Brown Bark Park
Stream Restoration Monitoring Report
EEP Project # 52
Monitoring Year – 04
2008

Submitted to:

Ecosystem Enhancement PROGRAM

NCEEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

March 2009

Monitoring Firm

Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609
Phone: (919) 783-9214
Fax: (919) 783-9266

Project Contact: Adam Spiller
Email: aspiller@kci.com

Design Firm

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX A – VEGETATION DATA

APPENDIX B – GEOMORPHOLOGIC DATA

APPENDIX C – CURRENT CONDITIONS PLAN VIEW

EXECUTIVE SUMMARY

In 2004, the North Carolina Ecosystem Enhancement Program (EEP) conducted stream restoration at Brown Bark Park within the Buffalo Creek Watershed in Greensboro, North Carolina. The 0.3-mi^2 watershed is located within the USGS 14-digit HUC 03030002020040 and the NCDWQ Sub-basin 03-06-02 of the Cape Fear River Basin. The project restored approximately 798 linear feet and enhanced 2,036 linear feet of channel. The design was developed to address vertical instability and the lack of bed variability. The restoration plan called for correcting these problems by stabilizing stream banks, installing in-stream structures, adjusting the stream planform, and replanting the riparian areas with native vegetation. Project construction occurred in 2004. This report describes the results from the fourth year of monitoring that took place in 2008.

The riparian buffer was planted with seven different species of bare root trees and four different species of live stakes. Three vegetation monitoring plots were established during the as-built survey: two buffer plots, each approximately 25' x 100', and one live stake plot, approximately 175' x 5'. The fourth year of monitoring found an average of 279 stems per acre in the buffer plots, and 2,788 stems per acre in the live stake plot. Exotic vegetation that has been documented on site does not warrant immediate corrective actions, but should continue to be monitored.

The stream assessment completed during the fourth year of monitoring found the stream to be functioning for the majority of the project. Channel dimensions have changed minimally from the as-built conditions. With the exception of isolated deposition and erosion, the profile has changed little from previous monitoring. The majority of the in-stream structures are functioning and some previously documented areas of erosion have stabilized with vegetation.

1.0 PROJECT BACKGROUND

1.1 Project Objectives

- Restore unstable stream channels to natural stable forms by modifying dimension, pattern, and/or profile based on reference reach parameters.
- Improve floodplain functionality by matching bankfull stage with floodplain elevation.
- Establish native floodplain vegetation through a forested riparian buffer.
- Improve the natural aesthetics of the stream corridor.
- Obtain mitigation credits for unavoidable impacts to streams within the same Hydrologic Unit Code (HUC).

1.2 Project Structure, Restoration Type, and Approach

A previously incised channel at Brown Bark Park was restored and enhanced using channel dimension, pattern, and profile modifications and the establishment of a vegetated riparian zone adjacent to the creek. The new channel profile is maintained through the use of rock cross vanes and constructed riffles. Channel pattern is maintained through the use of cross vanes, root wads, and vegetation along the channel banks.

1.3 Location and Setting

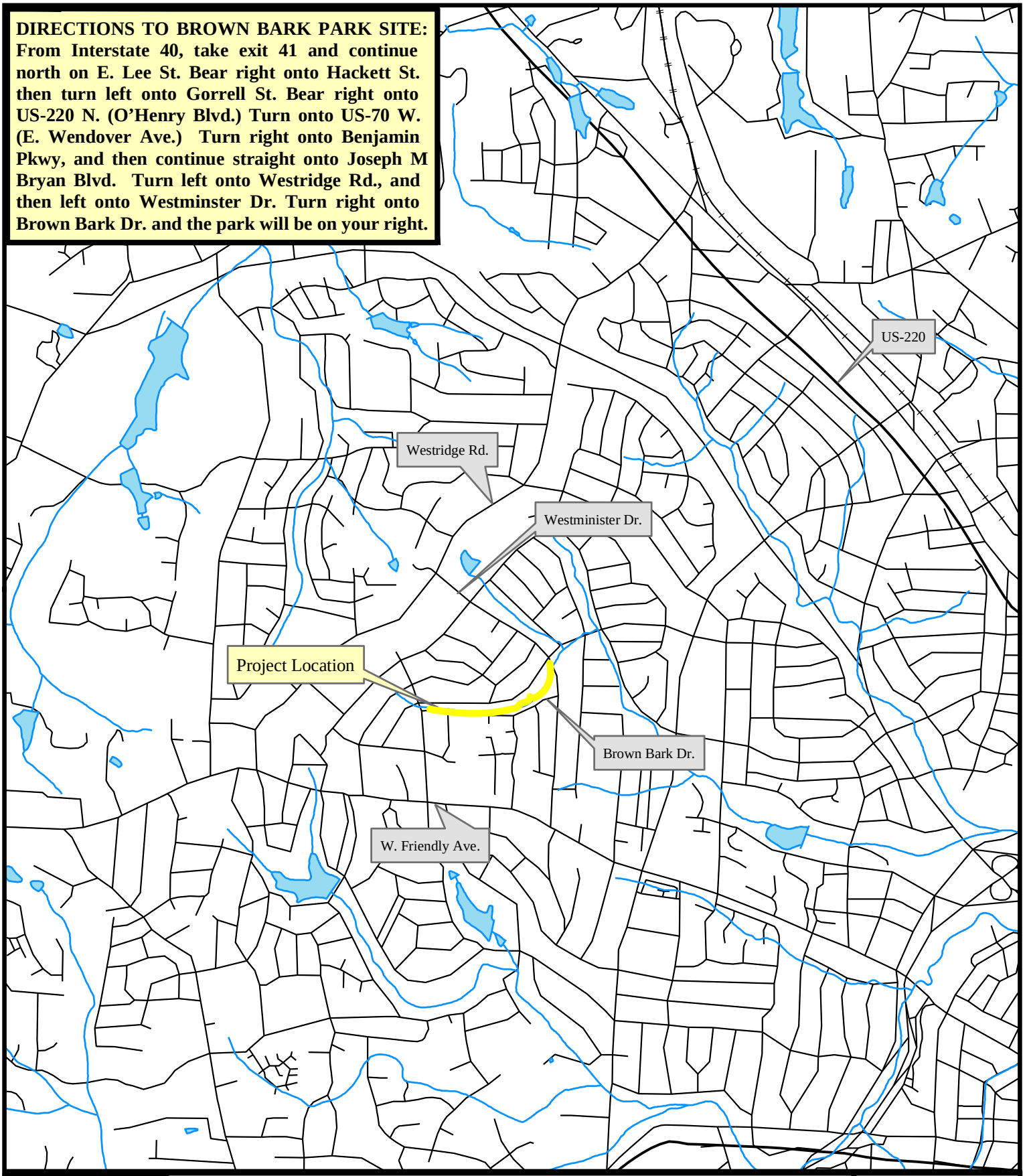
Brown Bark Park is located within the city limits of Greensboro, North Carolina. The land use of the 0.3-mi^2 watershed is urban residential development. The watershed is completely built out with little potential for future development.

1.4 Project History and Background

Table I. Project Restoration Components
Project Number and Name: 52 - Brown Bark Park

Segment / Reach ID	Existing Linear Feet	Type	Approach	Linear Feet	Stationing	Comment
Reach I	635	EI	P2/3	635	10+00 - 16+35	
Reach II	324	R	P2/3	324	16+36 - 19+60	
Reach III	1,225	EI	P2/3	1,225	19+75 - 32+00	
Reach IV	474	R	P2/3	474	32+01 - 36+75	
Reach V	176	EI	P2/3	176	36+76 - 38+52	

DIRECTIONS TO BROWN BARK PARK SITE:
From Interstate 40, take exit 41 and continue north on E. Lee St. Bear right onto Hackett St. then turn left onto Gorrell St. Bear right onto US-220 N. (O'Henry Blvd.) Turn onto US-70 W. (E. Wendover Ave.) Turn right onto Benjamin Pkwy, and then continue straight onto Joseph M Bryan Blvd. Turn left onto Westridge Rd., and then left onto Westminster Dr. Turn right onto Brown Bark Dr. and the park will be on your right.



Ecosystem Enhancement PROGRAM

Figure 1. Site Vicinity Map
Brown Bark Park, Guilford County, EEP Project # 52

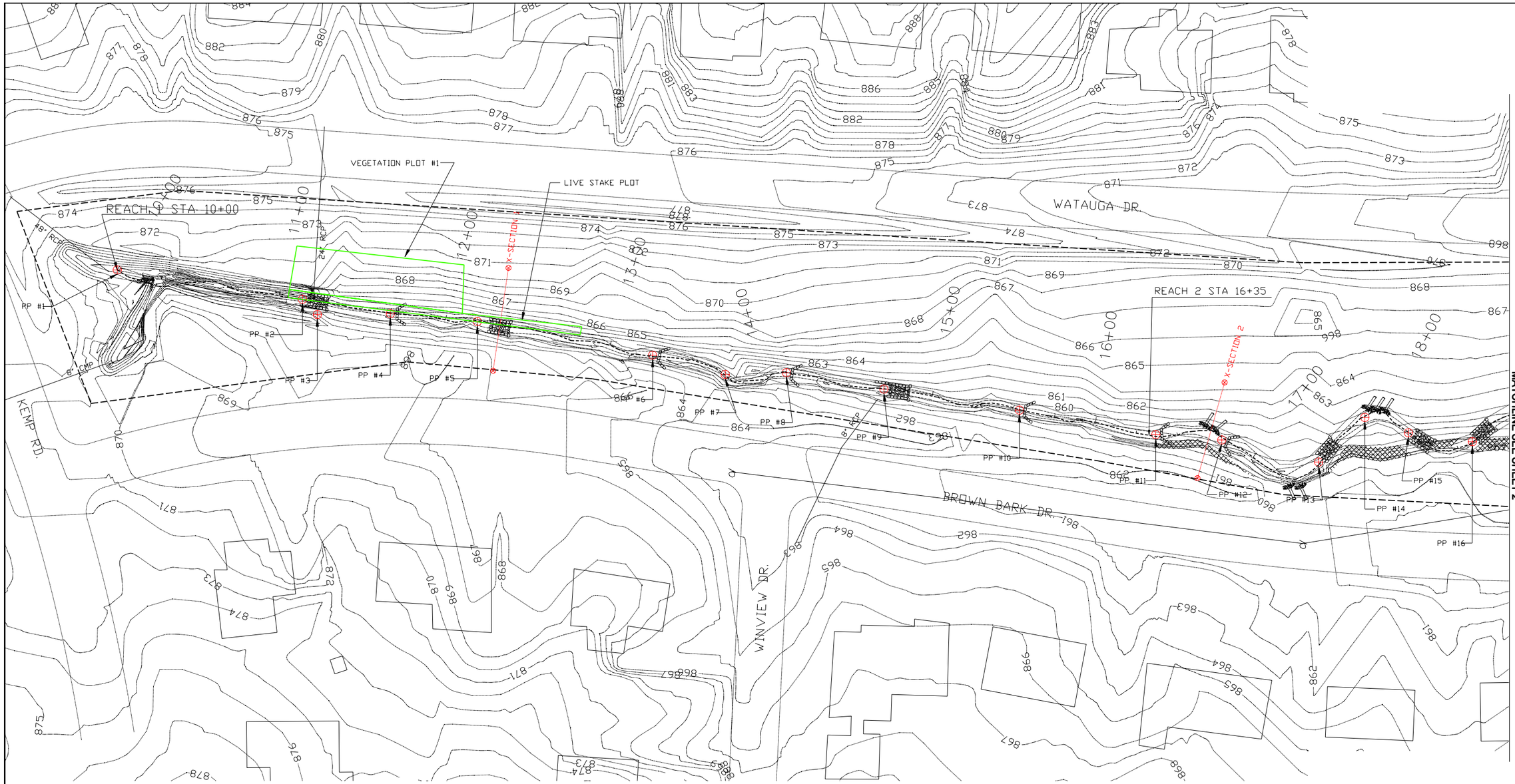
0.25 0.125 0 0.25 0.5
Miles

KCI ASSOCIATES OF NC

Table II. Project Activity and Reporting History Project Number and Name: 52 - Brown Bark Park		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan		
Final Design - 90%		
Construction		Aug 04
Stream Repair and Maintenance Seeding		Apr 05
As-Built Report	2005	Jun 05
Year 1 Monitoring	Nov 05	Jan 06
Year 2 Monitoring	Sep 06	Jan 07
Year 3 Monitoring	Aug 07	Jan 08
Year 4 Monitoring	Nov 08	Jan 09

Table III. Project Contact Table Project Number and Name: 52 – Brown Bark Park	
Design Firm	Buck Engineering 8000 Regency Parkway, Suite 200 Cary, North Carolina 27511 Contact: Mr. Mike Rooney Phone: (919) 463-5488 Fax: (919) 463-5490
Construction Contractor	Shamrock Construction P.O. Box 14987 Greensboro, North Carolina 27415 Contact: Mr. Bill Wright Phone: (336) 375-1989 Fax: (336) 375-1801
Monitoring Performers	
MY-01	Buck Engineering 8000 Regency Parkway, Suite 200 Cary, North Carolina 27511 Contact: Mr. Mike Rooney Phone: (919) 463-5488 Fax: (919) 463-5490
MY-02-04	KCI Associates of NC Landmark Center, II Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 783-9214 Fax: (919) 783-9266

Table IV. Project Background Table **Project Number and Name: 52 – Brown Bark Park**	
Project County	Guilford County
Drainage Area	0.3 sq. mi.
Drainage Impervious Cover Estimate (%)	32%
Stream Order	First Order
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Rosgen Classification of As-built	B5/C5
Dominant Soil Types	Cecil-Urban land complex (Brown Bark)
Reference Site ID	N/A
USGS HUC for Project and Reference	03030002020040 (Brown Bark)
NCDWQ Sub-basin for Project and Reference	03-06-02 (Brown Bark)
NCDWQ Classification for Project and Reference	N/A (Brown Bark)
Any portion of the project segment 303(d) listed?	No - not rated
Any portion of the project segment upstream of a 303(d) listed segment?	N/A
Reasons for 303(d) Listing or Stressor	N/A
% of Project Easement Fenced	0%
% of Project Easement Demarcated with Bollards	approx. 100%



MATCHLINE SEE SHEET 2

CROSS-SECTION COORDINATES

	NORTHING	EASTING	ELEVATION
CROSS SECTION 1 LB	854764.00	1746575.78	868.72
RB	854702.75	1746566.80	867.17
CROSS SECTION 2 LB	854697.11	1747001.81	861.95
RB	854640.09	1746985.84	861.03
CROSS SECTION 3 LB	854720.10	1747301.05	860.12
RB	854670.41	1747312.08	859.03
CROSS SECTION 4 LB	854819.75	1748121.89	849.07
RB	854751.04	1748141.23	849.17
CROSS SECTION 5 LB	855254.33	1748454.35	843.60
RB	855166.17	1748509.37	845.77
CROSS SECTION 6 LB	855306.44	1748489.65	843.94
RB	855266.18	1748559.39	843.04

VEGETATION PLOT COORDINATES

	NORTHING	EASTING
VEGETATION PLOT #1	854776.63	1746449.92
	854765.69	1746549.34
	854736.87	1746548.45
	854750.71	1746445.55
VEGETATION PLOT #2	854759.56	1747969.16
	854784.70	1748070.71
	854751.50	1748085.79
	854730.74	1747972.89
LIVE STAKE PLOT, BEGIN -	854750.71	1746445.55
END -	854729.16	1746619.43

LEGEND

- PHOTO POINT
- THALWEG
- AS-BUILT VEGETATIVE BUFFER BOUNDARY
- CROSS-SECTION
- ROOT WAD
- ROCK CROSS VANE
- CONSTRUCTED RIFFLE

NAD 83

–60 –30 0 30 60

GRAPHIC SCALE

REVISIONS

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

BROWN BARK PARK

GUILFORD COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 52 - MY04

STATION 10+00 TO STATION 18+85

DATE: NOVEMBER 2008
SCALE: SEE SHEET

MONITORING PLAN VIEW

SHEET 1 OF 3

MATCHLINE SEE SHEET 1

MATCHLINE SEE SHEET 3

MATCHLINE SEE SHEET 3

WATAUGA DR.

BROWN BARK DR.

LAUREL WOOD DR.

REACH 3 STA 19+59

EXISTING STREAM CROSSING

B-BALL COURT

VEGETATION PLOT #2

PP #17
PP #18
PP #19A
PP #19B
PP #20A
PP #20B
PP #21A
PP #21B
PP #22
PP #23
PP #24
PP #25
PP #26
PP #27
PP #28

SECTION 3

24" RCP
18" RCP

19+00
20+00
21+00
22+00
23+00
24+00
25+00
26+00
27+00
28+00

LEGEND

- PHOTO POINT
- THALWEG
- AS-BUILT VEGETATIVE BUFFER BOUNDARY
- CROSS-SECTION
- ROOT WAD
- ROCK CROSS VANE
- CONSTRUCTED RIFFLE

NAD 83

–60 –30 0 30 60

GRAPHIC SCALE

REVISIONS

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
460 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

BROWN BARK PARK

GUILFORD COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 52 - MY04

STATION 18+55 TO STATION 28+40

DATE: NOVEMBER 2008
SCALE: SEE SHEET

MONITORING PLAN VIEW

MATCHLINE SEE SHEET 2

WATAUGA DR.

BROWN BARK DR.

COLERIDGE DR.

WEST MINSTER DR.

REACH 4 STA 31+84

REACH 5 STA 36+58

X-SECTION 4

X-SECTION 5

18" RCP

24" RCP

PP #29A

PP #29B

PP #30

PP #31

PP #32

PP #33

PP #35

PP #36

PP #37

PP #38

PP #39

PP #40

PP #41

PP #42

LEGEND

PHOTO POINT

THALWEG

AS-BUILT VEGETATIVE BUFFER BOUNDARY

CROSS-SECTION

ROOT WAD

ROCK CROSS VANE

CONSTRUCTED RIFFLE

NAD 83

–60 –30 0 30 60

GRAPHIC SCALE

REVISIONS

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SW FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

BROWN BARK PARK

GUILFORD COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 52 - MY04

STATION 28+40 TO STATION 38+55

DATE: NOVEMBER 2008
SCALE: SEE SHEET

MONITORING PLAN VIEW

2.0 PROJECT CONDITIONS AND MONITORING RESULTS

2.1 Vegetation Assessment

The fourth year of monitoring found an average of 279 stems/acre in the buffer plots, and 2,788 stems/acre in the live stake plot. The density of planted trees in the riparian buffer is lower than the fourth year success criteria of 288 stems/acre, but there is consistent vegetative cover throughout most of the riparian buffer and the density is not lower than the fifth year success criteria of 260 stems/acre. Where there are problem areas associated with poor vegetative cover, this is primarily because of poor soil conditions on the side slopes and the lack of top soil where it was removed during construction. Due to the urban nature of the project, there are numerous exotic species that are present at the project site. These species include mimosa (*Albizia julibrissin*), white mulberry (*Morus alba*), Japanese honeysuckle (*Lonicera japonica*), ornamental pear (*Pyrus calleryana)*, multiflora rose (*Rosa multiflora*), and porcelainberry (*Ampelopsis brevipedunculata*), the last of which has become more prevalent throughout the entire site this year. Most of the invasive species are scattered throughout the buffer and do not densely populate any one area more than others. Controlling the invasive species within the conservation easement would greatly benefit the planted native riparian vegetation. See the vegetation monitoring data and photos in Appendix A and Current Conditions Plan View in Appendix C. The taxonomic standard being used for vegetation identifications is "Flora of the Carolinas, Virginia, Georgia, and surrounding areas by Alan S. Weakley.

2.2 Stream Assessment

The stream assessment completed during the fourth year of monitoring found the stream to be functioning for the majority of the project. Channel dimensions have changed minimally from the as-built conditions. With the exception of a few places of deposition and erosion, the profile has changed little from previous monitoring. The majority of the in-stream structures are functioning. This will be looked at closely next year, and should continue to be monitored. See the stream assessment in Appendix B and Current Conditions Plan View in Appendix C.

2.2.1 Bankfull Event and Stability Assessment

2.2.1.a Verification of Bankfull Events Table

Table V. Verification of Bankfull Events
Project Number and Name: 52 – Brown Bark Park

Date of Data Collection	Date of Occurrence	Method	Photo Number
9/18/2006	9/18/2006	On site	N/A
8/17/2007	4/15/2007	Crest gauge	N/A
11/15/2007	10/26/2007	Crest gauge	N/A
11/5/2008	8/27/2008	Crest gauge	N/A

2.2.1.b BEHI and Sediment Export Table

Table VI. BEHI and Sediment Export Estimates
Project Number and Name: 52 – Brown Bark Park

To Be Conducted During Monitoring Year 05

2.2.2 Stability Assessment Table

Table VII. Categorical Stream Feature Visual Stability Assessment Project Number and Name: 52 – Brown Bark Park						
Feature	**Initial**	**MY - 01**	**MY - 02**	**MY - 03**	**MY - 04**	**MY - 05**
A. Riffles	100%	N/A	86%	83%	81%	
B. Pools	100%	N/A	94%	93%	93%	
C. Thalweg	100%	N/A	68%	82%	82%	
D. Meanders	100%	N/A	60%	100%	100%	
E. Bed General	100%	N/A	99%	100%	99%	
F. Bank Condition	100%	N/A	93%	98%	98%	
G. Vanes / J Hooks etc.	100%	N/A	100%	100%	100%	
H. Wads and Boulders	100%	N/A	83%	83%	84%	

2.2.3 Quantitative Measures Summary Tables

Table VIII. Baseline Morphology and Hydraulic Summary
Project Number and Name: 52 – Brown Bark Park

Parameter	Brown Bark Existing			Brown Bark Design			Reach 1 As-built			Reach 3* As-built			Reach 4 As-built			Reach 5 As-built		
Dimension	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Bankfull Width (ft)	6.0	9.0				13.0			8.3			9.3			11.2			10.0
Floodprone Width (ft)	50					50			19			32			41			46
Bankfull Cross-Sectional Area	4.0	9.0				12.0			7.0			13.1			9.8			10.1
Bankfull Mean Depth (ft)	0.7	1.0				1.1			0.8			1.4			0.9			1.0
Bankfull Maximum Depth (ft)	1.2					1.2			1.4			2.5			1.5			1.7
Width/Depth Ratio	8.0					10.0			9.8			6.7			12.9			9.8
Entrenchment Ratio	5.6					3.9			2.3			3.4			3.7			4.6
Bank Height Ratio	1.2	2.6				1.0			1.0			1.0			1.0			1.0
Wetted Perimeter (ft)																		
Hydraulic Radius (ft)																		
Pattern																		
Channel Beltwidth (ft)				39	52													
Radius of Curvature (ft)				26	39													
Meander Wavelength (ft)				78	117													
Meander Width Ratio				3	4													
Profile																		
Riffle Length (ft)																		
Riffle Slope (ft/ft)	0.0150			0.0070	0.0100													
Pool Length (ft)																		
Pool Spacing (ft)																		
Substrate																		
d50 (mm)																		
d84 (mm)																		
Additional Reach Parameters																		
Valley Length (ft)																		
Channel Length (ft)	2,748			2,872														
Sinuosity	1.1 - 1.2			1.2 - 1.4														
Water Surface Slope (ft/ft)	0.0093			0.0067														
BF Slope (ft/ft)																		
Rosgen Classification	C4/E4			E4														

*There are no riffle cross-sections on Reach 2 and therefore are no as-built data.

Note: As-built data were recalculated in MY-04 to make the bankfull elevations consistent throughout the monitoring period.

Table IXa. Morphology and Hydraulic Monitoring Summary
Project Number and Name: 52 – Brown Bark Park

Parameter	Cross-Section 1 Riffle - Reach 1						Cross-Section 2 Pool - Reach 2						Cross-Section 3 Riffle - Reach 3					
Dimension	MY1*	MY2	MY3	MY4	MY5	MY+	MY1*	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)		6.4	5.7	7.4				15.3	17.3	17.0			11.7	9.6	9.8	9.8		
Floodprone Width (ft)		17	18	18				36	36	34			43	32	35	35		
Bankfull Cross Sectional Area (ft^2)		5.3	5.3	5.6				11.0	12.1	9.8			16.4	12.7	13.3	13.5		
Bankfull Mean Depth (ft)		0.8	0.9	0.8				0.7	0.7	0.6			1.4	1.3	1.4	1.4		
Bankfull Maximum Depth (ft)		1.3	1.3	1.4				1.7	1.9	1.7			3.2	2.5	2.7	2.4		
Width/Depth Ratio		7.8	6.2	9.8				21.3	24.7	29.5			8.4	7.2	7.2	7.2		
Entrenchment Ratio		2.6	3.2	2.5				2.4	2.1	2.0			3.6	3.3	3.5	3.5		
Bank Height Ratio		1.0	1.0	1.0				1.0	1.0	1.0			1.0	1.0	1.0	1.0		
Wetted Perimeter (ft)		7.2	6.8	8.2				16.0	18.2	17.9				11.1	12.0	11.9		
Hydraulic Radius (ft)		0.7	0.8	0.7				0.7	0.7	0.5				1.1	1.1	1.1		
Substrate																		
d50 (mm)		19.1	14.0	17.0				8.4	6.9	11.0				15.3	25.0	24.0		
d84 (mm)		56	53	53				18	17	21				101	110	85		

Table IXb. Morphology and Hydraulic Monitoring Summary
Project Number and Name: 52 – Brown Bark Park

Parameter	Cross-Section 4 Pool - Reach 3						Cross-Section 5 Riffle - Reach 4						Cross-Section 6 Riffle - Reach 5					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	8.3	6.1	5.9	6.2			12.5	9.8	10.0	9.9			9.2	9.9	8.7	9.2		
Floodprone Width (ft)	25	23	24	24			43	35	39	39			45.8	46	45	44		
Bankfull Cross Sectional Area (ft^2)	8.5	5.6	6.3	7.7			10.3	8.0	8.6	8.0			9.7	9.4	9.0	9.1		
Bankfull Mean Depth (ft)	1.0	0.9	1.1	1.2			0.8	0.8	0.9	0.8			1.1	0.9	1.0	1.0		
Bankfull Maximum Depth (ft)	1.9	1.7	1.8	1.8			1.5	1.3	1.4	1.4			1.5	1.6	1.6	1.6		
Width/Depth Ratio	8.2	6.8	5.6	5.0			15.3	12.0	11.5	12.2			8.7	10.4	8.4	9.3		
Entrenchment Ratio	3.0	3.8	4.0	3.8			3.5	3.7	3.9	3.9			5.0	4.6	5.1	4.8		
Bank Height Ratio	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0		
Wetted Perimeter (ft)		7.5	7.4	8.0				10.3	10.8	11.2				10.6	9.6	10.1		
Hydraulic Radius (ft)		0.7	0.8	1.0				0.8	0.8	0.7				0.9	0.9	0.9		
Substrate																		
d50 (mm)		6.8	8.3	1.6				15.2	12.0	18.0				21.1	32.0	35.0		
d84 (mm)		31	42	9.5				70	140	110				83	150	160		

* Station and elevation data unavailable to plot cross-section and calculate summary data.

Table IXc. Morphology and Hydraulic Monitoring Summary continued Project Number and Name: 52 – Brown Bark Park															
Parameter	MY - 01 (2005)			MY - 02 (2006)			MY - 03 (2007)			MY - 04 (2008)			MY - 05 (2009)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)				22	71	37	32	58	43	32	58	43			
Radius of Curvature (ft)				17	33	19	17	33	19	17	33	19			
Meander Wavelength (ft)				79	105	91	81	111	92	81	111	92			
Meander Width Ratio				1.7	5.5	2.9	2.4	4.4	3.2	3.5	6.4	4.7			
Profile															
Riffle Length (ft)				3	60	13	3	67	14	3	39	14			
Riffle Slope (ft/ft)				0.003	0.160	0.027	0.000	0.200	0.020	0.004	0.070	0.027			
Pool Length (ft)				4	64	14	3	44	8	3	61	14			
Pool Spacing (ft)				13	174	45	14	173	44	14	121	51			
Additional Reach Parameters															
Valley Length (ft)				2,623			2,623			2,623					
Channel Length (ft)				2,855			2,855			2,855					
Sinuosity				1.1			1.1			1.1					
Water Surface Slope (ft/ft)				0.0090			0.0098			0.0096					
Rosgen Classification	B5c/C5			B4c/C4			B4c/C4			B4c/C4					

Some of the cross-section data from previous monitoring years has been recalculated using the most recent bankfull elevations. This is not a product of the stream dimensions changing or the formation of a bankfull indicating feature. The elevations were changed because those used previously were greater than the top of the bank, which is the intended bankfull elevation. Without other bankfull indicators, this elevation is the most accurate and best corresponds to the definition of bankfull. Future monitoring has and will continue to use these top of bank elevations unless other bankfull features develop over the course of monitoring.

3.0 METHODOLOGY

The EEP 2004 Stem Counting Protocol was used to collect vegetation data from Brown Bark Park this year, the fourth year of monitoring.

4.0 REFERENCES

Weakley, Alan S. 2006. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas. (http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2006-Jan.pdf)

Appendix A
Vegetation Data

Appendix A1: Vegetation Data Tables

Table A1. Stem Counts for Each Species Arranged by Plot
Project Number and Name: 52 – Brown Bark Park

Species	Buffer Plot 1	Buffer Plot 2	Live Stake Plot	Initial Totals	Year 1 Totals	Year 2 Totals	Year 3 Totals	Year 4 Totals	Survival %*
Shrubs									
Cornus amomum			26			26	26	26	N/A
Sambucus canadensis			10			7	10	10	N/A
Trees									
Quercus phellos		1				1	1	1	N/A
Fraxinus pennsylvanica		3				4	3	3	N/A
Nyssa sylvatica	5	9				14	14	14	N/A
Betula nigra	1	3				5	4	4	N/A
Cornus florida	1					1	1	1	N/A
Hamamelis virginiana	9					11	11	9	N/A
Salix nigra			6			6	6	6	N/A
Salix sericea			14			25	14	14	N/A
Total	**16**	**16**	**56**	**179**	**127**	**100**	**90**	**88**	**49%**

*The survival percentage for each species is unknown because the as-built and first year monitoring data are not available

Table A2. Stem Density By Plot
Project Number and Name: 52 – Brown Bark Park
Crew : B. Roberts

Plot #	Witch Hazel *Hamamelis virginiana*	Green Ash *Fraxinus pennsylvanica*	Black Gum *Nyssa sylvatica*	River Birch *Betula nigra*	Silky Dogwood *Cornus amomum*	Elderberry *Sambucus canadensis*	Flowering Dogwood *Cornus florida*	Willow Oak *Quercus phellos*	Silky Willow *Salix sericea*	Black Willow *Salix nigra*	Total (Year 4)	Density (Trees/Acre)
1	9		5	1			1				16	279
2		3	9	3				1			16	279
LS					26	10			14	6	56	2,788

Appendix A2 – Representative Vegetation Problem Area Photos

VP1 – Japanese honeysuckle (*Lonicera japonica*) and porcelainberry (*Ampelopsis brevipedunculata)*. Photo taken near Station 10+00. 11/7/08 - MY 04

VP2 – Banks with unvegetated coir matting. Photo taken near Station 10+75. 11/7/08 - MY 04

VP3 – The riparian buffer has been cut to create a path. Photo taken near Station 14+20. 10/29/08 - MY 04

VP4 – Bare floodplain/bank with exposed subsoil. Photo taken near Station 27+10. 10/29/08 - MY 04

Appendix A3 - Vegetation Monitoring Plot Photos

Plot 1 Photo – Taken from Photo Point #3, Buffer Plot #1 and the Live Stake Plot are on the left side of the stream. 11/7/08 - MY 04

Plot 2 Photo – Taken from Photo Point #28, Buffer Plot #2 is on the left side of the stream. 11/5/08 - MY 04

Appendix B
Geomorphologic Data

Appendix B1 – Representative Stream Problem Area Photos

SP1 –Scour behind rootwads under the streambank. Photo taken near Station 18+00. 11/5/08 - MY 04

SP2 – Base flow going around a header stone in cross vane. Photo taken near Station 19+20. 11/5/08 - MY 04

SP3 – Bank erosion. Photo taken near Station 31+50. 10/29/08 - MY 04

Appendix B2 –Stream Photo Station Photos

PP#1 – MY04 – 11/7/08

PP#2 – MY04 – 11/5/08

PP#3 – MY04 – 11/7/08

PP#4 – MY04 – 11/5/08

PP#5 – MY04 – 11/5/08

PP#6 – MY04 – 11/5/08

PP#7 – MY04 – 11/7/08

PP#8 – MY04 – 11/5/08

PP#9 – MY04 – 11/5/08

PP#10 – MY04 – 11/5/08

PP#11 – MY04 – 11/5/08

PP#12 – MY04 – 11/7/08

PP#13 – MY04 – 11/5/08

PP#14 – MY04 – 11/5/08

PP#15 – MY04 – 11/5/08

PP#16 – MY04 – 11/5/08

PP#17 – MY04 – 11/5/08

PP#18 – MY04 – 11/7/08

PP#19A – MY04 – 11/5/08

PP#19B – MY04 – 11/7/08

PP#20A – MY04 – 11/7/08

PP#20B – MY04 – 11/7/08

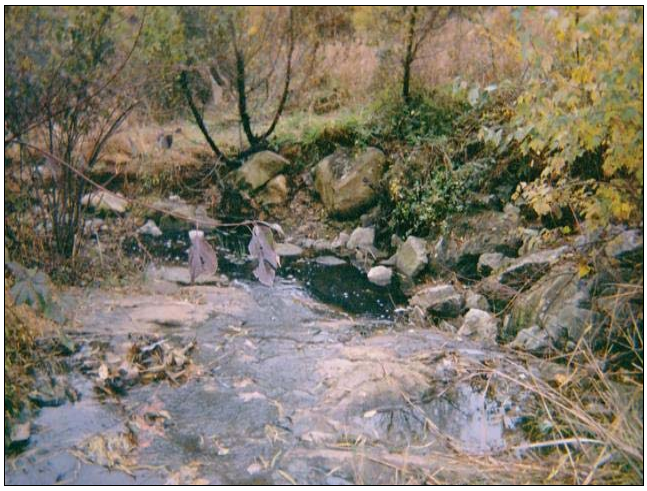
PP#21A – MY04 – 11/5/08

PP#21B – MY04 – 11/5/08

PP#22 – MY04 – 11/5/08

PP#23 – MY04 – 11/5/08

PP#24 – MY04 – 11/5/08



PP#25 – MY04 – 11/5/08

PP#26 – MY04 – 11/5/08

PP#27 – MY04 – 11/5/08

PP#28 – MY04 – 11/5/08

PP#29A – MY04 – 11/5/08

PP#29B – MY04 – 11/5/08

PP#30 – MY04 – 11/5/08

PP#31 – MY04 – 11/5/08

PP#32 – MY04 – 11/5/08

PP#33 – MY04 – 11/7/08

PP#34 – MY04 – 11/5/08

PP#35 – MY04 – 11/5/08

PP#36 – MY04 – 11/5/08

PP#37 – MY04 – 11/5/08

PP#38 – MY04 – 11/5/08

PP#39 – MY04 – 11/5/08

PP#40 – MY04 – 11/5/08

PP#41 – MY04 – 11/5/08

PP#42 – MY04 – 11/5/08

Appendix B3 – Qualitative Visual Stability Assessment

Table B2. Qualitative Visual Stability Assessment
Project Number and Name: 52 – Brown Bark Park

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built *	Total Number / feet in unstable state	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	45	52	N/A	85%	
	2. Armor stable (e.g. no displacement)?	43	52	N/A	81%	
	3. Facet grade appears stable?	45	52	N/A	85%	
	4. Minimal evidence of embedding/fining?	43	52	N/A	81%	
	5. Length appropriate?	38	52	N/A	71%	81%
B. Pools	1. Present? (e.g. no severe aggradation)	48	50	N/A	94%	
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)	48	50	N/A	94%	
	3. Length appropriate?	43	50	N/A	92%	93%
C. Thalweg	1. Upstream of meander bend centering?	13	14	N/A	93%	
	2. Downstream of meander centering?	10	14	N/A	71%	82%
D. Meanders	1. Outer bend in state of limited/controlled erosion?	14	14	N/A	100%	
	2. Of those eroding, # w/ concomitant point bar formation?	0	0	N/A		
	3. Apparent Rc within spec?**			N/A		
	4. Sufficient floodplain access and relief?	14	14	N/A	100%	100%
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	2/15	99%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0/0		99%
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	6/95	98%	98%
G. Vanes	1. Free of back or arm scour?	6	6	N/A	100%	
	2. Height appropriate?	6	6	N/A	100%	
	3. Angle and geometry appear appropriate?	6	6	N/A	100%	
	4. Free of piping or other structural failures?	6	6	N/A	100%	100%
H. Wads / Boulders	1. Free of scour?	15	18	N/A	84%	
	2. Footing stable?	15	18	N/A	84%	84%

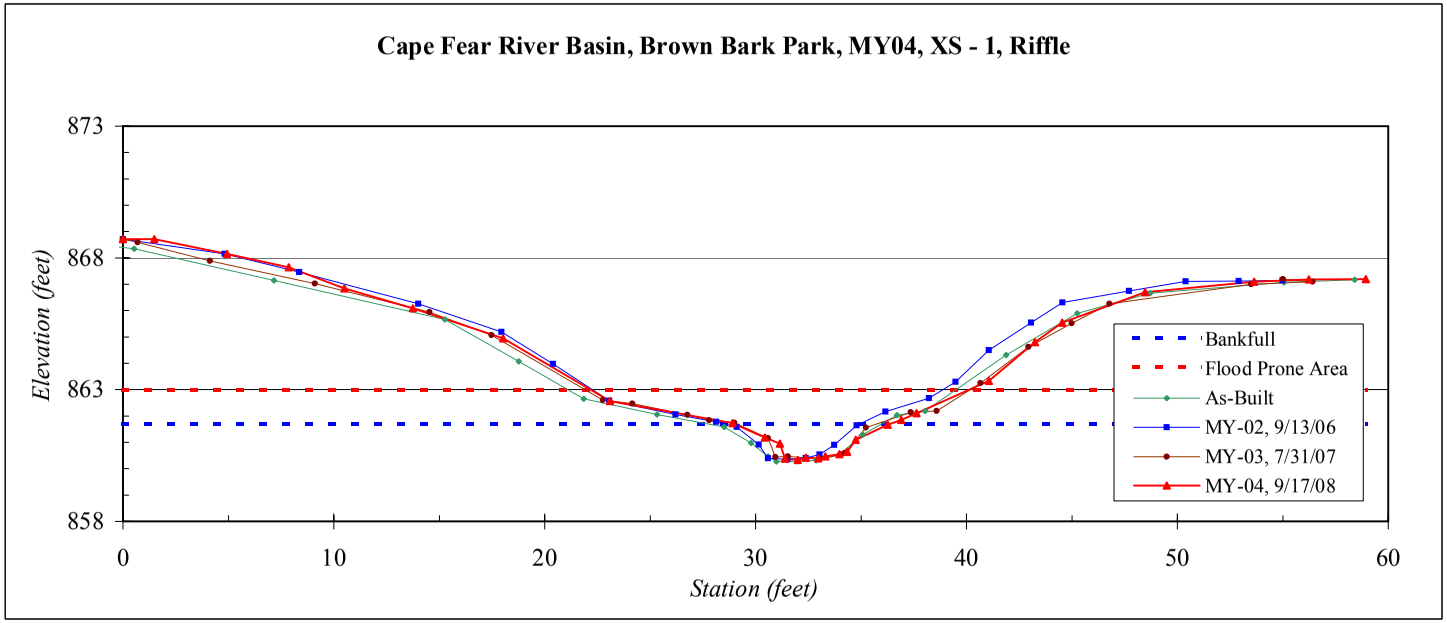
*Total number of features per as-built estimated from as-built profile and planview sheets.
**Rc of design unknown

B4 - Cross Section Plots

River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY04
XS ID	XS - 1, Riffle
Drainage Area (sq mi):	0.3
Date:	9/17/2008
Field Crew:	B. Roberts, Z. Wendling

Station	Elevation
0.0	868.72
1.5	868.72
4.9	868.16
7.9	867.64
10.5	866.84
13.8	866.09
18.0	864.95
23.1	862.57
28.9	861.72
30.4	861.19
31.1	860.95
31.4	860.39
32.0	860.33
32.4	860.42
33.0	860.39
33.3	860.47
34.0	860.55
34.3	860.63
34.7	861.10
36.3	861.67
36.9	861.85
37.6	862.11
41.1	863.34
43.2	864.80
44.5	865.54
48.5	866.70
53.6	867.10
56.2	867.18
58.9	867.19

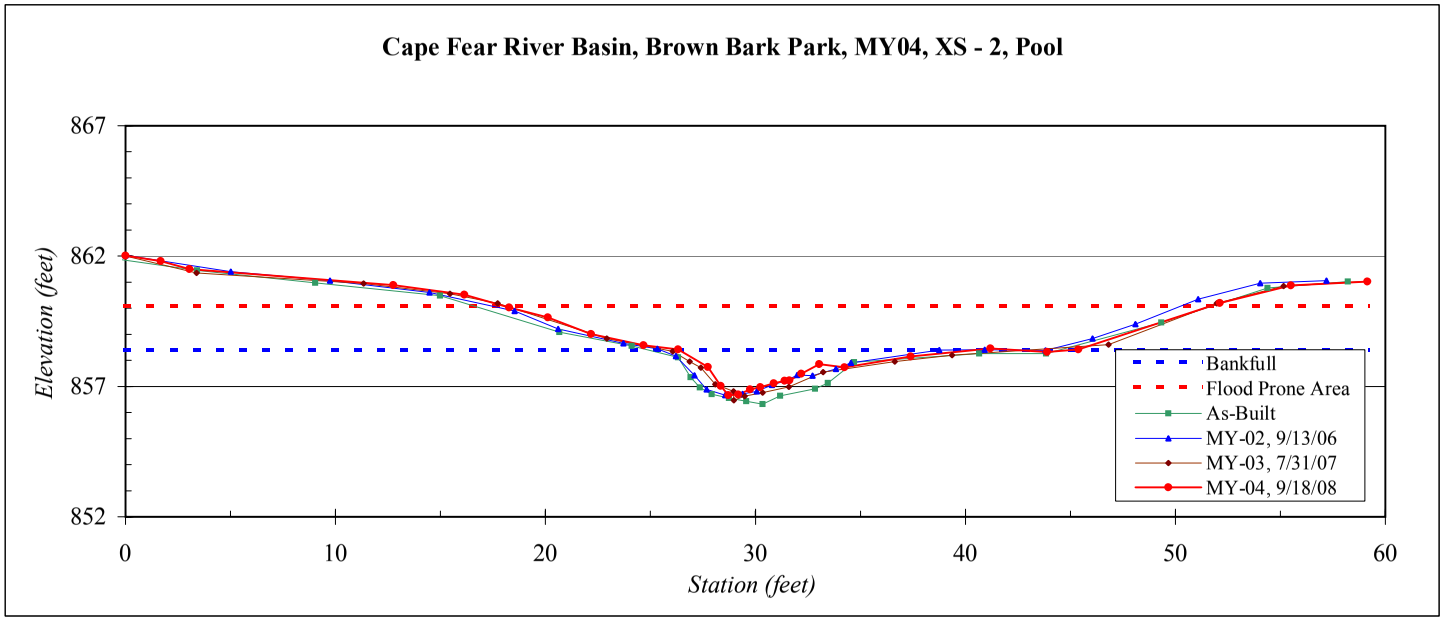
SUMMARY DATA	
Bankfull Elevation:	861.7
Bankfull Cross-Sectional Area:	5.6
Bankfull Width:	7.4
Flood Prone Area Elevation:	863.0
Flood Prone Width:	18
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.8
W / D Ratio:	9.8
Entrenchment Ratio:	2.5
Bank Height Ratio:	1.0



River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY04
XS ID	XS - 2, Pool
Drainage Area (sq mi):	0.3
Date:	9/18/2008
Field Crew:	B. Roberts, Z. Wendling

Station	Elevation
0.0	862.01
1.7	861.81
3.0	861.50
12.8	860.88
16.1	860.51
18.3	860.03
20.1	859.65
22.2	859.01
24.7	858.59
26.3	858.42
27.7	857.74
28.3	857.02
28.7	856.67
29.2	856.69
29.7	856.89
30.2	856.97
30.9	857.12
31.4	857.22
31.6	857.23
32.2	857.49
33.0	857.85
34.2	857.73
37.4	858.14
41.2	858.46
43.9	858.32
45.4	858.42
52.1	860.21
55.5	860.87
59.1	861.03

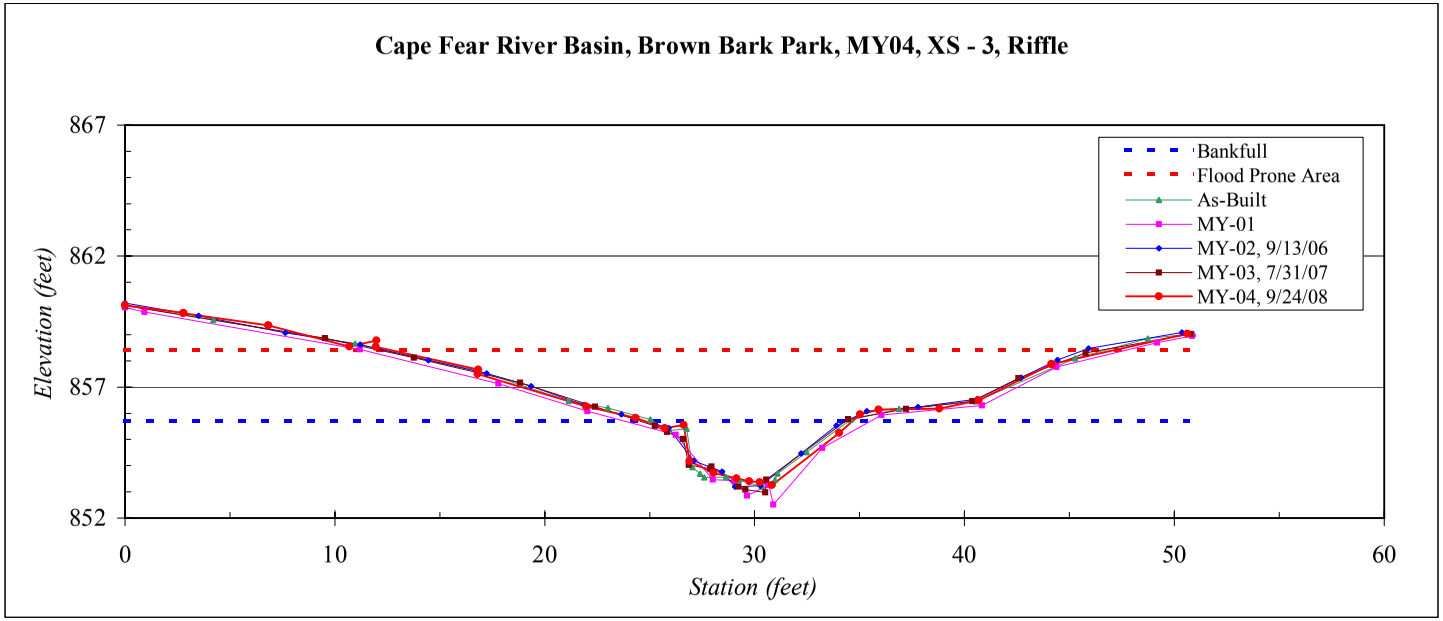
SUMMARY DATA	
Bankfull Elevation:	858.4
Bankfull Cross-Sectional Area:	9.8
Bankfull Width:	17.0
Flood Prone Area Elevation:	860.1
Flood Prone Width:	34
Max Depth at Bankfull:	1.7
Mean Depth at Bankfull:	0.6
W / D Ratio:	29.5
Entrenchment Ratio:	2.0
Bank Height Ratio:	1.0



River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY04
XS ID	XS - 3, Riffle
Drainage Area (sq mi):	0.3
Date:	9/24/2008
Field Crew:	B. Roberts, Z. Wendling

Station	Elevation
0.0	860.12
2.8	859.83
2.8	859.82
6.8	859.35
6.8	859.36
10.7	858.55
12.0	858.78
11.9	858.54
16.8	857.67
16.8	857.50
22.0	856.26
24.3	855.83
25.7	855.43
26.6	855.56
26.9	854.18
28.0	853.72
29.1	853.52
29.8	853.41
30.2	853.37
30.8	853.25
34.0	855.25
35.0	855.96
35.9	856.14
38.8	856.18
40.7	856.49
44.2	857.88
44.1	858.60
50.6	859.03

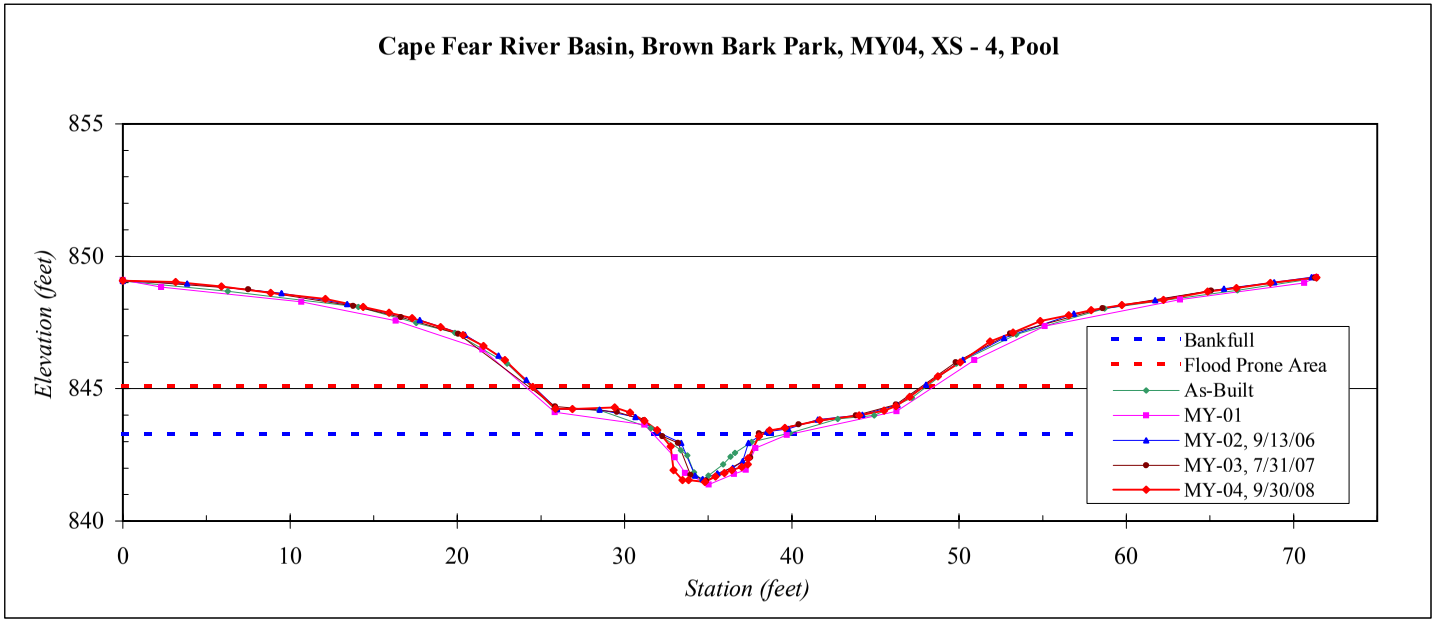
SUMMARY DATA	
Bankfull Elevation:	855.7
Bankfull Cross-Sectional Area:	13.3
Bankfull Width:	9.8
Flood Prone Area Elevation:	858.4
Flood Prone Width:	35
Max Depth at Bankfull:	2.4
Mean Depth at Bankfull:	1.4
W / D Ratio:	7.2
Entrenchment Ratio:	3.5
Bank Height Ratio:	1.0



River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY04
XS ID	XS - 4, Pool
Drainage Area (sq mi):	0.3
Date:	9/30/2008
Field Crew:	B. Roberts, K. Knight-Meng

Station*	Elevation*
0.0	849.08
3.2	849.03
5.9	848.86
8.8	848.62
12.1	848.39
14.4	848.09
15.9	847.87
17.3	847.66
19.0	847.32
20.3	847.03
21.6	846.61
22.8	846.08
24.5	845.06
33.5	841.55
33.8	841.54
34.8	841.47
35.4	841.68
36.0	841.82
36.4	841.92
37.0	842.05
37.4	842.14
37.4	842.37
38.0	843.20
38.7	843.42
39.6	843.51
41.7	843.80
44.0	843.99
45.5	844.17
57.9	847.97
59.7	848.15
62.2	848.35
64.9	848.67
66.6	848.80
68.6	848.99
71.4	849.20

SUMMARY DATA	
Bankfull Elevation:	843.3
Bankfull Cross-Sectional Area:	7.7
Bankfull Width:	6.2
Flood Prone Area Elevation:	845.1
Flood Prone Width:	24
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.2
W / D Ratio:	5.0
Entrenchment Ratio:	3.8
Bank Height Ratio:	1.0

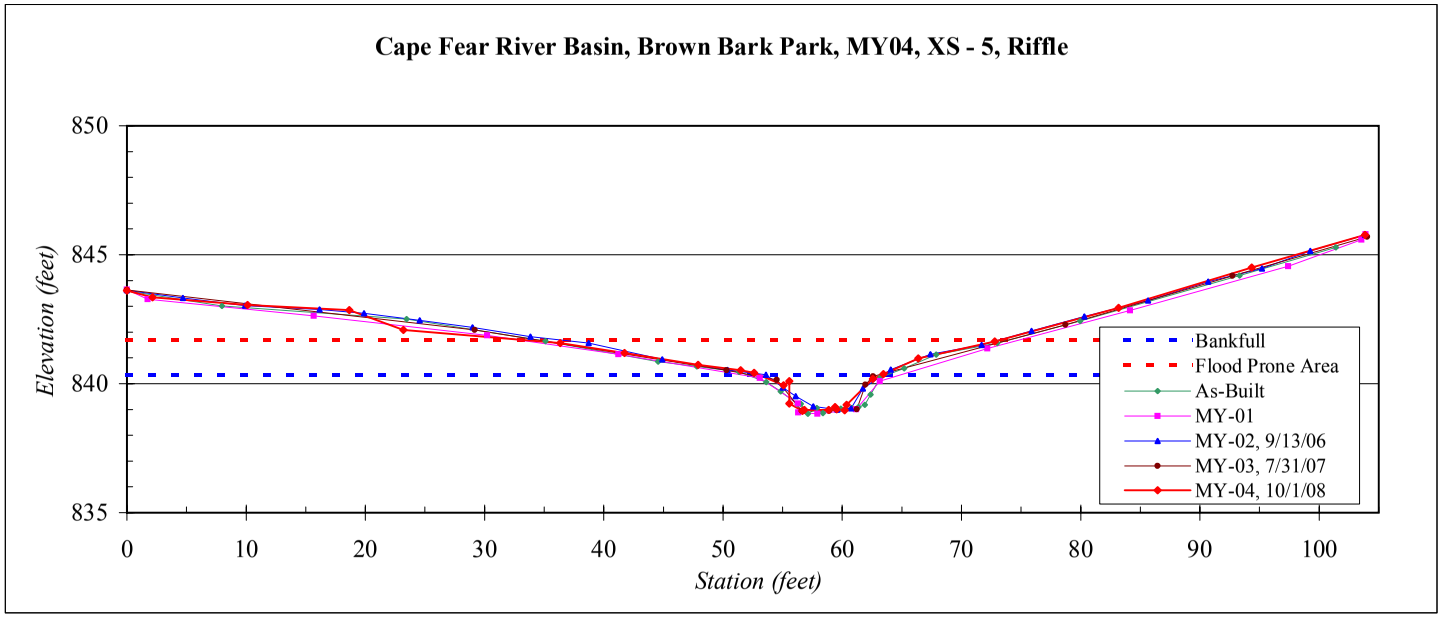


* Not all shots present in table due to space constraints

River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY04
XS ID	XS - 5, Riffle
Drainage Area (sq mi):	0.3
Date:	10/1/2008
Field Crew:	B. Roberts, A. Davis

Station	Elevation
0.0	843.62
2.1	843.35
10.1	843.06
18.7	842.86
23.2	842.08
36.3	841.57
41.7	841.19
47.9	840.73
51.5	840.52
52.6	840.42
55.1	839.94
55.6	840.10
55.6	839.23
56.7	838.95
56.8	838.98
58.9	838.98
59.4	839.10
59.5	839.01
60.2	838.97
60.4	839.19
62.6	840.18
63.5	840.37
66.4	840.98
72.8	841.64
83.2	842.95
94.3	844.50
103.8	845.77

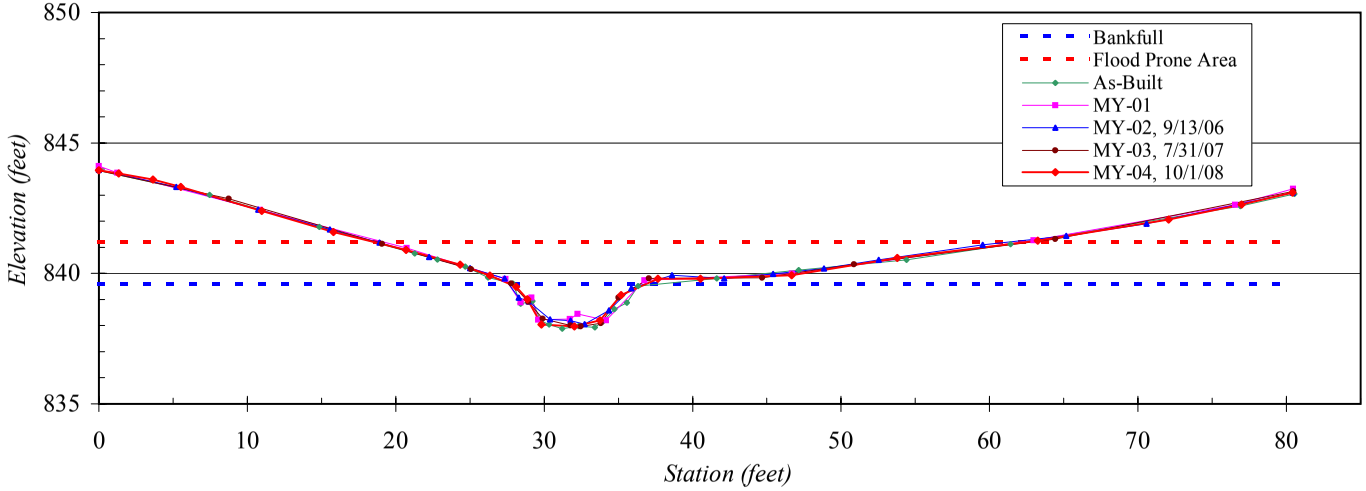
SUMMARY DATA	
Bankfull Elevation:	840.3
Bankfull Cross-Sectional Area:	8.0
Bankfull Width:	9.9
Flood Prone Area Elevation:	841.7
Flood Prone Width:	39
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.8
W / D Ratio:	12.2
Entrenchment Ratio:	3.9
Bank Height Ratio:	1.0



River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY04
XS ID	XS - 6, Riffle
Drainage Area (sq mi):	0.3
Date:	10/1/2008
Field Crew:	B. Roberts, A. Davis

Station	Elevation
0.0	843.96
1.3	843.82
3.6	843.59
5.5	843.32
11.0	842.39
15.8	841.59
20.7	840.90
24.3	840.33
26.3	839.92
28.1	839.49
28.9	839.01
29.8	838.04
32.0	837.97
33.8	838.20
35.2	839.16
37.7	839.80
40.5	839.79
46.7	839.93
53.8	840.60
63.3	841.26
72.1	842.06
77.0	842.64
80.4	843.10

SUMMARY DATA	
Bankfull Elevation:	839.6
Bankfull Cross-Sectional Area:	9.1
Bankfull Width:	9.2
Flood Prone Area Elevation:	841.2
Flood Prone Width:	44
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.0
W / D Ratio:	9.3
Entrenchment Ratio:	4.8
Bank Height Ratio:	1.0



B5 -Longitudinal Plots

Longitudinal Profile
Brown Bark Park
EEP Project Number 52 - MY04
Stations 10+00 - 20+00

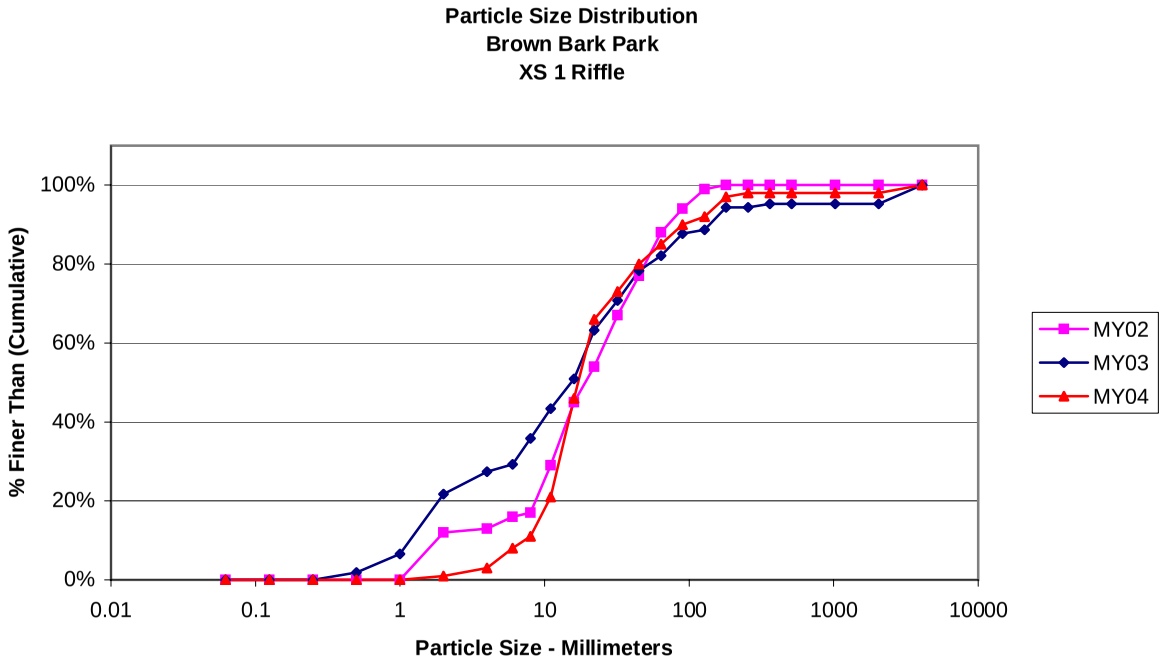
Longitudinal Profile
Brown Bark Park
EEP Project Number 52 - MY04
Stations 20+00 - 30+00

Longitudinal Profile
Brown Bark Park
EEP Project Number 52 - MY04
Stations 30+00 - 40+00

B6 - Pebble Count Plots

Cross Section 1 Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	1
Very Fine	2 - 4		2
Fine	4 - 5.7	G	5
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	10
Medium	11.3 - 16	V	25
Coarse	16 - 22.6	E	20
Coarse	22.6 - 32	L	7
Very Coarse	32 - 45	S	7
Very Coarse	45 - 64		5
Small	64 - 90	C	5
Small	90 - 128	O	2
Large	128 - 180	B	5
Large	180 - 256	L	1
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	2
		Total	100

Note:



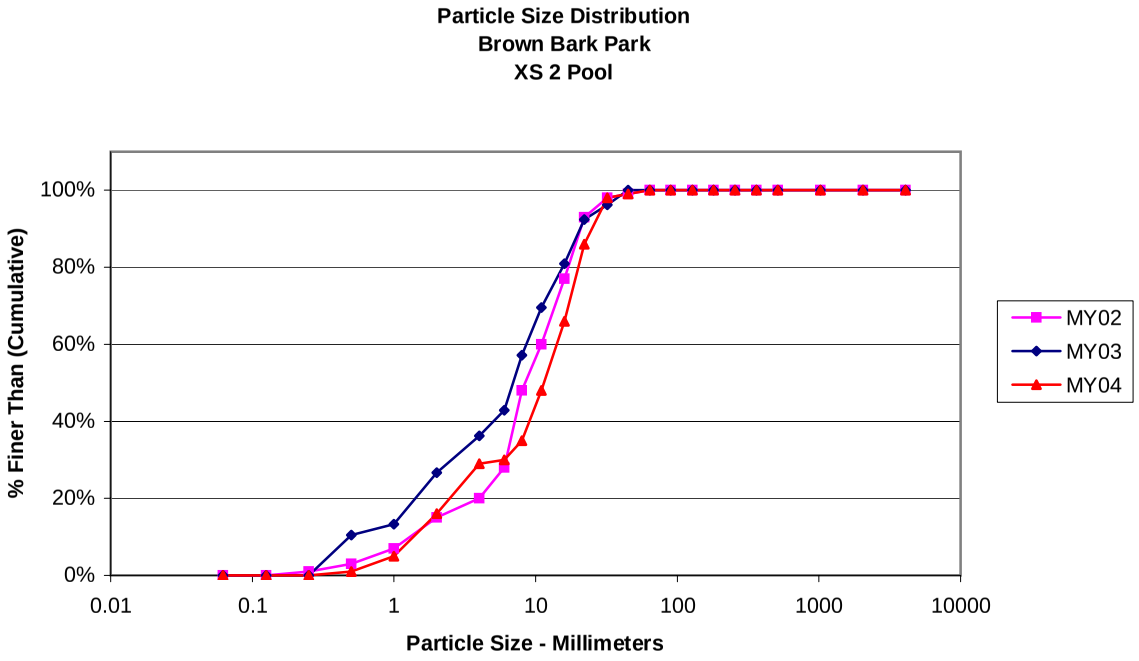
Size (mm)	
D16	9.3
D35	13
D50	17
D65	21
D84	53
D95	140

Size Distribution	
mean	22.2
dispersion	2.5
skewness	0.13

Type	
silt/clay	0%
sand	1%
gravel	84%
cobble	13%
boulder	0%
bedrock	2%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 2 Pool - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	1
Coarse	.50 - 1	D	4
Very Coarse	1 - 2	S	11
Very Fine	2 - 4		13
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	5
Medium	8 - 11.3	A	13
Medium	11.3 - 16	V	18
Coarse	16 - 22.6	E	20
Coarse	22.6 - 32	L	12
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		1
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



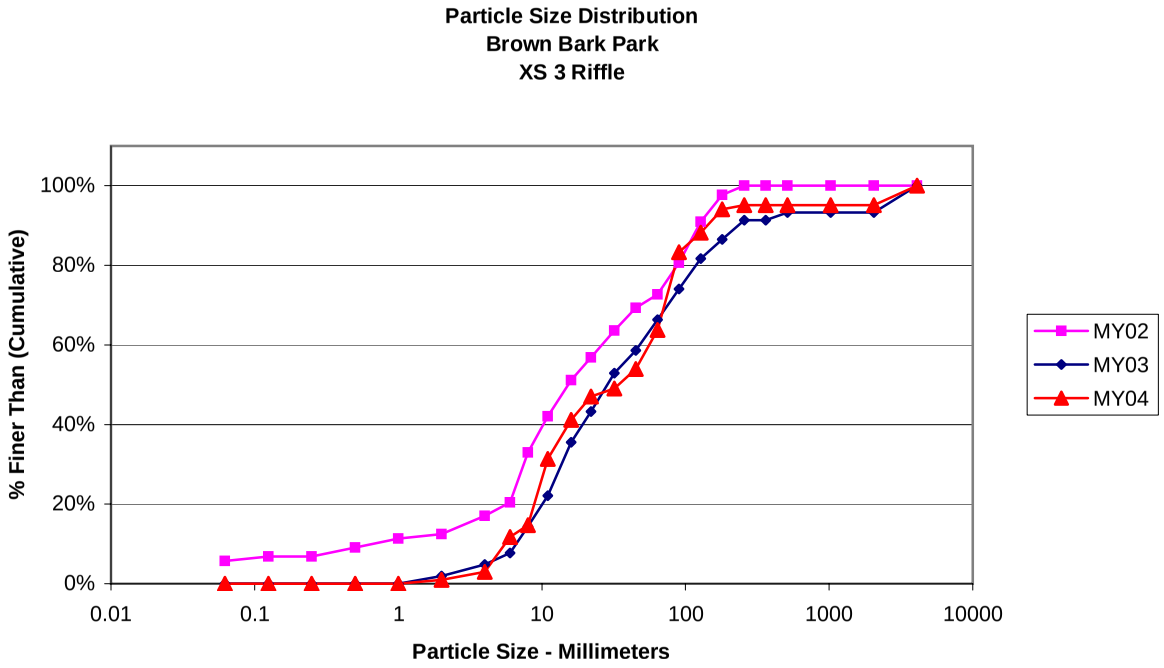
Size (mm)	
D16	2
D35	8
D50	11
D65	16
D84	21
D95	29

Size Distribution	
mean	6.5
dispersion	3.7
skewness	-0.23

Type	
silt/clay	0%
sand	16%
gravel	84%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 3 Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	1
Very Fine	2 - 4		2
Fine	4 - 5.7	G	9
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	17
Medium	11.3 - 16	V	10
Coarse	16 - 22.6	E	6
Coarse	22.6 - 32	L	2
Very Coarse	32 - 45	S	5
Very Coarse	45 - 64		10
Small	64 - 90	C	20
Small	90 - 128	O	5
Large	128 - 180	B	6
Large	180 - 256	L	1
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	5
		Total	102

Note:



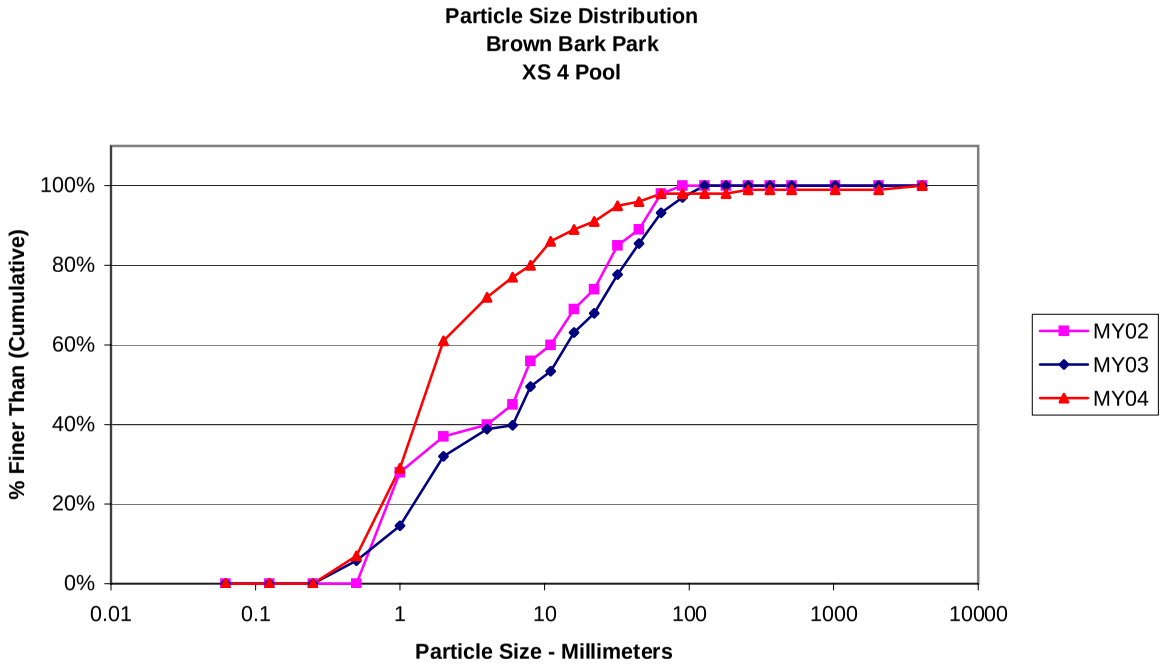
Size (mm)	
D16	8.1
D35	12
D50	24
D65	60
D84	85
D95	140

Size Distribution	
mean	26.2
dispersion	3.3
skewness	0.04

Type	
silt/clay	0%
sand	1%
gravel	63%
cobble	31%
boulder	0%
bedrock	5%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 4 Pool - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	7
Coarse	.50 - 1	D	22
Very Coarse	1 - 2	S	32
Very Fine	2 - 4		11
Fine	4 - 5.7	G	5
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		2
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	1
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	1
		Total	100

Note:



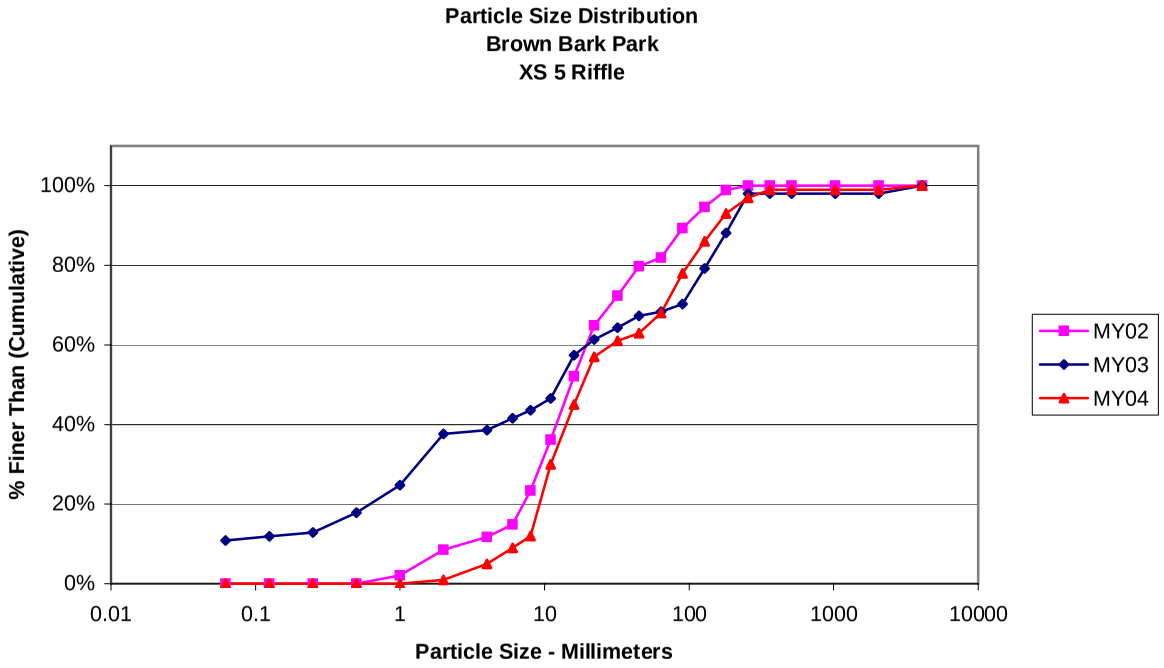
Size (mm)	
D16	0.66
D35	1.1
D50	1.6
D65	2.5
D84	9.5
D95	29

Size Distribution	
mean	2.5
dispersion	4.2
skewness	0.18

Type	
silt/clay	0%
sand	61%
gravel	37%
cobble	1%
boulder	0%
bedrock	1%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 5 Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	1
Very Fine	2 - 4		4
Fine	4 - 5.7	G	4
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	18
Medium	11.3 - 16	V	15
Coarse	16 - 22.6	E	12
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	2
Very Coarse	45 - 64		5
Small	64 - 90	C	10
Small	90 - 128	O	8
Large	128 - 180	B	7
Large	180 - 256	L	4
Small	256 - 362	B	2
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	1
		Total	100

Note:



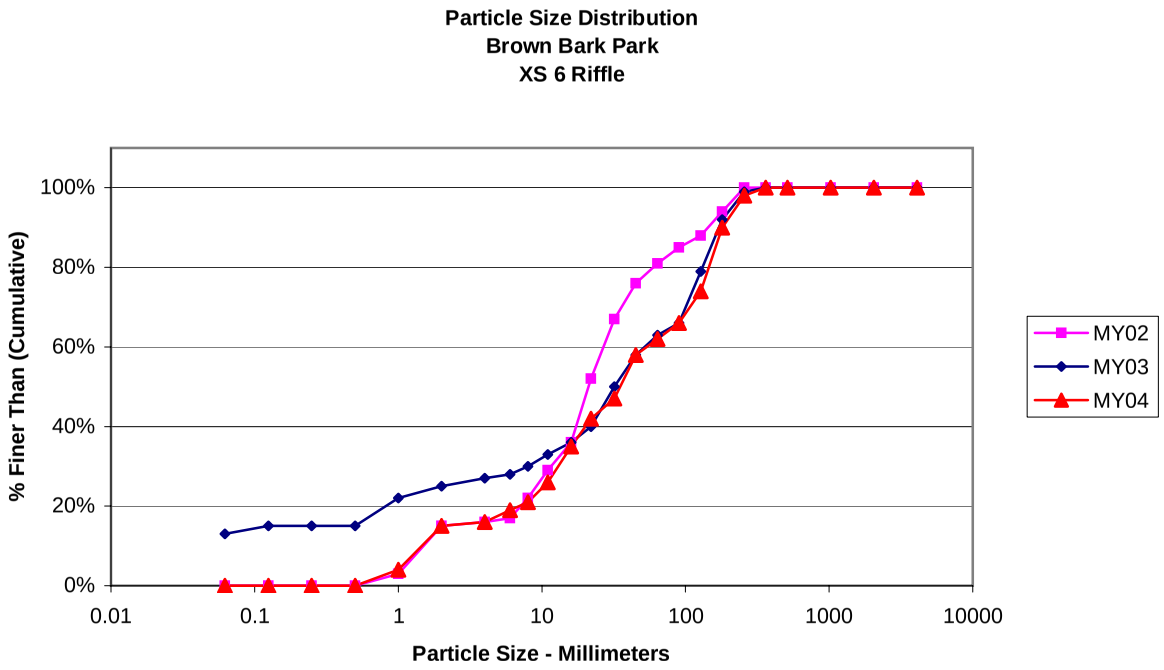
Size (mm)	
D16	8.6
D35	12
D50	18
D65	49
D84	110
D95	200

Size Distribution	
mean	30.8
dispersion	4.1
skewness	0.22

Type	
silt/clay	0%
sand	1%
gravel	67%
cobble	29%
boulder	2%
bedrock	1%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 6 Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	4
Very Coarse	1 - 2	S	11
Very Fine	2 - 4		1
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	5
Medium	11.3 - 16	V	9
Coarse	16 - 22.6	E	7
Coarse	22.6 - 32	L	5
Very Coarse	32 - 45	S	11
Very Coarse	45 - 64		4
Small	64 - 90	C	4
Small	90 - 128	O	8
Large	128 - 180	B	16
Large	180 - 256	L	8
Small	256 - 362	B	2
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



Size (mm)	
D16	4
D35	16
D50	35
D65	83
D84	160
D95	220

Size Distribution	
mean	25.3
dispersion	6.7
skewness	-0.11

Type	
silt/clay	0%
sand	15%
gravel	47%
cobble	36%
boulder	2%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Appendix C
Current Conditions Plan View

BANK EROSION

UNVEGETATED BANKS

PATH CUT THROUGH EASEMENT

SMALL AGGRADATION/ DEBRIS BLOCKAGE

MINOR BED AGGRADATION

STRESSED ROOT WADS DUE TO EROSION BEHIND ROOT WADS

REACH 2 STA 10+00

REACH 2 STA 16+35

WATAUGA DR.

KEMP RD.

BROWN BARK DR.

WINVIEW DR.

HONEYSUCKLE AND PORCELAINBERRY

FUNCTIONING BUT PIPING CROSS VANE

LEGEND

- THALWEG
- AS-BUILT VEGETATIVE BUFFER BOUNDARY
- ROOT WAD
- ROCK CROSS VANE
- CONSTRUCTED RIFFLE

NAD 83

–60 –30 0 30 60

GRAPHIC SCALE

REVISIONS

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601-SW. FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

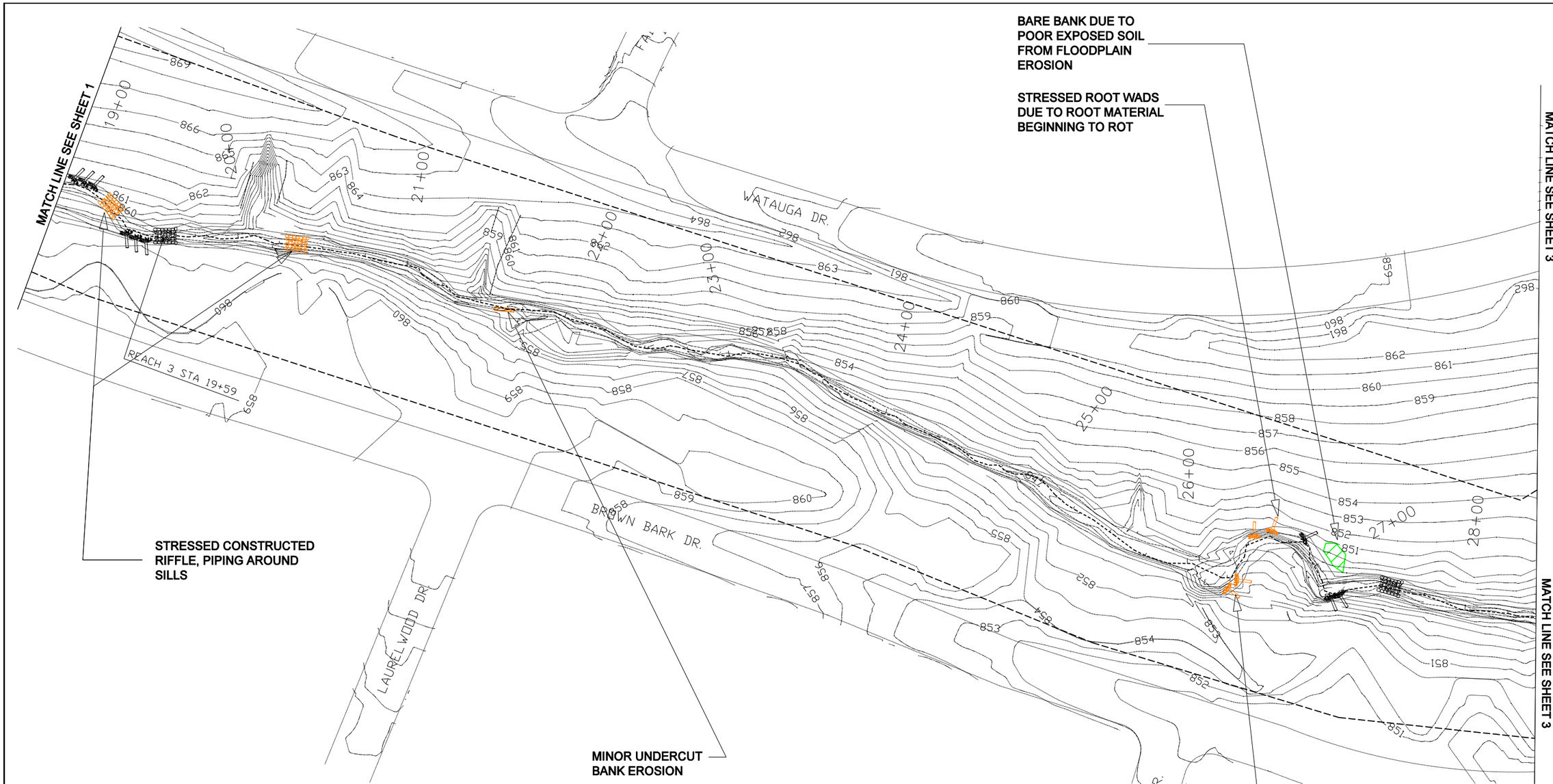
BROWN BARK PARK

GUILFORD COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 52 - MY04

STATION 10+00 TO STATION 18+85

DATE: NOVEMBER 2008
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW



REVISIONS

Ecosystem Enhancement

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

BROWN BARK PARK
GUILFORD COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 52 - MY04
STATION 18+85 TO STATION 28+40

DATE: NOVEMBER 2008
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW

SHEET 2 OF 3

MATCHLINE SEE SHEET 2

MODERATE FLOODPLAIN EROSION

MINOR BANK EROSION

MINOR UNDERCUT BANK EROSION

STRESSED CONSTRUCTED RIFFLE DUE TO PIPING AROUND RIGHT TOE PROTECTION

STRESSED CONSTRUCTED RIFFLE DUE TO PIPING AROUND RIGHT TOE PROTECTION

MOWED BUFFER

MINOR UNDERCUT BANK EROSION

MINOR UNDERCUT BANK EROSION

WATAUGA DR.

BROWN BARK DR.

WEST MINSTER DR.

COLERIDGE DR.

REACH 4 STA 31+84

REACH 5 STA 36+58

NAD 83

LEGEND

- THALWEG
- AS-BUILT VEGETATIVE BUFFER BOUNDARY
- ROOT WAD
- ROCK CROSS VANE
- CONSTRUCTED RIFFLE

–60 –30 0 30 60

GRAPHIC SCALE

REVISIONS

Ecosystem Enhancement Program

KCI
ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601SW FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

BROWN BARK PARK

GUILFORD COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 52 - MY04

STATION 28+40 TO STATION 38+55

DATE: NOVEMBER 2008
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW