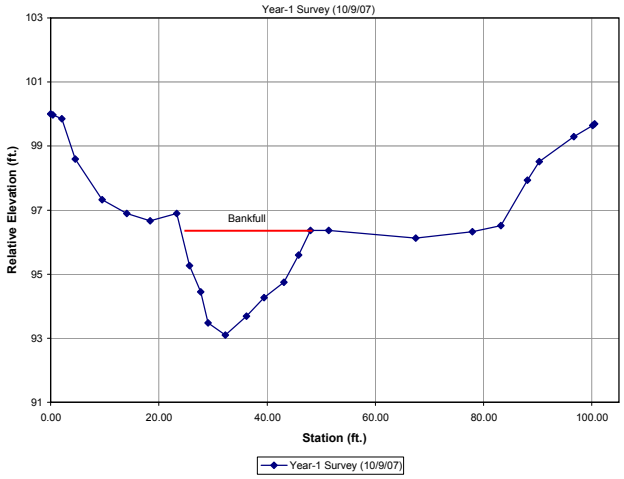
Title	**Cross-Section 2**		
Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**
10/9/07	Sunny	Jim Cooper, Michael Gloden	Station 9+33

Survey Data			
Cross-Section 3: Pool			
Station		**Elevation**	**Feature**
0.00		100.00	LPIN
0.42		99.97	
2.07		99.85	
4.56		98.59	
9.53		97.32	
14.06		96.90	
18.36		96.67	
23.28		96.90	
25.68		95.27	
27.71		94.45	
29.11		93.48	
32.28		93.10	TW
36.18		93.69	
39.44		94.27	
43.09		94.75	
45.83		95.60	
48.00		96.37	RBKF
51.37		96.37	
67.48		96.13	
77.92		96.33	
83.17		96.52	
88.10		97.93	
90.30		98.51	
96.65		99.29	
100.14		99.64	
100.52		99.69	RPIN

Summary Data	2007
Bankful Cross Sectional Area	47.4 sq. ft.
Bankfull Width	23.9 ft
Bankfull Mean Depth	2.0 ft
Bankful Max Depth	3.3 ft
Width/Depth Ratio	12.0
Entrenchment Ratio	3.6
Classification	C5

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 3, looking downstream

Cross-Section 3, looking upstream

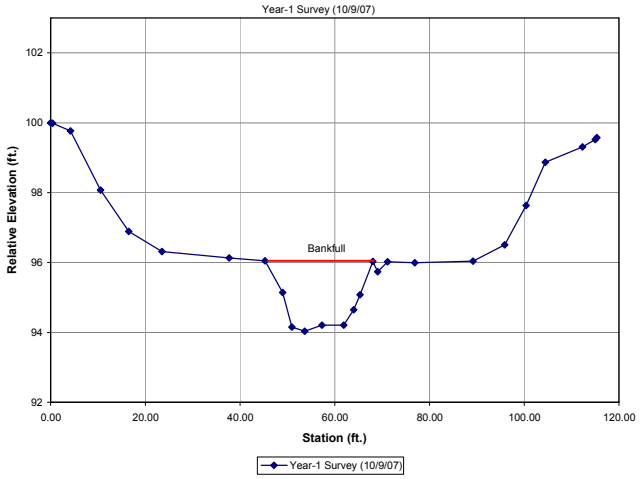
Title	**Cross-Section 3**		
Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**
10/9/07	Sunny	Jim Cooper, Michael Gloden	Station 13+77

Survey Data			
Cross-Section 4: Riffle			
Station		**Elevation**	**Feature**
0.00		100.00	LPIN
0.41		99.99	
4.22		99.77	
10.53		98.07	
16.47		96.89	
23.53		96.31	
37.68		96.13	
45.24		96.05	LBKF
48.96		95.14	
50.96		94.15	
53.64		94.03	TW
57.27		94.21	
61.88		94.21	
63.98		94.65	
65.34		95.08	
68.07		96.03	
69.05		95.74	
71.16		96.02	
76.90		95.99	
89.19		96.04	
95.89		96.51	
100.41		97.63	
104.45		98.87	
112.31		99.31	
115.02		99.52	
115.35		99.57	RPIN

Summary Data	2007
Bankful Cross Sectional Area	31.6 sq. ft.
Bankfull Width	22.8 ft
Bankfull Mean Depth	1.4 ft
Bankful Max Depth	2.0 ft
Width/Depth Ratio	16.3
Entrenchment Ratio	4.0
Classification	C4

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 4, looking downstream

Cross-Section 4, looking upstream

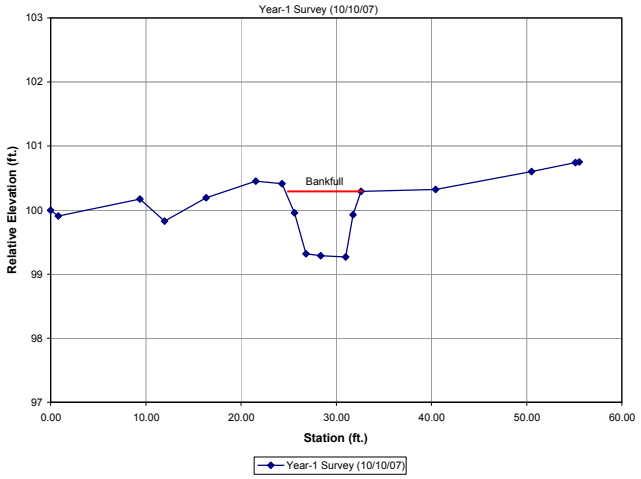
Title	**Cross-Section 4**		
Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**
10/9/07	Sunny	Jim Cooper, Michael Gloden	Station 14+14

Survey Data			
Cross-Section 5: Riffle			
Station		**Elevation**	**Feature**
0.00		100.00	LPIN
0.79		99.91	
9.38		100.17	
11.98		99.83	
16.32		100.19	
21.53		100.45	
24.29		100.41	
25.63		99.96	
26.83		99.32	
28.37		99.29	
30.99		99.27	TW
31.77		99.93	
32.60		100.29	RBKF
40.44		100.32	
50.52		100.60	
55.12		100.74	
55.53		100.75	RPIN

Summary Data	2007
Bankful Cross Sectional Area	5.8 sq. ft.
Bankfull Width	8.0 ft
Bankfull Mean Depth	0.7 ft
Bankful Max Depth	1.0 ft
Width/Depth Ratio	11.4
Entrenchment Ratio	> 6.9
Classification	E3

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 5, looking downstream

Cross-Section 5, looking upstream

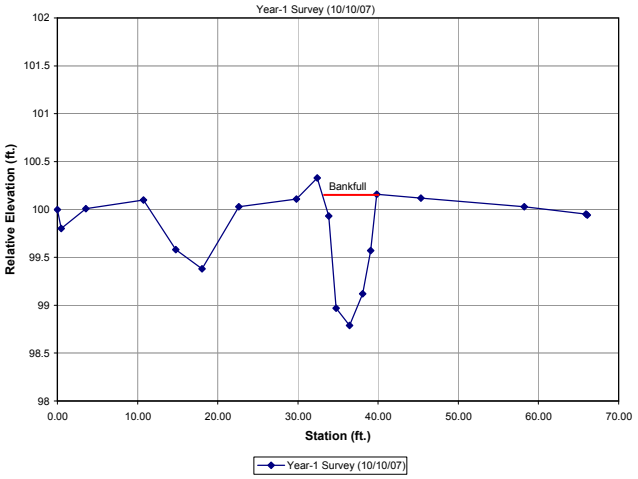
Title	**Cross-Section 5**			
Project	**Bishop Site Stream and Wetland Restoration, Anson County**		**EEP Project #**	D05010S
			Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**	
10/10/07	Sunny	Jim Cooper, Michael Gloden	Station 2+25	

Survey Data			
Cross-Section 6: Pool			
Station		**Elevation**	**Feature**
0.00		100.00	LPIN
0.47		99.80	
3.54		100.01	
10.75		100.10	
14.76		99.58	
18.02		99.38	
22.63		100.03	
29.83		100.11	
32.41		100.33	
33.86		99.93	
34.75		98.97	
36.45		98.79	TW
38.08		99.12	
39.08		99.57	
39.83		100.16	RBKF
45.33		100.12	
58.23		100.03	
65.92		99.95	
66.09		99.94	RPIN

Summary Data	2007
Bankful Cross Sectional Area	5.9 sq. ft.
Bankfull Width	6.8 ft
Bankfull Mean Depth	0.9 ft
Bankful Max Depth	1.4 ft
Width/Depth Ratio	7.6
Entrenchment Ratio	> 9.7
Classification	E5

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 6, looking downstream

Cross-Section 6, looking upstream

Title	**Cross-Section 6**

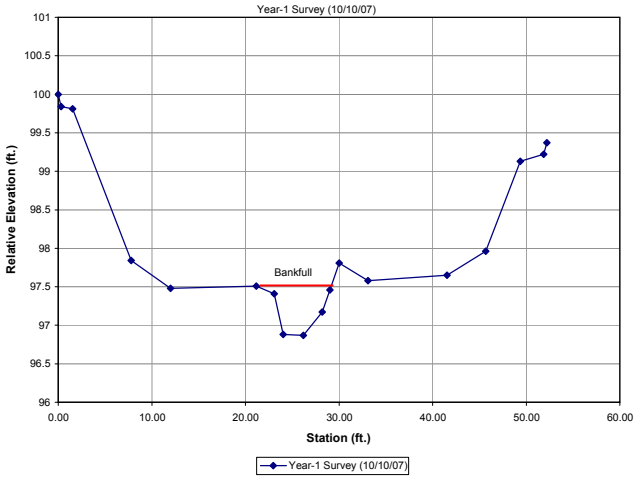
Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**
10/10/07	Sunny	Jim Cooper, Michael Gloden	Station 2+48

Survey Data			
Cross-Section 7: Riffle			
Station		**Elevation**	**Feature**
0.00		100.00	LPIN
0.30		99.84	
1.55		99.81	
7.78		97.84	
11.99		97.48	
21.17		97.51	LBKF
23.06		97.41	
24.04		96.88	
26.19		96.87	TW
28.22		97.17	
29.04		97.46	
30.01		97.81	
33.09		97.58	
41.53		97.65	
45.67		97.96	
49.38		99.13	
51.87		99.22	
52.20		99.37	RPIN

Summary Data	2007
Bankful Cross Sectional Area	3.0 sq. ft.
Bankfull Width	7.9ft
Bankfull Mean Depth	0.4 ft
Bankful Max Depth	0.6 ft
Width/Depth Ratio	19.8
Entrenchment Ratio	4.4
Classification	C4

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 7, looking downstream

Cross-Section 7, looking upstream

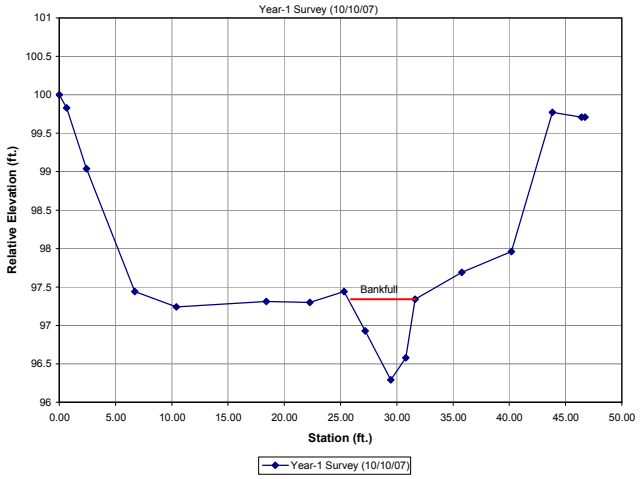
Title	**Cross-Section 7**		
Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**
10/10/07	Sunny	Jim Cooper, Michael Gloden	Station 4+43

Survey Data			
Cross-Section 8: Pool			
Station		**Elevation**	**Feature**
0.00		100.00	LPIN
0.65		99.83	
2.43		99.04	
6.71		97.44	
10.40		97.24	
18.39		97.31	
22.26		97.30	
25.32		97.44	
27.19		96.93	
29.47		96.29	TW
30.81		96.58	
31.62		97.34	RBKF
35.79		97.69	
40.18		97.96	
43.82		99.77	
46.43		99.71	
46.72		99.71	RPIN

Summary Data	2007
Bankful Cross Sectional Area	3.5 sq. ft.
Bankfull Width	5.9 ft
Bankfull Mean Depth	0.6 ft
Bankful Max Depth	1.1 ft
Width/Depth Ratio	9.8
Entrenchment Ratio	6.4
Classification	E5

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 8, looking downstream

Cross-Section 8, looking upstream

Title	**Cross-Section 8**			
Project	**Bishop Site Stream and Wetland Restoration, Anson County**		**EEP Project #**	D05010S
			Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**	
10/10/07	Sunny	Jim Cooper, Michael Gloden	Station 4+59	

Survey Data

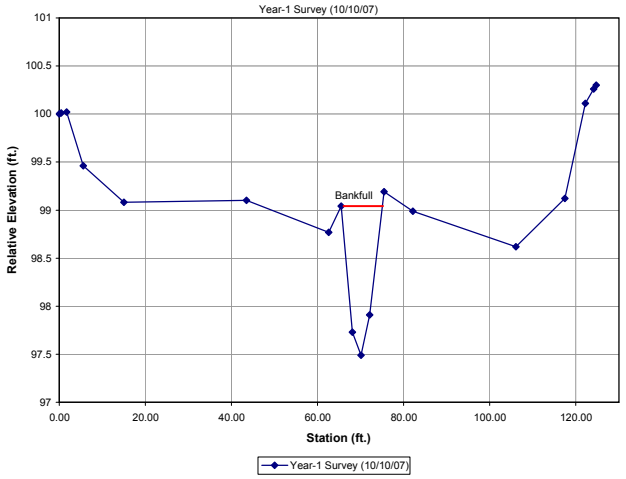
Cross-Section 9

Station		Elevation	Feature
0.00		100.00	LPIN
0.47		100.01	
1.71		100.02	
5.58		99.46	
14.99		99.08	
43.50		99.10	
62.57		98.77	
65.46		99.04	LBKF
68.10		97.73	
70.07		97.49	TW
72.12		97.91	
75.43		99.19	
82.14		98.99	
106.10		98.62	
117.46		99.12	
122.17		100.11	
124.14		100.26	
124.75		100.30	RPIN

Summary Data	2007
Bankful Cross Sectional Area	8.9 sq. ft.
Bankfull Width	9.6 ft
Bankfull Mean Depth	0.9 ft
Bankful Max Depth	1.5 ft
Width/Depth Ratio	10.6
Entrenchment Ratio	> 12.9
Classification	E5/6

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 9, looking downstream

Cross-Section 9, looking upstream

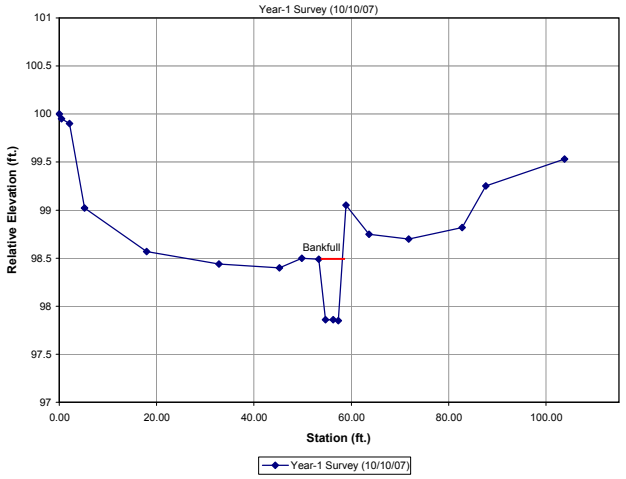
Title	**Cross-Section 9**		
Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**
10/10/07	Sunny	Jim Cooper, Michael Gloden	Station N/A (longitudinal profile not conducted)

Survey Data			
Cross-Section 10			
Station		Elevation	Feature
0.00		100.00	LPIN
0.44		99.95	
2.08		99.90	
5.18		99.02	
17.98		98.57	
32.78		98.44	
45.23		98.40	
49.84		98.50	
53.31		98.49	LBKF
54.72		97.86	
56.31		97.86	
57.32		97.85	TW
58.93		99.05	
63.62		98.75	
71.81		98.70	
82.79		98.82	
87.67		99.25	
103.85		99.53	
107.28		99.90	
112.28		99.87	
115.73		100.37	
116.35		100.37	RPIN

Summary Data	2007
Bankful Cross Sectional Area	2.4 sq. ft.
Bankfull Width	4.9 ft
Bankfull Mean Depth	0.5 ft
Bankful Max Depth	0.6 ft
Width/Depth Ratio	10.3
Entrenchment Ratio	17.1
Classification	E5

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 10, looking downstream

Cross-Section 10, looking upstream

Title	Cross-Section 10				
Project	Bishop Site Stream and Wetland Restoration, Anson County			EEP Project #	D05010S
				Figure	Cross-Section Appendix B
Survey Date	Survey Weather	Field Team	Location		
10/10/07	Sunny	Jim Cooper, Michael Gloden	Station N/A (longitudinal profile not conducted)		

Survey Data

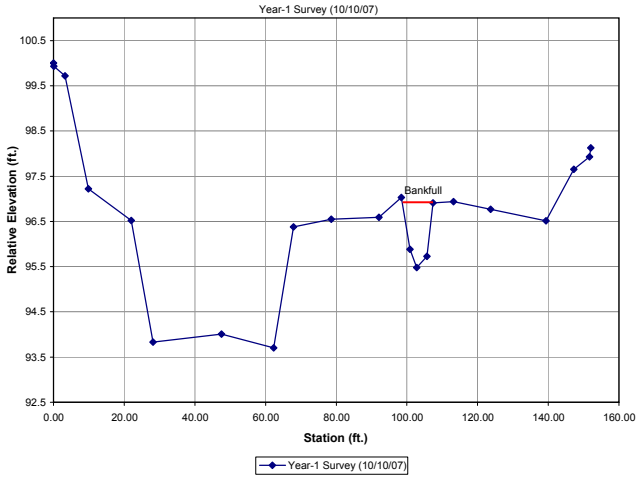
Cross-Section 11

Station		Elevation	Feature
0.00		100.00	LPIN
0.06		99.93	
3.29		99.72	
9.83		97.22	
22.01		96.52	
28.20		93.83	
47.58		94.01	
62.32		93.70	
67.87		96.38	
78.62		96.55	
92.09		96.59	
98.42		97.03	
100.91		95.88	
102.80		95.48	TW
105.65		95.73	
107.37		96.91	RBKF
113.21		96.94	
123.68		96.77	
139.39		96.51	
147.25		97.65	
151.66		97.93	
152.05		98.13	RPIN

Summary Data	2007
Bankful Cross Sectional Area	8.2 sq. ft.
Bankfull Width	8.7 ft
Bankfull Mean Depth	0.9 ft
Bankful Max Depth	1.4 ft
Width/Depth Ratio	9.7
Entrenchment Ratio	14.5
Classification	E5

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 11, looking downstream

Cross-Section 11, looking upstream

Title Cross-Section 11

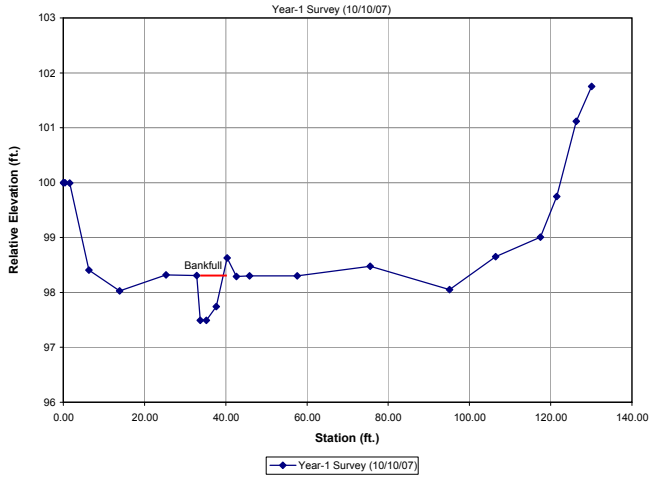
Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date 10/10/07	**Survey Weather** Sunny	**Field Team** Jim Cooper, Michael Gloden	**Location** Station N/A (longitudinal profile not conducted)

Survey Data			
Cross-Section 12			
Station		Elevation	Feature
0.00		100.00	LPIN
0.36		100.00	
1.55		99.99	
6.34		98.41	
13.87		98.03	
25.26		98.32	
32.82		98.31	LBKF
33.75		97.49	
35.24		97.49	TW
37.67		97.74	
40.30		98.63	
42.65		98.29	
45.88		98.30	
57.61		98.30	
75.58		98.48	
95.06		98.05	
106.43		98.65	
117.46		99.01	
121.50		99.75	
126.33		101.12	
130.09		101.75	RPIN

Summary Data	2007
Bankful Cross Sectional Area	3.8 sq. ft.
Bankfull Width	6.5 ft
Bankfull Mean Depth	0.6 ft
Bankful Max Depth	0.8 ft
Width/Depth Ratio	10.8
Entrenchment Ratio	14.6
Classification	E5/6

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 12, looking downstream

Cross-Section 12, looking upstream

Title	Cross-Section 12				
Project	Bishop Site Stream and Wetland Restoration, Anson County			EEP Project #	D05010S
				Figure	Cross-Section Appendix B
Survey Date	Survey Weather	Field Team	Location		
10/10/07	Sunny	Jim Cooper, Michael Gloden	Station N/A (longitudinal profile not conducted)		

Survey Data

Cross-Section 13: Pool

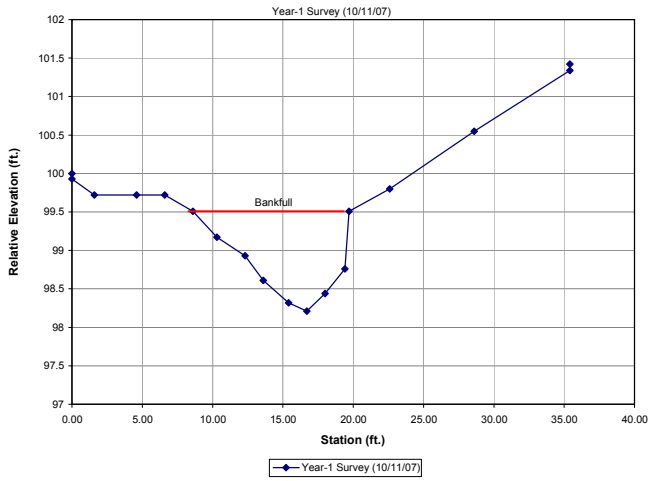
Station		Elevation	Feature
0.00		100.00	LPIN
0.00		99.93	
1.60		99.72	
4.60		99.72	
6.60		99.72	
8.60		99.51	
10.30		99.17	
12.30		98.93	
13.60		98.61	
15.40		98.32	
16.70		98.21	TW
18.00		98.44	
19.40		98.76	
19.70		99.51	RBKF
22.60		99.80	
28.60		100.55	
35.40		101.34	
35.40		101.42	RPIN

Summary Data

Bankful Cross Sectional Area	8.6 sq. ft.
Bankfull Width	11.1 ft
Bankfull Mean Depth	0.8 ft
Bankful Max Depth	1.3 ft
Width/Depth Ratio	14.3
Entrenchment Ratio	> 2.4
Classification	C5

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 13, looking downstream

Cross-Section 13, looking upstream

Title	**Cross-Section 13**
Project	**Bishop Site Stream and Wetland Restoration, Anson County**
EEP Project #	D05010S
Figure	Cross-Section Appendix B
Survey Date	10/11/07
Survey Weather	Sunny
Field Team	Jim Cooper, Michael Gloden
Location	Station N/A (longitudinal profile not conducted)

Survey Data

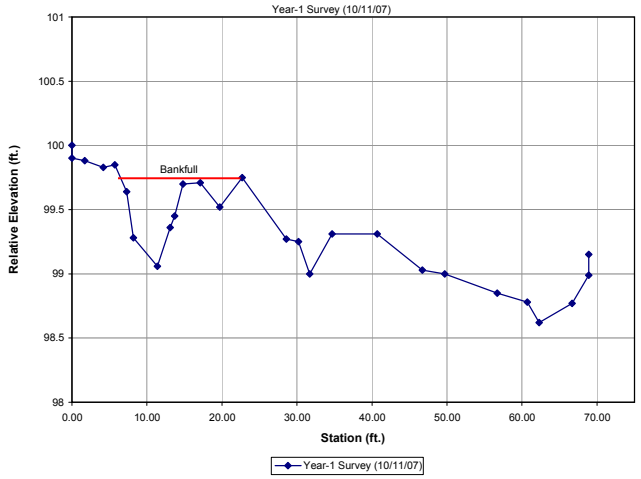
Cross-Section 14: Riffle/Braided System

Station		Elevation	Feature
0.00		100.00	LPIN
0.00		99.90	
1.70		99.88	
4.20		99.83	
5.70		99.85	
7.30		99.64	
8.20		99.28	
11.40		99.06	TW
13.10		99.36	
13.70		99.45	
14.80		99.70	
17.10		99.71	
19.70		99.52	
22.70		99.75	RBKF
28.60		99.27	
30.20		99.25	
31.70		99.00	
34.70		99.31	
40.70		99.31	
46.70		99.03	
49.70		99.00	
56.70		98.85	
60.70		98.78	
62.30		98.62	
66.70		98.77	
68.90		98.99	
68.90		99.15	RPIN

Summary Data	2007
Bankful Cross Sectional Area	4.3 sq. ft.
Bankfull Width	16.2 ft
Bankfull Mean Depth	0.3 ft
Bankful Max Depth	0.7 ft
Width/Depth Ratio	54.0
Entrenchment Ratio	> 4.3
Classification	C/D5

Cross-Section

Cross-Section Plot - Looking Downstream



Cross-Section Photos

Cross-Section 14, looking downstream

Cross-Section 14, looking upstream

Title Cross-Section 14

Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date 10/11/07	**Survey Weather** Sunny	**Field Team** Jim Cooper, Michael Gloden	**Location** Station N/A (longitudinal profile not conducted)

Survey Data

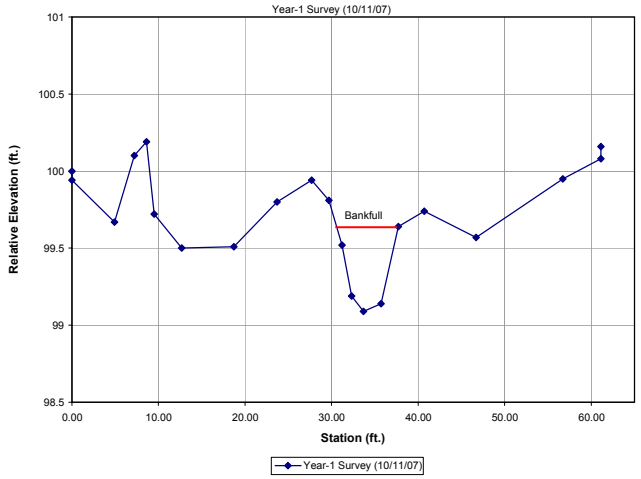
Cross-Section 15: Riffle

Station		Elevation	Feature
0.00		100.00	LPIN
0.00		99.94	
4.90		99.67	
7.20		100.10	
8.60		100.19	
9.50		99.72	
12.70		99.50	
18.70		99.51	
23.70		99.80	
27.70		99.94	
29.70		99.81	
31.20		99.52	
32.30		99.19	
33.70		99.09	TW
35.70		99.14	
37.70		99.64	RBKF
40.70		99.74	
46.70		99.57	
56.70		99.95	
61.10		100.08	
61.10		100.16	RPIN

Summary Data	2007
Bankful Cross Sectional Area	2.6 sq. ft.
Bankfull Width	7.1 ft
Bankfull Mean Depth	0.4 ft
Bankful Max Depth	0.6 ft
Width/Depth Ratio	17.8
Entrenchment Ratio	> 8.7
Classification	C4

Cross-Section

Cross-Section Plot - Looking Downstream



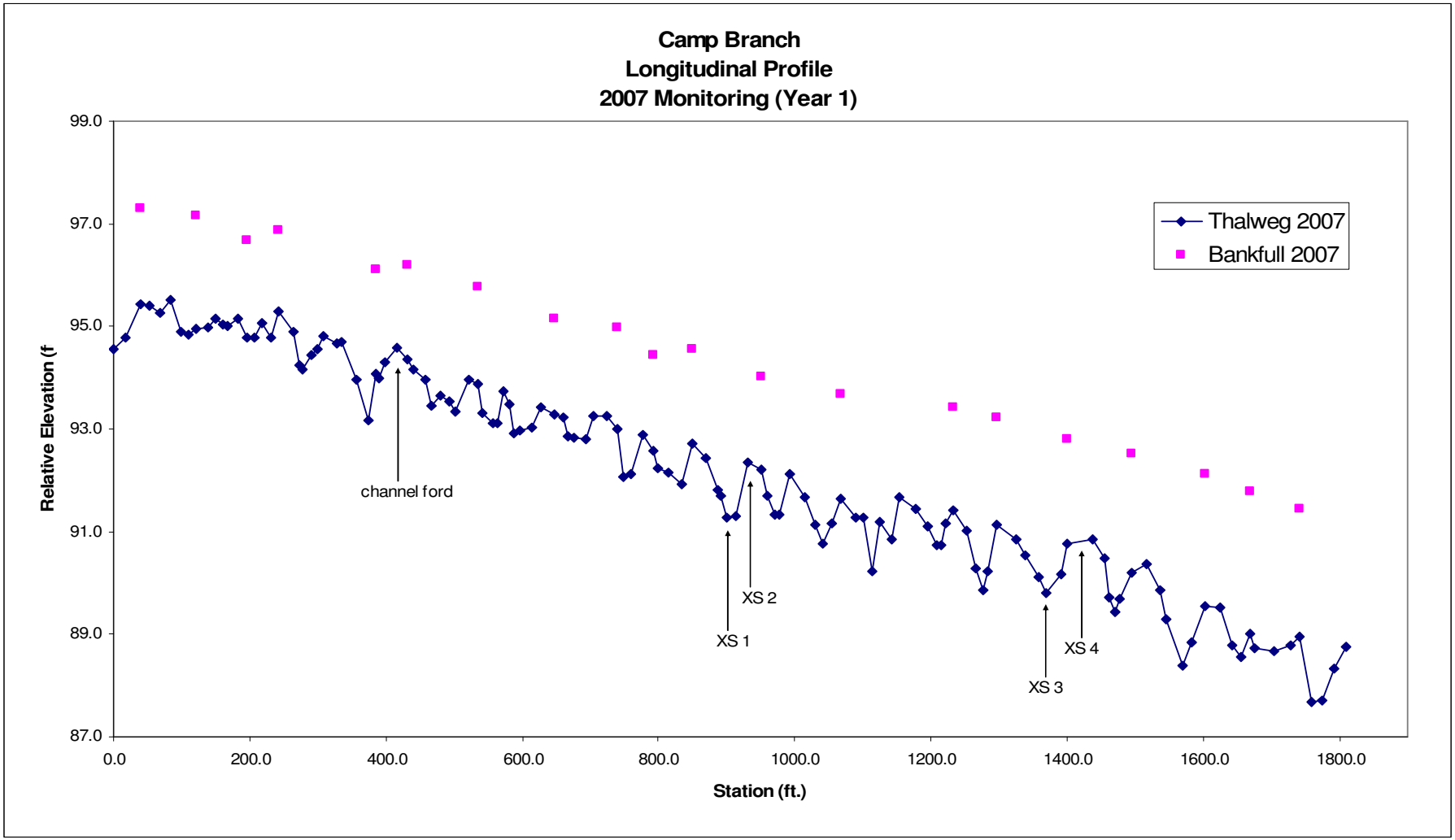
Cross-Section Photos

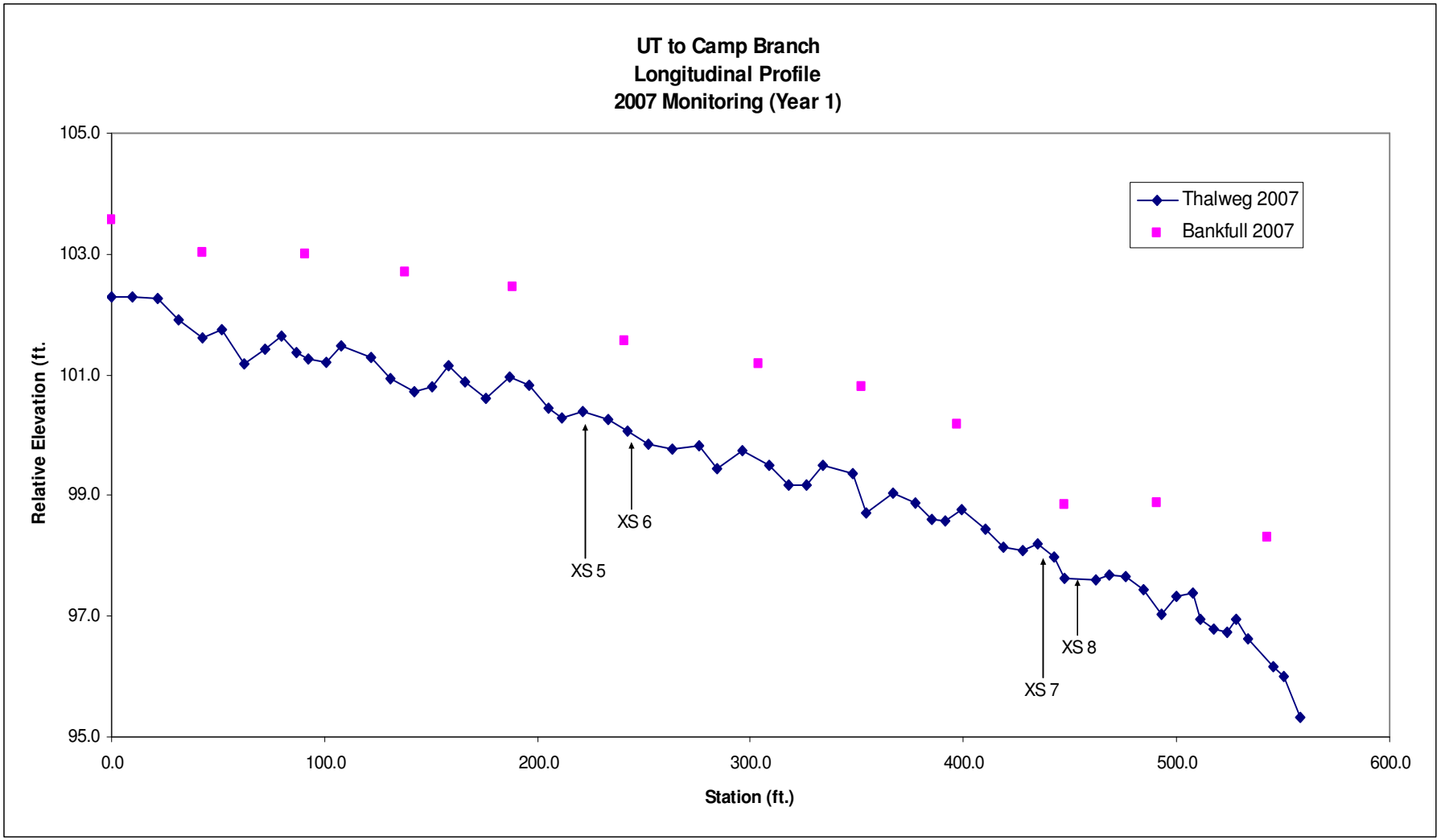
Cross-Section 15, looking downstream

Cross-Section 15, looking upstream

Title	**Cross-Section 15**

Project	**Bishop Site Stream and Wetland Restoration, Anson County**	**EEP Project #**	D05010S
		Figure	Cross-Section Appendix B
Survey Date	**Survey Weather**	**Field Team**	**Location**
10/11/07	Sunny	Jim Cooper, Michael Gloden	Station N/A (longitudinal profile not conducted)


Camp Branch
Longitudinal Profile
2007 Monitoring (Year 1)
Relative Elevation (f
99.0
97.0
95.0
93.0
91.0
89.0
87.0
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
1800.0
Station (ft.)
Thalweg 2007
Bankfull 2007
channel ford
XS 1
XS 2
XS 3
XS 4


UT to Camp Branch
Longitudinal Profile
2007 Monitoring (Year 1)
Relative Elevation (ft.
105.0
103.0
101.0
99.0
97.0
95.0
0.0
100.0
200.0
300.0
400.0
500.0
600.0
Station (ft.)
Thalweg 2007
Bankfull 2007
XS 5
XS 6
XS 7
XS 8

Stream:	Camp Branch (Reach 1)	Page 1
	Longitudinal Profile	
Date:	10/9/2007	
Crew:	Jim Cooper, Michael Gloden	

Station	TW Elevation	BKF Elevation	Feature	Riffle Length	Riffle Slope	Pool Length	Pool Spacing
0.00	94.55		(tp)			18.34	
18.34	94.79		(bp)				
39.12	95.43	97.29	(tr)	28.26	0.00566		
52.93	95.40		(tw)				
67.38	95.27		(br)				
83.89	95.52		(tw)				
98.91	94.90		(tp)			11.58	98.91
110.49	94.85		(bp)				
121.55	94.95	97.16	(tr)				
139.23	94.97		(tw)				
149.16	95.14		(tw)				
161.55	95.05		(tw)				
168.31	95.02		(tw)				
183.02	95.16		(tw)				
195.24	94.79	96.67	(tw)				
205.93	94.78		(tw)				
218.79	95.07		(tw)				
231.36	94.78		(tw)				
243.27	95.29	96.89	(tr)	20.95	0.0186		
264.22	94.90		(br)				
272.30	94.24		(tp)			17.5	173.39
277.56	94.15		(mp)				
289.80	94.43		(bp)				
299.26	94.57		(tw)				
308.83	94.82		(tr)	18.85	0.00796		
327.68	94.67		(br)				
334.97	94.69		(tw)				
355.92	93.96		(tp)			18.08	83.62
374.00	93.18		(bp)				
384.70	94.07	96.12	(tw)				
389.99	93.98		(tw)				
399.47	94.29		(tw)				
415.47	94.59		(to)				
431.07	94.37	96.21	(bo)				
441.42	94.17		(tw)				
457.58	93.95		(tw)				
466.99	93.44		(tp)			35.13	111.07
479.39	93.64		(tw)				
493.41	93.54		(tw)				
502.12	93.35		(bp)				
522.50	93.97		(tr)	13.23	0.0068		
535.73	93.88	95.78	(br)				
542.21	93.31		(tp)			21.71	75.22

Stream:	Camp Branch (Reach 1)	Page 2
	Longitudinal Profile	
Date:	10/9/2007	
Crew:	Jim Cooper, Michael Gloden	

Station	TW Elevation	BKF Elevation	Feature	Riffle Length	Riffle Slope	Pool Length	Pool Spacing
556.14	93.11		(tw)				
563.92	93.11		(bp)				
571.76	93.73		(tr)	10.17	0.0236		
581.93	93.49		(br)				
587.09	92.92		(tp)			26.51	44.81
597.67	92.98		(tw)				
613.60	93.04		(bp)				
627.25	93.43		(tr)	19.4	0.00842		
646.65	93.27	95.14	(br)				
660.73	93.24		(tw)				
667.79	92.85		(tp)			24.87	80.7
675.47	92.84		(tw)				
692.66	92.81		(bp)				
703.60	93.25		(tr)	35.92	0.00667		
723.35	93.25		(tw)				
739.52	93.01	94.98	(br)				
748.21	92.06		(tp)			12.42	80.42
760.63	92.13		(bp)				
777.26	92.90		(tr)	14.69	0.022		
791.95	92.57	94.43	(br)				
798.96	92.25		(tp)			35.48	50.75
815.18	92.15		(tw)				
834.44	91.93		(bp)				
849.49	92.72	94.56	(tr)	19.97	0.015		
869.46	92.42		(br)				
887.11	91.80		(tw)				
892.42	91.71		(tp)			21.35	93.46
900.87	91.28		(tw)				
913.77	91.30		(bp)				
931.00	92.36		(tr)	19.72	0.007		
950.72	92.22	94.03	(br)				
960.69	91.69		(tp)			17.42	68.27
971.09	91.32		(tw)				
978.11	91.33		(bp)				
992.42	92.13		(tr)	23.55	0.0204		
1015.97	91.66		(br)				
1029.74	91.12		(tp)			25.07	69.05
1041.73	90.76		(tw)				
1054.81	91.16		(bp)				
1067.60	91.65	93.67	(tr)	21.65	0.0173		
1089.25	91.27		(br)				
1101.65	91.27		(tw)				
1113.94	90.24		(tp)			29.51	84.2

Stream:	Camp Branch (Reach 1)	Page 3
	Longitudinal Profile	
Date:	10/9/2007	
Crew:	Jim Cooper, Michael Gloden	

Station	TW Elevation	BKF Elevation	Feature	Riffle Length	Riffle Slope	Pool Length	Pool Spacing
1125.78	91.18		(tw)				
1143.45	90.85		(bp)				
1152.68	91.67		(tr)	24.11	0.00958		
1176.79	91.44		(br)				
1194.50	91.10		(tp)			21.24	80.56
1208.38	90.75		(tw)				
1215.74	90.73		(bp)				
1222.63	91.17		(tw)				
1233.10	91.42	93.43	(tr)	20.15	0.0186		
1253.25	91.03		(br)				
1266.26	90.28		(tp)			17.81	71.76
1276.00	89.86		(tw)				
1284.07	90.23		(bp)				
1297.54	91.12	93.24	(tr)	27.2	0.00963		
1324.74	90.86		(br)				
1338.57	90.55		(tw)				
1358.50	90.10		(tp)			32.22	92.24
1370.05	89.80		(tw)				
1390.72	90.18		(bp)				
1400.24	90.77	92.80	(tr)	37.02	0		
1437.26	90.86		(br)				
1455.97	90.47		(tw)				
1462.33	89.72		(tp)			14.02	103.83
1469.69	89.42		(tw)				
1476.35	89.70		(bp)				
1494.57	90.20	92.53	(tr)	43.26	0.00814		
1515.98	90.36		(tw)				
1537.83	89.85		(br)				
1545.89	89.28		(tp)			37	83.56
1570.71	88.38		(tw)				
1582.89	88.84		(bp)				
1602.68	89.55	92.13	(tr)	22.81	0.00231		
1625.49	89.52		(br)				
1643.16	88.78		(tp)				97.27
1655.53	88.56		(tw)				
1668.24	89.00	91.79	(tw)				
1676.26	88.74		(tw)				
1703.67	88.68		(tw)				
1727.69	88.79		(tw)				
1742.42	88.94	91.45	(tw)				

Stream:	Camp Branch (Reach 1)	Page 4
	Longitudinal Profile	
Date:	10/9/2007	
Crew:	Jim Cooper, Michael Gloden	

Station	TW Elevation	BKF Elevation	Feature	Riffle Length	Riffle Slope	Pool Length	Pool Spacing
1759.49	87.68		(tw)				
1773.45	87.70		(tw)				
1791.42	88.32		(tw)				
1810.17	88.75		(tw)				

NOTE: All above elevations are based on an assumed ESC Benchmark #1 elevation equivalent to 100.0 ft.

Stream:	UT to Camp Branch (Reaches 3 and 4)	Page 1
	Longitudinal Profile	
Date:	10/10/2007	
Crew:	Jim Cooper, Michael Gloden	

Station	TW Elevation	BKF Elevation	Feature
0.00	102.30	103.55	(tw)
9.54	102.29		(tw)
21.66	102.26		(tw)
31.55	101.90		(tw)
42.54	101.60	103.02	(tw)
52.06	101.74		(tw)
62.24	101.17		(tw)
72.46	101.42		(tw)
79.97	101.65		(tw)
86.65	101.38		(tw)
92.65	101.25	103.00	(tw)
100.74	101.20		(tw)
108.14	101.47		(tw)
121.81	101.29		(tw)
130.72	100.92		(tw)
142.36	100.73	102.70	(tw)
150.35	100.79		(tw)
158.17	101.16		(tw)
166.01	100.89		(tw)
175.49	100.62		(tw)
186.62	100.95	102.46	(tw)
196.11	100.82		(tw)
205.41	100.44		(tw)
211.10	100.29		(tw)
221.57	100.38		(tw)
233.34	100.26		(tw)
242.46	100.07	101.57	(tw)
252.03	99.84		(tw)
263.15	99.78		(tw)
276.10	99.81		(tw)
284.00	99.45		(tw)
296.28	99.73		(tw)
309.03	99.50	101.19	(tw)
318.19	99.16		(tw)
326.18	99.18		(tw)
334.11	99.49		(tw)
347.81	99.37		(tw)
354.29	98.72	100.80	(tw)
366.67	99.04		(tw)

Stream:	UT to Camp Branch (Reaches 3 and 4)	Page 2
	Longitudinal Profile	
Date:	10/10/2007	
Crew:	Jim Cooper, Michael Gloden	

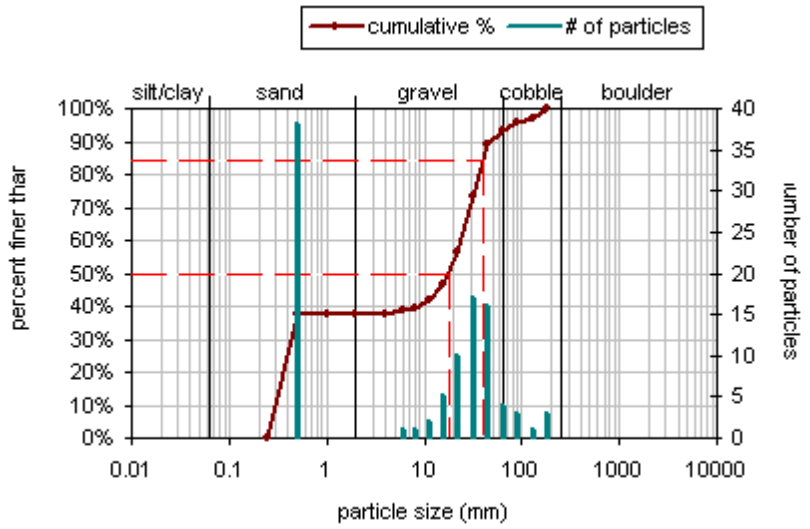
Station	TW Elevation	BKF Elevation	Feature
377.62	98.87		(tw)
385.30	98.61		(tw)
391.58	98.58		(tw)
399.27	98.77	100.18	(tw)
410.14	98.43		(tw)
418.53	98.14		(tw)
427.61	98.10		(tw)
435.05	98.20		(tw)
442.44	97.98		(tw)
447.53	97.62	98.84	(tw)
461.89	97.61		(tw)
468.05	97.67		(tw)
476.02	97.66		(tw)
484.40	97.45		(tw)
492.81	97.04	98.87	(tw)
499.71	97.34		(tw)
507.28	97.37		(tw)
510.97	96.96		(tw)
517.27	96.79		(tw)
523.42	96.74		(tw)
528.12	96.94		(tw)
533.43	96.63		(tw)
545.47	96.16	98.30	(tw)
549.98	96.00		(tw)
558.06	95.33		(tw)

NOTE: Water was not present within the channel at the time of stream monitoring activities. Thus, it was infeasible to provide facet lengths, slopes, and pool-to-pool spacing.

NOTE: All above elevations are based on an assumed ESC Benchmark #1 elevation equivalent to 100.0 ft.

Camp Branch (Reach 1) Reach-Wide Pebble Count

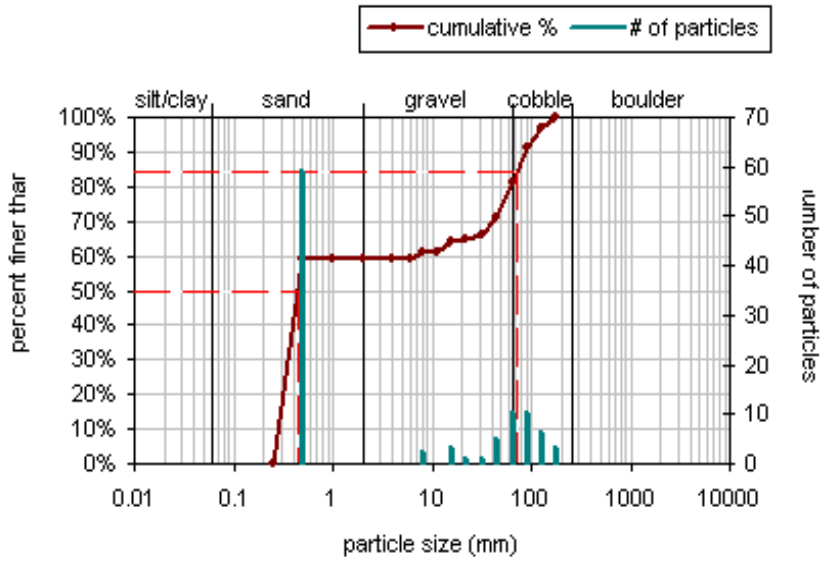
Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	**38**
coarse sand	0.5 - 1	
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	**1**
fine gravel	6 - 8	**1**
medium gravel	8 - 11	**2**
medium gravel	11 - 16	**5**
coarse gravel	16 - 22	**10**
coarse gravel	22 - 32	**17**
very coarse gravel	32 - 45	**16**
very coarse gravel	45 - 64	**4**
small cobble	64 - 90	**3**
medium cobble	90 - 128	**1**
large cobble	128 - 180	**3**
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
	total particle count:	101



	Size (mm)
D16	0.34
D35	0.48
D50	18
D65	27
D84	40
D95	80

UT to Camp Branch (Reaches 3 and 4) Reach-Wide Pebble Count

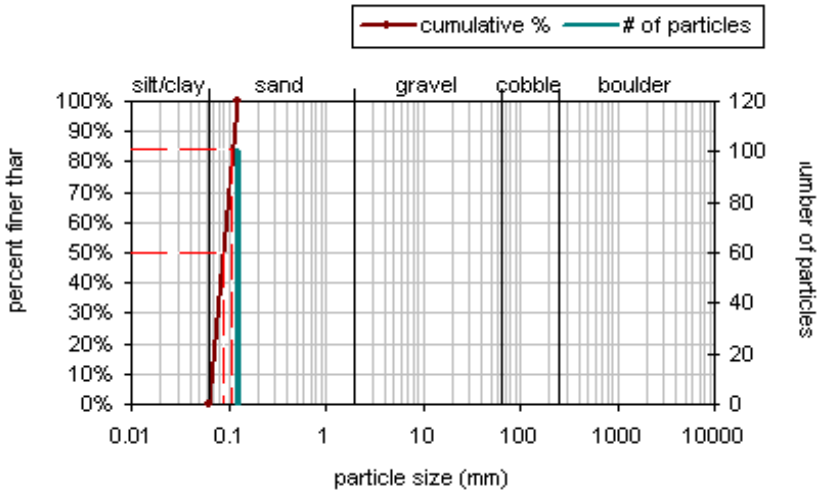
Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	**59**
coarse sand	0.5 - 1	
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	
fine gravel	6 - 8	**2**
medium gravel	8 - 11	
medium gravel	11 - 16	**3**
coarse gravel	16 - 22	**1**
coarse gravel	22 - 32	**1**
very coarse gravel	32 - 45	**5**
very coarse gravel	45 - 64	**10**
small cobble	64 - 90	**10**
medium cobble	90 - 128	**6**
large cobble	128 - 180	**3**
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
	total particle count:	100



	Size (mm)
D16	0.3
D35	0.38
D50	0.45
D65	22
D84	71
D95	110

Dula Thoroughfare (Reaches 5 and 6) Reach-Wide Pebble Count

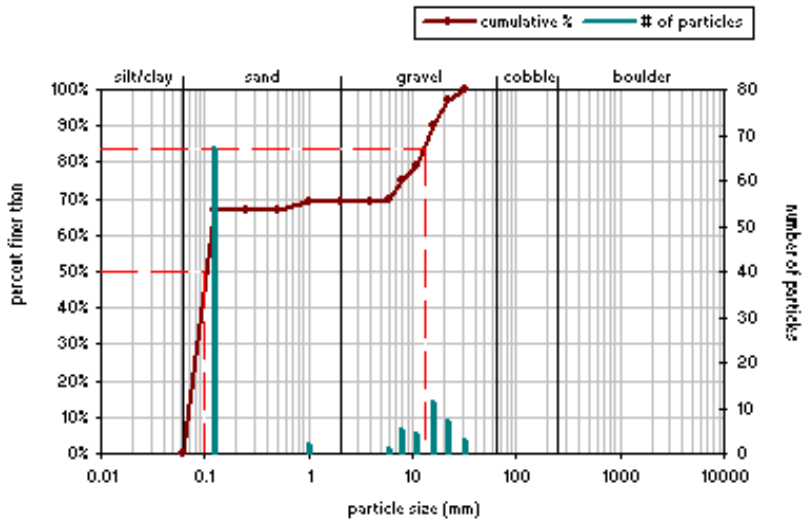
Material	Size Range (mm)			Count
silt/clay	0	-	0.062	
very fine sand	0.062	-	0.125	**100**
fine sand	0.125	-	0.25	
medium sand	0.25	-	0.5	
coarse sand	0.5	-	1	
very coarse sand	1	-	2	
very fine gravel	2	-	4	
fine gravel	4	-	6	
fine gravel	6	-	8	
medium gravel	8	-	11	
medium gravel	11	-	16	
coarse gravel	16	-	22	
coarse gravel	22	-	32	
very coarse gravel	32	-	45	
very coarse gravel	45	-	64	
small cobble	64	-	90	
medium cobble	90	-	128	
large cobble	128	-	180	
very large cobble	180	-	256	
small boulder	256	-	362	
small boulder	362	-	512	
medium boulder	512	-	1024	
large boulder	1024	-	2048	
very large boulder	2048	-	4096	
	total particle count:			100



Size (mm)	
D16	0.069
D35	0.079
D50	0.088
D65	0.098
D84	0.11
D95	0.12

UT to Dula Thoroughfare (Reach 7) Reach-Wide Pebble Count

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	**67**
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	**2**
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	**1**
fine gravel	6 - 8	**5**
medium gravel	8 - 11	**4**
medium gravel	11 - 16	**11**
coarse gravel	16 - 22	**7**
coarse gravel	22 - 32	**3**
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
	total particle count:	100



	Size (mm)
D16	0.073
D35	0.089
D50	0.1
D65	0.12
D84	13
D95	20

Table B-7. Benchmark Locations and Relative Elevations*
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Benchmark	Location	Northing	Easting	Relative Elevation
ESC BM1	Camp Branch	514973.328	1672616.468	100.00
ESC BM2	Camp Branch	514919.126	1672498.599	99.95
ESC BM3	Camp Branch	515034.418	1672785.243	99.08
ESC BM4	Dula Thoroughfare	512318.048	1675296.654	100.00
ESC BM5	Dula Thoroughfare	511856.214	1675575.692	100.74
ESC BM6	Dula Thoroughfare	511376.948	1675951.906	100.43

***See Figures 2A and 2B for benchmark locations**

Table B-8. GPSd Cross-Section Pin Locations*
Bishop Site Stream and Wetland Restoration/EEP Project No. D05010S

Cross-Section	Pin ID	Northing	Easting
XS 1	LPIN	514632.513	1672926.642
XS 1	RPIN	514574.972	1672820.192
XS 2	LPIN	514589.272	1672949.650
XS 2	RPIN	514574.972	1672820.192
XS 3	LPIN	514283.030	1673167.595
XS 3	RPIN	514217.058	1673092.301
XS 4	LPIN	514234.833	1673206.045
XS 4	RPIN	514217.058	1673092.301
XS 5	LPIN	514869.414	1672311.319
XS 5	RPIN	514814.619	1672319.003
XS 6	LPIN	514869.414	1672311.319
XS 6	RPIN	514824.773	1672359.853
XS 7	LPIN	514993.448	1672275.625
XS 7	RPIN	515004.123	1672326.182
XS 8	LPIN	514993.448	1672275.625
XS 8	RPIN	515022.613	1672308.191
XS 9	LPIN	512246.371	1675315.753
XS 9	RPIN	512174.486	1675213.387
XS 10	LPIN	511926.018	1675047.974
XS 10	RPIN	511828.923	1675111.251
XS 11	LPIN	511677.619	1675681.854
XS 11	RPIN	511596.832	1675553.146
XS 12	LPIN	511167.049	1676021.478
XS 12	RPIN	511087.167	1675919.097
XS 13	LPIN	509761.720	1672413.476
XS 13	RPIN	509716.789	1672416.146
XS 14	LPIN	509916.334	1672836.351
XS 14	RPIN	509845.800	1672875.848
XS 15	LPIN	509993.785	1673628.268
XS 15	RPIN	509923.837	1673649.764

***Note: All cross-section plot elevations are based on an assumed left pin (LPIN) elevation of 100.0 ft.**

APPENDIX C: WETLAND RAW DATA

WETLAND RAW DATA

Three groundwater gauges were installed within wetland restoration areas adjacent to Dula Thoroughfare (Figure 2B). Gauges 2 and 3 remain in their original locations. Gauge 1 was moved to its present location to better reflect local groundwater conditions. Since gauges achieved hydrologic success criteria (see Section 3.3 "Wetland Assessment"), no wetland problem area table has been included.

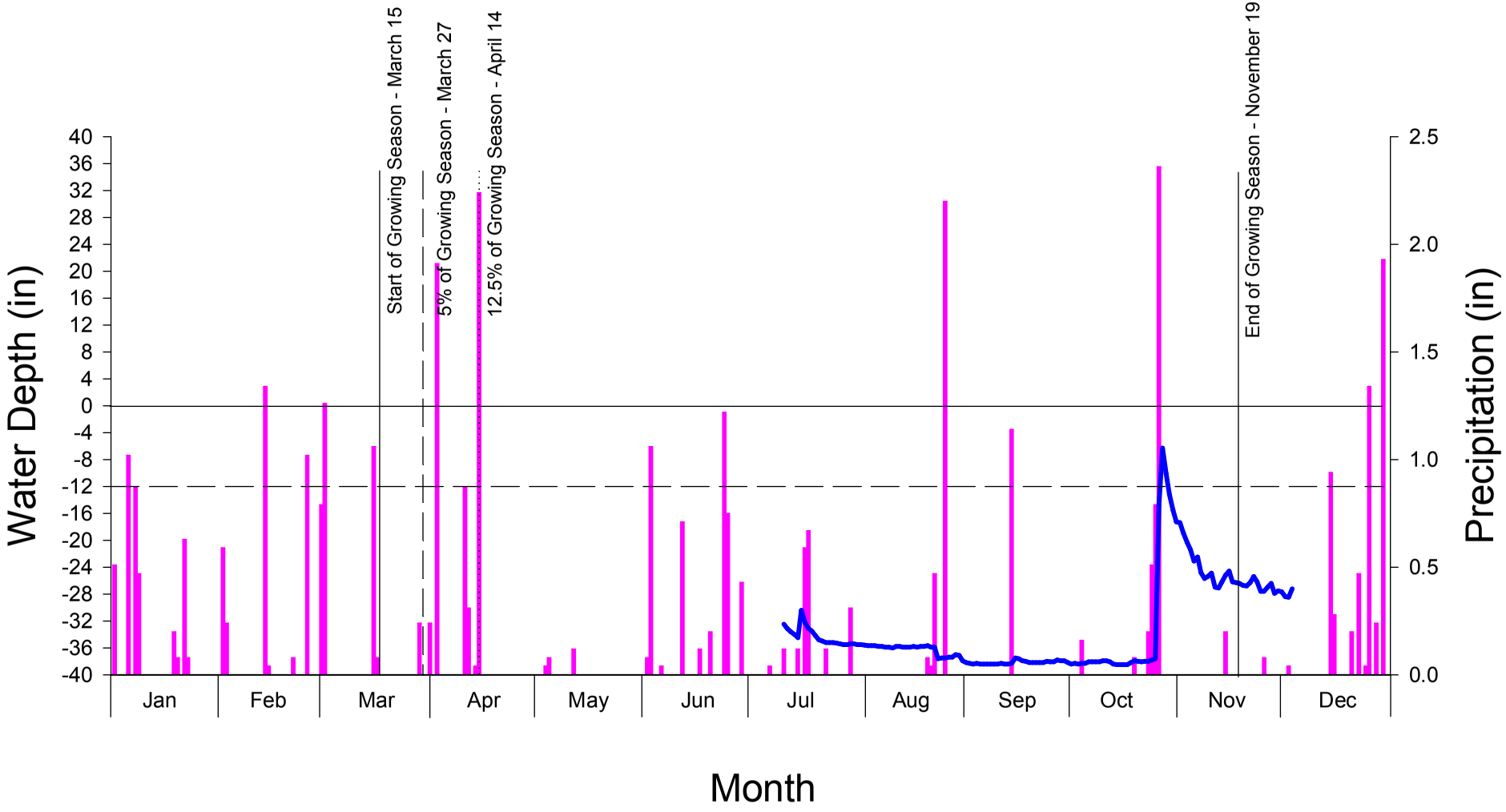
Precipitation data for the following hydrographs was obtained from Weather Underground for the Troy, NC weather station (the nearest offering daily precipitation data) at the following URL:

http://www.wunderground.com/weatherstation/WXDailyHistory.asp?ID=KNCTROY1&day=15&year=2007&month=12&graphspan=year

Bishop Stream and Wetland Mitigation

2007

Monitoring Gauge 1 - 9DE7744

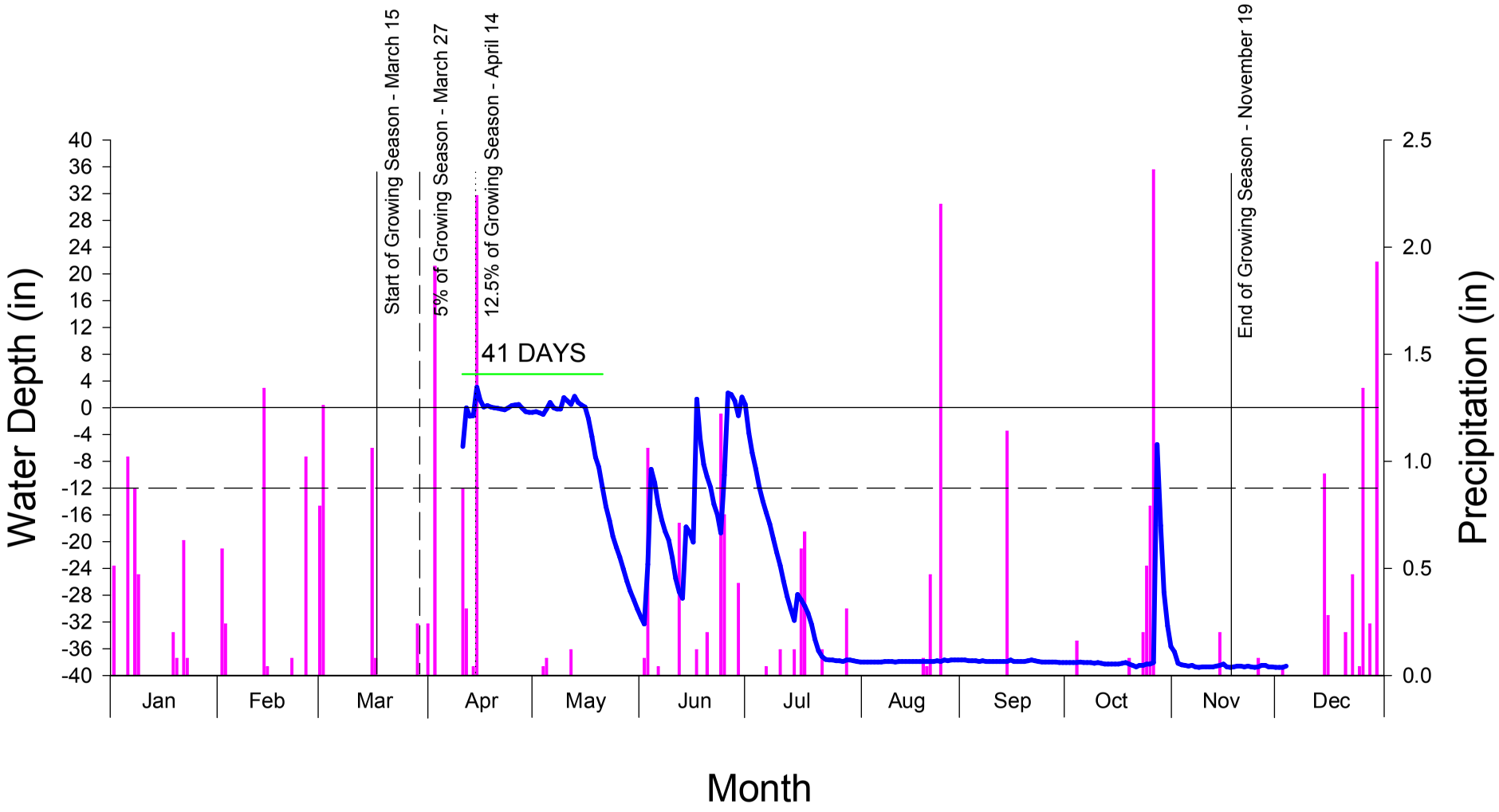


*Gauge installed 7/11/07

Bishop Stream and Wetland Mitigation

2007

Monitoring Gauge 2 - B6513B5

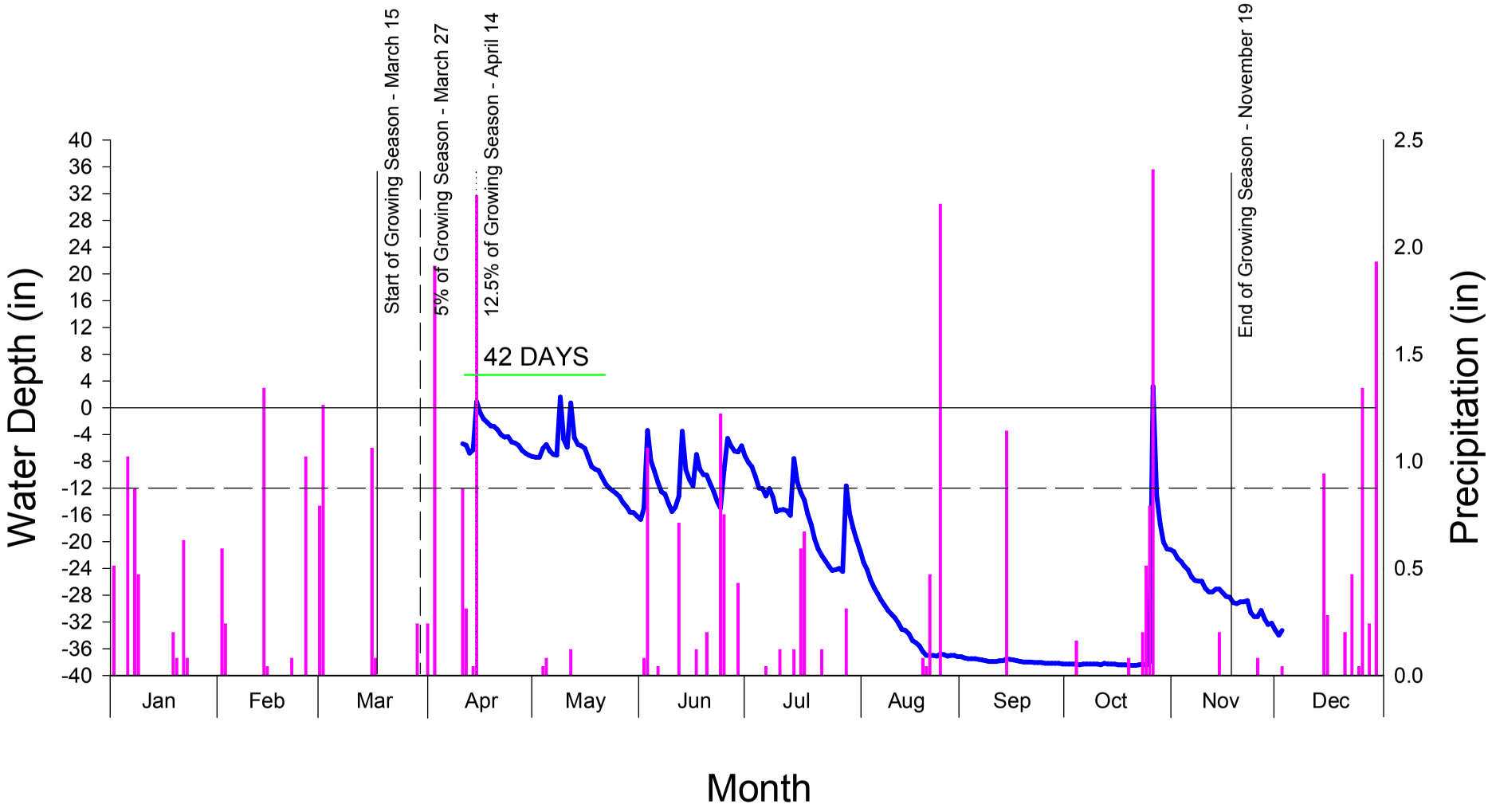


*Gauge installed 4/10/07

Bishop Stream and Wetland Mitigation

2007

Monitoring Gauge 3 - 9DF22A3



*Gauge installed 4/10/07