

# As-Built/Monitoring Year 1 Report

## LITTLE BUGABOO CREEK Wilkes County, North Carolina

Submitted to: NCDENR-EEP  
Address: 1652 Mail Service Center  
Raleigh, NC 27699-1652



June 2005

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NC ECOSYSTEM  
ENHANCEMENT PROGRAM



**E A R T H T E C H**

701 Corporate Center Drive Suite 475  
Raleigh, NC 27607

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Appendix B: Raw Stream Survey Data and Stream Cross-Section Photo Log

## **1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT**

The Ecosystem Enhancement Program (EEP) formally the North Carolina Wetlands Restoration Program (NCWRP) identified Little Bugaboo Creek (LBC) and an Unnamed Tributary to Little Bugaboo Creek (UT) as potential stream restoration sites in 2002. Existing conditions were surveyed and a restoration design was developed based upon the conditions of the channels, reference reaches, and goals of the project. The existing channel was severely eroding due to unlimited cattle access and a lack of vegetation. The farmers who owned the sections of the restoration project were concerned about losing valuable farmland. The design involved a Priority Level II restoration and LBC and the UT were designed to be Rosgen stream type "C". Section 2.0 describes in more detail the project background with Tables summarizing the goals, objectives, history, background, and contact information. This report serves as the as-built report and the first year of the 5-year monitoring plan for the Little Bugaboo Creek Stream Restoration project.

The vegetation described in more detail in section 3.0 does not meet mitigation requirements. The stem count data collected indicates high tree mortality at the sixteen vegetation plots. Woody vegetation restoration within the riparian buffer of Little Bugaboo Creek and the UT is considered unsuccessful. On the main channel five of the eleven plots were significantly disturbed because of repair activities. The plots disturbed by channel repairs were replanted, but plantings appeared concentrated closer to the channel. The disturbed conditions and planting patterns may have contributed to lower planting densities in these plots. Along the UT, four of the five plots were described as significantly wet or very wet. Only one of the wet plots has greater than 50% of the expected stems. One of the plots had a significant stand of black willows from natural regeneration. Other factors besides the repair work that could explain why the vegetation was not successful at this site include: drought/flashy flows; improper application (seeding, fertilizer, planting or timing) of vegetation seeds and stems; and mowing/grazing by cattle and farmer due to no fence in several locations. Recommendations include replanting trees to obtain mitigation requirements and controlling exotic species in the future.

The stream channel described in more detail in Section 4.0 has significant areas of bank erosion. These areas of erosion may be due to any of the following: lack of vegetation, improper installation and/or design of structures, stream design dimensionless ratios, the inner berm was not constructed as according to the plans for typical cross-sections, and overland flow/drainageways entering the stream channel. Twelve cross-sections were surveyed and pebble counts were performed at each cross-section. Two representative longitudinal profiles were surveyed along LBC and one along the UT. It is recommended that vegetation needs to be planted to help stabilize the stream banks and the major problem areas need to be watched over time to see if repair work is needed.

## **2.0 PROJECT BACKGROUND**

The background information for this report is referenced from the restoration plan conducted by Earth Tech, Inc. The following was excerpted from the 2002 Little Bugaboo Creek Stream Restoration Plan report sections 1.1 and 2.1.1.

The Wilkes County Soil and Water Conservation District (WCSWCD) staff first identified LBC as a potential restoration site through their work with farmers throughout the county. The landowners main concern at that time was the loss of valuable farmland due to actively eroding streambanks. Un-restricted cattle access to the stream and the removal of vegetation along the banks by grazing were the main causes of degradation. Lands adjacent to the streams were being

used for cattle production and the spreading of chicken litter. Prior to restoration, the pastures adjacent to the stream consisted of fescue with sparse trees along drainages. Most streambanks were vertical with little or no vegetation and were actively eroding. There were numerous signs of lateral meander migration. Prior to restoration, the main channel classified as a Rosgen 'F' type system where the channel had downcut and was eroding its banks to establish a floodplain at the new channel elevation. The existing channel appeared to be in a state of transition. Streambanks were very unstable and meanders were continuing to migrate, creating a wider floodplain as necessary to reach stability.

The combination of extreme streambank erosion, degraded vegetation, poor cattle management practices, and willing landowners made this an excellent restoration site. Restoration required determining how far the stream had departed from its natural stability and then establishing the stable form of the stream under the current hydrologic conditions within the drainage area. The restoration involved constructing a stable meander geometry, modifying channel cross-sections, and establishing a floodplain at the existing stream elevation, thus, restoring a stable dimension, pattern, and profile. This restoration was based on analysis of current watershed hydrologic conditions, field evaluation of the project site, and assessments of stable reference reaches. LBC was designed as a Rosgen type "E" channel and the UT was designed as a Rosgen type "C" channel.

A tributary to the Roaring River, Little Bugaboo Creek is located on agricultural land northeast of the town of Roaring River in Wilkes County, North Carolina (Figure 1). The headwaters of the project originate approximately 3 miles to the north-northwest of the restoration site. From the headwaters, LBC flows for approximately 4 miles before joining with Big Bugaboo Creek. An Unnamed Tributary to Little Bugaboo Creek enters LBC at the end of the project site and was included in the restoration project. The headwaters for the UT originate approximately 1.6 miles from the restoration site. From the headwaters, the UT flows for approximately 2.5 miles before the confluence with LBC. Several tributaries enter LBC along its extent.

The Priority II restoration involved increasing the existing streams length and providing a floodplain. Cross-vanes and rootwads were incorporated for aquatic habitat enhancement and bed and bank stability. A 50-foot riparian buffer on either side of the stream was planted with native vegetation.

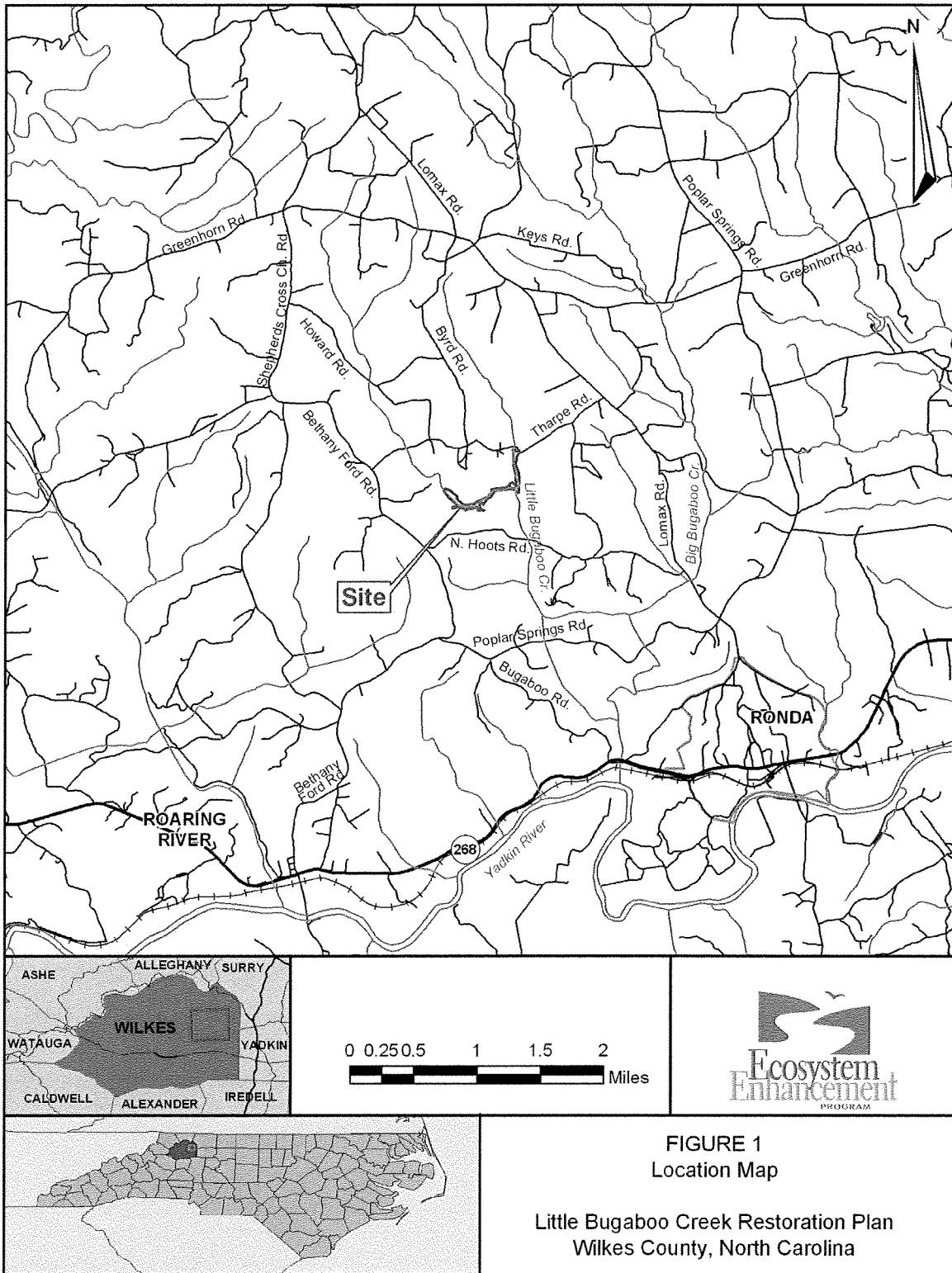
## **2.1 Project Location**

The Little Bugaboo Creek (LBC) project site is located in Wilkes County, North Carolina. Roaring River is located 7 miles east, northeast of North Wilkesboro. The project is contained within the property of five landowners. LBC flows northwest to southeast, and the UT flows north to south. The project reach is bound to the north by Tharpe Road (S.R. 2014) and to the south by Hoots Road (S.R. 1924).

### *Directions to Little Bugaboo Creek Stream Restoration*

Between Yadkinville and Wilkesboro off of Highway 421 West turn onto Red, White, and Blue Road. Follow Red, White, and Blue Road to the stop sign at Old NC 60 road (Mathis Mill Road). Turn left at the stop sign and follow Old NC 60 about 200 yards and turn right on Roaring River Road. (Note: this section of road is currently being realigned. In future Mathis and Roaring River Road will be joined.) Old NC 60 crosses over the Roaring River and railroad tracks then at a t-intersection with Highway 268 turn right. After 200 yards turn left onto White Plains Road.

Follow White Plains Road for about 3 miles then turn right onto North Hoots Road. After 200 yards turn left into driveway with chicken houses (Woody Farms).



**FIGURE 1**  
**Location Map**  
**Little Bugaboo Creek Restoration Plan**  
**Wilkes County, North Carolina**

## 2.2 Goals and Objective

Little Bugaboo Creek was enhanced/restored through the North Carolina Ecosystem Enhancement Program (NCEEP). Exhibit Table I and Table II summarizes the goals and objectives of the project.

<b>Exhibit Table I. Project Structure Table</b>	
<b>Project Number and Name: SCO# 00-5327-01A (LBC/UT)</b>	
<b>Segment/Reach ID</b>	<b>Linear Feet</b>
Little Bugaboo Creek	4,276 lf
UT to Little Bugaboo	1,954 lf

<b>Exhibit Table II. Project Objectives Table</b>			
<b>Project Number and Name: SCO# 00-5327-01A (LBC/UT)</b>			
<b>Segment/Reach ID</b>	<b>Objectives</b>	<b>Linear Feet or Acreage</b>	<b>Comment</b>
Little Bugaboo Creek	Restore 4,276.4 linear feet of Little Bugaboo Creek (as measured along the thalweg)	4,276 lf	
	Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load		
	Improve water quality and reduce further property loss by stabilizing eroding stream banks		
	Reconnect the stream to its floodplain or establish a new floodplain at a lower elevation		
	Improve aquatic habitat with the use of natural material stabilization structures such as root wads, rock vanes, woody debris and a riparian buffer		
	Provide aesthetic value, wildlife habitat and bank stability through the creation or enhancement of a riparian zone		
UT to Little Bugaboo Creek	Restore 1,954 linear feet along the tributary (as measured along the thalweg);	1,954 lf	
	Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load		
	Improve water quality and reduce further property loss by stabilizing eroding stream banks		
	Reconnect the stream to its floodplain or establish a new floodplain at a lower elevation		
	Improve aquatic habitat with the use of natural material stabilization structures such as root wads, rock vanes, woody debris and a riparian buffer		
	Provide aesthetic value, wildlife habitat and bank stability through the creation or enhancement of a riparian zone		

## 2.3 Project History and Background

The Little Bugaboo Creek restoration site begins approximately 4,420 feet from the confluence of LBC and UT. The project also includes the restoration of 1,954 feet of an unnamed tributary (UT). The project is located within the property boundaries of five different landowners. LBC flows from northwest to southeast through a 200 to 400-foot wide floodplain that narrows to less than 100-feet for the last 1,500-feet of the project. The UT flows from north to south through a 100 to 150-foot wide valley. The UT is much straighter than LBC, although both show signs of increasing their sinuosity over time.

Historically, a mill and dam were located about 150-feet below the confluence of LBC and UT. The milldam backed up water within approximately half of the project length (believed to be about elevation 1,107 feet). Both streams had incised down to bedrock through the alluvial sediments of the historic pond. The dam was removed near the beginning of the 20<sup>th</sup> century. It is not known when the dam was constructed.

Landuse throughout the restoration site is predominantly agricultural land presently being used for cattle production and the spreading of chicken litter. Fences within the project area divide pastureland but did not restrict cattle access to the streams and drainages for a majority of the site prior to restoration. LBC is bound upstream and downstream by bedrock outcroppings that result in significant (greater than 10-feet of fall) waterfalls. The UT is bound upstream by an outcropping of bedrock and downstream by the confluence with LBC. The lower 1,600 feet of LBC and 450 feet of the UT did have fencing along one side of each respective stream prior to restoration, which restricted cattle access.

The causes of impairment throughout the restoration site were:

- Cattle access to the stream and riparian areas;
- Incision partially due to aggradation of material from the historic milldam below the end of the project limits;
- Indications of previous channelization along the reach; and
- Removal of riparian vegetation.

Cattle access to the stream and riparian areas directly resulted in streambank erosion prior to restoration. Continual grazing limited the ability of vegetation to reestablish itself along the majority of the stream. Dense rooting vegetation along the stream banks was extremely sparse for large lengths of the stream. Additional degradation resulted from historic channelization of the streams and tributaries. In an effort to maximize available land for chicken litter spreading, landowners had straightened sections of LBC. This increased the channel slope and significantly modified the channel dimension, pattern, and profile. The downstream portions of both reaches were deeply incised partially due to the alluvial sediments that deposited during the existence of the downstream milldam. After the milldam was removed, a head cut worked up from the mill site through the deposited sediments.

Exhibit Table III summarizes the project activity with the year of planned completion and actual completion. This table will need to be updated for each additional year of monitoring after year 1. Exhibit Table IV gives the project contact information for designer, contractors, and who performed the monitoring. Exhibit Table V summarizes the background information for the project. The design involved a Priority Level II restoration and LBC and the UT were designed to be a Rosgen stream type "C". Figures 2a-2e detail the proposed plan view for the streams



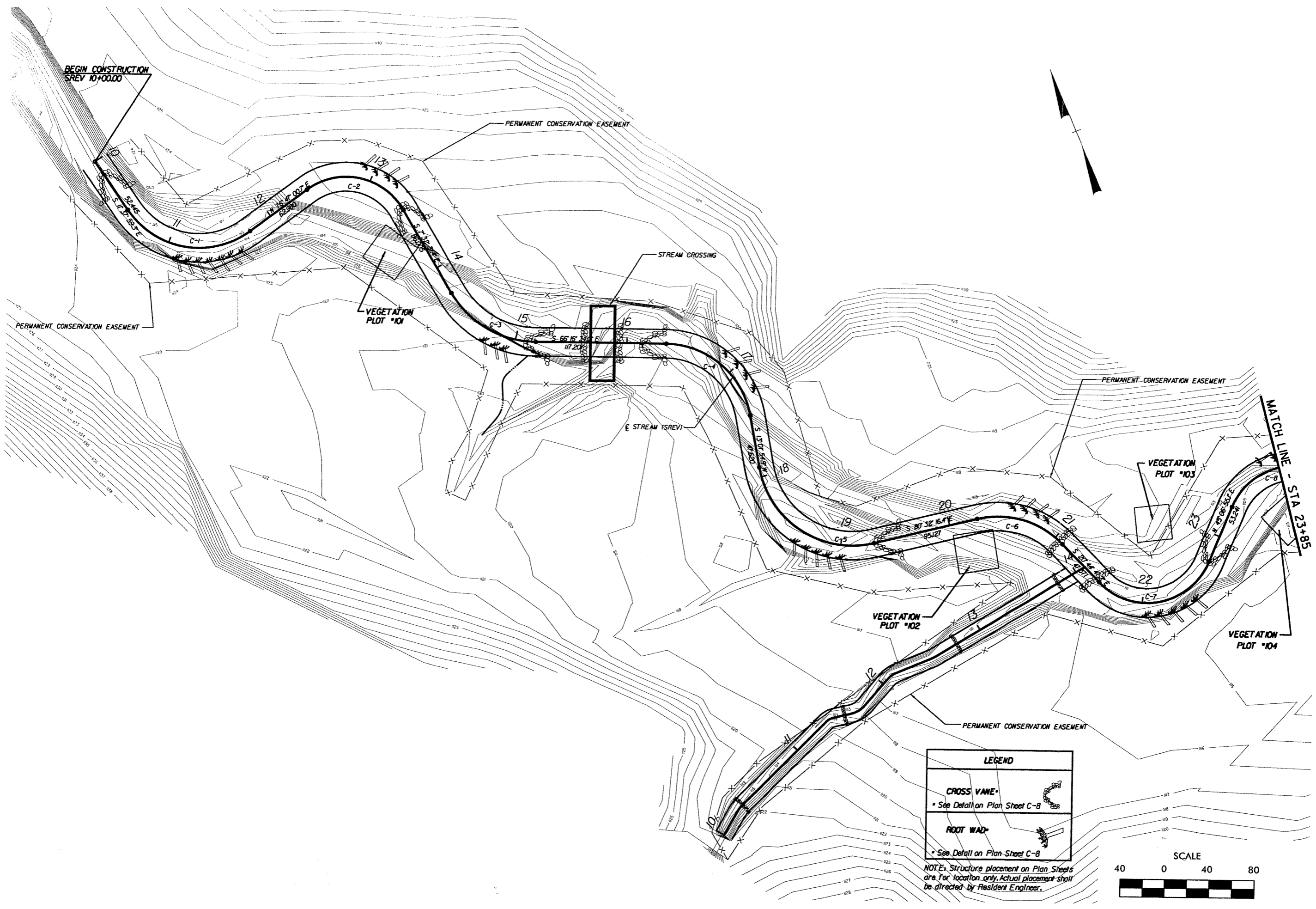
pattern and locations of structures for the original design and the repair work completed on LBC and the UT.

<b>Exhibit Table III. Project Activity and Reporting History</b>		
<b>Project Number and Name: SCO# 00-5327-01A (LBC and UT)</b>		
<b>Activity or Report</b>	<b>Calendar Year of Completion of Planned Completion</b>	<b>Actual Completion Date</b>
Restoration Plan	2002	2002
Mitigation Plan	2005	2005
Construction	2003	2003/2004
Temporary S&E mix applied to entire project area	2003/2004	2003/2004
As-Built Report	2004	2005
Permanent seed mix applied	2004	2004
Containerized and B&B plantings	2004	2004
Structural maintenance	2004	2004
Initial - Year 1 Monitoring	2004	2005
Year 2 Monitoring	2006	
Year 3 Monitoring	2007	
Supplemental Planting of containerized material		
Year 4 Monitoring	2008	
Year 5 Monitoring	2009	

<b>Exhibit Table IV. Project Contact Table</b>	
<b>Project Number and Name: SCO# 00-5327-01A (LBC and UT)</b>	
<b>Designer POC</b>	Earth Tech of NC, Inc 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 Jan Patterson P.E. 919-854-6246
<b>Construction Contractor POC</b>	Dixie Grading and Equipment Company 5228 W. US HWY 421 Wilkesboro, NC 28697 Randall Miles 336-973-7281
<b>Planting Contractor POC</b>	Carolina Environmental P.O. Box 99 Booneville, NC 277 Joanne Cheetam 919-868-2807
<b>Seeding Contractor POC</b>	Carolina Environmental P.O. Box 99 Booneville, NC 277 Joanne Cheetam 919-868-2807
Seed Mix Sources	Unknown
Nursery Stock Suppliers	Unknown
<b>Monitoring Performers</b>	Earth Tech of NC, Inc
Stream Monitoring	Amanda Todd 919-854-6251
Vegetation Monitoring	George Lankford 919-854-6248

<b>Exhibit Table V. Project Background</b>	
<b>Project Number and Name: SCO# 00-5327-01A (LBC and UT)</b>	
Project County	Wilkes
Drainage Area	3.45/1.4
Drainage impervious cover estimate (%)	2%
Stream Order	2nd/1st
Physiographic Region	Piedmont (foothills)
Ecoregion	N. Inner Piedmont
Rosgen Classification of As-Built	C
Cowardin Classification	Riverine
Dominant Soil Types	Chewacla and Rion
Reference site ID	Basin Creek
USGS HUC for Project	03040101
USGS HUC for Reference	05050001
NCDWQ Sub-basin for Project	030701
NCDWQ Sub-basin for Reference	030701
NCDWQ Classification for Project	C
NCDWQ Classification for Reference	UNKNOWN
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
% of project easement fenced	50%

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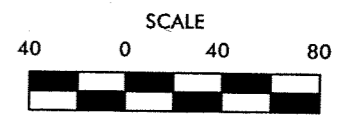


**LEGEND**

**CROSS VANE**  
 • See Detail on Plan Sheet C-8

**ROOT WAD**  
 • See Detail on Plan Sheet C-8

NOTE: Structure placement on Plan Sheets are for location only. Actual placement shall be directed by Resident Engineer.



NO	REVISIONS	DATE	CHK	DATE

**EARTHTECH**

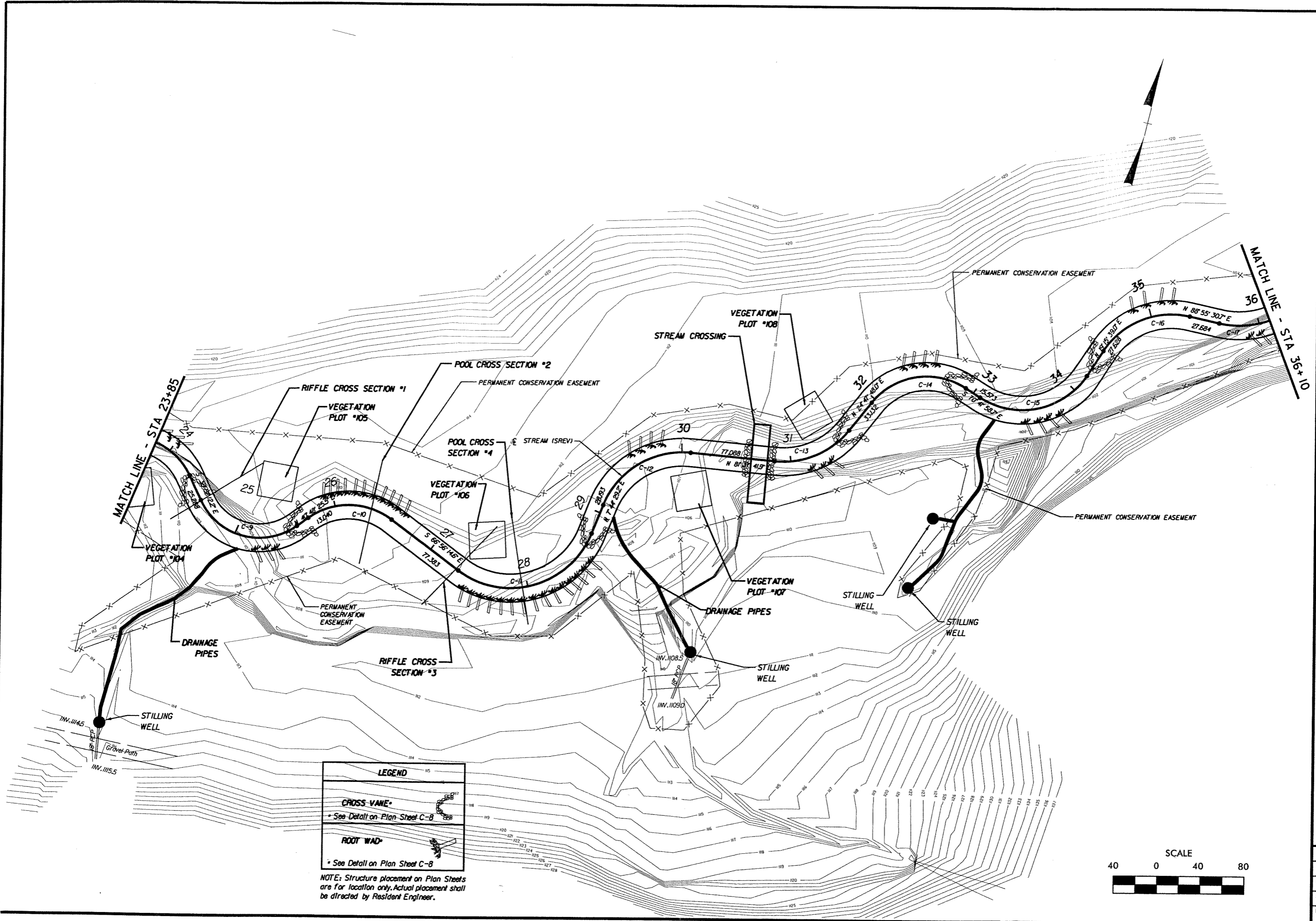
701 Corporate Center Drive, Suite #475, Raleigh, NC 27607  
 Phone: (919) 854-6200 Fax: (919) 854-6259

LITTLE BUGABOO CREEK STREAM MONITORING  
 WILKES COUNTY  
 ECOSYSTEM ENHANCEMENT PROGRAM


PLAN VIEW OF AS-BUILT CONDITIONS  
 AND MONITORING  
 FIGURE 2A


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PROJECT NO	53675
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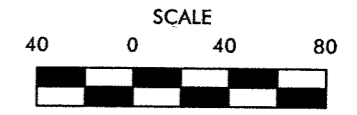


**LEGEND**

**CROSS-VANE**   
 • See Detail on Plan Sheet C-8

**ROOT WAD**   
 • See Detail on Plan Sheet C-8

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NO	REVISIONS	CHK	DATE

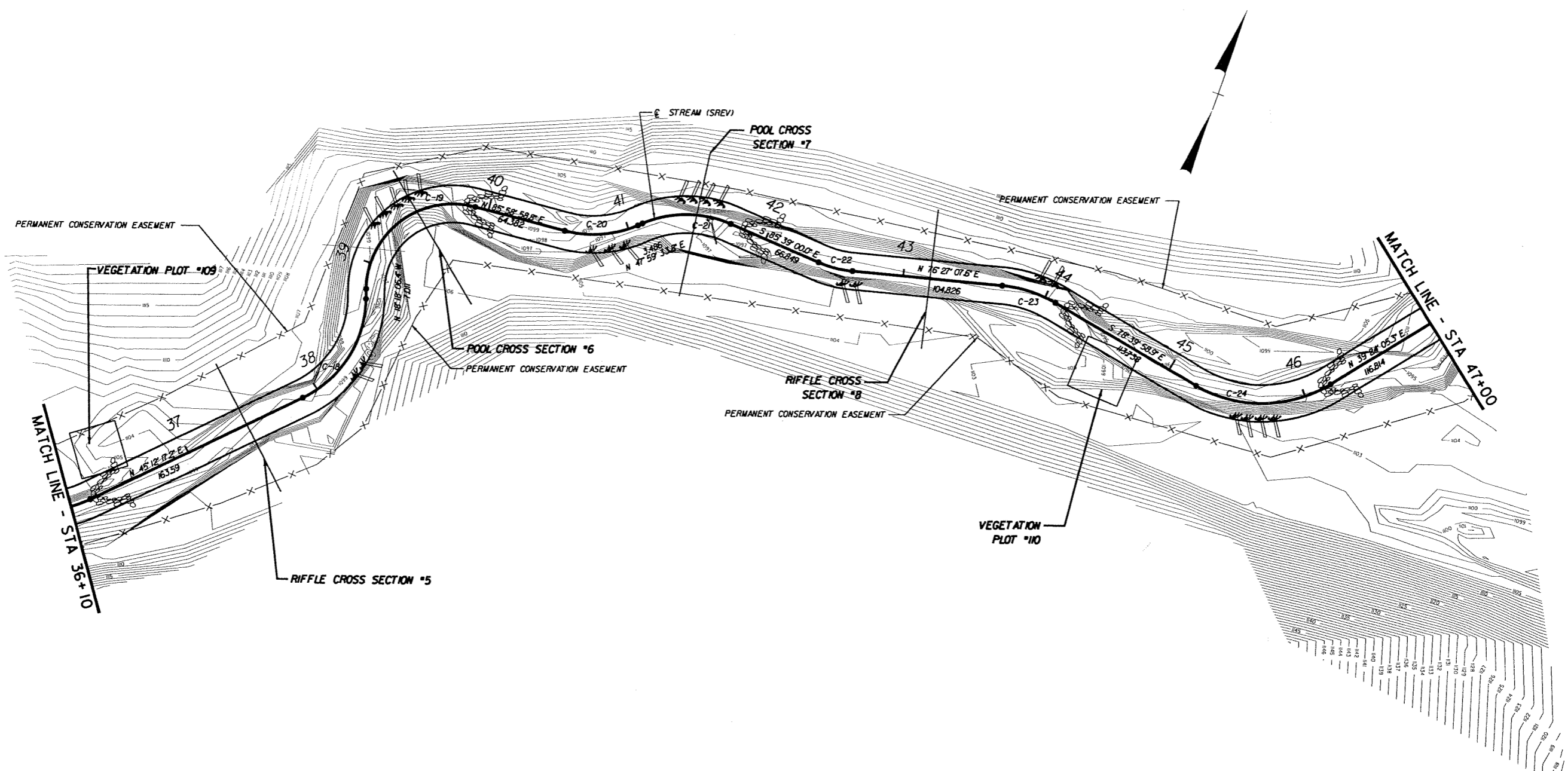
**EARTHTECH**

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LITTLE BUGABOO CREEK STREAM MONITORING  
 WILKES COUNTY  
 ECOSYSTEM ENHANCEMENT PROGRAM


PLAN VIEW OF AS-BUILT CONDITIONS  
 AND MONITORING  
 FIGURE 2B

DATE 02/11/2005  
 PROJECT NO 53675  
 FILENAME  
 SHEET NO  
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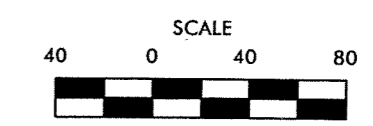


**LEGEND**

**CROSS VANE**   
 • See Detail on Plan Sheet C-8

**ROOT WAD**   
 • See Detail on Plan Sheet C-8


NOTE: Structure placement on Plan Sheets are for location only. Actual placement shall be directed by Resident Engineer.



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**EARTHTECH**



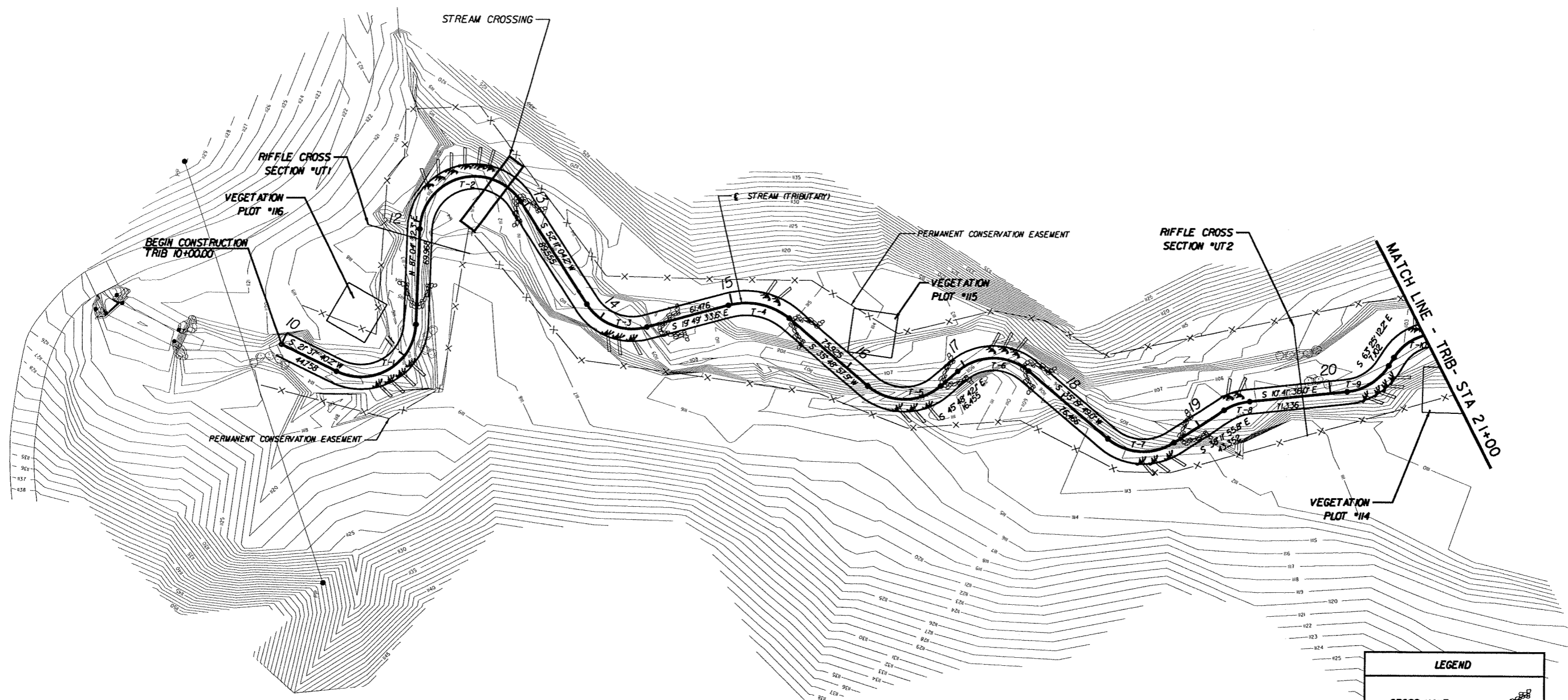
701 Corporate Center Drive, Suite #475, Raleigh, NC 27607  
 Phone: (919) 854-6200 Fax: (919) 854-6259

LITTLE BUGABOO CREEK STREAM MONITORING  
 WILKES COUNTY  
 ECOSYSTEM ENHANCEMENT PROGRAM

PLAN VIEW OF AS-BUILT CONDITIONS  
 AND MONITORING  
 FIGURE 2C

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FILENAME	
SHEET NO	
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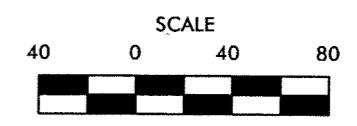


**LEGEND**

**CROSS VANE**  
 \* See Detail on Plan Sheet C-8

**ROOT WAD**  
 \* See Detail on Plan Sheet C-8

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 WILKES COUNTY  
 ECOSYSTEM ENHANCEMENT PROGRAM


PLAN VIEW OF AS-BUILT CONDITIONS  
 AND MONITORING  
 FIGURE 2D

DATE	02/11/2005
PROJECT NO	53675
FILENAME	
SHEET NO	
DRAWN BY	CRB

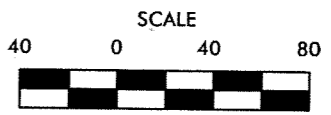
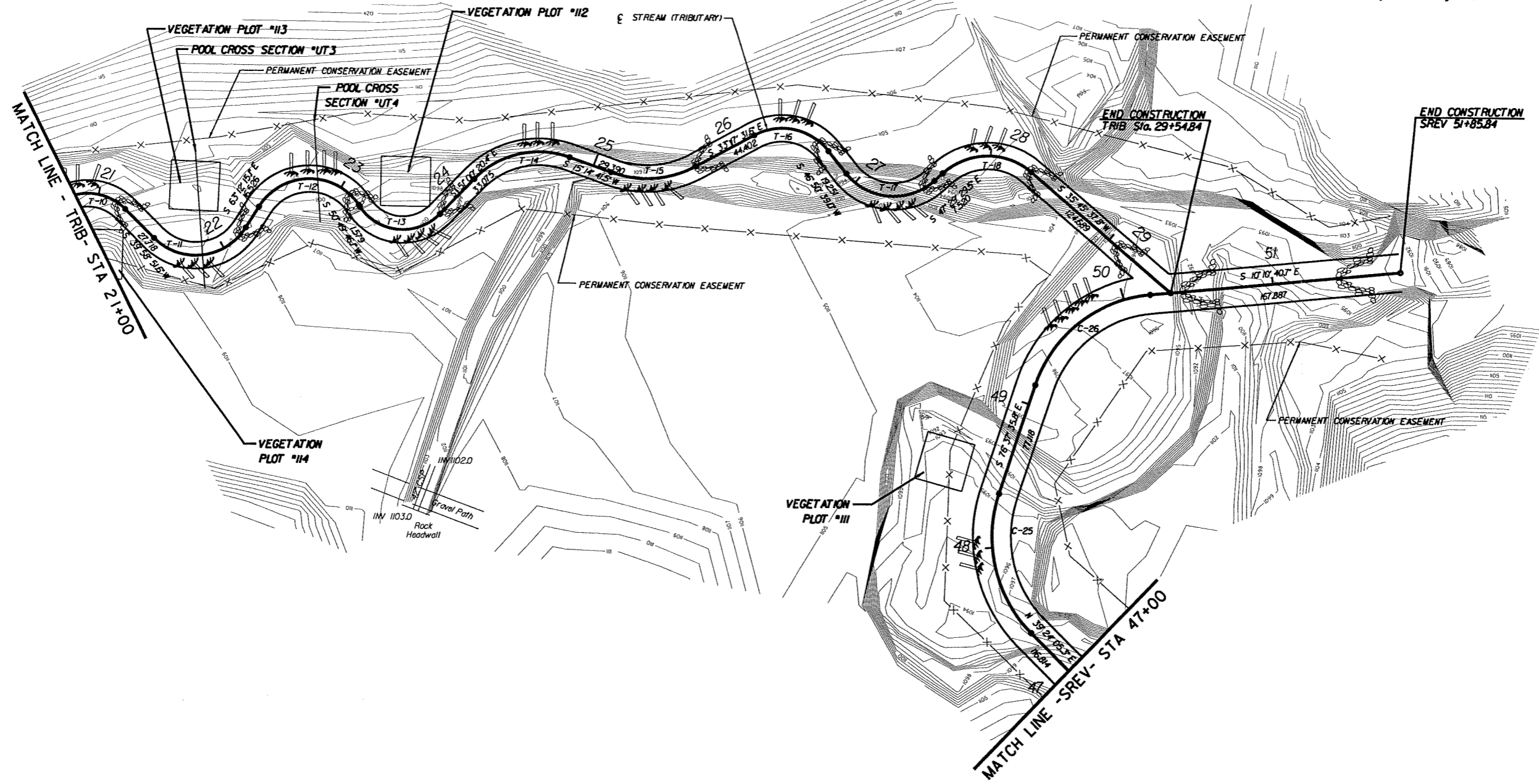


**LEGEND**

**CROSS VANE**   
\* See Detail on Plan Sheet C-8

**ROOT WAD**   
\* See Detail on Plan Sheet C-8


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PLAN VIEW OF AS-BUILT CONDITIONS  
AND MONITORING  
FIGURE 2E

DATE	02/11/2005
PROJECT NO	53675
FILENAME	
SHEET NO	
DRAWN BY	CRB

### 3.0 VEGETATION CONDITIONS AND MONITORING RESULTS

Year 1 monitoring in 2005 and as-built results are described in detail within the following sections for vegetation results for Little Bugaboo Creek and the UT. Section 3.1 discusses the vegetation monitoring, Section 3.2 discusses soil conditions, Section 3.3 describes the vegetation problem areas with summary tables and plan views that is followed in Section 3.4 with results and discussions. One figure (Figure 3a-e) was used to describe the problem areas with the stream and vegetation since the eroded streambanks were at least partially due to a lack of vegetation.

#### 3.1 Vegetation Monitoring Protocol

The following describes the results of the 2005 as-built vegetation monitoring conducted at the Little Bugaboo Creek Stream Restoration Site. Sampling and analysis methods follow guidelines issued by North Carolina Department of Environment and Natural Resources Ecosystem Enhancement Program (EEP Version 2/21/05).

Stem counts were conducted on 16 representative plots placed throughout the entire site, 11 plots along the main channel and 5 plots along the tributary. All plot sizes are 10m x 10m (32.8 feet x 32.8 feet). A total area of 1,600 square meters was sampled at this site for 5% of the site. Two opposite corners were permanently marked with metal conduit (Figure 2a-e). No contiguous plot configurations were used. Stems were counted only for planted and transplanted woody vegetation within each plot. For shrubby species with multiple branching stems, the base is considered one stem. Trees with two or more main stems branching from the base or near the ground are considered one stem.

Initial stem counts were conducted on April 4-5, 2005. All woody stems in plots were marked with orange survey flagging. Some difficulty was encountered in identifying species because of lack of leaves and small and/or damaged stems. Characteristic buds were often difficult to identify.

#### 3.2 Soil Data

Preliminary soil data was taken from the Soil Survey of Wilkes County North Carolina (1997).

Exhibit Table VI. Preliminary Soil Data					
Series	Max Depth (in.)	% Clay in Surface Horizon	K	T	OM % (Surface)
CkA - <i>Chewacla</i> loam - 0 to 2% frequently flooded	60	10 - 25	5	5	1 - 4
RnE - <i>Rion</i> fine sandy loam -- 15 to 20% slope	40 (over saprolite)	5 - 20	3	3	0.5 - 2



### 3.2 Vegetative Problem Areas

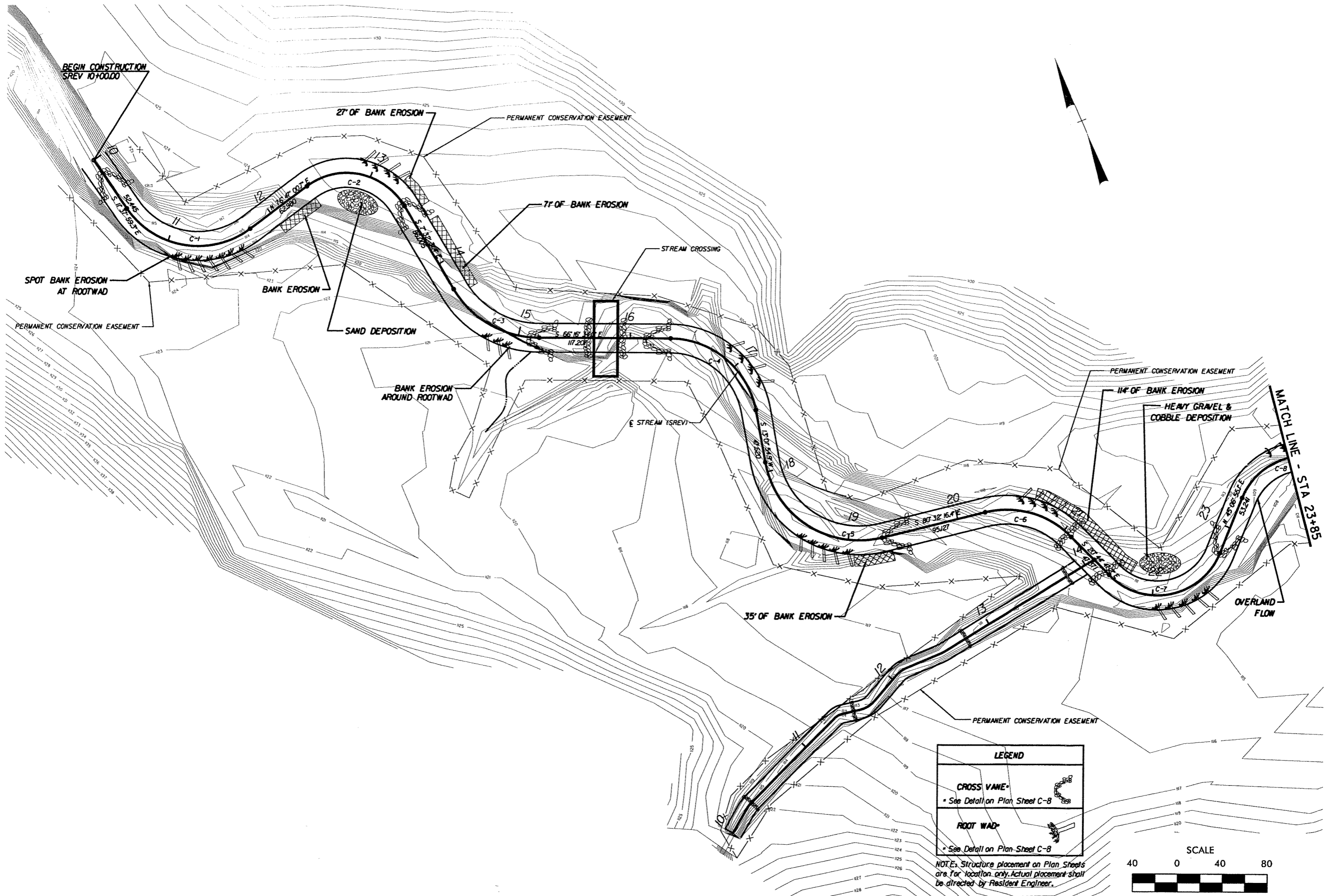
There were numerous areas throughout the project on LBC that lacked vegetation on the banks. The UT had only a few minor problem areas. Exhibit Table VII describes the vegetative problem areas (which also correspond to the stream bank erosion areas) with the approximate station number or distance, probable cause, and photo number. Exhibits 3a-e show the problem area reference to station numbers and Appendix A gives photo numbers.

<b>Exhibit Table VIIa. Vegetative Problem Areas Little Bugaboo Creek*</b>			
Project Number and Name: SCO# 00-5327-01A (Little Bugaboo Creek)			
Feature/Issue	Station #/Range	Probable Cause	Photo #
<b>Bare Bank</b>	11+00	rootwads	1
	12+00	stormflow convergence	2
	13+50-14+50	stormflow convergence	3
	19+25	back eddy below cross-vane	4
	20+90-22+00	back eddy behind rootwads and incoming flow from tributary	5
	24+50	unknown	6
	25+00	overland flow/small drainageway	7
	25+50	cross-vane	8
	29+00	overland flow	9
	33+30	eroding drainageway, overland flow	10
	36+00	unknown	11
	36+50	cross vane	12
	46+25	cross-vane	13
	51+00	overland flow/cross vane	14
<b>Bare Bench</b>			
<b>Bare Floodplain</b>	3,676 lf	Unknown	
<b>Invasive/Exotic Populations</b>			

\*In general, banks, bars, and floodplain are lacking significant vegetation. However, vegetation between station 40+00 and 46+00 is relatively stable due to minimal disturbance during construction.

<b>Exhibit Table VIIb. Vegetative Problem Areas UT to Little Bugaboo Creek</b>			
Project Number and Name: SCO# 00-5327-01A (UT Little Bugaboo Creek)			
Feature/Issue	Station #/Range	Probable Cause	Photo #
<b>Bare Bank</b>	15+25	Overland flow and eddies around rootwads	2
	17+80	Erosion below cross-vane, angle of vane	3
	23+80	Erosion upstream of vane, tight bend	4
<b>Bare Bench</b>			
<b>Bare Floodplain</b>			
<b>Invasive/Exotic Populations</b>			

DATE: \$DATE\$  
 TIME: \$TIME\$  
 USER: \$USER\$  
 DGN: \$DGN\$

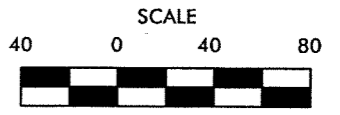


**LEGEND**

**CROSS VANE**  
 • See Detail on Plan Sheet C-8

**ROOT WAD**  
 • See Detail on Plan Sheet C-8

NOTE: Structure placement on Plan Sheets are for location only. Actual placement shall be directed by Resident Engineer.



NO	REVISIONS	DRN	CHK	DATE

**EARTHTECH**

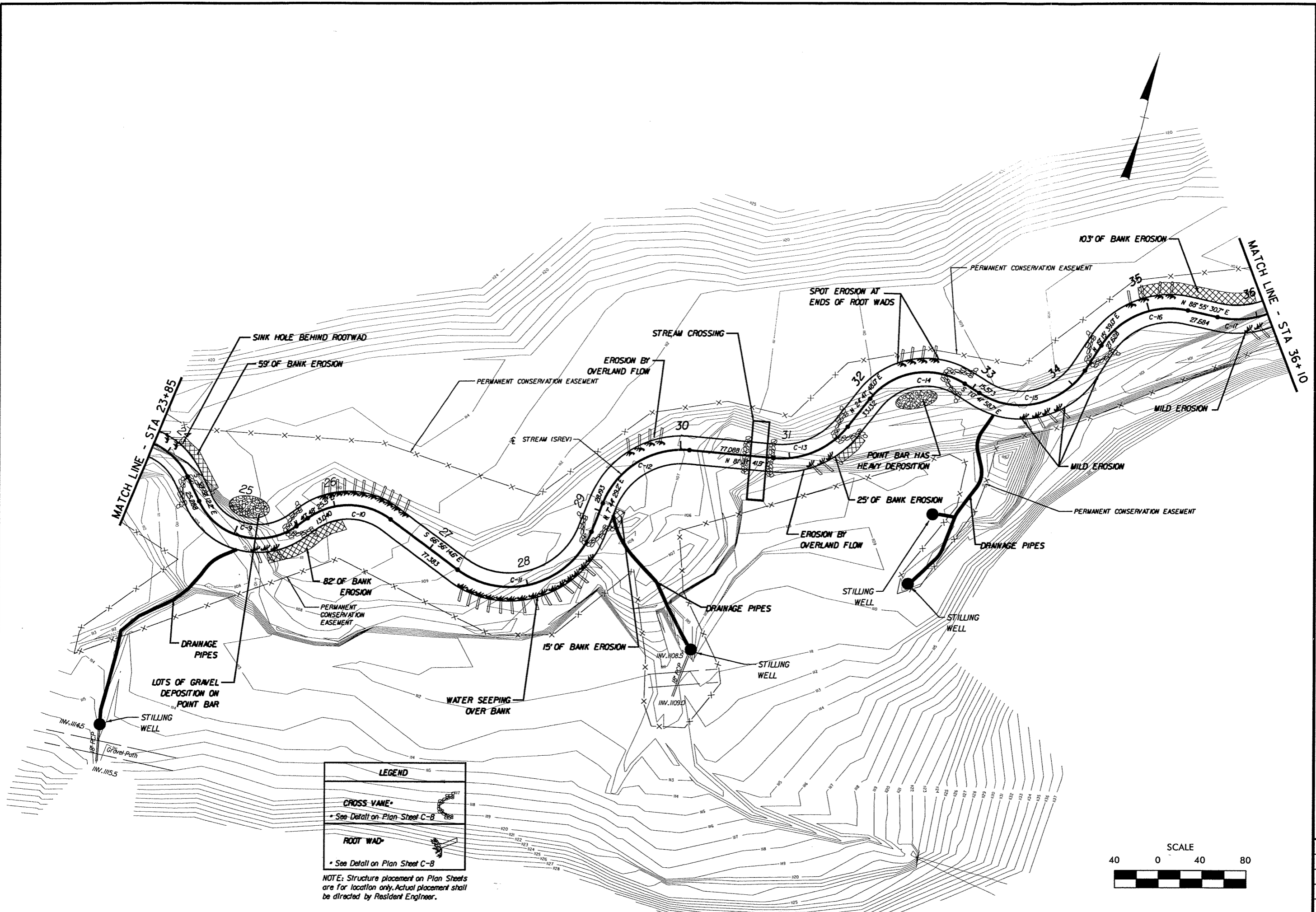
701 Corporate Center Drive, Suite 475, Raleigh, NC 27607  
 Phone: (919) 854-6200 Fax: (919) 854-6259

LITTLE BUGABOO CREEK STREAM MONITORING  
 WILKES COUNTY  
 ECOSYSTEM ENHANCEMENT PROGRAM

PROBLEM AREAS PLAN VIEW  
 FIGURE 3A

DATE: 02/11/2005  
 PROJECT NO: 53675  
 FILENAME:  
 SHEET NO:  
 DRAWN BY: CRB

DATE: 02/11/2005  
 TIME: 11:55 AM  
 USER: JLM  
 CON: JLM  
 DATE: 02/11/2005  
 TIME: 11:55 AM  
 USER: JLM  
 CON: JLM

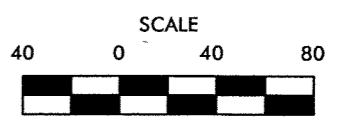


**LEGEND**

**CROSS-VANE**  
 • See Detail on Plan Sheet C-B

**ROOT WAD**  
 • See Detail on Plan Sheet C-B

NOTE: Structure placement on Plan Sheets are for location only. Actual placement shall be directed by Resident Engineer.



NO.	REVISIONS	CHK	DATE

**EARTHTECH**

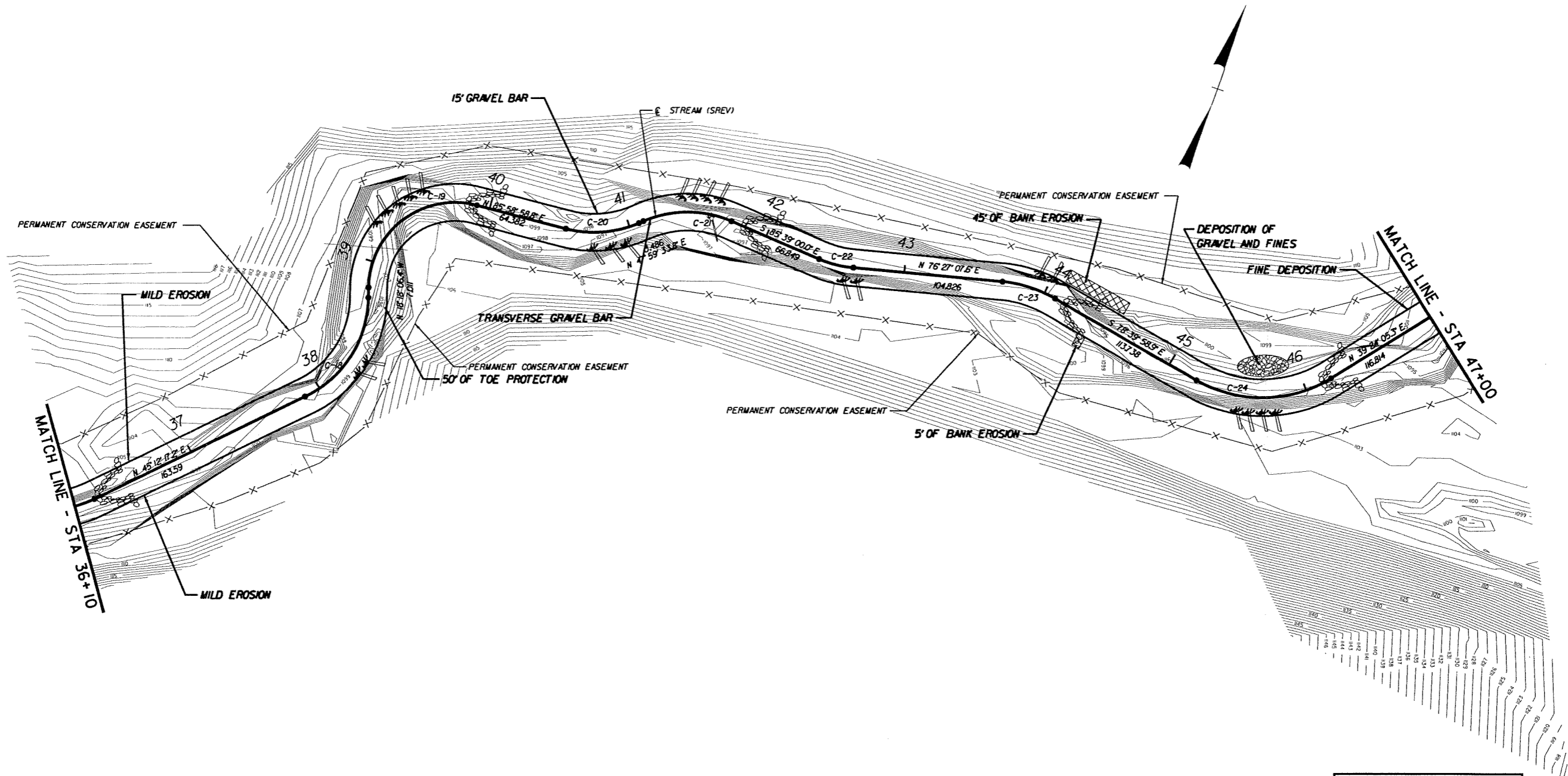
701 Corporate Center Drive, Suite 475, Raleigh, NC 27607  
 Phone: (919) 854-6200 Fax: (919) 854-6259

LITTLE BUGABOO CREEK STREAM MONITORING  
 WILKES COUNTY  
 ECOSYSTEM ENHANCEMENT PROGRAM


PROBLEM AREAS PLAN VIEW  
 FIGURE 3B


DATE	02/11/2005
PROJECT NO	53675
FILENAME	
SHEET NO	
DRAWN BY	CRB

USER: \$\$\$USER\$\$\$  
 DATE: \$\$\$DATE\$\$\$  
 TIME: \$\$\$TIME\$\$\$

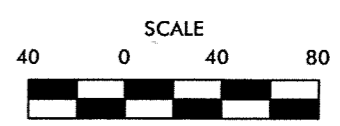


**LEGEND**

**CROSS VANE**   
 \* See Detail on Plan Sheet C-8

**ROOT WAD**   
 \* See Detail on Plan Sheet C-8

NOTE: Structure placement on Plan Sheets are for location only. Actual placement shall be directed by Resident Engineer.



NO	REVISIONS	CHK	DATE

**EARTHTECH**

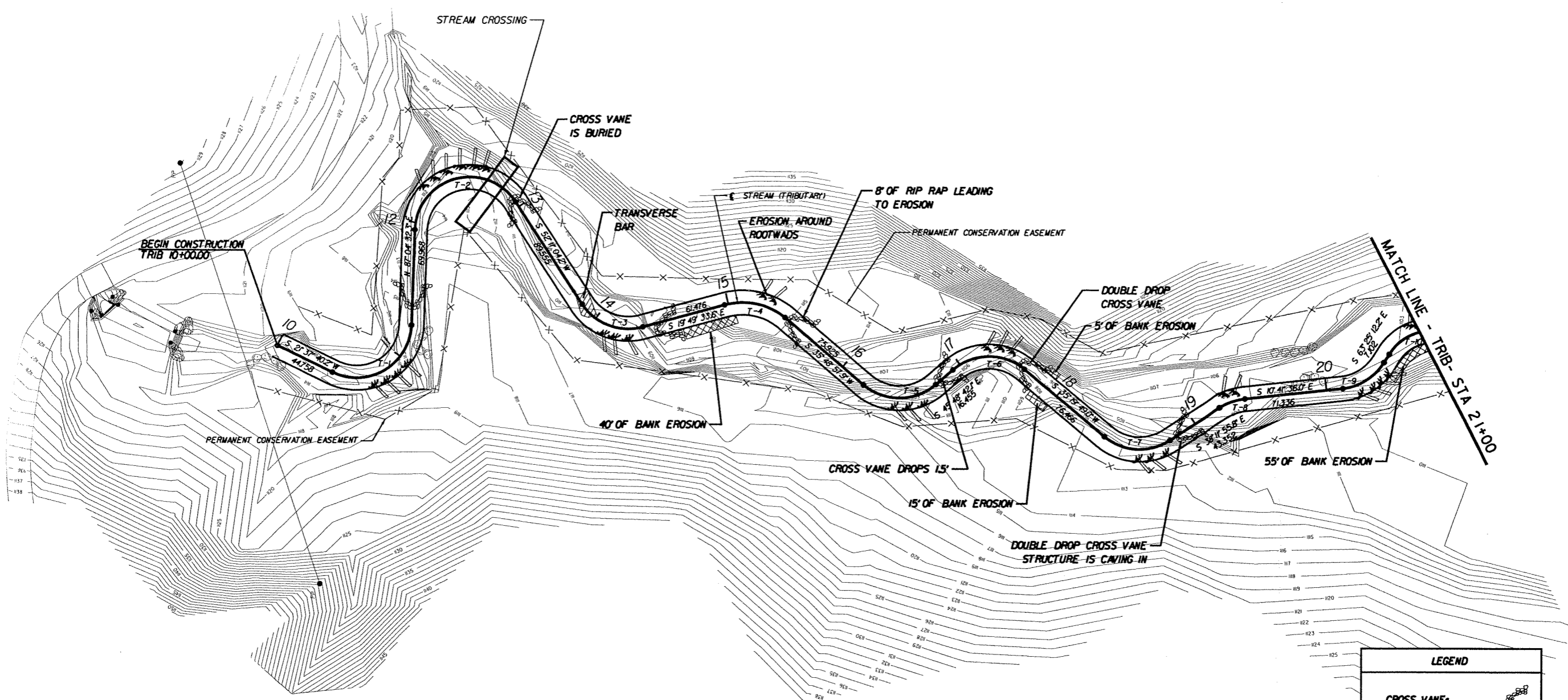
701 Corporate Center Drive, Suite #475, Raleigh NC 27607  
 Phone: (919) 854-6200 Fax: (919) 854-6259

LITTLE BUGABOO CREEK STREAM MONITORING  
 WILKES COUNTY  
 ECOSYSTEM ENHANCEMENT PROGRAM

PROBLEM AREAS PLAN VIEW  
 FIGURE 3C

DATE: 02/11/2005  
 PROJECT NO: 53675  
 FILENAME:  
 SHEET NO:  
 DRAWN BY: CRB

USER: \$\$\$USER\$\$\$  
 DATE: \$\$DATE\$\$  
 TIME: \$\$TIME\$\$

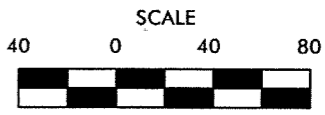


**LEGEND**

**CROSS VANE** -   
 \* See Detail on Plan Sheet C-8

**ROOT WAD** -   
 \* See Detail on Plan Sheet C-8

NOTE: Structure placement on Plan Sheets are for location only. Actual placement shall be directed by Resident Engineer.



NO.	REVISIONS	CHK	DATE

**EARTHTECH**

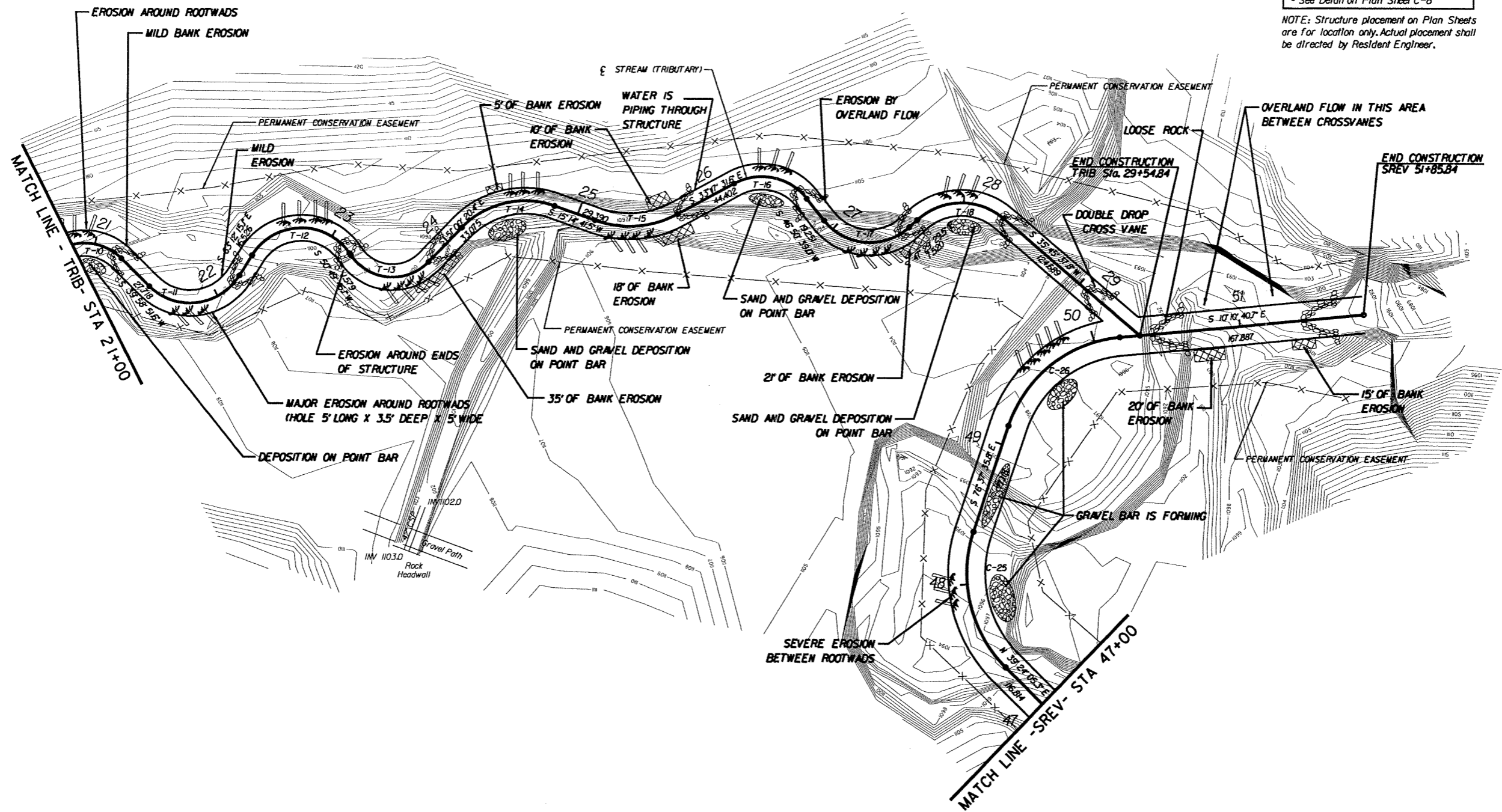
701 Corporate Center Drive, Suite #475, Raleigh NC 27607  
 Phone: (919) 854-6200 Fax: (919) 854-6259

LITTLE BUGABOO CREEK STREAM MONITORING  
 WILKES COUNTY  
 ECOSYSTEM ENHANCEMENT PROGRAM


PROBLEM AREAS PLAN VIEW  
 FIGURE 3D


DATE	02/11/2005
PROJECT NO	53675
FILENAME	
SHEET NO	
DRAWN BY	CRB

DATE: \$\$DATE\$\$  
 TIME: \$\$TIME\$\$  
 USER: \$\$USER\$\$  
 PGN: \$\$PGN\$\$

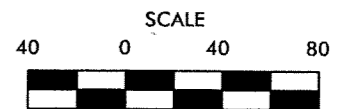


**LEGEND**

**CROSS VANE**   
 \* See Detail on Plan Sheet C-8

**ROOT WAD**   
 \* See Detail on Plan Sheet C-8

NOTE: Structure placement on Plan Sheets are for location only. Actual placement shall be directed by Resident Engineer.



**EARTHTECH**

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 Phone: (919) 854-6200 Fax: (919) 854-6259

LITTLE BUGABOO CREEK STREAM MONITORING  
 WILKES COUNTY  
 ECOSYSTEM ENHANCEMENT PROGRAM

PROBLEM AREAS PLAN VIEW  
 FIGURE 3E

DATE	02/11/2005
PROJECT NO	53675
FILENAME	
SHEET NO	
DRAWN BY	CRB

NO	REVISIONS	CHK	DATE

### 3.3 Stem Counts

The stem count indicates high tree mortality across the site (Exhibit Table VIII). The planting plan indicated a planting density of 800 stems per acre (200 canopy, 300 sub canopy, and 300 shrubs). The plots average only 50 % of the expected density and many plots were significantly lower. Plot 113 had 10 % of the specified density. Only two plots have greater than 80 % of the specified density, one located along the main channel and one along the tributary. A total of eight tree species and four shrub species were observed.

### 3.4 Vegetation Plot Photos

A representative photo of each plot was taken at the time of the stem count (Appendix A). Each photo was taken from the downstream corner closest to the channel and facing toward the opposite corner.

### 3.5 Results and Discussion

Woody vegetation restoration within the riparian buffer of Little Bugaboo Creek and the UT is considered unsuccessful. On the main channel, five of the eleven plots were significantly disturbed because of repair activities. Another contained 30% bare soil and may have been mowed by the farmer recently. The plots disturbed by channel repairs were replanted, but plantings appeared concentrated closer to the channel. The disturbed conditions and planting patterns may have contributed to lower planting densities in these plots. All but one of the plots along the main channel had less than expected densities for both disturbed and undisturbed areas. This plot is significantly sheltered by a clump of trees and by the steeper slope to the south. Although the smallest seedlings were considered to be from natural regeneration, it is possible that some counted stems were also from seed regeneration.

Along the tributary, four of the five plots were described as significantly wet or very wet. Only one of the wet plots has greater than 50% of the expected stems. The source of moisture appears to be toe slope seepage. The wet plots are all dominated by common rush (*Juncus effusus*) and sedges (*Carex* spp). Plot 112 has a significant stand of black willow from natural regeneration.

Three tree species counted were observed only along LBC and not in the plots along the UT. These species include box elder (*Acer negundo*), serviceberry (*Amelanchier arborea*), and American holly (*Ilex opaca*). Of the trees present, green ash (*Fraxinus pennsylvanica*) and sycamore (*Platanus occidentalis*) were the most common having greater than 10% of the total planted. The most common shrubs, tag alder (*Alnus serrulata*) and red chokeberry (*Aronia arbutifolia*) were the most common but were less than 10% of the total planted. Invasive plant species on the site included privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*). Neither species were observed in more than two plots and at low densities. Both are of concern due to their potential for prolific spreading and degradation of habitat. Adjacent to the tributary along the existing pasture edge is a dense border of privet. This will provide an ongoing source of seeds to invade this site.

Recommendations include replanting trees to obtain mitigation requirements. Natural regeneration can obviously play an important role in the restoration of this site; however, more trees are needed to meet mitigation requirements. Although invasive vegetation is not currently a problem, the potential for rapid invasion of exotics is present. Upstream and adjacent to the site are large populations of privet.

		Exhibit Table VIII. Stem Counts for each species arranged by plot																Initial Totals	Year 1 Totals	Survival %
Species		Plots																		
		Main Channel										Tributary								
		101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116			
<b>Shrubs</b>																				
<i>Alnus serrulata</i>	Tag Alder				1		1			1		4	4	1			4	16		
<i>Viburnum nudum</i>	Possumhaw Viburnum		2	3	1	1			1	1		1					2	12		
<i>Sambucus canadensis</i>	Elderberry		2		1				1			1		1		2		8		
<i>Aronia arbutifolia</i>	Red Chokeberry					1			2	2	3	3			2			13		
<b>Trees</b>																				
<i>Acer negundo</i>	Box Elder	1									3							4		
<i>Amelanchier arborea</i>	Serviceberry	1		2	1		1	1	1									7		
<i>Diospyros virginiana</i>	Persimmon			3		1			1	1					2			8		
<i>Ilex opaca</i>	American Holly			2														2		
<i>Quercus alba</i>	White Oak		2		1	1	1	1	1				1		1		4	13		
<i>Fraxinus pennsylvanica</i>	Green Ash	1	2	1	3	3	2	1			7	1	1		1	1	2	26		
<i>Juglans nigra</i>	Black Walnut	1	1	2	3	1			1	1	1					2	1	14		
<i>Platanus occidentalis</i>	Sycamore	5	3	1		2	1	1	2	1	5	2	7		1		7	38		
	<b>Total Stems of planted Woody vegetaion.</b>	9	12	14	11	10	6	4	10	7	19	12	13	2	7	5	20	161		
	percent of expected*	0.45	0.60	0.70	0.55	0.50	0.30	0.20	0.50	0.35	0.95	0.60	0.65	0.10	0.35	0.25	1.00	Average	0.50	
	current density stems/ac	365	486	567	446	405	243	162	405	283.5	770	486	527	81	284	203	810	Average	408	

\* based on 20 expected stems per plot (800 stems per acres)



## 4.0 STREAM CONDITIONS AND MONITORING RESULTS

The restored channels dimension, pattern, profile, and substrate were examined during the 2005 as-built survey and year 1 monitoring period in April 2005. The monitoring protocol is described in Section 4.1 and the problem areas are described in Section 4.2. Section 4.3 includes tables that summarize the morphological data collected. Results and discussion follow in Section 4.4 for the stream portion of the project.

### 4.1 Stream Monitoring Protocol

Eleven cross-sections were surveyed along the main channel and two longitudinal profiles were surveyed. On the UT, four cross-sections were surveyed and one longitudinal. The locations of these cross-sections are shown on Figures 2a-e. Cross-Sections were established at representative riffles and pools (1 good and 1 bad area for each longitudinal survey). Cross-sections were established at one per 1,000 feet, which totaled eight on LBC, and four on the UT. Data for the cross-sections and longitudinal survey are included in Appendix B. Pebble Counts were performed at each cross-section and the data sheets are also located in Appendix B as well as the photos of the cross-sections looking upstream and downstream.

### 4.2 Stream Problem Areas

In general, the problems appeared to be primarily due to a lack of vegetation along the banks, which triggered or accelerated bank erosion especially on the main channel. Some of the eroding banks were in places where there was not a good root mass to hold the soil in place. This was also the case around some structures. Erosion around the structures could have been caused by the lack of vegetation and also due to back eddy flows that occur around such structures. In normal situations, where vegetation has stabilized the banks these eddies would not have created these large areas of erosion. However, with no vegetation to hold the bank together, these banks were scoured away or caved in. The photos below represent a majority of the problems along the main channel. Exhibit Table IX for the main channel and UT below summarize the problem areas recorded during the site visit with the approximate station number and photo number. Figures 3a-e show the location of these problem areas. Appendix A contains photos of all the problem areas discussed within the table.



Lack of vegetation to hold the bank together.



Lack of vegetation, leading to bank erosion also triggered by eddy downstream of structure (bowling effect).

<b>Exhibit Table IXa. Stream Problem Areas Little Bugaboo Creek</b> <b>Project Number and Name: SCO# 00-5327-01A (Little Bugaboo Creek)</b>			
Feature Issue	Station Numbers	Suspected Cause	Photo Number
Aggradation/Bar Formation			
Bank Scour	11+00	Back eddy in front of rootwads	1
	12+00	no vegetation	2
	13+50-14+50	no vegetation	3
	19+25	back eddy below cross-vane	4
	20+90-22+00	no vegetation, back eddy behind rootwads, and incoming flow from tributary	5
	24+50	no vegetation	6
	25+00	overland flow/small drainageway	7
	25+50	cross-vane, no vegetation	8
	29+00	no vegetation, overland flow	9
	33+30	eroding drainageway, overland flow	10
	36+00	no vegetation	11
	36+50	cross vane, no vegetation	12
	46+25	back eddy from cross-vane	13
	51+00	overland flow/cross vane	14
Engineered structures		see also bank scour at rock structures	

<b>Exhibit Table IXb. Stream Problem Areas UT Little Bugaboo Creek</b>			
<b>Project Number and Name: SCO# 00-5327-01A (Little Bugaboo Creek)</b>			
<b>Feature Issue</b>	<b>Station Numbers</b>	<b>Suspected Cause</b>	<b>Photo Number</b>
Aggradation/Bar Formation	14+00	Transverse Bar, narrowing channel	1
Bank Scour	15+25	Overland flow and eddies around rootwads	2
	17+80	Erosion below cross-vane, angle of vane	3
	23+80	Erosion upstream of vane, tight bend	4
Engineered structures		see also bank scour at rock structures	

### 4.3 Quantitative Morphology, Results and Discussion

Pebble counts were performed at each of the twelve cross-sections. Two longitudinal profiles were surveyed along LBC and one along the UT. Exhibit Table XI and XII summarize the morphology of Little Bugaboo Creek and the UT to Little Bugaboo Creek. Additional survey data is located in Appendix B.

The stream channel has significant areas of bank erosion as noted in Section 4.2. These areas of erosion may be due to one of the following: lack of vegetation, improper installation and/or design of structures, stream design dimensionless ratios, the inner berm was not constructed as according to the plans for typical cross-sections, and overland flow/drainageways entering the stream channel. The vegetation as discussed in Section 3.0 does not meet mitigation requirements and could be triggering or accelerating the bank erosion observed along LBC.

It was also noted that the design parameters were perhaps too large and the channel was built larger than it should have been and without inner berms. The cross-sectional area for LBC design channel was constructed slightly larger (median 61.1 square feet) than specified in the restoration plan (55.7 square feet). However, after examining the Piedmont regional curves for the LBC watershed area it is believed that the channel should have been designed with a cross-sectional area of 50 square feet. Also, the bankfull width was designed at 25.8 and constructed the median bankfull width is 28.8. From the Piedmont Regional Curve, the bankfull width should be around 21.90 with a mean depth of 2.28, which for LBC the data indicates that the mean depth is appropriate and bankfull width should be smaller. The UT's dimensions match the Piedmont regional curve recommendations.

There are several areas where overland flow is causing bank instability. These include drainageways that were present prior to construction and a few new ones since construction. The overland flow in some locations is causing major erosion as shown in Appendix A. A lack of vegetation could also contribute to this problem, which needs to be addressed throughout the entire project.

**Exhibit Table XIa. Baseline Morphology and Hydraulic Summary**

Project Number and Name: SCO# 00-5327-01A (Little Bugaboo Creek)

Segment/Reach: Main (1,180 feet)

Parameter	USGS GAGE DATA			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design-LBC			As-Built- LBC				
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med *	Min	Max	Med *	Min	Max	Avg ^	Min	Max	Med		
BKF Width (ft)						21.9	26	35.5	30.75	20	21.5	20.75			25.8	20.3	44	28.8		
Floodprone Width (ft)						NA			90			130			255	87.5	100	100		
BKF Cross-Sectional Area (ft <sup>2</sup> )						50.42	54	87.7	70.85	40.9	42.8	41.85			55.7	53.9	67.5	60.1		
BKF Mean Depth (ft)						2.28	1.9	2.9	2.4	2	2	2			2.15	1.4	3.2	2.2		
BKF Max Depth (ft)						NA	2.7	4.1	3.4	2.5	2.7	2.6			3.5	3.6	4.6	4.1		
Width/Depth Ratio						NA	8.8	17.4	13.1	9.8	10.8	10.3			12	12	32.6	12.6		
Entrenchment Ratio						NA			2.7			65			9.9	3.1	3.5	3.3		
Wetted Perimeter (ft)						26.46	29.8	41.3	35.55	24	25.5	24.75			30.1	32.7	46.8	33.3		
Hydraulic radius (ft)		NA				1.906	1.812	2.123	1.993	1.704	1.678	1.691			1.850	1.3	2.0	1.9		
<b>Pattern</b>																				
Channel Beltwidth (ft)									36	140	88	31	44	37.5	NA	NA	NA	63	122	92.5
Radius of Curvature (ft)									62	234	148	42	63	52.5	72.9	102.9	87.9	60	110	85
Meander Wavelength (ft)									133	590	361.5	185	260	222.5	196	366	281	206	366	286
Meander Width Ratio		NA			NA				4.4	19.3	11.85	8.9	12.6	10.75	6.5	12.2	9.35	7.2	12.7	9.9
<b>Profile</b>																				
Riffle length (ft)												23	78	50.5	115	38		3	91	47
Riffle slope (ft/ft)												0.02	0.02	0.02			0.01	0.00	0.20	0.10
Pool length (ft)												8	32	20				47	94	70.5
Pool spacing (ft)		NA			NA				57	287	172	98	180	139	106	217	161.5	121	127	124
<b>Substrate</b>																				
d50 (mm)												0.25			3			0.25	11.3	5.8
d84 (mm)		NA			NA							23			50			1	64	32.5
<b>Additional Reach Parameters</b>																				
Valley Length (ft)																				3,420
Channel Length (ft)																				4,276
Sinuosity									1.3			1.1			1.2					1.3
Water Surface Slope (ft/ft)									0.00			0.01			0.01		0.00	0.01	0.01	0.01
BKFslope (ft/ft)																	0.00	0.01	0.00	0.00
Rosgen Classification									Bc, C, E, & F			E4			C			C		
Number of Bankfull Events																				
Extent of BKF floodplain (acres)																				
BEHI									20.3	47.9	34.1									
Habitat Index																				
Macrobenthos		NA			NA							NA			NA			NA		NA

\* Median is median of min and max for this table

^ Average is used in design parameters (morphology table, not median)

**Exhibit Table XIb. Baseline Morphology and Hydraulic Summary**

Project Number and Name: SCO# 00-5327-01A (for UT Little Bugaboo Creek)

Segment/Reach:UT (383 feet)

Parameter	USGS GAGE DATA			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design-UT LBC			As-Built- UT LBC		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med*	Min	Max	Med*	Min	Max	Avg^	Min	Max	Med
BKF Width (ft)						15.55	17.5	18	17.75	29.5	36.9	33.2			18	14.8	31	18.6
Floodprone Width (ft)									38			329			170	61	75	68.0
BKF Cross-Sectional Area (ft <sup>2</sup> )						27.55	21.2	21.9	21.55	64.9	71.9	68.4			27	22.1	34.4	30.9
BKF Mean Depth (ft)						1.74	1.2	1.2	1.2	1.9	2.2	2.05			1.5	1.1	2.3	1.4
BKF Max Depth (ft)							2.2	2.3	2.25	3	3.2	3.1			2.1	2.64	3.8	3.1
Width/Depth Ratio							14.4	14.8	14.6	13.4	19.4	16.4			12	11.2	17.2	14.2
Entrenchment Ratio							1.8	2.5	2.15			8.9			9.4	3.47	3.8	3.6
Wetted Perimeter (ft)							19.9	20.4	20.15	33.3	41.3	37.3			21	19.4	33.2	21.3
Hydraulic radius (ft)		NA					1.07	1.07	1.07	1.95	1.74	1.84			1.29	1.0	1.8	1.2
<b>Pattern</b>																		
Channel Beltwidth (ft)							26	74	50	59	75	67				40	131	59.5
Radius of Curvature (ft)							27	98	62.5	40.1	69.3	54.7	1.8	3.7	2.8			
Meander Wavelength (ft)							87	355	221			350	129	224	176.5	130	204	175
Meander Width Ratio		NA			NA		4.9	19.9	12.4			10.5	9	12	10.5	7.01	11.00	9.43
<b>Profile</b>																		
Riffle length (ft)										10	245	127.5				22	28	25
Riffle slope (ft/ft)												0.02			0.02	0.00	0.20	0.10
Pool length (ft)										8	32	20				47	94	70.5
Pool spacing (ft)		NA			NA		33	176	104.5	271	334	302.5	64	166	115.0	121	127	124
<b>Substrate</b>																		
d50 (mm)									5			58				0.5	5.7	3.1
d84 (mm)		NA			NA				23			180				8	32	20
<b>Additional Reach Parameters</b>																		
Valley Length (ft)																		1,603
Channel Length (ft)																		1,954
Sinuosity									1.2						1.3			1.2
Water Surface Slope (ft/ft)									0.01			0.014			0.01			0.01
BKFslope (ft/ft)																		0.01
Rosgen Classification							C and F			C4			C and F			C		
Number of Bankfull Events																		
Extent of BKF floodplain (acres)																		
BEHI							21.5	45.5	33.5									
Habitat Index																		
Macrobenthos		NA			NA							NA			NA			NA

\* Median is median of min and max for this table

^ Average is used in design parameters (morphology table, not median)

**Exhibit Table XIa. Baseline Morphology and Hydraulic Summary**  
**Project Number and Name: SCO# 00-5327-01A (Little Bugaboo Creek)**  
**Segment/Reach: Main (Cross-Sections 1-4 upper reach and 5-8 lower reach)**

Parameter	Cross-Section 1 Riffle					Cross-Section 2 Pool					Cross-Section 3 Riffle					Cross-Section 4 Pool					Cross-Section 5 Riffle					Cross-Section 6 Pool					Cross-Section 7 Pool					Cross-Section 8 Riffle				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
Dimension																																								
BKF Width (ft)	29					28.5					44					30.2					29					20.3					20.7					28.5				
Floodprone Width (ft)	100					*					100					*					100					*					*					87.5				
BKF Cross-Sectional Area (ft <sup>2</sup> )	66.8					60.5					59.5					53.9					59.6					55.2					65.8					67.5				
BKF Mean Depth (ft)	2.3					2.1					1.4					1.8					2.1					2.7					3.2					2.4				
BKF Max Depth (ft)	3.7					4.6					3.9					3.6					3.8					4.6					4.2					4.2				
Width/Depth Ratio	12.6					*					32.6					*					14.1					*					*					12				
Entrenchment Ratio	>3.5					*					>2.3					*					>3.4					*					*					3.1				
Wetted Perimeter (ft)	33.6					32.7					46.8					33.8					33.2					25.7					27.1					33.3				
Hydraulic radius (ft)	1.988095					1.85015					1.27137					1.59467					1.7952					2.14786					2.42804					2.02703				
Substrate																																								
d50 (mm)	1					4					11.3					0.25					8					0.25					0.5					5.7				
d84 (mm)	16					8					45					4					64					4					1					22.6				

\* Pool data does not include these measurements

**Exhibit Table XIa (con't). Baseline Morphology and Hydraulic Summary**  
**Project Number and Name: SCO# 00-5327-01A (Little Bugaboo Creek)**  
**Segment/Reach: Main**

Parameter	MY-01 (20XX)			MY-02 (20XX)			MY-03 (20XX)			MY-04 (20XX)			MY-05 (20XX)			MY-06 (20XX)		
	Min	Max	Med *	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension																		
BKF Width (ft)	20.3	44	28.8															
Floodprone Width (ft)	87.5	100	100.0															
BKF Cross-Sectional Area (ft <sup>2</sup> )	53.9	67.5	60.1															
BKF Mean Depth (ft)	1.4	3.2	2.2															
BKF Max Depth (ft)	3.6	4.6	4.1															
Width/Depth Ratio	12	32.6	12.6															
Entrenchment Ratio	3.1	3.5	3.3															
Wetted Perimeter (ft)	32.7	46.8	33.3															
Hydraulic radius (ft)	1.3	2.0	1.9															
Profile																		
Riffle length (ft)	3	91	47															
Riffle slope (ft/ft)	0.0036	0.1967	0.1002															
Pool length (ft)	47	94	70.5															
Pool spacing (ft)	121	127	124															
Additional Reach Parameters																		
Valley Length (ft)	3,420																	
Channel Length (ft)	4,276																	
Sinuosity	1.3																	
Water Surface Slope (ft/ft)	0.0041	0.0066	0.0054															
BKF slope (ft/ft)	0.0002	0.0061	0.0032															
Rosgen Classification	C																	
Number of Bankfull Events																		
Extent of BKF floodplain (acres)																		
BEHI																		
Habitat Index																		
Macrobenthos																		

\* Median taken from riffle and pool cross-sections

Exhibit Table XIb. Baseline Morphology and Hydraulic Summary  
 Project Number and Name: SCO# 00-5327-01A (UT Little Bugaboo Creek)

Parameter	Cross-Section 1 Riffle					Cross-Section 2 Riffle					Cross-Section 3 Pool					Cross-Section 4 Pool				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
Dimension	19.5					17.6					14.8					31				
CF Width (ft)	75					61					*					*				
CF Width (ft)	22.1					27.6					34.4					34.2				
CF Depth (ft)	1.13					1.57					2.3					1.1				
CF Depth Ratio	2.9					2.64					3.8					3.2				
Channel Ratio	17.2					11.2					*					*				
Channel Ratio	3.8					3.47					*					*				
Perimeter (ft)	21.76					20.74					19.4					33.2				
Wet radius (ft)	1.015625					1.33076181					1.77319588					1.03012048				
Substrate																				
450 (mm)	2					8					1					0.5				
484 (mm)	8					32					5.7					22.6				

Exhibit Table XIb (cont). Baseline Morphology and Hydraulic Summary  
 Project Number and Name: SCO# 00-5327-01A (UT Little Bugaboo Creek)

Parameter	MY-01 (20XX)					MY-02 (20XX)					MY-03 (20XX)					MY-04 (20XX)					MY-05 (20XX)					MY-06 (20XX)				
	Min	Max	Med*	Med	Med	Min	Max	Med	Med	Med	Min	Max	Med	Med	Med	Min	Max	Med	Med	Med	Min	Max	Med	Med	Med	Min	Max	Med	Med	Med
CF Length (ft)	14.8	31	18.6																											
CF Length (ft)	61	75	68.0																											
CF Area (ft <sup>2</sup> )	22.1	34.4	30.9																											
CF Depth (ft)	1.1	2.3	1.4																											
CF Depth Ratio	2.64	3.8	3.1																											
CF Depth Ratio	11.2	17.2	14.2																											
Channel Ratio	3.47	3.8	3.6																											
Perimeter (ft)	19.4	33.2	21.3																											
Wet radius (ft)	1.015625	1.77319588	1.2																											
Profile																														
CF length (ft)	22	28	25																											
CF slope (ft/ft)	0.0036	0.1967	0.002																											
CF length (ft)	46	75	60.5																											
CF spacing (ft)	70	104	87																											
Additional Reach Parameters																														
CF Length (ft)	1.603																													
CF Length (ft)	1.954																													
CF Slope (ft/ft)	1.2																													
CF Slope (ft/ft)	0.0101																													
CF Slope (ft/ft)	0.009																													
Classification	C																													
Bedform																														
Channel (acres)																														
Habitat Index																														
Macrobenthos																														

\*Median taken from riffle and pool cross-sections

## **APPENDIX A**

### **RAW VEGETATION DATA, VEGETATION PLOT PHOTO LOG, AND PROBLEM AREA PHOTO LOG**



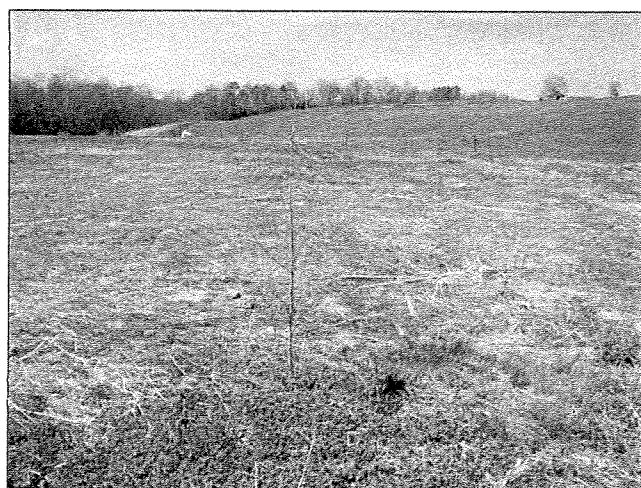
See Figures 2a-2e for location of vegetation plots and identifying plot number. Photos representing the plots follow with the raw data for each plot.



Vegetation Plot 101



Vegetation Plot 102



Vegetation Plot 103



Vegetation Plot 104



Vegetation Plot 105



Vegetation Plot 106



Vegetation Plot 107



Vegetation Plot 108



Vegetation Plot 109



Vegetation Plot 110



Vegetation Plot 111



Vegetation Plot 112



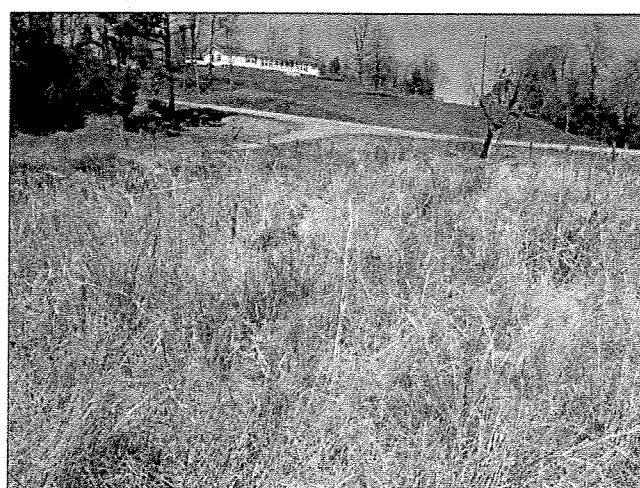
Vegetation Plot 113



Vegetation Plot 114



Vegetation Plot 115



Vegetation Plot 116

LITTLE BUGABOO		Date 4/4/05			
AS-BUILT VEGETATION MONITORING		Investigator G. Langford			
Species		Plots			
Live Stakes		101	108		
<i>Salix sericea</i>	Silky Willow				
<i>Cornus amomum</i>	Silky Dogwood				
Canopy Trees					
<i>Acer negundo</i>	Box Elder	o			
<i>Amelanchier arborea</i>	Serviceberry		o		
<i>Carpinus caroliniana</i>	Iron Wood	.			
<i>Diospyros virginiana</i>	Persimmon		o		
<i>Ilex opaca</i>	American Holly				
<i>Quercus alba</i>	White Oak		o		
<i>Betula nigra</i>	River Birch				
<i>Fraxinus pennsylvanica</i>	Green Ash	.			
<i>Juglans nigra</i>	Black Walnut	o	o		
<i>Plantanus occidentalis</i>	Sycamore	! :	o		
Shrubs					
<i>Alnus serrulata</i>	Tag Alder				
<i>Celtis laevigata</i>	Hackberry				
<i>Corylus americana</i>	Hazelnut				
<i>Ilex verticillata</i>	Winterberry Holly				
<i>Lindera benzoin</i>	Spice Bush				
<i>Viburnum dentatum</i>	Arrowwood				
service berry?? <i>Amelanchier</i> ??	Dogwood??				
<i>Viburnum nudum</i>			o		
Elderberry			p		
<i>Aronia arbutifolia</i>			o e		
Plot #		1	13		

Canopy

Photo # 1 only 3 rows trees planted  
 All w/in plot w/ orange flags - photo from downstream

LITTLE BUGABOO		Date 4-4-05				
AS-BUILT VEGETATION MONITORING		Investigator GLANIK FORD				
Species		Plots				
Live Stakes		102	103	105	106	107
<i>Salix sericea</i>	Silky Willow					
<i>Cornus amomum</i>	Silky Dogwood					
Canopy Trees						
<i>Acer negundo</i>	Box Elder					•
Redish tinted + 5 ft <i>Amelanchier arborea</i>	Serviceberry		• •		•	
<i>Carpinus caroliniana</i>	Iron Wood					
Black buds <i>Diospyros virginiana</i>	Persimmon		? • • •	• •		
<i>Ilex opaca</i>	American Holly		• •			
<i>Quercus alba</i>	White Oak	• •		•	•	•
<i>Betula nigra</i>	River Birch					
<i>Fraxinus pennsylvanica</i>	Green Ash	• •	•	• • •	• •	•
<i>Juglans nigra</i>	Black Walnut	•	• •	•		
<i>Plantanus occidentalis</i>	Sycamore	• •	•	• •	•	•
Shrubs						
<i>Alnus serrulata</i>	Tag Alder				•	
<i>Celtis laevigata</i>	Hackberry					
<i>Corylus americana</i>	Hazelnut					
<i>Ilex verticillata</i>	Winterberry Holly					
<i>Lindera benzoin</i>	Spice Bush					
<i>Viburnum dentatum</i>	Arrowwood	• •		• •		
<i>Viburnum nudum?</i>			• •			
Unknown weed? opp leaf. sp.	vert.?? opp. leaves?	• •	•			
elderberry		• •				
Arnicia				•		
Photo #		2	3	11	12	

unknown  
Total (No. of weeds)  
0 unknown weeds

5/12      2/14      2/10      0/5  
1

< ?

LITTLE BUGABOO		Date 4-5-05				
AS-BUILT VEGETATION MONITORING		Investigator G. LANICFORD				
Species		111	110	Plots		
Live Stakes		1/2	1/1	109		104
<i>Salix sericea</i>	Silky Willow					
<i>Cornus amomum</i>	Silky Dogwood					
Canopy Trees						
<i>Acer negundo</i>	Box Elder		••			
<i>Amelanchier arborea</i>	Serviceberry					
<i>Carpinus caroliniana</i>	Iron Wood					•
<i>Diospyros virginiana</i>	Persimmon					•
<i>Ilex opaca</i>	American Holly					
<i>Quercus alba</i>	White Oak					•
<i>Betula nigra</i>	River Birch					
<i>Fraxinus pennsylvanica</i>	Green Ash	•	U			••
<i>Juglans nigra</i>	Black Walnut		•	•		••
<i>Plantanus occidentalis</i>	Sycamore	•	••	•		••
Shrubs						
<i>Alnus serrulata</i>	Tag Alder	••		•		•
<i>Celtis laevigata</i>	Hackberry					
<i>Corylus americana</i>	Hazelnut	•				
<i>Ilex verticillata</i>	Winterberry Holly					
<i>Lindera benzoin</i>	Spice Bush					
<i>Viburnum dentatum</i>	Arrowwood					
Elderberry		•				•
Aronia		••	••	••		
Multiflora Rose		••	•			•
<i>Viburnum nudum</i>		•		•		•
Unknown waxy sp Thrifts 000 10			•			•
Photo #		14	15	16/18		37

all  
Main  
Checked

ombel

1/12

0/19

1/7

2/11

LITTLE BUGABOO		Date April 5 '05				
AS-BUILT VEGETATION MONITORING		Investigator G. LANMFORD				
Species		Plots 112 113 114 115 116				
Live Stakes		112	113	114	115	116
<i>Salix sericea</i>	Silky Willow					
<i>Cornus amomum</i>	Silky Dogwood					
Canopy Trees						
<i>Acer negundo</i>	Box Elder					
<i>Amelanchier arborea</i>	Serviceberry					
<i>Carpinus caroliniana</i>	Iron Wood					
<i>Diospyros virginiana</i>	Persimmon			20		
<i>Ilex opaca</i>	American Holly					
<i>Quercus alba</i>	White Oak	•		•		••
<i>Betula nigra</i>	River Birch					
<i>Fraxinus pennsylvanica</i>	Green Ash	•		•	•	••
<i>Juglans nigra</i>	Black Walnut				••	•
<i>Plantanus occidentalis</i>	Sycamore	⌈		•		⌈
Shrubs						
<i>Alnus serrulata</i>	Tag Alder	••	•			••
<i>Celtis laevigata</i>	Hackberry					
<i>Corylus americana</i>	Hazelnut					
<i>Ilex verticillata</i>	Winterberry Holly					
<i>Lindera benzoin</i>	Spice Bush					
<i>Viburnum dentatum</i>	Arrowwood					
<i>Salix nigra</i> <sup>not?</sup> <sub>Reg?</sub>	Blk willow	⌈	•			
<i>Sambucus can.</i>	Elderberry		•		•	
<i>Aronia arbutifolia</i>				••		
<i>Viburnum nudum</i>						••
unkn Sorrelwood??						•
Photo #		24	29	30	33	34

unkn

unkn / total

1/3

0/2

2/7

0/5

3/21

↑ woody veg absent or

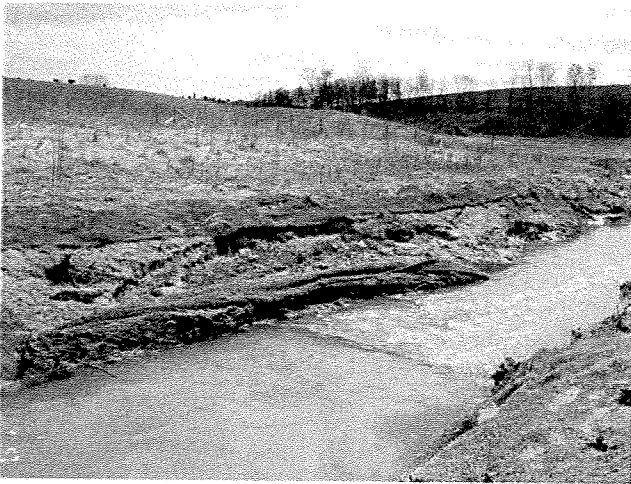




1. Station 11+00



2. Station 12+00



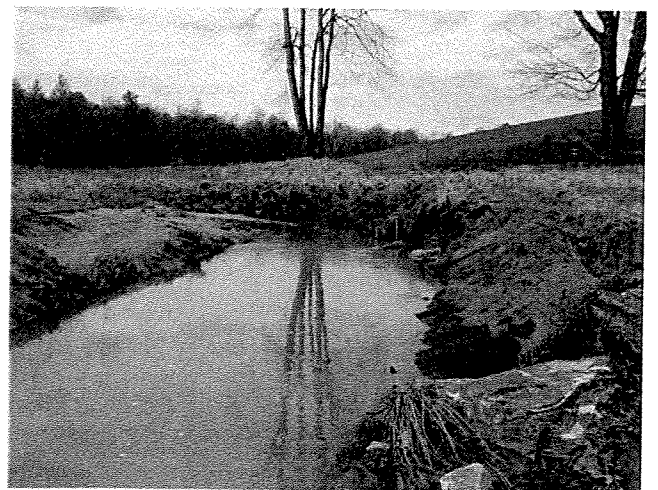
3. Station 13+50 – 14+50



4. Station 19+25



5. Station 20+90 – 22+00



6. Station 24+50



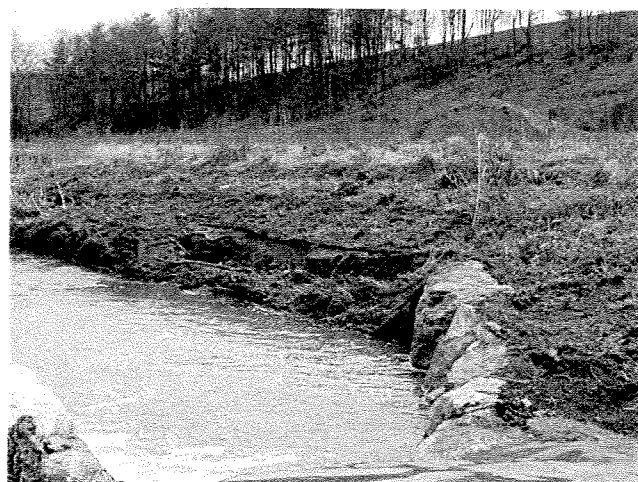
1. Station 11+00



2. Station 12+00



3. Station 13+50 – 14+50



4. Station 19+25



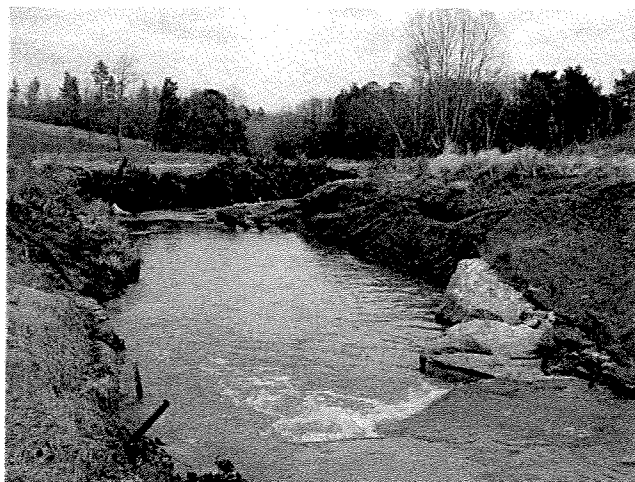
5. Station 20+90 – 22+00



6. Station 24+50



7. Station 25+00



8. Station 25+50



9. Station 29+00



10. Station 33+30



11. Station 36+00



12. Station 36+50



13. Station 46+25



14. Station 51+00

UT LITTLE BUGABOO CREEK -2005 PHOTO LOG PROBLEM AREAS – AS-BUILT



15. Station 14+00



16. Station 15+25



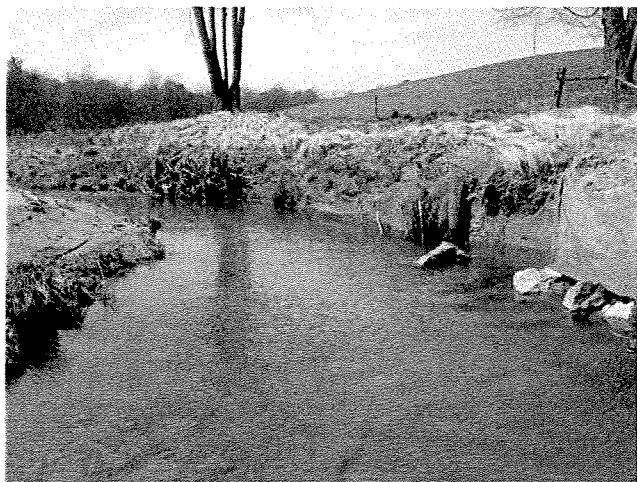
17. Station 17+80



18. Station 23+80

**APPENDIX B**

**RAW STREAM DATA AND  
CROSS-SECTION PHOTO LOG**



Cross-Section 1 Upstream



Cross-Section 1 Downstream



Cross-Section 2 Upstream



Cross-Section 2 Downstream



Cross-Section 3 Upstream



Cross-Section 3 Downstream



Cross-Section 4 Upstream



Cross-Section 4 Downstream



Cross-Section 5 Upstream



Cross-Section 5 Downstream



Cross-Section 6 Upstream

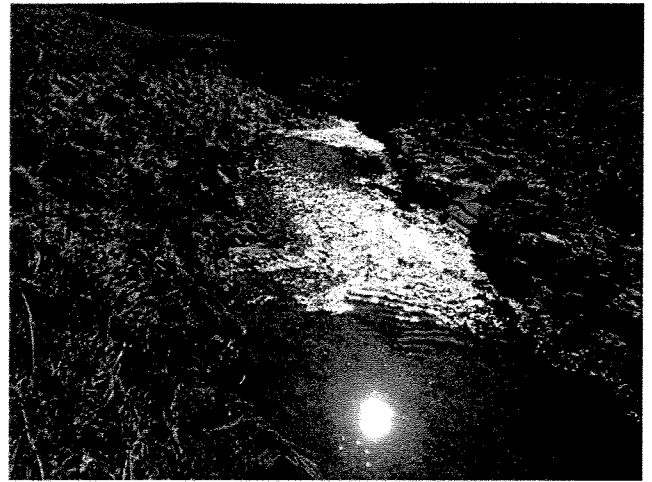


Cross-Section 6 Downstream





Cross-Section 7 Upstream



Cross-Section 7 Downstream



Cross-Section 8 Upstream



Cross-Section 8 Downstream



UT Cross-Section 1 Upstream



UT Cross-Section 1 Downstream



UT Cross-Section 2 Upstream



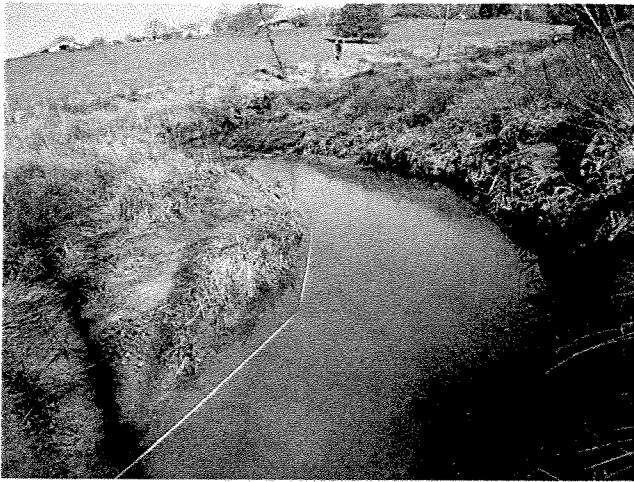
UT Cross-Section 2 Downstream



UT Cross-Section 3 Upstream



UT Cross-Section 3 Downstream



UT Cross-Section 4 Upstream



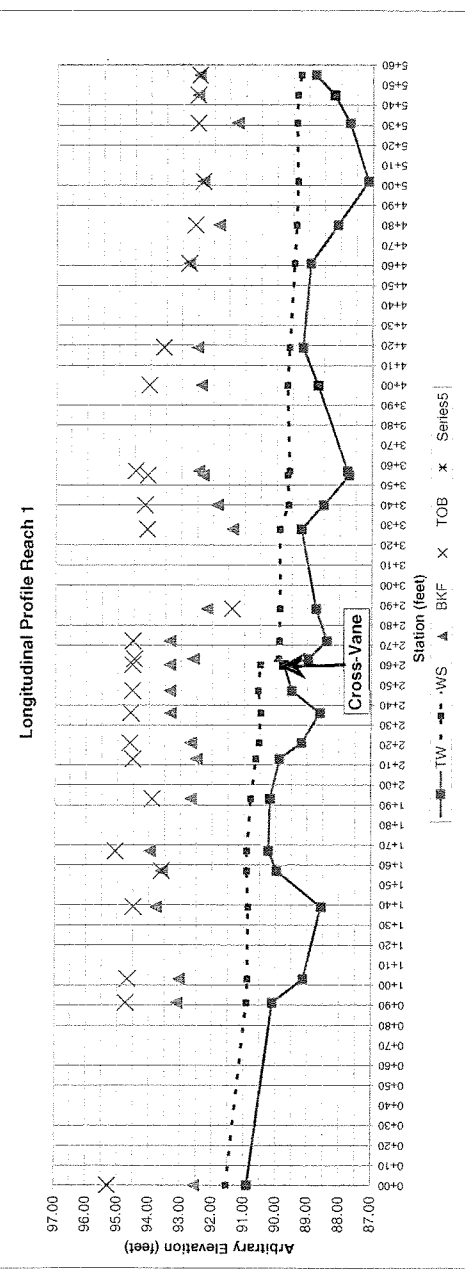
UT Cross-Section 4 Downstream

LITTLE BUGABOO CREEK AS-BUILT SURVEY

Field Crew: Amanda Toxli and Wade Patton  
 River Basin: Yadon Pee-Dee  
 Stream Reach: Reach 1  
 Drainage Area: 3.45  
 Date: 4/5/2005  
 Description: LONGITUDINAL PROFILE

Station	TW (ft)	WS (ft)	WS (ft)	WS (ft)	BKE (ft)	BKE (ft)	BKE (ft)	TOB (ft)	TOB (ft)	IOB	Notes	HI	Bk H/Bk/H/L	P-P	Pool Length	Max Pool Depth	Pool Slope	Riffle Length	Riffle Slope	ELEV NOTE	FS
0+00	92.74	90.90	8.63	91.54	92.57	7.60	92.57	4.87	95.30	HR		100.17	2.63	122	76	0.00000	91	0.00668	100.00		
0+91	10.06	90.11	9.28	90.92	93.12	7.05	93.12	5.44	94.73	HP		100.17	1.53						100.00		
1+03	11.03	88.14	9.28	90.89	93.05	7.12	93.05	5.49	94.68	IM		100.17	1.42						95.33		
1+39	11.60	88.57	9.29	90.88	93.79	6.38	93.79	5.67	94.50	MP		100.17	1.14		5.22				95.33		
1+57	10.19	89.98	9.25	90.92	93.61	6.56	93.61	5.03	95.01	IM		100.17	1.00						95.33		
1+67	9.93	90.24	9.25	90.92	93.98	6.19	93.98	5.03	95.08	HRVCS1		100.17	1.29						95.33		
2+13	9.98	90.19	9.37	90.80	92.69	7.48	92.69	6.26	93.91	IM		100.17	1.49						95.33		
2+13	10.28	89.89	9.54	90.63	92.52	7.65	92.52	5.64	94.53	HP		100.17	1.76	127	47	0.0028	46	0.00663	100.02		
2+36	11.56	88.61	9.69	90.48	92.71	7.46	92.71	5.55	94.62	IM		100.17	1.54						100.02		
2+47	10.66	89.51	9.61	90.56	93.35	6.82	93.35	5.58	94.59	MP		100.17	1.26		4.74				100.02		
2+60	10.41	88.76	9.67	90.50	93.37	6.80	93.37	5.63	94.54	IM		100.17	1.30						100.02		
2+63	11.19	86.98	9.67	90.50	93.37	6.80	93.37	5.63	94.54	IM	94.54 INVERT CV	100.17	1.32		65	0.00003	3	0.1967	100.00		
2+72	11.76	88.41	10.27	89.91	7.54	92.63	5.68	94.49	cross vane do			100.17	1.51						100.00		
2+88	11.43	88.74	10.29	89.90	6.80	93.37	5.63	94.54	SHMP			100.17	1.24		4.96				100.00		
3+28	10.95	89.22	8.78	89.88	7.98	92.19	8.78	91.39	IM			100.17	0.77						100.00		
3+40	11.66	88.51	10.55	89.89	8.29	91.88	6.07	94.10	HR			100.17	2.25	121	79	0.0001	12	0.0225	100.00		
3+55	12.45	87.72	10.52	89.65	7.85	92.32	6.03	94.09	IMVCS2			100.17	1.38						100.00		
3+57	12.40	87.77	10.58	89.59	7.70	92.47	5.71	94.46	MP			100.17	1.42		4.70				100.00		
4+19	10.50	88.70	9.63	89.67	6.81	92.39	5.16	94.04	IM			99.20	1.45						100.00		
4+19	10.01	89.19	9.59	89.61	6.67	92.53	5.61	93.59	HR			99.20	1.32						100.00		
4+61	10.26	88.94	9.74	89.46	6.40	92.80	6.40	92.80	HPV/CS3			99.20	1.20		94	0.0021	42	0.0036	100.00		
4+80	11.11	88.09	9.80	89.40	7.35	91.85	6.60	92.60	IM			99.20	1.00						100.00		
5+02	12.07	87.13	9.84	89.36	6.85	92.35	6.85	92.35	MP			99.20	1.00		5.22				100.00		
5+31	11.48	87.72	9.81	89.39	7.93	91.27	6.67	92.53	IMVCS4			99.20	1.35						100.00		
5+45	11.00	88.20	9.83	89.37	6.67	92.53	6.67	92.53	im			99.20	1.00						100.00		
5+55	10.41	88.79	9.94	89.26	6.72	92.48	6.72	92.48	HR			99.20	1.00						100.00		

tw slope 0.0038 ws slope 0.0041 bkf slope 0.0002  
 min max  
 BKF W (ft) = 29.0  
 BKF D (ft) = 2.3  
 BKF Max D (ft) = 3.7



LITTLE BUGABOO CREEK AS-BUILT SURVEY

Field Crew: Amanda Todd and Wade Patton  
 River Basin: Yackin Pee-Dee  
 Watershed: Little Bugaboo  
 Stream Reach: Reach 1  
 Drainage Area: 3.45  
 Date: 4/5/2005  
 Station: 1+67  
 Feature: CSI RIFFLE

STATION (FEET)	HI (FEET)	FS (FEET)	ELEVATION (FEET)	NOTES
0+00.0	101.17	4.34	96.23	REBAR 4.78
0+07.0	101.17	4.95	96.22	
0+16.5	101.17	5.09	96.08	
0+22.0	101.17	5.32	95.85	TOBlint
0+29.0	101.17	5.61	95.56	
0+36.0	101.17	6.19	94.98	BKF
0+37.5	101.17	6.72	94.45	EROSION
0+40.0	101.17	6.30	94.87	
0+41.5	101.17	7.26	93.91	
0+42.5	101.17	7.02	94.15	
0+46.3	101.17	9.28	91.89	LEOWWS
0+47.5	101.17	9.85	91.32	
0+51.7	101.17	9.91	91.25	
0+59.0	101.17	9.91	91.26	
0+59.6	101.17	9.93	91.24	TW
0+64.0	101.17	9.25	91.92	REOWWS
0+65.0	101.17	6.48	94.66	
0+67.9	101.17	6.19	94.98	BKFLINT
0+76.0	101.17	5.32	95.85	TOB
0+85.0	101.17	4.90	96.27	
1+00.0	101.17	3.78	97.39	
		3.90	97.27	REBAR 3.57

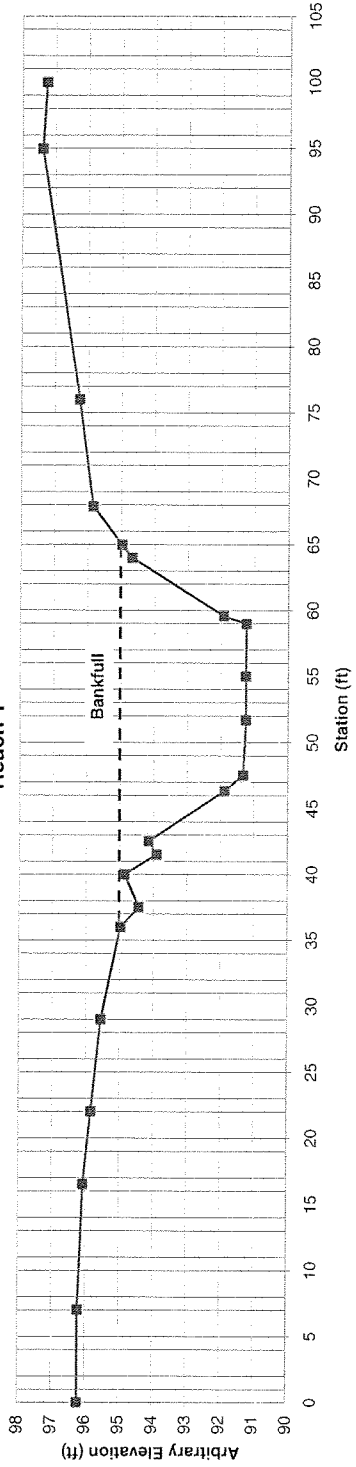
BANKFULL Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
1.5	0.5	0.4
2.5	0.1	0.8
1.5	1.1	0.9
1.0	0.8	1.0
3.8	3.1	7.4
1.2	3.7	4.1
4.2	3.7	15.5
3.3	3.7	12.3
4.0	3.7	14.9
0.6	3.1	2.0
4.4	0.3	7.4
1.0	0.0	0.1
TOTALS		66.8

TOB Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
7.0	0.3	1.0
7.0	0.9	4.1
1.5	1.4	1.7
2.5	1.0	3.0
1.5	1.9	2.2
1.0	1.7	1.8
3.8	4.0	10.8
1.2	4.5	5.1
4.2	4.6	19.2
3.3	4.6	15.2
4.0	4.8	18.4
0.6	3.9	2.6
4.4	1.2	11.2
1.0	0.9	1.0
2.9	0.0	1.3
TOTALS		98.4

SUMMARY DATA (BANKFULL)	
A(BKF)	66.8
W(BKF)	29.0
Max d	3.7
Mean d	2.3
W/D	12.6
Enrichment	>3.5
Stream Type	C
Area from Rural Regional Curve	50.42

SUMMARY DATA (TOB)	
A(BKF)	98.4
W(BKF)	45.9
Max d	4.6
Mean d	2.1

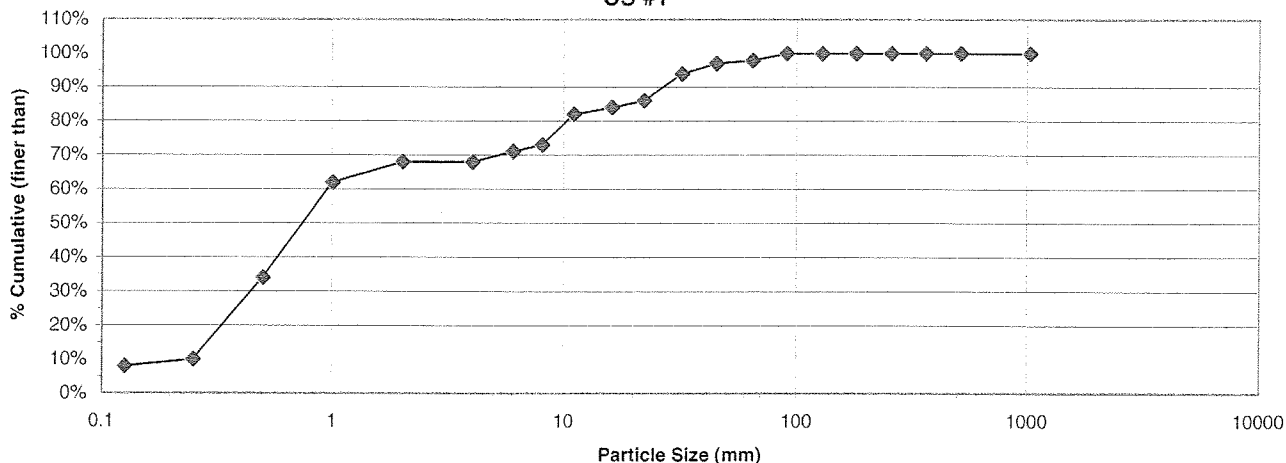
Cross-Section 1  
Reach 1



### LITTLE BUGABOO CREEK AS-BUILT SURVEY

PEBBLE COUNT									
Site: LBC						4/5/2005			
Party: Amanda Todd and Wade Patton						CS#1			
Particle Count									
Inches	Particle	Millimeter		Riffle			Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	4			4	4%	4%
.04 - .08	Very Fine	.062 - .125	S	4			4	4%	8%
	Fine	.125 - .25	A	2			2	2%	10%
	Medium	.25 - .50	N	24			24	24%	34%
	Coarse	.50 - 1.0	D	28			28	28%	62%
	Very Coarse	1.0 - 2.0	S	6			6	6%	68%
.08 - .16	Very Fine	2.0 - 4.0		0			0	0%	68%
.16 - .22	Fine	4.0 - 5.7	G	3			3	3%	71%
.22 - .31	Fine	5.7 - 8.0	R	2			2	2%	73%
.31 - .44	Medium	8.0 - 11.3	A	9			9	9%	82%
.44 - .63	Medium	11.3 - 16.0	V	2			2	2%	84%
.63 - .89	Coarse	16.0 - 22.6	E	2			2	2%	86%
.89 - 1.26	Coarse	22.6 - 32.0	L	8			8	8%	94%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	3			3	3%	97%
1.77 - 2.5	Very Coarse	45.0 - 64.0		1			1	1%	98%
2.5 - 3.5	Small	64 - 90	C	2			2	2%	100%
3.5 - 5.0	Small	90 - 128	O	0			0	0%	100%
5.0 - 7.1	Large	128 - 180	B	0			0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0			0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0			0	0%	100%
14.3 - 20	Small	362 - 512	L	0			0	0%	100%
20 - 40	Medium	512 - 1024	D	0			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0			0	0%	100%
	Bedrock		BDRK	0			0	0%	100%
<b>Totals</b>				<b>100</b>			<b>100</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
Little Bugaboo Creek  
CS #1**



LITTLE BUGABOO CREEK AS-BUILT SURVEY

Field Crew: Amanda Todd and Wade Patton  
 River Basin: Yadkin Pee-Dee  
 Watershed: Little Bugaboo  
 Stream Reach: Reach1  
 Drainage Area: 3.45  
 Date: 4/5/2005  
 Station: 3+55  
 Feature: CS.2.POOL

STATION (FEET)	HI (FEET)	FS (FEET)	ELEVATION (FEET)	NOTES
0+00.0	101.17	5.77	95.40	REBAR 5.65
0+11.0	101.17	6.20	94.97	
0+21.3	101.17	6.19	94.98	
0+23.5	101.17	5.99	95.18	LTOB
0+25.0	101.17	6.08	95.09	
0+27.5	101.17	6.45	94.72	
0+28.4	101.17	7.35	93.82	LBKFLINT
0+28.5	101.17	7.85	93.32	
0+28.5	101.17	11.92	89.25	
0+32.0	101.17	12.45	88.72	TW
0+33.5	101.17	11.90	89.27	
0+35.5	101.17	11.05	90.12	REOW
0+37.5	101.17	10.52	90.65	
0+40.0	101.17	9.67	91.50	
0+44.0	101.17	9.46	91.71	
0+52.0	101.17	8.38	92.79	RBKF
0+54.0	101.17	7.85	93.32	
0+57.0	101.17	7.90	93.27	
0+62.0	101.17	6.08	95.09	RTOB
0+78.0	101.17	4.95	96.22	REBAR 5.47
1+00.0	101.17	5.80	95.37	

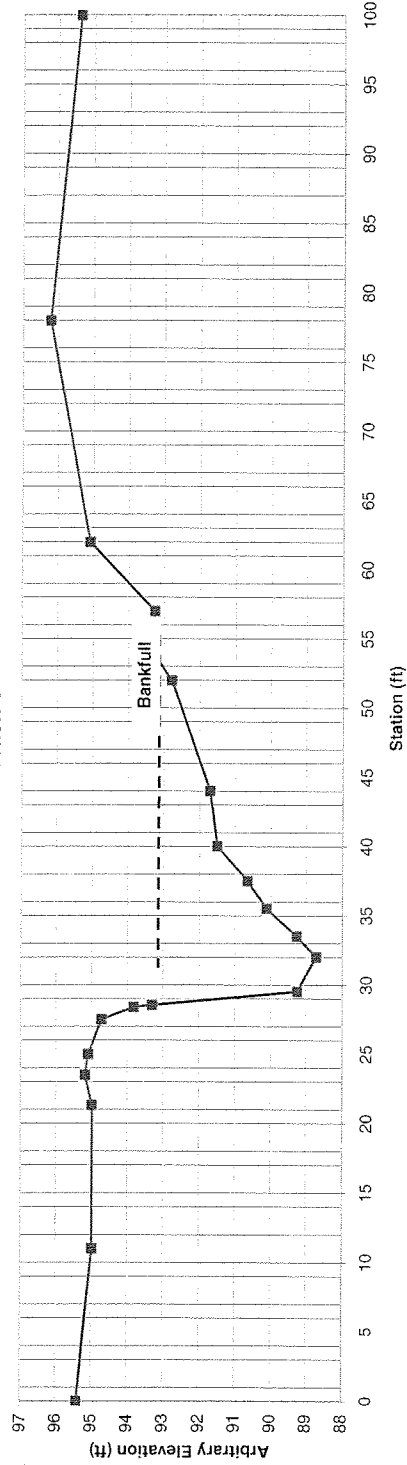
BANKFULL Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
1.0	0.0	0.0
2.5	4.1	5.1
1.5	4.6	6.5
2.0	4.1	8.7
2.0	3.2	7.3
2.5	2.7	7.3
4.0	1.8	9.0
8.0	1.6	13.7
2.0	0.5	2.1
3.0	0.0	0.8
<b>TOTALS</b>	<b>28.5</b>	<b>60.5</b>

SUMMARY DATA (TOB)		
A(BKF)	60.5	
W(BKF)	28.5	
Max d	4.6	
Mean d	2.1	

TOB Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
2.5	0.4	0.5
0.9	1.3	0.7
0.1	1.8	0.2
1.0	5.8	3.7
2.5	6.4	15.3
1.5	5.8	9.1
2.0	5.0	10.8
2.0	4.4	9.4
2.5	3.6	10.0
4.0	3.4	13.9
8.0	2.3	22.7
2.0	1.8	4.1
3.0	1.8	5.4
5.0	0.0	4.6
<b>TOTALS</b>	<b>37.0</b>	<b>110.4</b>

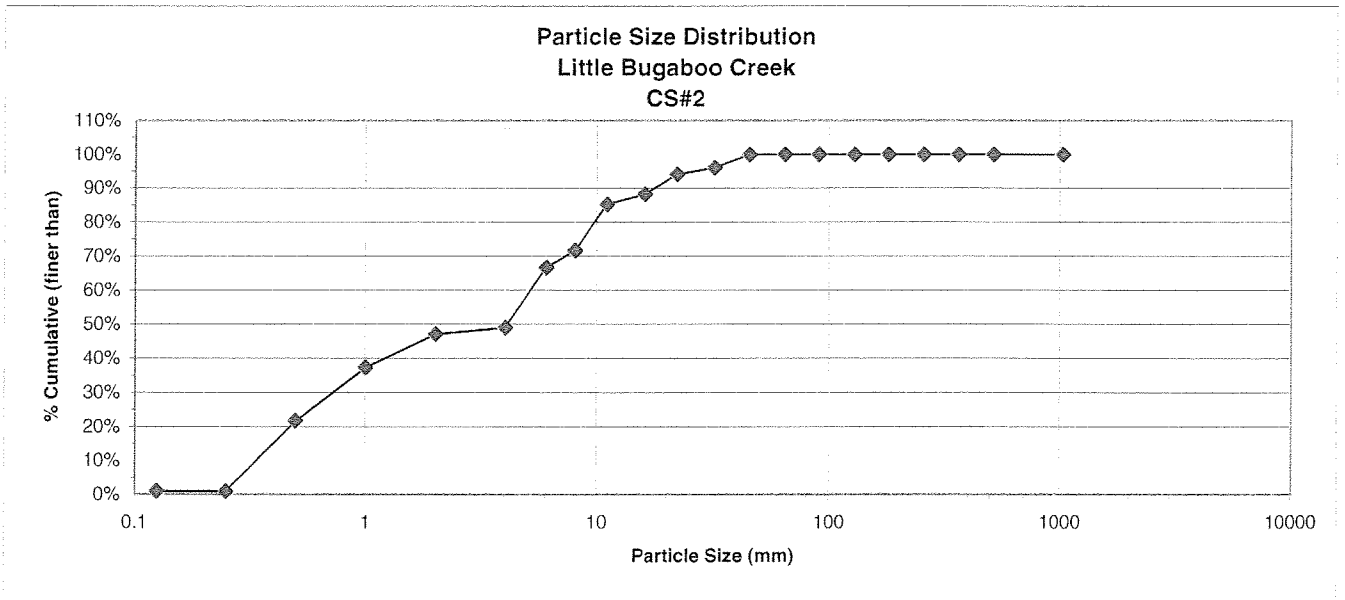
SUMMARY DATA (TOB)		
A(BKF)	110.4	
W(BKF)	37.0	
Max d	6.4	
Mean d	3.0	

Cross-Section 2  
Reach 1



LITTLE BUGABOO CREEK AS-BUILT SURVEY

PEBBLE COUNT								
Site: LBC						4/5/2005		
Party: Amanda Todd and Wade Patton						CS#2		
Particle Count								
Inches	Particle	Millimeter		Riffle		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	1		1	1%	1%
.04 - .08	Very Fine	.062 - .125	S	0		0	0%	1%
	Fine	.125 - .25	A	0		0	0%	1%
	Medium	.25 - .50	N	21		21	21%	22%
	Coarse	.50 - 1.0	D	16		16	16%	37%
	Very Coarse	1.0 - 2.0	S	10		10	10%	47%
.08 - .16	Very Fine	2.0 - 4.0		2		2	2%	49%
.16 - .22	Fine	4.0 - 5.7	G	18		18	18%	67%
.22 - .31	Fine	5.7 - 8.0	R	5		5	5%	72%
.31 - .44	Medium	8.0 - 11.3	A	14		14	14%	85%
.44 - .63	Medium	11.3 - 16.0	V	3		3	3%	88%
.63 - .89	Coarse	16.0 - 22.6	E	6		6	6%	94%
.89 - 1.26	Coarse	22.6 - 32.0	L	2		2	2%	96%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	4		4	4%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0		0		0	0%	100%
2.5 - 3.5	Small	64 - 90	C	0		0	0%	100%
3.5 - 5.0	Small	90 - 128	O	0		0	0%	100%
5.0 - 7.1	Large	128 - 180	B	0		0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0		0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0		0	0%	100%
14.3 - 20	Small	362 - 512	L	0		0	0%	100%
20 - 40	Medium	512 - 1024	D	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0		0	0%	100%
	Bedrock		BDRK	0		0	0%	100%
<b>Totals</b>				<b>102</b>		<b>102</b>	<b>100%</b>	<b>100%</b>

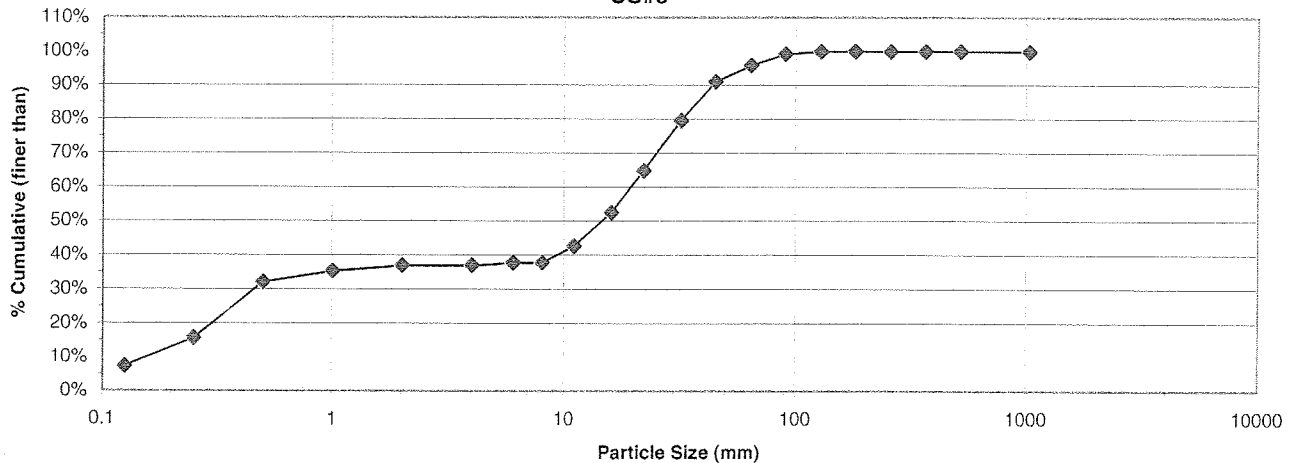




### LITTLE BUGABOO CREEK AS-BUILT SURVEY

PEBBLE COUNT									
Site: LBC							4/5/2005		
Party: Amanda Todd and Wade Patton							CS#3		
Particle Count									
Inches	Particle	Millimeter		Riffle			Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	4			4	3%	3%
.04 - .08	Very Fine	.062 - .125	S	5			5	4%	7%
	Fine	.125 - .25	A	10			10	8%	16%
	Medium	.25 - .50	N	20			20	16%	32%
	Coarse	.50 - 1.0	D	4			4	3%	35%
	Very Coarse	1.0 - 2.0	S	2			2	2%	37%
.08 - .16	Very Fine	2.0 - 4.0		0			0	0%	37%
.16 - .22	Fine	4.0 - 5.7	G	1			1	1%	38%
.22 - .31	Fine	5.7 - 8.0	R	0			0	0%	38%
.31 - .44	Medium	8.0 - 11.3	A	6			6	5%	43%
.44 - .63	Medium	11.3 - 16.0	V	12			12	10%	52%
.63 - .89	Coarse	16.0 - 22.6	E	15			15	12%	65%
.89 - 1.26	Coarse	22.6 - 32.0	L	18			18	15%	80%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	14			14	11%	91%
1.77 - 2.5	Very Coarse	45.0 - 64.0		6			6	5%	96%
2.5 - 3.5	Small	64 - 90	C	4			4	3%	99%
3.5 - 5.0	Small	90 - 128	O	1			1	1%	100%
5.0 - 7.1	Large	128 - 180	B	0			0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0			0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0			0	0%	100%
14.3 - 20	Small	362 - 512	L	0			0	0%	100%
20 - 40	Medium	512 - 1024	D	0			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0			0	0%	100%
	Bedrock		BDRK	0			0	0%	100%
<b>Totals</b>				<b>122</b>			<b>122</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
Little Bugaboo Creek  
CS#3**



LITTLE BUGABOO CREEK AS-BUILT SURVEY

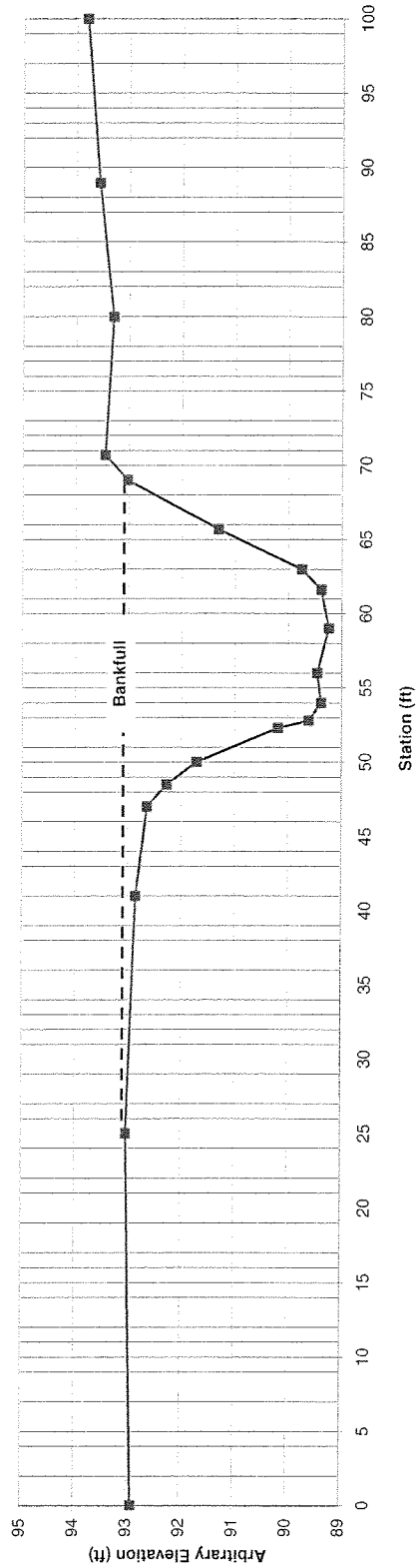
Field Crew: Amanda Todd and Wade Patton  
 River Basin: Yadkin Pee-Dee  
 Watershed: Little Bugaboo  
 Stream Reach: Reach 7  
 Drainage Area: 3.45  
 Date: 4/5/2005  
 Station: 44.61  
 Feature: CS.3 RIFFLE

STATION (FEET)	HI (FEET)	FS (FEET)	ELEVATION (FEET)	NOTES
0+00.0	99.03	6.52	92.51	REBAR 6.42
0+25.0	99.03	6.40	92.63	BKF
0+41.0	99.03	6.58	92.45	
0+47.0	99.03	6.79	92.24	
0+48.5	99.03	7.17	91.86	
0+50.0	99.03	7.74	91.29	
0+52.3	99.03	8.28	88.74	
0+52.8	99.03	9.87	88.16	LEOW
0+54.0	99.03	10.11	86.92	
0+56.0	99.03	10.04	88.99	
0+59.0	99.03	10.26	86.77	TW
0+61.6	99.03	10.11	88.92	
0+63.0	99.03	9.74	89.29	REOW/MS
0+65.7	99.03	8.14	90.89	
0+69.0	99.03	6.40	92.63	BKF
0+70.7	99.03	5.97	93.06	
0+80.0	99.03	6.12	92.91	
0+89.0	99.03	5.85	93.18	
1+00.0	99.03	5.61	93.42	REBAR 5.43

BANKFULL/TOB Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
16.0	0.2	1.4
6.0	0.4	1.7
1.5	0.8	0.9
1.5	1.3	1.6
2.3	2.9	4.9
0.5	3.5	1.6
1.2	3.7	4.3
2.0	3.6	7.3
3.0	3.9	11.3
2.6	3.7	9.8
1.4	3.3	4.9
2.7	1.7	6.9
3.3	0.0	2.9
<b>TOTALS</b>	<b>44.0</b>	<b>59.5</b>

SUMMARY DATA [BANKFULL/TOB]		
A/B(KF)	W(FPA)	>100
W(BKF)	44.0	0.004
Mean d	3.9	
W/D	32.6	
Entrenchment	>2.3	
Stream Type	C	
Bankfull= BKF		
Area from Rural Regional Curve		50.42

Cross-Section 3  
Reach 1



LITTLE BUGABOO CREEK AS-BUILT SURVEY

Field Crew: Amanda Todd and Wade Patton  
 River Basin: Yackin Pee-Dee  
 Watershed: Little Bugaboo  
 Stream Reach: Reach 1  
 Drainage Area: 3.45  
 Date: 4/5/2005  
 Station: 5+31  
 Feature: CS-4 POOL

STATION (FEET)	HI (FEET)	FS (FEET)	ELEVATION (FEET)	NOTES
0+00.0	99.03	6.29	92.74	REBAR 6.29
0+16.0	99.03	6.58	92.45	
0+37.0	99.03	6.67	92.36	TOB
0+44.4	99.03	6.67	92.36	
0+50.2	99.03	8.03	91.00	LBKF
0+53.6	99.03	7.83	91.10	
0+61.8	99.03	9.04	89.99	
0+64.5	99.03	9.36	89.67	
0+69.0	99.03	9.71	89.32	
0+70.6	99.03	9.81	89.22	LEOW/MS
0+71.2	99.03	10.27	88.76	
0+74.0	99.03	10.60	88.43	
0+77.5	99.03	10.91	88.12	
0+80.0	99.03	11.48	87.55	TW
0+82.0	99.03	11.00	88.03	
0+83.8	99.03	7.93	91.10	RBKFLINT
0+84.5	99.03	6.84	92.19	
0+84.8	99.03	6.67	92.36	
0+86.0	99.03	5.87	93.16	FTOBLINT
0+88.0	99.03	5.52	93.51	
0+90.0	99.03	5.45	93.58	
0+95.0	99.03	5.48	93.55	
1+00.0	99.03	6.08	92.95	REBAR 5.72

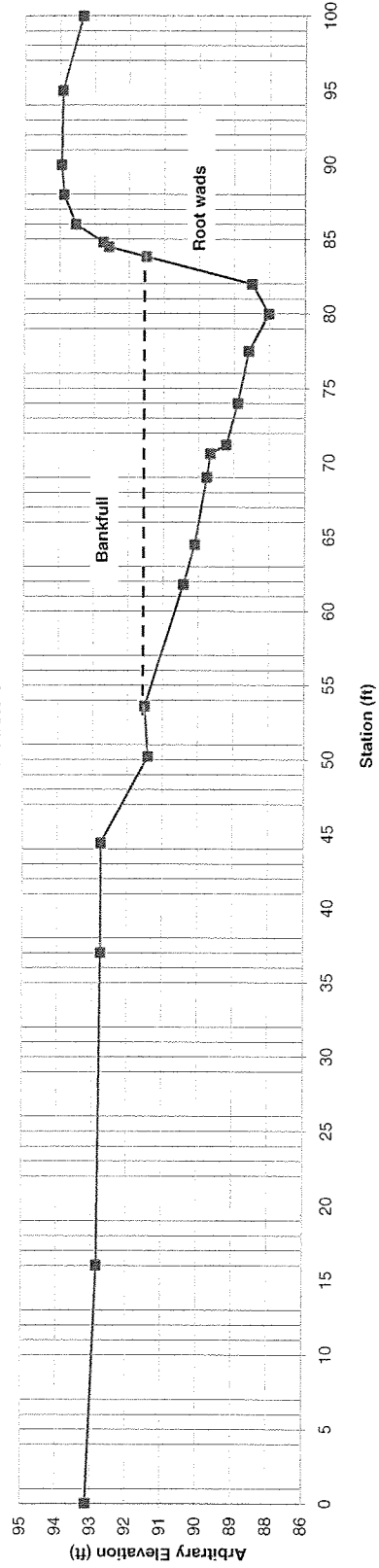
BANKFULL		
Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
8.2	1.1	4.6
2.7	1.4	3.4
4.5	1.8	7.2
1.6	1.9	2.9
0.6	2.3	1.3
2.8	2.7	7.0
3.5	3.0	9.9
2.5	3.6	8.2
2.0	3.1	6.6
1.8	0.0	2.8
TOTALS		53.9

SUMMARY DATA (TOB)		
A(BKF)	53.9	
W(BKF)	30.2	
Max d	3.6	
Mean d	1.8	

TOB		
Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
5.8	1.4	3.9
3.4	1.3	4.5
8.2	2.4	14.9
2.7	2.7	6.8
4.5	3.0	12.9
1.6	3.1	4.9
0.6	3.6	2.0
2.8	3.9	10.5
3.5	4.2	14.3
2.5	4.8	11.3
2.0	4.3	9.1
1.8	1.3	5.1
0.7	0.2	0.5
0.3	0.0	0.0
TOTALS		100.9

SUMMARY DATA (TOB)		
A(BKF)	100.9	
W(BKF)	40.4	
Max d	4.8	
Mean d	2.5	

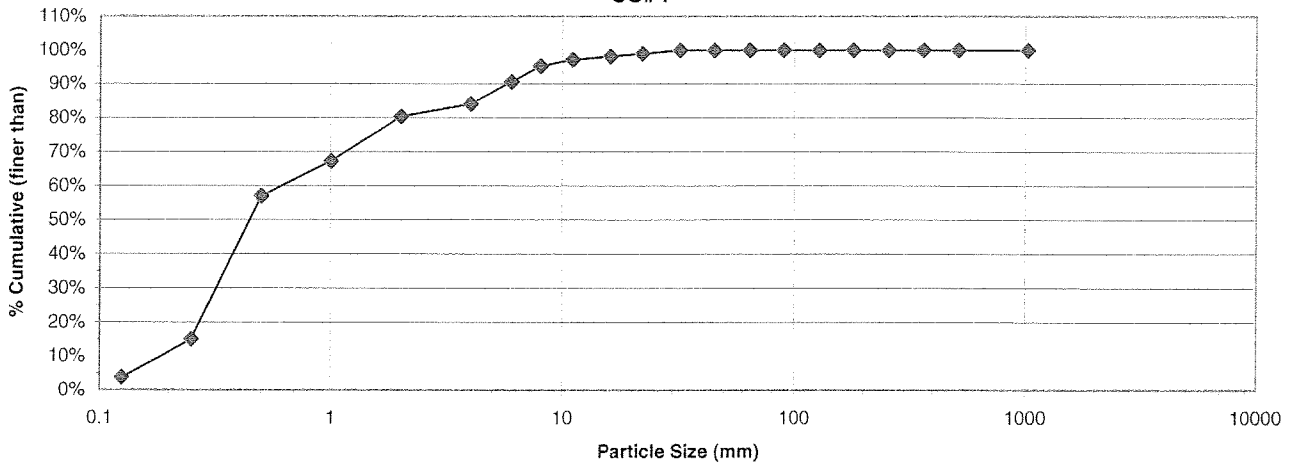
Cross-Section 4  
Reach 1



### LITTLE BUGABOO CREEK AS-BUILT SURVEY

PEBBLE COUNT									
Site: LBC						4/5/2005			
Party: Amanda Todd and Wade Patton						CS#4			
Particle Count									
Inches	Particle	Millimeter		Riffle			Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	3			3	3%	3%
.04 - .08	Very Fine	.062 - .125	S	1			1	1%	4%
	Fine	.125 - .25	A	12			12	11%	15%
	Medium	.25 - .50	N	45			45	42%	57%
	Coarse	.50 - 1.0	D	11			11	10%	67%
	Very Coarse	1.0 - 2.0	S	14			14	13%	80%
.08 - .16	Very Fine	2.0 - 4.0		4			4	4%	84%
.16 - .22	Fine	4.0 - 5.7	G	7			7	7%	91%
.22 - .31	Fine	5.7 - 8.0	R	5			5	5%	95%
.31 - .44	Medium	8.0 - 11.3	A	2			2	2%	97%
.44 - .63	Medium	11.3 - 16.0	V	1			1	1%	98%
.63 - .89	Coarse	16.0 - 22.6	E	1			1	1%	99%
.89 - 1.26	Coarse	22.6 - 32.0	L	1			1	1%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	0			0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0		0			0	0%	100%
2.5 - 3.5	Small	64 - 90	C	0			0	0%	100%
3.5 - 5.0	Small	90 - 128	O	0			0	0%	100%
5.0 - 7.1	Large	128 - 180	B	0			0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0			0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0			0	0%	100%
14.3 - 20	Small	362 - 512	L	0			0	0%	100%
20 - 40	Medium	512 - 1024	D	0			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0			0	0%	100%
	Bedrock		BDRK	0			0	0%	100%
<b>Totals</b>				<b>107</b>			<b>107</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
Little Bugaboo Creek  
CS#4**

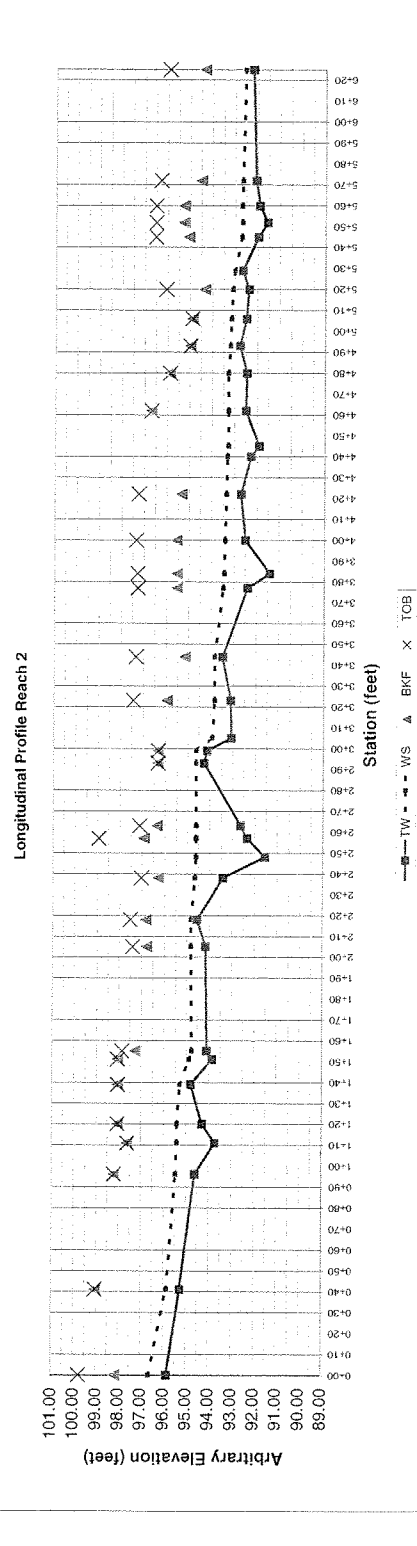


LITTLE BUGABOO CREEK AS-BUILT SURVEY

Field Crew: Amanda Todd and Wade Patton  
 River Basin: Yarkin Free-Dee  
 Stream Reach: Reach 2  
 Drainage Area: 3.45  
 Date: 4/5/2005  
 Description: LONGITUDINAL PROFILE

Station	TW (FS)	TW (FS)	WS (FS)	WS (FS)	BKF (FS)	BKF (FS)	BKF (FS)	TOB (FS)	TOB (FS)	TOB (FS)	Notes	HI	BK HUBD HL	P.P	Pool Length	Max Pool Depth	Pool Slope	Pool Slope	FS	FLV	NOTE	Run Length	Run Slope	Run Length	Run Slope	Glide Length	Glide Slope
0+00	10.60	95.85	96.65	8.40	8.30	98.15	6.68	99.76	99.76	99.76	HR	106.45	1.00						100.00								
0+41	11.16	95.29	95.85	10.60	7.40	99.05	7.40	99.05	99.05	99.05	CS1	106.45	1.00						4.48	101.97							
0+96	11.84	94.61	95.49	10.96	8.22	98.23	8.22	98.23	98.23	98.23	HP	106.45	1.00	142	43	0.0044			6.45	101.97							
1+11	12.71	93.74	95.43	11.02	8.80	97.65	8.80	97.65	97.65	97.65	MP	106.45	1.00														
1+20	12.15	94.30	95.43	11.02	8.38	98.07	8.38	98.07	98.07	98.07	HG	106.45	1.00														
1+39	11.64	94.81	95.30	11.15	8.38	98.07	8.38	98.07	98.07	98.07	BR/HR	106.45	1.00														
1+51	12.57	93.88	94.77	11.57	9.88	97.30	9.88	97.30	97.30	97.30	END BR	106.45	1.00														
2+05	12.35	94.10	94.81	11.68	9.15	97.30	9.15	97.30	97.30	97.30	HRU	106.45	1.18														
2+18	12.27	94.18	94.81	11.64	9.64	96.81	9.64	96.81	96.81	96.81	IM	106.45	1.24														
2+48	13.03	93.42	94.56	11.79	9.60	96.85	9.60	96.85	96.85	96.85	IM	106.45	1.30														
2+58	14.87	91.58	91.58	11.83	9.39	96.30	9.39	96.30	96.30	96.30	HP	106.45	1.26	139	25	0.0020											
2+63	14.10	92.35	94.62	11.83	9.50	96.95	9.50	96.95	96.95	96.95	CS2	106.45	1.44														
2+63	13.81	92.64	94.61	11.84	10.08	96.37	9.30	97.15	97.15	97.15	HG	106.45	1.21														
2+93	12.17	94.28	94.61	11.84	10.11	96.34	10.11	96.34	96.34	96.34	HRU	106.45	1.00														
2+99	12.31	94.14	94.62	11.83	10.11	96.34	10.11	96.34	96.34	96.34	CV	106.45	1.00														
3+05	13.37	93.08	93.92	12.53	9.92	95.95	9.92	95.95	95.95	95.95	CV DO	106.45	1.00														
3+23	14.43	93.11	93.82	13.72	9.82	95.95	10.09	97.45	97.45	97.45	HG	107.54	1.53														
3+44	14.06	93.48	93.82	13.72	12.30	95.15	10.20	97.34	97.34	97.34	HR	107.54	2.31														
3+77	15.15	92.39	93.46	14.08	12.02	95.52	10.27	97.27	97.27	97.27	HP	107.54	1.56	63	23	0.0026											
3+84	16.12	91.42	93.42	14.12	12.02	95.52	10.27	97.27	97.27	97.27	MP	107.54	1.43														
4+00	15.04	92.50	93.40	14.14	11.96	95.55	10.18	97.35	97.35	97.35	HG	107.54	1.59														
4+22	14.85	92.69	93.34	14.20	12.20	95.34	10.29	97.25	97.25	97.25	HR	107.54	1.72														
4+40	15.28	92.26	93.31	14.23	9.31	96.31	9.31	96.31	96.31	96.31	MP	107.54	1.00														
4+45	15.62	91.92	93.26	14.28	9.32	96.71	10.83	96.71	96.71	96.71	CS3	107.54	1.00														
4+62	15.04	92.50	93.27	14.27	10.83	96.71	10.83	96.71	96.71	96.71	CS3	107.54	1.00														
4+80	15.09	92.45	93.28	14.26	11.65	95.89	11.65	95.89	95.89	95.89	HG	107.54	1.00														
4+93	14.77	92.77	93.18	14.36	12.55	94.99	12.55	94.99	94.99	94.99	HR	107.54	1.00														
5+06	15.05	92.49	93.15	14.39	12.65	94.89	12.65	94.89	94.89	94.89	IM	107.54	1.00														
5+20	15.15	92.39	93.09	14.45	13.19	94.35	11.48	96.06	96.06	96.06	IM	107.54	1.87														
5+29	14.89	92.65	92.99	14.55	12.99	94.35	11.48	96.06	96.06	96.06	IM	107.54	1.87														
5+45	15.55	91.99	94.84	14.84	12.48	95.06	11.00	96.54	96.54	96.54	HP	107.54	1.48														
5+52	15.96	91.58	92.67	14.87	12.25	95.29	11.00	96.54	96.54	96.54	MP	107.54	1.34														
5+80	15.61	91.93	92.69	14.85	12.25	95.29	11.00	96.54	96.54	96.54	HG	107.54	1.37														
5+72	15.45	92.09	92.65	13.04	13.04	94.50	11.23	96.31	96.31	96.31	IM	107.54	1.75														
6+25	15.32	92.22	92.54	15.00	13.20	94.34	11.51	95.93	95.93	95.93	HR	107.54	1.75														

Pool Length	Max Pool Depth	Pool Slope	Riffle Length	Riffle Slope	Run Length	Run Slope	Glide Length	Glide Slope
13	2.06	0.0007	16	0.0017	12	0.0013	12	0.0000
43	3.77	0.0044	95	0.0331	83	0.0575	30	0.0077
29	2.96	0.0021	43	0.0134	48	0.0294	20	0.0034
2.2	0.87	0.1014		0.2534		0.2015		0.0000
0.55	1.59	5.0373		5.0373		8.7493		1.1688
3.9	1.25	0.3176		2.0382		4.4727		0.5220



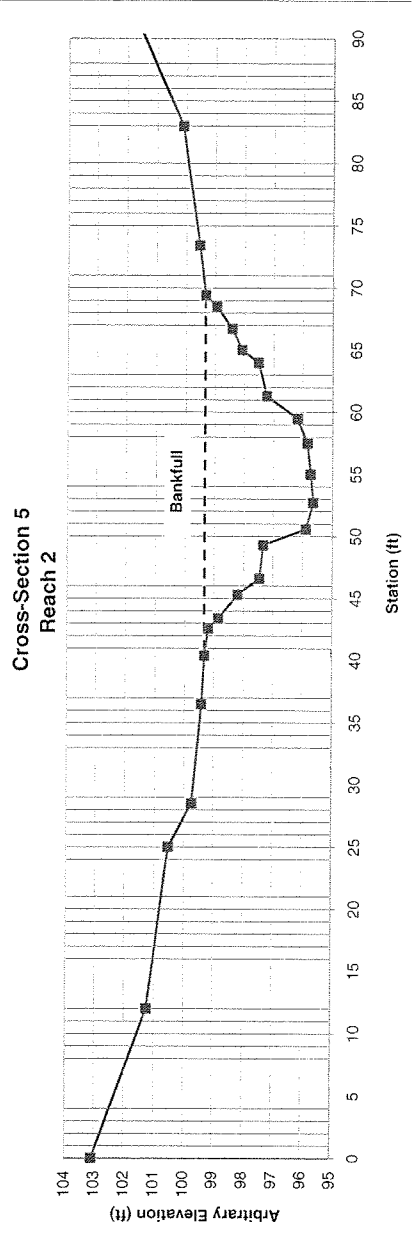
LITTLE BUGABOO CREEK AS-BUILT SURVEY

Field Crew: Amanda Todd and Wade Falton  
 River Basin: Yalquin Pee-Dee  
 Watershed: Little Bugaboo  
 Stream Reach: Reach 2  
 Drainage Area: 3.45  
 Date: 4/5/2005  
 Station: 0+41  
 Feature: CS 3 RIFLE

STATION (FEET)	HI (FEET)	FS (FEET)	ELEVATION (FEET)	NOTES
0+00.0	102.86	3.59	102.86	3.26 cm rebar
0+12.0	106.45	5.45	101.00	
0+25.0	106.45	6.18	100.27	
0+38.5	106.45	6.98	99.47	
0+36.5	106.45	7.30	99.15	LBKF
0+40.4	106.45	7.40	99.05	
0+42.6	106.45	7.53	98.92	
0+43.4	106.45	7.88	98.57	
0+45.3	106.45	8.54	97.91	
0+46.6	106.45	9.28	97.17	
0+49.3	106.45	9.42	97.03	
0+50.6	106.45	10.91	95.54	LEOW
0+52.7	106.45	11.16	95.29	TW
0+55.0	106.45	11.07	95.38	
0+57.5	106.45	10.86	95.49	
0+59.5	106.45	10.60	95.85	REOW/WS
0+61.3	106.45	9.53	96.92	
0+64.0	106.45	9.23	97.22	
0+65.0	106.45	8.67	97.78	
0+66.7	106.45	8.32	98.13	
0+68.5	106.45	7.79	98.66	
0+69.4	106.45	7.40	99.05	RBKF
0+73.4	106.45	7.18	99.27	
0+83.0	106.45	6.60	99.85	
0+91.0	106.45	5.09	101.36	
1+00.0	106.45	4.16	102.29	rebar flush with ground

BANKFULL/TOB Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
2.2	0.1	0.1
0.8	0.5	0.2
1.9	1.1	1.5
1.3	1.9	2.0
2.7	2.0	5.3
1.3	3.5	3.6
2.1	3.8	7.6
2.3	3.7	8.5
2.5	3.6	9.0
2.0	3.2	6.8
1.8	2.1	4.8
2.7	1.8	5.3
1.0	1.3	1.6
1.7	0.9	1.9
1.8	0.4	1.2
0.9	0.0	0.2
<b>TOTALS</b>	<b>25.0</b>	<b>59.6</b>

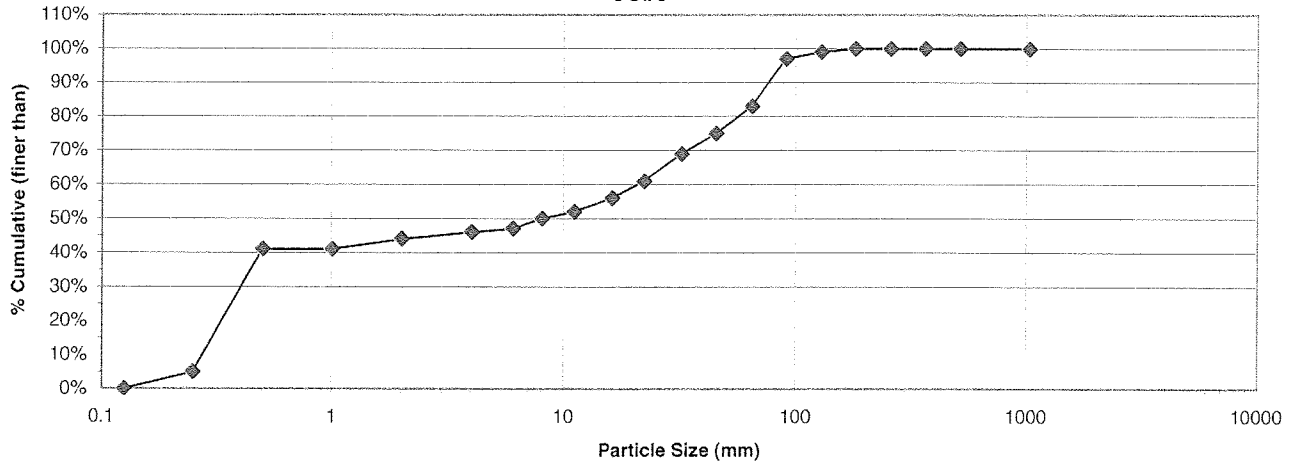
SUMMARY DATA (BANKFULL)	
A(BKF)	59.6
W(BKF)	25.0
Max d	3.8
Mean d	2.1
W/D	14.1
Entrenchment	>3.4
Stream Type	Cb
Area from Rural Regional Curve	50.42
W(FPA)	>100
Slope	0.007
Simutosity	
Area= A	
Width= W	
Depth= D	
Bankfull= BKF	



LITTLE BUGABOO CREEK AS-BUILT SURVEY

PEBBLE COUNT									
Site: LBC							4/5/2005		
Party: Amanda Todd and Wade Patton							CS#5		
Particle Count									
Inches	Particle	Millimeter	S/C	Riffle			Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	0			0	0%	0%
.04 - .08	Very Fine	.062 - .125	S	0			0	0%	0%
	Fine	.125 - .25	A	5			5	5%	5%
	Medium	.25 - .50	N	36			36	36%	41%
	Coarse	.50 - 1.0	D	0			0	0%	41%
	Very Coarse	1.0 - 2.0	S	3			3	3%	44%
.08 - .16	Very Fine	2.0 - 4.0		2			2	2%	46%
.16 - .22	Fine	4.0 - 5.7	G	1			1	1%	47%
.22 - .31	Fine	5.7 - 8.0	R	3			3	3%	50%
.31 - .44	Medium	8.0 - 11.3	A	2			2	2%	52%
.44 - .63	Medium	11.3 - 16.0	V	4			4	4%	56%
.63 - .89	Coarse	16.0 - 22.6	E	5			5	5%	61%
.89 - 1.26	Coarse	22.6 - 32.0	L	8			8	8%	69%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	6			6	6%	75%
1.77 - 2.5	Very Coarse	45.0 - 64.0		8			8	8%	83%
2.5 - 3.5	Small	64 - 90	C	14			14	14%	97%
3.5 - 5.0	Small	90 - 128	O	2			2	2%	99%
5.0 - 7.1	Large	128 - 180	B	1			1	1%	100%
7.1 - 10.1	Large	180 - 256	L	0			0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0			0	0%	100%
14.3 - 20	Small	362 - 512	L	0			0	0%	100%
20 - 40	Medium	512 - 1024	D	0			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0			0	0%	100%
	Bedrock		BDRK	0			0	0%	100%
<b>Totals</b>				<b>100</b>			<b>100</b>	<b>100%</b>	<b>100%</b>

Particle Size Distribution  
Little Bugaboo Creek  
CS#5



LITTLE BUGABOO CREEK AS-BUILT SURVEY

Field Crew: Amanda Todd and Wade Patton  
 River Basin: Yackin Pee-Dee  
 Watershed: Little Bugaboo  
 Stream Reach: Reach 2  
 Drainage Area: 3.45  
 Date: 4/5/2005  
 Station: 2+57  
 Feature: CS 6 POOL

STATION	HI (FEET)	FS (FEET)	ELEVATION (FEET)	NOTES
0+00.0	106.45	4.73	101.72	rebar 4.48
0+08.0	106.45	8.06	98.39	
0+13.0	106.45	8.40	98.05	
0+19.2	106.45	7.49	98.96	lob
0+20.7	106.45	9.50	96.95	blkflint
0+23.2	106.45	12.93	93.52	
0+24.0	106.45	14.10	92.35	lw
0+25.5	106.45	14.09	92.45	
0+27.5	106.45	14.09	92.36	
0+29.5	106.45	13.34	93.11	
0+32.0	106.45	12.63	93.82	
0+34.7	106.45	11.89	94.56	
0+35.7	106.45	11.49	94.96	eo/w/s
0+36.7	106.45	10.72	95.73	
0+40.6	106.45	9.95	96.50	
0+41.0	106.45	9.50	96.95	blkf
0+42.8	106.45	9.52	96.93	
0+45.0	106.45	9.58	96.87	
0+45.7	106.45	9.30	97.15	
0+47.0	106.45	8.79	97.66	
0+51.0	106.45	7.88	98.57	
0+59.5	106.45	7.49	98.96	tblint
0+67.0	106.45	6.29	100.16	
0+79.0	106.45	4.65	101.80	
0+85.0	106.45	3.81	102.64	rebar 3.75

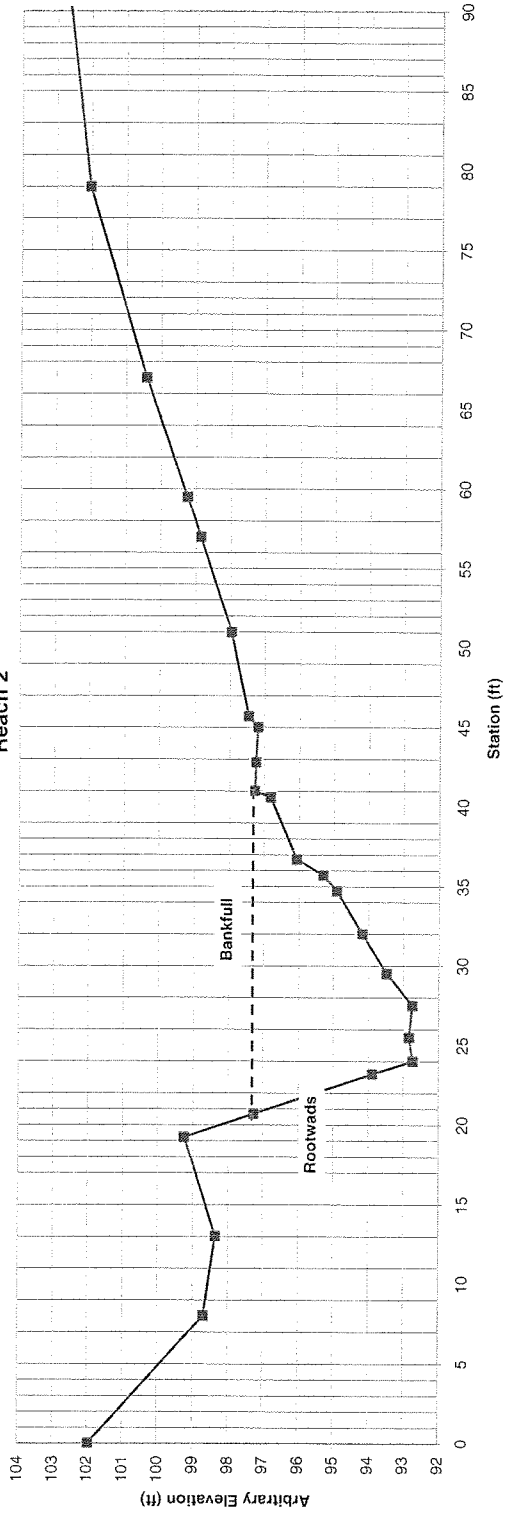
BANKFULL			
Hydraulic Geometry			
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)	
0.0	0.0	0.0	
2.5	3.4	4.3	
0.8	4.6	3.2	
1.5	4.5	6.8	
2.0	4.6	9.1	
2.0	3.8	8.4	
2.5	3.1	8.7	
2.7	2.4	7.5	
1.0	2.0	2.2	
1.0	1.2	1.6	
3.9	0.5	3.3	
0.4	0.0	0.1	
<b>TOTALS</b>	<b>20.3</b>	<b>55.2</b>	

SUMMARY DATA (TOB)			
W(BKF)	20.3		
Max d	4.6		
Mean d	2.7		

TOB			
Hydraulic Geometry			
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)	
0.0	0.0	0.0	
1.5	3.4	2.5	
2.5	4.6	10.1	
0.8	4.5	3.6	
1.5	4.6	6.8	
2.0	3.8	8.4	
3.1	2.0	7.0	
2.5	2.4	6.9	
2.7	2.0	5.9	
1.0	1.2	1.6	
1.0	0.5	0.8	
3.9	0.0	0.9	
<b>TOTALS</b>	<b>21.4</b>	<b>54.6</b>	

SUMMARY DATA (TOB)			
W(BKF)	21.4		
Max d	4.6		
Mean d	2.6		

Cross-Section 6  
Reach 2

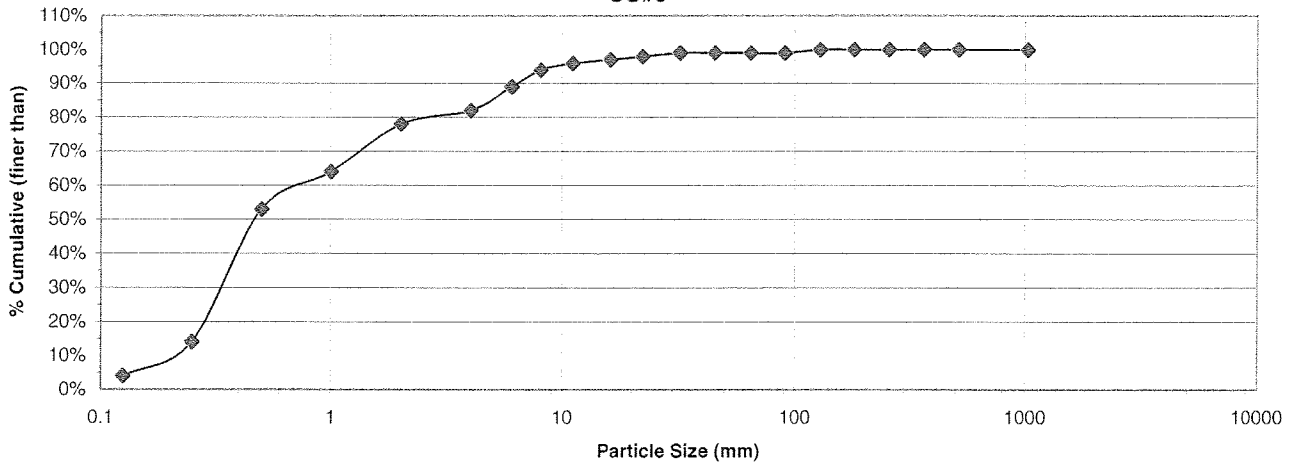




### LITTLE BUGABOO CREEK AS-BUILT SURVEY

PEBBLE COUNT								
Site: LBC						4/5/2005		
Party: Amanda Todd and Wade Patton						Pool CS#2		
Particle Count								
Inches	Particle	Millimeter		Riffle		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	3		3	3%	3%
.04 - .08	Very Fine	.062 - .125	S	1		1	1%	4%
	Fine	.125 - .25	A	10		10	10%	14%
	Medium	.25 - .50	N	39		39	39%	53%
	Coarse	.50 - 1.0	D	11		11	11%	64%
	Very Coarse	1.0 - 2.0	S	14		14	14%	78%
.08 - .16	Very Fine	2.0 - 4.0		4		4	4%	82%
.16 - .22	Fine	4.0 - 5.7	G	7		7	7%	89%
.22 - .31	Fine	5.7 - 8.0	R	5		5	5%	94%
.31 - .44	Medium	8.0 - 11.3	A	2		2	2%	96%
.44 - .63	Medium	11.3 - 16.0	V	1		1	1%	97%
.63 - .89	Coarse	16.0 - 22.6	E	1		1	1%	98%
.89 - 1.26	Coarse	22.6 - 32.0	L	1		1	1%	99%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	0		0	0%	99%
1.77 - 2.5	Very Coarse	45.0 - 64.0		0		0	0%	99%
2.5 - 3.5	Small	64 - 90	C	0		0	0%	99%
3.5 - 5.0	Small	90 - 128	O	1		1	1%	100%
5.0 - 7.1	Large	128 - 180	B	0		0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0		0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0		0	0%	100%
14.3 - 20	Small	362 - 512	L	0		0	0%	100%
20 - 40	Medium	512 - 1024	D	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0		0	0%	100%
	Bedrock		BDRK	0		0	0%	100%
<b>Totals</b>				<b>100</b>		<b>100</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
Little Bugaboo Creek  
CS#6**



LITTLE BUGABOO CREEK AS-BUILT SURVEY

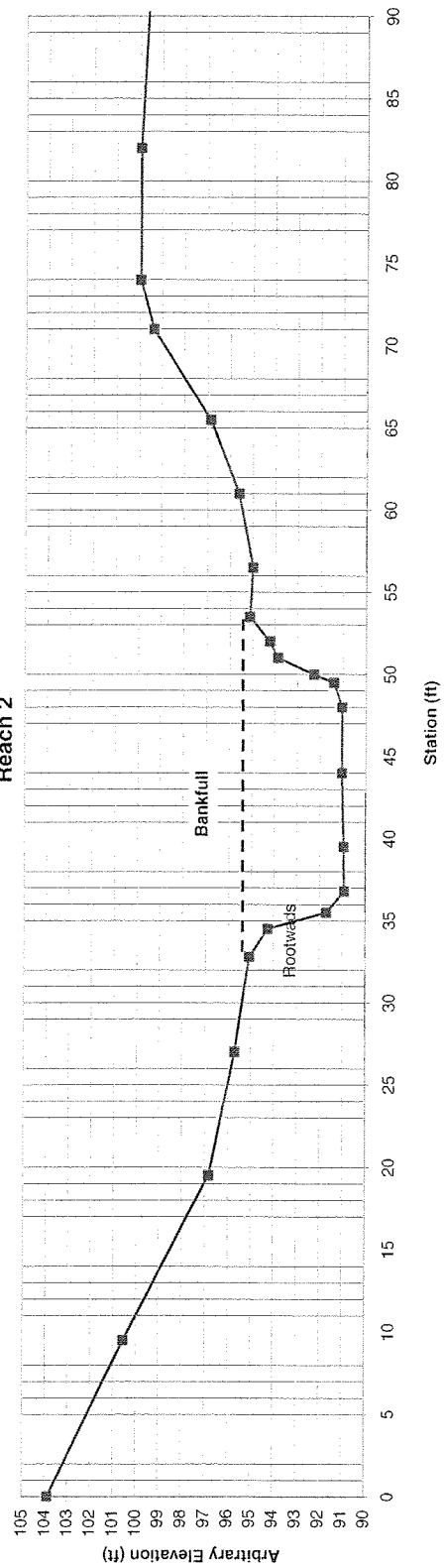
Field Crew: Amanda Todd and Wade Patton  
 River Basin: Yadkin Pee-Dee  
 Watershed: Little Bugaboo  
 Stream Reach: Reach 2  
 Drainage Area: 0.86  
 Date: 1/10/2005  
 Station: 4+62  
 Feature: CS.7 POOL

STATION (FEET)	HI (FEET)	FS (FEET)	ELEVATION (FEET)	NOTES
0+00.0	105.57	1.89	103.68	rb 1.46
0+09.5	105.57	5.28	100.29	
0+19.5	105.57	9.05	96.52	
0+27.0	105.57	10.19	95.38	
0+32.8	105.57	10.83	94.74	llubbkfk
0+34.5	105.57	11.66	93.91	
0+35.5	105.57	14.27	91.30	leow/lws
0+36.8	105.57	15.07	90.50	
0+39.5	105.57	15.04	90.53	tw
0+44.0	105.57	14.95	90.62	
0+48.0	105.57	14.95	90.62	
0+49.5	105.57	14.59	90.98	reow
0+50.0	105.57	13.69	91.88	
0+51.0	105.57	12.07	93.50	
0+52.0	105.57	11.71	93.86	
0+53.5	105.57	10.80	94.77	
0+56.5	105.57	10.93	94.64	
0+61.0	105.57	10.30	95.27	
0+65.5	105.57	9.03	96.54	
0+71.0	105.57	6.48	99.09	
0+74.0	105.57	5.88	99.69	
0+82.0	105.57	5.88	99.69	
0+92.0	105.57	6.29	99.28	
1+00.0	105.57	6.60	98.97	rb 6.53

BANKFULL/TOB Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
1.7	0.8	0.7
1.0	3.4	2.1
1.3	4.2	5.0
2.7	4.2	11.4
4.5	4.1	18.7
4.0	4.1	16.5
1.5	3.8	5.9
0.5	2.9	1.7
1.0	1.2	2.1
1.0	0.9	1.1
1.5	0.0	0.6
<b>TOTALS</b>	<b>20.7</b>	<b>65.8</b>

SUMMARY DATA (TOB)	
A/(BK <sup>2</sup> )	65.8
W/(BK <sup>2</sup> )	20.7
Max d	4.2
Mean d	3.2

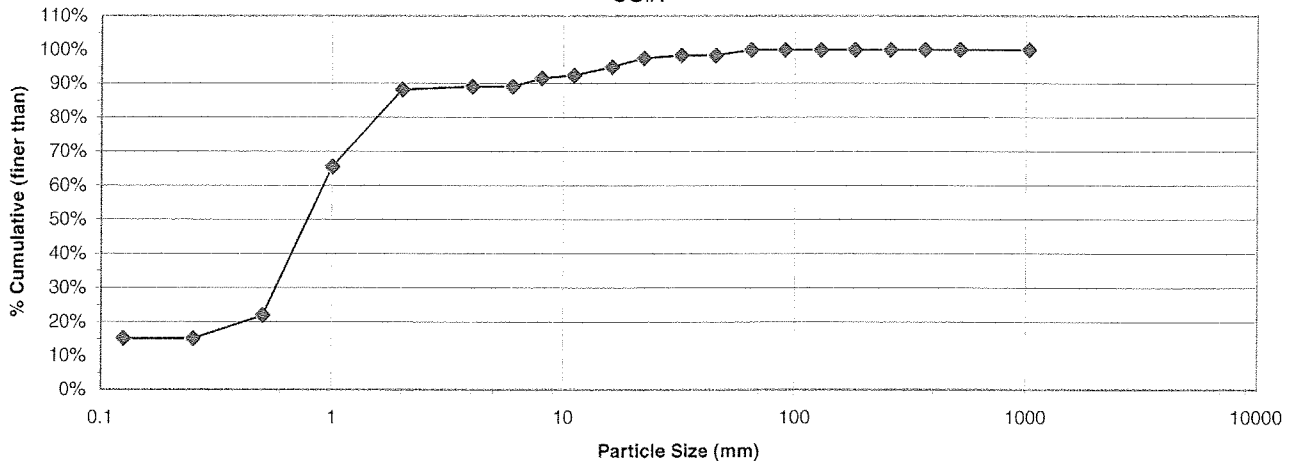
Cross-Section 7  
Reach 2



### LITTLE BUGABOO CREEK AS-BUILT SURVEY

PEBBLE COUNT									
Site: LBC							4/5/2005		
Party: Amanda Todd and Wade Patton							CS#7		
Particle Count									
Inches	Particle	Millimeter		Riffle			Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	16			16	13%	13%
.04 - .08	Very Fine	.062 - .125	S	2			2	2%	15%
	Fine	.125 - .25	A	0			0	0%	15%
	Medium	.25 - .50	N	8			8	7%	22%
	Coarse	.50 - 1.0	D	52			52	44%	66%
	Very Coarse	1.0 - 2.0	S	27			27	23%	88%
.08 - .16	Very Fine	2.0 - 4.0		1			1	1%	89%
.16 - .22	Fine	4.0 - 5.7	G	0			0	0%	89%
.22 - .31	Fine	5.7 - 8.0	R	3			3	3%	92%
.31 - .44	Medium	8.0 - 11.3	A	1			1	1%	92%
.44 - .63	Medium	11.3 - 16.0	V	3			3	3%	95%
.63 - .89	Coarse	16.0 - 22.6	E	3			3	3%	97%
.89 - 1.26	Coarse	22.6 - 32.0	L	1			1	1%	98%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	0			0	0%	98%
1.77 - 2.5	Very Coarse	45.0 - 64.0		2			2	2%	100%
2.5 - 3.5	Small	64 - 90	C	0			0	0%	100%
3.5 - 5.0	Small	90 - 128	O	0			0	0%	100%
5.0 - 7.1	Large	128 - 180	B	0			0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0			0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0			0	0%	100%
14.3 - 20	Small	362 - 512	L	0			0	0%	100%
20 - 40	Medium	512 - 1024	D	0			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0			0	0%	100%
	Bedrock		BDRK	0			0	0%	100%
<b>Totals</b>				<b>119</b>			<b>119</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
Little Bugaboo Creek  
CS#7**



LITTLE BUGABOO CREEK AS-BUILT SURVEY

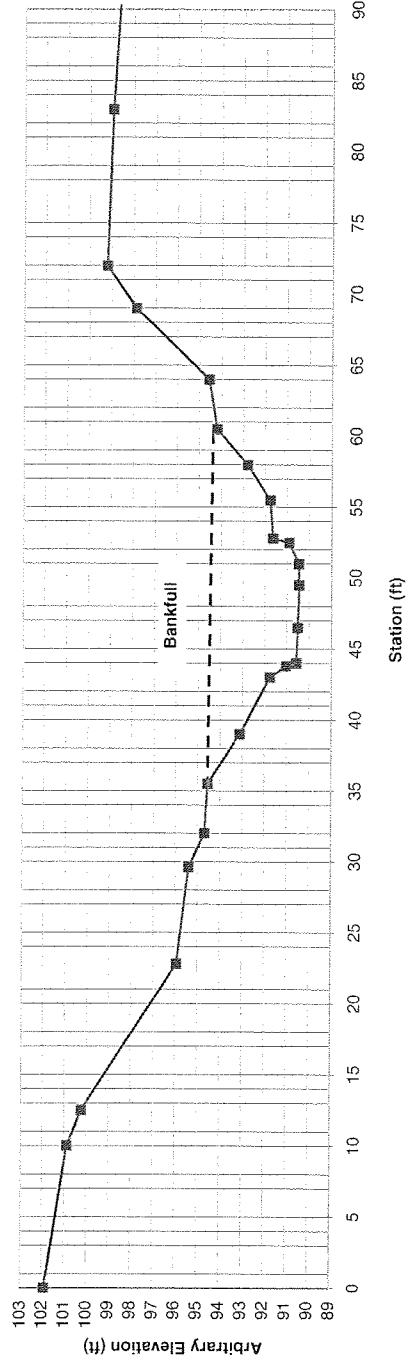
Field Crew: Amanda Todd and Wade Patton  
 River Basin: Yarkin Pee-Dee  
 Watershed: Little Bugaboo  
 Stream Reach: Reach 2  
 Drainage Area: 3.45  
 Date: 1/10/2005  
 Station: 6+30  
 Feature: CS 8

STATION (FEET)	HI (FEET)	FS (FEET)	ELEVATION (FEET)	NOTES
0+00.0	105.57	3.89	101.68	RB 3.55
0+10.0	105.57	4.95	100.62	
0+12.5	105.57	5.60	99.97	w/tpa
0+22.8	105.57	9.97	95.60	
0+29.6	105.57	10.51	95.06	
0+32.0	105.57	11.23	94.34	
0+35.5	105.57	11.36	94.21	LBKF
0+39.0	105.57	12.83	92.74	
0+43.0	105.57	14.22	91.35	LEOW/MS
0+43.8	105.57	14.95	90.62	
0+44.0	105.57	15.43	90.14	
0+46.5	105.57	15.49	90.08	
0+49.5	105.57	15.55	90.02	
0+51.0	105.57	15.53	90.04	
0+52.5	105.57	15.08	90.49	REOW
0+52.8	105.57	14.34	91.23	
0+55.5	105.57	14.20	91.37	
0+58.0	105.57	13.15	92.42	
0+60.5	105.57	11.73	93.84	
0+64.0	105.57	11.36	94.21	RBKF
0+69.0	105.57	8.00	97.57	
0+72.0	105.57	6.64	98.93	
0+83.0	105.57	6.90	98.67	
1+00.0	105.57	7.61	97.96	RB 7.55

BANKFULL/TOB Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq Ft)
0.0	0.0	0.0
3.5	1.5	2.6
4.0	2.9	8.7
0.8	3.6	2.6
0.2	4.1	0.8
2.5	4.1	10.3
3.0	4.2	12.5
1.5	4.2	6.3
3.7	5.9	5.9
3.0	3.0	1.0
2.7	2.8	7.9
2.5	1.8	5.8
2.5	0.4	2.7
3.5	0.0	0.6
<b>TOTALS</b>	<b>28.5</b>	<b>67.5</b>

SUMMARY DATA (BANKFULL)	
A/BKF	67.5
W/BKF	28.5
Max d	4.2
Mean d	2.4
W/D	12.0
Entrenchment	3.1
Stream Type	C
Area from Rural Regional Curve	50.42
W/FPA	87.5
Slope	0.007
Stimosity	
Area= A	
Width= W	
Depth= D	
Bankfull= BKF	

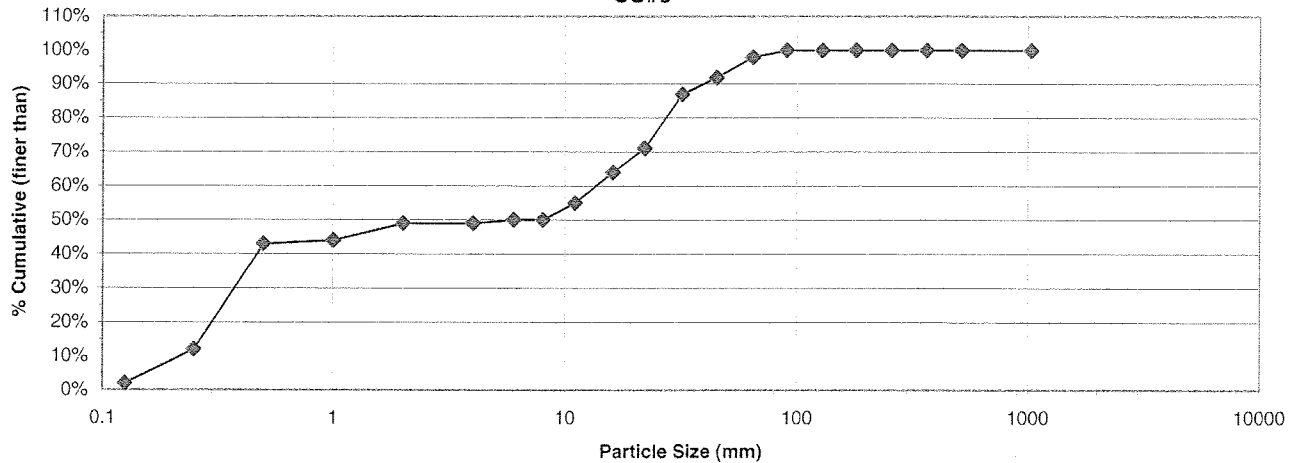
Cross-Section 8  
Reach 2



### LITTLE BUGABOO CREEK AS-BUILT SURVEY

PEBBLE COUNT									
Site: LBC						4/5/2005			
Party: Amanda Todd and Wade Patton						CS#8			
Particle Count									
Inches	Particle	Millimeter		Riffle			Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	0			0	0%	0%
.04 - .08	Very Fine	.062 - .125	S	2			2	2%	2%
	Fine	.125 - .25	A	10			10	10%	12%
	Medium	.25 - .50	N	31			31	31%	43%
	Coarse	.50 - 1.0	D	1			1	1%	44%
	Very Coarse	1.0 - 2.0	S	5			5	5%	49%
.08 - .16	Very Fine	2.0 - 4.0		0			0	0%	49%
.16 - .22	Fine	4.0 - 5.7	G	1			1	1%	50%
.22 - .31	Fine	5.7 - 8.0	R	0			0	0%	50%
.31 - .44	Medium	8.0 - 11.3	A	5			5	5%	55%
.44 - .63	Medium	11.3 - 16.0	V	9			9	9%	64%
.63 - .89	Coarse	16.0 - 22.6	E	7			7	7%	71%
.89 - 1.26	Coarse	22.6 - 32.0	L	16			16	16%	87%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	5			5	5%	92%
1.77 - 2.5	Very Coarse	45.0 - 64.0		6			6	6%	98%
2.5 - 3.5	Small	64 - 90	C	2			2	2%	100%
3.5 - 5.0	Small	90 - 128	O	0			0	0%	100%
5.0 - 7.1	Large	128 - 180	B	0			0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0			0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0			0	0%	100%
14.3 - 20	Small	362 - 512	L	0			0	0%	100%
20 - 40	Medium	512 - 1024	D	0			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0			0	0%	100%
	Bedrock		BDRK	0			0	0%	100%
<b>Totals</b>				<b>100</b>			<b>100</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
Little Bugaboo Creek  
CS#8**



UT Little Bugaboo Creek As-Built Survey

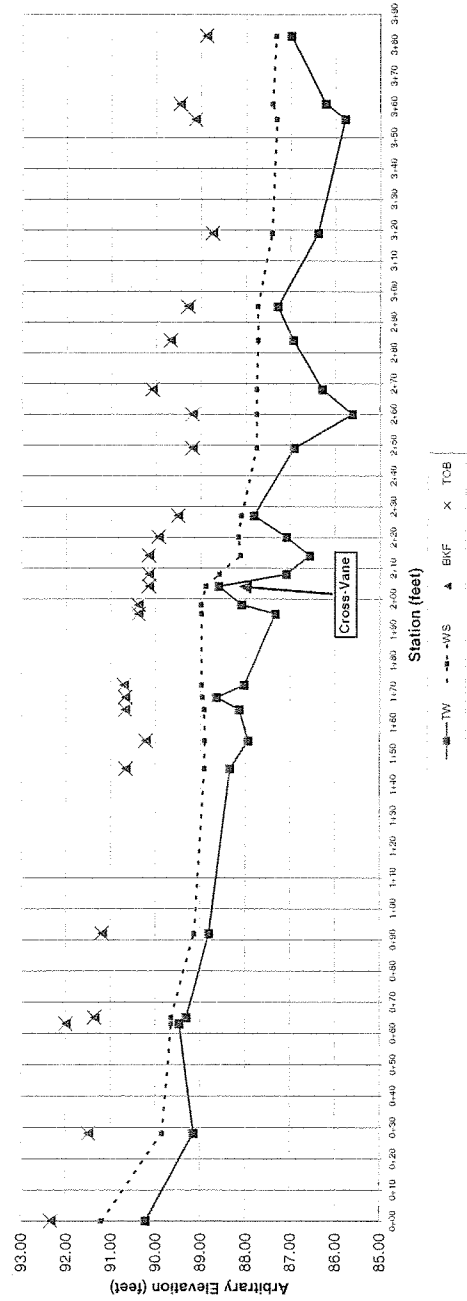
Field Crew: Annette Todd and Wade Patton  
 River Basin: Tuckahoe  
 Township: Liberty  
 Drainage Area: 1.40  
 Date: 4/8/2005  
 Description: LONGITUDINAL PROFILE

Station	TW (FS)	IW (FS)	WS (FS)	BKF (FS)	BKF (FS)	top (FS)	TOB	Noises	HI	Bk.H/Bk.L HI	P.P	Pool Length	Max Pool Depth	Pool Slope	Riffle Length	Riffle Slope	Cicle Length	Glide Length	Run Length	Run Slope	ELEV	NOTE	FS	HI	BS	STA	IBM #1	
0+00.0	12.08	30.21	11.08	91.21	9.96	92.33	9.96	92.33 HR	102.29	1.00											100.00							
0+25.0	13.14	89.15	12.44	89.85	10.80	91.49	10.80	91.49 HRU	102.29	1.00																		
0+50.0	12.83	89.46	12.84	89.65	10.29	92.00	10.29	92.00 cs2	102.29	1.00																		
0+75.0	12.88	89.31	12.84	89.65	10.93	91.36	10.93	91.36 HR	102.29	1.00																		
1+00.0	13.44	89.24	13.44	89.24	11.61	90.68	11.61	90.68 HRU	102.29	1.00																		
1+25.0	13.94	89.26	13.37	89.32	12.06	90.23	12.06	90.23 IM	102.29	1.00																		
1+50.0	14.14	89.15	13.56	89.93	11.60	90.69	11.60	90.69 IM	102.29	1.00																		
1+75.0	13.64	88.65	13.32	88.97	11.60	90.69	11.60	90.69 IM	102.29	1.00																		
2+00.0	14.85	88.04	13.30	88.99	11.57	90.72	11.57	90.72 IM	102.29	1.00																		
2+25.0	14.19	86.10	13.25	89.00	11.90	90.39	11.90	90.39 IM	102.29	1.00																		
2+50.0	14.59	86.60	13.40	88.99	12.13	90.16	12.13	90.16 CV	102.29	1.00																		
2+75.0	15.19	87.19	13.70	88.59	12.13	90.16	12.13	90.16 CV	102.29	1.00																		
3+00.0	15.59	87.19	14.16	88.19	12.35	89.94	12.35	89.94 MP	102.29	1.00																		
3+25.0	15.20	87.09	14.12	88.17	12.35	89.94	12.35	89.94 MP	102.29	1.00																		
3+50.0	14.46	87.83	14.18	88.11	12.76	89.51	12.76	89.51 HR	102.29	1.00																		
3+75.0	15.37	86.92	14.52	87.77	13.10	89.19	13.10	89.19 HR	102.29	1.00																		
4+00.0	16.67	85.82	14.52	87.77	13.10	89.19	13.10	89.19 MP	102.29	1.00																		
4+25.0	16.00	86.29	14.50	87.74	12.21	90.08	12.21	90.08 cs3	102.29	1.00																		
4+50.0	15.35	86.94	14.55	87.74	12.61	89.68	12.61	89.68 IM	102.29	1.00																		
4+75.0	15.00	87.29	14.54	87.75	13.00	89.29	13.00	89.29 HR	102.29	1.00																		
5+00.0	16.80	86.39	14.86	87.43	13.54	88.75	13.54	88.75 HR	102.29	1.00																		
5+25.0	17.52	85.79	14.96	87.33	13.15	89.14	13.15	89.14 MP	102.29	1.00																		
5+50.0	17.52	85.79	14.96	87.33	13.15	89.14	13.15	89.14 MP	102.29	1.00																		
5+75.0	15.29	87.00	14.95	87.34	13.40	88.69	13.40	88.69 CV	102.29	1.00																		

tw slope 0.0084  
 BKF W (ft) = 22.1  
 BKF D (ft) = 1.13  
 BKF Max D (ft) = 2.90

Pool Length	Max Pool Depth	Pool Slope	Riffle Length	Riffle Slope	Cicle Length	Glide Length	Run Length	Run Slope
48	3.03	0.0004	22	0.0133	7	0.0096	37	0.0042
75	3.35	0.0011	28	0.0466	7	0.0096	53	0.0064
62	3.20	0.0040	25	0.0241	7	0.0096	45	0.0048
4.7	2.56	1.0029	4.7	1.3186				0.4108
3.9	2.63	0.3950	3.9	2.3813				0.6350
								0.4729

Longitudinal Profile UT



Field Crew: Aracelis Todd and Wade Patton  
 River Basin: Yackin-Pear-Dee  
 Watershed: Little Bugaboo Creek  
 Stream Reach: Longitudinal Reach 1  
 Drainage Area: 1.40  
 Date: 4/6/2005  
 Station: NA  
 Feature: CS 1 (Riffle)

DO NOT TIE INTO LONGITUDINAL

STATION (FEET)	HI (FEET)	FS (FEET)	ELEVATION (FEET)	NOTES
0+00.0	3.80	96.20	96.20	RB 3.61
0+10.0	100.00	4.60	95.40	
0+20.0	100.00	5.10	94.27	
0+27.0	100.00	6.71	93.86	
0+31.0	100.00	6.87	92.97	LBKF
0+33.5	100.00	7.13	92.59	
0+35.0	100.00	7.41	92.28	
0+36.3	100.00	7.72	91.95	
0+38.9	100.00	8.04	91.65	
0+38.0	100.00	8.35	90.93	LEOW
0+39.0	100.00	9.07	90.01	TW
0+39.9	100.00	9.99	89.67	
0+41.0	100.00	10.03	90.06	REOW/WS
0+42.2	100.00	9.94	90.37	
0+43.2	100.00	9.63	91.32	
0+43.8	100.00	8.88	91.57	
0+45.5	100.00	8.43	91.75	
0+46.0	100.00	8.25	92.03	
0+47.0	100.00	7.97	92.70	
0+48.3	100.00	7.30	92.67	RBKF
0+50.0	100.00	7.01	92.96	
0+60.0	100.00	7.01	93.16	RB 6.39
0+75.9	100.00	6.84		

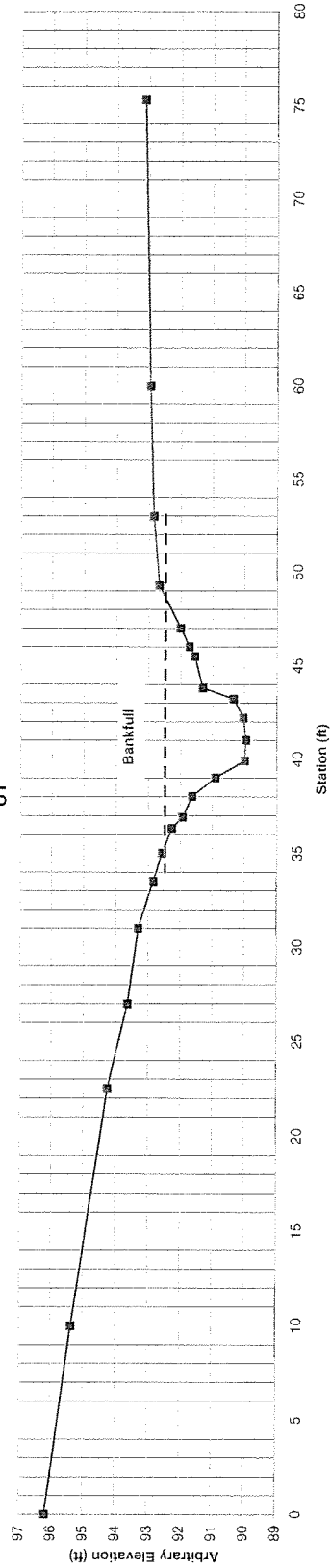
TOTALS 19.5 22.1

BANKFULL/TOB Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
1.5	0.3	0.2
1.3	0.6	0.6
0.6	0.9	0.5
1.1	1.2	1.2
1.1	1.9	1.6
0.9	2.9	2.2
1.1	2.9	3.2
1.2	2.8	3.4
1.0	2.5	2.7
1.7	1.3	2.4
0.5	1.1	0.6
1.0	0.8	1.0
2.3	0.2	1.2
3.7	0.0	0.3

SUMMARY DATA (BANKFULL/TOB)	
A/B(KF)	22.1
W(BKF)	19.5
Mean d	2.90
W/D	1.13
Entrenchment	>3.8
Stream Type	C
Area from Rural Regional Curve	27.55

SLOPE	TW	WS
0+00.0	9.41	9.18
1+00.0	10.19	9.83
	0.0078	0.0065

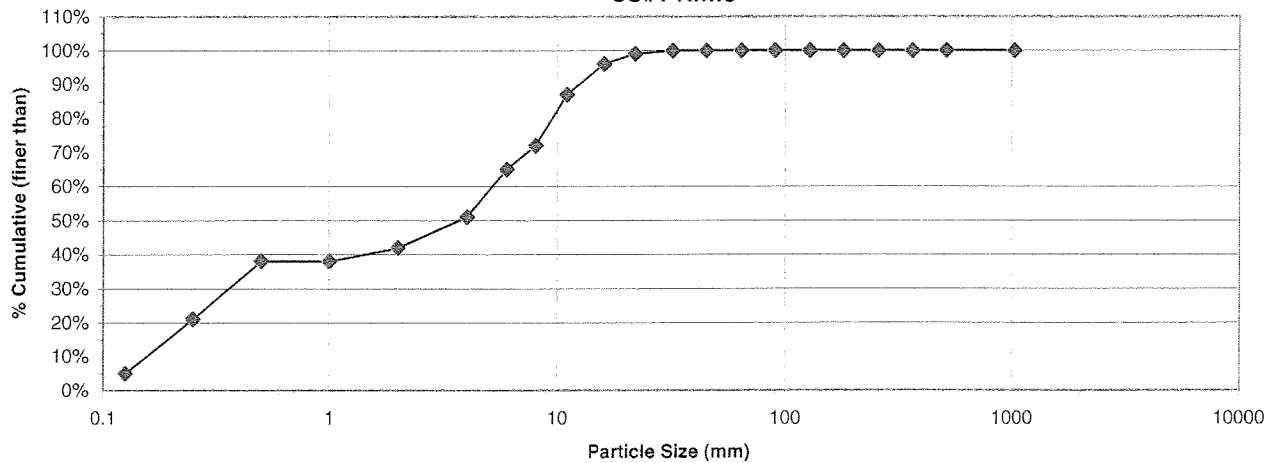
Cross-Section 1  
UT



### UT Little Bugaboo Creek As-Built Survey

PEBBLE COUNT									
Site: Tributary to LBC							3/24/2005		
Party: Amanda Todd and Russel Barbour							Riffle CS#1		
Particle Count									
Inches	Particle	Millimeter	S/C	Riffle			Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	0			0	0%	0%
.04 - .08	Very Fine	.062 - .125	S	5			5	5%	5%
	Fine	.125 - .25	A	16			16	16%	21%
	Medium	.25 - .50	N	17			17	17%	38%
	Coarse	.50 - 1.0	D	0			0	0%	38%
	Very Coarse	1.0 - 2.0	S	4			4	4%	42%
.08 - .16	Very Fine	2.0 - 4.0		9			9	9%	51%
.16 - .22	Fine	4.0 - 5.7	G	14			14	14%	65%
.22 - .31	Fine	5.7 - 8.0	R	7			7	7%	72%
.31 - .44	Medium	8.0 - 11.3	A	15			15	15%	87%
.44 - .63	Medium	11.3 - 16.0	V	9			9	9%	96%
.63 - .89	Coarse	16.0 - 22.6	E	3			3	3%	99%
.89 - 1.26	Coarse	22.6 - 32.0	L	1			1	1%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	0			0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0		0			0	0%	100%
2.5 - 3.5	Small	64 - 90	C	0			0	0%	100%
3.5 - 5.0	Small	90 - 128	O	0			0	0%	100%
5.0 - 7.1	Large	128 - 180	B	0			0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0			0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0			0	0%	100%
14.3 - 20	Small	362 - 512	L	0			0	0%	100%
20 - 40	Medium	512 - 1024	D	0			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0			0	0%	100%
	Bedrock		BDRK	0			0	0%	100%
<b>Totals</b>				<b>100</b>			<b>100</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
UT Little Bugaboo Creek  
CS#1 Riffle**



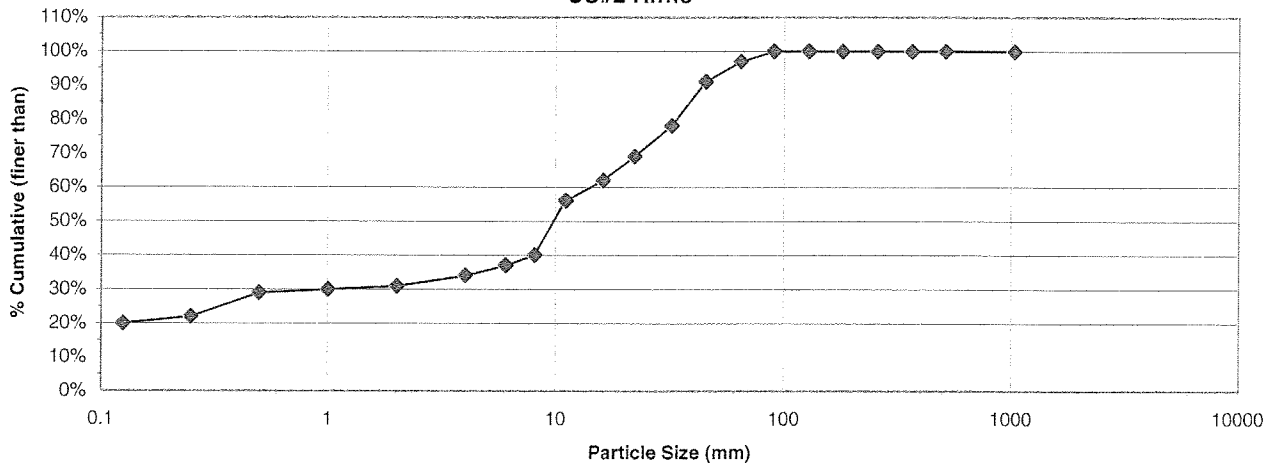




**UT Little Bugaboo Creek As-Built Survey**

PEBBLE COUNT									
Site: Tributary to LBC							3/24/2005		
Party: Amanda Todd and Russel Barbour							Riffle CS#2		
Particle Count									
Inches	Particle	Millimeter	S/C	Riffle			Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	7			7	7%	7%
.04 - .08	Very Fine	.062 - .125	S	13			13	13%	20%
	Fine	.125 - .25	A	2			2	2%	22%
	Medium	.25 - .50	N	7			7	7%	29%
	Coarse	.50 - 1.0	D	1			1	1%	30%
	Very Coarse	1.0 - 2.0	S	1			1	1%	31%
.08 - .16	Very Fine	2.0 - 4.0		3			3	3%	34%
.16 - .22	Fine	4.0 - 5.7	G	3			3	3%	37%
.22 - .31	Fine	5.7 - 8.0	R	3			3	3%	40%
.31 - .44	Medium	8.0 - 11.3	A	16			16	16%	56%
.44 - .63	Medium	11.3 - 16.0	V	6			6	6%	62%
.63 - .89	Coarse	16.0 - 22.6	E	7			7	7%	69%
.89 - 1.26	Coarse	22.6 - 32.0	L	9			9	9%	78%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	13			13	13%	91%
1.77 - 2.5	Very Coarse	45.0 - 64.0		6			6	6%	97%
2.5 - 3.5	Small	64 - 90	C	3			3	3%	100%
3.5 - 5.0	Small	90 - 128	O	0			0	0%	100%
5.0 - 7.1	Large	128 - 180	B	0			0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0			0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0			0	0%	100%
14.3 - 20	Small	362 - 512	L	0			0	0%	100%
20 - 40	Medium	512 - 1024	D	0			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0			0	0%	100%
	Bedrock		BDRK	0			0	0%	100%
<b>Totals</b>				<b>100</b>			<b>100</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
UT Little Bugaboo Creek  
CS#2 Riffle**

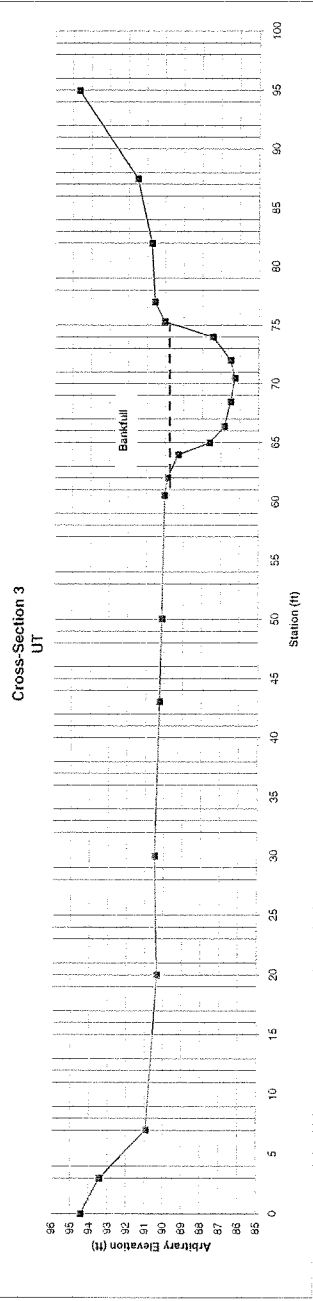


**Field Crew:** Amarah, Todd, Jack, Wade, Patrick  
**River Basin:** Yonkers-Powder Mill  
**County:** Dutchess  
**Stream Reach:** Little Bigabee Creek  
**Drainage Area:** 1.40  
**Date:** 4/26/2006  
**Feature:** CS 1 (Point)

STATION	W1	W2	ELEVATION NOTES
(FEET)	(FEET)	(FEET)	
0+00.0	102.29	7.65	to finish
0+02.0	8.93	53.46	WFFA
0+04.0	1.66	50.39	
0+20.0	102.29	11.90	50.39
0+30.0	102.29	11.78	50.35
0+35.0	102.29	13.96	50.31
0+40.0	102.29	12.21	50.38
0+45.0	102.29	12.39	50.50
0+50.0	102.29	14.95	50.65
0+55.0	102.29	15.42	50.67
0+60.0	102.29	15.77	50.52
0+70.0	102.29	15.77	50.52
0+72.0	102.29	14.86	50.49
0+74.0	102.29	14.21	50.49
0+75.0	102.29	11.50	50.75
0+82.0	102.29	11.50	50.75
0+87.5	102.29	7.50	50.75 WFFA
0+95.0			

BANKFULL		Hydraulic Geometry		Area	
Width	Depth	Width	Depth	(sq ft)	(sq ft)
0.0	0.0	0.0	0.0	0.0	0.0
1.5	0.2	1.5	0.2	0.1	0.1
2.0	0.4	2.0	0.4	0.8	0.8
2.1	0.6	2.1	0.6	1.3	1.3
1.4	0.2	1.4	0.2	0.3	0.3
2.1	0.6	2.1	0.6	1.3	1.3
1.5	0.3	1.5	0.3	0.5	0.5
2.0	0.4	2.0	0.4	0.8	0.8
2.0	0.2	2.0	0.2	0.4	0.4
1.5	0.0	1.5	0.0	0.0	0.0
TOTALS	11.8	TOTALS	5.0	10.2	10.2

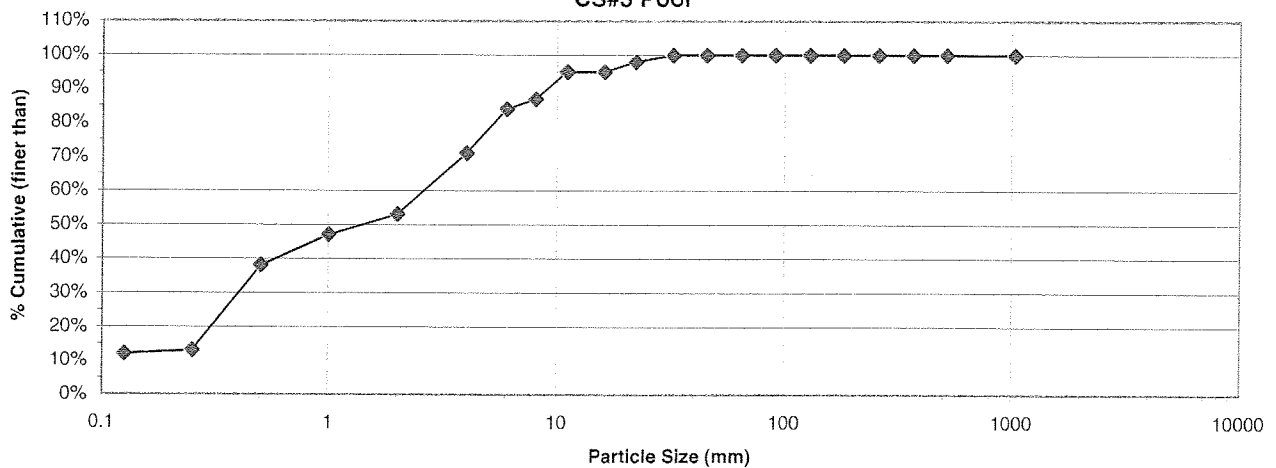
SUMMARY STATISTICS	
W1/W2/F1	5/4
W2/F1	1/4
W1/F1	2.0
W1/W2	2.0



### UT Little Bugaboo Creek As-Built Survey

PEBBLE COUNT								
Site: Tributary to LBC						3/24/2005		
Party: Amanda Todd and Russel Barbour						Pool CS#3		
Particle Count								
Inches	Particle	Millimeter	S/C	Riffle		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	12		12	12%	12%
.04 - .08	Very Fine	.062 - .125	S	0		0	0%	12%
	Fine	.125 - .25	A	1		1	1%	13%
	Medium	.25 - .50	N	25		25	25%	38%
	Coarse	.50 - 1.0	D	9		9	9%	47%
	Very Coarse	1.0 - 2.0	S	6		6	6%	53%
.08 - .16	Very Fine	2.0 - 4.0		18		18	18%	71%
.16 - .22	Fine	4.0 - 5.7	G	13		13	13%	84%
.22 - .31	Fine	5.7 - 8.0	R	3		3	3%	87%
.31 - .44	Medium	8.0 - 11.3	A	8		8	8%	95%
.44 - .63	Medium	11.3 - 16.0	V	0		0	0%	95%
.63 - .89	Coarse	16.0 - 22.6	E	3		3	3%	98%
.89 - 1.26	Coarse	22.6 - 32.0	L	2		2	2%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	0		0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0		0		0	0%	100%
2.5 - 3.5	Small	64 - 90	C	0		0	0%	100%
3.5 - 5.0	Small	90 - 128	O	0		0	0%	100%
5.0 - 7.1	Large	128 - 180	B	0		0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0		0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0		0	0%	100%
14.3 - 20	Small	362 - 512	L	0		0	0%	100%
20 - 40	Medium	512 - 1024	D	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0		0	0%	100%
	Bedrock		BDRK	0		0	0%	100%
<b>Totals</b>				<b>100</b>		<b>100</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
UT Little Bugaboo Creek  
CS#3 Pool**

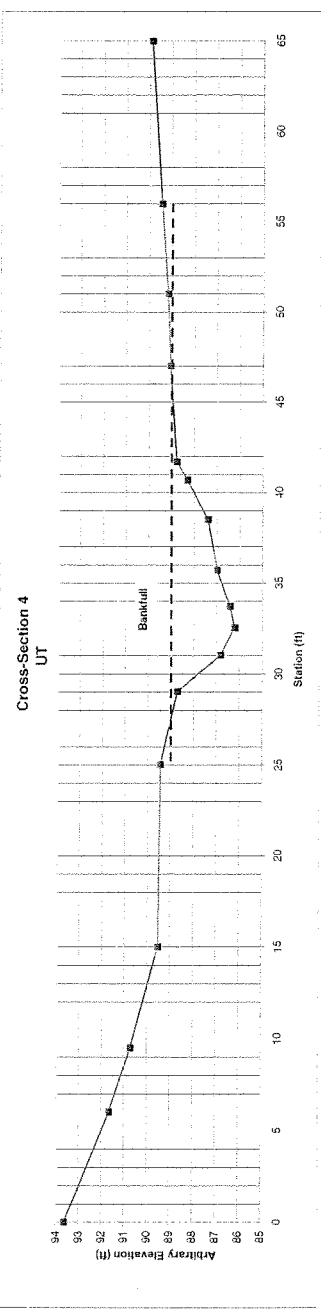


**From Crew:** Andrew Cook and Wade Pabian  
**River Basin:** Yukon-Paleo Bow  
**Waterbody:** Little Bugabo Creek  
**Project/Section:** 48/0000  
**Drawn By:** J. D. [Name]  
**Date:** 4/8/2008  
**Station:** 5481  
**Center:** 551.1000

STATION	ELEVATION			NOTES
	HI (FEET)	FS (FEET)	BEFLUSH (FEET)	
0+00.0	102.29	10+52	91.07	Top of
0+08.9	102.29	11.55	93.74	
0+18.5	102.29	12.82	96.41	
0+25.0	102.29	13.54	98.47	Uts
0+29.0	102.29	13.45	98.94	LEOUW
0+31.0	102.29	13.85	99.44	
0+33.7	102.29	15.29	97.01	RECOW
0+35.7	102.29	15.29	97.01	
0+38.7	102.29	14.97	98.32	
0+41.7	102.29	13.55	98.79	
0+47.0	102.29	13.22	99.07	
0+50.0	102.29	12.82	99.47	
0+56.0	102.29	12.96	99.95	RB 12 14
0+65.0	102.29	12.96	99.95	

Wetm. (Feet)	Hyd. Excess (Feet)	Wetm. Occ. Area (Sq. Ft.)	Area (Sq. Ft.)
4.0	0.7	1.0	
2.0	2.6	3.4	
1.5	3.2	4.4	
2.0	2.5	5.5	
2.8	2.1	6.5	
1.5	0.7	5	
5.3	0.4	2.9	
4.0	0.3	1.4	
2.0	0.0	0.7	
TOTALS	31.0	54.2	

**SUMMARY DATA (10/08)**  
 Station: 31.0  
 Wetm: 31.0  
 Hyd. Excess: 2.2  
 Area: 1.1



### UT Little Bugaboo Creek As-Built Survey

PEBBLE COUNT									
Site: Tributary to LBC						3/24/2005			
Party: Amanda Todd and Russel Barbour						Pool CS#4			
Particle Count									
Inches	Particle	Millimeter		Riffle			Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	10			10	10%	10%
.04 - .08	Very Fine	.062 - .125	S	7			7	7%	17%
	Fine	.125 - .25	A	5			5	5%	22%
	Medium	.25 - .50	N	30			30	29%	51%
	Coarse	.50 - 1.0	D	6			6	6%	57%
	Very Coarse	1.0 - 2.0	S	7			7	7%	64%
.08 - .16	Very Fine	2.0 - 4.0		4			4	4%	68%
.16 - .22	Fine	4.0 - 5.7	G	7			7	7%	75%
.22 - .31	Fine	5.7 - 8.0	R	4			4	4%	78%
.31 - .44	Medium	8.0 - 11.3	A	3			3	3%	81%
.44 - .63	Medium	11.3 - 16.0	V	0			0	0%	81%
.63 - .89	Coarse	16.0 - 22.6	E	3			3	3%	84%
.89 - 1.26	Coarse	22.6 - 32.0	L	4			4	4%	88%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	7			7	7%	95%
1.77 - 2.5	Very Coarse	45.0 - 64.0		2			2	2%	97%
2.5 - 3.5	Small	64 - 90	C	1			1	1%	98%
3.5 - 5.0	Small	90 - 128	O	1			1	1%	99%
5.0 - 7.1	Large	128 - 180	B	1			1	1%	100%
7.1 - 10.1	Large	180 - 256	L	0			0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0			0	0%	100%
14.3 - 20	Small	362 - 512	L	0			0	0%	100%
20 - 40	Medium	512 - 1024	D	0			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0			0	0%	100%
	Bedrock		BDRK	0			0	0%	100%
<b>Totals</b>				<b>102</b>			<b>102</b>	<b>100%</b>	<b>100%</b>

**Particle Size Distribution  
UT Little Bugaboo Creek  
CS#4 Pool**

