Stonebridge Stream Mitigation Project

Year 1 Monitoring Report

Prepared for
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1.0 SUMMARY

The Stonebridge Stream Mitigation Project site is located in Moore County, North Carolina, north of the town of Carthage within hydrologic unit 03030003 in the Cape Fear River Basin. This project was identified by EBX-Neuse I, LLC (EBX) as having potential to help meet the compensatory mitigation requirements of the NC Department of Transportation (NC DOT). NC DOT contracted EBX to perform the mitigation work under Full Delivery Project S-1. A total of 6,120 stream mitigation units (SMU) were generated from this project through stream restoration. All restoration is being monitored for five years to document success. Baseline data on stream morphology and vegetation were collected immediately after construction and planting were complete. This information is documented in the *As-Built Report* dated April 27, 2006. The As-Built survey is included as Appendix A of this report. Information on stream morphology and vegetation will be collected each year and compared to the baseline data and data from previous monitoring years.

This report details the monitoring data collected during Monitoring Year 1. WK Dickson (WKD) staff collected vegetation and stream morphology data for the Stonebridge monitoring site throughout 2006. Collected data included: monthly crest gauge readings, monthly observations of current conditions, vegetation monitoring, benthic macroinvertebrate survey, cross section survey, digital images, and observations of potential problems with stream stability.

The vegetation is generally surviving well, but two of twelve vegetation plots (plots four and five) had notable mortality. There have been at least three out-of-bank or bankfull events since the project was constructed. The stream morphology is stable and very little fluvial erosion was observed.

Overall, the project objectives are being met. Fish were observed all along the UT-1 restoration reach. Habitat has been improved significantly throughout the project. Based on initial observations, the buffer vegetation is expected to succeed and provide riparian habitat, water quality benefits, and cover for the stream system. No remedial action is required at this time.

2.0 INTRODUCTION

2.1 Location and Setting

The project site is located in Moore County, North Carolina, north of the town of Carthage (Figure 1 & Figure 2) within hydrologic unit 03030003 in the Cape Fear River Basin. The project site is accessed from the west via Glendon-Carthage Road. The 1,196 acre parcel has been used for agricultural purposes as a cow/calf operation. The surrounding area is rural, covered with a mix of farms, woods and modest homesites.

2.2 Project Structure, Mitigation Type, Approach and Objectives

This project was identified by EBX-Neuse I, LLC as having potential to help meet the compensatory mitigation requirements of the NC Department of Transportation (NCDOT) as solicited through the NCDOT Full Delivery Project S-1. The objective of this project is to provide at least 5,556 stream mitigation units (SMU) to the NC DOT through the full delivery process. The mitigation units are to be accomplished through the restoration and

enhancement of stream and riparian habitats as defined in the inter-agency Stream Mitigation Guidelines (USACE, 2003).

Two unnamed tributaries to Crawley Creek flow across the project site. The streams are referred to in this report as UT-1 and UT-2. Prior to implementation of the mitigation plan, the streams were in a disturbed condition due to the impacts of unrestricted cattle access, dredging, and other anthropic channel manipulations. UT-1 was the most degraded resource and was the focus of restoration efforts. A total of 5,556 mitigation units were achieved by restoring plan form, cross section, and profile features on UT-1. This number is derived from the as-built survey of 5,676 linear feet of restored stream length minus 70 feet for a crossing reservation near the middle of the project and minus another 50 feet adjacent to the culvert at the downstream end of the project.

UT-2 was similarly degraded and flows east-southeast from a small dam, entering UT-1 near the center of the project area. The design for this small tributary yielded an additional 564 linear feet of restored stream. The total SMU's generated from stream restoration on UT-1 and UT-2 are 6,120. All mitigation objectives are summarized in Table 1.

Table 1. Project Mitigation Structure and Objectives

Project Segment	Mitigation Type	Approach	Linear Footage or Acreage	SMU	Stationing	Comment
UT-1	Restoration	P1, CE, BP	5,556 LF	5,556	0+00 – 56+75	
UT-2	Restoration	P1, CE, BP	564 LF	564	0+00 – 5+64	
Total			**6,120 LF**	**6,120**		

PP = Planform and Profile CE = Cattle Exclusion BP = Buffer Planting

2.3 Project History and Background

This project was identified by EBX in the Spring of 2003. The following three tables outline project history and milestones (Table 2), contacts (Table 3), and background information (Table 4).

Table 2. Project History and Milestones

Activity or Report	Completion or Delivery
Mitigation Plan	June-05
Final Design	December-05
Construction	February-06
Vegetation Planting	March-06
As-built (Baseline) Report	April-06
Year 2 Monitoring	November-06
Year 2 Monitoring	November -07 (Scheduled)
Year 3 Monitoring	November -08 (Scheduled)
Year 4 Monitoring	November -09 (Scheduled)
Year 5 Monitoring	November -10 (Scheduled)

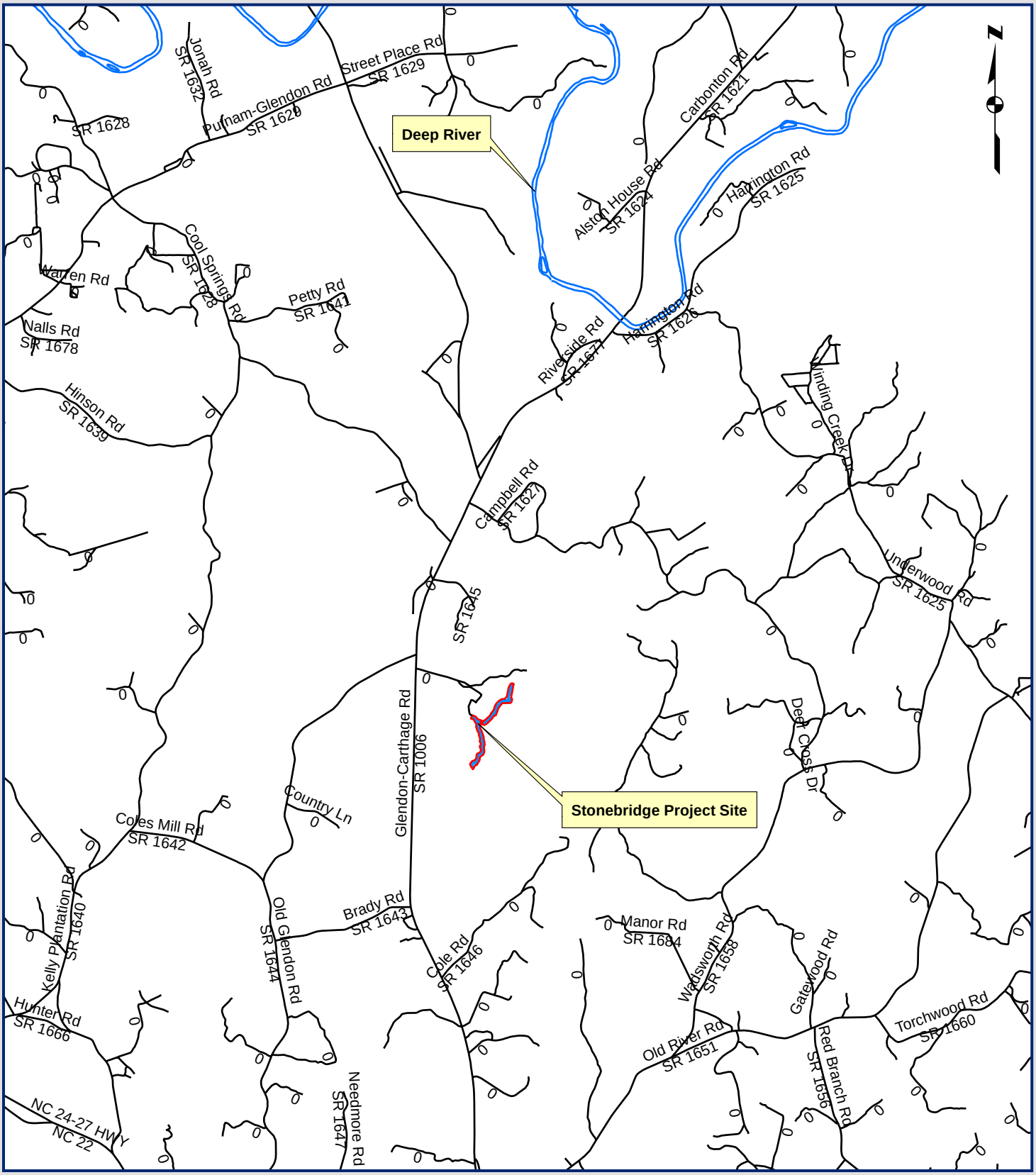
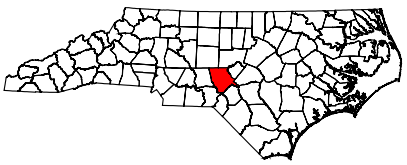


Figure 1.
Stonebridge Stream Mitigation Site
Project Location Map
Moore County, NC

1 inch equals 1 miles



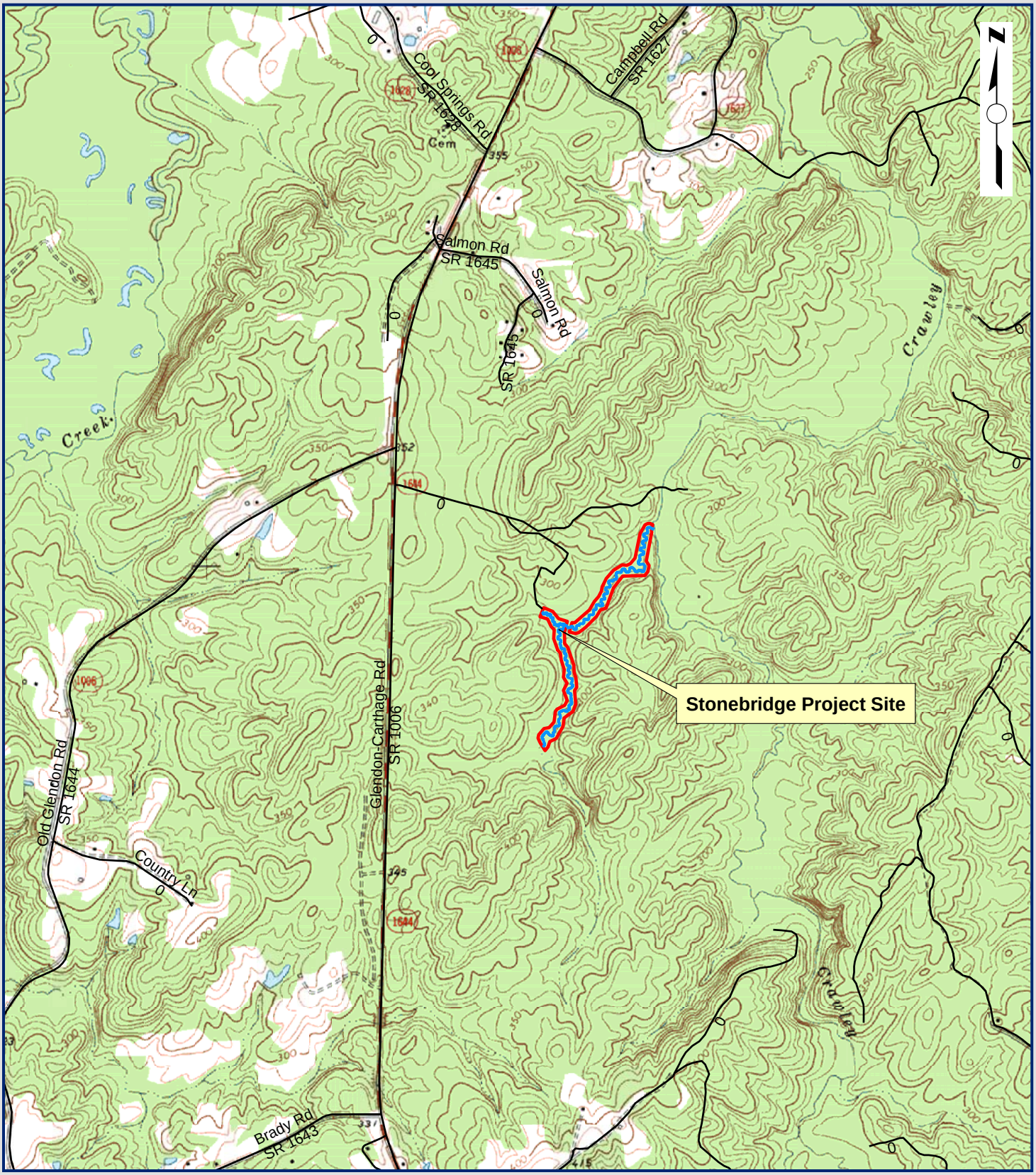


Figure 2.
Stonebridge Stream Mitigation Site
USGS Topographic Map
Moore County, NC

1 inch equals 2,000 feet

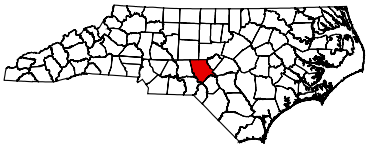


Table 3. Project Contacts

Project Manager Norton Webster	EBX-Neuse 1, LLC (919) 608-9688
Designer Michael Ellison	WK Dickson and Co., Inc. (919) 782-0495
Monitoring Contractor Daniel Ingram	WK Dickson and Co., Inc. (919) 782-0495

Table 4. Project Background Table

Project County	Moore
Drainage Area	UT-1-688 ac., UT-2-182 ac., UT-3-189 ac.
Drainage Impervious Cover Estimate	< 10%
Stream Order	Second
Physiographic Region	Piedmont
Rosgen Classification of As-built	C4/E4
Dominant Soil Types	Congaree, Mooshaunee, Pinkston, Tetotum
Reference Site ID	NA
USGS HUC for Project and Reference	03030003
Any portion of project 303(d) listed?	No
Percent of project easement fenced	100%

2.4 Monitoring Plan View

Plan view drawings of the project site are provided in Figures 3a and 3b. The drawings include the appropriate information pertaining to monitoring of the project. These drawings show the locations of the following features:

- Bankfull channel limits
- Centerline of channel
- Easement boundary
- Fencing
- Road crossings
- Root wads
- Log vanes
- Cuttings bundles
- Channel plugs
- Log toe protection
- Riffle grade control
- Cross weir structures
- Step pool structures
- Tributaries

The drawings show locations of monitoring activities as well. These include:

- Cross sections survey locations
- Crest gage locations
- Vegetation plots
- Benthic macroinvertebrate monitoring locations

3.0 VEGETATION ASSESSMENT

3.1 Vegetation Monitoring Plan

All vegetation was planted in March 2006 after construction was complete. Bare root native tree and shrub species were planted to establish forested riparian buffers of at least fifty feet on both sides of the restored stream. The plants were selected to establish vertical habitat structure and a diverse mix of species. The planted area consists of two zones. The first is a wetter zone predominantly consisting of moist soil species such as green ash (*Fraxinus pennslyvanica*), ironwood (*Carpinus caroliniana*), and elderberry (*Sambucus canadensis*). The second is a drier zone predominantly consisting of more mesic species such as yellow poplar (*Liriodendron tulipifera*) and Northern red oak (*Quercus rubra*). Black locust (*Robinia pseudo-acacia*) was planted as a nurse tree in the upland zone. The initial stocking of riparian plantings across the site was approximately 798 stems per acre. Total trees planted are included in Table 5. In addition to the riparian plantings, black willow (*Salix nigra*) cuttings bundles were installed on the outside of bends.

Fourteen 100 square meter vegetation sampling plots were established at the restoration site to monitor the success of riparian buffer vegetation. The locations of these plots were randomly distributed across the planted portions of the site. The plots cover approximately 2 percent of the site. The center of each plot is located with a ten-foot section of metal fence post with a white PVC cover. Each planted woody stem was located with a three-foot section of white PVC and identified with an aluminum tag. Total numbers of each species planted are listed in Table 5.

STONEBRIDGE STREAM MITIGATION SITE
OVERALL MONITORING PLAN VIEW

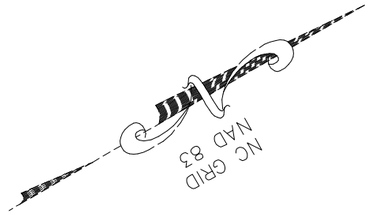


Figure 3a

100 50 0 100 200

SCALE (FT)

STONEBRIDGE STREAM MITIGATION SITE
OVERALL MONITORING PLAN VIEW

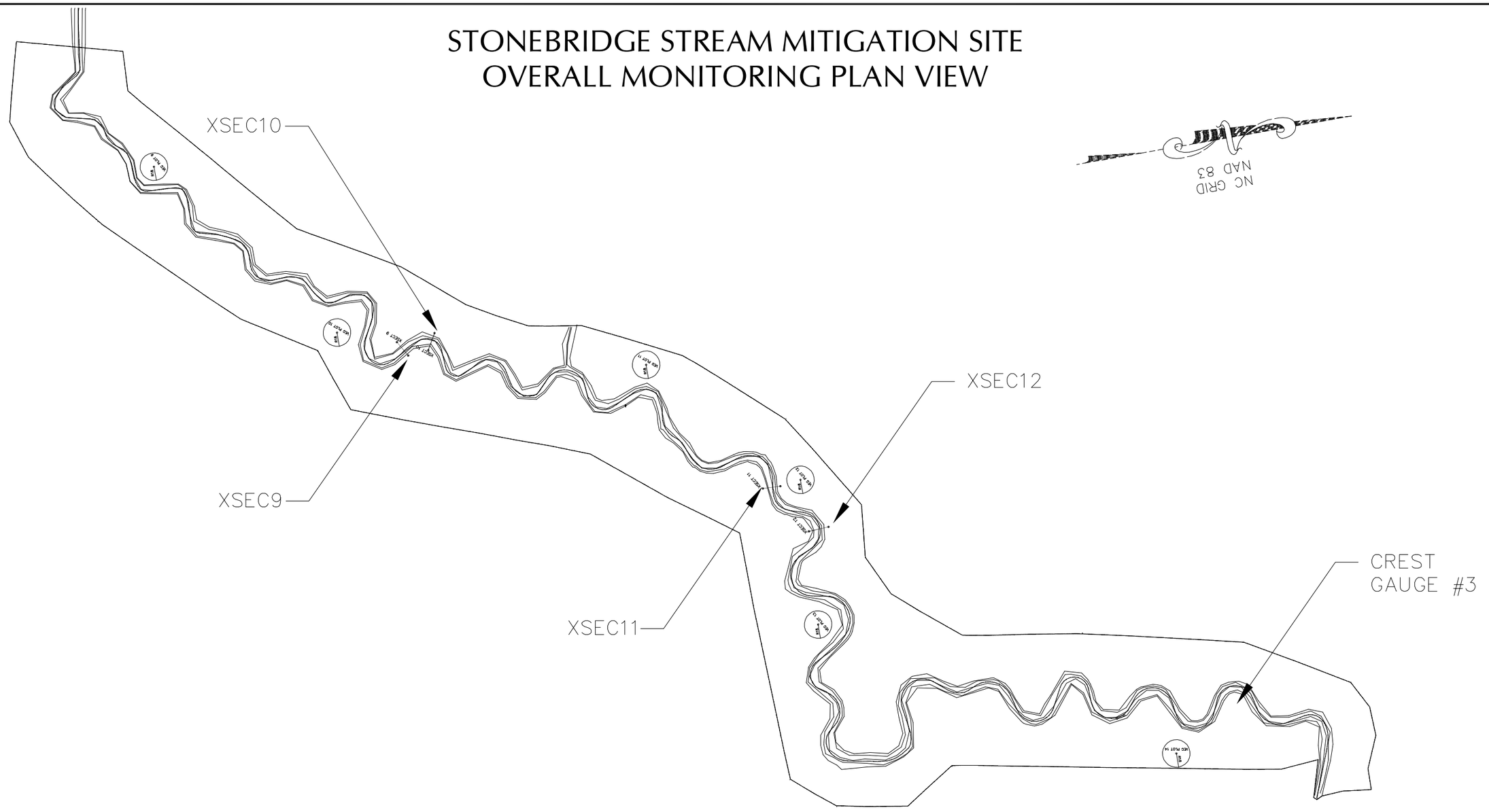


Figure 3b

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Table 5. Planted Trees per Plot and Per Acre

Plot #	Trees Planted per Plot	Trees Planted per Acre
Plot 1	16	663
Plot 2	20	829
Plot 3	21	871
Plot 4	16	663
Plot 5	24	995
Plot 6	29	1203
Plot 7	14	580
Plot 8	16	663
Plot 9	17	705
Plot 10	19	788
Plot 11	20	829
Plot 12	17	705
Plot 13	14	580
Plot 14	19	788
Average	**18.7**	**775.8**

Herbaceous and woody volunteer species noted are common old-field, disturbed site, and pasture weed species. Black willow (Salix nigra) cuttings bundles at meander bends were observed during monitoring set-up. Observations during the monitoring set-up indicated that ninety percent of the live stakes had notable sprouting and growth.

Planted woody species will be monitored twice per year each year for the first three years. Herbaceous plant cover will be monitored annually using the notched=boot method.

3.2 Results of Vegetation Monitoring - Year 1

All vegetation monitoring plots were evaluated for success (see results in Table 7) and the overall condition of vegetation at the site was assessed during October 2006. Very few problems with the vegetation were observed. The project has begun to grow a larger amount of herbaceous vegetation that consists of annual grasses and pasture grasses. Regeneration of the herbaceous cover should be monitored, but will likely fill in with native species. Conditions appear good for promoting herbaceous and planted tree seedling growth throughout most of the site. This herbaceous cover was found on approximately 94 percent of the site utilizing the notched-boot method. Volunteer species are not out-competing the planted community.

The most notable vegetation result is that the majority of yellow poplar and red oaks in two of the twelve vegetation plots (4 and 5) have not survived. There are several likely contributing factors to this mortality. These include drought conditions during the summer and an initial infestation of beetles that affected the yellow poplar. The lack of rainfall may have exacerbated the mesic conditions which would lead to desiccation of this moderately hydrophytic species. Vegetative plot 4 high mortality resulted from poor species selection, poor stock, and low planting density. Table 6 lists all problem areas with respect to vegetation identified within the project boundary. Photos of vegetation plots are included in Appendix D.

Table 6. Vegetation Problem Areas

Type of Problem	Location/ Station	Probable Cause	Photo ID
Mortality of Planted Woody Species	Vegetation Plot 4	Insects , human disturbance, dry conditions	VP 4
Mortality of Planted Woody Species	Vegetation Plot 5	Insects, dry conditions	VP 5

A plan view drawing of the vegetation problem areas is provided in Figures 4a and 4b on the following pages. The drawing includes the appropriate information pertaining to vegetation monitoring of the project. The drawing shows the locations of the following features:

- Vegetation monitoring plots
- Locations of any vegetation problem areas.
- Vegetation plot photo points
- Symbology to represent vegetative problem types

3.3 Stem Counts - Year 1

Stem counts were conducted at each monitoring plot during October 2006 to determine the success rates. Table 7 shows the number of each species of woody plants that were planted at the site and the success rate of those species. The range of surviving planted stems per acre after the first year was 20 to 71, and an average of 574 planted trees per acre surviving at the site. Photos of each vegetation plot were taken at the time of the stem counts. The photos are included in Appendix D.

Table 7. Vegetation Assessment Results

		Plots															
Common Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Total Obs.**	**TPA**	**% Comp.**
Green ash	2	1	0	2	2	3	0	1	0	3	2	0	2	1	19	54	9.45
Elderberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sweet Bay Magnolia	0	1	0	0	0	1	0	0	1	0	0	1	2	0	6	17	2.99
River birch	4	1	3	0	2	4	1	3	4	1	0	4	0	4	31	89	15.42
Sycamore	1	1	4	2	3	1	6	1	2	5	3	0	1	1	31	89	15.42
Yellow poplar	2	0	2	0	1	3	1	0	1	2	2	3	0	2	19	54	9.45
Black locust	3	1	2	0	2	0	0	0	1	0	0	1	1	1	12	34	5.97
Ironwood	0	3	4	2	1	1	0	3	4	0	1	0	0	1	20	57	9.95
Silky dogwood	0	3	4	1	3	7	2	3	3	1	4	3	5	2	41	117	20.4
Red Bud	0	1	0	0	0	0	1	1	0	2	2	0	0	3	10	29	4.98
No. Red oak	1	1	0	0	0	4	1	1	0	0	1	1	2	0	12	34	5.97
Total stems per plot:	**13**	**13**	**19**	**7**	**14**	**25**	**12**	**13**	**16**	**14**	**15**	**13**	**13**	**15**	**201**	**574**	**100**
Total stems per acre:	**37**	**37**	**54**	**20**	**40**	**71**	**34**	**37**	**46**	**40**	**43**	**37**	**37**	**43**	**AVG. 39**		
% Survival	**81**	**65**	**91**	**44**	**58**	**86**	**86**	**81**	**94**	**74**	**75**	**77**	**93**	**79**	**AVG. 77**		

4.0 STREAM MORPHOLOGY ASSESSMENT

4.1 Stream Morphology Monitoring Plan

Along UT-1 and UT-2 a natural channel design approach was applied to develop stable hydraulic geometry parameters. Construction began in October 2005 and was completed in February 2006. The rebuilding of the channel established stable cross-sectional geometry, increased plan form sinuosity, and restored streambed diversity to improve benthic habitat. Approximately 6,120 linear feet of stream restoration has been constructed.

Cross Sections

The mitigation plan for the Stonebridge Stream Mitigation Project requires twelve permanent cross sections to be monitored along the restored tributaries UT-1 and UT-2. The cross sections were established during monitoring set-up in evenly distributed pairs of one riffle and one pool per 1,000 linear feet of restored stream. Locations of cross sections are specified on Figures 3a and 3b. The cross section surveys and photographs are shown in Appendix B. Each cross section will be surveyed annually including measurements of

STONEBRIDGE STREAM MITIGATION SITE
VEGETATION PROBLEM AREAS PLAN VIEW

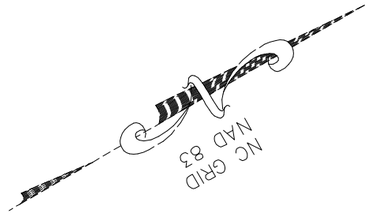

Figure 4

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floodplain, top of bank, bankfull, inner berm, edge of water, and thalweg. In addition, any fluvial features present will be documented.

Longitudinal Profile
Longitudinal profiles will be surveyed in years one, three, and five of the monitoring period. The cumulative length of the measured profiles will be at least 3,000 linear feet. Features measured will include thalweg, inverts of in-stream structures, water surface, bankfull and top of low bank.

Hydrology
Three crest gages were installed at the site: one on UT-1 near the downstream end of the project and one each on UT-2 and UT-1 immediately above the confluence (see locations on Figures 3a and 3b). Crest gages will be checked monthly to document high flows. During each visit, a determination will be made if an out-of-bank event has occurred since the prior visit. During the gage inspections, any high water marks will or debris lines will be documented and photographed.

4.2 Stream Morphology Monitoring Results- Year 1

Cross Sections
The cross sections were surveyed during the monitoring set-up and again during Year 1 monitoring activities in October 2006. The baseline cross-section surveys are shown with the Year 1 monitoring cross section surveys in Appendix B. There is very little difference between the baseline cross sections and the monitoring Year 1 cross sections.

Longitudinal Profile
The baseline longitudinal profiles were derived from the as-built survey data. Profiles were resurveyed during Year 1 monitoring activities in October 2006. The Year 1 monitoring profile is shown in Appendix C. There is very little difference between the baseline profile and the monitoring Year 1 profile.

Hydrology
During each visit to the site, the crest gages were read and reset. This was done March-October of 2006. At least three out-of-bank or bankfull events occurred during this period on UT-2. Crest gauge data are included in Table 8. Weather data were collected from a nearby weather station- Carthage Water Treatment Plant and the Moore County Airport. The data are summarized in Table 9 and indicate that conditions were very dry during the months of January through March and July through October.

Table 8. Crest Gauge Data (feet)

Date of Data Collection	Crest Gauge 1 Reading	Crest Gauge 2 Reading	Crest Gauge 3 Reading
March-06	installed	installed	installed
April-06	0	0	0
May-06	0	0	0
June-06	>4	>4	>4
July-06	0	0	0
August-06	1.05	1.48	3.40
September-06	>4	>4	>4
October-06	0	3.60	0

Table 9. Moore County Normal Rainfall and 2006 Observed Rainfall

Month	Historic Average	Normal Limits		Carthage Precipitation
		30 Percent	70 percent	
January	4.51	3.44	5.43	2.61
February	3.54	2.39	4.24	1.52
March	4.65	3.52	5.64	0.84
April	3.08	1.93	4.17	3.91
May	4.06	2.65	4.86	2.99
June	4.18	2.36	5.16	8.77
July	5.37	3.06	6.70	4.61
August	4.65	3.22	5.57	2.89
September	4.45	3.23	6.24	2.66
October	3.54	1.86	4.73	2.44
November	3.47	2.20	4.52	9.4
December	3.38	2.28	4.04	0.51*

*Only 61.3% of the data for December was available for Carthage.

Very few problems with stream morphology were observed during the monitoring field visit. Photos of each structure taken during October 2006 are included in Appendix D. The locations of each structure (with numbers that correspond to the photos) are shown on a plan view in Appendix D. Some minor siltation was observed in pool features.

A plan view drawing of the stream problem areas is provided in Figures 5a and 5b. The drawings show the locations of the following features:

- As-built stream centerline and bankfull limits
- All in-stream structures (e.g. root wads and log vanes)
- Locations of any stream channel problem areas

Table 10 below gives a description of each stream problem area, the station where the problem occurs and the photo number for the problem area.

Table 10. Stream Problem Areas

Feature Issue	Station Numbers	Suspected Cause	Photo Number
Erosion matting coming up	1+50	Lack of vegetation to hold onto the bank	SPA1
Erosion beneath matting	12+00	Bank scour	SPA2
Log vane washing out	16+25	Installed at incorrect elevation	SPA3
Erosion beneath matting	19+65	Bank scour	SPA4

STONEBRIDGE STREAM MITIGATION SITE
STREAM PROBLEM AREAS PLAN VIEW

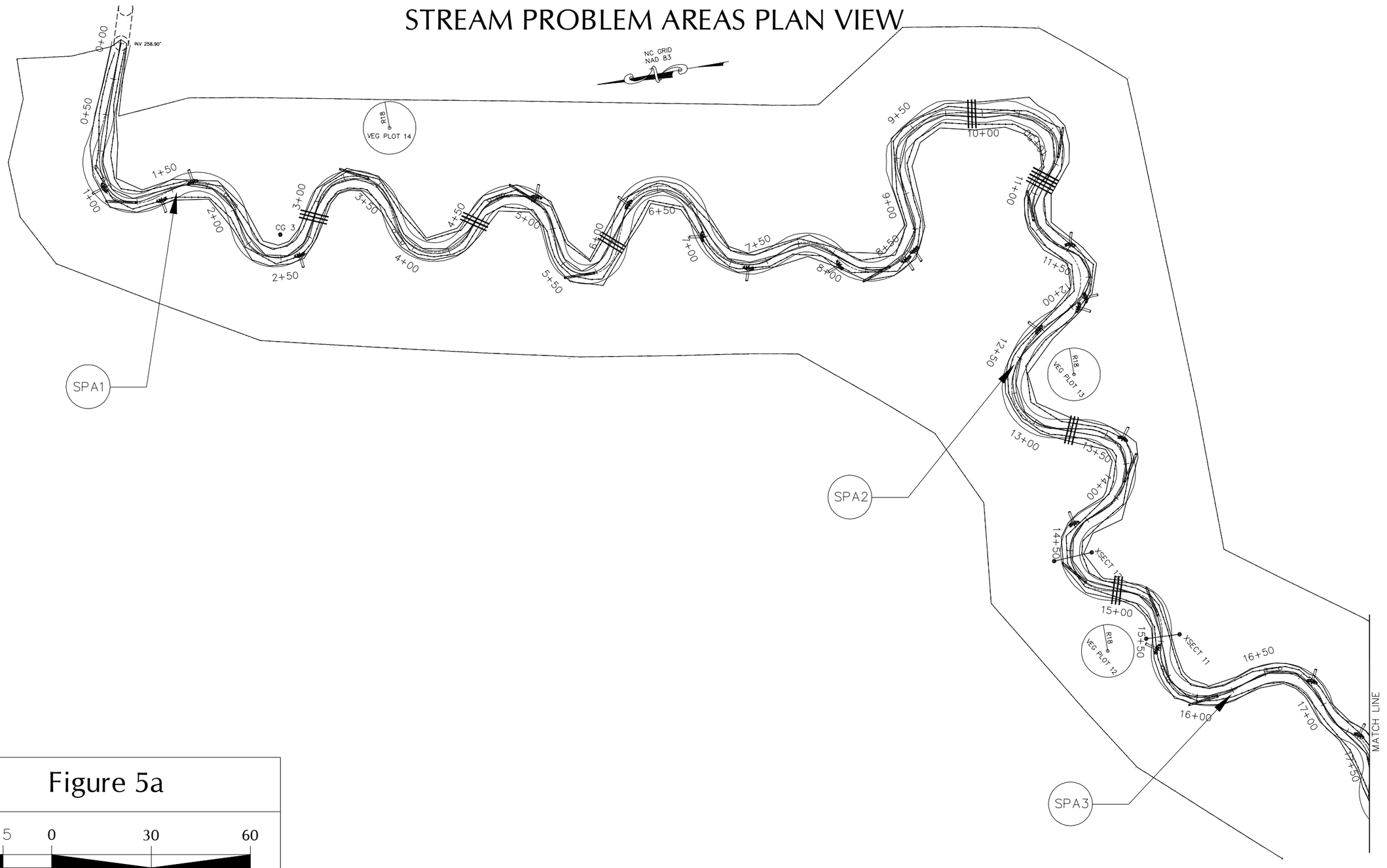


Figure 5a

30 15 0 30 60

SCALE (FT)

STONEBRIDGE STREAM MITIGATION SITE
STREAM PROBLEM AREAS PLAN VIEW

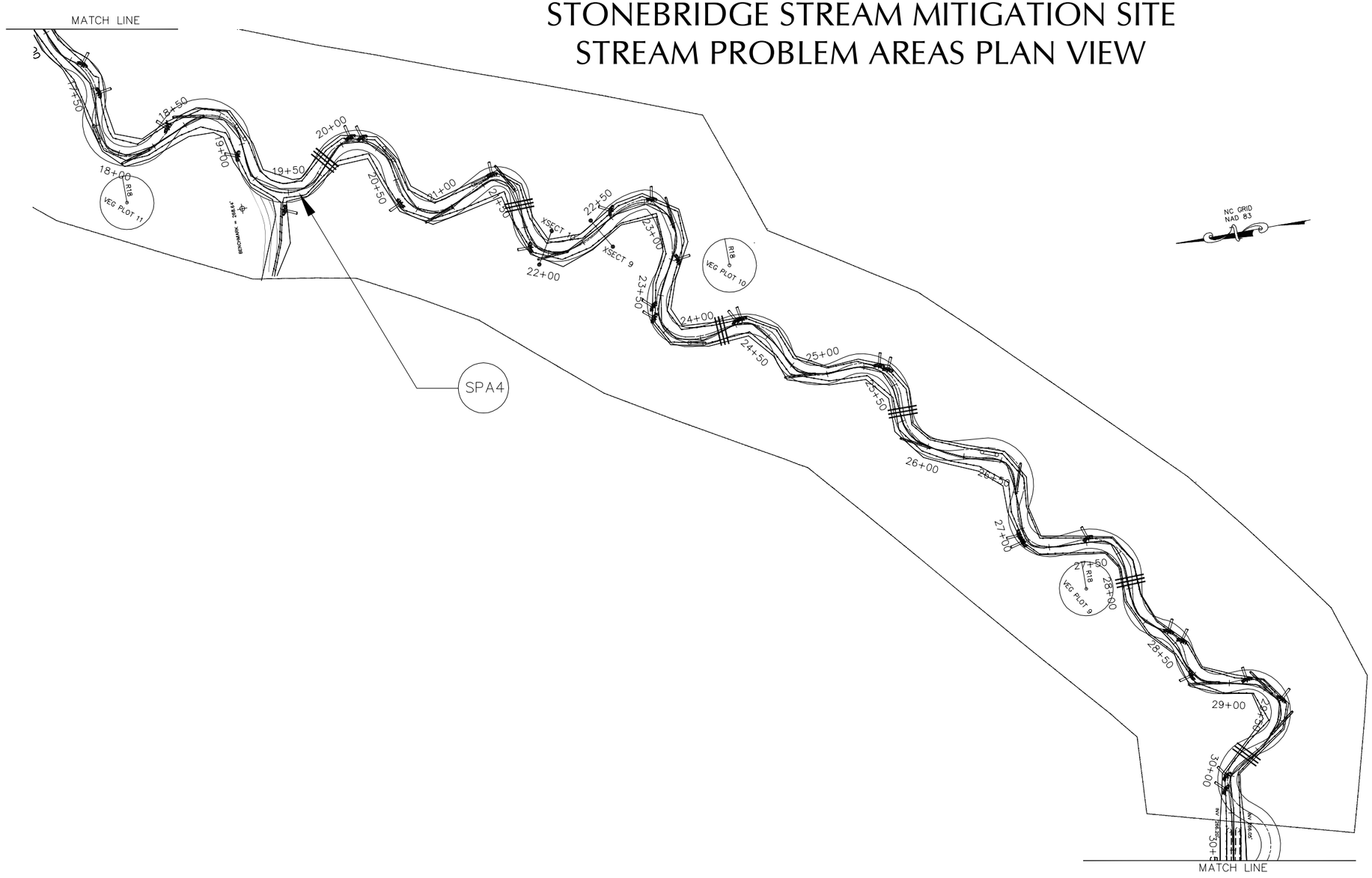


Figure 5b

30 15 0 30 60

SCALE (FT)

5.0 BENTHIC MACROINVERTEBRATE ASSESSMENT

Benthic macroinvertebrate monitoring was conducted during April 2006. Results of 2006 benthic macroinvertebrate monitoring will be in the 2007 monitoring report.

6.0 SUMMARY AND CONCLUSIONS

Data collected during monitoring for Year 1 and observations of conditions at the site indicate that the project is currently successful. The vegetation is generally surviving well. The stream morphology is stable. Very little fluvial erosion was observed. Some minor siltation was observed, especially in the pool features, along UT-1. This is not unexpected since the monitoring was conducted soon after construction was complete.

Overall, the project objectives are being met. Fish were observed all along the UT-1 restoration reach. Habitat has been improved significantly through this project. Fluvial erosion has been eliminated so that the project site no longer contributes sediment to the receiving stream. Based on initial observations, the buffer vegetation is expected to succeed and provide riparian habitat, water quality benefits, and cover for the stream system.

7.0 RECOMMENDATIONS FOR REMEDIAL ACTIONS

Remedial actions for stream morphology are not warranted at this time. Any sedimentation that has occurred is minor and does not need to be addressed at this time.

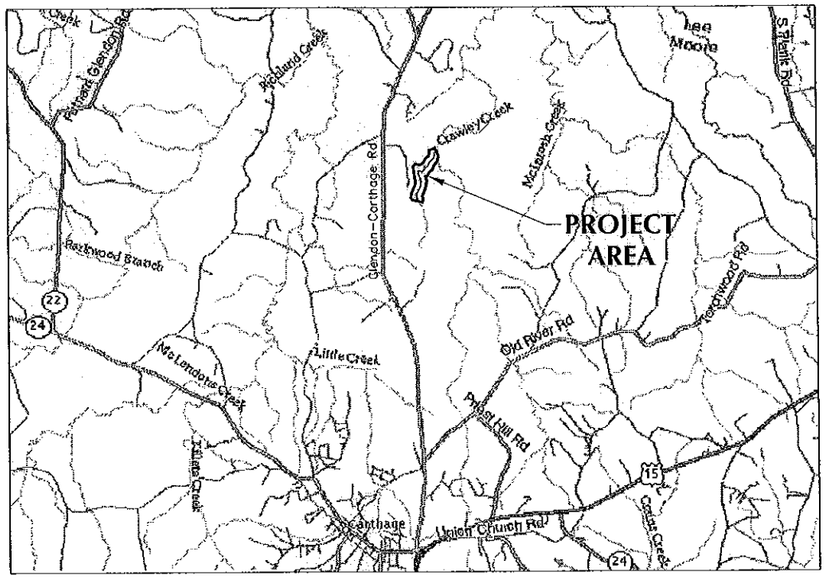
Remedial actions to be undertaken prior to the start of the next growing season suggested to improve vegetation conditions at the site includes the following: till, seed, and mulch areas on the floodplain where herbaceous vegetation could be improved. Vegetation plot 4 needs to be replanted in order for it to reach survival success criteria.

Appendix A

As-Built Survey

STONEBRIDGE STREAM AS-BUILT PLANS

APRIL 2006



VICINITY MAP
NTS

ENVIRONMENTAL BANC & EXCHANGE, LLC

MANAGERS, BANKERS AND TRADERS OF ENVIRONMENTAL RIGHTS

10055 RED RUN BOULEVARD, SUITE 130
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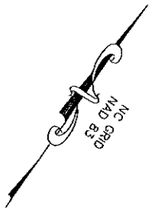
EBX



REV. NO.	DESCRIPTION	DATE
	REVISIONS	

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DRAWN BY	TRS
APPROVED BY	ME
FILE NAME	as-built.dwg
DRAWING SCALE	1" = 100'
PROJECT DATE	03/30/2004
PROJECT NUMBER	302450GRA
PLOT DATE	6/24/06

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Office Locations:
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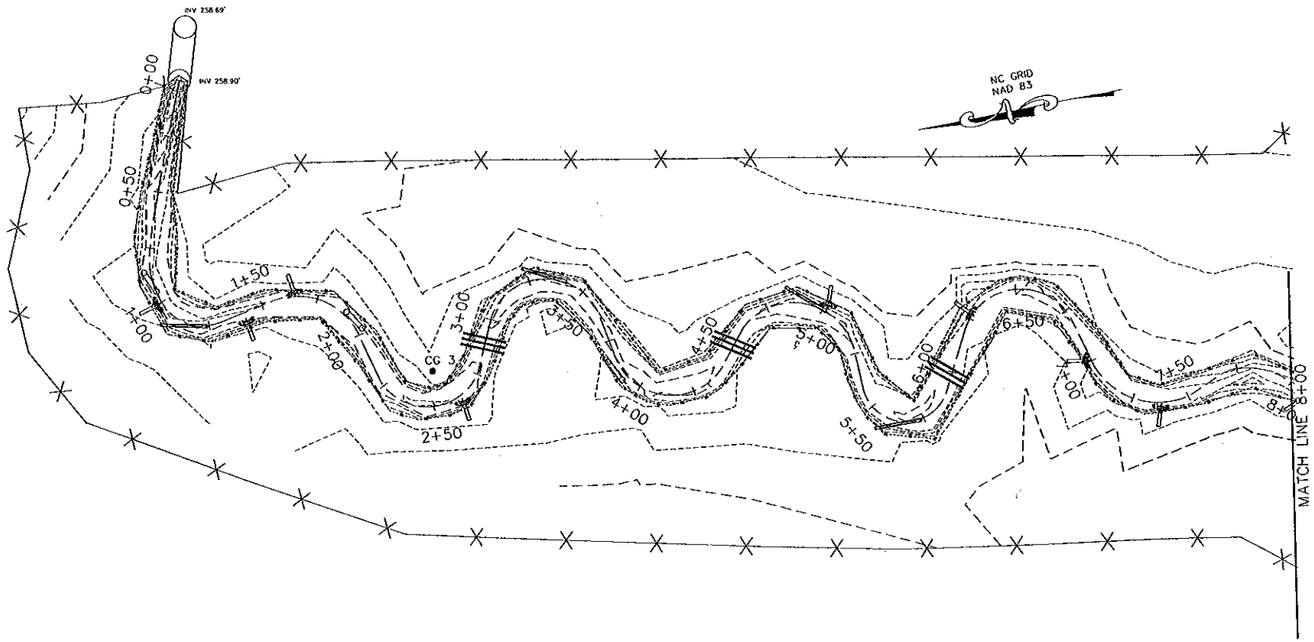
Florida

RELEASED FOR	DATE
APPROVALS	
BIDDING	
CONSTRUCTION	
RECORD DWG.	

EBX

ENVIRONMENTAL BANC & EXCHANGE, LLC
STONEBRIDGE STREAM MITIGATION PROJECT
CARTHAGE, NORTH CAROLINA

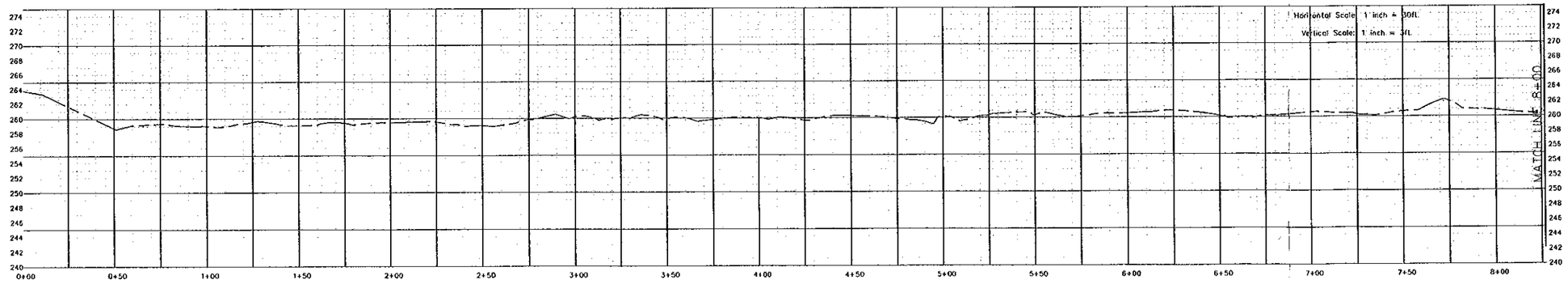
STONEBRIDGE AS-BUILT PLANS
STREAM MITIGATION AS-BUILT SURVEY



LEGEND

- CENTER OF CHANNEL
- FENCE (LIMITS OF CONSERVATION EASEMENT)
- MAJOR CONTOUR
- MINOR CONTOUR
- ROOTWAD
- LOG VANE
- LOG GRADE CONTROL
- LOG TOE PROTECTION
- CREST GAUGE
- SEMI-PERMANENT CROSS-SECTION

30 0 15 30 60
1 inch = 30ft.



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	REVISIONS	

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APPROVED BY	ME
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PROJECT DATE	03/30/2004
PROJECT NUMBER	3024600RA
PLOT DATE	9/24/06

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RALEIGH, NC 27612
(919) 782-0495

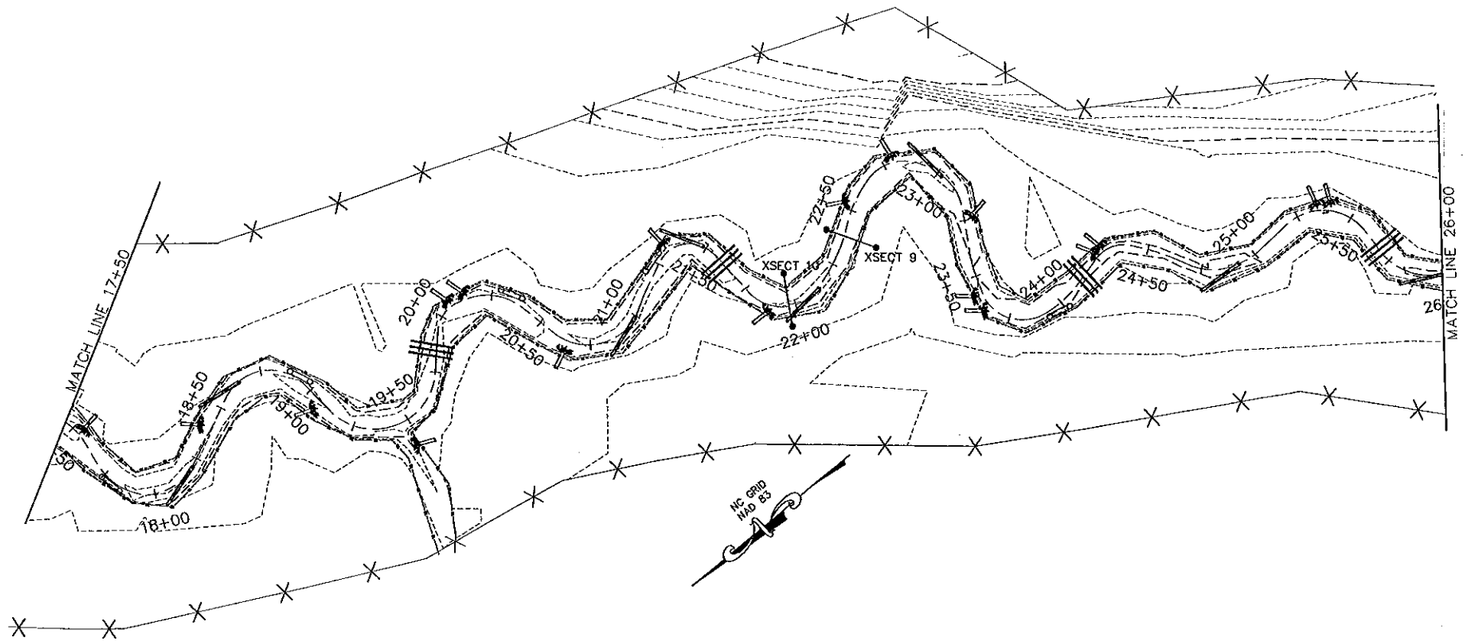
Office Locations:
North Carolina
South Carolina
Georgia
Florida

RELEASED FOR	DATE
APPROVALS	
BIDDING	
CONSTRUCTION	
RECORD DWG.	

EBX

ENVIRONMENTAL BANC & EXCHANGE, LLC
STONEBRIDGE STREAM MITIGATION PROJECT
CARTHAGE, NORTH CAROLINA

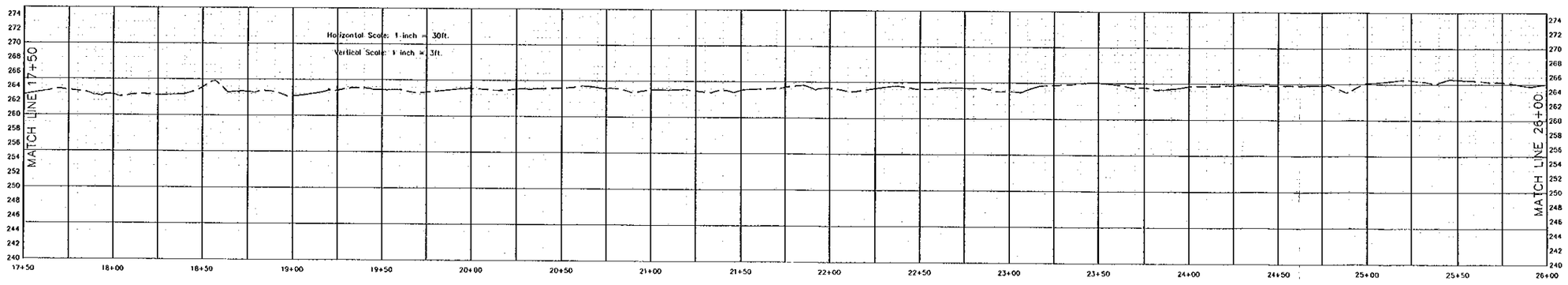
STONEBRIDGE AS-BUILT PLANS
UT-1 STA. 0+00 TO STA. 8+00



LEGEND

- CENTER OF CHANNEL
- FENCE (LIMITS OF CONSERVATION EASEMENT)
- MAJOR CONTOUR
- MINOR CONTOUR
- ROOTWAD
- LOG VANE
- LOG GRADE CONTROL
- LOG TOE PROTECTION
- CREST GAUGE
- SEMI-PERMANENT CROSS-SECTION

30 0 15 30 60
1 inch = 30ft.



REV. NO.	DESCRIPTION	DATE
	REVISIONS	

PROJECT MANAGER	ME
DRAWN BY	TRS
APPROVED BY	ME
FILE NAME	as-built.dwg
DRAWING SCALE	1" = 30'
PROJECT DATE	03/30/2004
PROJECT NUMBER	302400RA
PLOT DATE	4/24/06

WK DICKSON
community infrastructure consultants
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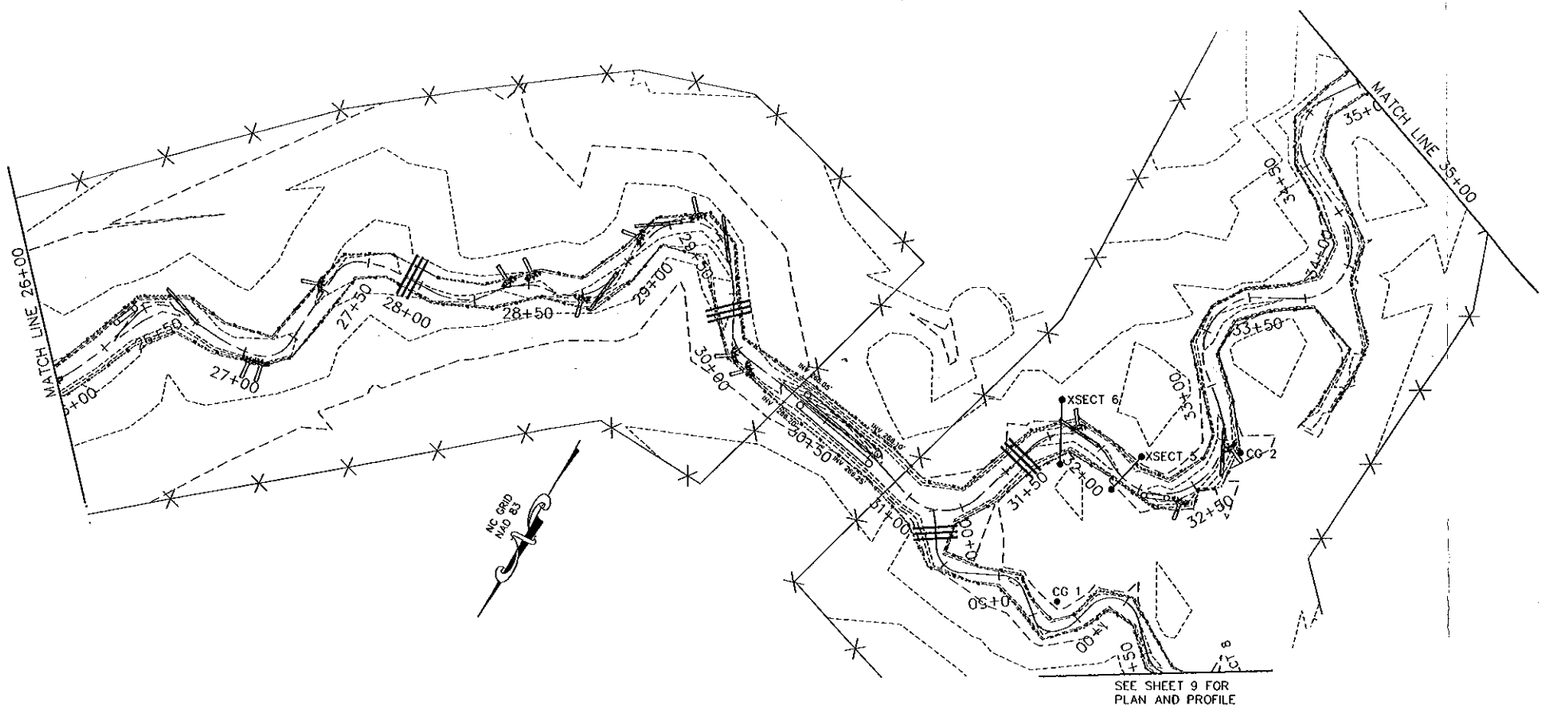
STONEBRIDGE STREAM MITIGATION PROJECT
CARTHAGE, NORTH CAROLINA

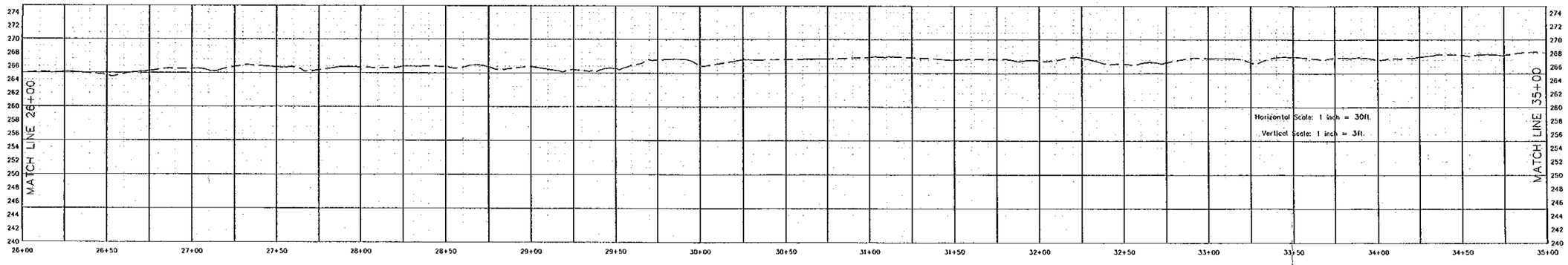
STONEBRIDGE AS-BUILT PLANS
UT-1 STA. 17+50 TO 26+00



LEGEND

- CENTER OF CHANNEL
- FENCE (LIMITS OF CONSERVATION EASEMENT)
- MAJOR CONTOUR
- MINOR CONTOUR
- ROOTWAD
- LOG VANE
- LOG GRADE CONTROL
- LOG TOE PROTECTION
- CREST GAUGE
- SEMI-PERMANENT CROSS-SECTION

1 inch = 30ft.



REV. NO.	DESCRIPTION	DATE
	REVISIONS	

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DRAWN BY	IRS
APPROVED BY	LE
FILE NAME	as-built.dwg
DRAWING SCALE	1" = 30'
PROJECT DATE	05/30/2006
PROJECT NUMBER	302600RA
PLOT DATE	4/24/06

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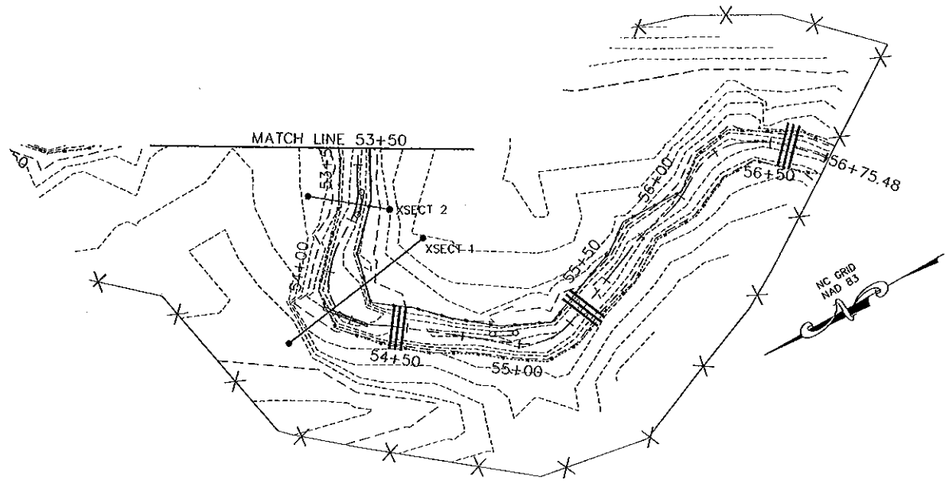
STONEBRIDGE STREAM MITIGATION PROJECT
CARTHAGE, NORTH CAROLINA

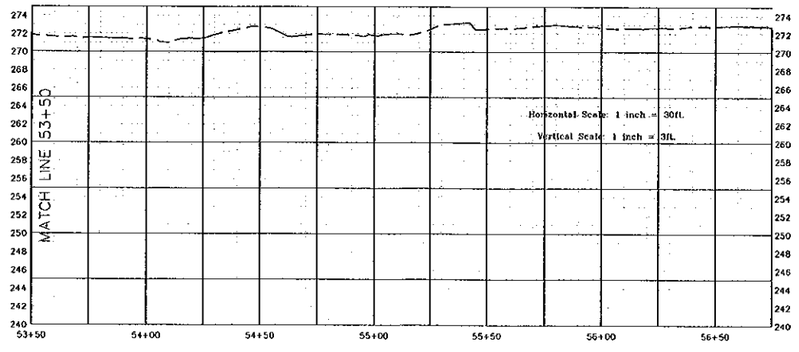
STONEBRIDGE AS-BUILT PLANS
UT-1 STA. 26+00 TO 35+00



LEGEND

- CENTER OF CHANNEL
- FENCE (LIMITS OF CONSERVATION EASEMENT)
- MAJOR CONTOUR
- MINOR CONTOUR
- ROOTWAD
- LOG VANE
- LOG GRADE CONTROL
- LOG TOE PROTECTION
- CREST GAUGE
- SEMI-PERMANENT CROSS-SECTION

30 0 15 30 60
1 inch = 30ft.



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	REVISIONS	

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DRAWN BY: IRS	PROJECT DATE: 03/30/2004
APPROVED BY: ME	PROJECT NUMBER:
FILE NAME: as-built.dwg	PLOT DATE: 4/24/06

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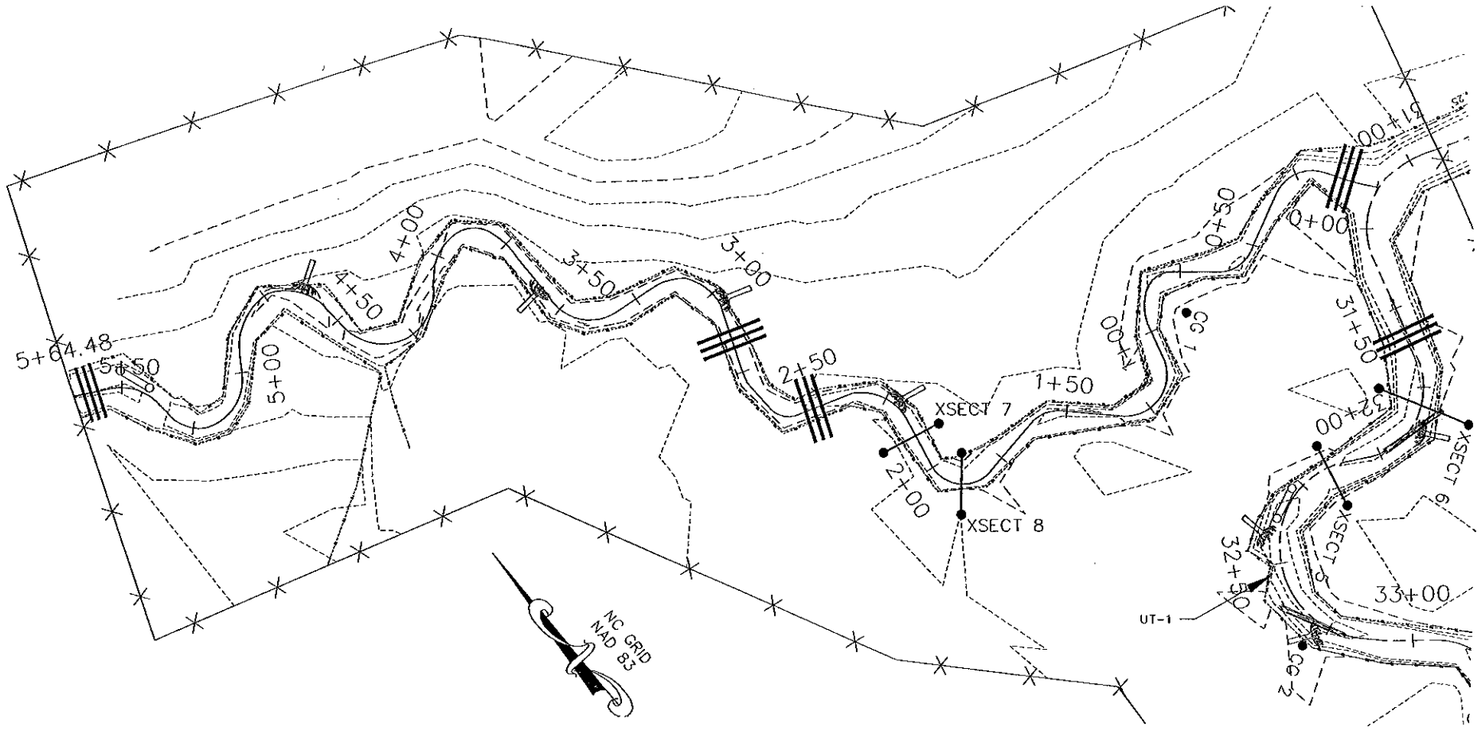
CARTHAGE, NORTH CAROLINA

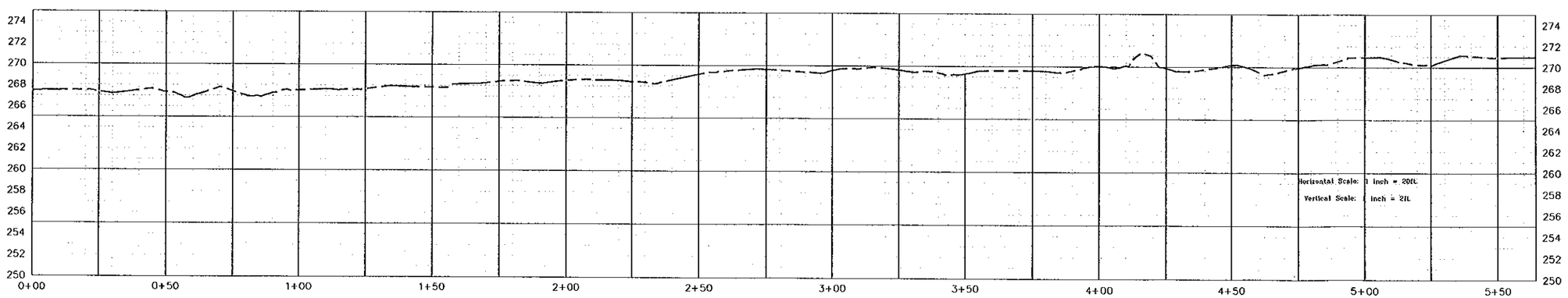
STONEBRIDGE AS-BUILT PLANS
UT-1 STA. 53+50 TO 56+75



LEGEND

- CENTER OF CHANNEL
- FENCE (LIMITS OF CONSERVATION EASEMENT)
- MAJOR CONTOUR
- MINOR CONTOUR
- ROOTWAD
- LOG VANE
- LOG GRADE CONTROL
- LOG TOE PROTECTION
- CREST GAUGE
- SEMI-PERMANENT CROSS-SECTION

20 0 10 20 40
1 inch = 20ft.



REV. NO.	DESCRIPTION	DATE
1	REVISION PER LOS COMMENTS	9/01/06

REVISIONS

PROJECT MANAGER	GRAPHIC SCALE
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DRAWN BY	PROJECT DATE
IRS	03/30/2004
APPROVED BY	PROJECT NUMBER
ME	3024600RA
FILE NAME	PLOT DATE
as-built.dwg	4/24/06

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STONEBRIDGE STREAM MITIGATION PROJECT
CARTHAGE, NORTH CAROLINA

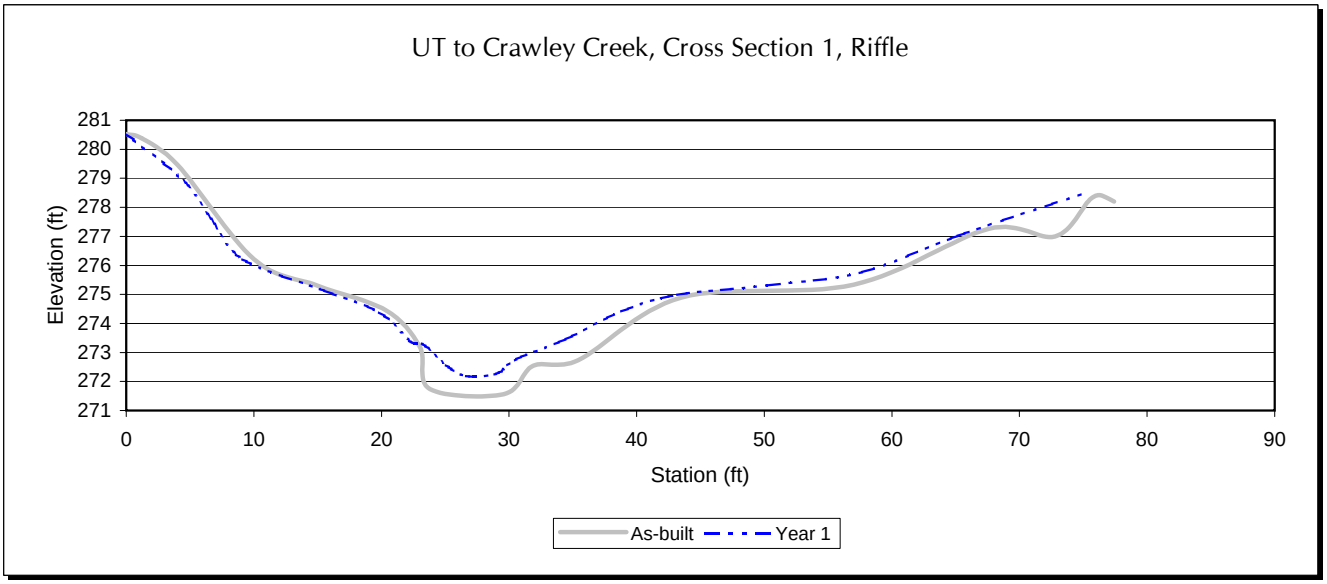
STONEBRIDGE AS-BUILT PLANS
UT-2 STA. 0+00 TO 5+64

Appendix B

Cross Section Data and Cross Section Graphs

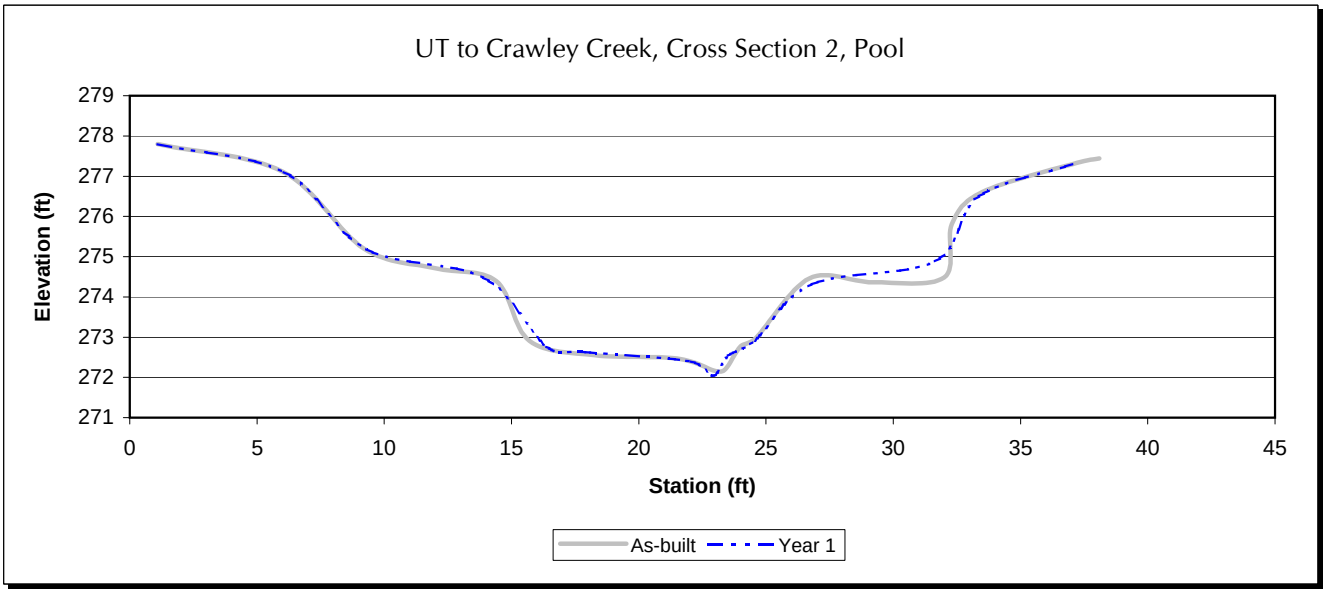
Looking at the left bank.

Looking at the right bank.



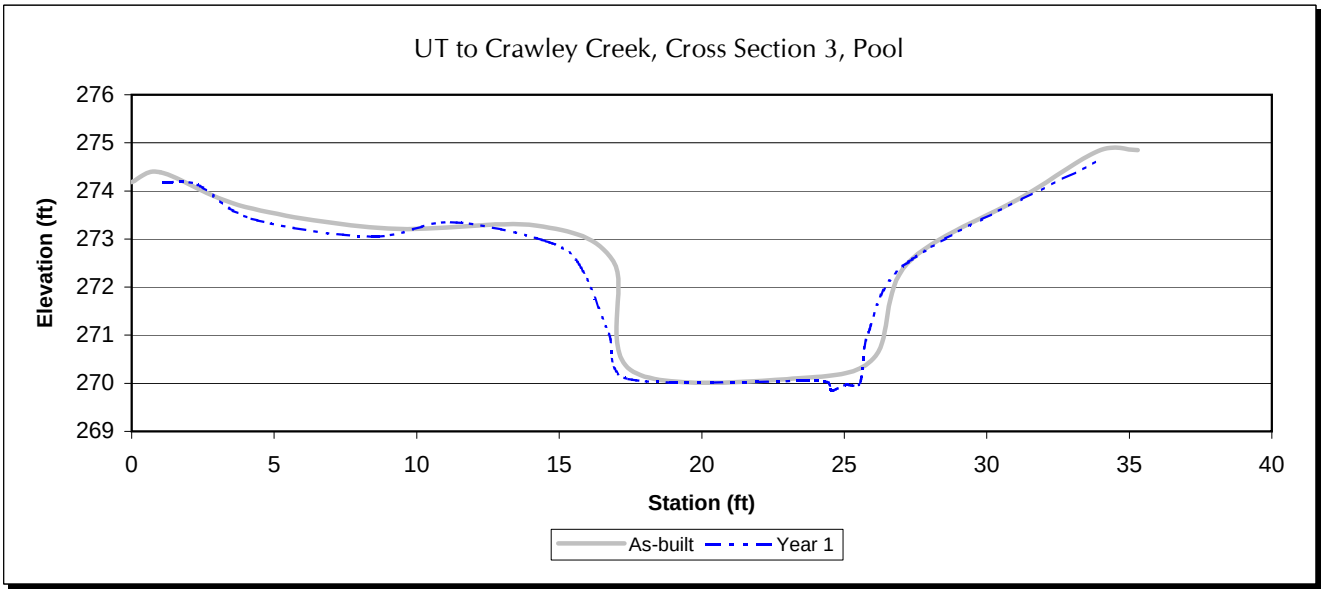
Looking at the left bank.

Looking at the right bank



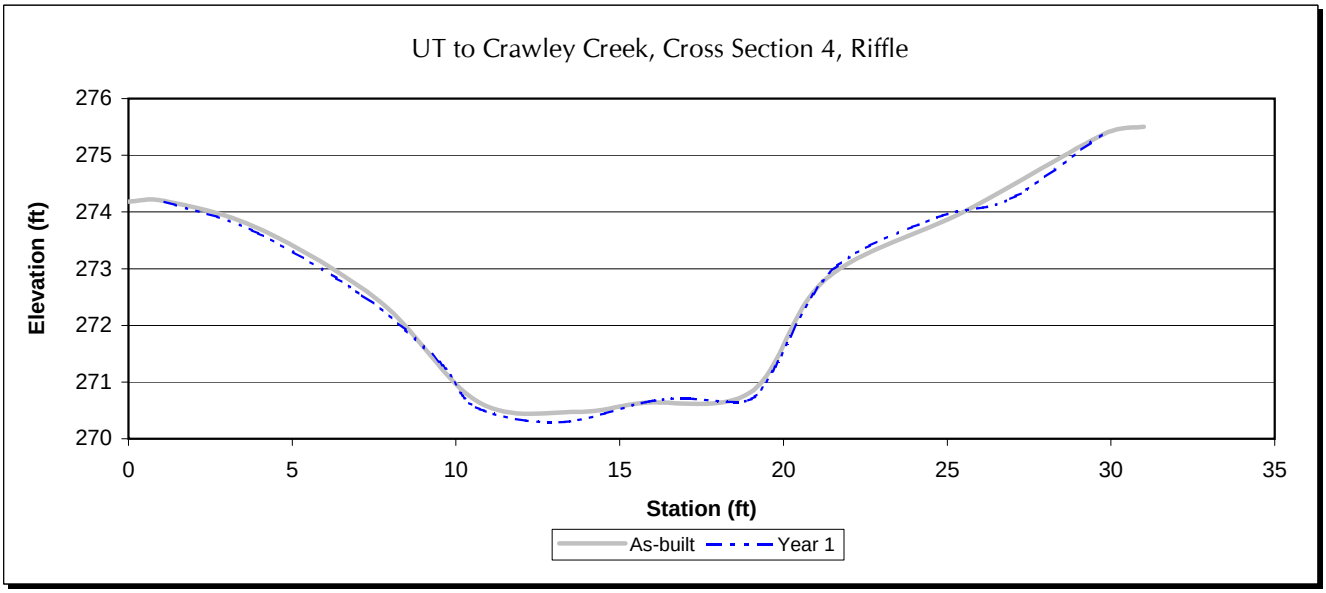
Looking at the left bank.

Looking at the right bank.



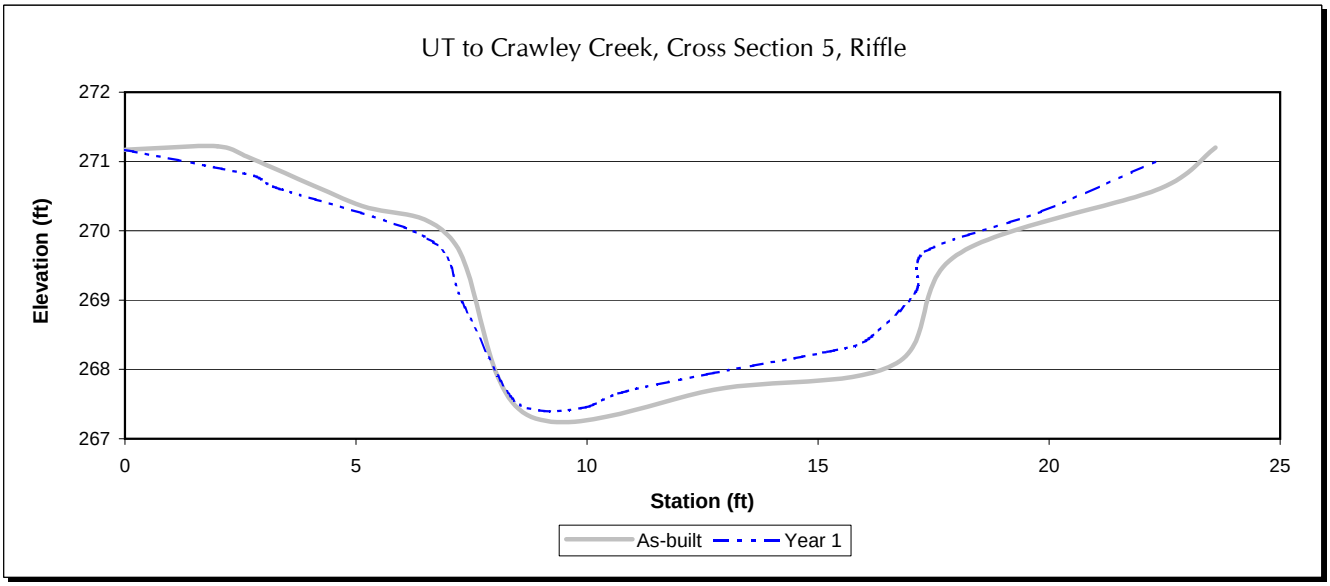
Looking at the left bank.

Looking at the right bank.



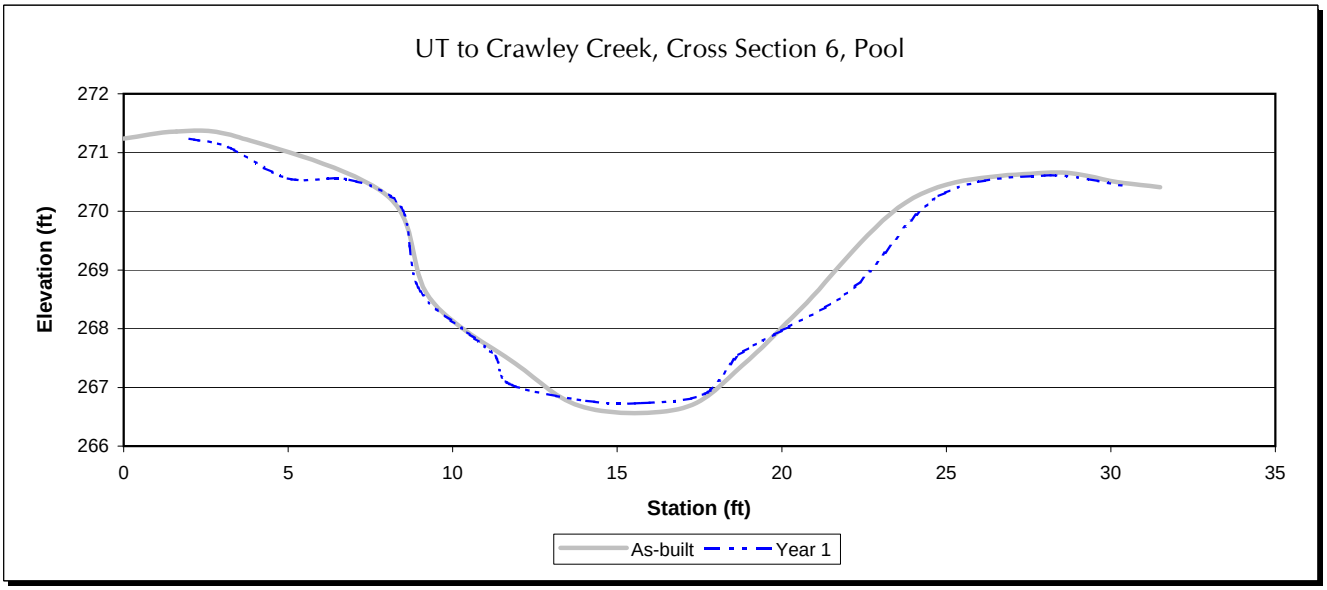
Looking at the left bank.

Looking at the right bank.



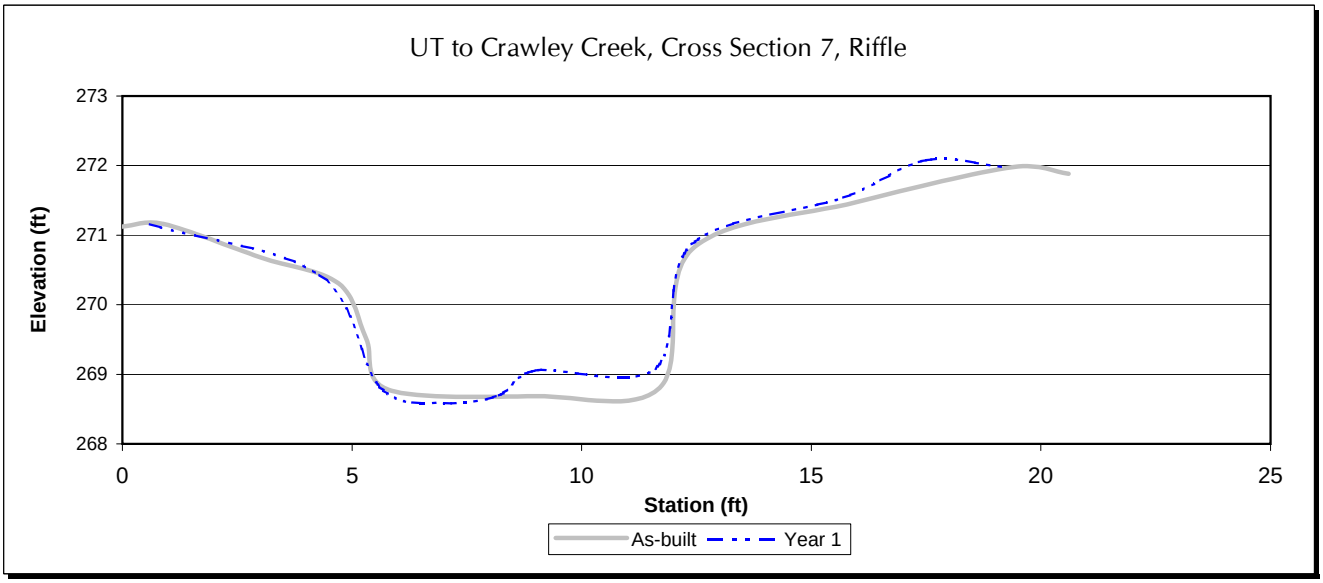
Looking at the left bank.

Looking at the right bank.



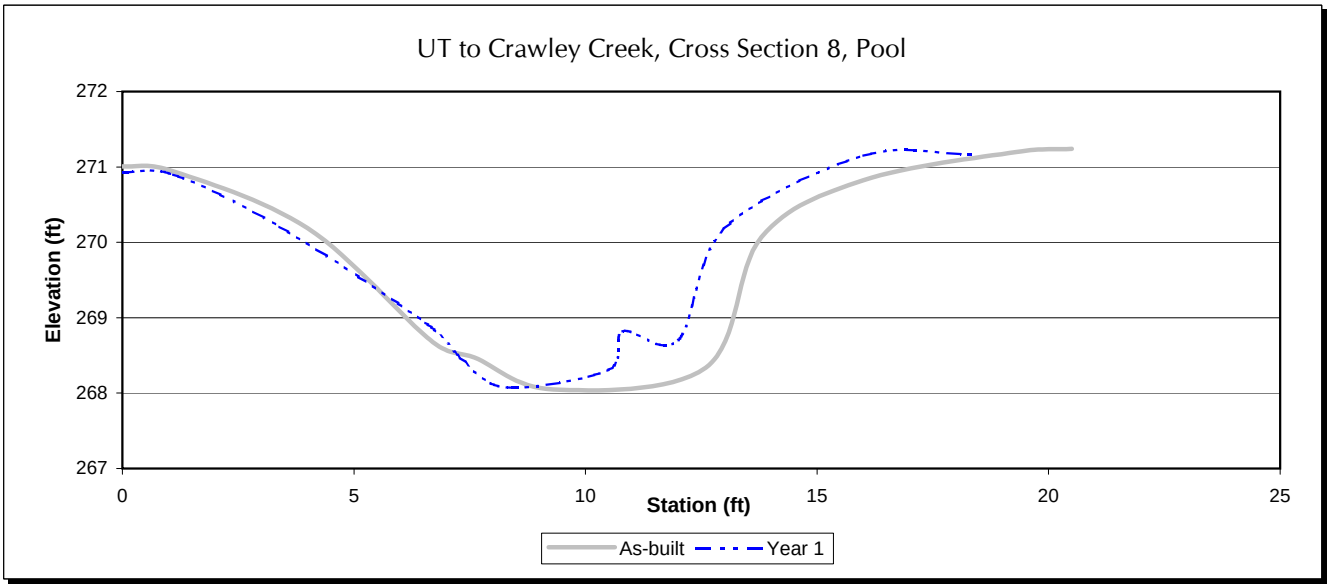
Looking at the left bank.

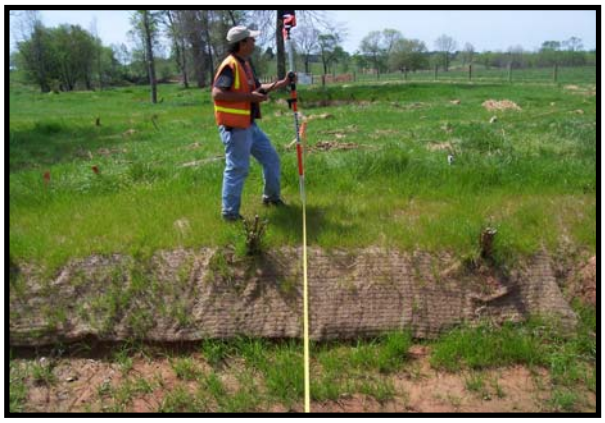
Looking at the right bank.



Looking at the left bank.

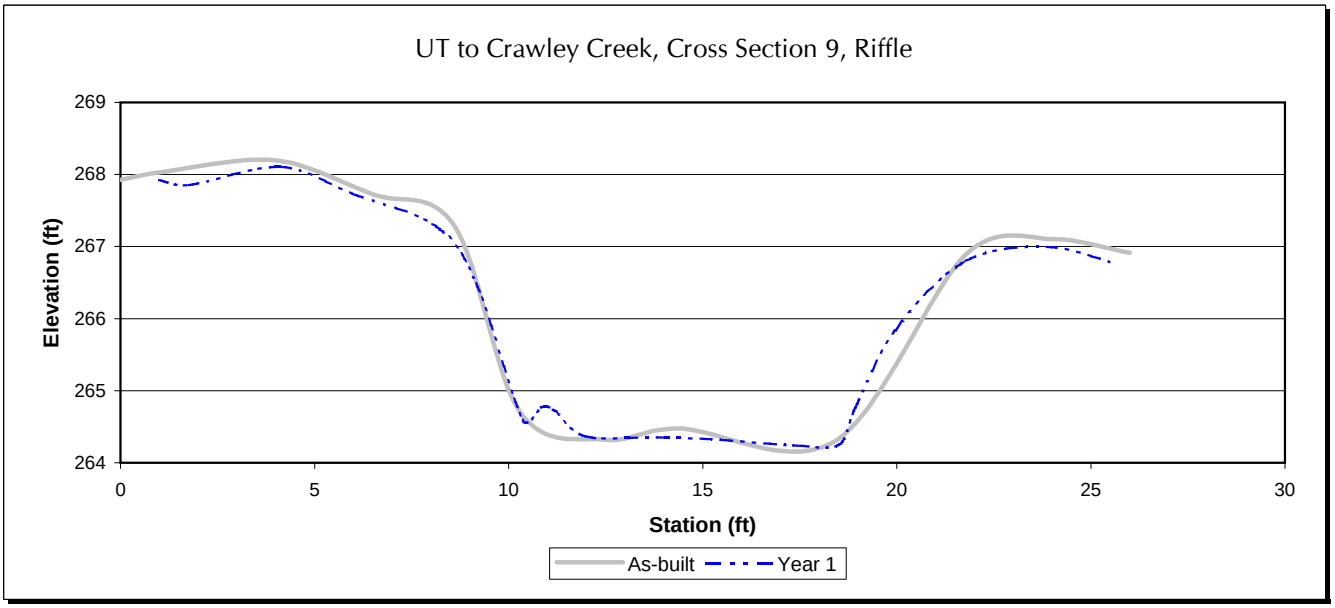
Looking at the right bank.





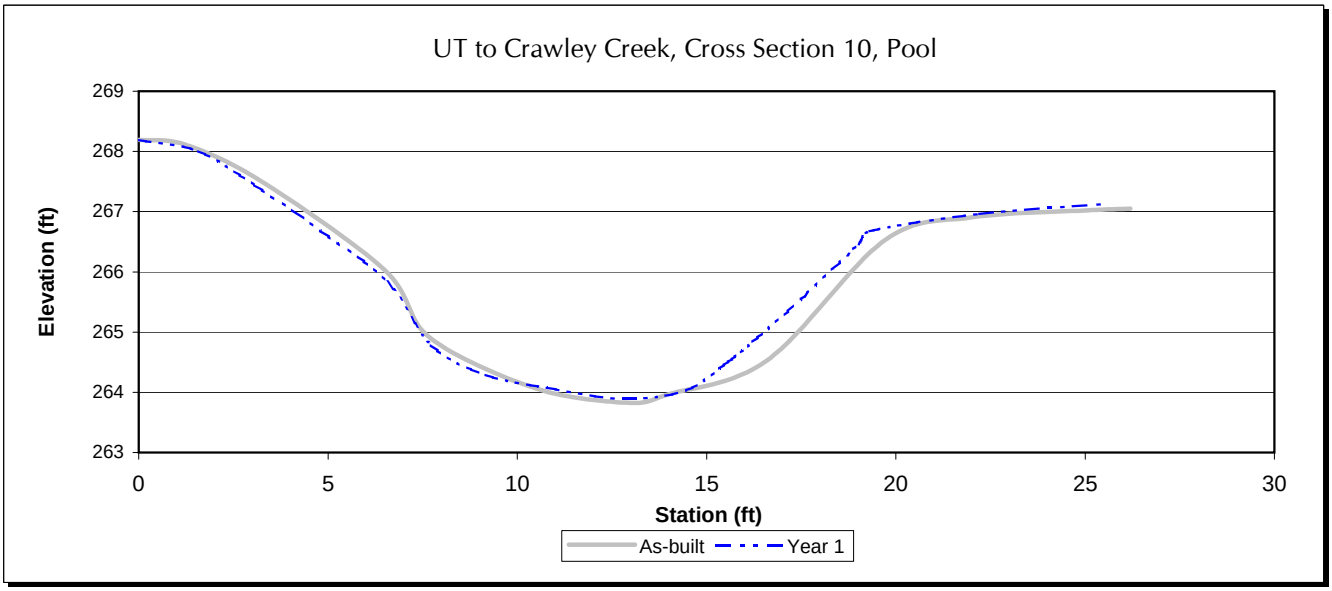
Looking at the left bank.

Looking at the right bank.



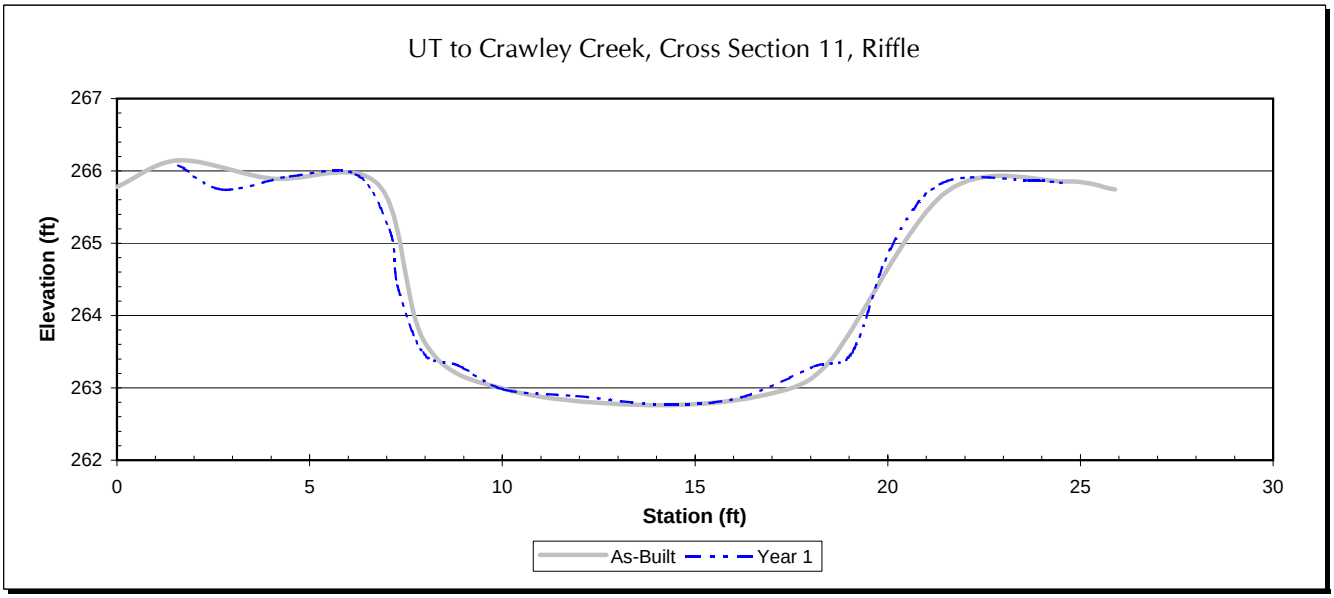
Looking at the left bank.

Looking at the right bank.



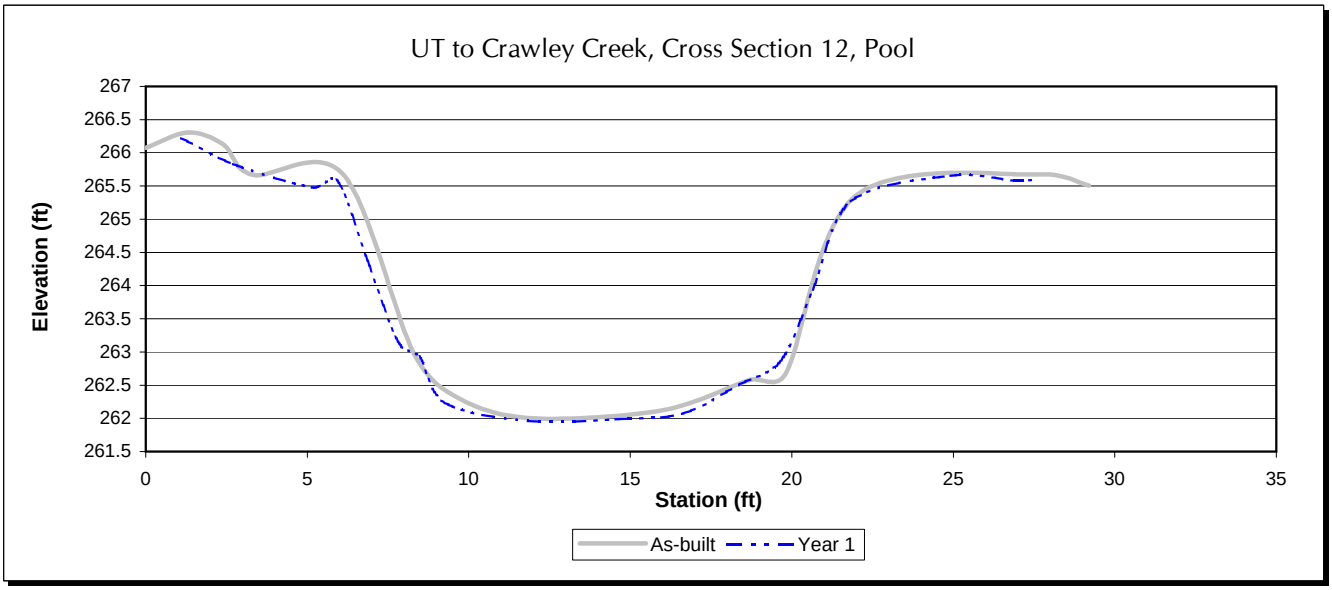
Looking at the left bank.

Looking at the right bank.



Looking at the left bank.

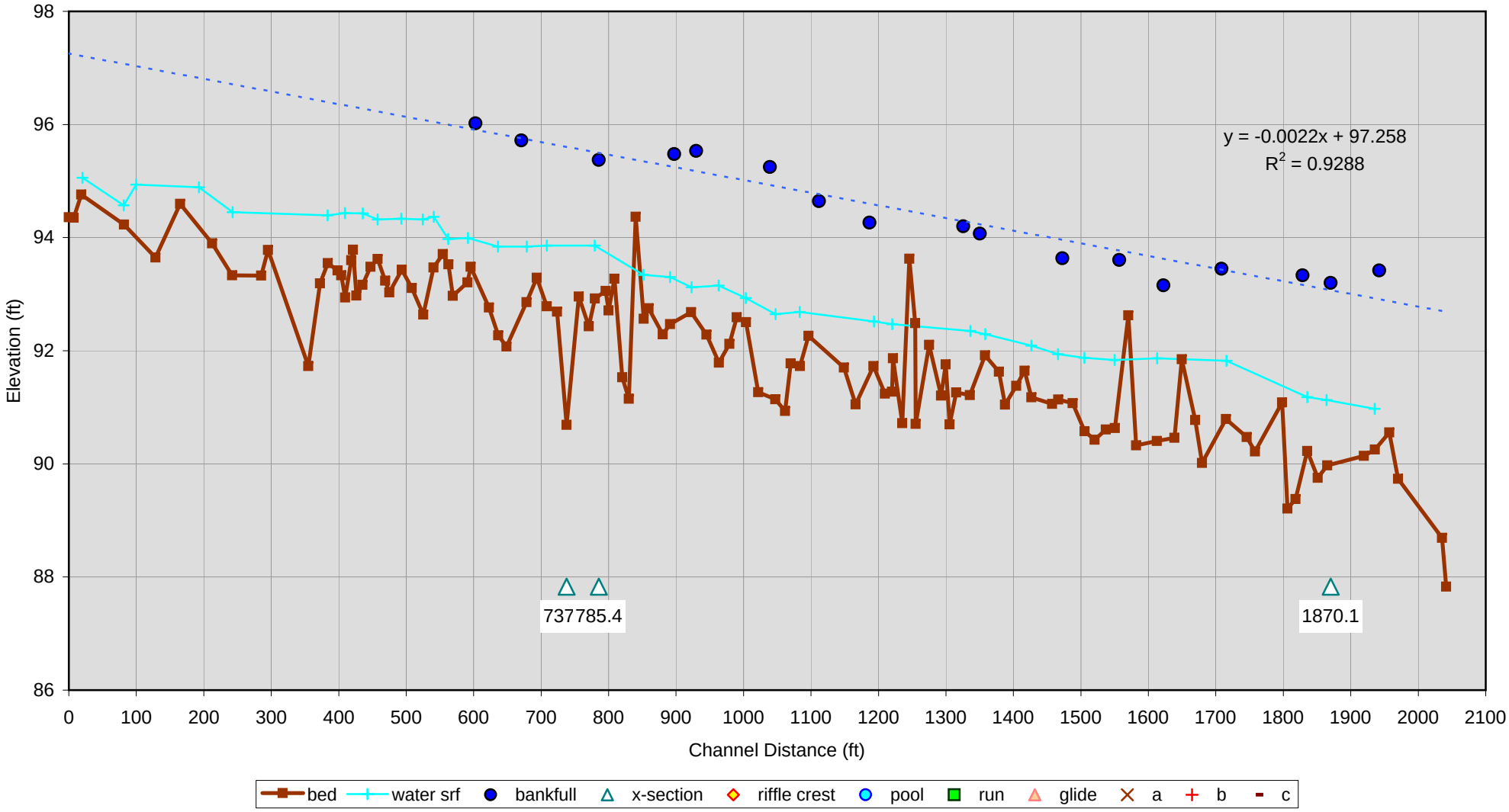
Looking at the right bank.



Appendix C

Longitudinal Profile Data

UT to Crawley Creek, Downstream End Longitudinal Profile



Appendix D

Stream Problem Areas
Structure Photographs
Vegetation Plot Photographs

Photo 1. Log vane structure-looking downstream.

Photo 2. Log ramp structure-looking upstream.

Photo 3. Ford crossing-looking downstream at log toe protection.

Photo 4. Stream channel-looking upstream.

Photo 5. Stream channel; rock bank stabilization, looking upstream.

Photo 6. Stream channel; looking downstream, notice live stake bundles on left bank.

Photo 7. End of the project-looking downstream.

Photo 8. Stream channel after Hurricane Alberto-looking downstream.

Photo 9. Stream channel after Hurricane Alberto-looking upstream.

Photo 10. Stream channel flooded from backup on Crawley Creek.

Photo 11. Flooded field from Crawley Creek from Hurricane Alberto.

Photo 12. Vegetation Plot #1.

Photo 13. Vegetation Plot #2.

Photo 14. Vegetation Plot #3.

Photo 15. Vegetation Plot #4.

Photo 16. Vegetation plot #5.

Photo 17. Vegetation plot #6.

Photo 18. Vegetation plot #7.

Photo 19. Vegetation plot #8.

Photo 20. Vegetation plot #9.

Photo 21. Vegetation plot #10.

Photo 22. Vegetation plot #11.

Photo 23. Vegetation plot #12.

Photo 24. Vegetation plot #13.

Photo 25. Vegetation plot #14.

Photo 26. SPA 1. Erosion control matting deteriorating and tearing from slope at STA 1+50.

Photo 27. SPA 2. Minor erosion occurring beneath the erosion control matting at STA 12+00.

Photo 28. SPA 3. Log toe protection footer log washing out (facing downstream) at STA 16+25.

Photo 29. SPA 4. Minor erosion beneath matting; outside of a bend at STA 19+65.