

**Big Warrior Creek Stream Restoration
2006 Monitoring Report
Monitoring Year Two**

Ecosystem Enhancement Program Project Number 00412



Submitted to: NCDENR-Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

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Project Designed by: CDM
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Submitted: January 19, 2007



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1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Big Warrior Creek Stream Restoration Site is located in Wilkes County, North Carolina, approximately 10 miles southwest of Wilkesboro. Big Warrior Creek drains a watershed area of approximately 7.4 square miles, beginning on the Wilkes and Alexander County line. Two major tributaries (Mountain Creek and Unnamed Tributary) flow into the main channel of Big Warrior Creek within the project reach. Sections of these two tributaries were also restored. The project restoration segments that are on the downstream property are completely fenced to exclude cattle from the creek and riparian areas.

Per the 2005 Mitigation Plan and As-Built report (CDM 2005), the objectives of the Big Warrior Creek Stream Restoration Project include the following: reduce bank erosion, exclude cattle from the stream and riparian zone, improve water quality, establish a floodplain at a lower elevation, enhance in-stream habitat, improve functional and aesthetic value of the riparian corridor, and preserve existing beneficial channel, floodplain features, and riparian vegetation.

URS did not receive a Restoration Plan for the site. URS assumes from site visits and survey work that Big Warrior Creek originally had failing banks, unstable plan form and cross sectional geometry, little or no riparian buffer, cattle access to the creek, and several unstable creek crossings.

The Priority II restoration involved converting the impaired channels into stable channels that meander for a total of 11,035 linear feet. Rock cross-vanes, single arm vanes, staked log toe protection, and root wads were incorporated for aquatic habitat enhancement and bed and bank stability. A riparian buffer on either side of the stream was planted using native vegetation. The cattle were fenced from the riparian area along the Unnamed Tributary, Mountain Creek, and most of Big Warrior Creek. The upstream-most portion of Big Warrior Creek is not fenced, but cattle are not present on the surrounding property. In addition, two stabilized creek crossings and two culverts were installed to allow vehicular access to different parts of the farm while limiting impacts.

The 2006 monitoring indicated that the Big Warrior Creek restoration is functioning well. The majority of the bed features appear stable, with well-developed pools in the meander bends and long riffles in the straight reaches. However there is significant aggradation in some areas, evidenced by well-vegetated mid-channel bars. In one location the channel has migrated laterally by a full bankfull width and is adjusting its planform. There is also a lot of vegetation growing in from the sides of the channel, indicating that the system may eventually transition from a C channel to a narrower E. Some of the rock structures are failing or causing bank erosion and should be repaired. Scour is common behind rootwads. Several animal burrows (likely muskrat or groundhog) were observed in the stream banks, which may lead to destabilized banks in the future.

The planted woody vegetation is doing fair along all three reaches. The streamside and floodplain zones are generally in better health than upland areas. Streamside survival appears to be the most successful. The banks of the Unnamed Tributary are covered with a dense mat of American hogpeanut (*Amphicarpaea bracteata*). This may become a problem in that the vine seems to be choking much of the planted vegetation and creating a monoculture. Hogpeanut is also evident along the mainstem and Mountain Creek; however, the presence of kudzu (*Pueraria montana*) and Chinese privet (*Ligustrum senense*) pose a more serious problem to the survival of vegetation along those reaches. Kudzu is a serious problem along the upstream reach of Big Warrior. Maintenance to control the presence and spread of kudzu is recommended. There are also several large areas of bare ground where the soil appears compacted and not conducive to natural colonization. Soil amendments and reseeding are recommended in these areas.

Fish, snails, and several aquatic insects were observed in all three reaches, and evidence of wildlife use was present throughout the project area. The rocks in the stream were covered with very thick algal

growth, possibly indicating a high nutrient concentration in the water. All of the fencing and gates along the reaches are intact and functioning properly. No evidence of cattle was observed within the conservation easement. The unfenced, upstream edge of the project reach (Big Warrior Creek) has a very minimal buffer on the left floodplain. The landowner along the left bank is mowing the adjacent field to the edge of the water.

2.0 PROJECT BACKGROUND

2.1 PROJECT OBJECTIVES

According to the 2005 Mitigation Plan prepared by CDM and Biohabitats, the overarching goal of the project was to establish a stable planform, cross-section, and profile pattern to Big Warrior Creek and its tributaries, with the premise that geomorphic and habitat function will follow appropriate channel form. Specific project objectives included the following:

1. Reduce bank erosion.
2. Exclude cattle from the stream and riparian zone.
3. Improve water quality.
4. Establish a floodplain at a lower elevation.
5. Enhance in-stream habitat.
6. Improve functional and aesthetic value of the riparian corridor.
7. Preserve existing beneficial channel, floodplain features, and riparian vegetation.

2.2 PROJECT STRUCTURE, MITIGATION TYPE, AND APPROACH

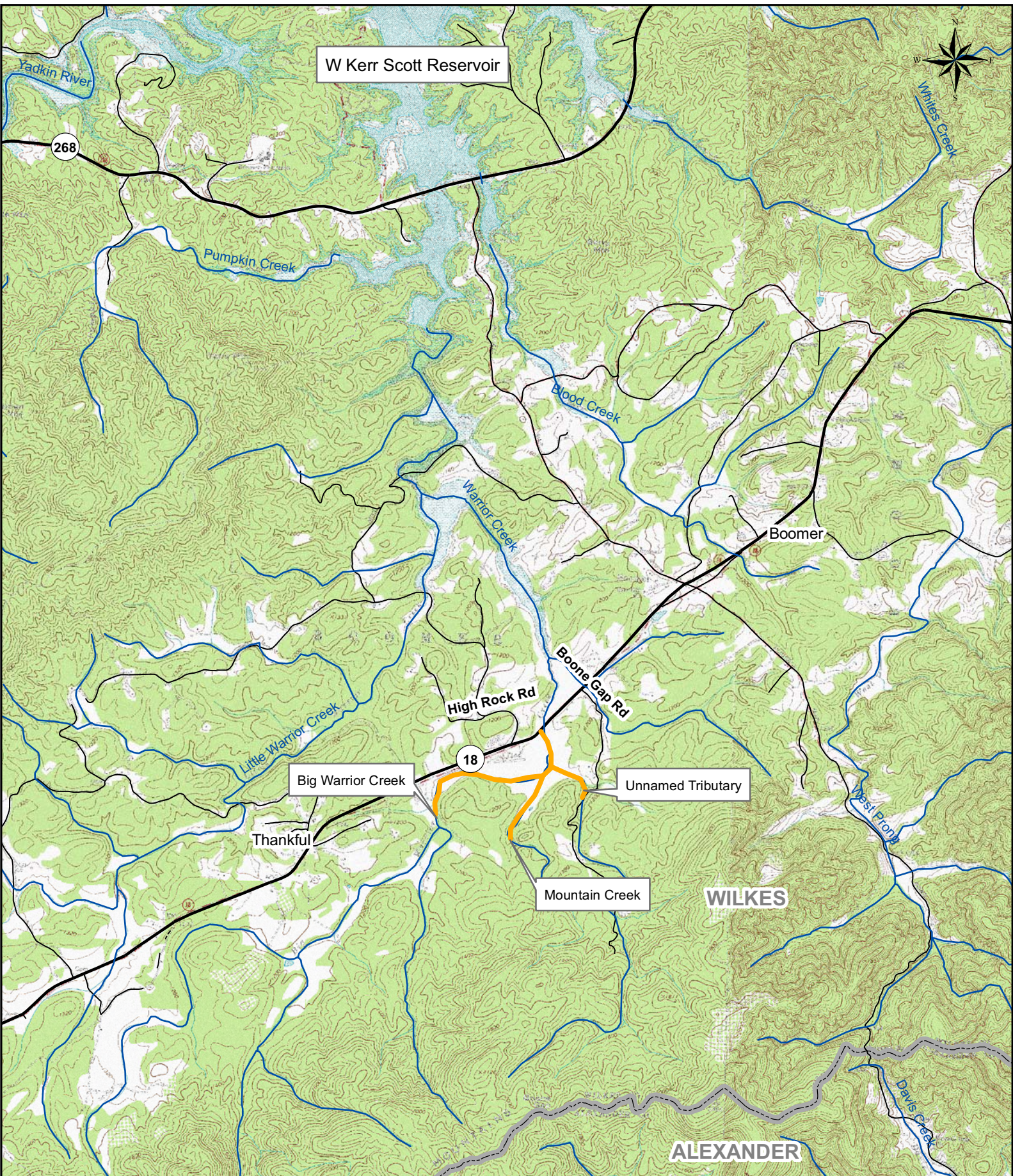
URS did not receive a Restoration Plan for the site. URS assumes from site visits and survey work that Big Warrior Creek originally had failing banks, unstable plan form and cross sectional geometry, little or no riparian buffer, cattle access to the creek, and several unstable creek crossings.

The Priority II restoration involved converting the impaired channels into stable channels that meander for a restored total of 11,035 feet as measured along the thalweg. Rock cross-vanes, single arm vanes, staked log toe protection, and root wads were incorporated for aquatic habitat enhancement and bed and bank stability. A riparian buffer was planted using native vegetation. Cattle were fenced from the riparian area. In addition, two stabilized creek crossings and two culverts were installed to allow vehicular access to different parts of the farm while limiting impacts.

2.3 LOCATION AND SETTING

The Big Warrior Creek Stream Restoration Site is located in Wilkes County, North Carolina, approximately 10 miles southwest of Wilkesboro (Figure 1). The project site is on the south side of North Carolina Highway 18, across from the intersection of northern end of the High Rock Road loop, which is about 4.5 miles east of the Caldwell County line. Big Warrior Creek drains a watershed area of approximately 7.4 square miles, beginning at the Wilkes and Alexander County line. Big Warrior Creek and its tributaries originate in the Brushy Mountains near the boundary between Wilkes County and Alexander County. Downstream of the project area, Big Warrior Creek ultimately flows into the W. Kerr Scott Reservoir, an impoundment of the Yadkin River. Two major tributaries (Mountain Creek and Unnamed Tributary) flow into the main channel of Big Warrior Creek within the project area. Sections of these two tributaries were also restored. The project restoration segments that are on the downstream property are completely fenced to exclude cattle from the creek and riparian areas.

To travel to the site from the Raleigh area, take I-40 West to US-421 North towards Wilkesboro. Take NC-16 South/NC-18 towards Wilkesboro/Lenoir/Taylorsville. Follow NC-18 to the site. It is approximately halfway between the towns of Boomer and Thankful.



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Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Project Number:
 00412

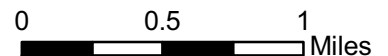
Monitoring Year:
 2 (2006)

Date:
 January 2007

Legend

 Project Reach

Figure 1
 Project Vicinity



2.4 PROJECT HISTORY AND BACKGROUND

The Big Warrior Stream Restoration project was designed by CDM and construction was completed in November 2004. The Mitigation and As-built Plan were completed in March 2005. The estimated restoration length was 11,035 linear feet. This length includes 7,185 feet of Big Warrior Creek, 2,415 feet of Mountain Creek, and 1,435 feet of an Unnamed Tributary.

EcoLogic conducted the Year 1 monitoring in 2005. At that time, Ecologic was provided with an As-built site map. Other documentation such as project history, contacts, goals, and the As-built report were not provided. The measured restoration amount is 10,698 linear feet, as measured by EcoLogic (7,013 on Big Warrior, 2,373 on Mountain Creek, and 1,312 on Unnamed Tributary). Since EcoLogic did not have complete project data at the time of the Year 1 monitoring, much of their quantitative data differs from that presented in the As-built Plan (EcoLogic 2006).

At the time URS was given the contract, URS had only Ecologic's Year One Monitoring Report. Therefore, our surveys, cross-sections, photo stations, and vegetation plots follow those of Ecologic.

**Table I. Project Mitigation Structure and Objectives Table
Big Warrior Creek
EEP Project Number 00412**

Project Segment or Reach ID	Existing Feet*	Mitigation Type	Approach	Linear Footage	Mitigation Ratio*	Mitigation Units*	Stationing	Comment
Big Warrior Creek	450	EII	PIII	450			0+00 to 4+50	
Big Warrior Creek	6,735	R	PII	6,735			4+50 to 70+00	
Mountain Creek	2,415	R	PII	2,352			0+00 to 25+00	
Unnamed Tributary	1,435	R	PII	1,409			0+00 to 15+00	

* Existing Feet, Mitigation Ratios, and Units were not provided in previous reports.

R= Restoration

P1= Priority I

EI= Enhancement I

PII= Priority II

EII= Enhancement II

PIII= Priority III

S= Stabilization

SS= Stream Bank Stabilization

Table II. Project Activity and Reporting History Big Warrior Creek EEP Project Number 00412			
Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	Unknown	Unknown	Unknown
Final Design – 90%	Unknown	Unknown	Unknown
Construction	Unknown	NA	November 2004
Permanent seed mix applied	Unknown	Unknown	Unknown
Live stakes and woody plants	Unknown	Unknown	Unknown
Final Walk Through	Unknown	Unknown	Unknown
Mitigation Plan/As-Built Report	Unknown	Unknown	March 2005
Year 1 Monitoring	October 2005	Unknown	April 2006
Year 2 Monitoring	Fall 2006	September 2006	December 2006
Year 3 Monitoring	Fall 2007	--	--
Year 4 Monitoring	Fall 2008	--	--
Year 5 Monitoring	Fall 2009	--	--
Year + Monitoring	Not scheduled	--	--

Table III. Project Contact Table Big Warrior Creek EEP Project Number 00412	
Designer Primary project design POC	Camp Dresser & McKee (CDM) 5400 Glenwood Ave, Suite 300 Raleigh, NC 27612 Kelly Boone 919-787-5620
Designer – Subcontractor Subcontractor POC	Biohabitats 15 W. Aylesbury Road Timonium, MD 21093 Ellen McClure 410-337-3659
Construction Contractor Construction contractor POC	Shamrock Environmental PO Box 14987 Greensboro, NC 27415 Bill Wright 336-375-1989
Planting Contractor Planting contractor POC	Seal Brothers Contracting 131 W Cleve Street Mt. Airy, NC 27030 Brian Seal 336-710-3560
Seeding Contractor Seeding contractor POC	Seal Brothers Contracting 131 W Cleve Street Mt. Airy, NC 27030 Brian Seal 336-710-3560
Seed Mix Sources	Unavailable

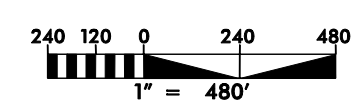
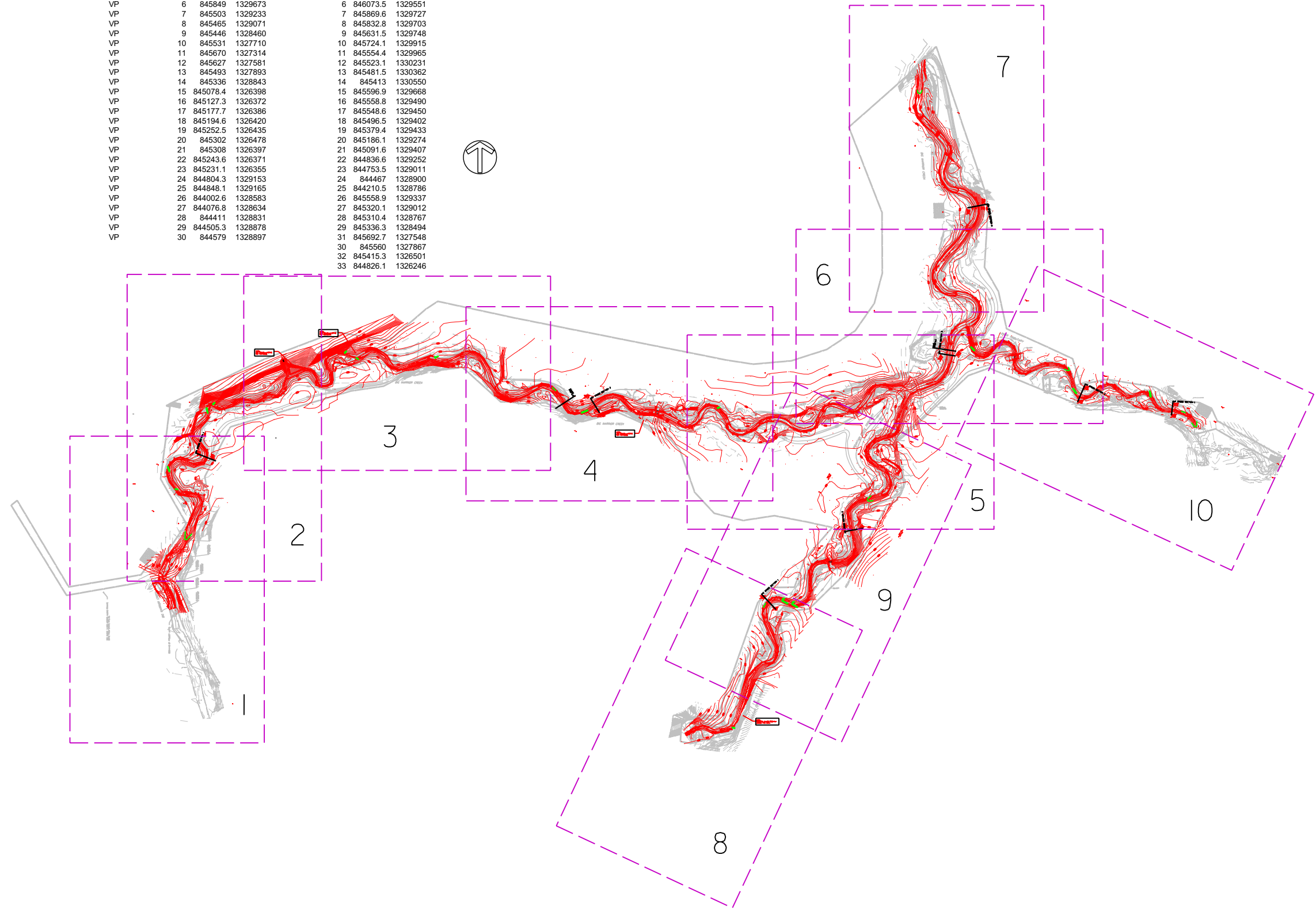
Nursery Stock Suppliers	Unavailable
2004 Monitoring Performers	Biohabitats 15 W. Aylesbury Road Timonium, MD 21093 Ellen McClure 410-337-3659
2005 Monitoring Performers	EcoLogic Associates, P.C. 4321-A South Elm-Eugene St. Greensboro, NC 27406 336-355-1108
Monitoring Performers	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 919-461-1100
Monitoring POC – Kathleen McKeithan	919-461-1597

Table IV. Project Background Table Big Warrior Creek EEP Project Number 00412	
Project County	Wilkes County
Drainage Area	Big Warrior Creek Mountain Creek Unnamed Tributary
	7.4 square miles 1.77 square miles 0.5 square miles
Drainage impervious cover estimate (%)	Estimated at <5%
Stream Order	3 rd for Big Warrior Creek 2 nd for Mountain Creek and Unnamed Tributary
Physiographic Region	Piedmont/Foothills
Ecoregion	Northern Inner Piedmont (45e)
Rosgen Classification of As-Built	C
Dominant soil types	Toccoa sandy loam, Douge fine sandy loam
Reference site ID	Unknown
USGS HUC for Project	03040101
NCDWQ Sub-basin for Project	YAD01
NCDWQ classification for Project	Class C, Index no. 12-29-2-(1)
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	NA
% of project easement fenced	75% - no cattle in upper reach

2.5 MONITORING PLAN VIEW

See Figure 2 for Monitoring Plan View.

Veg	Plots ID	Northing		Easting		Photo ID	Points	
VP	1	846695	1329477	1	846912.8	1329523		
VP	2	846596	1329584	2	846712.5	1329464		
VP	3	846351	1329638	3	846569.1	1329649		
VP	4	846273	1329696	4	846372	1329627		
VP	5	845893	1329659	5	846292.2	1329779		
VP	6	845849	1329673	6	846073.5	1329551		
VP	7	845503	1329233	7	845869.6	1329727		
VP	8	845465	1329071	8	845832.8	1329703		
VP	9	845446	1328460	9	845631.5	1329748		
VP	10	845531	1327710	10	845724.1	1329915		
VP	11	845670	1327314	11	845554.4	1329965		
VP	12	845627	1327581	12	845523.1	1330231		
VP	13	845493	1327893	13	845481.5	1330362		
VP	14	845336	1328843	14	845413	1330550		
VP	15	845078.4	1326398	15	845596.9	1329668		
VP	16	845127.3	1326372	16	845558.8	1329490		
VP	17	845177.7	1326386	17	845548.6	1329450		
VP	18	845194.6	1326420	18	845496.5	1329402		
VP	19	845252.5	1326435	19	845379.4	1329433		
VP	20	845302	1326478	20	845186.1	1329274		
VP	21	845308	1326397	21	845091.6	1329407		
VP	22	845243.6	1326371	22	844836.6	1329252		
VP	23	845231.1	1326355	23	844753.5	1329011		
VP	24	844804.3	1329153	24	844467	1328900		
VP	25	844848.1	1329165	25	844210.5	1328786		
VP	26	844002.6	1328583	26	845558.9	1329337		
VP	27	844076.8	1328634	27	845320.1	1329012		
VP	28	844411	1328831	28	845310.4	1328767		
VP	29	844505.3	1328878	29	845336.3	1328494		
VP	30	844579	1328897	31	845692.7	1327548		
				30	845560	1327867		
				32	845415.3	1326501		
				33	844826.1	1326246		



REVISIONS

NO.	DATE

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PROJECT: BIG WARRIOR CREEK
 STREAM RESTORATION
 2006 MONITORING REPORT
 TITLE: KEY MAP

CLIENT: NORTH CAROLINA DEPARTMENT
 OF ENVIRONMENT AND
 NATURAL RESOURCES


FIGURE 2
 DATE: NOV 2006
 TECHNICIAN: EHJ
 CHECKED BY: KM
 MONITORING
 YEAR 2
 EEP PROJECT NO.
 00412
 SHEET NO.
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SEE SHEET 3 FOR ACCESS ALONG PRIVATE DRIVE FROM STATE RTE. 18.



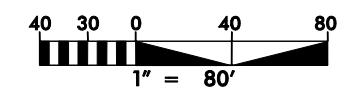
MATCH LINE SEE SHEET 2

COLOR LEGEND FOR STRUCTURES:

- SYMBOLS GRAY IN COLOR REPRESENT STRUCTURES AS PROPOSED
- SYMBOLS RED IN COLOR REPRESENT STRUCTURES AS BUILT AND SURVEYED
- SYMBOLS GREEN IN COLOR REPRESENT STRUCTURES BUILT, BUT NOT SURVEY LOCATED

LEGEND FOR DRAWING

	SURVEY CONTROL POINT		LOG VANE
	EXISTING SPOT ELEVATION		PROPOSED THALWEG
	EXISTING STREAM EDGE LIMITS		PROPOSED BANKFULL LIMITS
	EXISTING TREE		BRUSH PILE
	EXISTING CONTOUR		STANDING SNAG
	EXISTING FENCE		DOWNED LOG
	EXISTING THALWEG		CONTRACTORS STAGING AREA
	EXISTING WETLAND		LIMIT OF DISTURBANCE
	PROPOSED CONTOUR		SILT FENCE
	ROCK CROSS VANE		BLAZE ORANGE FENCE
	ROCK J-VANE		TREE SAVE
	LOG J-VANE		EXISTING SNAG TO REMAIN
	ROCK VANE		LIVE BRANCH LAYERING
	ROCK TOE PROTECTION		PHOTO PLOT
	ROOTWAD REVETMENT		VEG PLOT
	LOG TOE PROTECTION		



REVISIONS

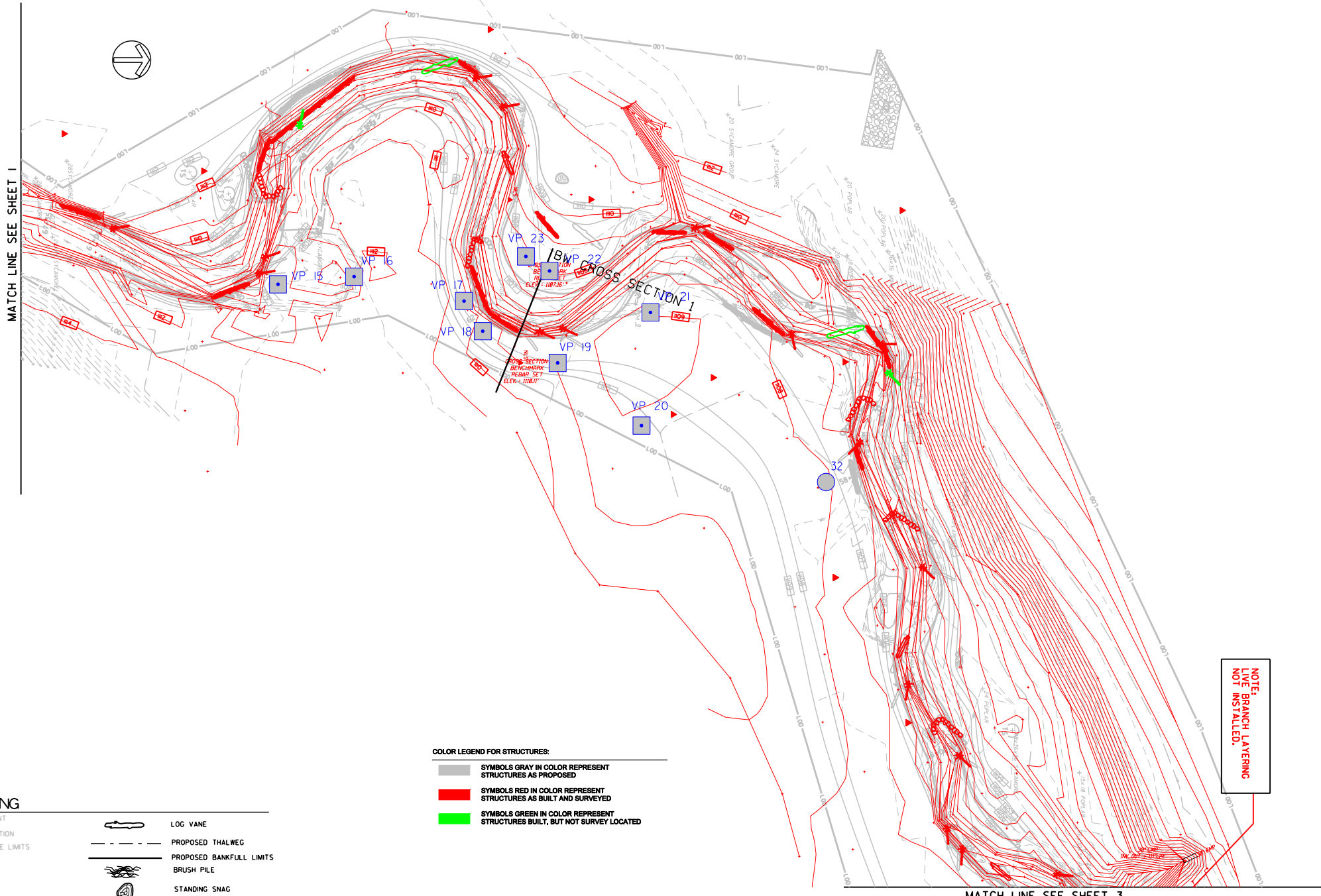
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PROJECT: **BIG WARRIOR CREEK STREAM RESTORATION 2006 MONITORING REPORT**
 TITLE: **MONITORING PLAN VIEW**

CLIENT: **NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES**

FIGURE 2
 DATE: NOV 2006
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 MONITORING YEAR 2
 EEP PROJECT NO. 00412
 SHEET NO. 1



MATCH LINE SEE SHEET 1

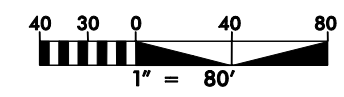
MATCH LINE SEE SHEET 3

NOTE:
LIVE BRANCH LAYERING
NOT INSTALLED.

LEGEND FOR DRAWING

- | | |
|--|---|
| <ul style="list-style-type: none"> ○ SURVEY CONTROL POINT × 273.1 EXISTING SPOT ELEVATION - - - EXISTING STREAM EDGE LIMITS × 30' SYCAMORE EXISTING TREE - - - 352 EXISTING CONTOUR - - - EXISTING FENCE - - - EXISTING THALWEG EXISTING WETLAND 1109 PROPOSED CONTOUR ROCK CROSS VANE ROCK J-VANE LOG J-VANE ROCK VANE ROCK TOE PROTECTION ROOTWAD REVETMENT LOG TOE PROTECTION | <ul style="list-style-type: none"> LOG VANE PROPOSED THALWEG PROPOSED BANKFULL LIMITS BRUSH PILE STANDING SNAG DOWNSIDE LOG CONTRACTORS STAGING AREA LOD LIMIT OF DISTURBANCE SF SF SILT FENCE BOF BLAZE ORANGE FENCE TS TREE SAVE EXISTING SNAG TO REMAIN LIVE BRANCH LAYERING 32 PHOTO PLOT VP 15 VEG PLOT |
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- COLOR LEGEND FOR STRUCTURES:**
- SYMBOLS GRAY IN COLOR REPRESENT STRUCTURES AS PROPOSED
 - SYMBOLS RED IN COLOR REPRESENT STRUCTURES AS BUILT AND SURVEYED
 - SYMBOLS GREEN IN COLOR REPRESENT STRUCTURES BUILT, BUT NOT SURVEY LOCATED



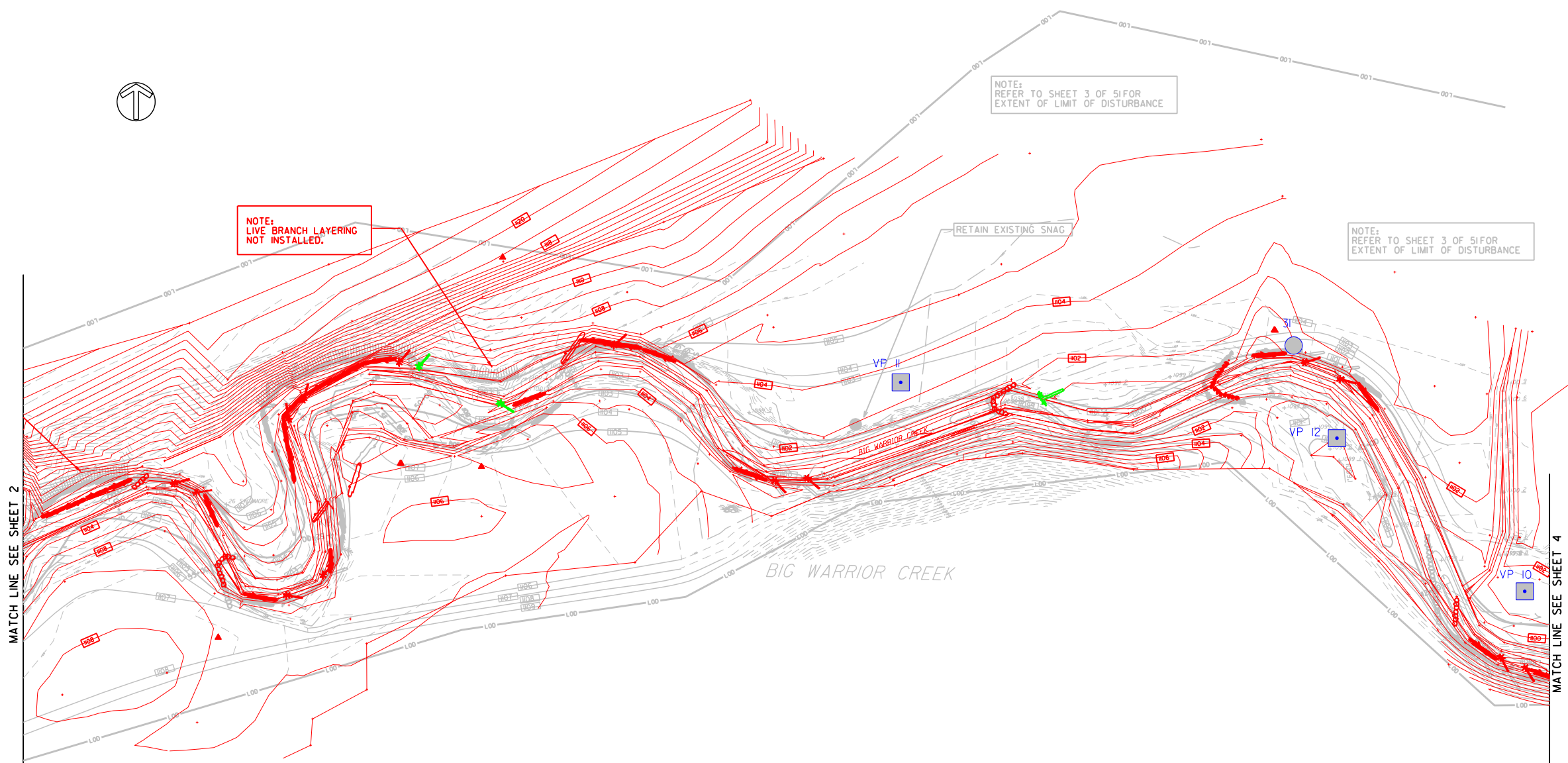
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 2006 MONITORING REPORT
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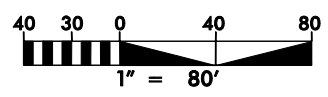
FIGURE 2
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 CHECKED BY: KM
 MONITORING YEAR 2
 EEP PROJECT NO. 00412
 SHEET NO. 2



LEGEND FOR DRAWING

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|---|---|
| <ul style="list-style-type: none"> ○ SURVEY CONTROL POINT × 273.1 EXISTING SPOT ELEVATION - - - EXISTING STREAM EDGE LIMITS × 30" SYCAMORE EXISTING TREE - - - 352 EXISTING CONTOUR - - - - - EXISTING FENCE - - - - - EXISTING THALWEG [] EXISTING WETLAND [] PROPOSED CONTOUR [] ROCK CROSS VANE [] ROCK J-VANE [] LOG J-VANE [] ROCK VANE [] ROCK TOE PROTECTION [] ROOTWAD REVETMENT [] LOG TOE PROTECTION | <ul style="list-style-type: none"> [] LOG VANE - - - PROPOSED THALWEG - - - PROPOSED BANKFULL LIMITS [] BRUSH PILE [] STANDING SNAG [] DOWNED LOG [] CONTRACTORS STAGING AREA LOD LIMIT OF DISTURBANCE SF - SF SILT FENCE BOF - BLAZE ORANGE FENCE ○ TS TREE SAVE ● EXISTING SNAG TO REMAIN [] LIVE BRANCH LAYERING ● 32 PHOTO PLOT ■ VP 15 VEG PLOT |
|---|---|

- COLOR LEGEND FOR STRUCTURES:**
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PROJECT: **BIG WARRIOR CREEK STREAM RESTORATION 2006 MONITORING REPORT**
 TITLE: **MONITORING PLAN VIEW**

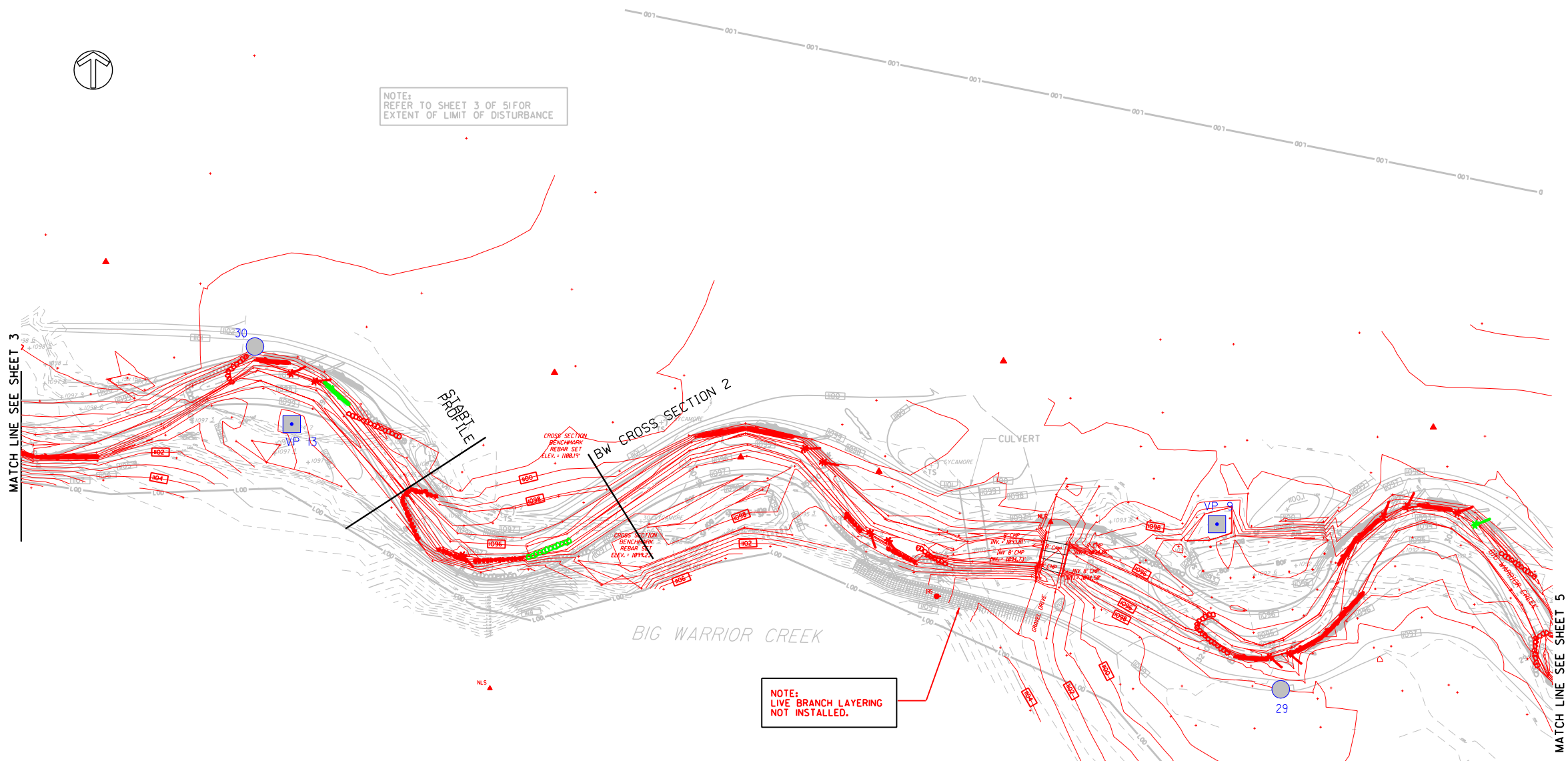
CLIENT: **NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES**

FIGURE 2
 DATE: NOV 2006
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 CHECKED BY: KM
 MONITORING YEAR 2
 EEP PROJECT NO. 00412
 SHEET NO. 3



NOTE: REFER TO SHEET 3 OF 5 FOR EXTENT OF LIMIT OF DISTURBANCE

MATCH LINE SEE SHEET 3



NOTE: LIVE BRANCH LAYERING NOT INSTALLED.

NOTE: REFER TO SHEET 3 OF 5 FOR EXTENT OF LIMIT OF DISTURBANCE

COLOR LEGEND FOR STRUCTURES:

- SYMBOLS GRAY IN COLOR REPRESENT STRUCTURES AS PROPOSED
- SYMBOLS RED IN COLOR REPRESENT STRUCTURES AS BUILT AND SURVEYED
- SYMBOLS GREEN IN COLOR REPRESENT STRUCTURES BUILT, BUT NOT SURVEY LOCATED

LEGEND FOR DRAWING

- SURVEY CONTROL POINT
- × 273.J EXISTING SPOT ELEVATION
- - - EXISTING STREAM EDGE LIMITS
- × 30" SYCAMORE EXISTING TREE
- - - 352 EXISTING CONTOUR
- - - - - EXISTING FENCE
- - - - - EXISTING THALWEG
- [Wavy Line] EXISTING WETLAND
- [Dashed Line] PROPOSED CONTOUR
- [Rock Symbol] ROCK CROSS VANE
- [Rock Symbol] ROCK J-VANE
- [Log Symbol] LOG J-VANE
- [Rock Symbol] ROCK VANE
- [Rock Symbol] ROCK TOE PROTECTION
- [Rock Symbol] ROOTWAD REVETMENT
- [Rock Symbol] LOG TOE PROTECTION
- [Log Symbol] LOG VANE
- [Dashed Line] PROPOSED THALWEG
- [Dashed Line] PROPOSED BANKFULL LIMITS
- [Brush Symbol] BRUSH PILE
- [Log Symbol] STANDING SNAG
- [Log Symbol] DOWNED LOG
- [Cross-hatch] CONTRACTORS STAGING AREA
- [Dashed Line] LOD LIMIT OF DISTURBANCE
- [Line with SF] SF SILT FENCE
- [Line with BOF] BOF BLAZE ORANGE FENCE
- [Circle with TS] TS TREE SAVE
- [Circle] EXISTING SNAG TO REMAIN
- [Vertical Lines] LIVE BRANCH LAYERING
- 32 PHOTO PLOT
- VP 15 VEG PLOT

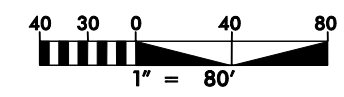
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PROJECT: BIG WARRIOR CREEK
 STREAM RESTORATION
 2006 MONITORING REPORT
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FIGURE 2
 DATE: NOV 2006
 TECHNICIAN: EHJ
 CHECKED BY: KM
 MONITORING YEAR 2
 EEP PROJECT NO. 00412
 SHEET NO. 4





NOTE:
REFER TO SHEET 3 OF 5 FOR
EXTENT OF LIMIT OF DISTURBANCE

MATCH LINE SEE SHEET 6

MATCH LINE SEE SHEET 4

NOTE:
REFER TO SHEET 3 OF 5 FOR
EXTENT OF LIMIT OF DISTURBANCE

MATCH LINE SEE SHEET 9

LEGEND FOR DRAWING

- | | | | |
|--|-----------------------------|--|--------------------------|
| | SURVEY CONTROL POINT | | LOG VANE |
| | EXISTING SPOT ELEVATION | | PROPOSED THALWEG |
| | EXISTING STREAM EDGE LIMITS | | PROPOSED BANKFULL LIMITS |
| | EXISTING TREE | | BRUSH PILE |
| | EXISTING CONTOUR | | STANDING SNAG |
| | EXISTING FENCE | | DOWNED LOG |
| | EXISTING THALWEG | | CONTRACTORS STAGING AREA |
| | EXISTING WETLAND | | LIMIT OF DISTURBANCE |
| | PROPOSED CONTOUR | | SILT FENCE |
| | ROCK CROSS VANE | | BLAZE ORANGE FENCE |
| | ROCK J-VANE | | TREE SAVE |
| | LOG J-VANE | | EXISTING SNAG TO REMAIN |
| | ROCK VANE | | LIVE BRANCH LAYERING |
| | ROCK TOE PROTECTION | | PHOTO PLOT |
| | ROOTWAD REVETMENT | | VEG PLOT |
| | LOG TOE PROTECTION | | |

COLOR LEGEND FOR STRUCTURES:

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- SYMBOLS RED IN COLOR REPRESENT STRUCTURES AS BUILT AND SURVEYED
- SYMBOLS GREEN IN COLOR REPRESENT STRUCTURES BUILT, BUT NOT SURVEY LOCATED

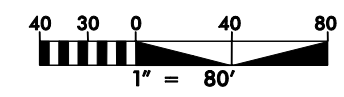
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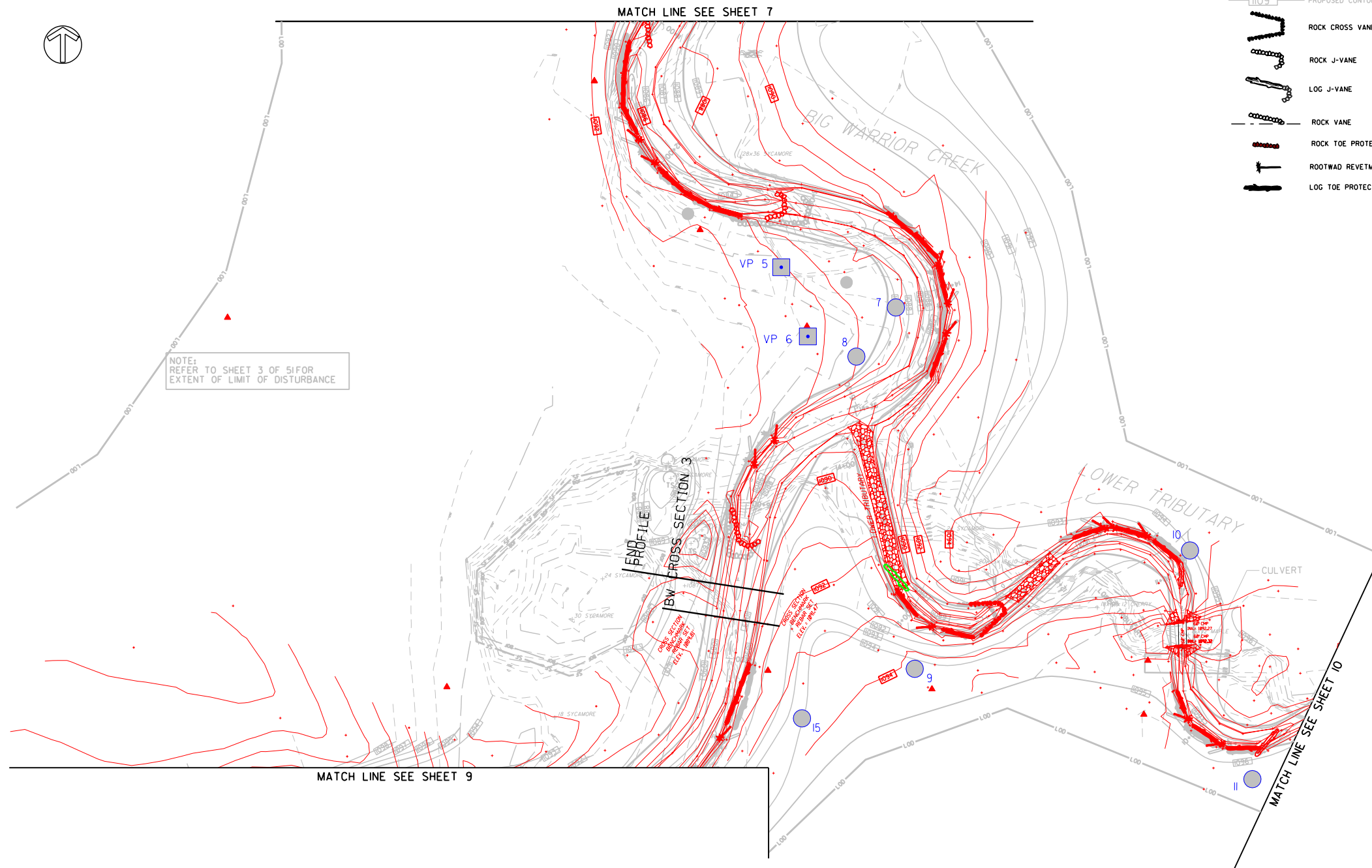
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 SHEET NO. 5





NOTE:
REFER TO SHEET 3 OF 5 FOR
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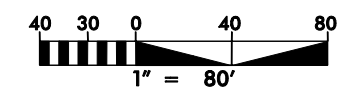
MATCH LINE SEE SHEET 7

MATCH LINE SEE SHEET 9

LEGEND FOR DRAWING

- SURVEY CONTROL POINT
- EXISTING SPOT ELEVATION
- EXISTING STREAM EDGE LIMITS
- EXISTING TREE
- EXISTING CONTOUR
- EXISTING FENCE
- EXISTING THALWEG
- EXISTING WETLAND
- PROPOSED CONTOUR
- ROCK CROSS VANE
- ROCK J-VANE
- LOG J-VANE
- ROCK VANE
- ROCK TOE PROTECTION
- ROOTWAD REVETMENT
- LOG TOE PROTECTION
- LOG VANE
- PROPOSED THALWEG
- PROPOSED BANKFULL LIMITS
- BRUSH PILE
- STANDING SNAG
- DOWNED LOG
- CONTRACTORS STAGING AREA
- LIMIT OF DISTURBANCE
- SILTY FENCE
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- TREE SAVE
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- LIVE BRANCH LAYERING
- PHOTO PLOT
- VEG PLOT

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FIGURE 2

DATE: NOV 2006

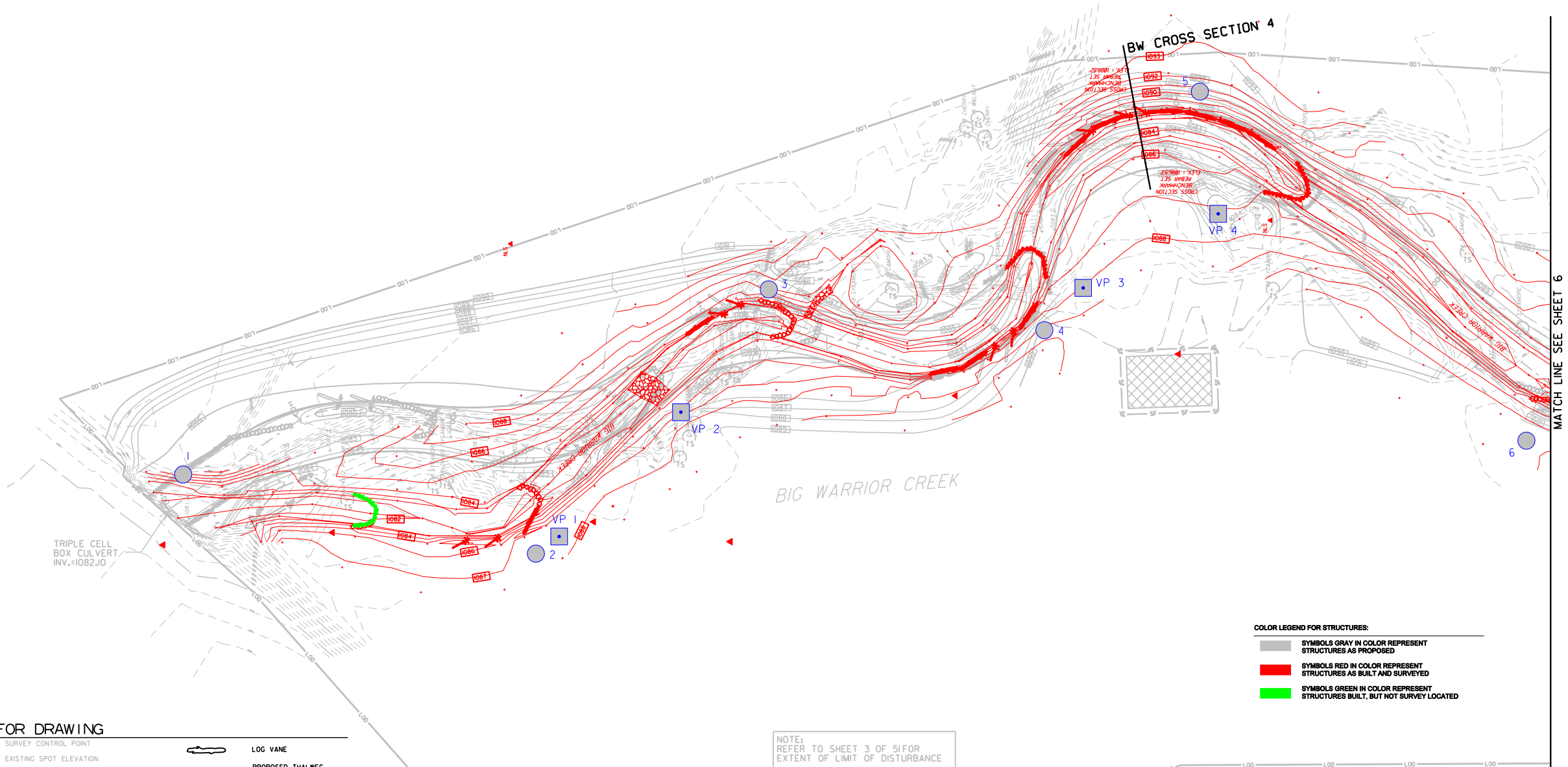
TECHNICIAN: EHJ

CHECKED BY: KM

MONITORING YEAR 2

EEP PROJECT NO. 00412

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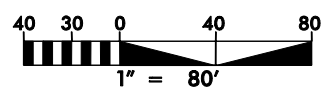


LEGEND FOR DRAWING

- SURVEY CONTROL POINT
- × 273.1 EXISTING SPOT ELEVATION
- - - EXISTING STREAM EDGE LIMITS
- × 30" SYCAMORE EXISTING TREE
- - - 352 EXISTING CONTOUR
- - - - - EXISTING FENCE
- - - - - EXISTING THALWEG
- [Wavy lines] EXISTING WETLAND
- [Dashed line] PROPOSED CONTOUR
- [Cross-hatched] ROCK CROSS VANE
- [Wavy line] ROCK J-VANE
- [Wavy line] LOG J-VANE
- [Wavy line] ROCK VANE
- [Wavy line] ROCK TOE PROTECTION
- [Wavy line] ROOTWAD REVETMENT
- [Wavy line] LOG TOE PROTECTION
- [Stick] LOG VANE
- [Dashed line] PROPOSED THALWEG
- [Dashed line] PROPOSED BANKFULL LIMITS
- [Wavy line] BRUSH PILE
- [Stick] STANDING SNAG
- [Stick] DOWNED LOG
- [Hatched] CONTRACTORS STAGING AREA
- [Dashed line] LOD LIMIT OF DISTURBANCE
- [Dashed line] SF SILT FENCE
- [Dashed line] BOF BLAZE ORANGE FENCE
- [Circle with T] TS TREE SAVE
- [Circle] EXISTING SNAG TO REMAIN
- [Stick] LIVE BRANCH LAYERING
- [Circle with 32] PHOTO PLOT
- [Square with VP 15] VEG PLOT

NOTE:
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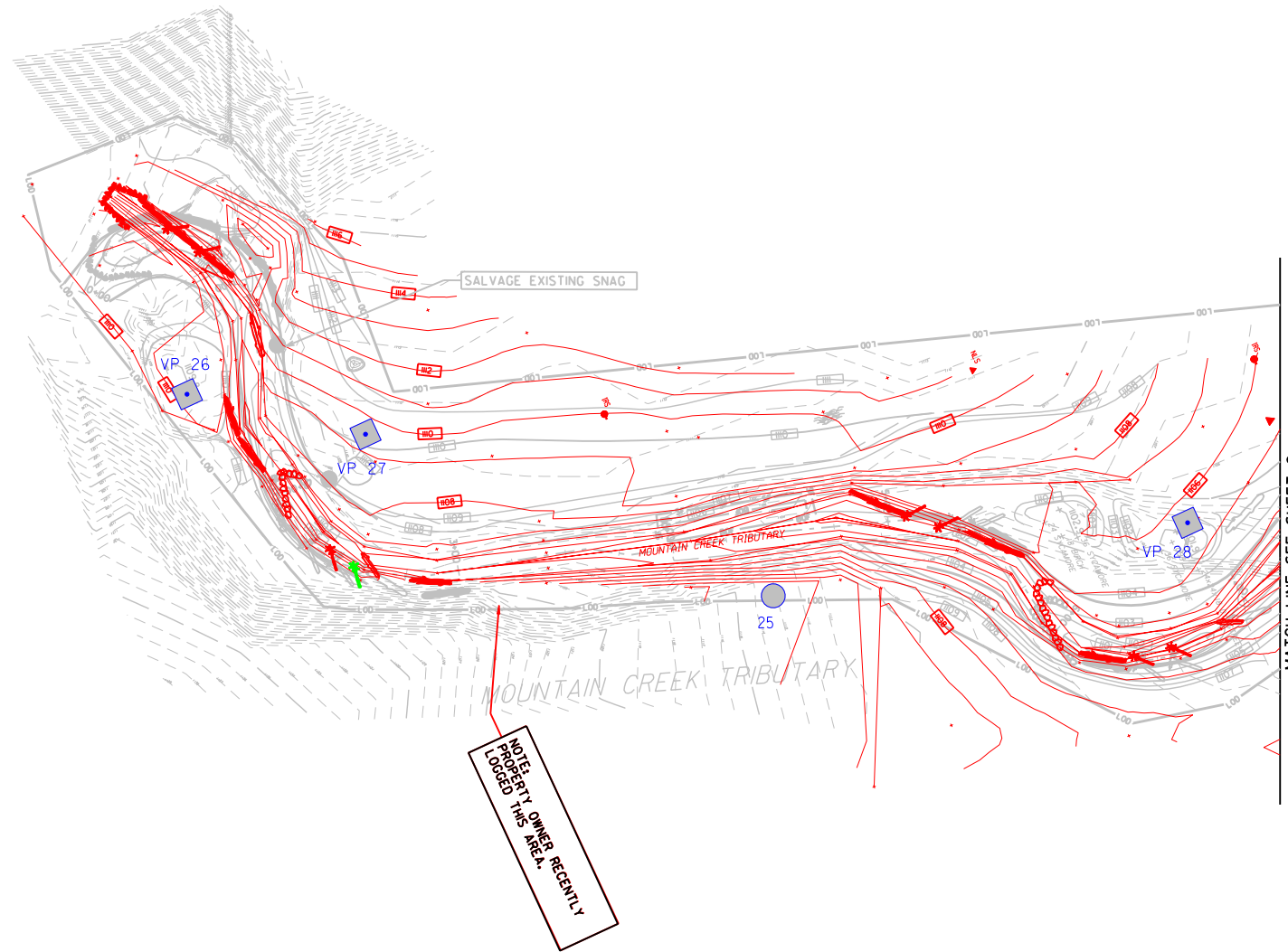
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 SHEET NO. 7

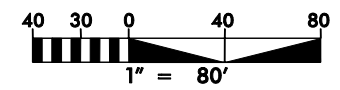


LEGEND FOR DRAWING

	SURVEY CONTROL POINT		LOG VANE
	EXISTING SPOT ELEVATION		PROPOSED THALWEG
	EXISTING STREAM EDGE LIMITS		PROPOSED BANKFULL LIMITS
	EXISTING TREE		BRUSH PILE
	EXISTING CONTOUR		STANDING SNAG
	EXISTING FENCE		DOWNED LOG
	EXISTING THALWEG		CONTRACTORS STAGING AREA
	EXISTING WETLAND		LIMIT OF DISTURBANCE
	PROPOSED CONTOUR		SILT FENCE
	ROCK CROSS VANE		BLAZE ORANGE FENCE
	ROCK J-VANE		TREE SAVE
	LOG J-VANE		EXISTING SNAG TO REMAIN
	ROCK VANE		LIVE BRANCH LAYERING
	ROCK TOE PROTECTION		PHOTO PLOT
	ROOTWAD REVETMENT		VEG PLOT
	LOG TOE PROTECTION		

COLOR LEGEND FOR STRUCTURES:

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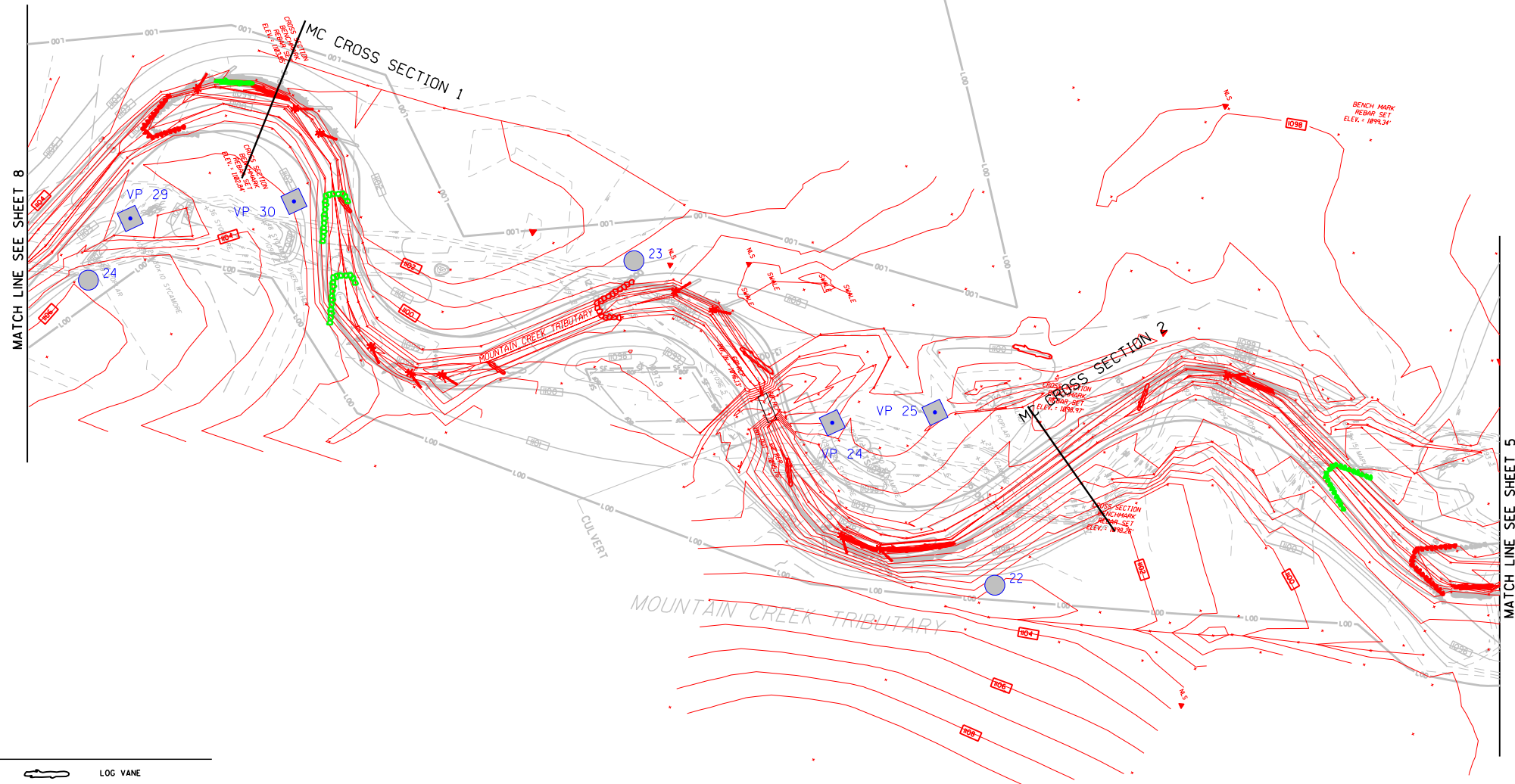
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FIGURE 2
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 EEP PROJECT NO.
 00412
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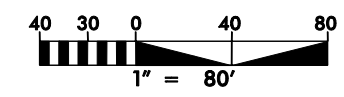
NOTE:
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LEGEND FOR DRAWING

- SURVEY CONTROL POINT
- × 273.1 EXISTING SPOT ELEVATION
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- - - 352 EXISTING CONTOUR
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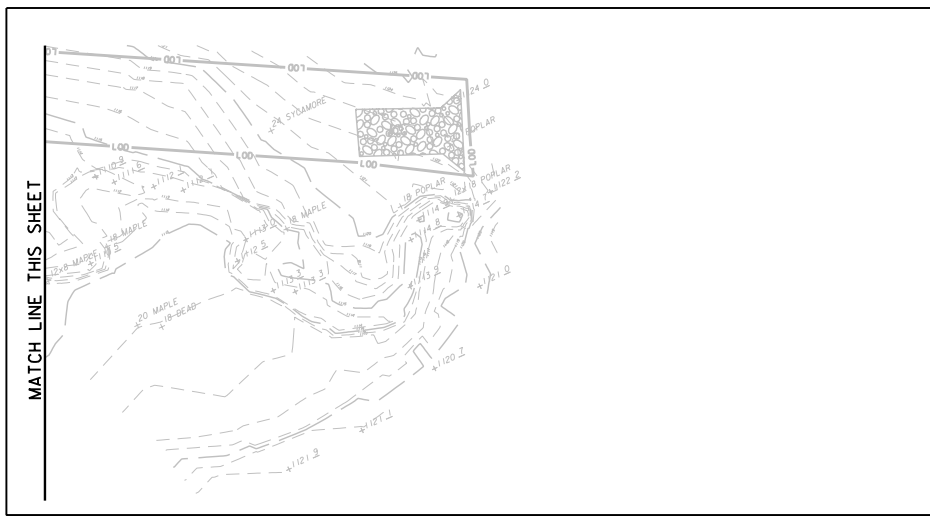
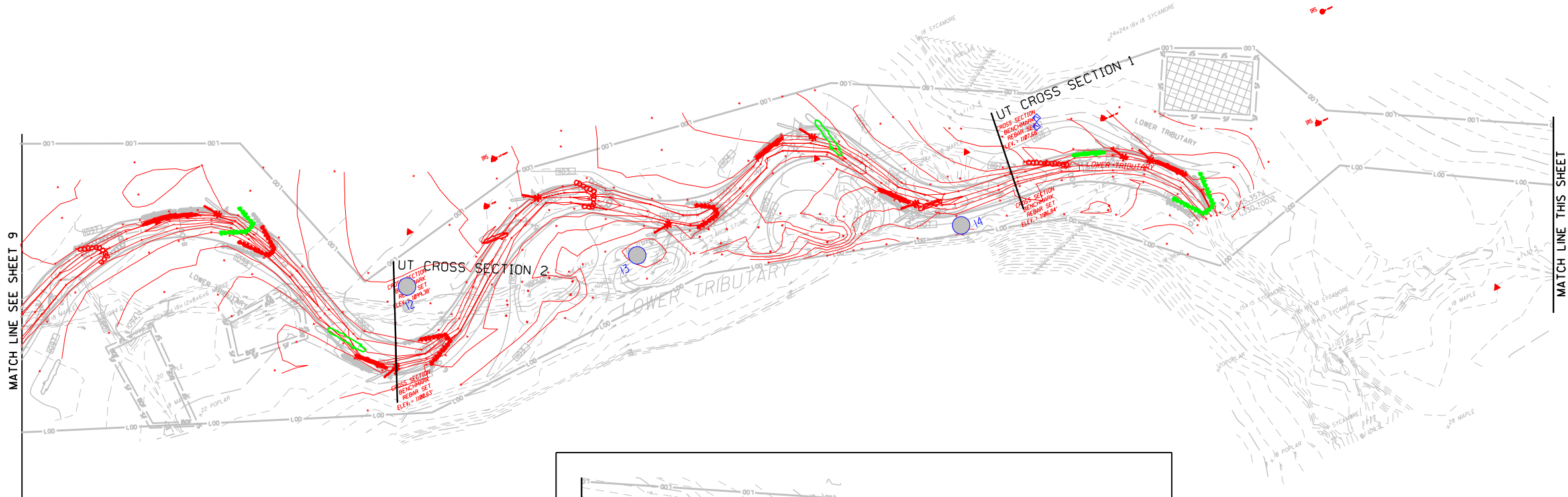
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FIGURE 2
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 EEP PROJECT NO. 00412
 SHEET NO. 9



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LEGEND FOR DRAWING

- | | |
|---|---|
| <ul style="list-style-type: none"> ○ SURVEY CONTROL POINT × 273.1 EXISTING SPOT ELEVATION - - - EXISTING STREAM EDGE LIMITS × 30° SYCAMORE EXISTING TREE - - - 352 EXISTING CONTOUR - - - - - EXISTING FENCE - - - - - EXISTING THALWEG ▨ EXISTING WETLAND ▭ 110.9 PROPOSED CONTOUR ⊥ ROCK CROSS VANE ⊥ ROCK J-VANE ⊥ LOG J-VANE ⊥ ROCK VANE ⊥ ROCK TOE PROTECTION ⊥ ROOTWAD REVETMENT ⊥ LOG TOE PROTECTION | <ul style="list-style-type: none"> — LOG VANE - - - PROPOSED THALWEG - - - PROPOSED BANKFULL LIMITS ⊥ BRUSH PILE ⊥ STANDING SNAG ⊥ DOWNED LOG ▨ CONTRACTORS STAGING AREA LOD LIMIT OF DISTURBANCE SF - SF SILT FENCE BOF BLAZE ORANGE FENCE ○ TS TREE SAVE ● EXISTING SNAG TO REMAIN ▨ LIVE BRANCH LAYERING ● 32 PHOTO PLOT ■ VP 15 VEG PLOT |
|---|---|

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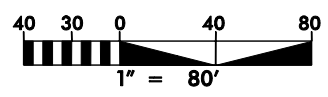
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FIGURE 2
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3.0 PROJECT CONDITION AND MONITORING RESULTS

3.1 VEGETATION ASSESSMENT

Vegetation monitoring plot stem counts and photos are located in Appendices A-I and A-IV.

3.1.1 Vegetative Problem Areas

The number of vegetative problem areas has decreased between 2005 and 2006, from 19 to 16, respectively. Of the 16 problem areas observed in 2006, six are areas of high concern. URS recommends that these areas receive repair or treatment. The other ten areas should be monitored further to see if they improve or worsen. The areas of high concern are related to invasive species and bare, eroding soil. Vegetative Problem Areas are listed in Tables A6a and A6b in Appendix A-I.

The presence and abundance of kudzu along Big Warrior Creek appears to have increased dramatically since 2005. The 2005 monitoring report described one vegetative problem area related to kudzu, while four kudzu-related problem areas were observed during 2006 monitoring. Because of the highly aggressive growth habit of kudzu, it is expected to continue expanding across the site and endangering the planted vegetation if it is not treated. American hogpeanut is also growing very aggressively along the Unnamed Tributary and portions of the other reaches. While this vine is a native species, it is a vigorous climber and may threaten the survivability of planted stems. The presence of American hogpeanut was not documented in 2005. Small Chinese privet were observed along the mainstem of Big Warrior Creek during the 2006 monitoring period. While these individuals do not pose an immediate threat, their presence should be noted and monitored.

Other problem areas include bare banks and floodplains along the mainstem (BWVPA1 through BWVPA8) and Mountain Creek (MCVPA1 through MCVPA8). No problem areas were documented along the Unnamed Tributary. These problems are likely resulting from poor site soils or soils that were compacted during construction. URS recommends soil amendments and reseeding in these areas.

Vegetative Problem Area Photos are located in Appendix A-II.

3.1.2 Vegetative Problem Areas Plan View

See Figure 3 in Appendix A-III for the Vegetative Problem Areas Plan View.

3.2 STREAM ASSESSMENT

3.2.1 Procedural Items

3.2.1.1 Morphometric Criteria

Dimension and profile were sampled per the 2003 Stream Mitigation Guidelines (USACE 2003) as follows:

Dimension: Eight permanent cross sections were surveyed. Two are located on Mountain Creek (one riffle and one pool), two on the Unnamed Tributary (one riffle and one pool), and four on Big Warrior Creek (two riffles and two pools). The survey includes points measured at all breaks in slope, including top of bank, bankfull, and thalweg.

Profile: A total of 6,841 linear feet of longitudinal profile was surveyed, broken into three segments as follows: 2,352 linear feet on Mountain Creek, 1,409 linear feet on the Unnamed Tributary, and 3,079 linear feet on Big Warrior Creek. Survey points include the top of bank, the beginning of each stream feature such as riffle, run, glide, or pool, and the maximum pool depth.

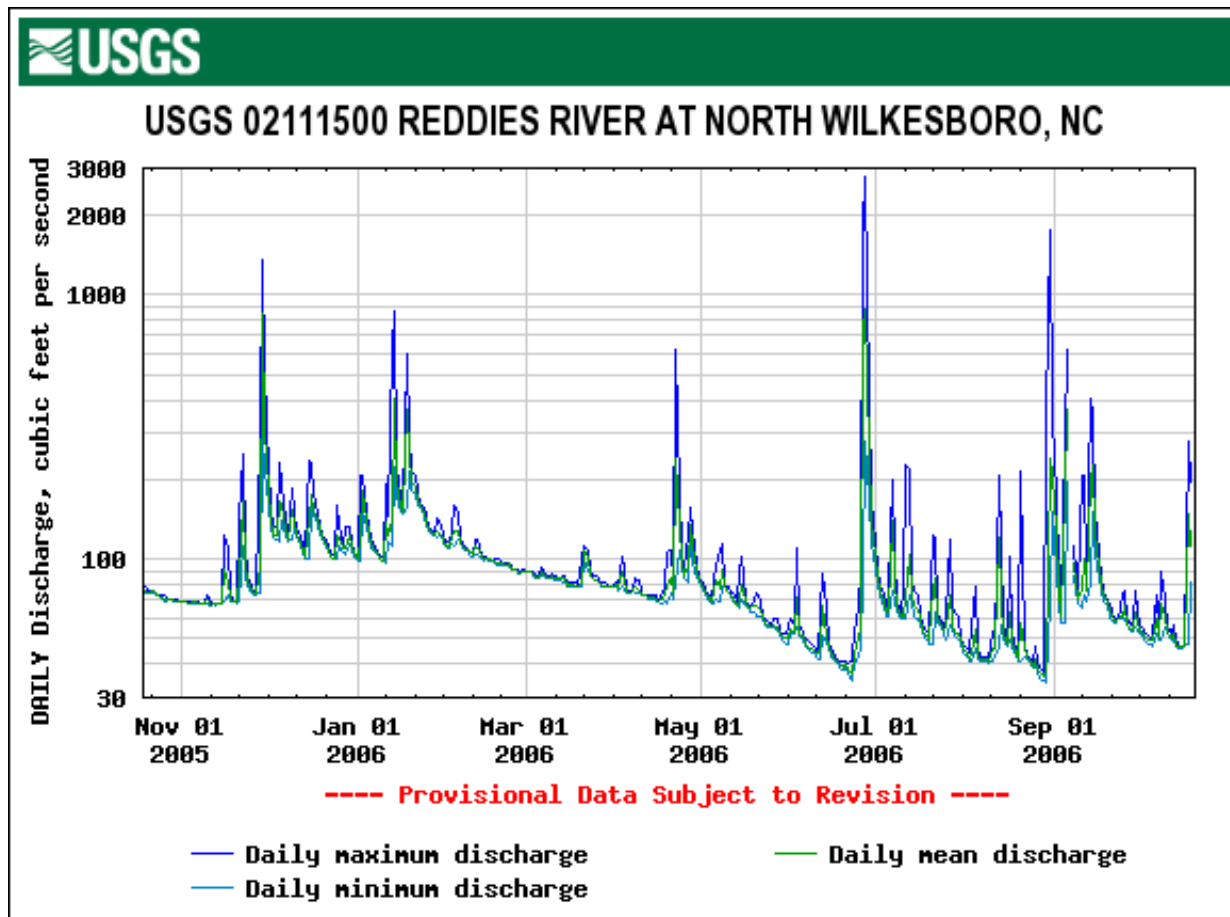
3.2.1.2 Hydrologic Criteria

No crest gages are installed at this site to document bankfull events. Therefore, potential occurrence was extrapolated based on USGS stream gage discharge data for the Reddies River at North Wilkesboro, NC (USGS 2006). The USGS gage plot is shown below. The gage is located about 10 miles from the project site in the same watershed and has a drainage area of 89 square miles. An estimate of the number of bankfull events in 2006 was made by comparing the stream discharges from the USGS data in cubic feet per second (cfs) against the bankfull discharge estimated from the drainage area on the Rural Piedmont Regional Curve. According to the regional curve, a bankfull event occurs on a stream with an 89-square mile drainage area when the discharge is about 2,250 cfs. This discharge was exceeded in late June of 2006, indicating that the Reddies River has had one bankfull event this year (as of October 19, 2006). Big Warrior Creek is in close proximity to the Reddies River, and it is likely that the project site also experienced a bankfull event in late June 2006.

**Table V. Verification of Bankfull Events
Big Warrior Creek
EEP Project Number 00412**

Date of Data Collection	Date of Occurrence	Method
10/19/2006	Late June 2006	Proximal USGS Gage Resource

Figure 4. USGS Stream Gage Discharge Data



3.2.1.3 Bank Stability Assessments

A detailed BEHI and NBS assessment was not required for the Big Warrior Creek Stream Restoration site during this monitoring year. According to the 2006 Monitoring Guidelines (EEP 2006), an assessment is required during year 5, post construction only.

3.2.2 Stream Problem Areas

There were a total of 26 problem areas identified for the project, 19 on the mainstem and 7 on Mountain Creek. Fifteen problem areas were classified as areas of high concern, and URS recommends repair or maintenance on these areas. The remaining eleven should be watched closely to see if they improve or worsen.

The stream problem areas consisted primarily of bank erosion, structure failure, and bed aggradation. One especially problematic area is the structure failure at the beginning of Mountain Creek, MCPA1. Water is piping behind and around the structure, and it is constructed at a large elevation drop. If this structure fails, it is likely to induce a headcut that will work up the unrestored section of Mountain Creek. Many of the rootwads were causing scour on the downstream side. A common problem was also observed with many of the J-hook vanes, as shown in photos BWPA1, BWPA3, and BWPA10. These structures were often constructed with three rocks placed high above the invert of the bed, which caused an obstruction of flow, and the water to be diverted into the banks. This problem was further exacerbated by the fact that the rocks trap debris and create a larger obstruction. The Problem Areas Plan View is

located in Appendix B-I, Problem Area data tables are located in Appendix B-II, and Problem Area Photos are located in Appendix B-III.

3.2.3 Fixed Photo Station Photos

Stream Photo Station photos are located in Appendix B-IV.

3.2.4 Stability Assessment

Table VI. Categorical Stream Feature Visual Stability Assessment (% Functioning)						
Big Warrior Creek						
EEP Project Number 00412						
Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffle	100	N/A	100			
B. Pool	100	N/A	100			
C. Thalweg	100	N/A	96			
D. Meanders	100	N/A	98			
E. Bed General	100	N/A	93			
F. Bank Condition	100	N/A	96			
G. Vanes / J Hooks	100	N/A	72			
H. Wads and Boulders	100	N/A	70			

3.2.5 Quantitative Measures Summary Tables (Morphology and Hydrology)

Neither EcoLogic nor URS received the Restoration Plan for the Big Warrior Stream Restoration Site, and the 2005 Mitigation Plan contained little pre-restoration data. Therefore, populating the Baseline Morphology and Hydraulic Summary Table was not possible. The table has been condensed to show the Regional Curve Interval data for each reach. URS was unable to generate data for the rest of the table.

Table VII. Baseline Morphology and Hydraulic Summary									
Big Warrior Creek									
EEP Project Number 00412									
Parameter	Big Warrior Creek Regional Curve Interval			Mountain Creek Regional Curve Interval			Unnamed Tributary Regional Curve Interval		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)	17	52	30	17	60	30	6	28	14
Floodprone Width (ft)									
BF Cross Sectional Area (ft ²)	45	170	80	9	30	18	5.5	20	11
BF Mean Depth (ft)	1.9	4.0	3.0	1.1	3.0	1.9	0.8	2.0	1.5
BF Max Depth (ft)									
Width/Depth Ratio									
Entrenchment Ratio									
Wetted Perimeter (ft)									
Hydraulic radius (ft)									
Pattern									
Channel Beltwidth (ft)									
Radius of Curvature (ft)									
Meander Wavelength (ft)									
Meander Width Ratio									
Profile									
Riffle Length (ft)									
Riffle Slope (ft/ft)									
Pool Length (ft)									
Pool Spacing (ft)									
Substrate									
d50 (mm)									
d84 (mm)									
Additional Reach Parameters									
Valley Length (ft)									
Channel Length (ft)									
Sinuosity									
Water Surface Slope (ft/ft)									
BF Slope (ft/ft)									
Rosgen Classification									

Table VIIIa. Morphology and Hydraulic Monitoring Summary – Big Warrior Creek
Big Warrior Creek
EEP Project Number 00412

Parameter	Cross Section 1 Pool					Cross Section 2 Riffle					Cross Section 3 Riffle*					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																				
BF Width (ft)	35.3	13.9				23	23.8				24.2	27.5				22.6	25.9			
Floodprone Width (ft)	99	>65				41.4	>55				31.6	>60				40.5	>60			
BF Cross Sectional Area (ft ²)	48.3	12.4				33.3	34.4				30	39.3				36.2	36.8			
BF Mean Depth	1.4	0.9				1.5	1.4				1.2	1.4				1.6	1.4			
BF Max Depth	3.2	1.6				2.5	2.5				1.8	2.1				3.1	3.1			
Width/Depth Ratio	25.8	15.5				15.9	16.5				19.6	19.2				14.1	18.2			
Entrenchment Ratio	2.8	>4.7				1.8	>2.3				1.3	>2.2				1.8	>2.3			
Bank Height Ratio	N/A	1.0				N/A	1.0				N/A	1.0				N/A	1.0			
Wetted Perimeter (ft)	36.5	15.2				24.7	26.0				24.8	28.6				23.9	27.3			
Hydraulic radius (ft)	1.3	0.8				1.4	1.3				1.2	1.4				1.5	1.3			
Substrate**																				
d50 (mm)	0.45	2.8				11.8	26				0.83	36				0.84	0.93			
d84 (mm)	1.5	25				39.4	82				1.91	110				8.83	12			

*Cross section 3 is transitioning to a glide. It was surveyed as a riffle to maintain consistency with MY1 monitoring.

** The d50 and d84 for MY2 are not comparable to the MY1 data because different methods were used for the pebble count.

Table VIIIb. Morphology and Hydraulic Monitoring Summary – Big Warrior Creek
Big Warrior Creek
EEP Project Number 00412

Parameter	MY1 (2005)			MY2 (2006)			MY3 (2007)			MY4 (2008)			MY5 (2009)			MY+		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	--	--	--	--	--	--												
Radius of Curvature (ft)	--	--	--	28	76	52												
Meander Wavelength (ft)	--	--	--	--	--	--												
Meander Width Ratio	--	--	--	--	--	--												
Profile																		
Riffle Length (ft)	34	166	54	11	185	49												
Riffle Slope (ft/ft)	0.004	0.017	0.008	0.005	0.010	0.026												
Pool Length (ft)	13	200	70.5	12	259	77												
Pool Spacing (ft)	37.9	397	119	16	453	132												
Additional Reach Parameters																		
Valley Length (ft)	--	--	--	--	5200	--												
Channel Length (ft)	--	7021	--	--	7185	--												
Sinuosity	--	--	--	--	1.38	--												
Water Surface Slope (ft/ft)	--	0.0041	--	--	0.0032	--												
BF Slope (ft/ft)	--	0.0041	--	--	0.0034	--												
Rosgen Classification	--	C/B/F	--	--	C4	--												

Table VIIIc. Morphology and Hydraulic Monitoring Summary – Mountain Creek Big Warrior Creek 00412										
Parameter	Cross Section 1 Pool					Cross Section 2 Riffle				
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	26.7	18.8				13.1	15.8			
Floodprone Width (ft)	56	>45				45.8	>45			
BF Cross Sectional Area (ft ²)	45.2	28.9				17.6	24.2			
BF Mean Depth	1.7	1.5				1.3	1.5			
BF Max Depth	3.4	2.8				1.9	2.3			
Width/Depth Ratio	15.9	12.2				9.76	10.3			
Entrenchment Ratio	2.1	>2.4				3.5	>2.8			
Bank Height Ratio	N/A	1.0				N/A	1.0			
Wetted Perimeter (ft)	28.4	20.0				14.1	17.0			
Hydraulic radius (ft)	1.6	1.4				1.3	1.4			
Substrate*										
d50 (mm)	2.36	0.41				6.85	23			
d84 (mm)	10.5	17				16.4	69			

* The d50 and d84 for MY2 are not comparable to the MY1 data because different methods were used for the pebble count.

**Table VIIIId. Morphology and Hydraulic Monitoring Summary – Mountain Creek
Big Warrior Creek
EEP Project Number 00412**

Parameter	MY1 (2005)			MY2 (2006)			MY3 (2007)			MY4 (2008)			MY5 (2009)			MY+		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Pattern																		
Channel Beltwidth (ft)	84	180	147.5	--	--	--												
Radius of Curvature (ft)	40	70	50	--	--	--												
Meander Wavelength (ft)	140	300	200	--	--	--												
Meander Width Ratio	5.2	11.2	7.5	--	--	--												
Profile																		
Riffle Length (ft)	9.3	16.7	47	6	167	37												
Riffle Slope (ft/ft)	0.009	0.055	0.027	0.0034	0.063	0.023												
Pool Length (ft)	12	85	38	8	136	38												
Pool Spacing (ft)	22	208	75	16	187	84												
Additional Reach Parameters																		
Valley Length (ft)	--	1820	--	--	--	1820												
Channel Length (ft)	--	2373	--	--	--	2352												
Sinuosity	--	1.3	--	--	--	1.3												
Water Surface Slope (ft/ft)	--	0.009	--	--	--	0.008												
BF Slope (ft/ft)	--	0.009	--	--	--	0.008												
Rosgen Classification	--	B	--	--	--	C4												

Table VIIIe. Morphology and Hydraulic Monitoring Summary – Unnamed Tributary Big Warrior Creek EEP Project Number 00412										
Parameter	Cross Section 1 Riffle					Cross Section 2 Pool				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
Dimension										
BF Width (ft)	10.6	10.9				8.12	17.8			
Floodprone Width (ft)	15.5	>25				26.7	>40			
BF Cross Sectional Area (ft ²)	6.1	7.9				3.9	8.7			
BF Mean Depth	0.6	0.7				0.5	0.5			
BF Max Depth	1	1.2				1	1.1			
Width/Depth Ratio	18.3	14.9				16.8	36.1			
Entrenchment Ratio	1.5	>2.3				3.3	>2.3			
Bank Height Ratio	N/A	1.0				N/A	1.0			
Wetted Perimeter (ft)	10.8	11.2				8.6	18.0			
Hydraulic radius (ft)	0.56	0.7				0.5	0.5			
Substrate										
d50 (mm)	1.56	4				0.46	0.13			
d84 (mm)	13.6	48				0.83	0.42			

* The d50 and d84 for MY2 are not comparable to the MY1 data because different methods were used for the pebble counts.

**Table VIII.f. Morphology and Hydraulic Monitoring Summary – Unnamed Tributary
Big Warrior Creek
EEP Project Number 00412**

Parameter	MY1 (2005)			MY2 (2006)			MY3 (2007)			MY4 (2008)			MY5 (2009)			MY+		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Pattern																		
Channel Beltwidth (ft)	100	200	165	--	--	--												
Radius of Curvature (ft)	50	115	60	--	--	--												
Meander Wavelength (ft)	250	345	285	--	--	--												
Meander Width Ratio	23.6	32.5	26.8	--	--	--												
Profile																		
Riffle Length (ft)	9.6	60.2	32.5	5	54	31												
Riffle Slope (ft/ft)	0.002	0.065	0.035	0.006	0.043	0.024												
Pool Length (ft)	13.2	60.2	34	8	78	37												
Pool Spacing (ft)	15.7	200	64.4	20	137	61												
Additional Reach Parameters																		
Valley Length (ft)	--	1000	--	--	--	1000												
Channel Length (ft)	--	1309	--	--	--	1409												
Sinuosity	--	--	--	--	--	1.4												
Water Surface Slope (ft/ft)	--	0.01	--	--	--	0.014												
BF Slope (ft/ft)	--	0.01	--	--	--	0.0135												
Rosgen Classification	--	B	--	--	--	C4												

4.0 METHODOLOGY SECTION

All monitoring methodologies follow the most current templates and guidelines provided by EEP. Photographs were taken at high resolution using an Olympus Stylus 4.0 megapixel digital camera. GPS location information was collected using a Trimble Geo XT handheld mapping grade GPS unit. GPS locations were collected on both banks of each cross section and on all four corners of each vegetation plot. Stream and vegetation problem areas were noted in the field on As-Built Plan Sheets. Permanent photo station photographs were taken from locations marked in the Year One Monitoring Report, prepared by EcoLogic Associates.

4.1 STREAM METHODOLOGY

The methods used to generate the data in this report are standard fluvial geomorphology techniques as described in *Applied River Morphology* (Rosgen 1996) and related publications from US Forest Service and the interagency Stream Mitigation Guidelines (USACE 2003). URS' field morphology survey was conducted using a Zeiss Level Ni 2 and the data were analyzed and displayed using the Reference Reach Spreadsheet, Version 4.2L (Mecklenburg 2006). Modified Wolman weighted pebble counts were conducted in the vicinity of each cross section. Photographs were taken at each cross section. A photo was taken from the left bank towards the right bank, and from the right bank towards the left bank.

4.2 VEGETATION METHODOLOGY

Vegetation monitoring methods followed the 2006, Version 4.0 CVS-EEP Protocol for Recording Vegetation (Lee *et al* 2006). Vegetation plot photographs and GPS locations were collected at the southwest corner of each vegetation plot. Vegetation monitoring plots were re-marked in the field by replacing all old flagging with new flagging. Each vegetation plot was marked by Ecologic in 2005 with a four-foot PVC pipe at the upstream, outside corner. The remaining three corners were marked with steel conduit. URS placed orange flagging at the southwest corner of each vegetation plot and blue flagging at the remaining corners. The orientation of the plot was marked on the CVS-EEP data sheet if the PVC was not in the southwest corner (the origin of the plot). Planted stems were flagged in white. Volunteer/natural regeneration stems were inventoried and flagged with red. Stem height was measured with a folding one-meter rule. Diameter at breast height and decimeter height were measured with calipers. The X,Y coordinates relative to the southwest corner (origin) of each stem in the plot were recorded.

Seven vegetation plots were established by CDM in 2004. These seven plots were evaluated for the As-built survey. These plots consisted of 1/10-acre circular plots with the center points marked with rebar. For the Year 1 survey in 2005, EcoLogic did not have As-built project data. EcoLogic established 30 10-meter by 10-meter vegetation plots, per EEP's current protocol at that time.

According to the current CVS-EEP Protocol for Recording Vegetation (Version 4.0), the Big Warrior Creek Stream Restoration Project requires the monitoring of 16 vegetation plots. The new CVS-EEP Protocol for Recording Vegetation was used to inventory 16 (1, 2, 4, 6, 7, 8, 9, 11, 13, 15, 19, 25, 26, 28, 29, and 30) of the 30 vegetation plots established by EcoLogic.

Rebar was used to mark all four corners of the vegetation plots and the southwest corner is marked with a 4-foot PVC pipe flagged with orange ribbon. The remaining three corners were marked with blue flagging. GPS coordinates were taken for the southwest corner of each plot and a reference photograph was taken from the southwest corner towards the northeast corner for each plot.

The CVS-EEP Protocol for Recording Vegetation (Levels I-II) was used to inventory the plots for the Year 2 stem counts. All planted stems were marked again with white flagging. Natural regeneration stems were marked with red flagging. The results of the stem counts are located in Appendix A-I. Photographs of the monitoring plots are located in Appendix A-IV.

5.0 REFERENCES

- CDM. 2005. Big Warrior Stream Restoration Mitigation Plan. Prepared by Camp, Dresser, and McKee and Biohabitats, Inc. Prepared for NC Ecosystem Enhancement Program. March 2005.
- Daniels, R.B., Buol, S.W., Kleiss, H.J., and C.A Ditzler. 1999. Soil Systems in North Carolina. North Carolina State University, Soil Science Department. Technical Bulletin 314. January, 1999.
- EcoLogic Associates, P.C. 2006. Big Warrior Creek 2005 Monitoring Report, Monitoring Year One. Prepared for NC Ecosystem Enhancement Program. April 2006.
- Mecklenburg, Dan. 2006. The Reference Reach Spreadsheet for Channel Survey Data Management. Version 4.2L. Ohio Department of Natural Resources.
- EEP. 2006. Content, Format, and Data Requirements for EEP Monitoring Reports. Version 1.2 (11/16/06). NCDENR, NCEEP. 17pp.
- Lee, Michael T., Peek, Robert K., Roberts, Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. Retrieved October 30, 2006, from <http://www.nceep.net/business/monitoring/veg/datasheets.htm>.
- Radford, A.E., Ahles, H.E., and C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. The University of North Carolina Press. Chapel Hill, NC.
- Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.
- Tuttle, JohnW. 1997. Soil Survey of Wilkes County, North Carolina. US Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS).
- USACE, Wilmington District, US Environmental Protection Agency, NC Wildlife Resources Commission, and NC Division of Water Quality. 2003. Stream Mitigation Guidelines. April 2003. 26 pp.
- USGS. 2006. Reddies River at North Wilkesboro, NC streamflow gage. USGS Real-Time Water Data. Gage 02111500. <http://waterdata.usgs.gov>.

APPENDIX A

VEGETATION RAW DATA

APPENDIX A-I. VEGETATION SURVEY DATA TABLES

Table A1. Vegetation Metadata

Report Prepared By	Susan Shelingoski	
Date Prepared	1/10/2007 15:22	
database name	CVS_EEP_DataEntry_v202.mdb	
database location	C:\Documents and Settings\susan_shelingoski\My Documents\2005 On-call Kickoff Meeting	
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----		
Metadata	This worksheet, which is a summary of the project and the project data.	
Plots	List of plots surveyed.	
Vigor	Frequency distribution of vigor classes.	
Vigor by Spp	Frequency distribution of vigor classes listed by species.	
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.	
Damage by Spp	Damage values tallied by type for each species.	
Damage by Plot	Damage values tallied by type for each plot.	
Stem Count by Plot and Spp	Count of living stems of each species for each plot; dead and missing stems are excluded.	
PROJECT SUMMARY-----		
Project Code	412	
project Name	Big Warrior Creek	
Description	Stream Restoration	
length (ft)		
stream-to-edge width (ft)		
area (sq m)		
Required Plots (calculated)		
Sampled Plots	16	

APPENDIX A-I. VEGETATION SURVEY DATA TABLES

Table A2. Vegetation Vigor by Species

	Species	4	3	2	1	0	Missing
	Alnus serrulata	1	11				
	Betula nigra	1	6			2	
	Cephalanthus occidentalis			1			
	Cornus amomum	1	12	4			
	Fraxinus pennsylvanica			5	1		
	Juglans nigra	2	11	5	2		
	Nyssa sylvatica	1	1				
	Oxydendrum arboreum						
	Pinus virginiana						
	Salix nigra	1	5	1			
	Cercis canadensis		1	2			
	Carya						
	Lindera benzoin		1				
	Liriodendron tulipifera	1	12	4			
	Platanus occidentalis	1	12	6			
	Physocarpus opulifolius		8	3			
	Prunus						
	Acer rubrum						
	Ulmus americana						
TOT:	19	9	80	31	3	2	

Table A3. Vegetation Damage by Species

	Species	All Damage Categories	(no damage)	Deer	Insects
	Acer rubrum	1	1		
	Alnus serrulata	14	14		
	Betula nigra	12	12		
	Carya	1	1		
	Cephalanthus occidentalis	1	1		
	Cercis canadensis	4	4		
	Cornus amomum	18	17	1	
	Fraxinus pennsylvanica	9	9		
	Juglans nigra	22	21		1
	Lindera benzoin	1	1		
	Liriodendron tulipifera	22	22		
	Nyssa sylvatica	2	2		
	Oxydendrum arboreum	2	2		
	Physocarpus opulifolius	12	12		
	Pinus virginiana	1	1		
	Platanus occidentalis	26	25		1
	Prunus	4	4		
	Salix nigra	10	10		
	Ulmus americana	1	1		
TOT:	19	163	160	1	2

Table A4. Vegetation Damage by Plot

	plot	All Damage Categories	(no damage)	Deer	Insects
	412-01-0001	16	14	1	1
	412-01-0002	11	11		
	412-01-0004	3	3		
	412-01-0006	6	6		
	412-01-0007	19	19		
	412-01-0008	4	4		
	412-01-0009	12	12		
	412-01-0011	19	19		
	412-01-0013	10	10		
	412-01-0015	6	6		
	412-01-0019	6	6		
	412-01-0025	10	10		
	412-01-0026	13	12		1
	412-01-0028	9	9		
	412-01-0029	5	5		
	412-01-0030	14	14		
TOT:	16	163	160	1	2

Table A5. Stem Count by Plot and Species

	Species	Total Stems	# plots	avg# stems	plot 412-01-0001	plot 412-01-0002	plot 412-01-0004	plot 412-01-0006	plot 412-01-0007	plot 412-01-0008	plot 412-01-0009	plot 412-01-0011	plot 412-01-0013	plot 412-01-0015	plot 412-01-0019	plot 412-01-0025	plot 412-01-0026	plot 412-01-0028	plot 412-01-0029	plot 412-01-0030
	<i>Alnus serrulata</i>	12	6	2		1					2	1	1	2	5					
	<i>Betula nigra</i>	7	4	1.75									1			3		2		1
	<i>Cephalanthus occidentalis</i>	1	1	1														1		
	<i>Cercis canadensis</i>	3	2	1.5		1		2												
	<i>Cornus amomum</i>	17	7	2.43	2	1		1	9		1	2				1				
	<i>Fraxinus pennsylvanica</i>	6	3	2				2										1		3
	<i>Juglans nigra</i>	20	7	2.86	4	1	1		6		6			1		1				
	<i>Lindera benzoin</i>	1	1	1					1											
	<i>Liriodendron tulipifera</i>	17	5	3.4	5	3						5						1		3
	<i>Nyssa sylvatica</i>	2	2	1	1							1								
	<i>Physocarpus opulifolius</i>	11	4	2.75	3		1						5					2		
	<i>Platanus occidentalis</i>	19	7	2.71		2		1		1		6				2	6		1	
	<i>Salix nigra</i>	7	5	1.4			1						2			1	2		1	
TOT:	13	123	13		15	9	3	6	16	1	9	15	9	3	5	8	8	7	2	7

APPENDIX A-I. VEGETATION SURVEY DATA TABLES

Table A6a. Vegetative Problem Areas – Big Warrior Creek				
Big Warrior Creek				
EEP Project Number 00412				
Feature #	Feature/Issue	Station #/Range	Probable Cause	Photo #
BWVPA1	Bare bank	2+00 to 8+00	Bank erosion	BWVPA1
BWVPA2	Invasive/exotic plant	12+00 to 20+10	Invasive/exotic plant	BWVPA2
BWVPA3	Bare bank	29+70	Bank erosion	BWVPA3
BWVPA4	Invasive/exotic plant	33+00 to 35+00	Invasive/exotic plant	BWVPA4
BWVPA5	Bare bank	43+15	Bank erosion	BWVPA5
BWVPA6	Invasive/exotic plant	43+15	Invasive/exotic plant	BWVPA6
BWVPA7	Bare floodplain, gully erosion	49+00 to 50+00	Poor soil	BWVPA7
BWVPA8	Invasive/exotic plant	63+50	Invasive/exotic plant	BWVPA8

Table A6b. Vegetative Problem Areas – Mountain Creek				
Big Warrior Creek				
EEP Project Number 00412				
Feature #	Feature/Issue	Station #/Range	Probable Cause	Photo #
MCVPA1	Bare bank	5+00	Bank erosion	MCVPA1
MCVPA2	Bare bank	6+20	Bank erosion	MCVPA2
MCVPA3	Bare bank	13+60	Bank erosion	MCVPA3
MCVPA4	Bare bank	15+00	Bank erosion	MCVPA4
MCVPA5	Bare floodplain	17+00 to 17+60	Overflow	MCVPA5
MCVPA6	Bare bank	17+00	Bank erosion	MCVPA6
MCVPA7	Bare bank	17+60	Bank erosion	MCVPA7
MCVPA8	Bare bank	19+00	Bank erosion	MCVPA8

APPENDIX A-II. VEGETATIVE PROBLEM AREA PHOTOS

Photos Taken 9/26/06 to 9/29/06

BIG WARRIOR CREEK



BWVPA1



BWVPA2



BWVPA3



BWVPA4



BWVPA5



BWVPA6

APPENDIX A-II. VEGETATIVE PROBLEM AREA PHOTOS

Photos Taken 9/26/06 to 9/29/06



BWVPA7



BWVPA8

MOUNTAIN CREEK



MCVPA1



MCVPA2



MCVPA3



MCVPA4

APPENDIX A-II. VEGETATIVE PROBLEM AREA PHOTOS

Photos Taken 9/26/06 to 9/29/06



MCVPA5



MCVPA6



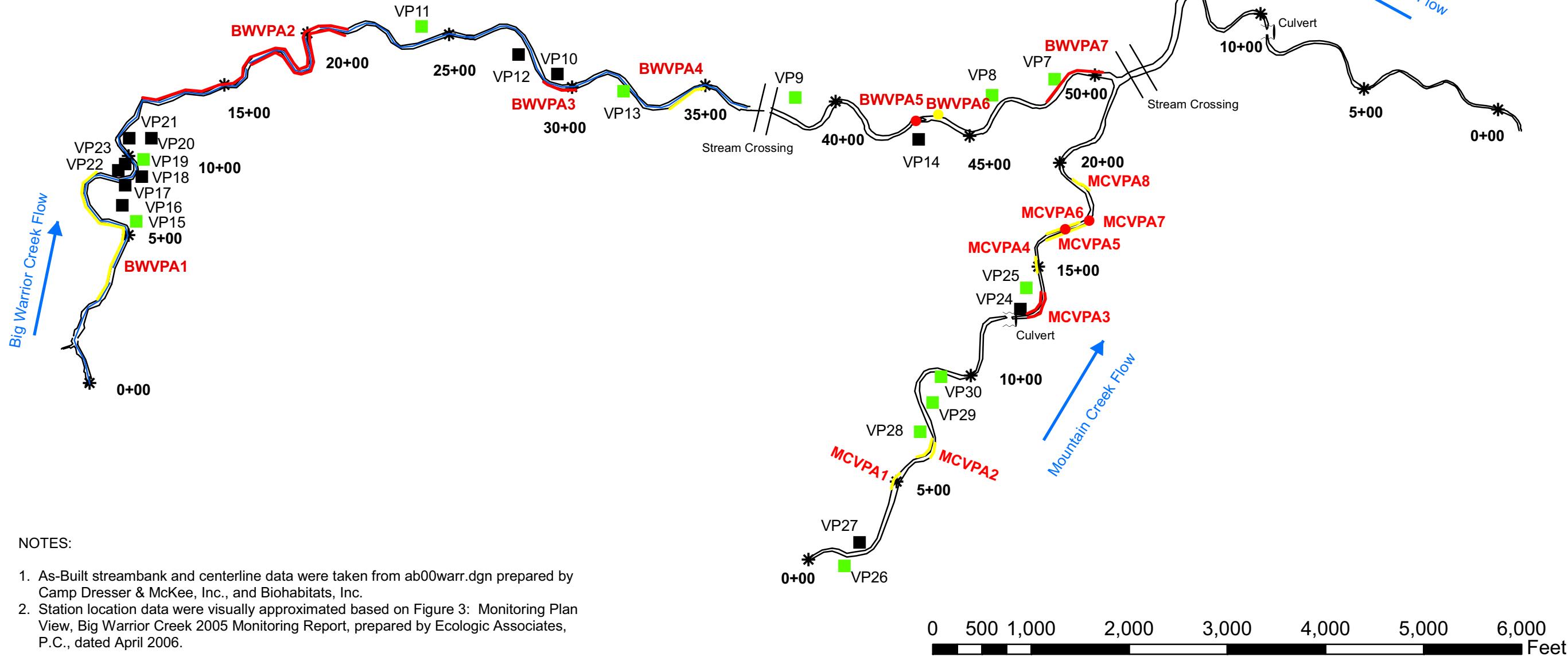
MCVPA7



MCVPA8

Vegetative Problem Areas – Big Warrior Creek				
Big Warrior Creek 00412				
Feature #	Feature/Issue	Station #/Range	Probable Cause	Photo #
BWVPA1	Bare bank	2+00 to 8+00	Bank erosion	BWVPA1
BWVPA2	Invasive/exotic plant	12+00 to 20+10	Invasive/exotic plant	BWVPA2
BWVPA3	Bare bank	29+70	Bank erosion	BWVPA3
BWVPA4	Invasive/exotic plant	33+00 to 35+00	Invasive/exotic plant	BWVPA4
BWVPA5	Bare bank	43+15	Bank erosion	BWVPA5
BWVPA6	Invasive/exotic plant	43+15	Invasive/exotic plant	BWVPA6
BWVPA7	erosion	49+00 to 50+00	Poor soil	BWVPA7
BWVPA8	Invasive/exotic plant	63+50	Invasive/exotic plant	BWVPA8

Vegetative Problem Areas – Mountain Creek				
Big Warrior Creek 00412				
Feature #	Feature/Issue	Station #/Range	Probable Cause	Photo #
MCVPA1	Bare bank	5+00	Bank erosion	MCVPA1
MCVPA2	Bare bank	6+20	Bank erosion	MCVPA2
MCVPA3	Bare bank	13+60	Bank erosion	MCVPA3
MCVPA4	Bare bank	15+00	Bank erosion	MCVPA4
MCVPA5	Bare floodplain	17+00 to 17+60	Overflow	MCVPA5
MCVPA6	Bare bank	17+00	Bank erosion	MCVPA6
MCVPA7	Bare bank	17+60	Bank erosion	MCVPA7
MCVPA8	Bare bank	19+00	Bank erosion	MCVPA8



NOTES:

1. As-Built streambank and centerline data were taken from ab00warr.dgn prepared by Camp Dresser & McKee, Inc., and Biohabitats, Inc.
2. Station location data were visually approximated based on Figure 3: Monitoring Plan View, Big Warrior Creek 2005 Monitoring Report, prepared by Ecologic Associates, P.C., dated April 2006.



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Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 2 (2006)

Project Number:
 00412

Date:
 January 2007

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
- Vegetation Plots**
- Inventoried
 - Not Inventoried
 - As-Built Centerline
 - As-Built Streambank
 - * Stations

Figure 3
 Vegetative
 Problem Areas
 Plan View

APPENDIX A-IV. VEGETATION MONITORING PLOT PHOTOS



VP1 (8/29/06)



VP2 (8/29/06)



VP4 (8/29/06)



VP6 (8/29/06)



VP7 (9/28/06)



VP8 (9/29/06)

APPENDIX A-IV. VEGETATION MONITORING PLOT PHOTOS



VP9 (9/27/06)



VP11 (9/27/06)



VP13 (9/27/06)



VP15 (9/27/06)



VP19 (9/27/06)



VP25 (9/26/06)

APPENDIX A-IV. VEGETATION MONITORING PLOT PHOTOS



VP26 (8/30/06)



VP28 (8/30/06)



VP29 (8/30/06)



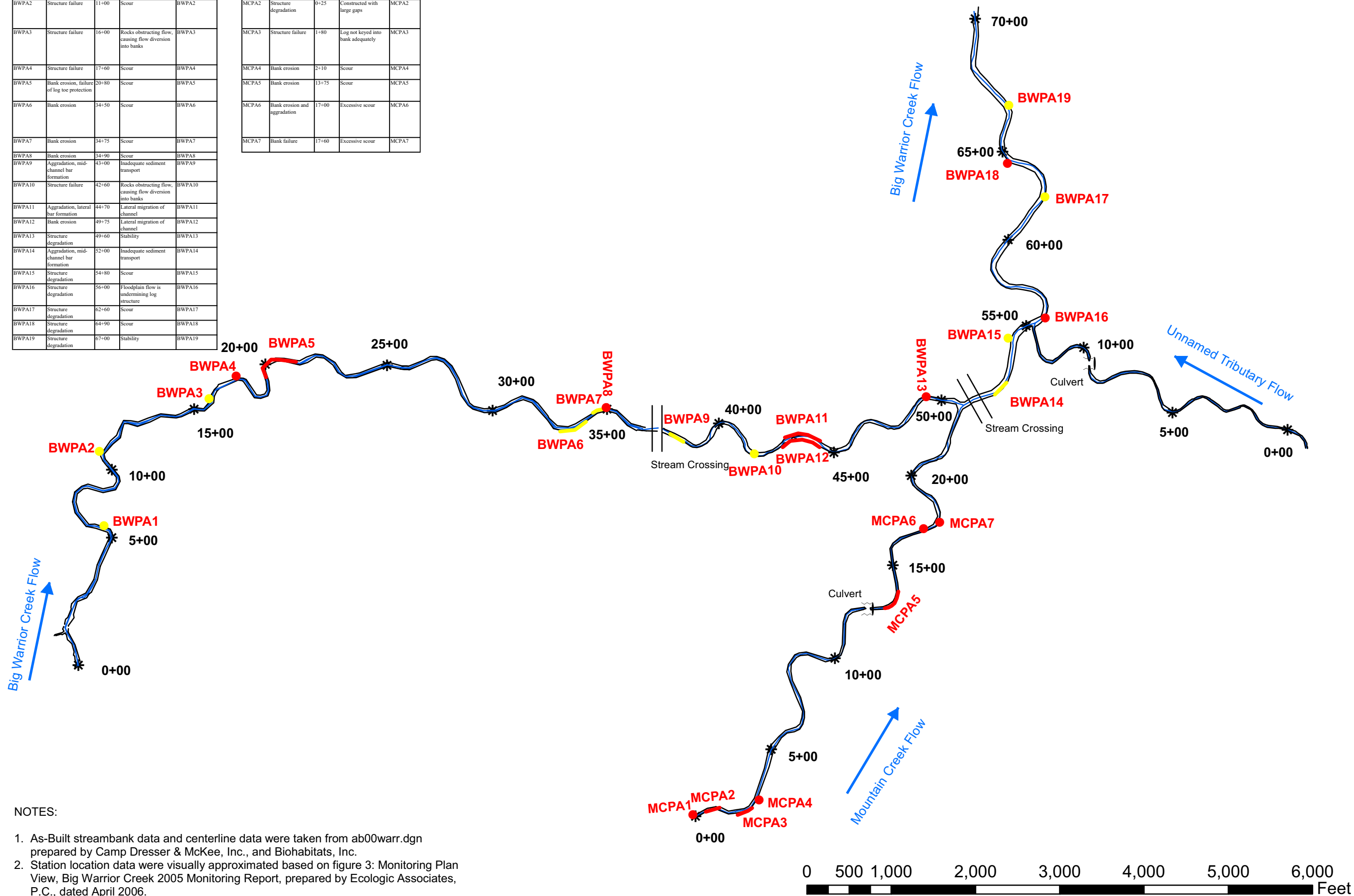
VP30 (8/30/06)

APPENDIX B

GEOMORPHIC RAW DATA

Stream Problem Areas - Big Warrior Creek Big Warrior Creek 00412				
Feature #	Feature Issue	Station	Suspected Cause	Photo #
BWPA1	Structure failure	5+00	Rocks obstructing flow, causing flow diversion into banks	BWPA1
BWPA2	Structure failure	11+00	Scour	BWPA2
BWPA3	Structure failure	16+00	Rocks obstructing flow, causing flow diversion into banks	BWPA3
BWPA4	Structure failure	17+60	Scour	BWPA4
BWPA5	Bank erosion, failure of log toe protection	20+80	Scour	BWPA5
BWPA6	Bank erosion	34+50	Scour	BWPA6
BWPA7	Bank erosion	34+75	Scour	BWPA7
BWPA8	Bank erosion	34+90	Scour	BWPA8
BWPA9	Aggradation, mid-channel bar formation	43+00	Inadequate sediment transport	BWPA9
BWPA10	Structure failure	42+60	Rocks obstructing flow, causing flow diversion into banks	BWPA10
BWPA11	Aggradation, lateral bar formation	44+70	Lateral migration of channel	BWPA11
BWPA12	Bank erosion	49+75	Lateral migration of channel	BWPA12
BWPA13	Structure degradation	49+60	Stability	BWPA13
BWPA14	Aggradation, mid-channel bar formation	52+00	Inadequate sediment transport	BWPA14
BWPA15	Structure degradation	54+80	Scour	BWPA15
BWPA16	Structure degradation	56+00	Floodplain flow is undermining log structure	BWPA16
BWPA17	Structure degradation	62+60	Scour	BWPA17
BWPA18	Structure degradation	64+90	Scour	BWPA18
BWPA19	Structure degradation	67+00	Stability	BWPA19

Stream Problem Areas - Mountain Creek Big Warrior Creek 00412				
Feature #	Feature Issue	Station	Suspected Cause	Photo #
MCPA1	Structure failure	0+00	Too much elevation drop	MCPA1
MCPA2	Structure degradation	0+25	Constructed with large gaps	MCPA2
MCPA3	Structure failure	1+80	Log not keyed into bank adequately	MCPA3
MCPA4	Bank erosion	2+10	Scour	MCPA4
MCPA5	Bank erosion	13+75	Scour	MCPA5
MCPA6	Bank erosion and aggradation	17+00	Excessive scour	MCPA6
MCPA7	Bank failure	17+60	Excessive scour	MCPA7



- NOTES:
- As-Built streambank data and centerline data were taken from ab00warr.dgn prepared by Camp Dresser & McKee, Inc., and Biohabitats, Inc.
 - Station location data were visually approximated based on figure 3: Monitoring Plan View, Big Warrior Creek 2005 Monitoring Report, prepared by Ecologic Associates, P.C., dated April 2006.

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Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 2 (2006)

Project Number:
 00412

Date:
 January 2007

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - As-Built Centerline
 - As-Built Streambank
 - * Stations

Figure 5
 Stream
 Problem Areas
 Plan View

Table B1a. Stream Problem Areas – Big Warrior Creek				
Big Warrior Creek				
EEP Project Number 00412				
Feature #	Feature Issue	Station	Suspected Cause	Photo #
BWPA1	Structure failure	5+00	Rocks obstructing flow, causing flow diversion into banks	BWPA1
BWPA2	Structure failure	11+00	Scour	BWPA2
BWPA3	Structure failure	16+00	Rocks obstructing flow, causing flow diversion into banks	BWPA3
BWPA4	Structure failure	17+60	Scour	BWPA4
BWPA5	Bank erosion, failure of log toe protection	20+80	Scour	BWPA5
BWPA6	Bank erosion	34+50	Scour	BWPA6
BWPA7	Bank erosion	34+75	Scour	BWPA7
BWPA8	Bank erosion	34+90	Scour	BWPA8
BWPA9	Aggradation, mid-channel bar formation	43+00	Inadequate sediment transport	BWPA9
BWPA10	Structure failure	42+60	Rocks obstructing flow, causing flow diversion into banks	BWPA10
BWPA11	Aggradation, lateral bar formation	44+70	Lateral migration of channel	BWPA11
BWPA12	Bank erosion	49+75	Lateral migration of channel	BWPA12
BWPA13	Structure degradation	49+60	Stability	BWPA13
BWPA14	Aggradation, mid-channel bar formation	52+00	Inadequate sediment transport	BWPA14
BWPA15	Structure degradation	54+80	Scour	BWPA15
BWPA16	Structure degradation	56+00	Floodplain flow is undermining log structure	BWPA16
BWPA17	Structure degradation	62+60	Scour	BWPA17
BWPA18	Structure degradation	64+90	Scour	BWPA18
BWPA19	Structure degradation	67+00	Stability	BWPA19

Table B1b. Stream Problem Areas – Mountain Creek				
Big Warrior Creek				
EEP Project Number 00412				
Feature #	Feature Issue	Station	Suspected Cause	Photo #
MCPA1	Structure failure	0+00	Too much elevation drop	MCPA1
MCPA2	Structure degradation	0+25	Potentially constructed with large gaps	MCPA2
MCPA3	Structure failure	1+80	Log not keyed into bank adequately	MCPA3
MCPA4	Bank erosion	2+10	Scour	MCPA4
MCPA5	Bank erosion	13+75	Scour	MCPA5
MCPA6	Bank erosion and aggradation	17+00	Excessive scour	MCPA6
MCPA7	Bank failure	17+60	Excessive scour	MCPA7

APPENDIX B-III. REPRESENTATIVE STREAM PROBLEM AREA PHOTOS

Photos Taken 9/26/06 to 9/29/06

BIG WARRIOR



BWPA1 facing upstream



BWPA2 facing left bank



BWPA3 facing left bank, upstream



BWPA4 facing left bank



BWPA5 facing left bank



BWPA6 facing right bank

APPENDIX B-III. REPRESENTATIVE STREAM PROBLEM AREA PHOTOS

Photos Taken 9/26/06 to 9/29/06



BWPA7 facing left bank



BWPA8 facing left bank



BWPA9 facing downstream



BWPA10 facing upstream



BWPA11 facing downstream



BWPA12 facing right bank

APPENDIX B-III. REPRESENTATIVE STREAM PROBLEM AREA PHOTOS

Photos Taken 9/26/06 to 9/29/06



BWPA13 looking down at left bank



BWPA14 facing upstream



BWPA15 facing left bank



BWPA16 facing right bank



BWPA17 facing right bank



BWPA18 facing left bank

APPENDIX B-III. REPRESENTATIVE STREAM PROBLEM AREA PHOTOS

Photos Taken 9/26/06 to 9/29/06



BWPA19 facing downstream

MOUNTAIN CREEK



MCPA1 facing downstream at right bank



MCPA2 facing right bank



MCPA3 facing upstream



MCPA4 facing right bank

APPENDIX B-III. REPRESENTATIVE STREAM PROBLEM AREA PHOTOS

Photos Taken 9/26/06 to 9/29/06



MCPA5 facing upstream



MCPA6 facing downstream



MCPA7 facing right bank

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos Taken 9/26/06 to 9/29/06



PS1 – Big Warrior Creek



PS2 – Big Warrior Creek



PS3 – Big Warrior Creek



PS4 – Big Warrior Creek



PS5 – Big Warrior Creek



PS6 – Big Warrior Creek

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos Taken 9/26/06 to 9/29/06



PS7 – Big Warrior Creek



PS8 - Big Warrior Creek



PS9 – Unnamed Tributary



PS10 – Unnamed Tributary



PS11 – Unnamed Tributary



PS12 – Unnamed Tributary

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos Taken 9/26/06 to 9/29/06



PS13 – Unnamed Tributary



PS14 – Unnamed Tributary



PS15 – Big Warrior Creek



PS16 – Big Warrior Creek



PS17 – Big Warrior Creek



PS18 – Mountain Creek

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos Taken 9/26/06 to 9/29/06



PS19 – Mountain Creek



PS20 – Mountain Creek



PS21 – Mountain Creek



PS22 – Mountain Creek



PS23 – Mountain Creek



PS24 – Mountain Creek

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos Taken 9/26/06 to 9/29/06



PS25 – Mountain Creek



PS26 – Big Warrior Creek



PS27 – Big Warrior Creek



PS28 – Big Warrior Creek



PS29 – Big Warrior Creek



PS30 – Big Warrior Creek

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos Taken 9/26/06 to 9/29/06



PS31 – Big Warrior Creek



PS32 – Big Warrior Creek



PS33 – Big Warrior Creek

APPENDIX B-V. VISUAL MORPHOLOGICAL STABILITY ASSESSMENT TABLE

Table B2. Visual Morphological Stability Assessment Big Warrior Creek EEP Project Number 00412						
Feature Category	Metric (per As-built and reference baselines)	(# stable) Number performing as Intended	Total number per As-built	Total number/feet in unstable state	% perform in stable condition	Feature perform. Mean or total
A. Riffles	1. Present?	41	41	NA	100	
	2. Armor stable (no displacement)?	41	41	NA	100	
	3. Facet grade appears stable?	41	41	NA	100	
	4. Minimal evidence of embedding/fining?	41	41	NA	100	
	5. Length appropriate?	41	41	NA	100	100
B. Pools	1. Present (not subject to severe aggrad. or migration)?	56	56	NA	100	
	2. Sufficiently deep (max pool D:mean Bkf >1.6)	56	56	NA	100	
	3. Length appropriate?	56	56	NA	100	100
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	54	56	NA	96	
	2. Downstream of meander (glide/inflection) centering?	54	56	NA	96	96
D. Meanders	1. Outer bend in state of limited/controlled erosion?	52	56	NA	93	
	2. Of those eroding, # w/concomitant point bar formation?	0	NA	NA	NA	
	3. Apparent Rc within spec?	56	56	NA	100	
	4. Sufficient floodplain access and relief?	56	56	NA	100	98
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	15/150 LF	85	
	2. Channel bed degradation—areas of increasing downcutting/headcutting?	NA	NA	0	100	93
F. Bank	1. Actively eroding, wasting, or slumping bank	NA	NA	450/11035	96	96
F. Vanes	1. Free of back or arm scour?	64	89	NA	72	
	2. Height appropriate?	64	89	NA	72	
	3. Angle and geometry appear appropriate?	64	89	NA	72	
	4. Free of piping or other structural failures?	64	89	NA	72	72
G. Wads/ Boulders	1. Free of scour?	50	71	NA	70	
	2. Footing stable?	50	71	NA	70	70

Several cross section pins were not able to be located during 2006 monitoring. In instances where pins were not located, URS re-established one or both pins in the field. Data from these cross sections are not comparable to data reported in 2005 monitoring reports. The re-establishment of pins effectively relocates the cross sections.

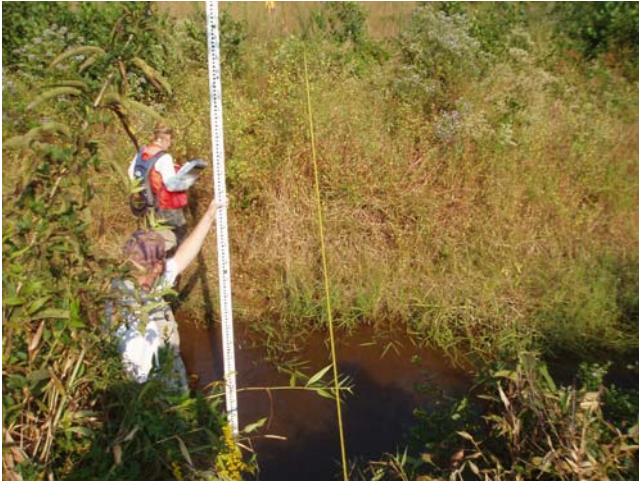
URS has plotted these data on the same graph for reference only. The data and/or graph should not be used to interpret channel change. Such cross sections include:

- Big Warrior mainstem, cross section 1
- Big Warrior mainstem, cross section 3
- Big Warrior mainstem, cross section 4
- Mountain Creek, cross section 1

APPENDIX B-VI. CROSS SECTION PHOTOS AND ANNUAL OVERLAYS OF PLOTS

Photos Taken 9/26/06 to 9/29/06

BIG WARRIOR



XS1 facing left bank



XS1 facing right bank



XS2 facing left bank



XS2 facing right bank



XS3 facing left bank



XS3 facing right bank

APPENDIX B-VI. CROSS SECTION PHOTOS AND ANNUAL OVERLAYS OF PLOTS

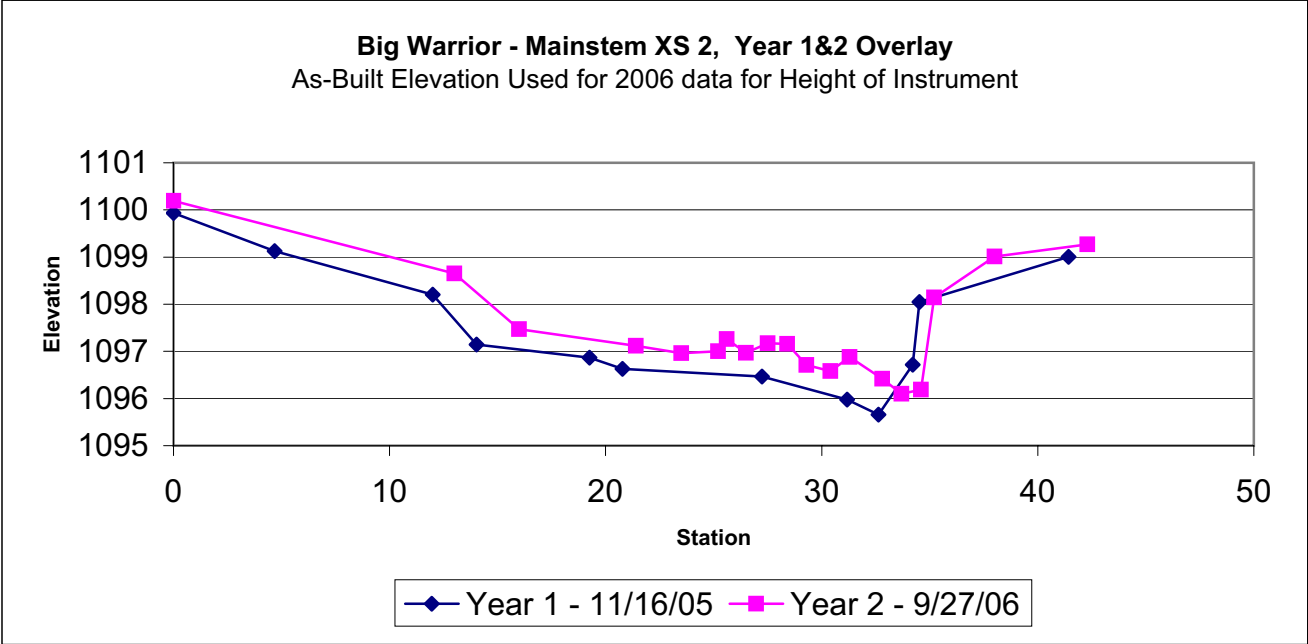
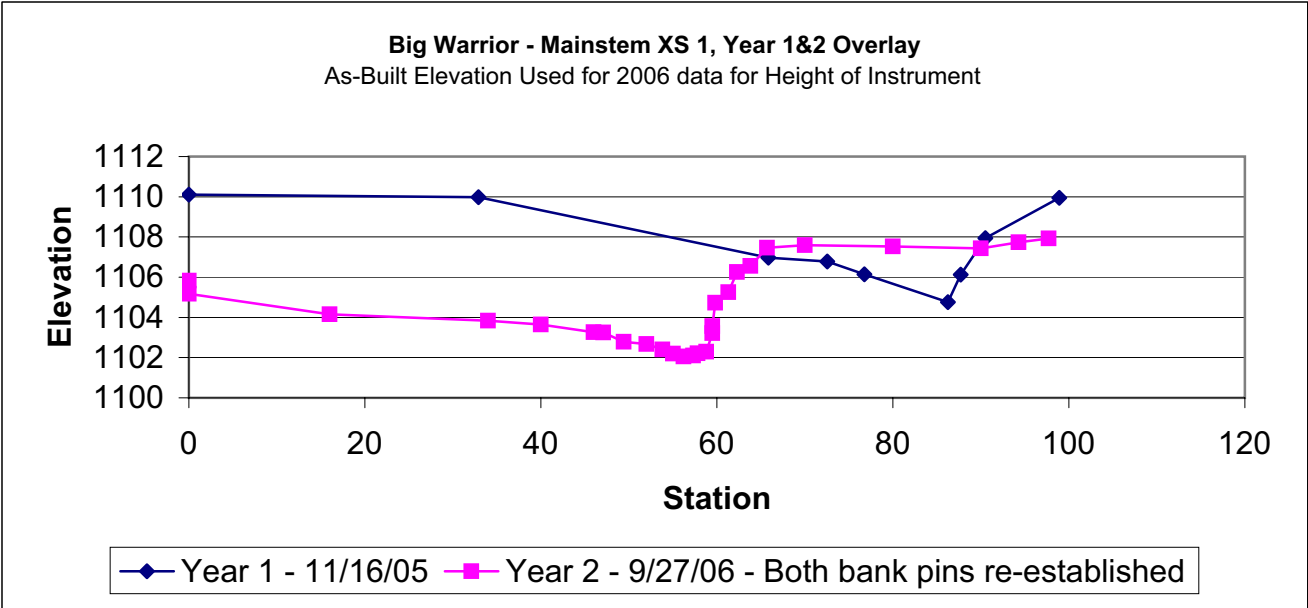
Photos Taken 9/26/06 to 9/29/06

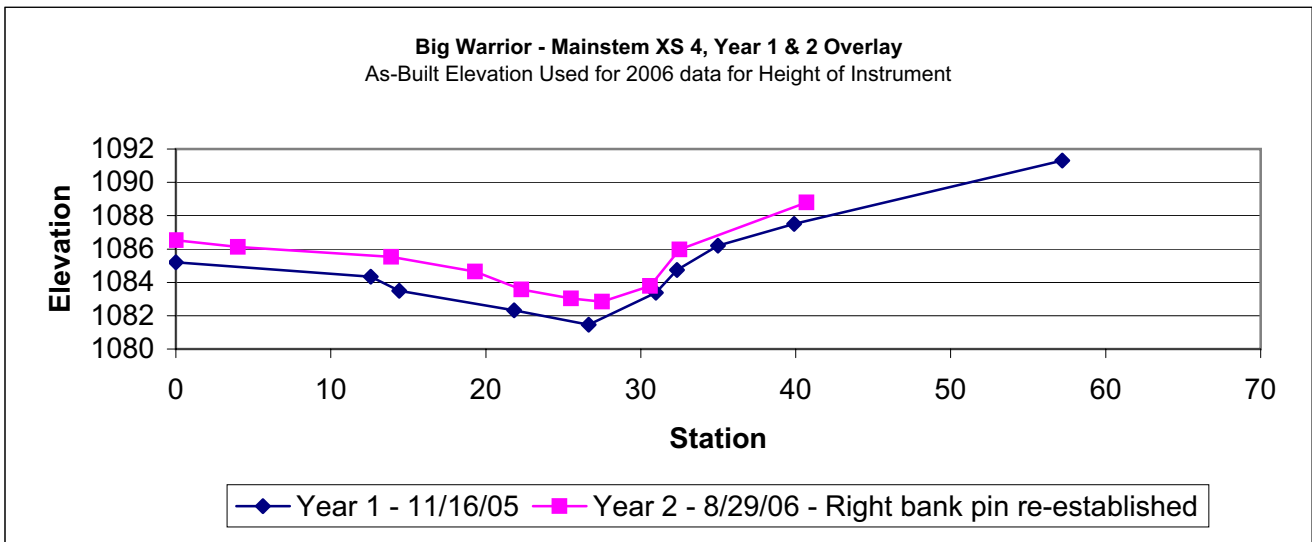
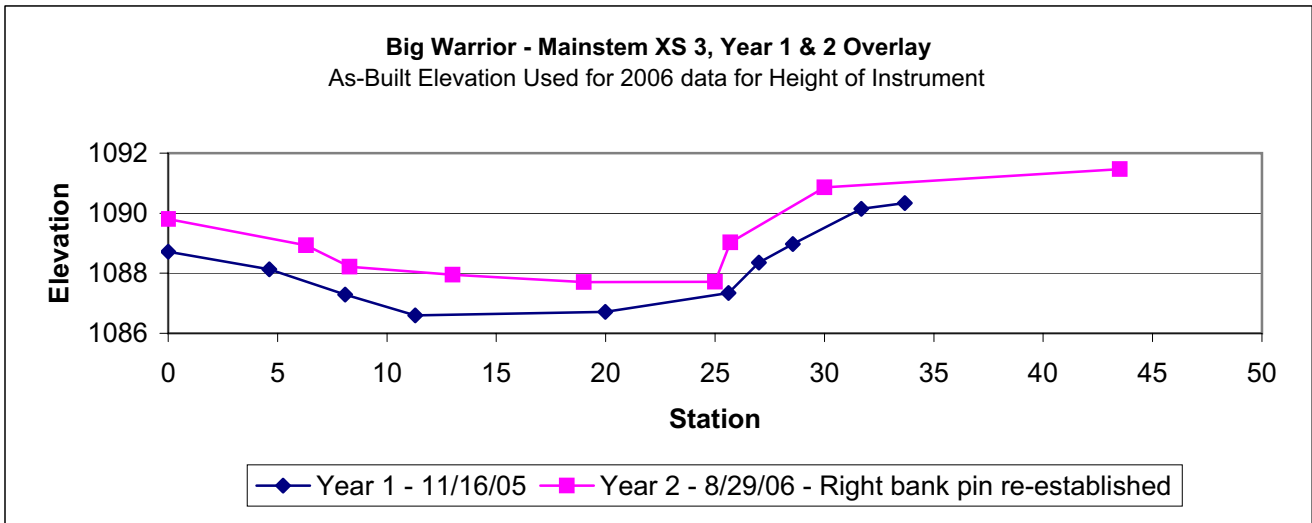


XS4 facing left bank



XS4 facing right bank





APPENDIX B-VI. CROSS SECTION PHOTOS AND ANNUAL OVERLAYS OF PLOTS

Photos Taken 9/26/06 to 9/29/06

MOUNTAIN CREEK



XS1 facing left bank



XS1 facing right bank

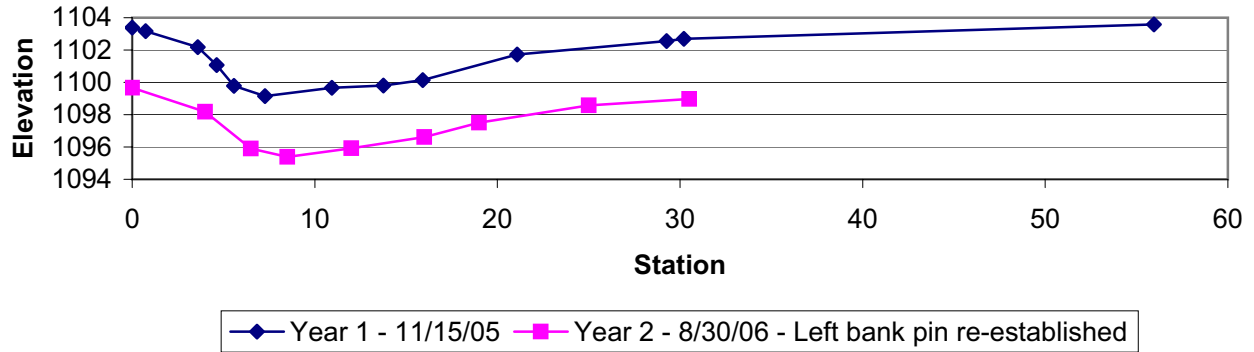


XS2 facing left bank

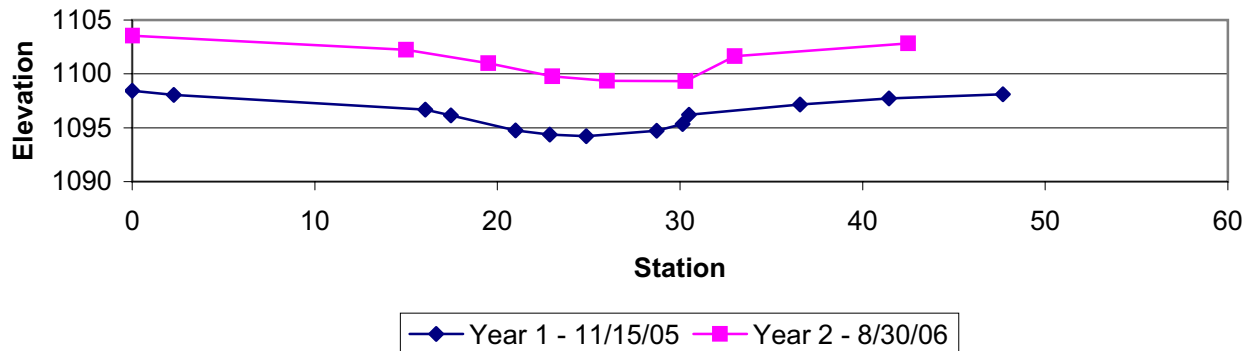


XS2 facing right bank

Big Warrior - Mountain Creek XS 1, Year 1 & 2 Overlay
 As-Built Elevation Used for 2006 data for Height of Instrument



Big Warrior - Mountain Creek XS 2 - Year 1 & 2 Overlay
 As-Built Elevation Used for 2006 data for Height of Instrument



APPENDIX B-VI. CROSS SECTION PHOTOS AND ANNUAL OVERLAYS OF PLOTS

Photos Taken 9/26/06 to 9/29/06

UNNAMED TRIBUTARY



XS1 facing left bank



XS1 facing right bank

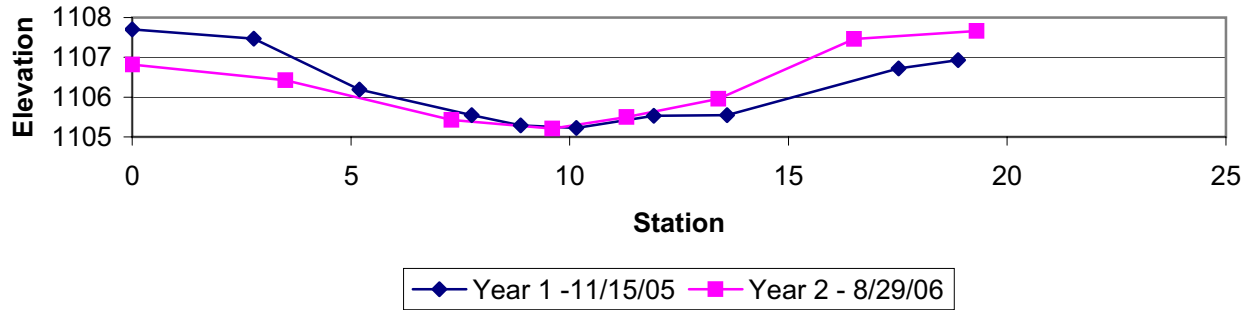


XS2 facing left bank

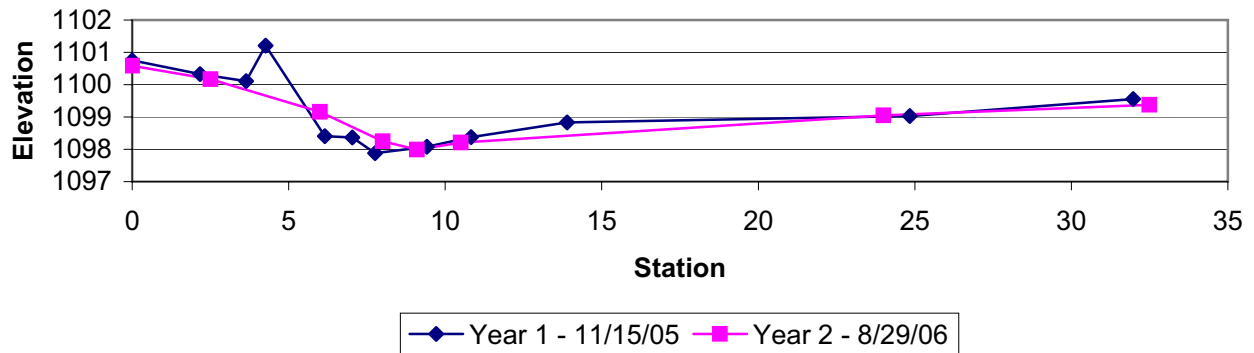


XS2 facing right bank

Big Warrior - Unnamed Trib XS 1 Overlay
 As-Built Elevation Used for 2006 data for Height of Instrument

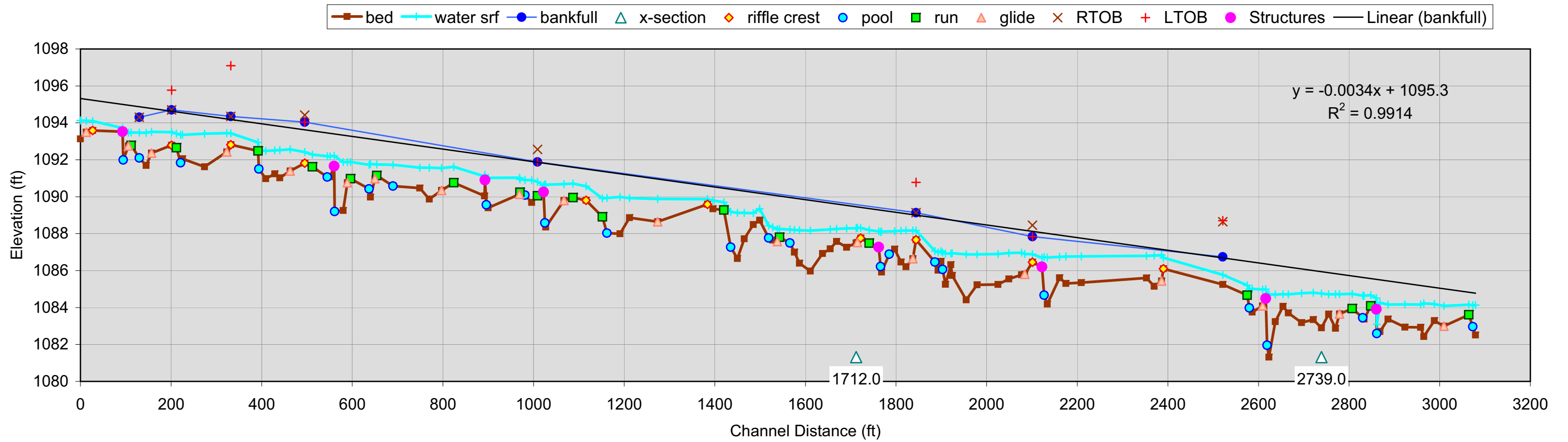


Big Warrior - Unnamed Trib XS 2, Year 1 & 2 Overlay
 As-Built Elevation Used for 2006 data for Height of Instrument



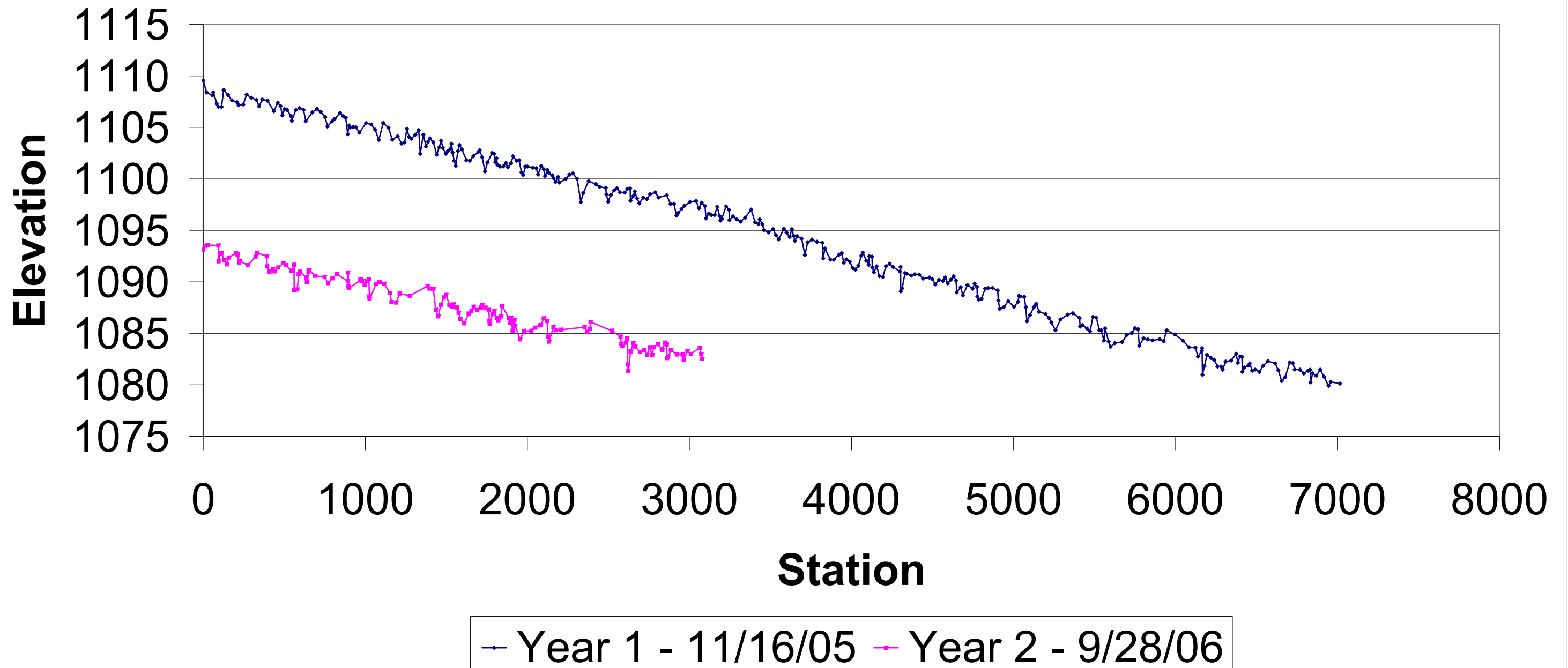
BIG WARRIOR

Big Warrior - Mainstem - 9/28/06



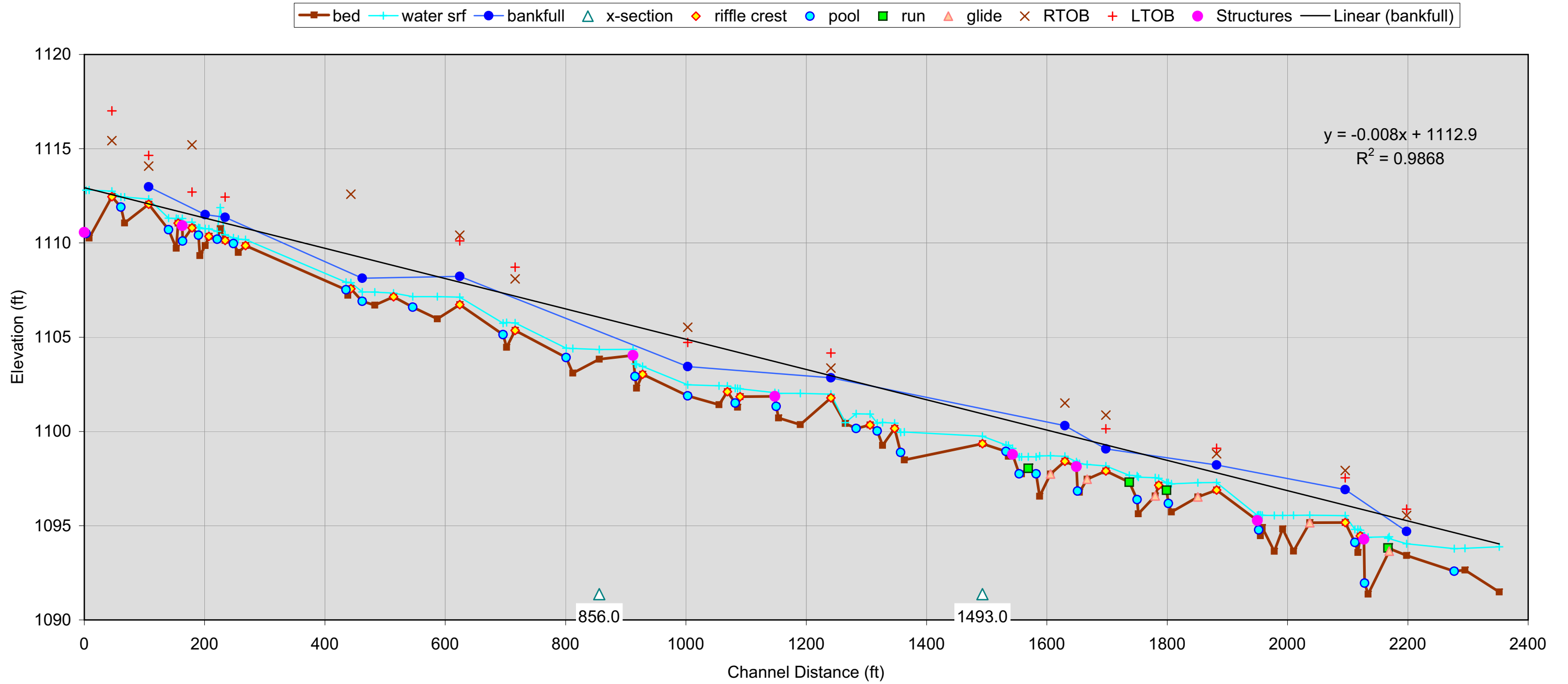
Big Warrior - Mainstem, Year 1 & 2 Overlay

2006 - Surveyed 3000 ft per EEP protocol
As-Built Elevation Used for 2006 data for Height of Instrument



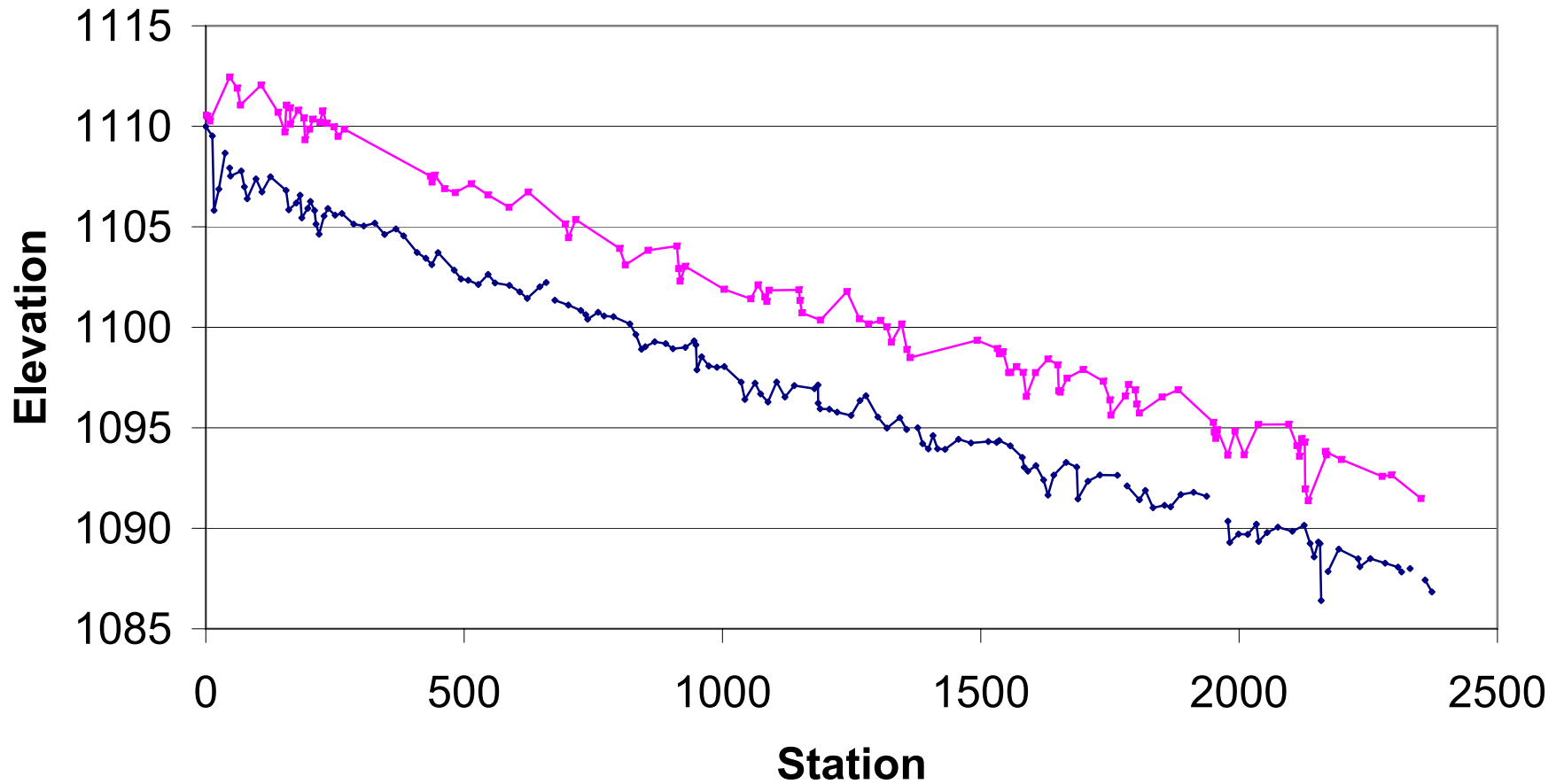
MOUNTAIN CREEK

Big Warrior - Mountain Creek - 9/26/06



Big Warrior - Mountain Creek, Year 1&2 Overlay

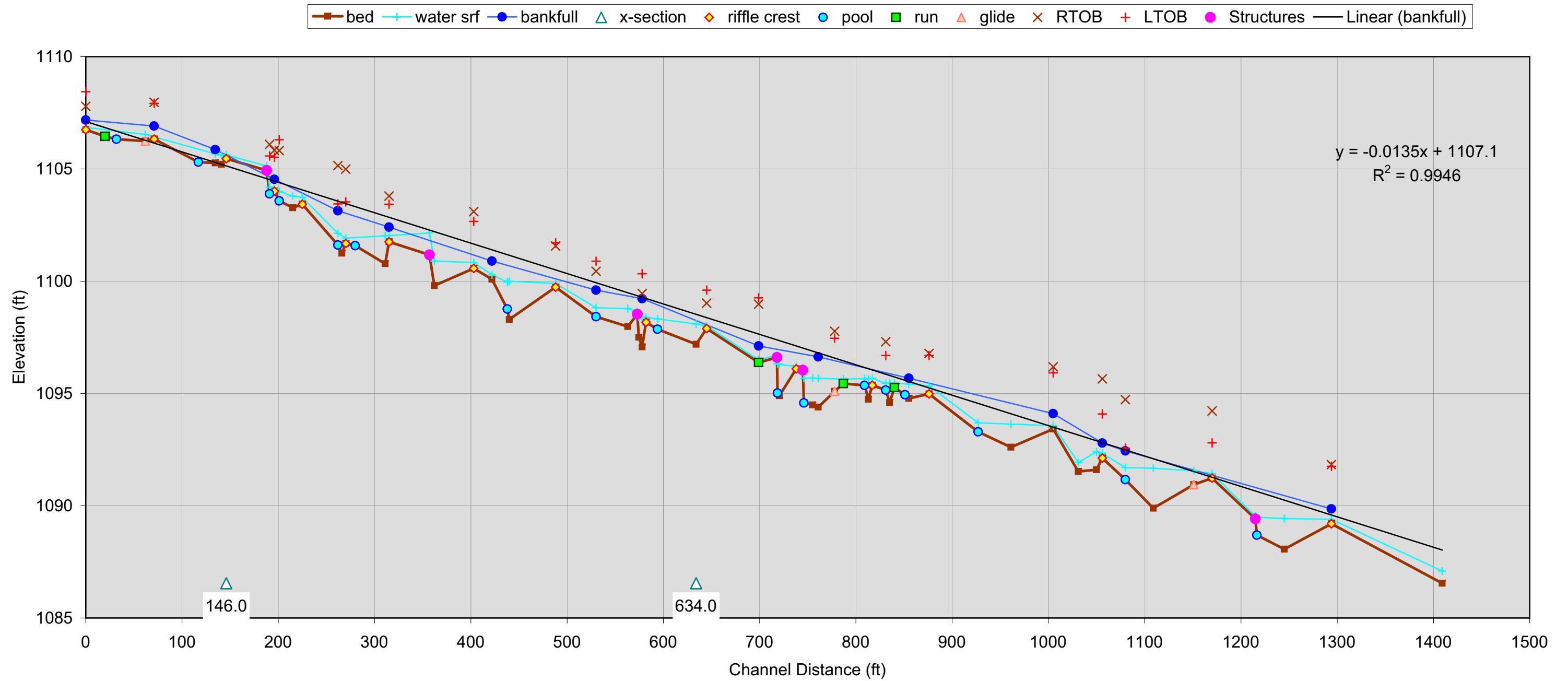
As-Built Elevation Used for 2006 data for Height of Instrument



—◆— Year 1 - 11/11/05 —■— Year 2 - 9/26/06

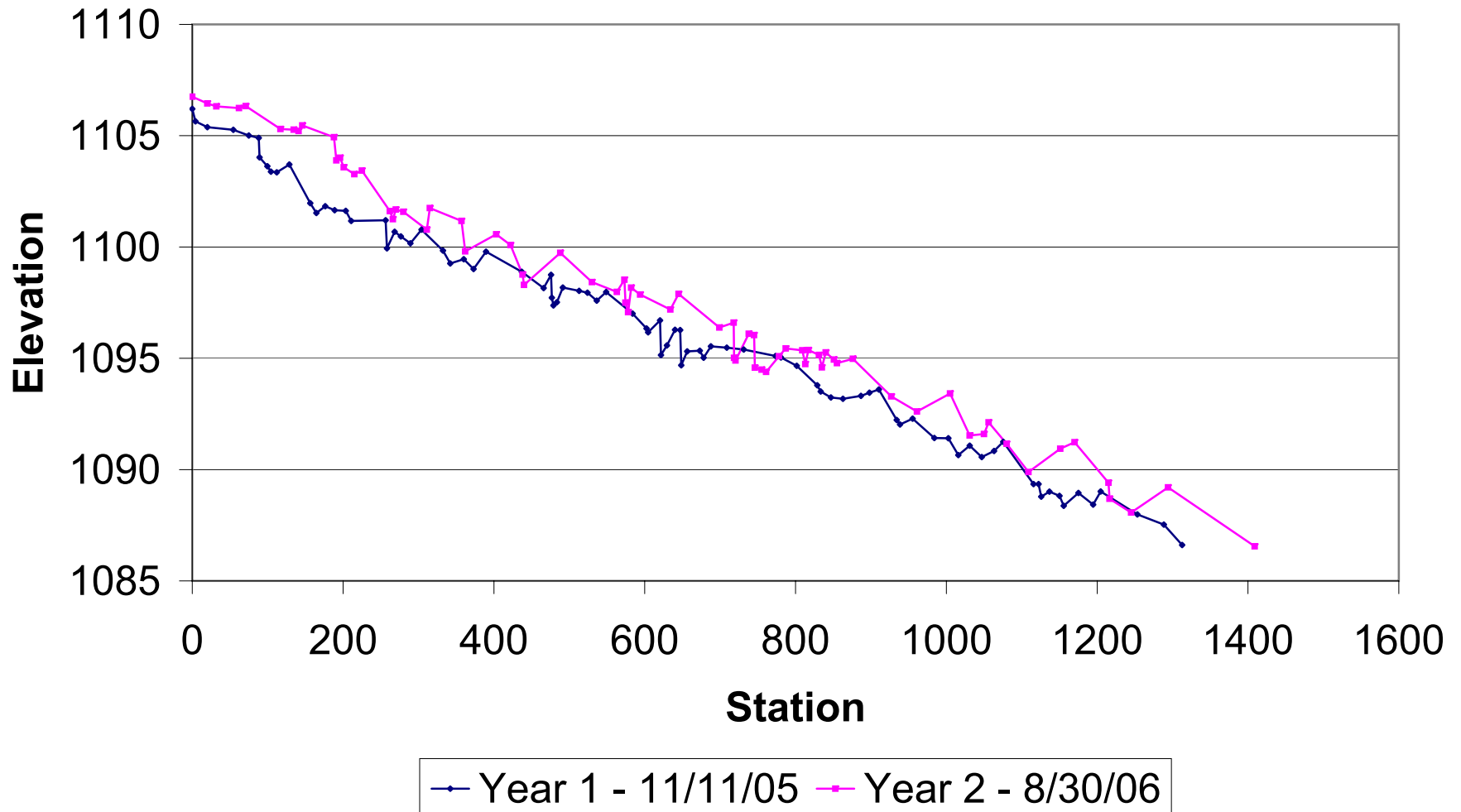
UNNAMED TRIBUTARY

Big Warrior - Unnamed Tributary - 8/30/06



Big Warrior - Unnamed Trib, Year 1 & 2 Overlay

As-Built Elevation Used for 2006 data for Height of Instrument



BIG WARRIOR

2) Weighted Pebble Count

Feature Percent of Reach

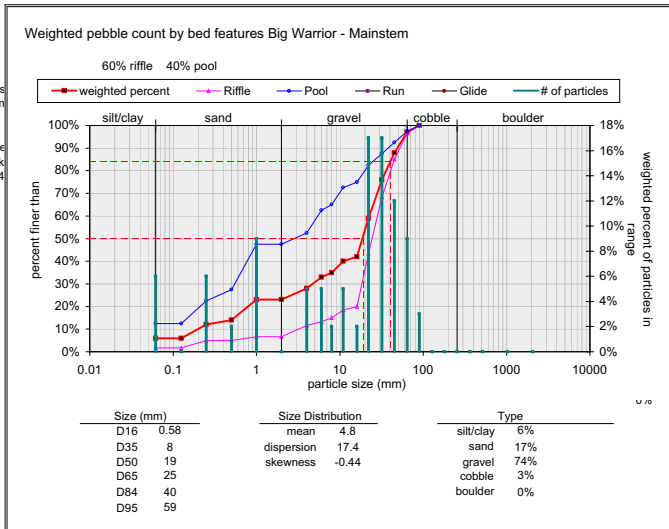
Rifle, Pool, Run, Glide

Rifle % Run %
 Pool % Glide %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	6.0
very fine sand	0.062 - 0.125	0.0
fine sand	0.125 - 0.25	6.0
medium sand	0.25 - 0.5	2.0
coarse sand	0.5 - 1	9.0
very coarse sand	1 - 2	0.0
very fine gravel	2 - 4	5.0
fine gravel	4 - 6	5.0
fine gravel	6 - 8	2.0
medium gravel	8 - 11	5.0
medium gravel	11 - 16	2.0
coarse gravel	16 - 22	17.0
coarse gravel	22 - 32	17.0
very coarse gravel	32 - 45	12.0
very coarse gravel	45 - 64	9.0
small cobble	64 - 90	3.0
medium cobble	90 - 128	0.0
large cobble	128 - 180	0.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
debris/wood		0.0
artificial		0.0
total weighted count:		100.0

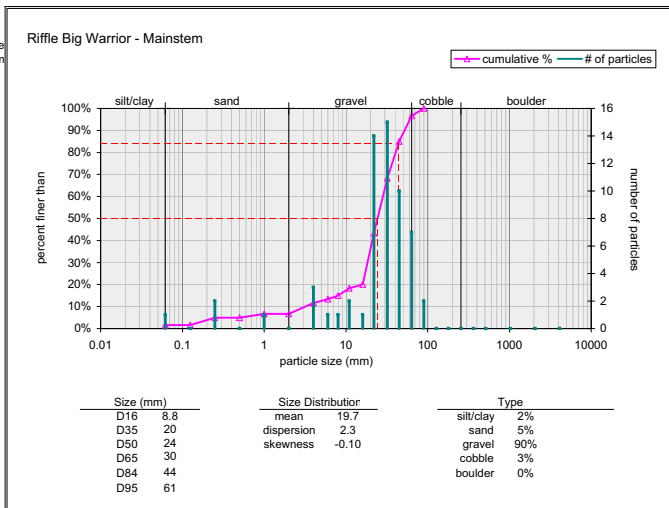
Note:



Rifle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	2
medium sand	0.25 - 0.5	0
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	0
very fine gravel	2 - 4	3
fine gravel	4 - 6	1
fine gravel	6 - 8	1
medium gravel	8 - 11	2
medium gravel	11 - 16	1
coarse gravel	16 - 22	14
coarse gravel	22 - 32	15
very coarse gravel	32 - 45	10
very coarse gravel	45 - 64	7
small cobble	64 - 90	2
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		60
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		60

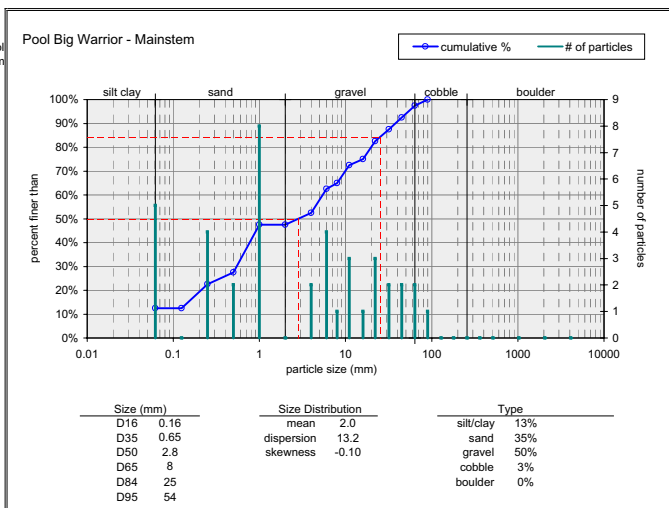
Note:



Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	5
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	4
medium sand	0.25 - 0.5	2
coarse sand	0.5 - 1	8
very coarse sand	1 - 2	0
very fine gravel	2 - 4	2
fine gravel	4 - 6	4
fine gravel	6 - 8	1
medium gravel	8 - 11	3
medium gravel	11 - 16	1
coarse gravel	16 - 22	3
coarse gravel	22 - 32	2
very coarse gravel	32 - 45	2
very coarse gravel	45 - 64	2
small cobble	64 - 90	1
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		40
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		40

Note:



2) Weighted Pebble Count

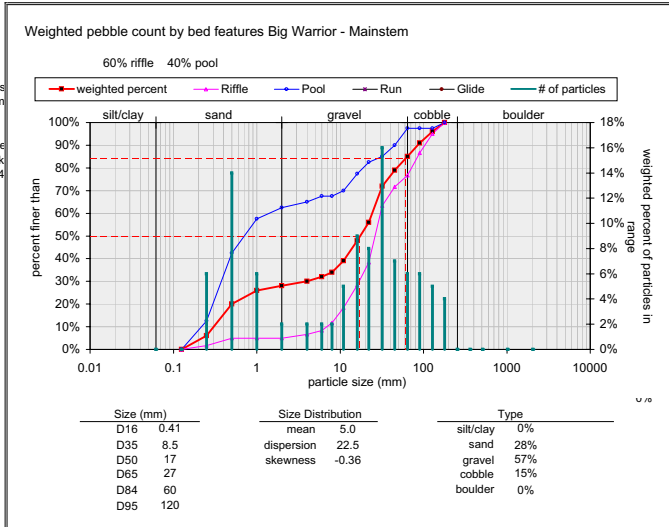
Feature Percent of Reach

Riffle % Pool % Run % Glide %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	0.0
very fine sand	0.062 - 0.125	0.0
fine sand	0.125 - 0.25	6.0
medium sand	0.25 - 0.5	14.0
coarse sand	0.5 - 1	6.0
very coarse sand	1 - 2	2.0
very fine gravel	2 - 4	2.0
fine gravel	4 - 6	2.0
fine gravel	6 - 8	2.0
medium gravel	8 - 11	5.0
medium gravel	11 - 16	9.0
coarse gravel	16 - 22	8.0
coarse gravel	22 - 32	16.0
very coarse gravel	32 - 45	7.0
very coarse gravel	45 - 64	6.0
small cobble	64 - 90	6.0
medium cobble	90 - 128	5.0
large cobble	128 - 180	4.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
debris/wood		0.0
artificial		0.0
total weighted count:		100.0

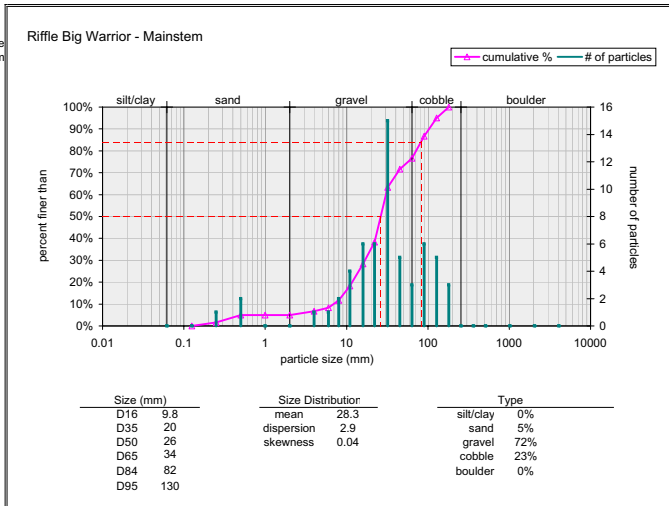
Note: _____



Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	0
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	1
medium sand	0.25 - 0.5	2
coarse sand	0.5 - 1	0
very coarse sand	1 - 2	0
very fine gravel	2 - 4	1
fine gravel	4 - 6	1
fine gravel	6 - 8	2
medium gravel	8 - 11	4
medium gravel	11 - 16	6
coarse gravel	16 - 22	6
coarse gravel	22 - 32	15
very coarse gravel	32 - 45	5
very coarse gravel	45 - 64	3
small cobble	64 - 90	6
medium cobble	90 - 128	5
large cobble	128 - 180	3
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		60
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		60

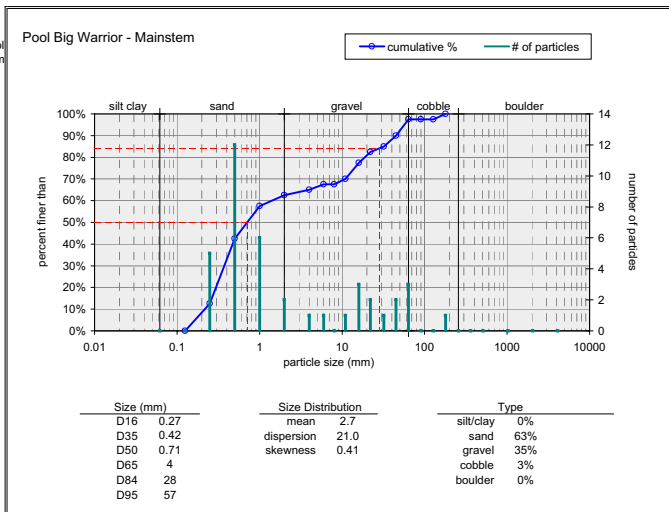
Note: _____



Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	0
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	5
medium sand	0.25 - 0.5	12
coarse sand	0.5 - 1	6
very coarse sand	1 - 2	2
very fine gravel	2 - 4	1
fine gravel	4 - 6	1
fine gravel	6 - 8	0
medium gravel	8 - 11	1
medium gravel	11 - 16	3
coarse gravel	16 - 22	2
coarse gravel	22 - 32	1
very coarse gravel	32 - 45	2
very coarse gravel	45 - 64	3
small cobble	64 - 90	0
medium cobble	90 - 128	0
large cobble	128 - 180	1
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		40
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		40

Note: _____



2) Weighted Pebble Count

Feature Percent of Reach

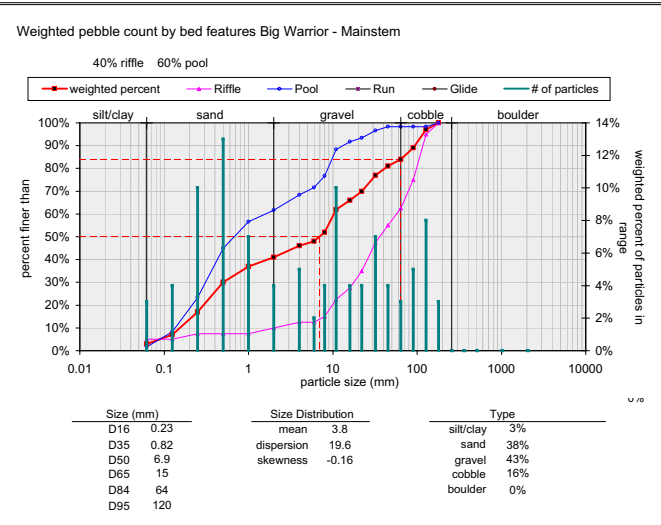
Riffle, Pool, Run, Glide

Riffle: % Run: %
 Pool: % Glide: %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	3.0
very fine sand	0.062 - 0.125	4.0
fine sand	0.125 - 0.25	10.0
medium sand	0.25 - 0.5	13.0
coarse sand	0.5 - 1	7.0
very coarse sand	1 - 2	4.0
very fine gravel	2 - 4	5.0
fine gravel	4 - 6	2.0
medium gravel	6 - 8	4.0
coarse gravel	8 - 11	10.0
very coarse gravel	11 - 16	4.0
small cobble	16 - 22	4.0
medium cobble	22 - 32	7.0
large cobble	32 - 45	4.0
very large cobble	45 - 64	3.0
small boulder	64 - 90	5.0
medium boulder	90 - 128	8.0
large boulder	128 - 180	3.0
very large boulder	180 - 256	0.0
small boulder	256 - 362	0.0
medium boulder	362 - 512	0.0
large boulder	512 - 1024	0.0
very large boulder	1024 - 2048	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
total weighted count:		100.0

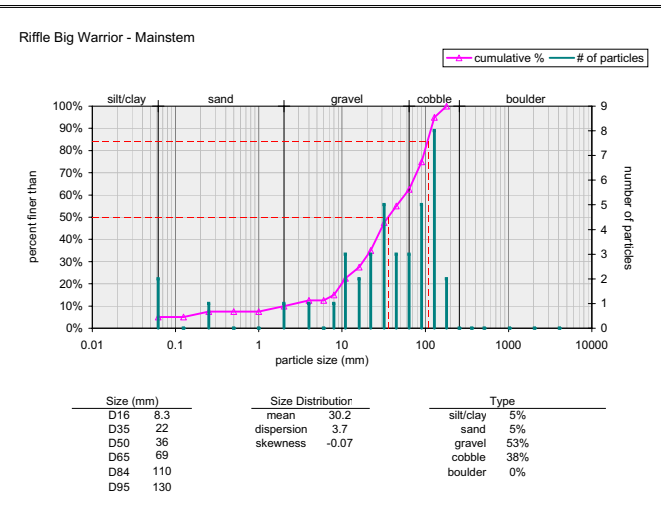
Note: _____



Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	2
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	1
medium sand	0.25 - 0.5	0
coarse sand	0.5 - 1	0
very coarse sand	1 - 2	1
very fine gravel	2 - 4	1
fine gravel	4 - 6	0
medium gravel	6 - 8	1
coarse gravel	8 - 11	3
very coarse gravel	11 - 16	2
small cobble	16 - 22	3
medium cobble	22 - 32	5
large cobble	32 - 45	3
very large cobble	45 - 64	3
small boulder	64 - 90	5
medium boulder	90 - 128	8
large boulder	128 - 180	2
very large boulder	180 - 256	0
small boulder	256 - 362	0
medium boulder	362 - 512	0
large boulder	512 - 1024	0
very large boulder	1024 - 2048	0
total particle count:		40
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		40

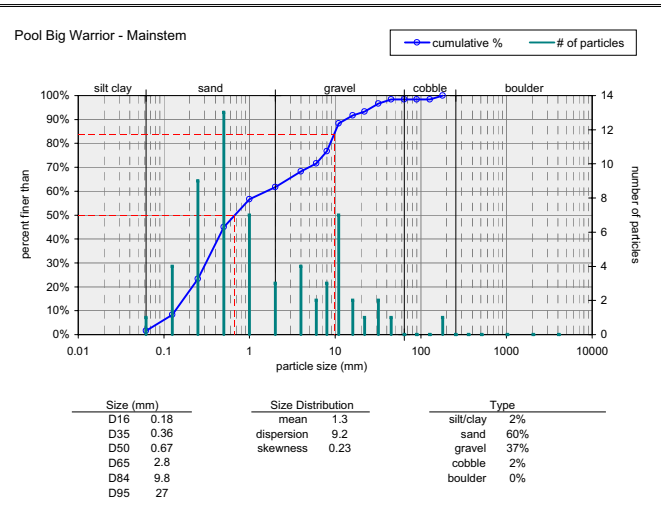
Note: _____



Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	4
fine sand	0.125 - 0.25	9
medium sand	0.25 - 0.5	13
coarse sand	0.5 - 1	7
very coarse sand	1 - 2	3
very fine gravel	2 - 4	4
fine gravel	4 - 6	2
medium gravel	6 - 8	3
coarse gravel	8 - 11	7
very coarse gravel	11 - 16	2
small cobble	16 - 22	1
medium cobble	22 - 32	2
large cobble	32 - 45	1
very large cobble	45 - 64	0
small boulder	64 - 90	0
medium boulder	90 - 128	0
large boulder	128 - 180	1
very large boulder	180 - 256	0
small boulder	256 - 362	0
medium boulder	362 - 512	0
large boulder	512 - 1024	0
very large boulder	1024 - 2048	0
total particle count:		60
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		60

Note: _____



2) Weighted Pebble Count

Feature Percent of Reach

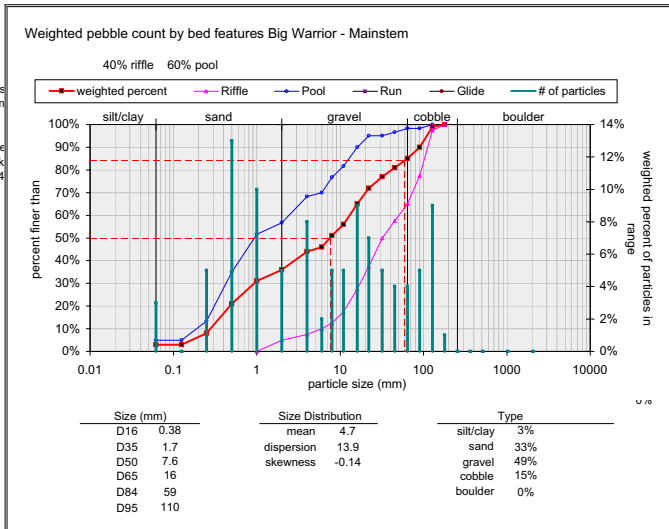
Rifle, Pool, Run, Glide

Rifle % Run %
 Pool % Glide %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	3.0
very fine sand	0.062 - 0.125	0.0
fine sand	0.125 - 0.25	5.0
medium sand	0.25 - 0.5	13.0
coarse sand	0.5 - 1	10.0
very coarse sand	1 - 2	5.0
very fine gravel	2 - 4	8.0
fine gravel	4 - 6	2.0
fine gravel	6 - 8	5.0
medium gravel	8 - 11	5.0
medium gravel	11 - 16	9.0
coarse gravel	16 - 22	7.0
coarse gravel	22 - 32	5.0
very coarse gravel	32 - 45	4.0
very coarse gravel	45 - 64	4.0
small cobble	64 - 90	5.0
medium cobble	90 - 128	9.0
large cobble	128 - 180	1.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
debris/wood		0.0
artificial		0.0
total weighted count:		100.0

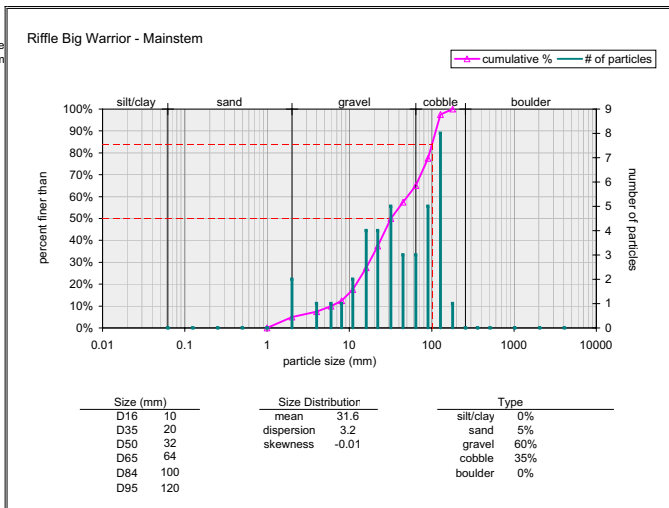
Note:



Rifle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	0
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	0
medium sand	0.25 - 0.5	0
coarse sand	0.5 - 1	0
very coarse sand	1 - 2	2
very fine gravel	2 - 4	1
fine gravel	4 - 6	1
fine gravel	6 - 8	1
medium gravel	8 - 11	2
medium gravel	11 - 16	4
coarse gravel	16 - 22	4
coarse gravel	22 - 32	5
very coarse gravel	32 - 45	3
very coarse gravel	45 - 64	3
small cobble	64 - 90	5
medium cobble	90 - 128	8
large cobble	128 - 180	1
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		40
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		40

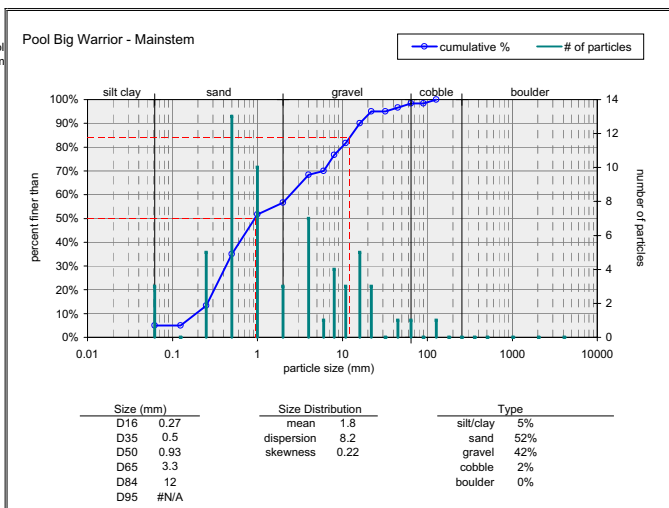
Note:



Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	3
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	5
medium sand	0.25 - 0.5	13
coarse sand	0.5 - 1	10
very coarse sand	1 - 2	3
very fine gravel	2 - 4	7
fine gravel	4 - 6	1
fine gravel	6 - 8	4
medium gravel	8 - 11	3
medium gravel	11 - 16	5
coarse gravel	16 - 22	3
coarse gravel	22 - 32	0
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	1
small cobble	64 - 90	0
medium cobble	90 - 128	1
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		60
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		60

Note:



APPENDIX B-VIII. PEBBLE COUNT FREQUENCY DISTRIBUTION PLOTS

MOUNTAIN CREEK

2) Weighted Pebble Count

Feature Percent of Reach

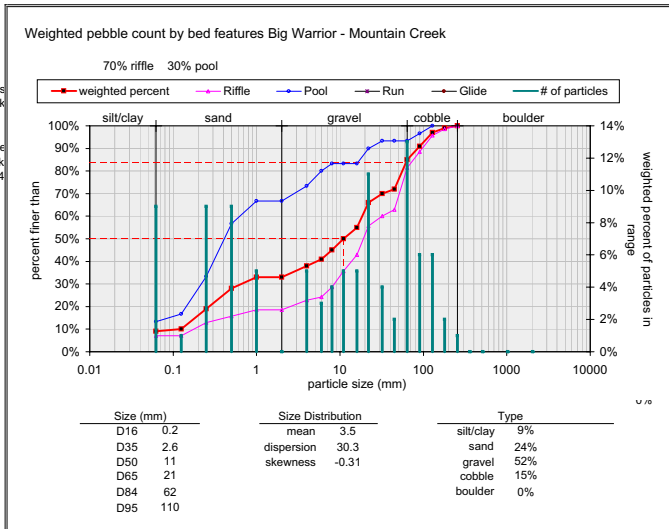
Riffle: Pool, Run, Glide

Riffle % Run %
 Pool % Glide %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	9.0
very fine sand	0.062 - 0.125	1.0
fine sand	0.125 - 0.25	9.0
medium sand	0.25 - 0.5	9.0
coarse sand	0.5 - 1	5.0
very coarse sand	1 - 2	0.0
very fine gravel	2 - 4	5.0
fine gravel	4 - 6	3.0
fine gravel	6 - 8	4.0
medium gravel	8 - 11	5.0
medium gravel	11 - 16	5.0
coarse gravel	16 - 22	11.0
coarse gravel	22 - 32	4.0
very coarse gravel	32 - 45	2.0
very coarse gravel	45 - 64	13.0
small cobble	64 - 90	6.0
medium cobble	90 - 128	6.0
large cobble	128 - 180	2.0
very large cobble	180 - 256	1.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
debris/wood		0.0
artificial		0.0
total weighted count:		100.0

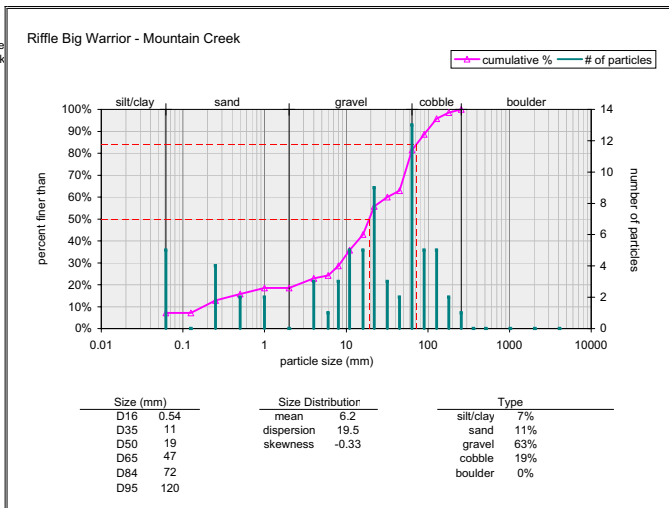
Note:



Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	5
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	4
medium sand	0.25 - 0.5	2
coarse sand	0.5 - 1	2
very coarse sand	1 - 2	0
very fine gravel	2 - 4	3
fine gravel	4 - 6	1
fine gravel	6 - 8	3
medium gravel	8 - 11	5
medium gravel	11 - 16	5
coarse gravel	16 - 22	9
coarse gravel	22 - 32	3
very coarse gravel	32 - 45	2
very coarse gravel	45 - 64	13
small cobble	64 - 90	5
medium cobble	90 - 128	5
large cobble	128 - 180	2
very large cobble	180 - 256	1
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		70
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		70

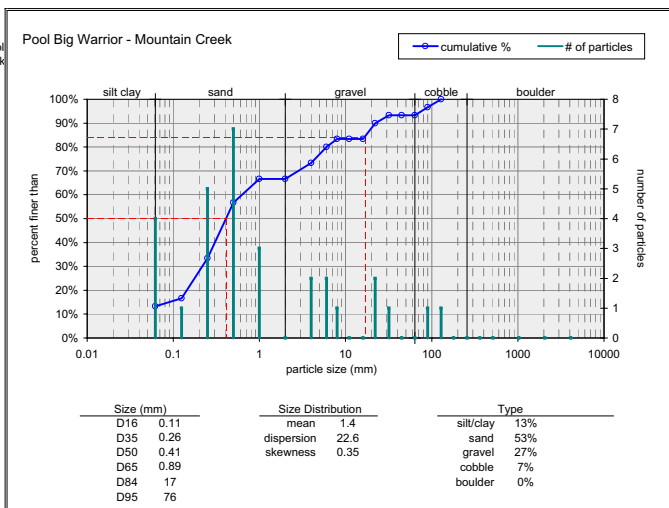
Note:



Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	4
very fine sand	0.062 - 0.125	1
fine sand	0.125 - 0.25	5
medium sand	0.25 - 0.5	7
coarse sand	0.5 - 1	3
very coarse sand	1 - 2	0
very fine gravel	2 - 4	2
fine gravel	4 - 6	2
fine gravel	6 - 8	1
medium gravel	8 - 11	0
medium gravel	11 - 16	0
coarse gravel	16 - 22	2
coarse gravel	22 - 32	1
very coarse gravel	32 - 45	0
very coarse gravel	45 - 64	0
small cobble	64 - 90	1
medium cobble	90 - 128	1
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		30
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		30

Note:



2) Weighted Pebble Count

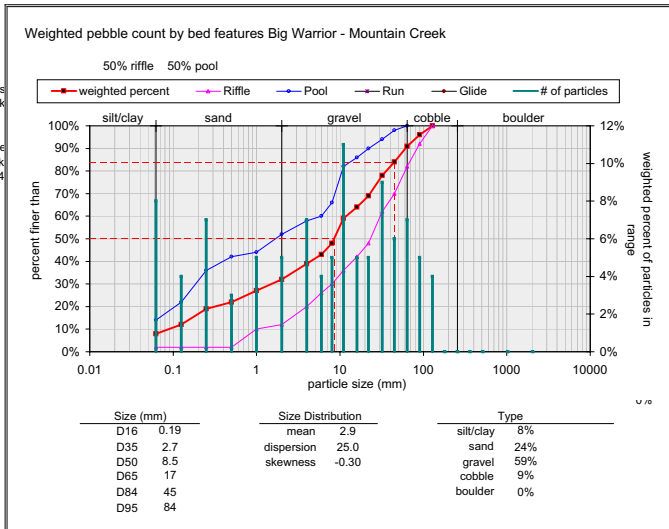
Feature Percent of Reach

Riffle % Pool % Run % Glide %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	8.0
very fine sand	0.062 - 0.125	4.0
fine sand	0.125 - 0.25	7.0
medium sand	0.25 - 0.5	3.0
coarse sand	0.5 - 1	5.0
very coarse sand	1 - 2	5.0
very fine gravel	2 - 4	7.0
fine gravel	4 - 6	4.0
fine gravel	6 - 8	5.0
medium gravel	8 - 11	11.0
medium gravel	11 - 16	5.0
coarse gravel	16 - 22	5.0
coarse gravel	22 - 32	9.0
very coarse gravel	32 - 45	6.0
very coarse gravel	45 - 64	7.0
small cobble	64 - 90	5.0
medium cobble	90 - 128	4.0
large cobble	128 - 180	0.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
debris/wood		0.0
artificial		0.0
total weighted count:		100.0

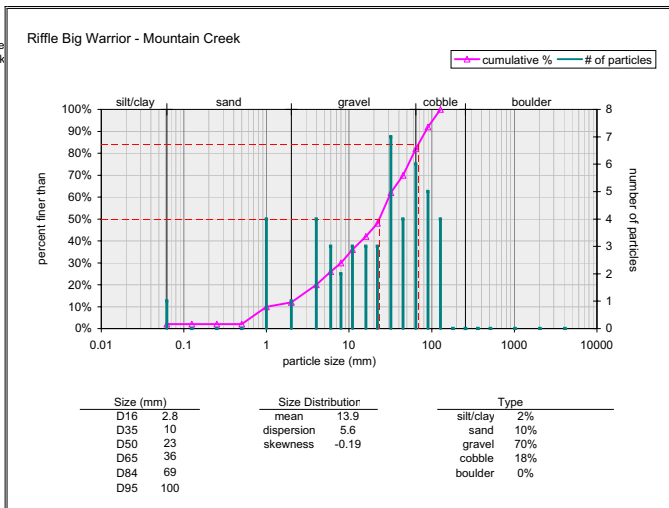
Note:



Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	0
medium sand	0.25 - 0.5	0
coarse sand	0.5 - 1	4
very coarse sand	1 - 2	1
very fine gravel	2 - 4	4
fine gravel	4 - 6	3
fine gravel	6 - 8	2
medium gravel	8 - 11	3
medium gravel	11 - 16	3
coarse gravel	16 - 22	3
coarse gravel	22 - 32	7
very coarse gravel	32 - 45	4
very coarse gravel	45 - 64	6
small cobble	64 - 90	5
medium cobble	90 - 128	4
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		50
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		50

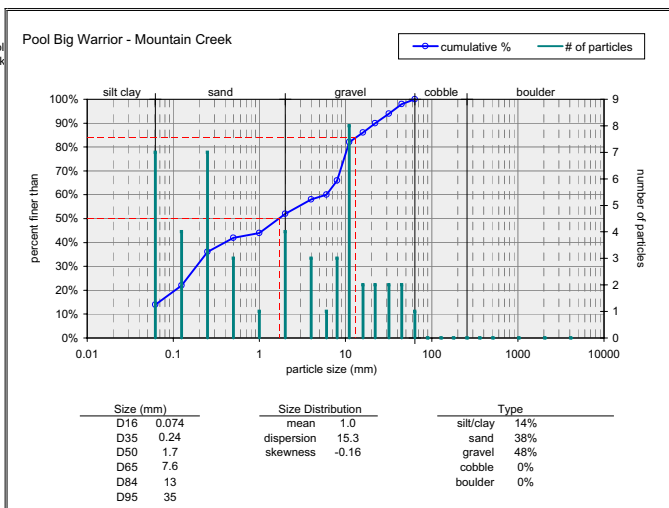
Note:



Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	7
very fine sand	0.062 - 0.125	4
fine sand	0.125 - 0.25	7
medium sand	0.25 - 0.5	3
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	4
very fine gravel	2 - 4	3
fine gravel	4 - 6	1
fine gravel	6 - 8	3
medium gravel	8 - 11	8
medium gravel	11 - 16	2
coarse gravel	16 - 22	2
coarse gravel	22 - 32	2
very coarse gravel	32 - 45	2
very coarse gravel	45 - 64	1
small cobble	64 - 90	0
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		50
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		50

Note:



APPENDIX B-VIII. PEBBLE COUNT FREQUENCY DISTRIBUTION PLOTS

UNNAMED TRIBUTARY

2) Weighted Pebble Count

Feature Percent of Reach

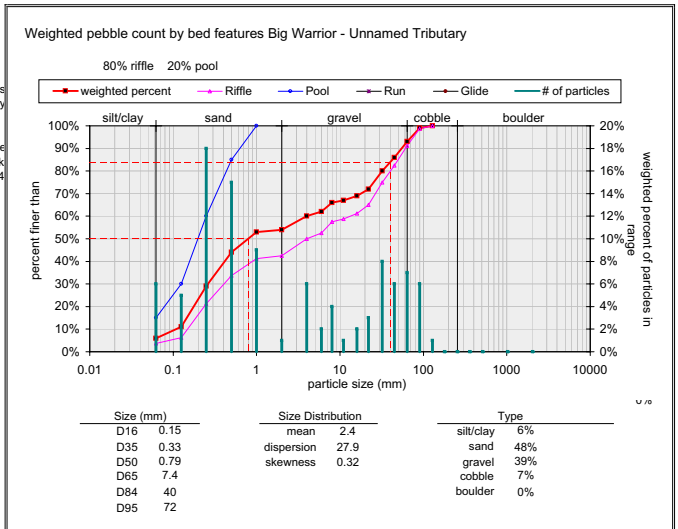
Riffle: Pool, Run, Glide

Riffle % Run %
 Pool % Glide %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	6.0
very fine sand	0.062 - 0.125	5.0
fine sand	0.125 - 0.25	18.0
medium sand	0.25 - 0.5	15.0
coarse sand	0.5 - 1	9.0
very coarse sand	1 - 2	1.0
very fine gravel	2 - 4	6.0
fine gravel	4 - 6	2.0
fine gravel	6 - 8	4.0
medium gravel	8 - 11	1.0
medium gravel	11 - 16	2.0
coarse gravel	16 - 22	3.0
coarse gravel	22 - 32	8.0
very coarse gravel	32 - 45	6.0
very coarse gravel	45 - 64	7.0
small cobble	64 - 90	6.0
medium cobble	90 - 128	1.0
large cobble	128 - 180	0.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
debris/wood		0.0
artificial		0.0
total weighted count:		100.0

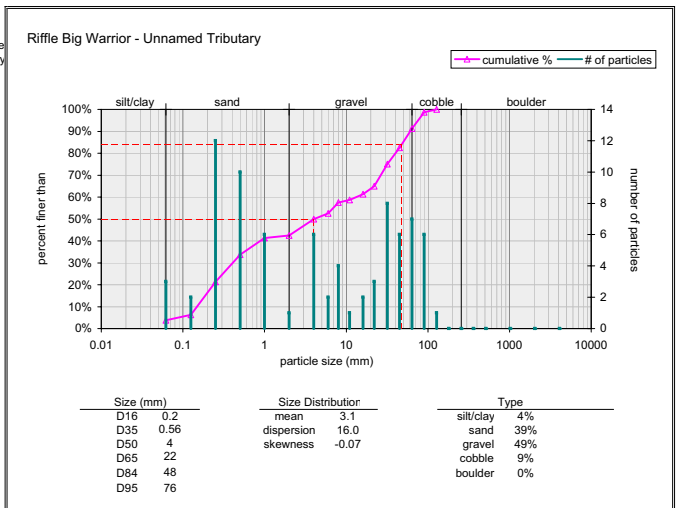
Note:



Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	3
very fine sand	0.062 - 0.125	2
fine sand	0.125 - 0.25	12
medium sand	0.25 - 0.5	10
coarse sand	0.5 - 1	6
very coarse sand	1 - 2	1
very fine gravel	2 - 4	6
fine gravel	4 - 6	2
fine gravel	6 - 8	4
medium gravel	8 - 11	1
medium gravel	11 - 16	2
coarse gravel	16 - 22	3
coarse gravel	22 - 32	8
very coarse gravel	32 - 45	6
very coarse gravel	45 - 64	7
small cobble	64 - 90	6
medium cobble	90 - 128	1
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		80
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		80

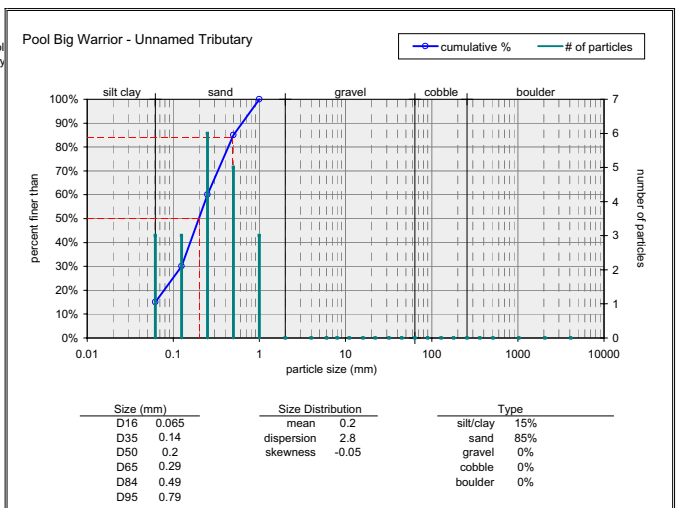
Note:



Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	3
very fine sand	0.062 - 0.125	3
fine sand	0.125 - 0.25	6
medium sand	0.25 - 0.5	5
coarse sand	0.5 - 1	3
very coarse sand	1 - 2	0
very fine gravel	2 - 4	0
fine gravel	4 - 6	0
fine gravel	6 - 8	0
medium gravel	8 - 11	0
medium gravel	11 - 16	0
coarse gravel	16 - 22	0
coarse gravel	22 - 32	0
very coarse gravel	32 - 45	0
very coarse gravel	45 - 64	0
small cobble	64 - 90	0
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		20
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		20

Note:



2) Weighted Pebble Count

Feature Percent of Reach

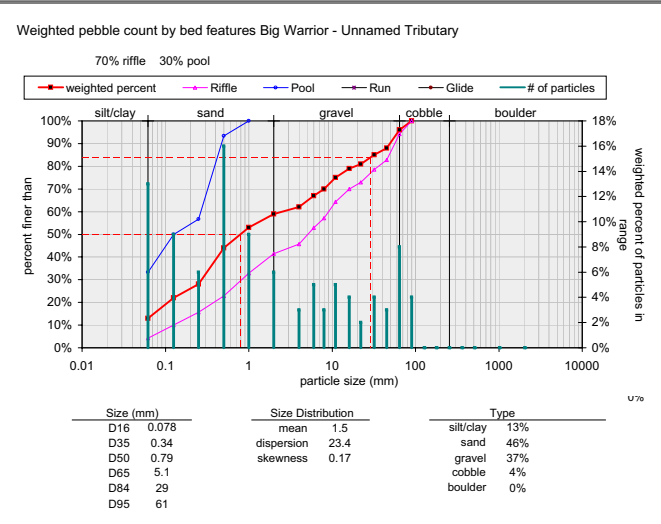
Riffle: Pool, Run, Glide

Riffle % Run %
 Pool % Glide %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	13.0
very fine sand	0.062 - 0.125	9.0
fine sand	0.125 - 0.25	6.0
medium sand	0.25 - 0.5	16.0
coarse sand	0.5 - 1	9.0
very coarse sand	1 - 2	6.0
very fine gravel	2 - 4	3.0
fine gravel	4 - 6	5.0
fine gravel	6 - 8	3.0
medium gravel	8 - 11	5.0
medium gravel	11 - 16	4.0
coarse gravel	16 - 22	2.0
coarse gravel	22 - 32	4.0
very coarse gravel	32 - 45	3.0
very coarse gravel	45 - 64	8.0
small cobble	64 - 90	4.0
medium cobble	90 - 128	0.0
large cobble	128 - 180	0.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
debris/wood		0.0
artificial		0.0
total weighted count:		100.0

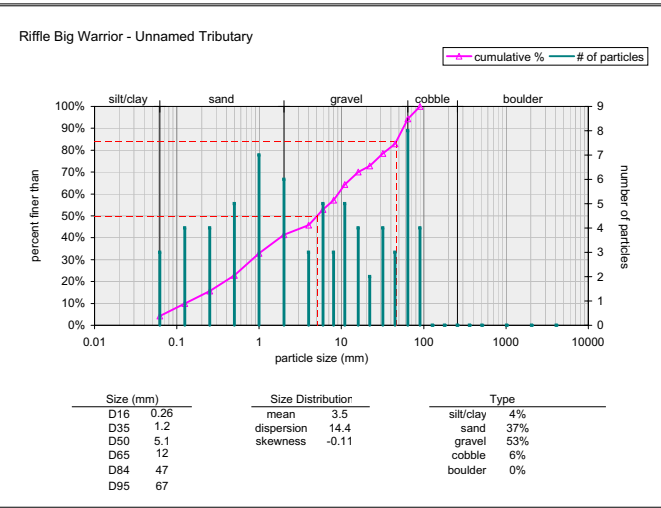
Note:



Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	3
very fine sand	0.062 - 0.125	4
fine sand	0.125 - 0.25	4
medium sand	0.25 - 0.5	5
coarse sand	0.5 - 1	7
very coarse sand	1 - 2	6
very fine gravel	2 - 4	3
fine gravel	4 - 6	5
fine gravel	6 - 8	3
medium gravel	8 - 11	5
medium gravel	11 - 16	4
coarse gravel	16 - 22	2
coarse gravel	22 - 32	4
very coarse gravel	32 - 45	3
very coarse gravel	45 - 64	8
small cobble	64 - 90	4
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
medium boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		70
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		70

Note:



Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	10
very fine sand	0.062 - 0.125	5
fine sand	0.125 - 0.25	2
medium sand	0.25 - 0.5	11
coarse sand	0.5 - 1	2
very coarse sand	1 - 2	0
very fine gravel	2 - 4	0
fine gravel	4 - 6	0
fine gravel	6 - 8	0
medium gravel	8 - 11	0
medium gravel	11 - 16	0
coarse gravel	16 - 22	0
coarse gravel	22 - 32	0
very coarse gravel	32 - 45	0
very coarse gravel	45 - 64	0
small cobble	64 - 90	0
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		30
bedrock		
clay hardpan		
debris/wood		
artificial		
total count:		30

Note:

