

**Big Warrior Creek Stream Restoration
2009 Final Monitoring Report
Monitoring Year Five**

Ecosystem Enhancement Program Project Number 00412



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

Project Designed by: CDM
5400 Glenwood Ave, Suite 300
Raleigh, NC 27612

Submitted: April 23, 2010



**Big Warrior Creek Stream Restoration
2009 Final Monitoring Report
Monitoring Year Five**

Ecosystem Enhancement Program Project Number 00412



Prepared by:

URS Corporation – North Carolina
1600 Perimeter Park Drive, Suite 400
Morrisville, NC 27560

Project Manager:

Kathleen McKeithan
kathleen_mckeithan@urscorp.com
919-461-1597

April 23, 2010

Table of Contents

1.0	Executive Summary/Project Abstract	1
2.0	Methodology Section	2
2.1	Stream Methodology	2
2.2	Vegetation Methodology	2
3.0	References.....	4

List of Tables

Table 1:	Project Restoration Components	32
Table 2:	Project Activity and Reporting History	32
Table 3:	Project Contacts Table	33
Table 4:	Project Attribute Table.....	34
Table 5:	Vegetation Metadata Table.....	41
Table 6:	Stem Count Total and Planted by Plot and Species	42
Table 7:	Visual Morphological Stability Assessment.....	53
Table 8:	Verification of Bankfull Events	56
Table 9:	Cross Section Pin Change Summary	58

List of Figures

Figure 1:	Vicinity Map.....	7
Figure 2:	Monitoring Plan View	8
Figure 3:	Stream Current Condition Plan View	9
Figure 4:	Vegetative Current Condition Plan View.....	20
Figure 5:	Percent Change in Cross Section Riffle	58
Figure 6:	Pebble Count Summaries	72

List of Appendices

Appendix A:	General Figures and Plan Views.....	6
Appendix B:	General Project Tables.....	31
Appendix C:	Vegetation Assessment Data.....	35
Appendix C-I:	Vegetation Monitoring Plot Photos	36
Appendix C-II:	Vegetation Data Tables	40
Appendix D:	Stream Assessment Data.....	44
Appendix D-I:	Stream Photo Station Photos	45
Appendix D-II:	Stream Data Tables	52
Appendix D-III:	Cross Section Photos and Plots	57
Appendix D-IV:	Longitudinal Profile Plot.....	67
Appendix D-V:	Pebble Count Frequency Distribution Plots.....	71

1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

According to the Mitigation Plan prepared by Camp, Dresser, and McKee and Biohabitats, Inc. (CDM 2005), the overarching goal of the Big Warrior Creek Stream Restoration 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:

- 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.

The 2009 Monitoring Year (MY) 5 monitoring indicated that the planted woody vegetation is doing poorly along all three reaches. Only one-third of the vegetation plots met the success criteria in 2008 (MY4). In 2009 (MY5), less than one-third of the vegetation plots met the success criteria (5 of 16). 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*) and arrowleaf tear thumb (*Polygonum sagittata*). This may become a problem in that the herbaceous species seem to be choking much of the planted vegetation along the streambanks. Tear thumb and hogpeanut are also evident along the mainstem and Mountain Creek; however, the presence of kudzu (*Pueraria montana* var. *lobata*) and Chinese privet (*Ligustrum sinense*) pose a more serious problem to the survival of vegetation along those reaches. There are also several large areas of bare ground where the soil appears compacted and not conducive to natural colonization. Beaver presence has been noted at the site for the last several years. During 2009 (MY5) monitoring, several areas affected by recent beaver activity were observed. In the upstream portion of Big Warrior Creek, three large dams were observed. Fresh stem chew was also observed during 2009 monitoring. Five of the 16 inventoried monitoring plots are meeting the success criteria of 260 stems per acre or at least seven stems per plot. With the inclusion of volunteer stems, an additional three plots meet the success criteria, bringing the successful plots to only 50 percent.

In 2009 (MY5) the Big Warrior Creek restoration is functioning well and has continued to improve and evolve since 2007 (MY3) monitoring. The majority of the bed features appear stable with well-developed pools in the meander bends and long riffles in the straight reaches (625 ft of 11,331 ft show aggradation). Some of the rock structures have shifted; however, no problem areas were ranked as high concern on Big Warrior Creek. Several rootwads and log bank protectors have some scour behind the device. Recent storm events (between March 2009 and December 2009) have caused several new problem areas along Mountain Creek and have created three problem areas of high concern. Failure in the first vane has caused the stream to divert the structure entirely, resulting in major bank erosion. Massive bank erosion has occurred at cross section 1 such that the easement fence has been moved further back. Bank erosion is anticipated to continue in this area. The percentage of bank experiencing instability is approximately 13 percent for this reach. Several log bank protectors dislodged from the bank prior to 2007 (MY3) monitoring and have been carried downstream. The recent storm events have exacerbated the issues in these areas and have caused additional bank erosion. Some bank erosion continues to be present along Big Warrior Creek. Beaver dams and signs of beaver activity were observed within the upstream portion

of Big Warrior Creek during 2009 (MY5) monitoring. The most upstream dam has lead to several hundred feet of backwater.

No known crest gages are installed at this site to document bankfull events. Therefore, potential occurrence was extrapolated based on US Geological Survey (USGS) stream gage discharge data for Reddies River at North Wilkesboro, NC (USGS 2009) and on-site evidence such as sediment on the banks and floodplains and the height of recent wrack lines. 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 2009 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 (Harman et al. 1999). 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. Recent and past bankfull events (2006, 2007, and 2008) are also shown in Table 8. This discharge was exceeded in January 2009, indicating that the Reddies River has had one bankfull event between November 1, 2008 and September 30, 2009. 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 January 2009. Wrack lines on-site support this conclusion.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Mitigation and Restoration Plan documents available on the Ecosystem Enhancement Program's (EEP) website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

2.0 METHODOLOGY SECTION

All monitoring methodologies follow the 2006 templates and guidelines provided by EEP (EEP 2006). Photographs were taken at high resolution using a Sealife EcoShot 6.0 megapixel digital camera. GPS location information was collected in 2006 (MY2) 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 (CDM 2005). Permanent photo station photographs were taken from locations marked in the Year One Monitoring Report, prepared by EcoLogic Associates (Ecologic 2006).

2.1 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 Nikon Total Station and the data were analyzed and displayed using the Reference Reach Spreadsheet, Version 4.1T (Mecklenburg 2006). Pebble counts were conducted by sampling a total of 100 pebbles from the feature of the cross section (the entire riffle or pool). According to the most recent guidance issued in Rosgen courses, the pebble count was concentrated within the wetted perimeter of the channel and did not include the banks. 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.

2.2 VEGETATION METHODOLOGY

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.

In 2005 (MY1), 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 2008, Version 4.2 CVS-EEP Protocol for Recording Vegetation (Lee *et al* 2008), 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.

Vegetation monitoring methods followed the 2008, Version 4.2 CVS-EEP Protocol for Recording Vegetation (<http://cvs.bio.unc.edu/methods.htm>). Vegetation plot photographs 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, but not flagged. Monitoring taxonomy follows 'Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas' (Weakley 2007). 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, as was the bearing of the x axis from the southwest corner.

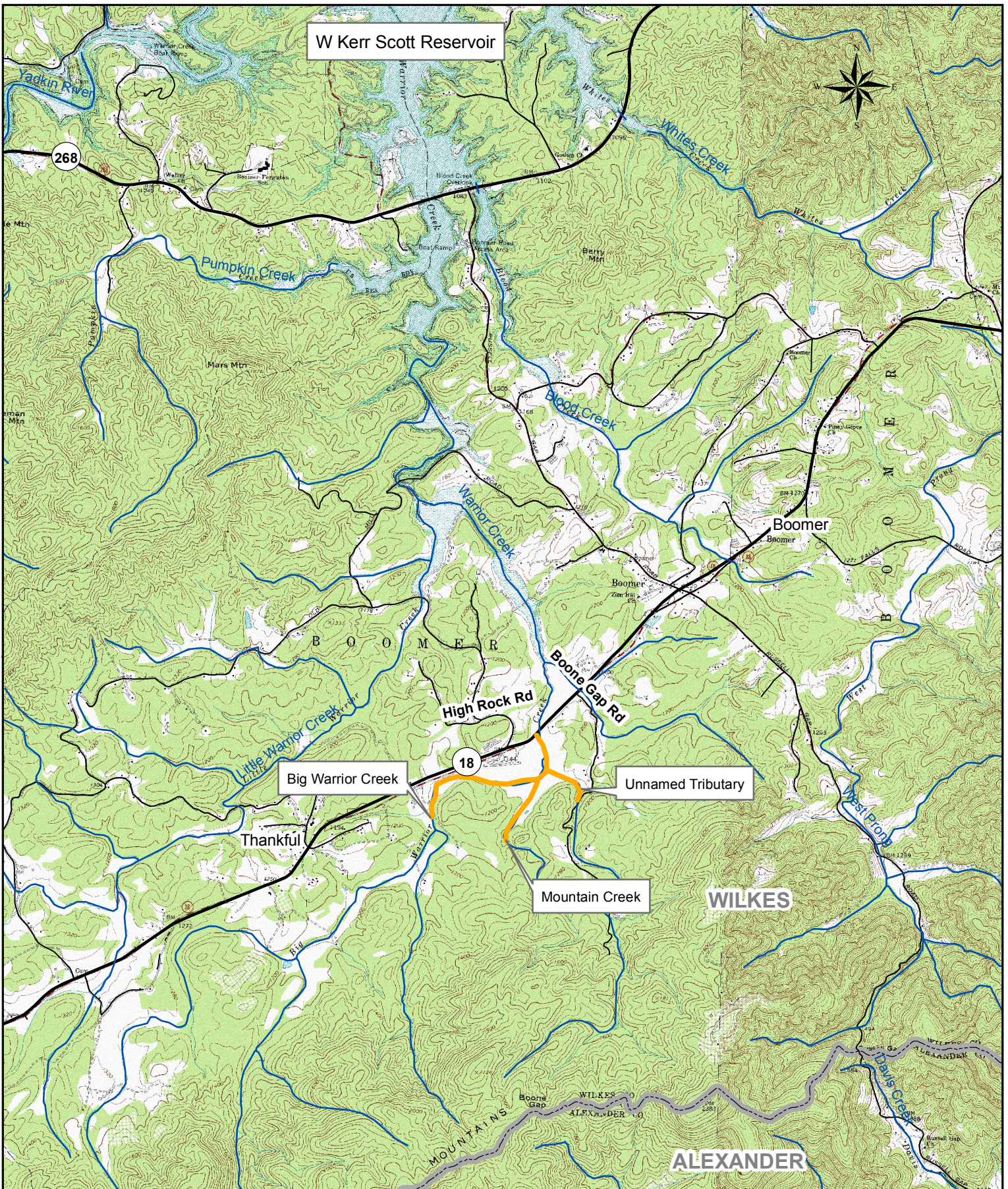
3.0 REFERENCES





- 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.
- EcoLogic Associates, P.C. 2006. Big Warrior Creek 2005 Monitoring Report, Monitoring Year One. Prepared for NC Ecosystem Enhancement Program. April 2006.
- EEP. 2006. Content, Format, and Data Requirements for EEP Monitoring Reports. Version 1.2 (11/16/06). NCDENR, NCEEP. 17pp.
- Harman, W.H., Jennings, G.D., Patterson, J.M., Clinton, D.R., Slate, L.O., Jessup, A.G., Everhart, J.R., and R.E Smith. 1999. Bankfull Hydraulic Geometry Relationships for North Carolina Streams. AWRA Wildland Hydrology Symposium Proceedings. Edited By: D.S. Olsen and J.P. Potyondy. AWRA Summer Symposium. Bozeman, MT.
- Lee, Michael T., Peek, Robert K., Roberts, Steven D., Wentworth, Thomas R. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. (<http://cvs.bio.unc.edu/methods.htm>).
- Mecklenburg, Dan. 2006. The Reference Reach Spreadsheet for Channel Survey Data Management. Version 4.1T. Ohio Department of Natural Resources.
- Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.
- 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. 2009. Reddies River at North Wilkesboro, NC streamflow gage. USGS Real-Time Water Data. Gage 02111500. <http://waterdata.usgs.gov>.
- Weakley, A.S. 2007. Flora of the Carolinas, Virginia, Georgia, and surrounding Areas. Working Draft as of 11 January 2007. UNC Herbarium. North Carolina Botanical Garden. UNC at Chapel Hill.

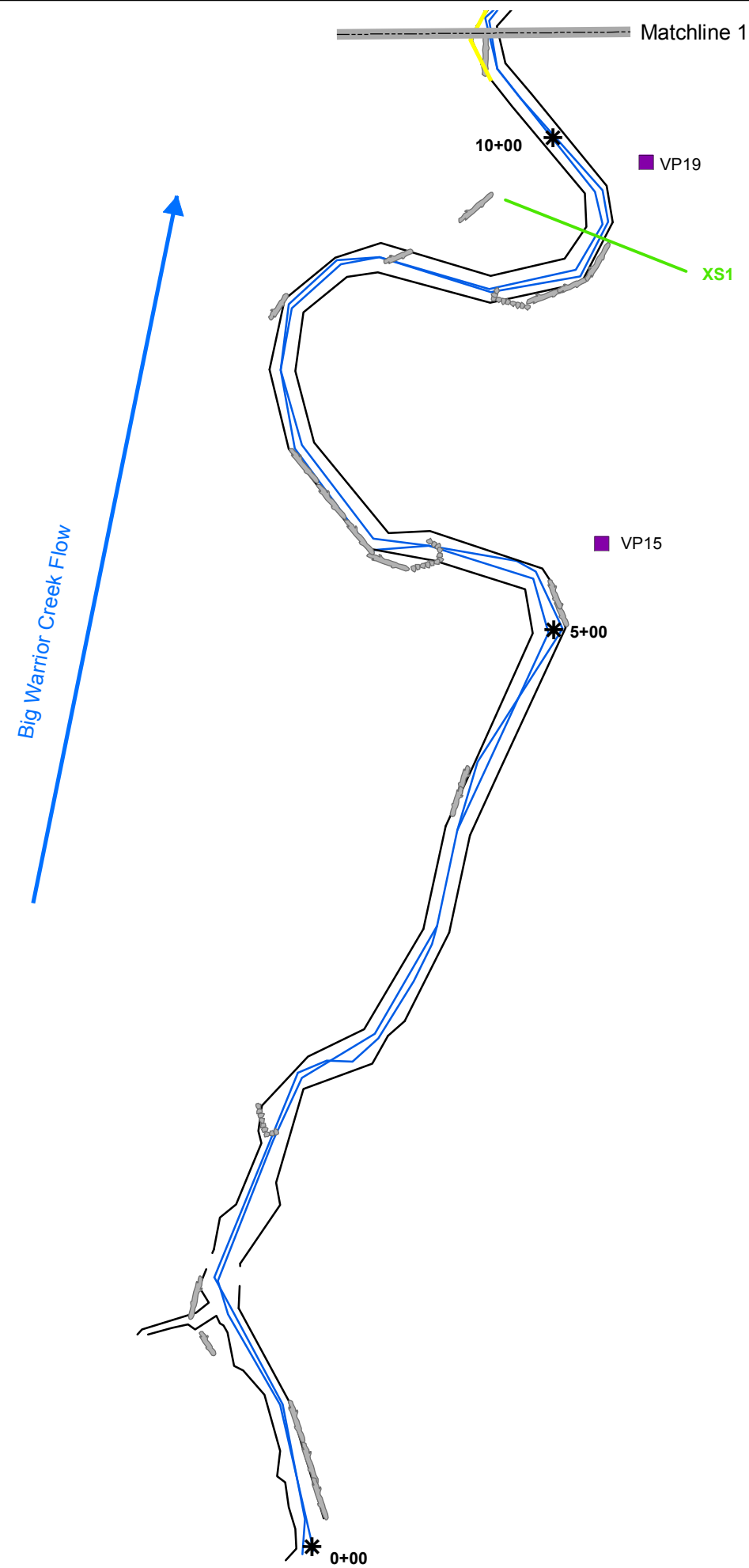
Project Condition and Monitoring Data Appendices



Appendix A: General Figures and Plan Views



<p>Prepared By: URS Corporation - North Carolina 1600 Perimeter Park Drive Suite 400 Morrisville, NC 27560 Phone: 919-461-1100 Fax: 919-461-1415</p> 	<p>Prepared For: NC Ecosystem Enhancement Program</p> 	<p>Project: Big Warrior Creek Stream Restoration Wilkes County, NC</p> <p>Project Number: 00412</p>	<p>Monitoring Year: 5 (2009)</p> <p>Date: December 2009</p>	<p>Legend</p> <p> Project Reach</p>	<p>Figure 1 Project Vicinity</p> <p>0 0.5 1 Miles</p> 
--	--	---	---	---	--



Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



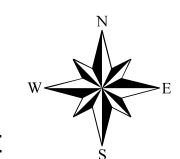
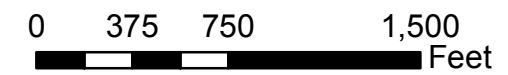
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures



**Stream
 Current Condition
 Plan View**

Big Warrior Creek Stream Problem Areas		
EEP Project Number 00412		
Big Warrior Creek		
Feature #	Feature Issue	Station #/Range
BWPA2	Structure failure	10+70 to 11+00
BWPA6	Structure degradation	23+60
BWPA27	Beaver dam and backwater	14+00 to 19+00

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

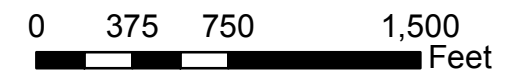
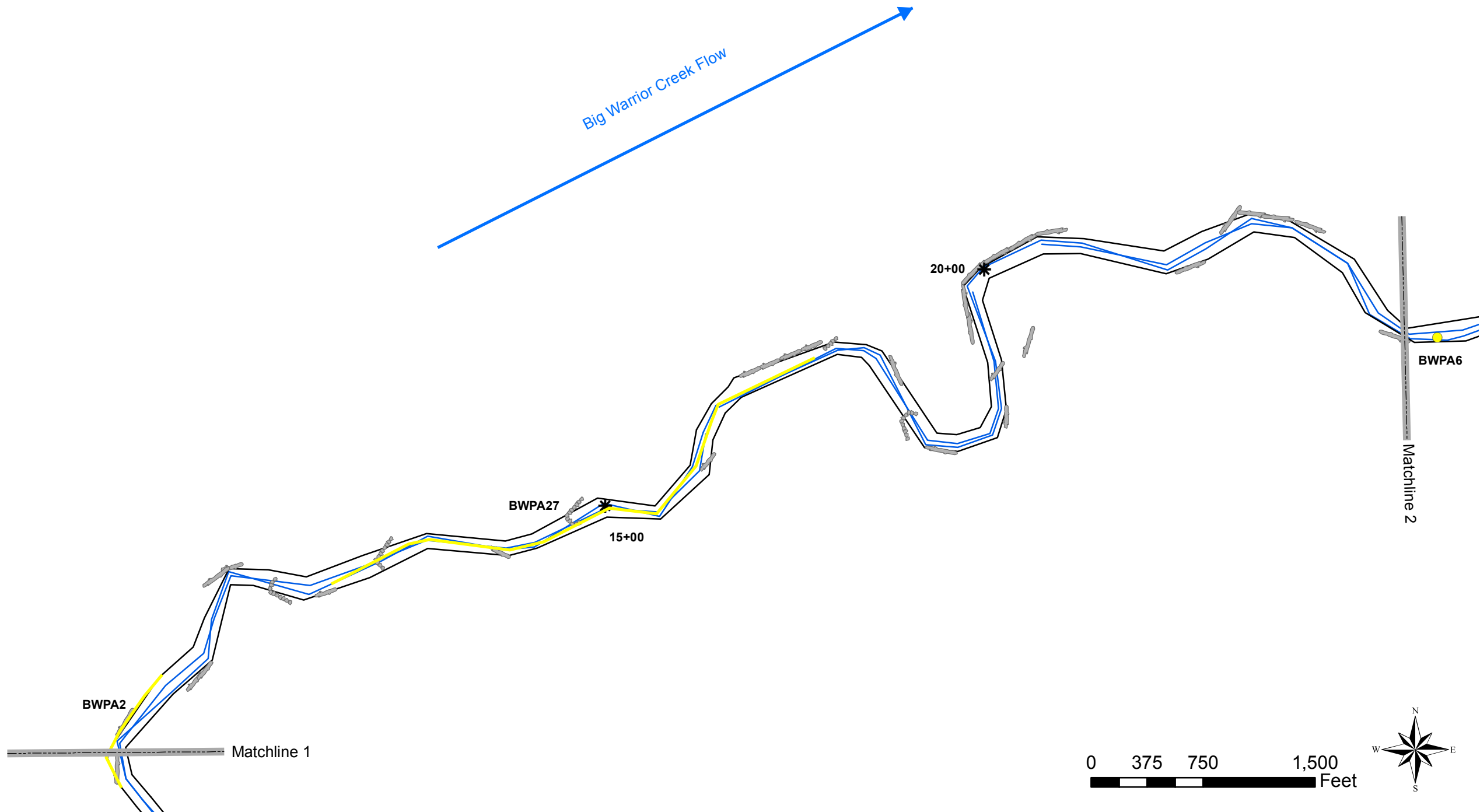
Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

Legend

- Problem Area Concern
- Problem Area High Concern
- Problem Area Concern
- Problem Area High Concern
- Vegetation Plot Meeting Success Criteria
- Vegetation Plot Not Meeting Success Criteria
- Cross Section
- * Stations
- As-Built Centerline
- As-Built Streambank
- Structures



**Stream
 Current Condition
 Plan View**

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



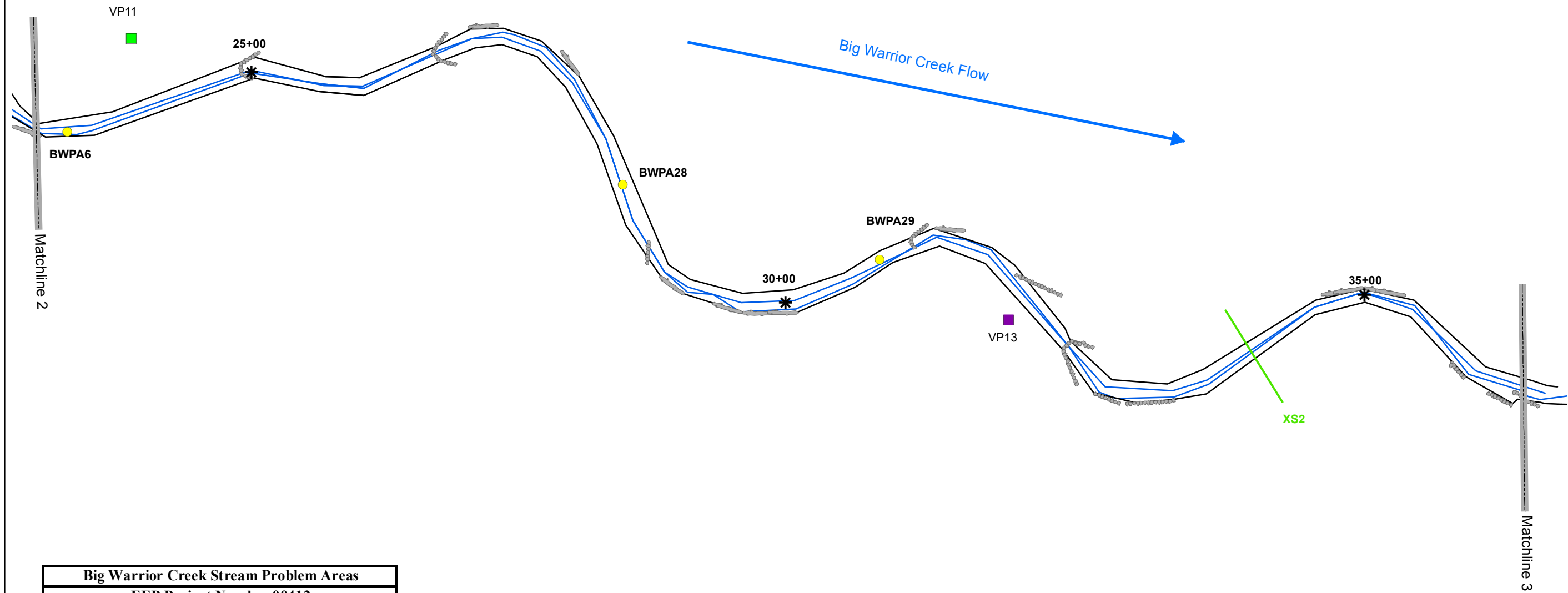
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

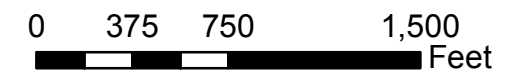
Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures



Big Warrior Creek Stream Problem Areas		
EEP Project Number 00412		
Big Warrior Creek		
Feature #	Feature Issue	Station #/Range
BWPA6	Structure degradation	23+60
BWPA28	Beaver dam	27+50
BWPA29	Beaver dam	30+50



**Stream
 Current Condition
 Plan View**

Sheet 3 of 11

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



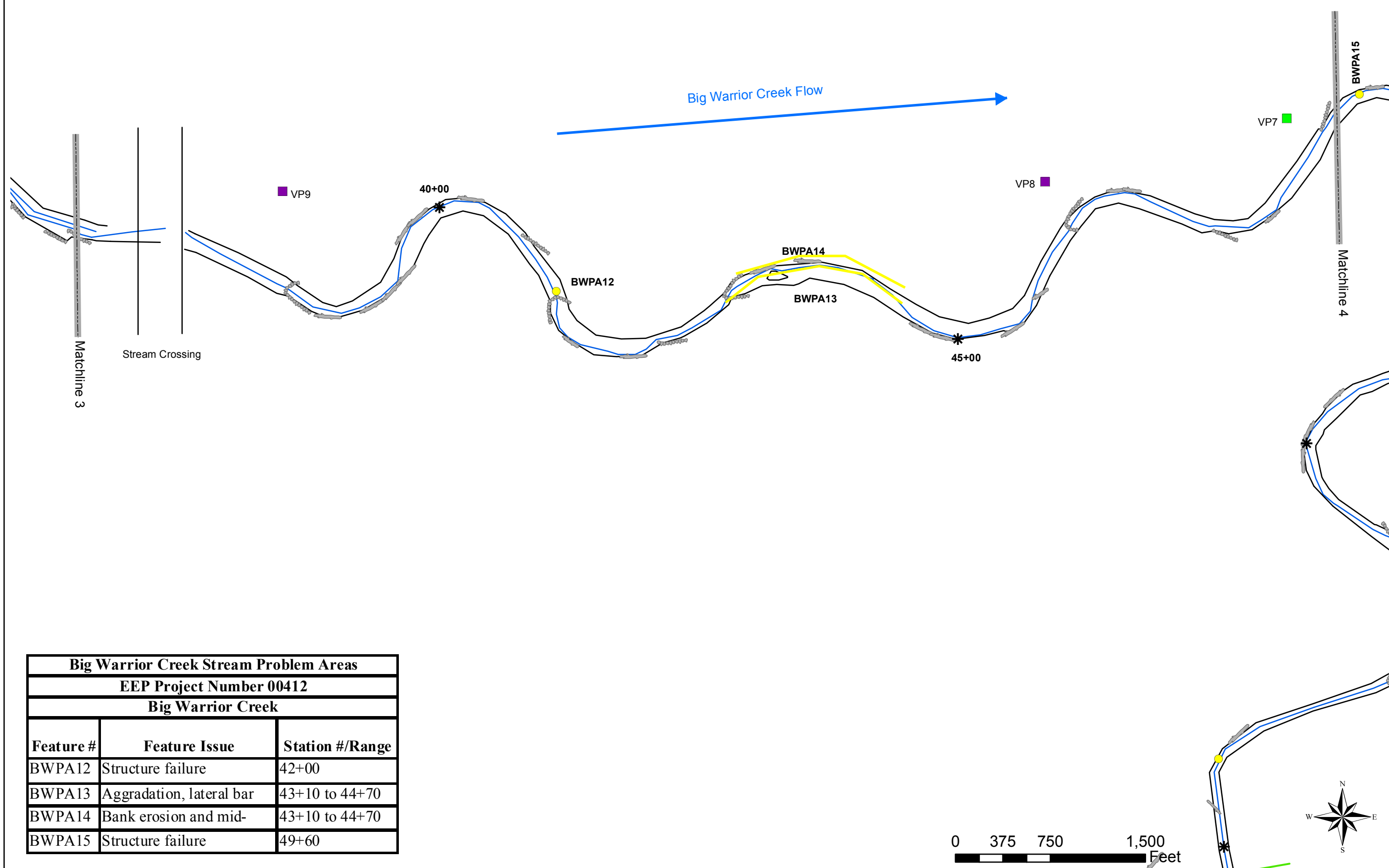
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

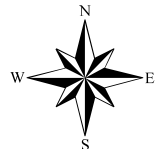
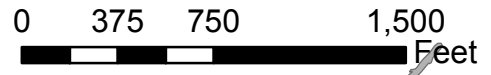
Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures



Big Warrior Creek Stream Problem Areas		
EEP Project Number 00412		
Big Warrior Creek		
Feature #	Feature Issue	Station #/Range
BWPA12	Structure failure	42+00
BWPA13	Aggradation, lateral bar	43+10 to 44+70
BWPA14	Bank erosion and mid-	43+10 to 44+70
BWPA15	Structure failure	49+60



Stream
 Current Condition
 Plan View

Big Warrior Creek Stream Problem Areas		
EEP Project Number 00412		
Big Warrior Creek		
Feature #	Feature Issue	Station #/Range
BWPA15	Structure failure	49+60

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

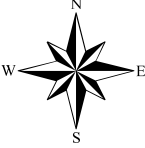
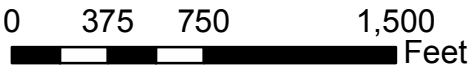
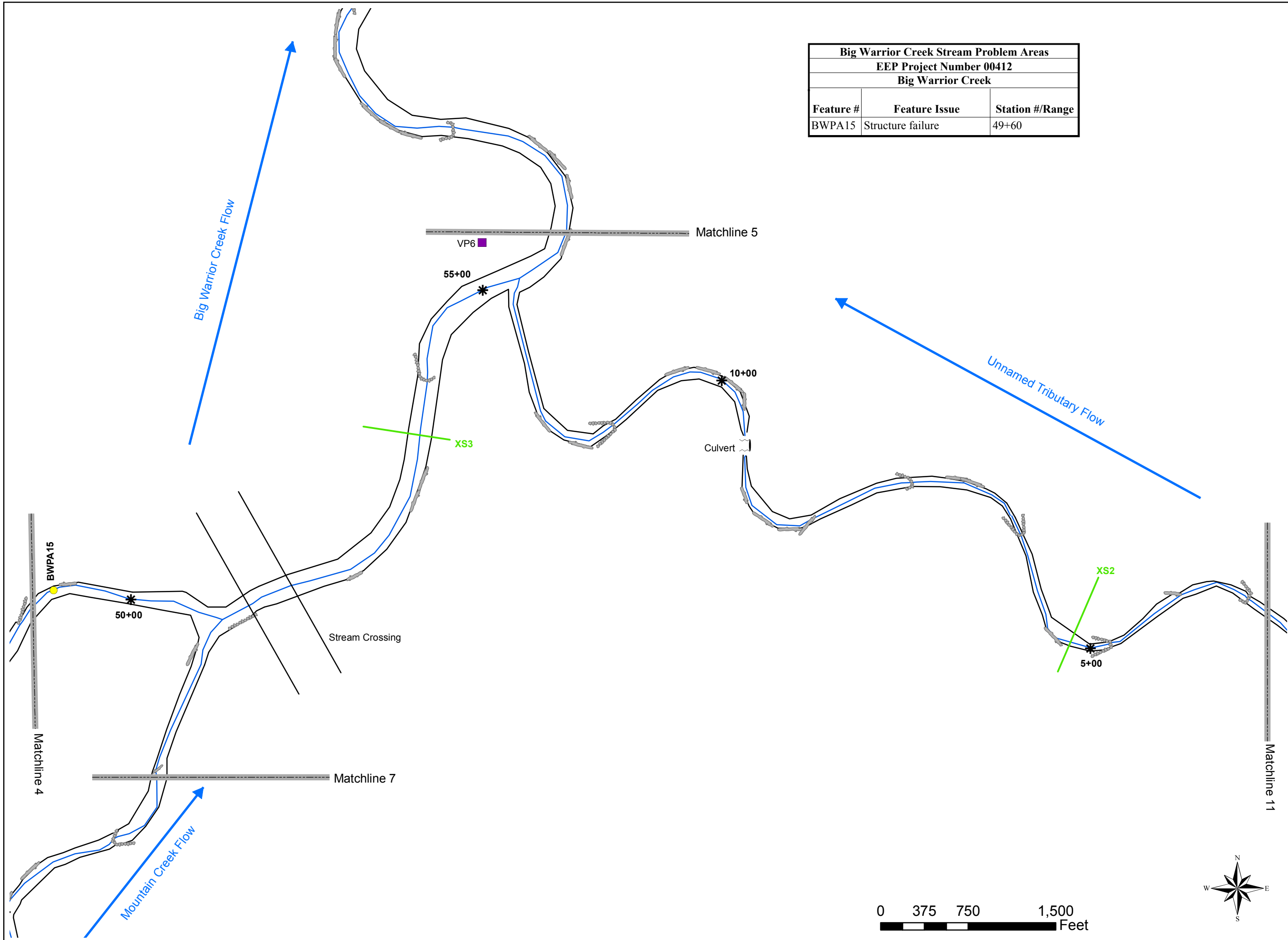
Project Number:
 00412

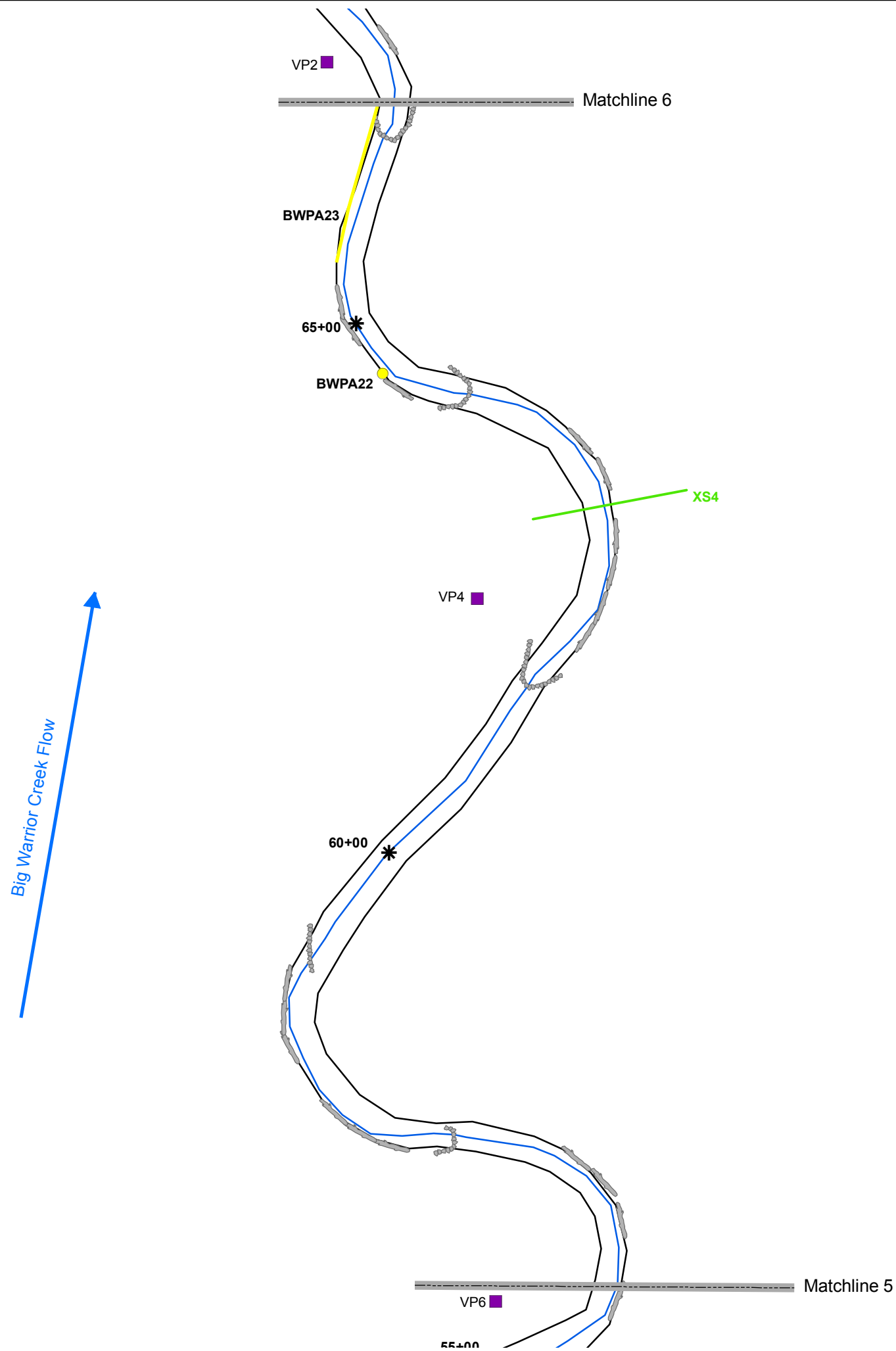
Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures

Stream
 Current Condition
 Plan View

Sheet 5 of 11





Big Warrior Creek Stream Problem Areas		
EEP Project Number 00412		
Big Warrior Creek		
Feature #	Feature Issue	Station #/Range
BWPA22	Structure degradation	64+90
BWPA23	Bank erosion	65+10 to 66+00

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



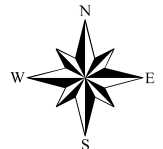
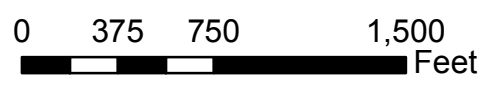
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures



**Stream
 Current Condition
 Plan View**

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

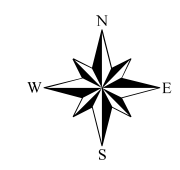
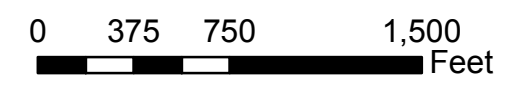
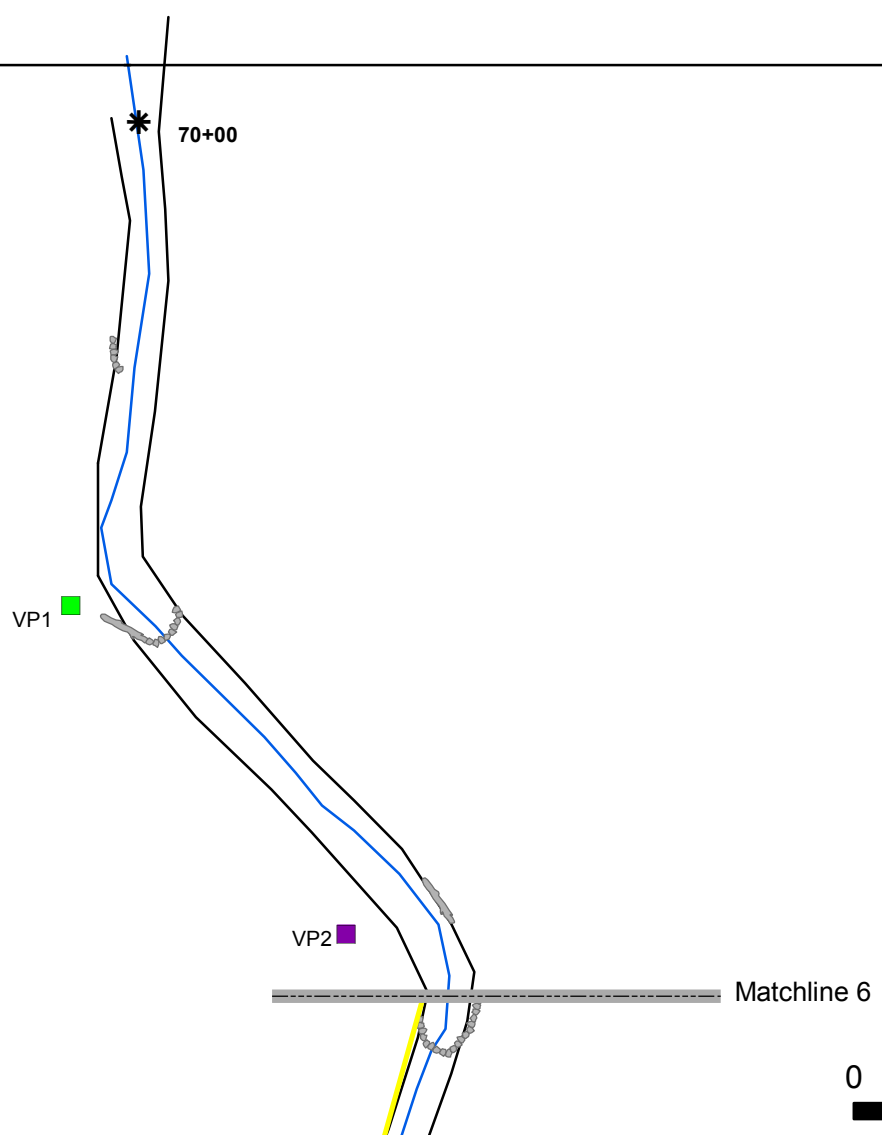
Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures

**Stream
 Current Condition
 Plan View**

Sheet 7 of 11

NC 18



Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

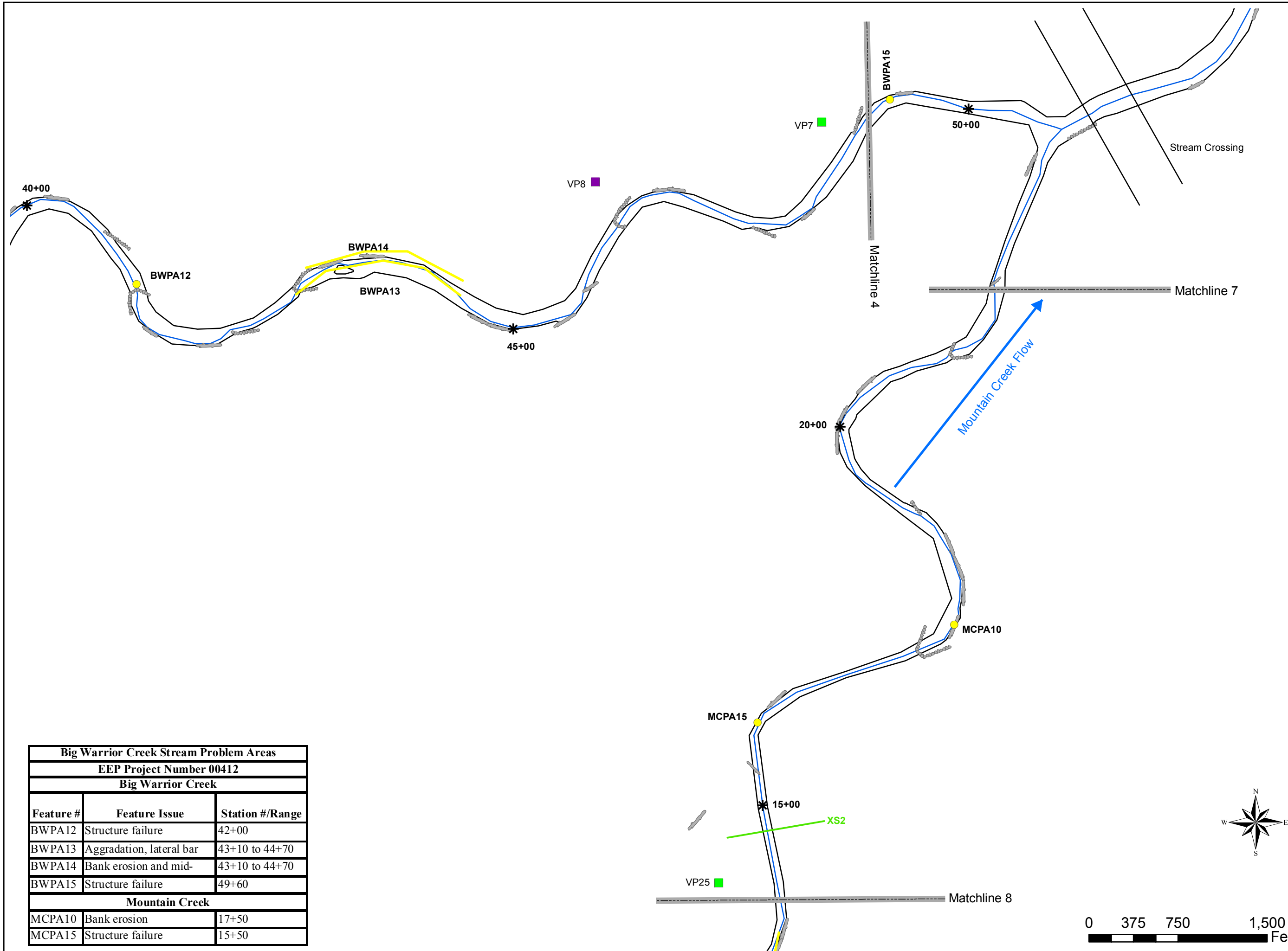
Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures

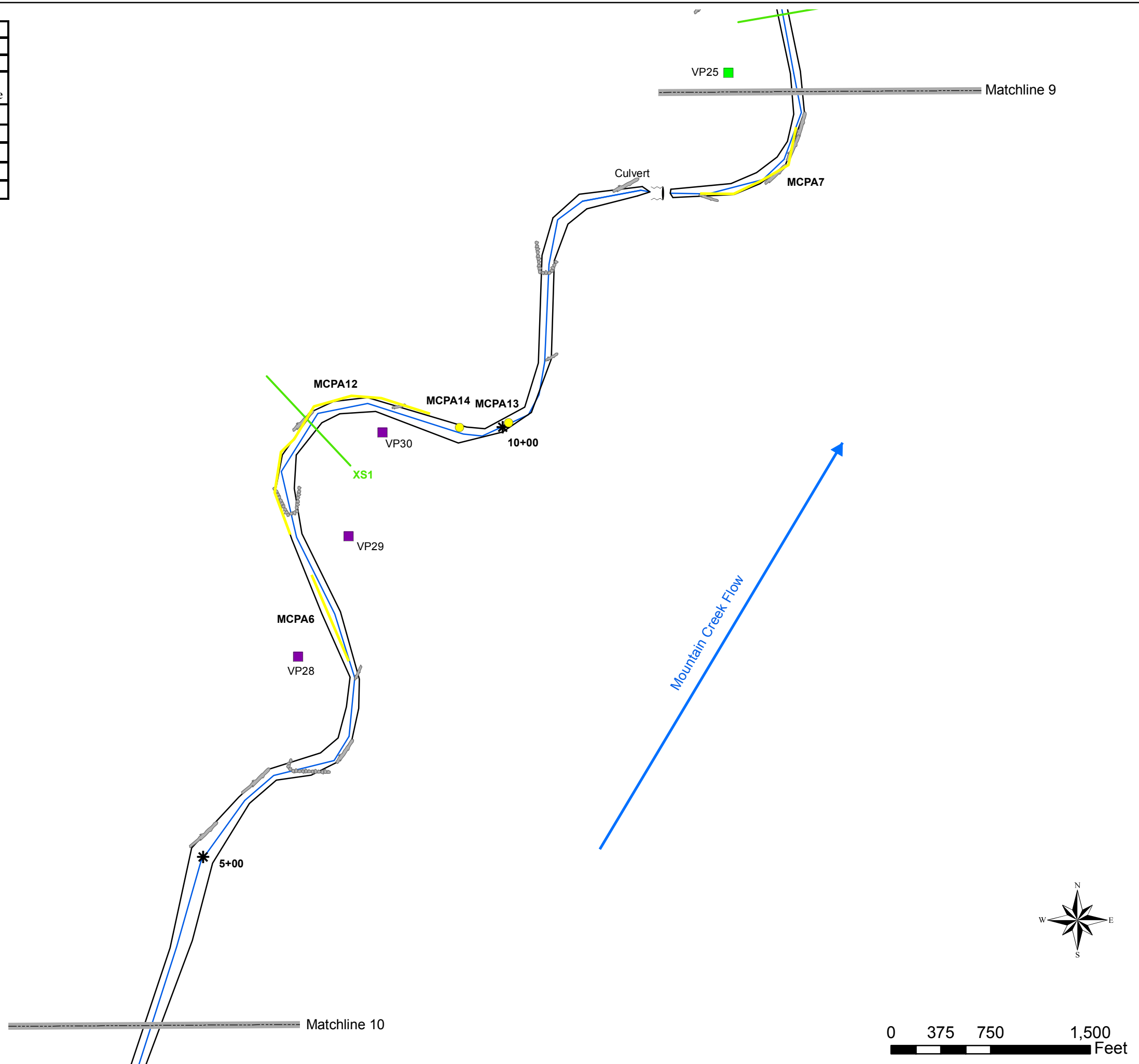
Stream
 Current Condition
 Plan View

Sheet 8 of 11



Big Warrior Creek Stream Problem Areas		
EEP Project Number 00412		
Big Warrior Creek		
Feature #	Feature Issue	Station #/Range
BWPA12	Structure failure	42+00
BWPA13	Aggradation, lateral bar	43+10 to 44+70
BWPA14	Bank erosion and mid-	43+10 to 44+70
BWPA15	Structure failure	49+60
Mountain Creek		
MCPA10	Bank erosion	17+50
MCPA15	Structure failure	15+50

Big Warrior Creek Stream Problem Areas		
EEP Project Number 00412		
Mountain Creek		
Feature #	Feature Issue	Station #/Range
MCPA6	Bank erosion and mid-	7+20 to 7+60
MCPA7	Bank failure	13+00 to 14+50
MCPA12	Structure failure / lateral	8+00 to 9+50
MCPA13	Aggradation	9+70
MCPA14	Structure failure	10+00



Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

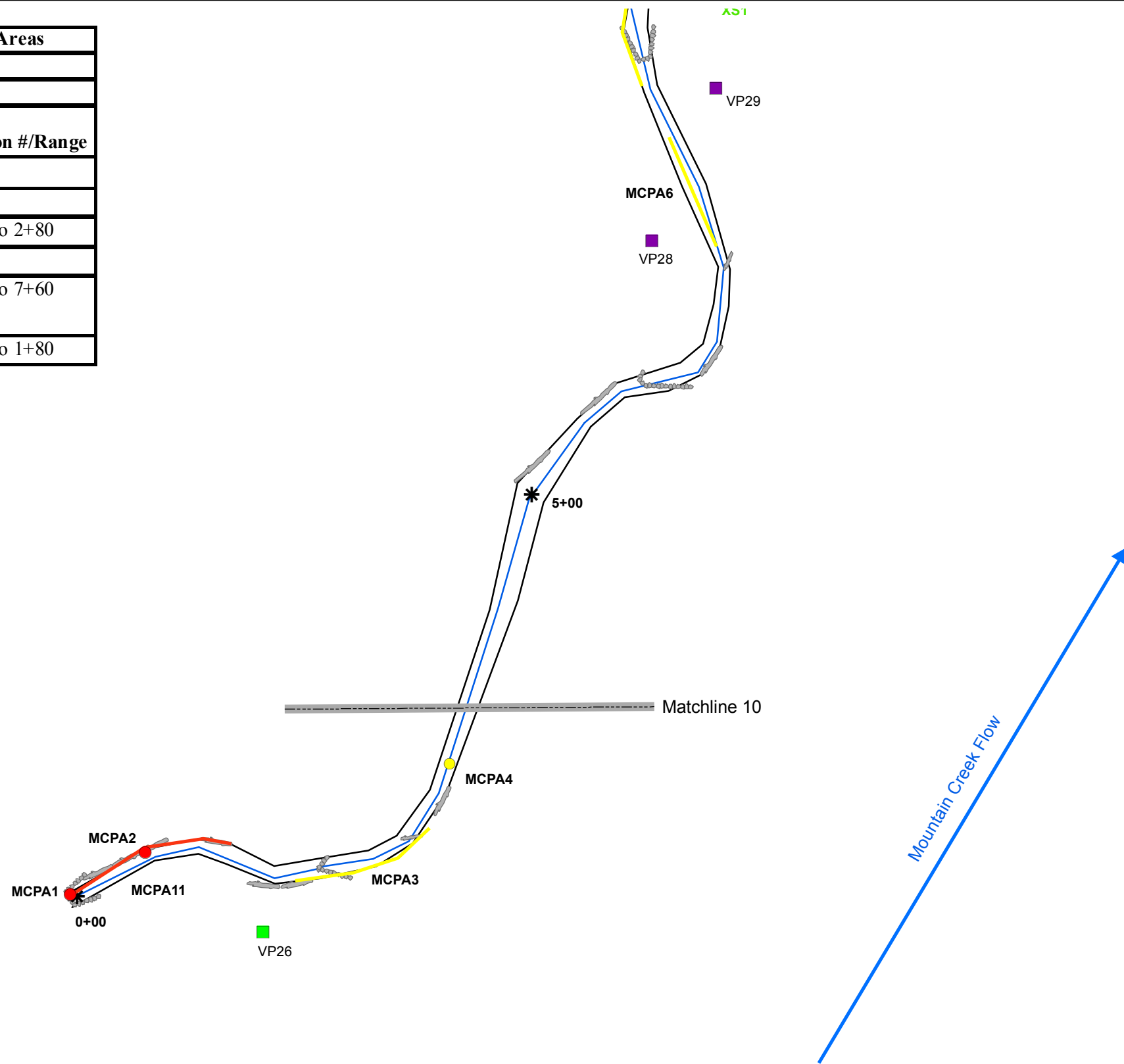
Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - ▭ Structures

**Stream
 Current Condition
 Plan View**

Big Warrior Creek Stream Problem Areas		
EEP Project Number 00412		
Mountain Creek		
Feature #	Feature Issue	Station #/Range
MCPA1	Structure failure	0+00
MCPA2	Structure failure	1+80
MCPA3	Bank erosion	1+90 to 2+80
MCPA4	Structure failure	3+00
MCPA6	Bank erosion and mid-channel bar formation	7+20 to 7+60
MCPA11	Bank erosion	0+00 to 1+80



Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



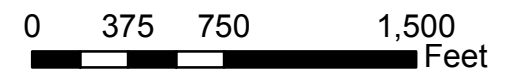
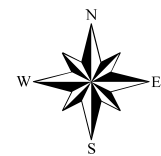
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - ▭ Structures



**Stream
 Current Condition
 Plan View**

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



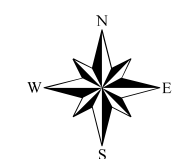
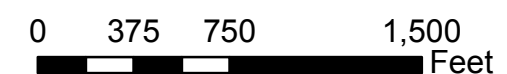
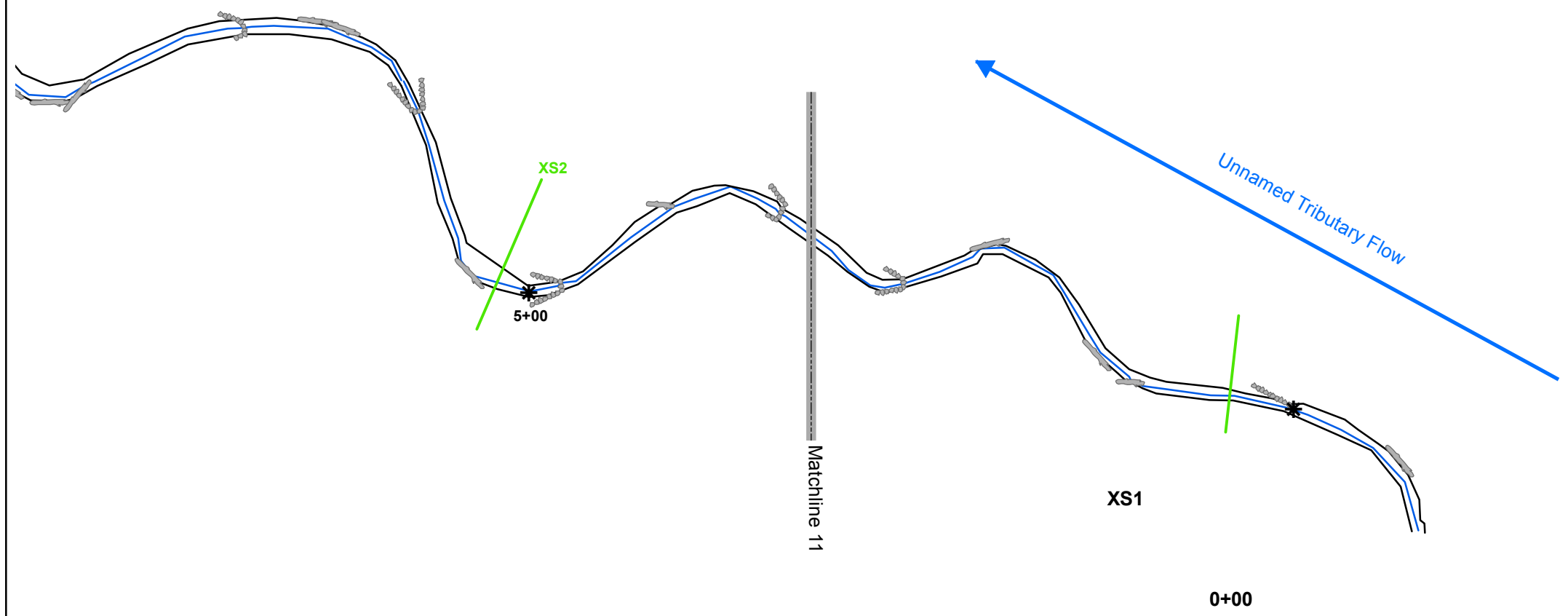
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

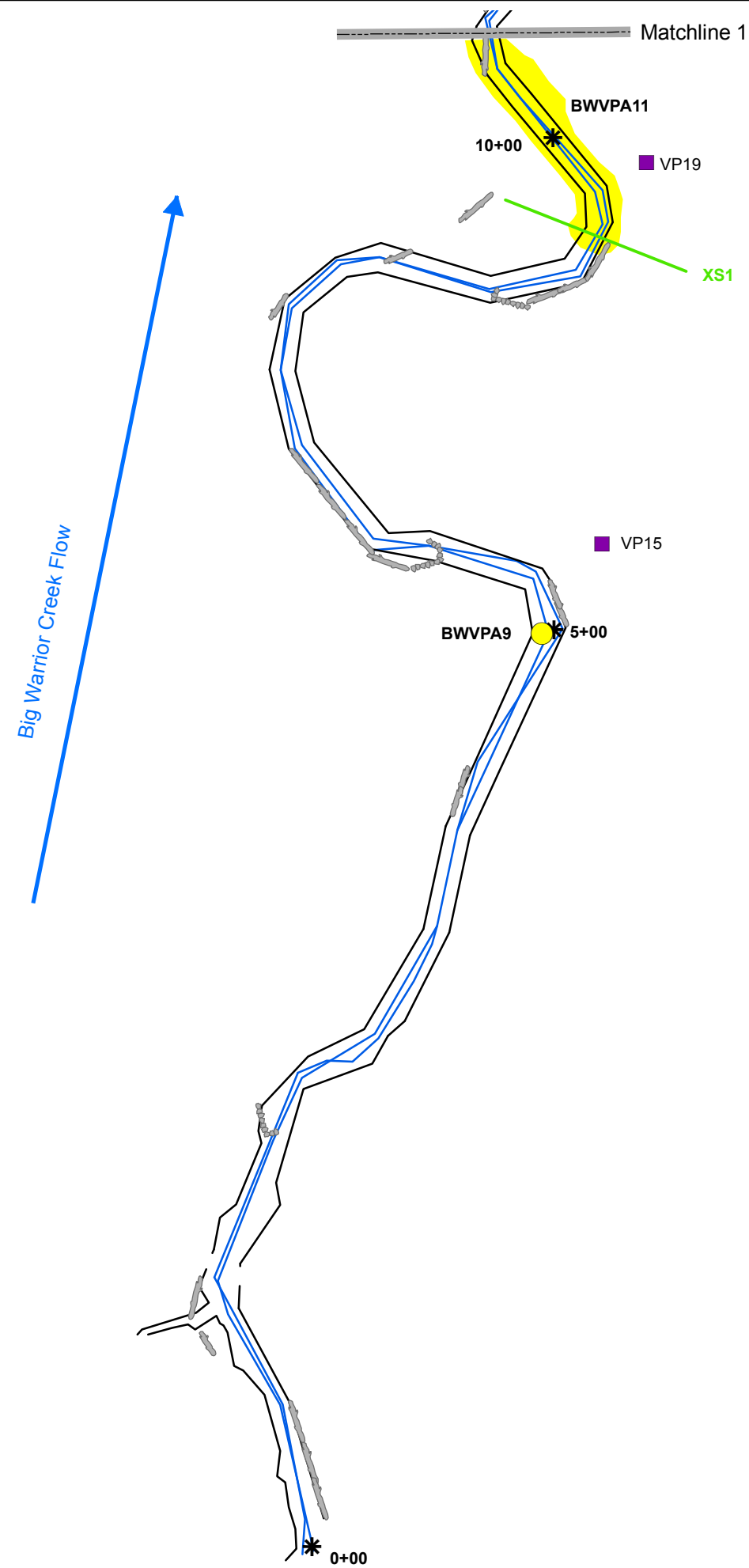
Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area High Concern
 - Problem Area Concern
 - Problem Area High Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures



**Stream
 Current Condition
 Plan View**



Big Warrior Creek Vegetative Problem Areas		
EEP Project Number 00412		
Big Warrior Creek		
Feature #	Feature/Issue	Station #/Range
BWVPA9	Invasive/exotic plant	5+00
BWVPA11	Beaver damage to planted stems	9+90 to 11+00

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



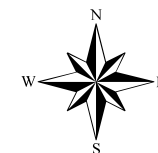
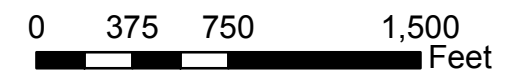
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area Concern
 - Problem Area Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures



Vegetation
 Current Condition
 Plan View

EEP Project Number 00412			
Big Warrior Creek			
Feature #	Feature/Issue	Station #/Range	Suspected Cause
BWVPA2	Invasive/exotic plant	12+00 to 20+10	Kudzu
BWVPA11	Beaver damage to planted stems	9+90 to 11+00	Beaver activity

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



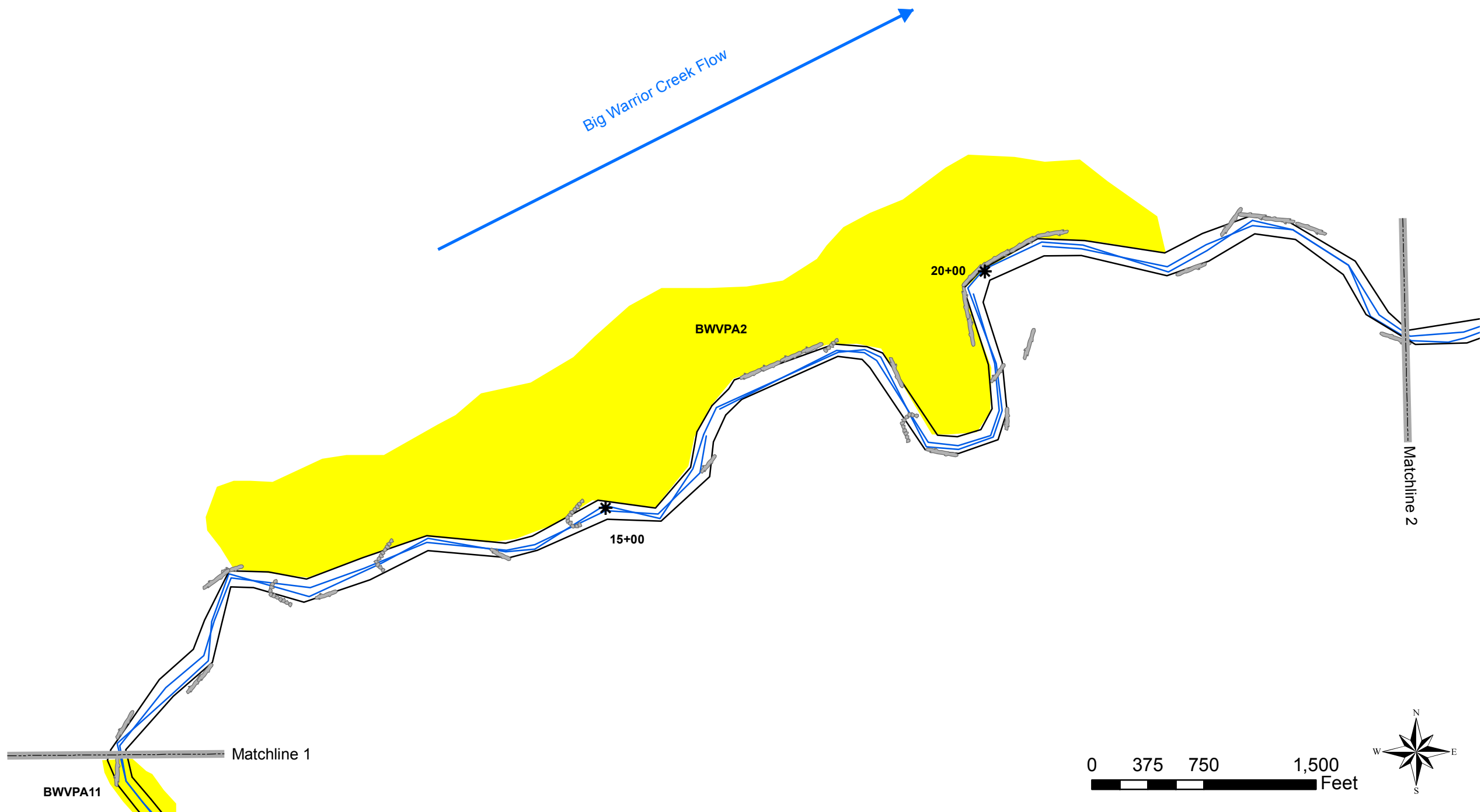
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area Concern
 - Problem Area Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures



**Vegetation
 Current Condition
 Plan View**

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



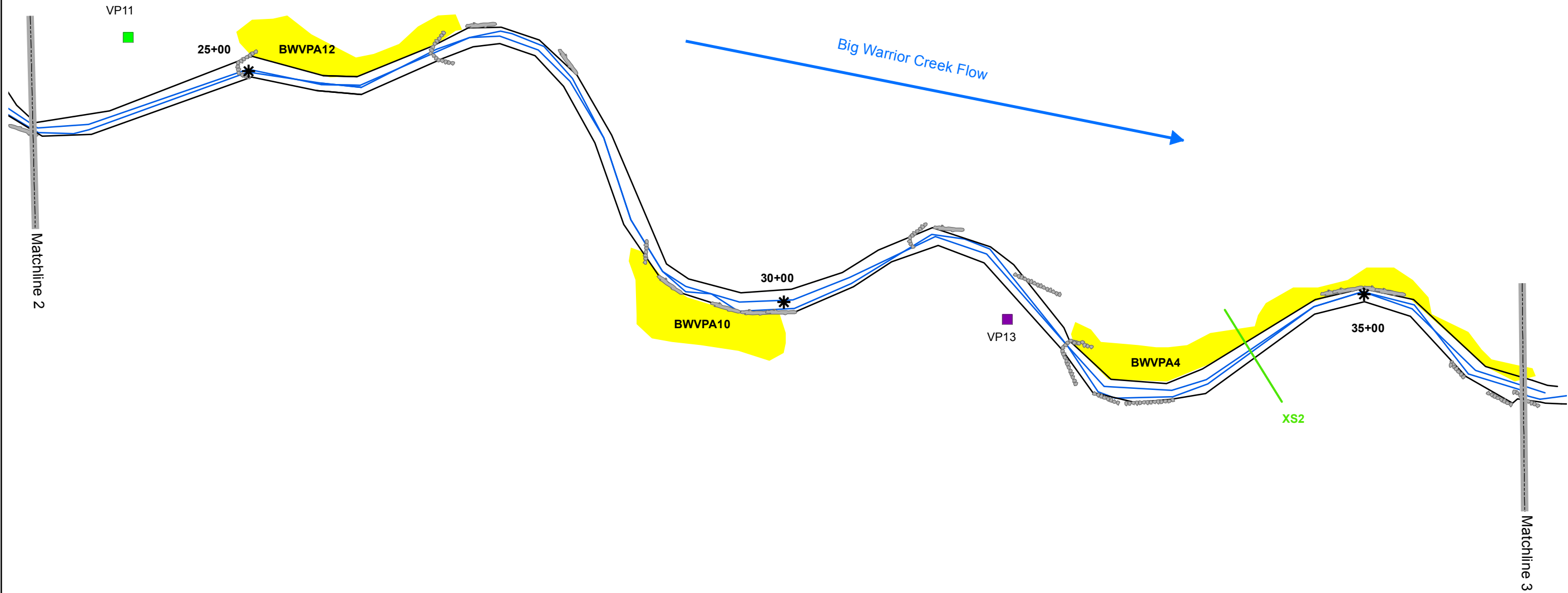
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

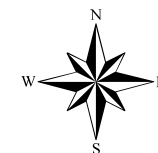
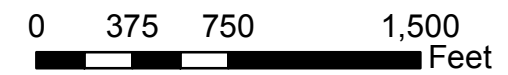
Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures



EEP Project Number 00412			
Big Warrior Creek			
Feature #	Feature/Issue	Station #/Range	Suspected Cause
BWVPA4	Invasive/exotic plant	33+00 to 37+00	Kudzu and Chinese privet
BWVPA10	Bare ground	28+00 to 30+00	Poor survivability, soil and slope
BWVPA12	Invasive/exotic plant	25+00 to 26+80	Kudzu and Japanese honeysuckle



Vegetation
 Current Condition
 Plan View

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



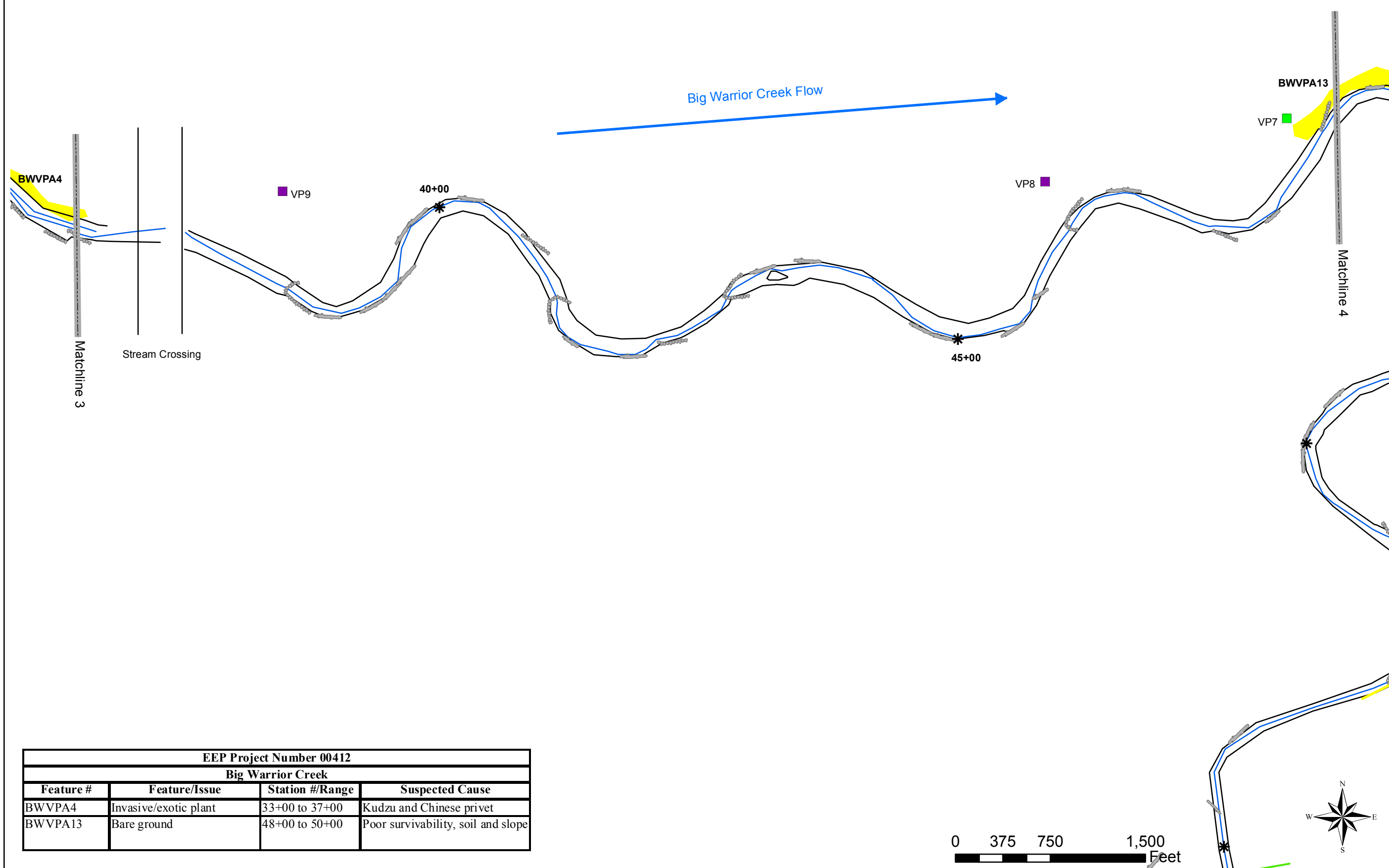
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area Concern
 - ▬ Problem Area Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - ▬ Cross Section
 - * Stations
 - ▬ As-Built Centerline
 - ▬ As-Built Streambank
 - ▬ Structures



EEP Project Number 00412			
Big Warrior Creek			
Feature #	Feature/Issue	Station #/Range	Suspected Cause
BWVPA4	Invasive/exotic plant	33+00 to 37+00	Kudzu and Chinese privet
BWVPA13	Bare ground	48+00 to 50+00	Poor survivability, soil and slope

Vegetation
 Current Condition
 Plan View

Big Warrior Creek Vegetative Problem Areas		
EEP Project Number 00412		
Big Warrior Creek		
Feature #	Feature/Issue	Station #/Range
BWVPA13	Bare ground	48+00 to 50+00

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



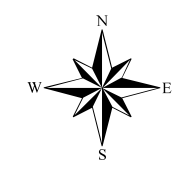
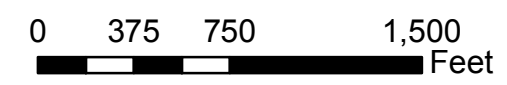
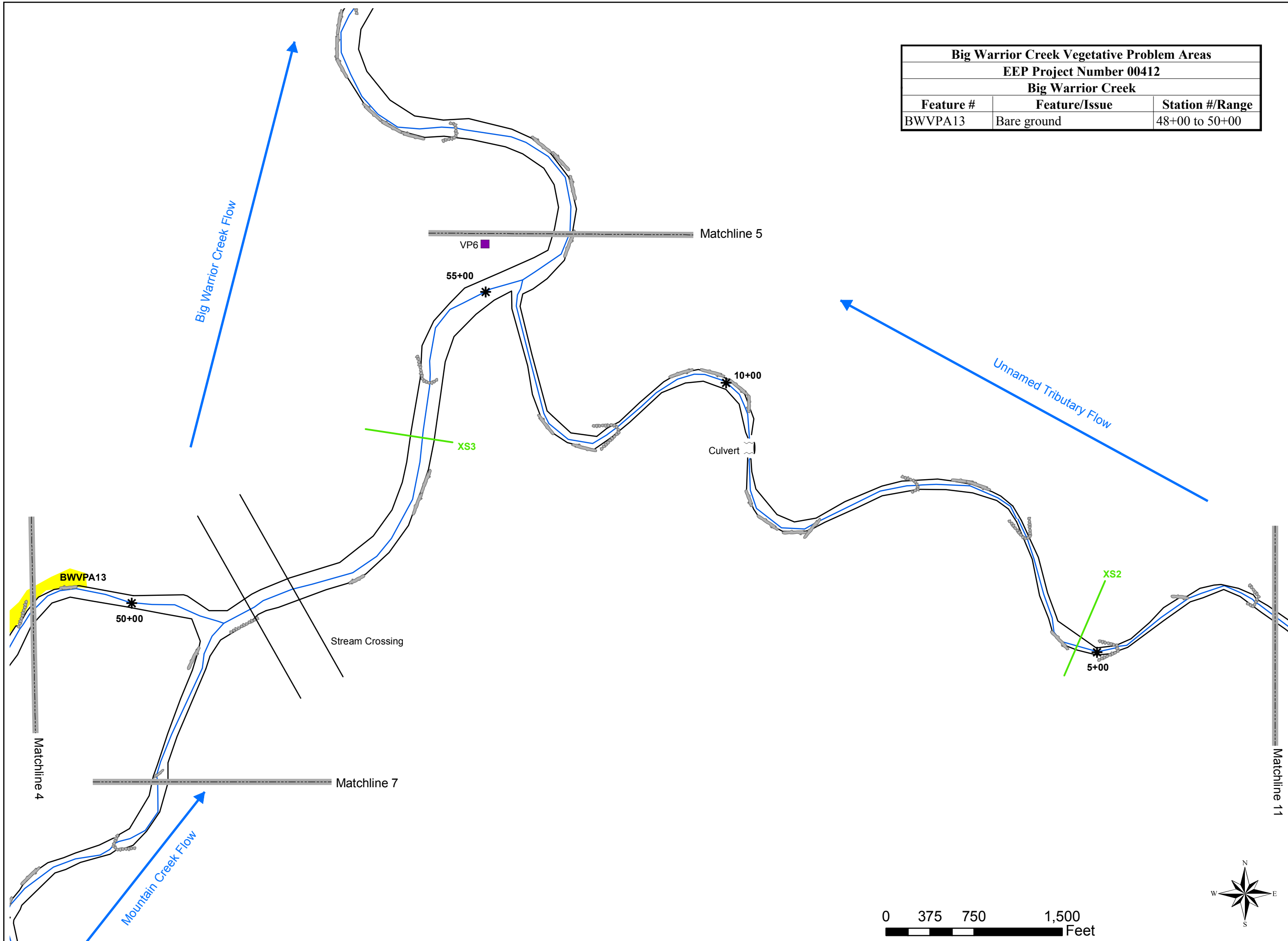
Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

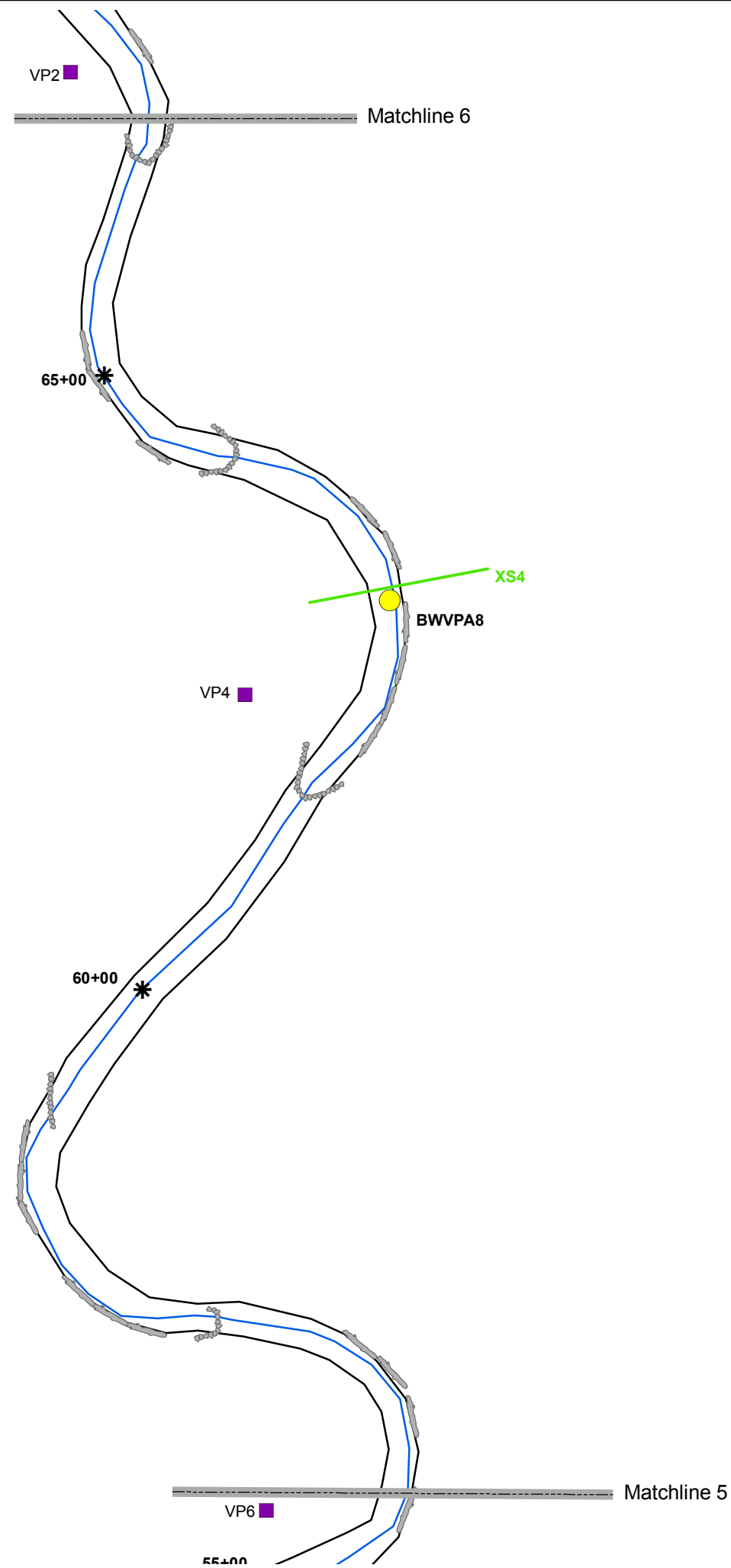
Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area Concern
 - Problem Area Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures



Vegetation
 Current Condition
 Plan View
 Sheet 5 of 11



Big Warrior Creek Vegetative Problem Areas		
EEP Project Number 00412		
Big Warrior Creek		
Feature #	Feature/Issue	Station #/Range
BWVPA8	Invasive/exotic plant	63+50

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

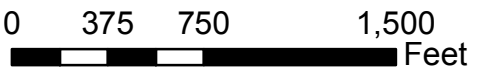
Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area Concern
 - Problem Area Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures

Vegetation
 Current Condition
 Plan View



Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

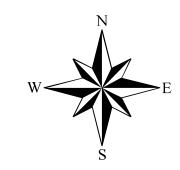
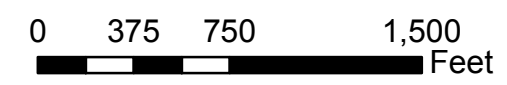
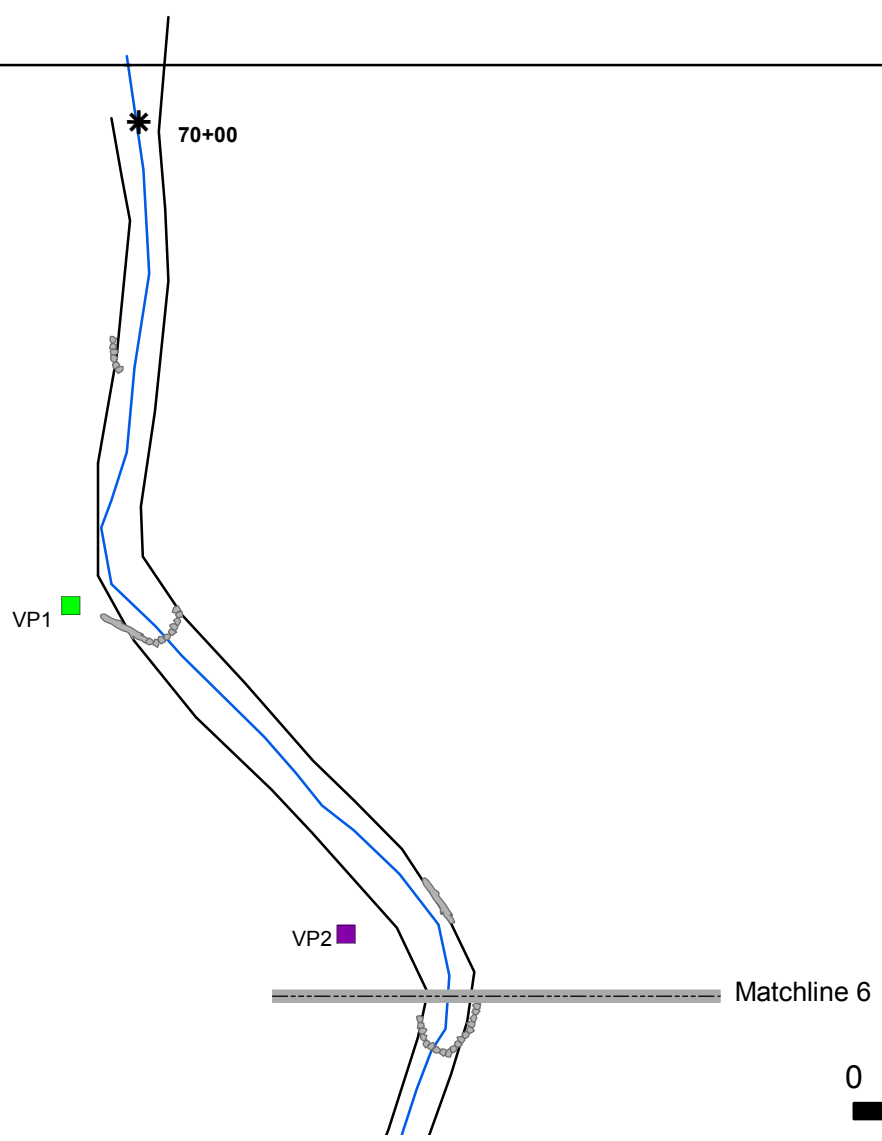
Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area Concern
 - Problem Area Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures

**Stream
 Current Condition
 Plan View**

Sheet 7 of 11

NC 18



Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

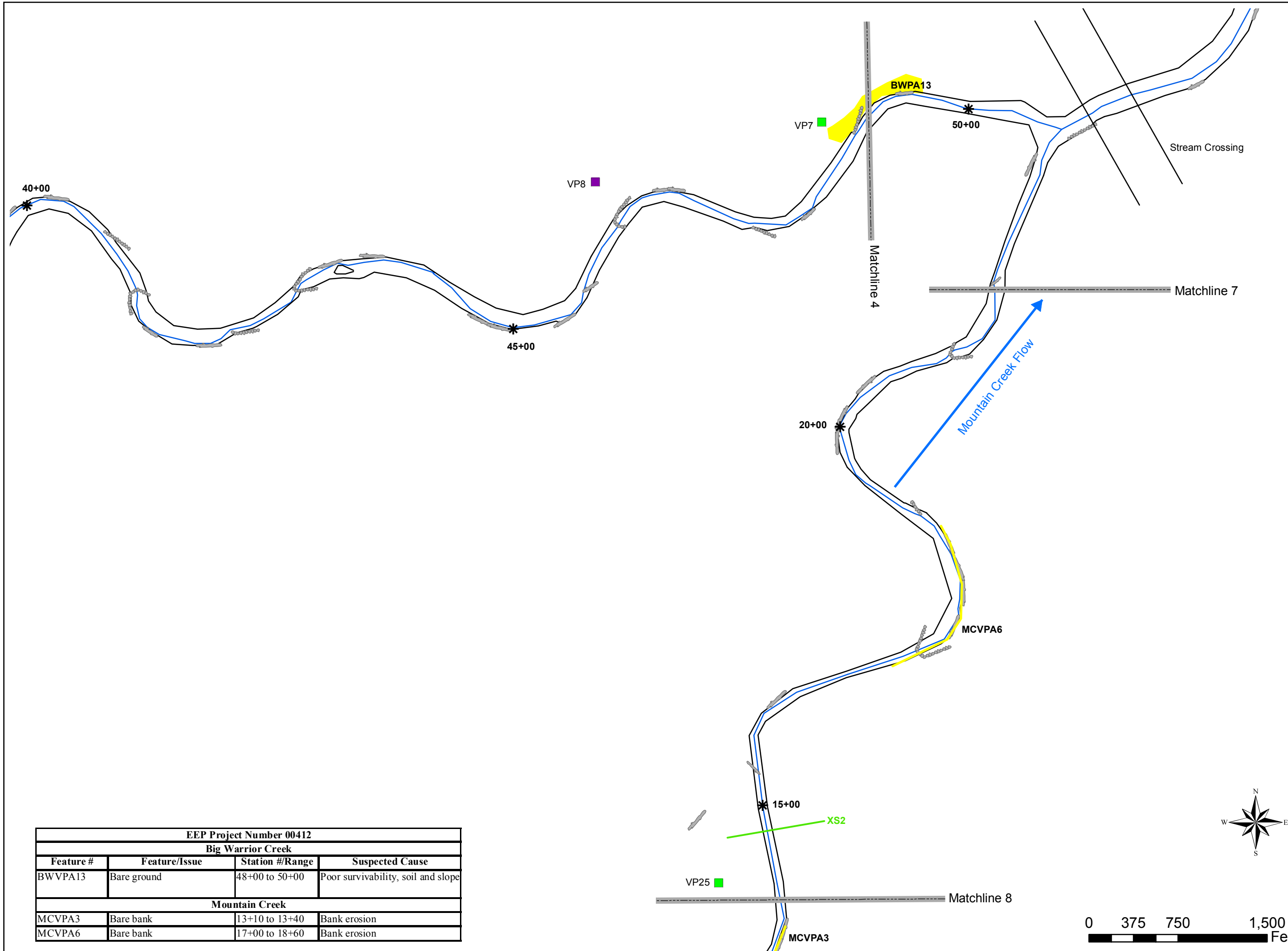
Project Number:
 00412

Date:
 April 2010

- Legend**
- Problem Area Concern
 - Problem Area Concern
 - Problem Area Concern
 - Vegetation Plot Meeting Success Criteria
 - Vegetation Plot Not Meeting Success Criteria
 - Cross Section
 - * Stations
 - As-Built Centerline
 - As-Built Streambank
 - Structures

Stream
 Current Condition
 Plan View

Sheet 8 of 11

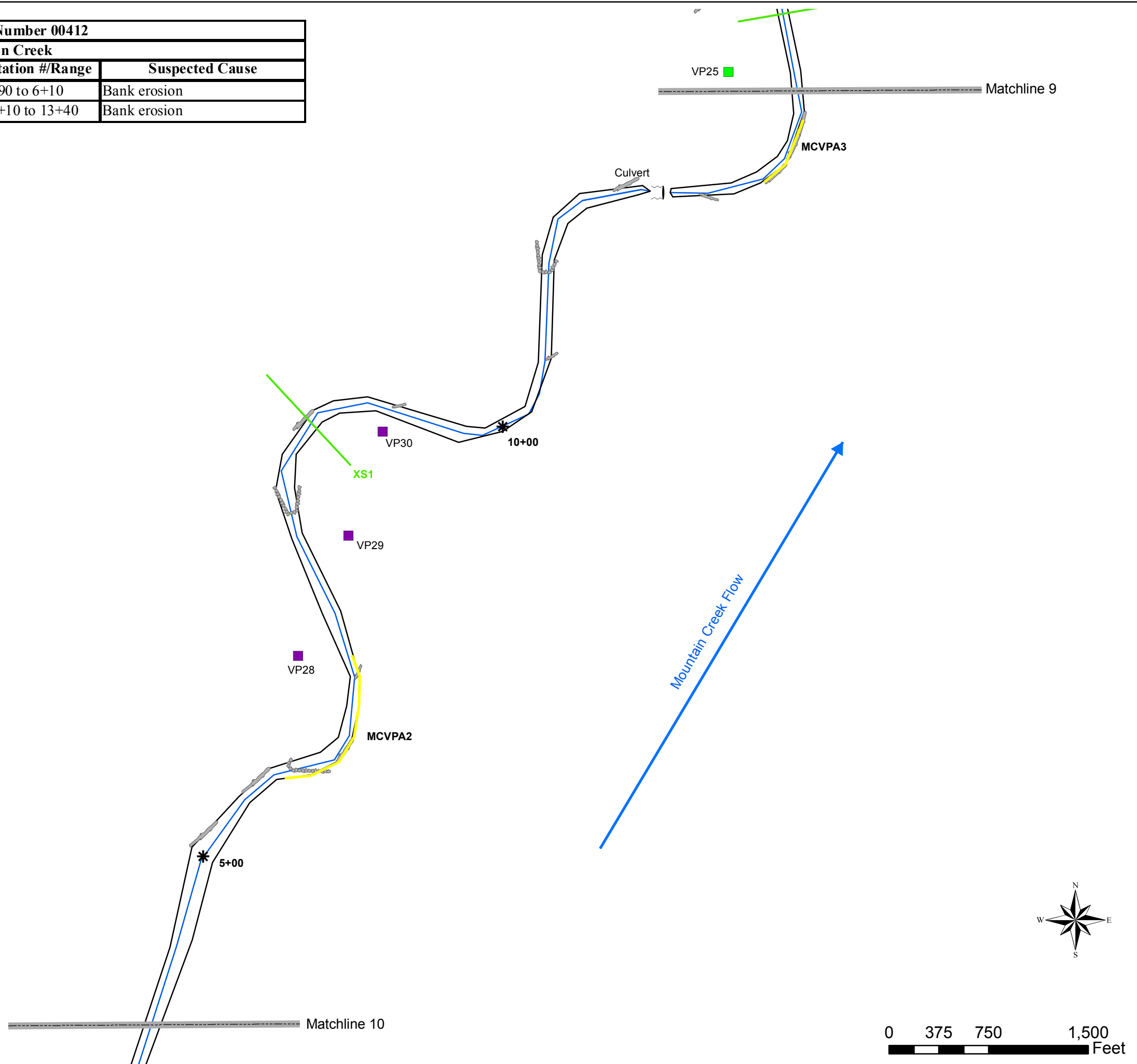


EEP Project Number 00412			
Big Warrior Creek			
Feature #	Feature/Issue	Station #/Range	Suspected Cause
BWVPA13	Bare ground	48+00 to 50+00	Poor survivability, soil and slope
Mountain Creek			
MCVPA3	Bare bank	13+10 to 13+40	Bank erosion
MCVPA6	Bare bank	17+00 to 18+60	Bank erosion

EEP Project Number 00412

Mountain Creek

Feature #	Feature/Issue	Station #/Range	Suspected Cause
MCVPA2	Bare bank	5+90 to 6+10	Bank erosion
MCVPA3	Bare bank	13+10 to 13+40	Bank erosion



Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

Legend

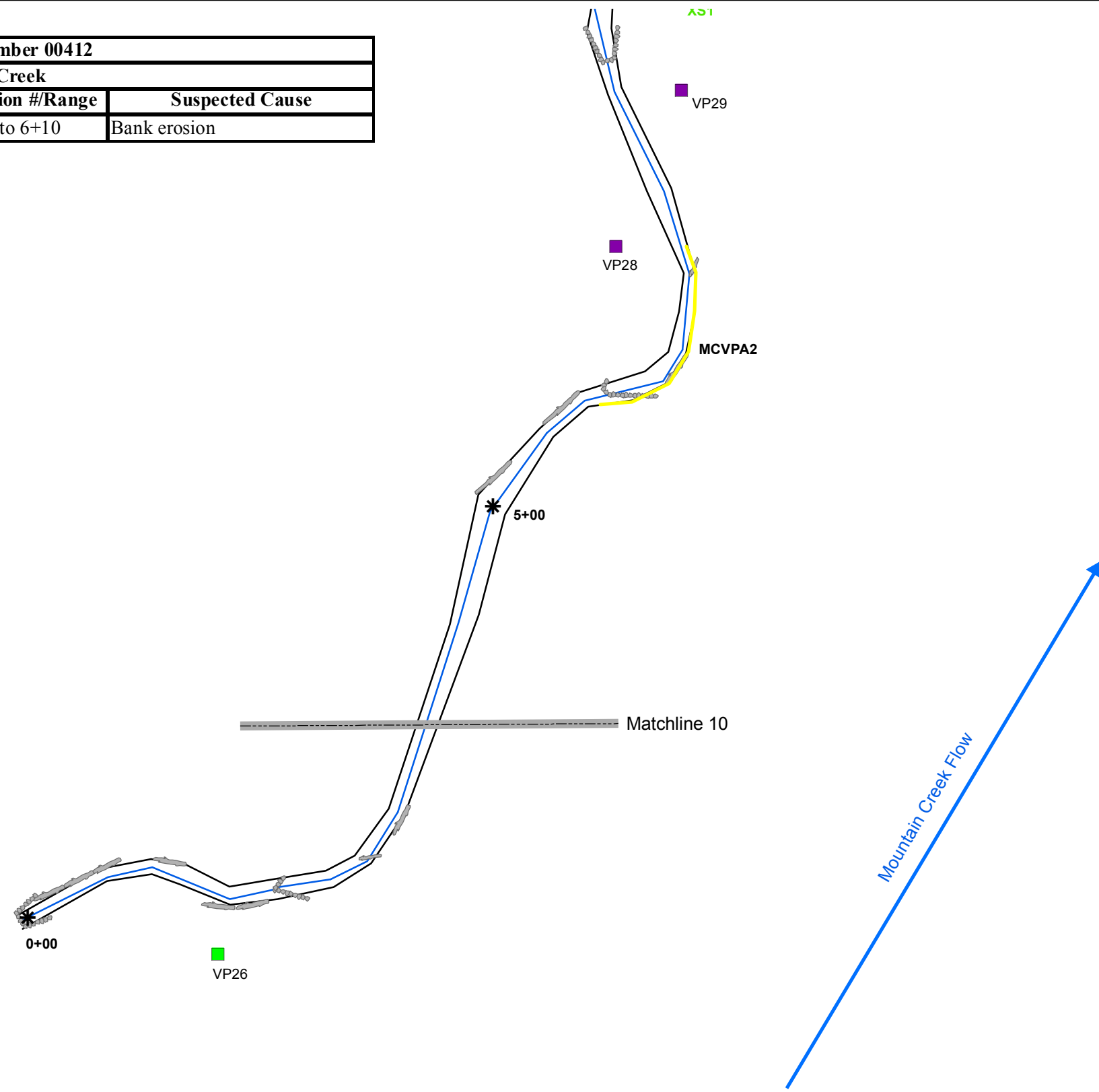
- Problem Area Concern
- Problem Area Concern
- Problem Area Concern
- Vegetation Plot Meeting Success Criteria
- Vegetation Plot Not Meeting Success Criteria
- Cross Section
- * Stations
- As-Built Centerline
- As-Built Streambank
- Structures

Vegetation
 Current Condition
 Plan View

EEP Project Number 00412

Mountain Creek

Feature #	Feature/Issue	Station #/Range	Suspected Cause
MCVPA2	Bare bank	5+90 to 6+10	Bank erosion



Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

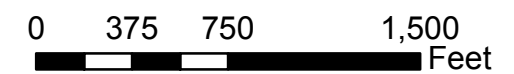
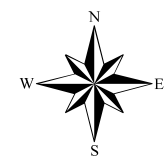
Monitoring Year:
 5 (2009)

Project Number:
 00412

Date:
 April 2010

Legend

- Problem Area Concern
- Problem Area Concern
- Problem Area Concern
- Vegetation Plot Meeting Success Criteria
- Vegetation Plot Not Meeting Success Criteria
- Cross Section
- Stations
- As-Built Centerline
- As-Built Streambank
- Structures



Vegetation
 Current Condition
 Plan View

Prepared By:
 URS Corporation - North Carolina
 1600 Perimeter Park Drive
 Suite 400
 Morrisville, NC 27560
 Phone: 919-461-1100
 Fax: 919-461-1415



Prepared For:
 NC Ecosystem
 Enhancement Program



Project:
 Big Warrior Creek
 Stream Restoration
 Wilkes County, NC

Monitoring Year:
 5 (2009)

Project Number:
 00412

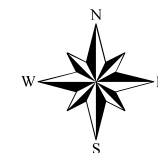
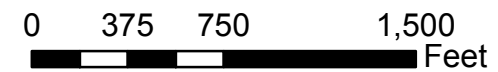
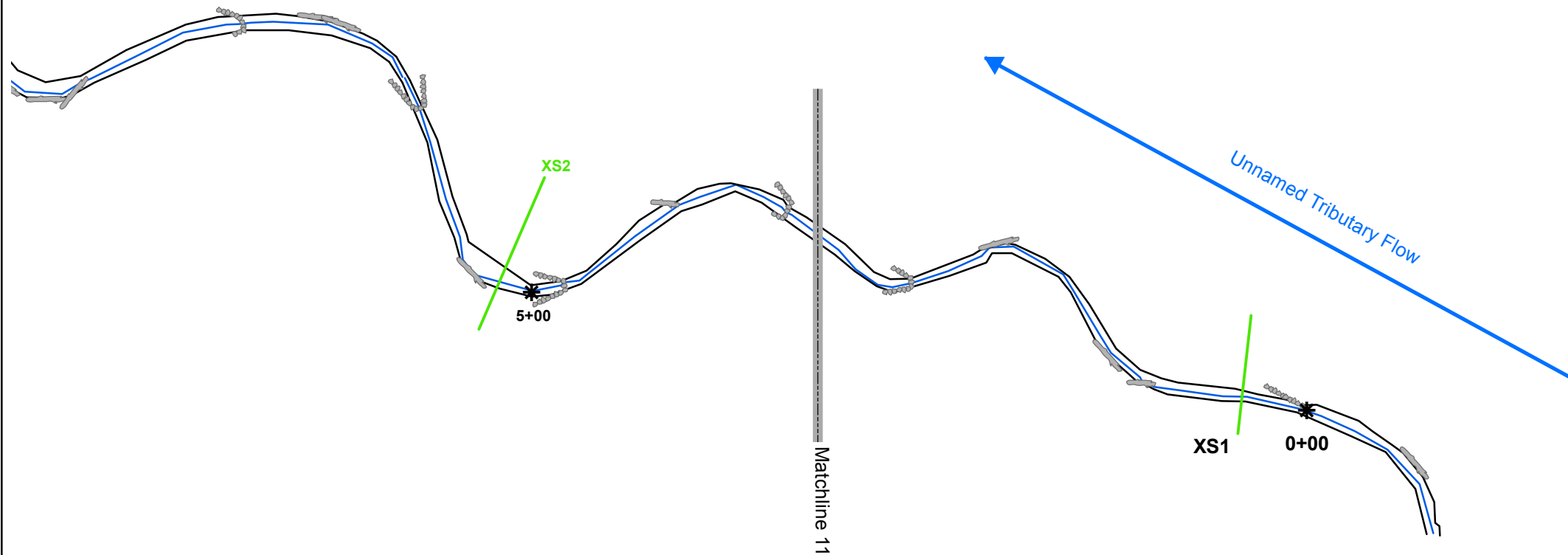
Date:
 April 2010

Legend

- Problem Area Concern
- Problem Area Concern
- Problem Area Concern
- Vegetation Plot Meeting Success Criteria
- Vegetation Plot Not Meeting Success Criteria
- Cross Section
- Stations
- As-Built Centerline
- As-Built Streambank
- Structures

**Vegetation
 Current Condition
 Plan View**

Sheet 11 of 11



Appendix B: General Project Tables

Table 1: Project Restoration Components

Big Warrior Creek EEP Project Number 00412					
Project Segment or Reach	Existing Feet	Mitigation Type	Approach	Linear Footage	Stationing*
Big Warrior Creek	450	EII	PIII	450	0+00 to 4+50
Big Warrior Creek	6,735	R	PII	6,550	4+50 to 70+00
Mountain Creek	2,415	R	PII	2,500	0+00 to 25+00
Unnamed Tributary	1,435	R	PII	1,500	0+00 to 15+00

*Per 2005 As-Built Plan (CDM 2005).

R = Restoration

EI = Enhancement

EII = Enhancement II

S = Stabilization

PI = Priority I

PII = Priority II

PIII = Priority III

SS = Stream Bank Stabilization

Table 2: 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	September 2002
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	September 2007	November 2007
Year 4 Monitoring	Fall 2008	October 2008	December 2008
Year 5 Monitoring	Fall 2009	December 2009	December 2009

Table 3: Project Contacts Table

Big Warrior Creek EEP Project Number 00412	
Activity or Report	Actual Completion or Delivery
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 Mike Granson 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
2006 Monitoring Performers Monitoring POC	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 919-461-1100 Kathleen McKeithan 919-461-1597
2007 Monitoring Performers Monitoring POC	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 919-461-1100 Kathleen McKeithan 919-461-1597

2008 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
2009 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 4: Project Attribute 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. 4 sites evaluated: Mountain Tributary, Basin Creek, Joe's Creek, and Richland Creek
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

Appendix C: Vegetation Assessment Data

Appendix C-I: Vegetation Monitoring Plot Photos



VP1



VP2



VP4



VP6



VP7



VP8



VP9



VP11



VP13



VP15



VP19



VP25



VP26



VP28



VP29



VP30

Appendix C-II: Vegetation Data Tables

Table 5: Vegetation Metadata Table

Report Prepared By	Susan Shelingoski
Date Prepared	12/21/2009 10:43
Database Name	URS-2009-C.mdb
Database Location	C:\Documents and Settings\susan_shelingoski\MyDocuments\PROJECT FILES\Monitoring
Computer Name	RDUXPL160
File Size	65703936
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	412
Project Name	Big Warrior Creek
Description St	ream Restoration
River Basin	Yadkin River
Length(ft) l	0,698
Stream-to-Edge Width (ft)	10
Area (sq m)	14.7 acres
Required Plots (calculated)	16
Sampled Plots	16

Table 6: Stem Count Total and Planted by Plot and Species

EEP Project Code 92715. Project Name: Big Warrior Creek

			Current Plot Data (MY5 2009)																										
Scientific Name	Common Name	Species Type	92715-01-0001			92715-01-0002			92715-01-0006			92715-01-0007			92715-01-0008			92715-01-0009			92715-01-0011			92715-01-0013			92715-01-0015		
			P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
Acer rubrum	red maple	Tree																											
Alnus serrulata	hazel alder	Shrub Tree					1	1										1	1		1	1					2	2	
Betula lenta	sweet birch	Tree																											
Betula nigra	river birch	Tree																											
Carya	hickory	Tree																											
Cephalanthus occidentalis	common buttonbush	Shrub Tree																											
Cercis canadensis	eastern redbud	Shrub Tree								1	1																		
Cornus amomum	silky dogwood	Shrub		1	1								6	6					1	1		2	2						
Cornus florida	flowering dogwood	Shrub Tree																										1	
Fraxinus pennsylvanica	green ash	Tree																											
Hamamelis virginiana	American witchhazel	Shrub Tree																	1	4									
Juglans nigra	black walnut	Tree		3	3														2	2							1	1	
Lindera benzoin	northern spicebush	Shrub Tree											1	1															
Liriodendron tulipifera	tuliptree	Tree		5	5		2	2													3	12							
Nyssa sylvatica	blackgum	Tree																							1	1			
Oxydendrum arboreum	sourwood	Shrub Tree																											
Physocarpus opulifolius	common ninebark	Shrub		2	2																						2	2	
Pinus taeda	loblolly pine	Tree																											
Pinus virginiana	Virginia pine	Tree																									8		
Platanus occidentalis	American sycamore	Tree					2	2		1	1				1	1					6	6						17	
Prunus	plum	Shrub Tree																											
Prunus serotina	black cherry	Shrub Tree																											
Rhus glabra	smooth sumac	Shrub Tree																											
Salix nigra	black willow	Tree																											
Sambucus canadensis	Common Elderberry	Shrub Tree																											
Ulmus americana	American elm	Tree																											
Unknown		unknown								1	1																		
Stem count			0	11	11	0	5	5	0	3	3	0	7	7	0	1	1	0	5	8	0	12	29	0	2	2	0	5	23
size (ares)			1			1			1			1			1			1			1			1					
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02					
Species count			0	4	4	0	3	3	0	3	3	0	2	2	0	1	1	0	4	4	0	4	5	0	2	2	0	3	5
Stems per ACRE			0	445.2	445.2	0	202.3	202.3	0	121.4	121.4	0	283.3	283.3	0	40.47	40.47	0	202.3	323.7	0	485.6	1174	0	80.94	80.94	0	202.3	930.8

EEP Project Code 92715. Project Name: Big Warrior Creek

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2009)															Annual Means															
			92715-01-0019			92715-01-0025			92715-01-0026			92715-01-0028			92715-01-0029			92715-01-0030			MY5 (2009)			MY4 (2008)			MY3 (2007)			MY2 (2006)			
			P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	
Acer rubrum	red maple	Tree																					1									1	
Alnus serrulata	hazel alder	Shrub Tree		5	5																	11	11		10	24		11	35		12	18	
Betula lenta	sweet birch	Tree																								13							
Betula nigra	river birch	Tree					3	8					4	14					1	1		8	23		7	57		7	67		7	41	
Carya	hickory	Tree																														1	
Cephalanthus occidentalis	common buttonbush	Shrub Tree																														1	
Cercis canadensis	eastern redbud	Shrub Tree																	1	1		1	1		2	2		3	4				
Cornus amomum	silky dogwood	Shrub					1	1														11	11		13	13		16	21		17	18	
Cornus florida	flowering dogwood	Shrub Tree																					1										
Fraxinus pennsylvanica	green ash	Tree															1						1					3	7		6	10	
Hamamelis virginiana	American witchhazel	Shrub Tree																				1	4										
Juglans nigra	black walnut	Tree					1	3														7	9		6	6		15	32		20	22	
Lindera benzoin	northern spicebush	Shrub Tree																				1	1					1	1				
Liriodendron tulipifera	tuliptree	Tree														2	2					12	21		16	35		15	61		17	25	
Nyssa sylvatica	blackgum	Tree																				1	1								2	2	
Oxydendrum arboreum	sourwood	Shrub Tree																					10			60						9	
Physocarpus opulifolius	common ninebark	Shrub												5								4	9		9	10		12	12		11	12	
Pinus taeda	loblolly pine	Tree																					6			4							
Pinus virginiana	Virginia pine	Tree																					8									4	
Platanus occidentalis	American sycamore	Tree					3	3		6	6						1	1					20	37		19	55		19	49		19	46
Prunus	plum	Shrub Tree																														7	
Prunus serotina	black cherry	Shrub Tree																														1	
Rhus glabra	smooth sumac	Shrub Tree																					1										
Salix nigra	black willow	Tree					1	1		2	2						1	1					4	4		4	15		7	12		7	15
Sambucus canadensis	Common Elderberry	Shrub Tree																					1										
Ulmus americana	American elm	Tree																														1	
Unknown	unknown	unknown															13					1	14										
Stem count			0	5	5	0	9	16	0	8	8	0	4	19	0	2	2	0	3	17	0	82	156	0	86	236	0	108	377	0	123	238	
size (ares)			1			1			1			1			1			16			16			15.98			15.98						
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.40			0.40			0.39			0.39						
Species count			0	1	1	0	5	5	0	2	2	0	1	2	0	2	2	0	2	4	0	13	16	0	10	15	0	11	15	0	13	19	
Stems per ACRE			0	202.3	202.3	0	364.2	647.5	0	323.7	323.7	0	161.9	768.9	0	80.94	80.94	0	121.4	688	0	207.4	394.6	0	217.5	596.9	0	273.5	954.7	0	311.5	602.7	

Appendix D: Stream Assessment Data

Appendix D-I: Stream Photo Station Photos



PS1 facing upstream PS2



facing upstream



PS3 facing upstream PS4



facing upstream



PS5 facing upstream PS6



facing upstream



PS7 facing upstream PS8



facing downstream



PS9 facing upstream PS10



facing upstream



PS11 facing upstream PS12



facing downstream



PS13 facing upstream PS14



facing upstream



PS15 facing upstream PS16



facing right bank



PS17 facing right bank



PS18 facing left bank



PS19 facing upstream PS20



facing upstream



PS21 facing upstream PS22



facing upstream



PS23 facing upstream PS24



facing downstream



PS25 facing upstream PS26



facing upstream



PS27 facing downstream PS28



facing upstream



PS29 facing upstream PS30



facing upstream



PS31 facing downstream PS32



facing upstream



PS33 facing upstream

Appendix D-II: Stream Data Tables

Table 7: Visual Morphological Stability Assessment

Big Warrior Creek (7,185 ft) 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	Present? 40		41	1	98	
	Armor stable (no displacement)?	41	41	0	100	
	Facet grade appears stable?	41	41	0	100	
	Minimal evidence of embedding/fining?	40	41	1	98	
	Length appropriate?	41	41	0	100	
						99
B. Pools	Present (not subject to severe aggrad. or migration)?	55	56	1	98	
	Sufficiently deep (max pool D:mean Bkf>1.6)	56	56	0	100	
	Length appropriate?	56	56	0	100	
						99
C. Thalweg	Upstream of meander bend (run/inflection) centering?	54	56	2	96	
	Downstream of meander (glide/inflection) centering?	54	56	2	96	
						96
D. Meanders	Outer bend in state of limited/controlled erosion?	53	56	3	95	
	Of those eroding, # w/concomitant point bar formation?	0	N/A	N/A	N/A	
	Apparent Rc within spec?	56	56	0	100	
	Sufficient floodplain access and relief?	53	56	3	95	
						97
E. Bed General	General channel bed aggradation areas (bar formation)	N/A	N/A	1/400	94	
	Channel bed degradation–areas of increasing downcutting/headcutting? N/A		N/A	N/A	N/A	
						94
F. Bank	Actively eroding, wasting, or slumping bank	N/A	N/A	10/200	97	
						97
G. Vanes	Free of back or arm scour?	84	89	5	94	
	Height appropriate?	84	89	5	94	
	Angle and geometry appear appropriate?	84	89	5	94	
	Free of piping or other structural failures?	84	89	5	94	
						94
H. Wads/ Boulders	Free of scour?	60	71	N/A	85	
	Footing stable?	60	71	N/A	85	
						85

**Mountain Creek (2,640 ft)
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	Present? 23		25	2	92	
	Armor stable (no displacement)?	23	25	2	92	
	Facet grade appears stable?	23	25	2	92	
	Minimal evidence of embedding/fining?	25	25	0	100	
	Length appropriate?	25	25	0	100	
						95
B. Pools	Present (not subject to severe aggrad. or migration)?	29	31	2	94	
	Sufficiently deep (max pool D:mean Bkf >1.6)	31	31	0	100	
	Length appropriate?	31	31	0	100	
						98
C. Thalweg	Upstream of meander bend (run/inflection) centering?	29	31	2	94	
	Downstream of meander (glide/inflection) centering?	29	31	2	94	
						94
D. Meanders	Outer bend in state of limited/controlled erosion?	29	31	2	94	
	Of those eroding, # w/concomitant point bar formation?	1	N/A	N/A	N/A	
	Apparent Rc within spec?	31	31	N/A	100	
	Sufficient floodplain access and relief?	29	31	2	94	
						96
E. Bed General	General channel bed aggradation areas (bar formation)	N/A	N/A	1/225	98	
	Channel bed degradation--areas of increasing downcutting/headcutting?	N/A	N/A	0	100	
						99
F. Bank	Actively eroding, wasting, or slumping bank	N/A	N/A	710	73	
						73
G. Vanes	Free of back or arm scour?	10	15	5	67	
	Height appropriate?	14	15	1	93	
	Angle and geometry appear appropriate?	15	15	0	100	
	Free of piping or other structural failures?	14	15	1	93	
						88
H. Wads/ Boulders	Free of scour?	20	21	1	95	
	Footing stable?	20	21	1	95	
						95

Unnamed Tributary (1,506 ft) 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	Present? 15		15	0	100	
	Armor stable (no displacement)?	15	15	0	100	
	Facet grade appears stable?	15	15	0	100	
	Minimal evidence of embedding/fining?	15	15	0	100	
	Length appropriate?	15	15	0	100	
						100
B. Pools	Present (not subject to severe aggrad. or migration)?	15	15	0	100	
	Sufficiently deep (max pool D:mean Bkf >1.6)	15	15	0	100	
	Length appropriate?	15	15	0	100	
						100
C. Thalweg	Upstream of meander bend (run/inflection) centering?	15	15	0	100	
	Downstream of meander (glide/inflection) centering?	15	15	0	100	
						100
D. Meanders	Outer bend in state of limited/controlled erosion?	15	15	0	100	
	Of those eroding, # w/concomitant point bar formation?	15	N/A	N/A	N/A	
	Apparent Rc within spec?	15	15	0	100	
	Sufficient floodplain access and relief?	15	15	0	100	
						100
E. Bed General	General channel bed aggradation areas (bar formation)	N/A	N/A	0	100	
	Channel bed degradation—areas of increasing downcutting/headcutting? N/A		N/A	N/A	N/A	
						100
F. Bank	Actively eroding, wasting, or slumping bank	N/A	N/A	0	100	
						100
G. Vanes	Free of back or arm scour?	9	9	N/A	100	
	Height appropriate?	9	9	N/A	100	
	Angle and geometry appear appropriate?	9	9	N/A	100	
	Free of piping or other structural failures?	9	9	N/A	100	
						100
H. Wads/ Boulders	Free of scour?	11	11	N/A	100	
	Footing stable?	11	11	N/A	100	
						100

Table 8: 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
9/13/2007	January 1, 2007	Proximal USGS Gage Resource
10/27/08	Late August 2008	Proximal USGS Gage Resource
10/1/2009	Early January 2009	Proximal USGS Gage Resource

Appendix D-III: Cross Section Photos and Plots

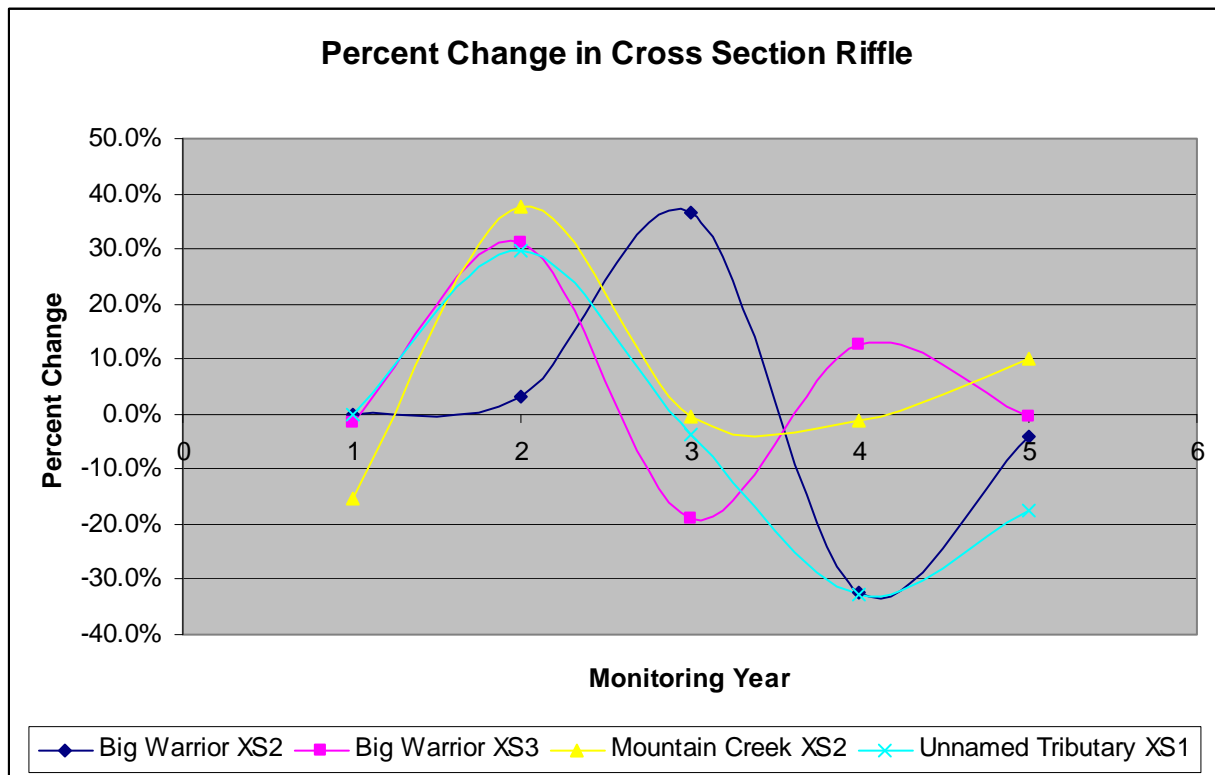
Table 9 summarizes the changes in pins each year. With the exception of Big Warrior's XS 1 in 2006 and Mountain Creek's XS 1 in 2009, at least one pin has been found each year through the course of monitoring.

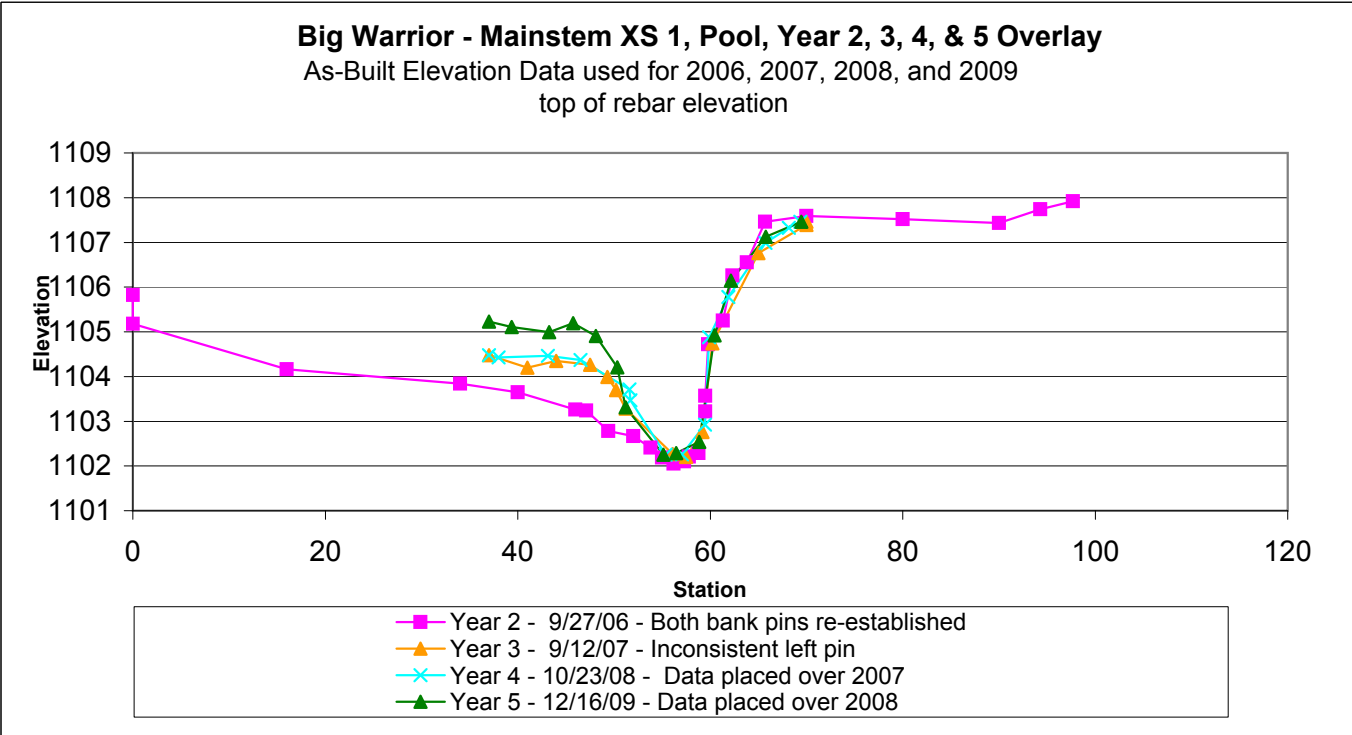
Table 9: Cross Section Pin Change Summary

Big Warrior Creek EEP Project Number 00412		
Reach ID	Cross Section	Description of Change
Big Warrior	XS1	2006: Both pins reestablished 2007: Inconsistent left pin
Big Warrior	XS3	2006: Right pin reestablished 2008: Right pin reestablished 2009: Left pin not found
Big Warrior	XS4	2006: Right pin reestablished
Mountain Creek	XS1	2006: Left pin reestablished 2009: Severe erosion, neither pin found

Figure 5 summarizes the percent changes in each riffle cross section monitored. The peaks and valleys beginning to reduce in size by monitoring year (remaining closer to zero) reveals a stabilizing trend as shown in each riffle cross section on-site.

Figure 5: Percent Change in Cross Section Riffle

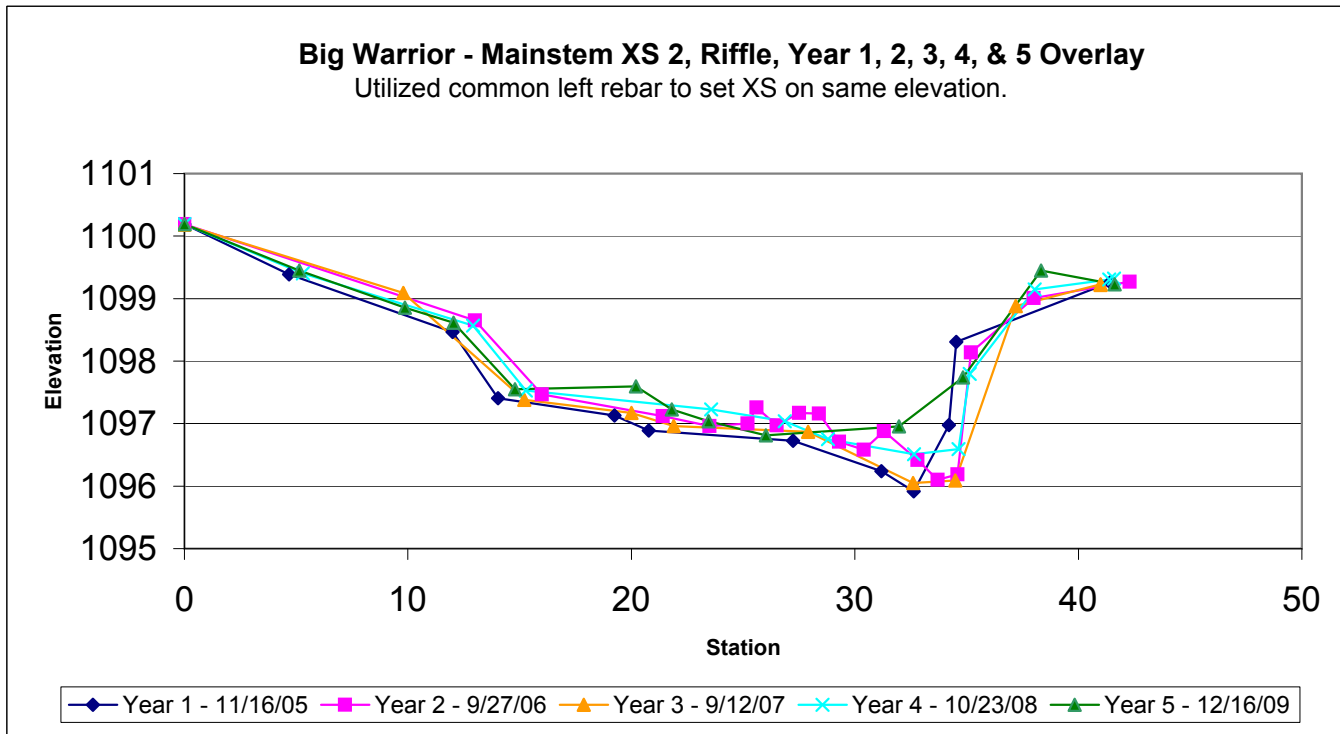




Facing Left Bank



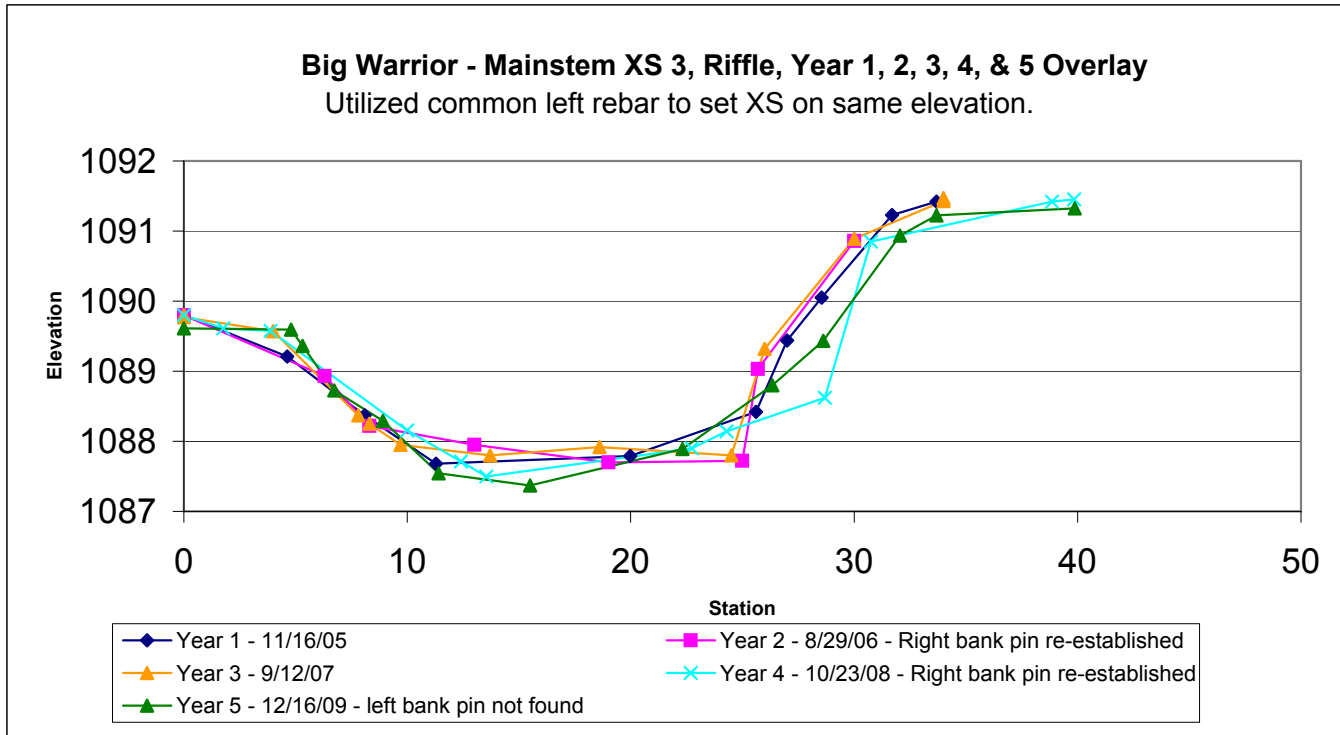
Facing Right Bank



Facing Left Bank



Facing Right Bank



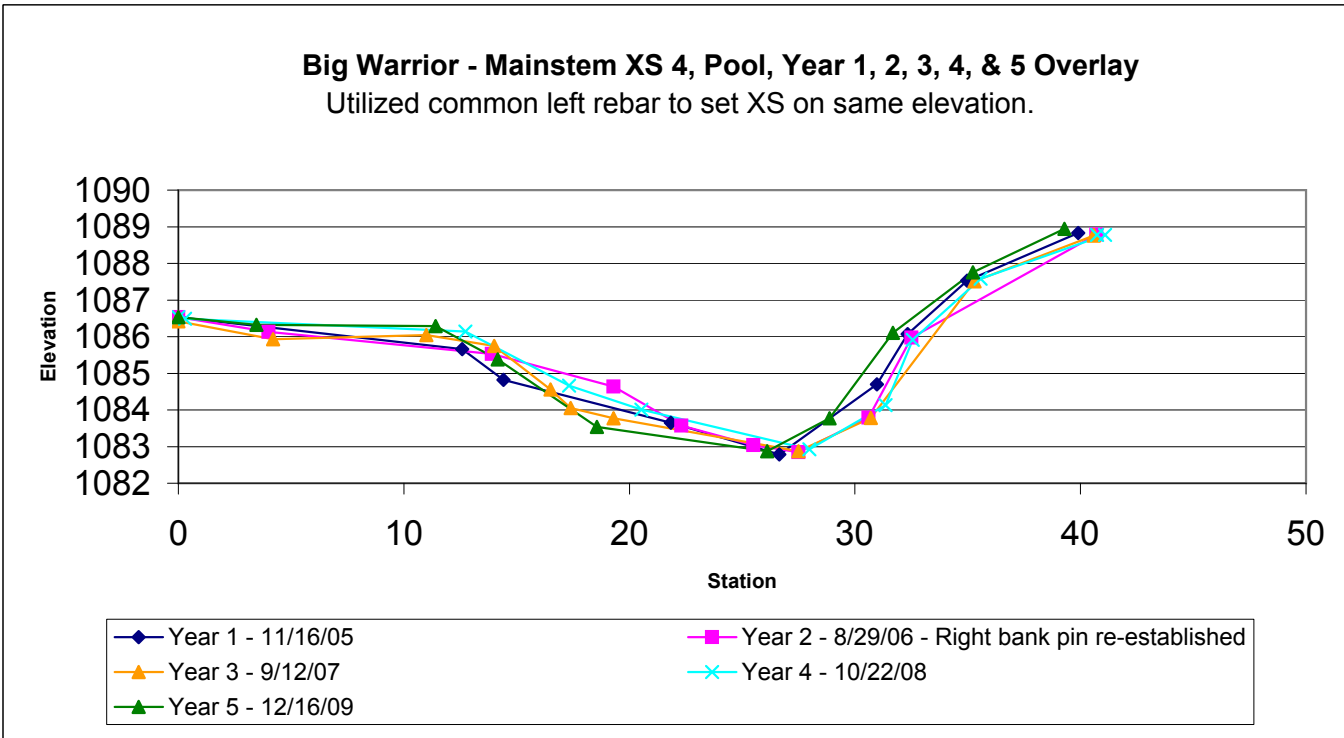
Facing Left Bank



Facing Right Bank

Big Warrior - Mainstem XS 4, Pool, Year 1, 2, 3, 4, & 5 Overlay

Utilized common left rebar to set XS on same elevation.



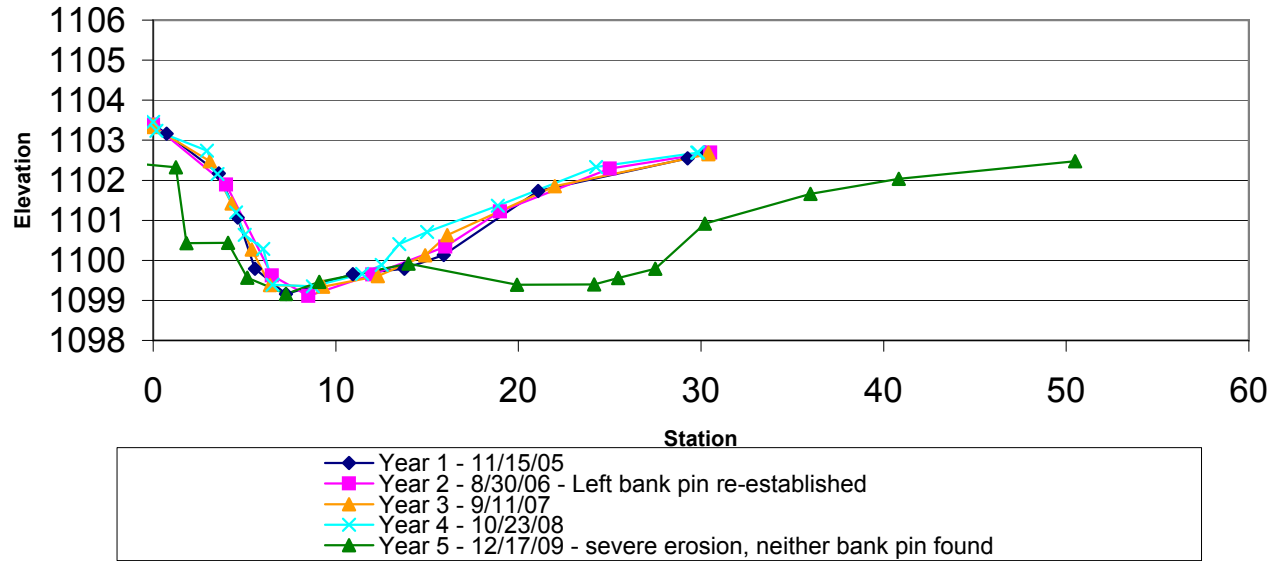
Facing Left Bank



Facing Right Bank

Big Warrior - Mountain Creek XS 1, Pool, Year 1, 2, 3, 4, & 5 Overlay

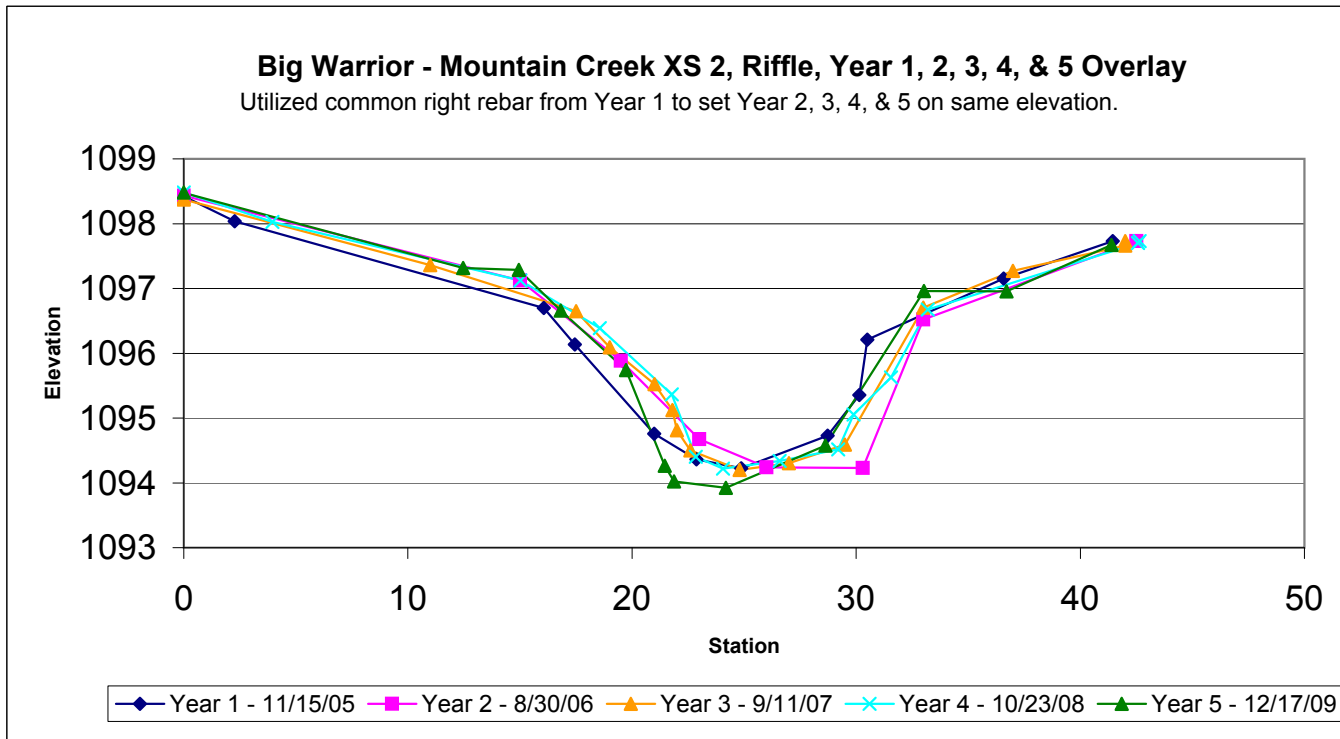
Utilized common right rebar from Year 1 to set Year 2, 3, 4, & 5 on same elevation. Severe bank erosion in 2009 - Right pin not located. Replaced on new top of bank.



Facing Left Bank



Facing Right Bank



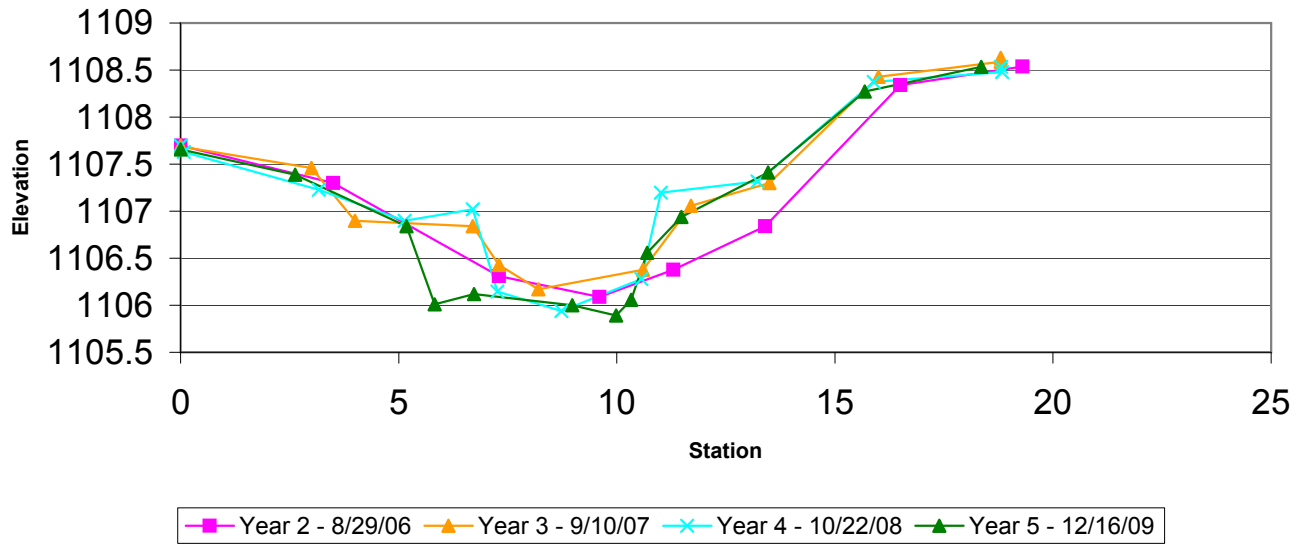
Facing Left Bank



Facing Right Bank

Big Warrior - Unnamed Trib XS 1, Riffle, Year 2, 3, 4, & 5 Overlay

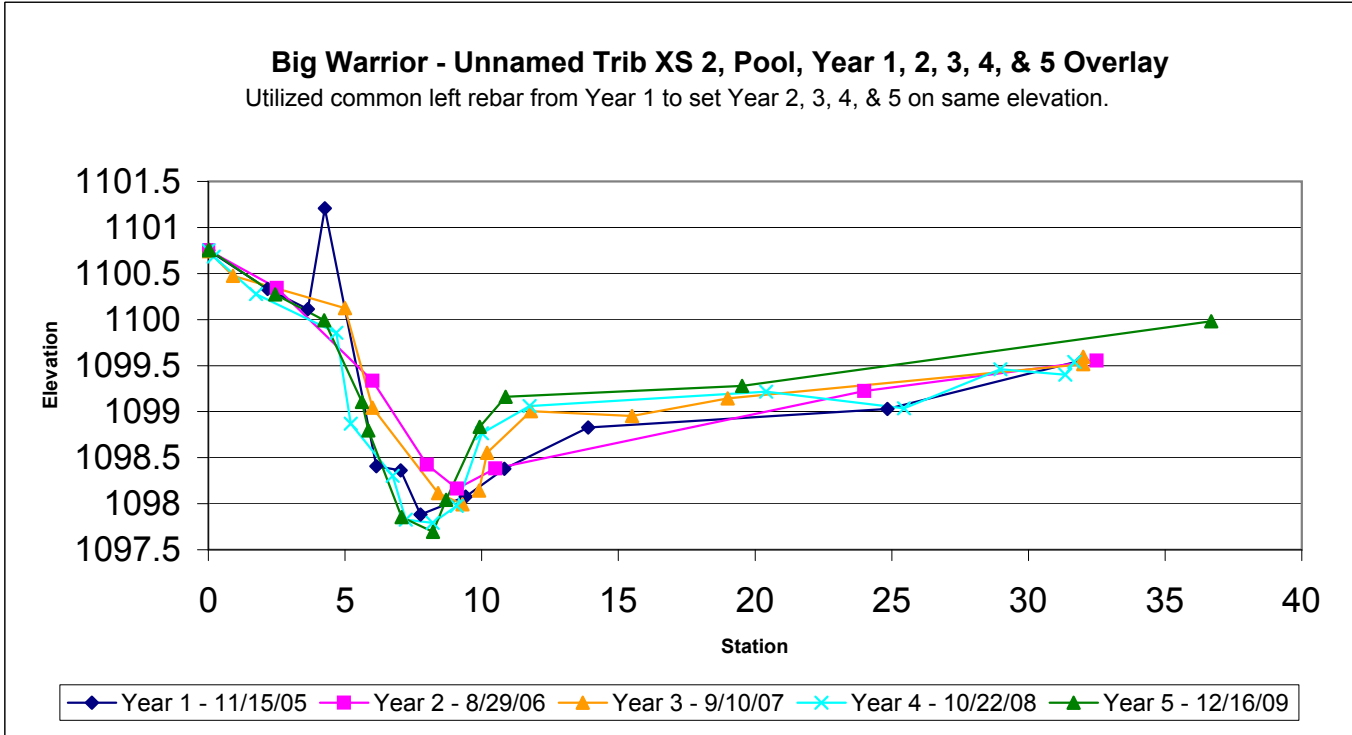
Utilized common left rebar to set Year 2, 3, 4, & 5 on same elevation.



Facing Left Bank



Facing Right Bank



Facing Left Bank



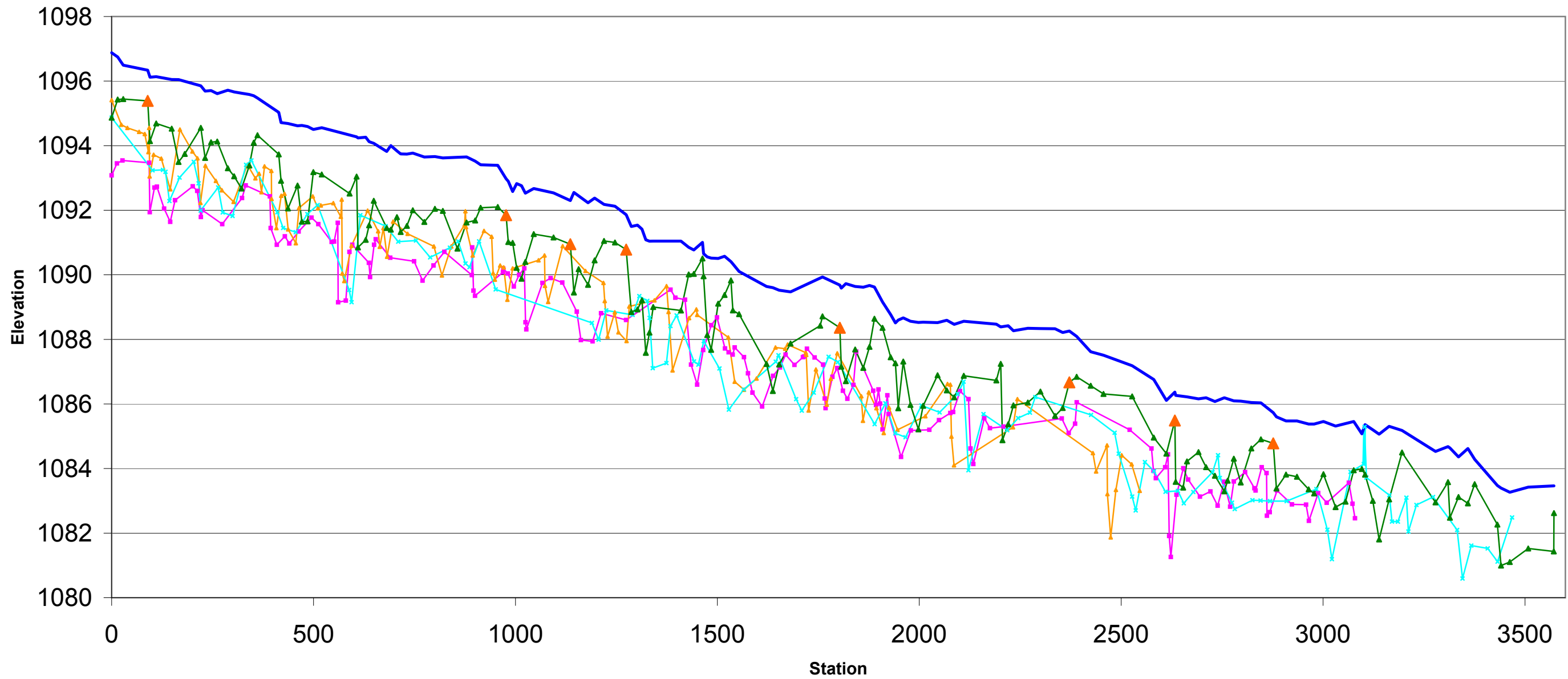
Facing Right Bank

Appendix D-IV: Longitudinal Profile Plot

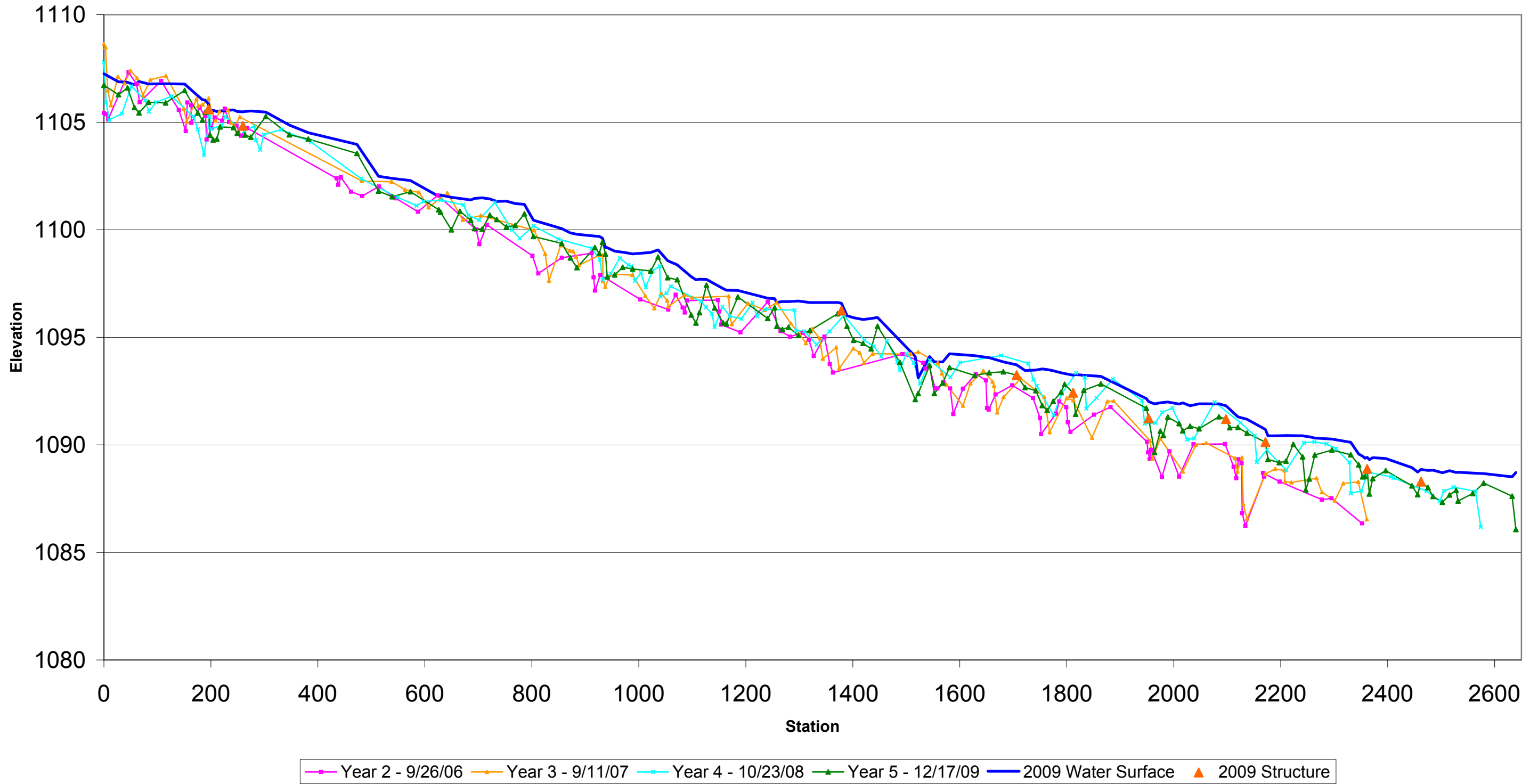
Big Warrior - Mainstem, Year 2, 3, 4, & 5 Overlay

Surveyed 3000 ft per EEP protocol

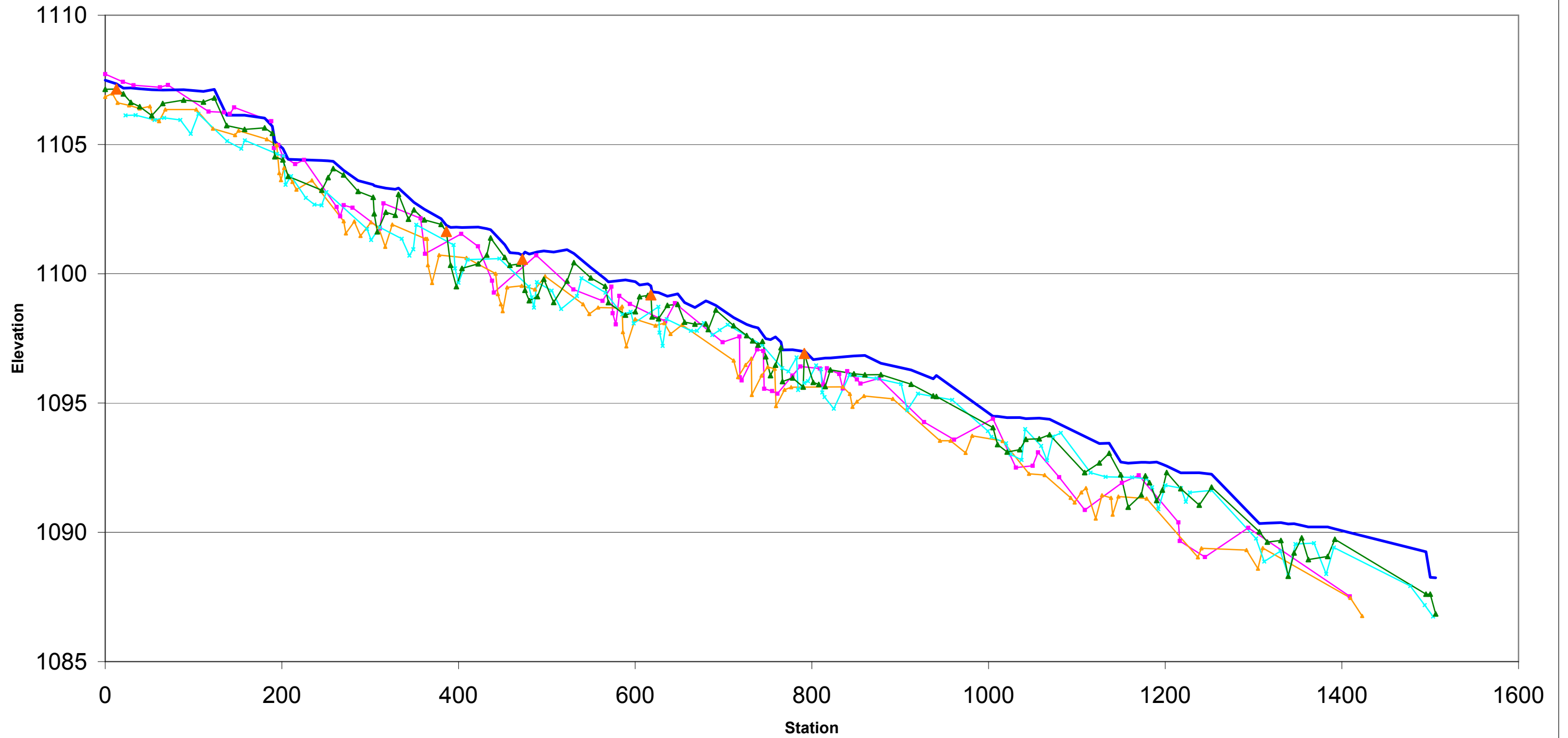
Set downstream-most point of 2005 survey to the 2008 downstream-most culvert reading.



Big Warrior - Mountain Creek, Year 2, 3, 4, & 5 Overlay



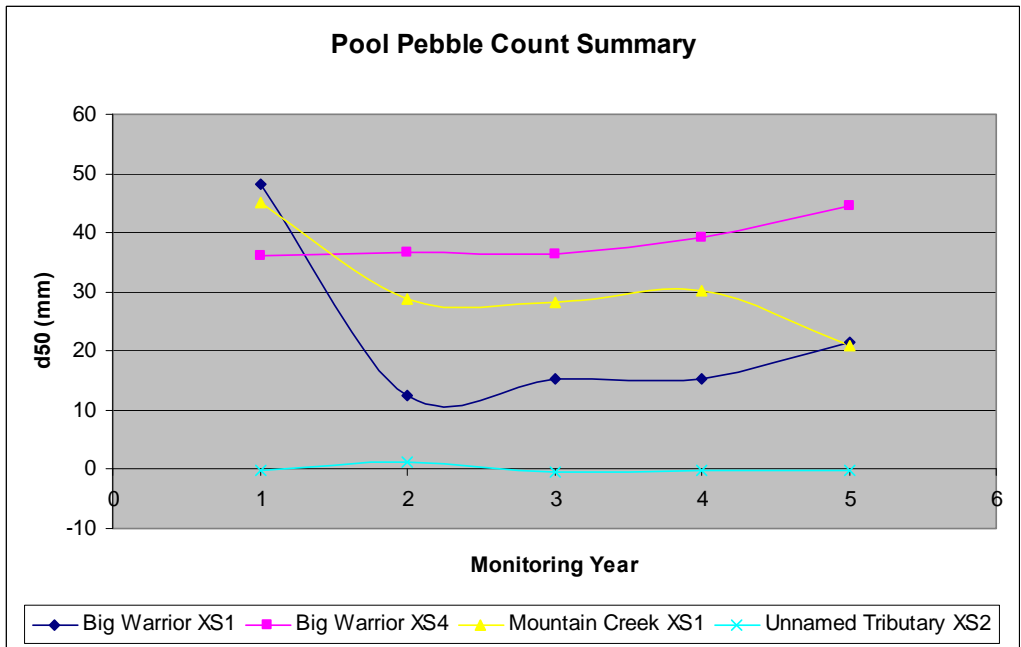
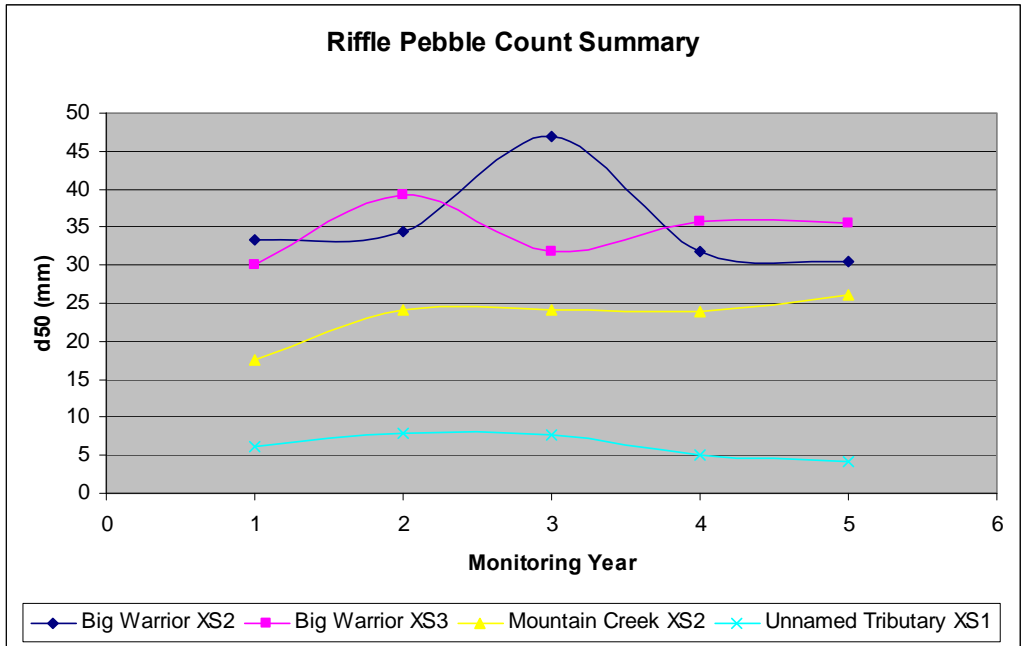
Big Warrior - Unnamed Trib, Year 2, 3, 4, & 5 Overlay



Year 2 - 8/30/06 Year 3 - 9/10/07 Year 4 - 10/22/08 Year 5 - 12/16/09 2009 Water Surface 2009 Structure

Appendix D-V: Pebble Count Frequency Distribution Plots

Figure 6: Pebble Count Summaries



In a riffle cross section, a stable system is indicated by a d50 maintaining or increasing. Maintaining a d50 indicates the riffles are not filling with sediment and pools are not moving into the reach. Fining of the riffle's bed material is not shown in Big Warrior's cross sections. In a pool cross section, the bed material in a stable system typically remains small. The pool's bed material is not getting significantly larger, even the slight increase in Big Warrior's XS4 bed material is not seen as significant.

