Brown Bark Park
Stream Restoration Monitoring Report
EEP Project # 52
Monitoring Year – 05
2009

Submitted to:

Ecosystem Enhancement PROGRAM

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

December 2009

Monitoring Firm

Landmark Center II, Suite 220
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Project Contact: Adam Spiller
Email: adam.spiller@kci.com
KCI Project No: 12071067B_BB

Design Firm

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

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 2,834 linear feet of channel. Project construction occurred in 2004. The project goals and objectives are listed below.

- Restore unstable stream channel to natural stable form 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.

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 fifth year of monitoring found an average of 279 stems per acre in the buffer plots, and 2,639 stems per acre in the live stake plot. Due to the urban nature of the project, there are several 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 invasive species listed do not exist in dense, dominant patches, they are scattered and are generally low in number. EEP has indicated that the City of Greensboro is taking over invasive control moving forward into stewardship. The fifth year monitoring found the vegetation component of the project to be on track to meeting the success criteria. Although the vegetation plots met the success criteria, the longer, narrow nature of the buffer in combination with plot placement made for 10-15 foot wide strips at various places within the buffer that exhibited lower woody stem densities and were subject to supplemental planting in late winter 2009/2010. These areas were mainly between the benching and upland zones. The total acreage subject to supplemental planting was approximately 0.9 acres. The plants were larger caliper material, 3 years in age, 5-10 gallon containerized with substantial root mass. EEP plans to observe these stems and summarize survival for 1 or 2 more growing seasons before offering the project for final closeout.

The stream assessment completed during the fifth year of monitoring found the stream to be functioning for the majority of the project. Longitudinal profile and channel dimensions have changed minimally from the as-built conditions. The majority of the in-stream structures are functioning and some previously documented areas of erosion have stabilized with vegetation.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to 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 EEPs website. All raw data supporting the tables and figures in the appendices are available upon request.

2.0 METHODOLOGY

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

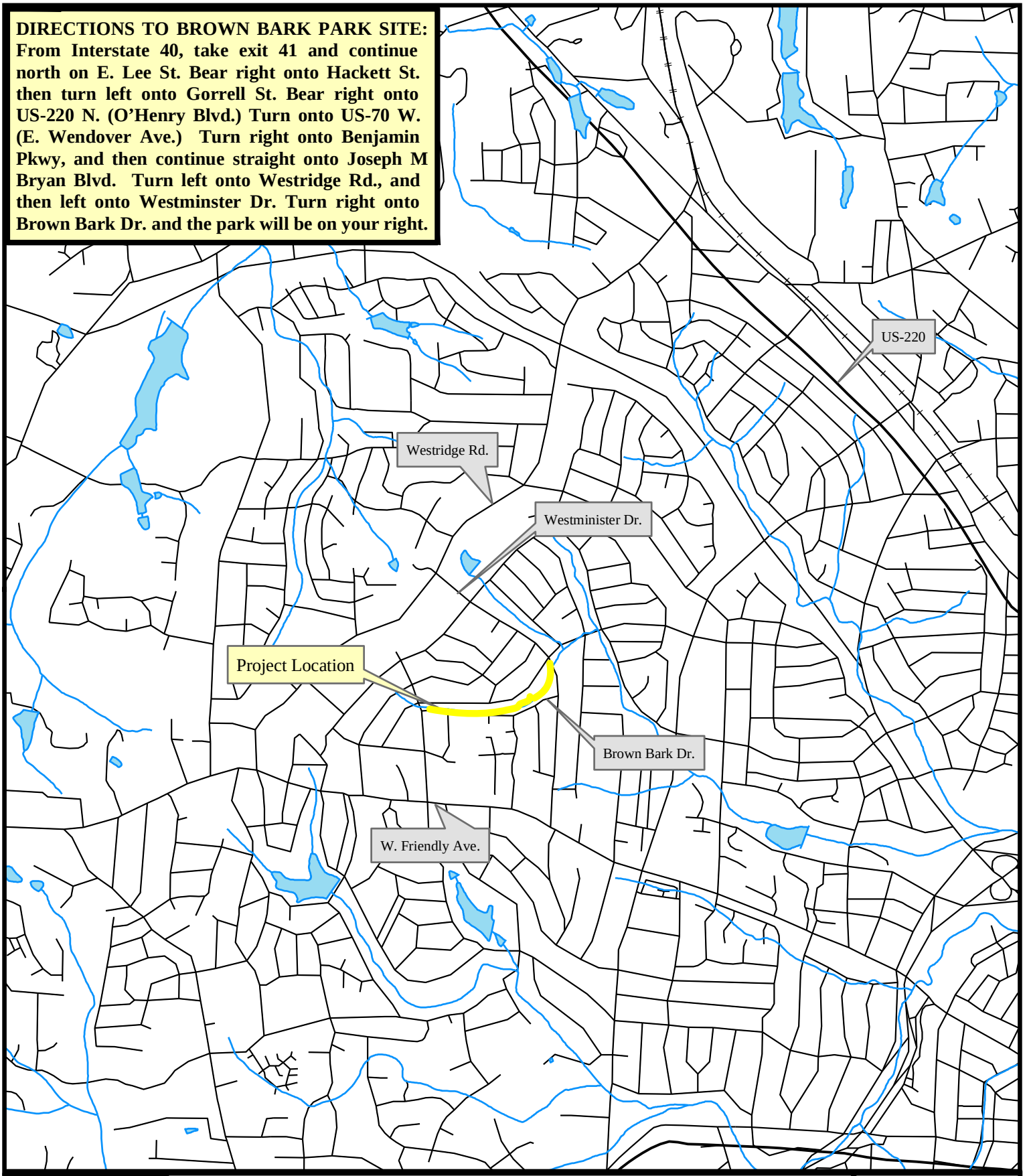
3.0 REFERENCES

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

Appendix A

General Figures and Plan Views

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.

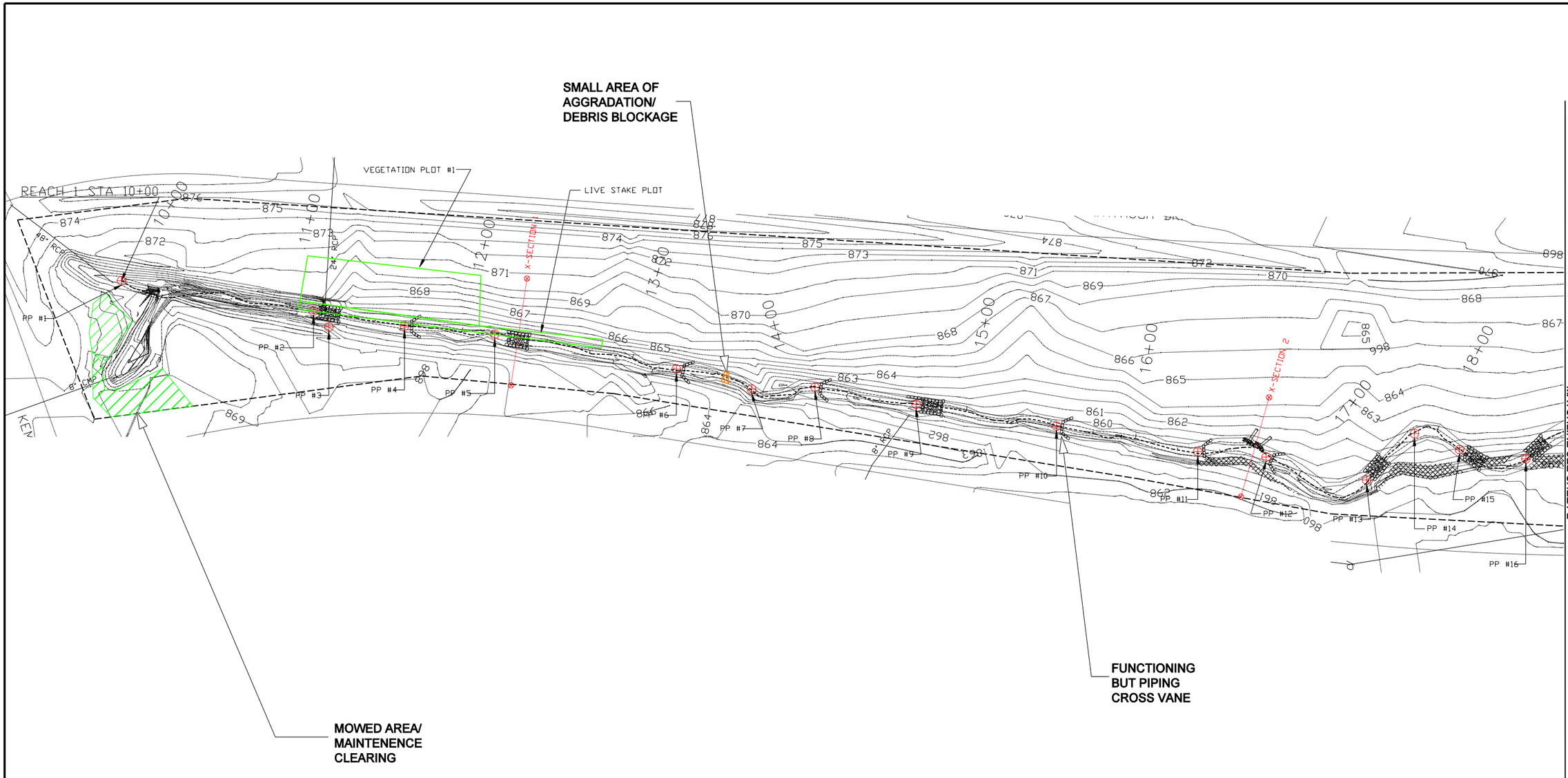


Ecosystem Enhancement PROGRAM

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



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
- CONSERVATION EASEMENT BOUNDARY
- CROSS-SECTION
- 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 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

BROWN BARK PARK
GUILFORD COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 52 - MY05
STATION 10+00 TO STATION 18+85

DATE: DECEMBER 2009
SCALE: SEE SHEET

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 3

MATCHLINE SEE SHEET 1

STRESSED ROOT WADS DUE TO MINOR EROSION BEHIND ROOT WADS. ROOT MATERIAL IS BEGINNING TO ROT, AND THERE IS DISPLACEMENT OF SOME OF THE ROCK BANK PROTECTION.

AREA ALONG SEWER LINE CLEARED

BARE BANK DUE TO POOR EXPOSED SOIL AND FLOODPLAIN EROSION

MATCHLINE SEE SHEET 3

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

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BROWN BARK PARK

GUILFORD COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 52 - MY05

STATION 18+85 TO STATION 28+40

DATE: DECEMBER 2009
SCALE: SEE SHEET

CURRENT CONDITION PLAN VIEW

MATCHLINE SEE SHEET 2

MOWED BUFFER

MINOR UNDERCUT BANK EROSION

REACH 5 STA 36+588

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

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RALEIGH, NORTH CAROLINA 27609

BROWN BARK PARK

GUILFORD COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 52 - MY05

STATION 28+40 TO STATION 38+55

DATE: DECEMBER 2009
SCALE: SEE SHEET

CURRENT CONDITION PLAN VIEW

Appendix B

General Project Tables

Table 1. 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	2,834	R	P2/3	2,834	10+00 - 38+34	

R = Restoration P2/3 = Combination of Priority 2 and 3

Table 2. 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		Jun 02
Permits		Jun 02
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
Year 5 Monitoring	Nov 09	Dec 09

Table 3. Project Contacts 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, 03, 04, 05	KCI Associates of NC Landmark Center, II Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Attribute 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?	No
Reasons for 303(d) Listing or Stressor	N/A
% of Project Easement Fenced	0%
% of Project Easement Demarcated with Bollards	100%

Appendix C

Vegetation Assessment Data

Table 5. Vegetation Plot Mitigation Success Summary Table		
Project Number and Name: 52 - Brown Bark Park		
Vegetation Plot ID	**Monitoring Year 05 Planted Stem Density (stems/acre)**	**Vegetation Survival Threshold Met?**
1	279	Yes
2	279	Yes
Live Stake Plot	2,639	Yes

Table 6. Planted 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	Year 5 Totals	Survival %*
Shrubs										
Cornus amomum			26			26	26	26	26	N/A
Sambucus canadensis			7			7	7	7	7	N/A
Trees										
Quercus phellos		1				1	1	1	1	N/A
Fraxinus pennsylvanica		3				4	3	3	3	N/A
Nyssa sylvatica	5	9				14	14	14	14	N/A
Betula nigra	1	3				5	4	4	4	N/A
Cornus florida	1					1	1	1	1	N/A
Hamamelis virginiana	9					11	11	9	9	N/A
Salix nigra			6			6	6	6	6	N/A
Salix sericea			22			25	22	22	22	N/A
Total	**16**	**16**	**61**	**179**	**127**	**100**	**95**	**93**	**93**	**52%**

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

Table 7. Planted 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 5)	Density (Trees/Acre)
1	9		5	1			1				16	279
2		3	9	3				1			16	279
LS					26	7			22	6	61	3,037

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. 11/3/09 - MY 05

Plot 2 Photo – Taken from Photo Point #28 Buffer Plot #2 is on the left side of the stream. 11/3/09 - MY 05

Appendix D

Stream Assessment Data

Stream Station Photos

PP#1 – MY05 – 11/3/09

PP#2 – MY05 – 11/3/09

PP#3 – MY05 – 11/3/09

PP#4 – MY05 – 11/3/09

PP#5 – MY05 – 11/3/09

PP#6 – MY05 – 11/3/09

PP#7 – MY05 – 11/3/09

PP#8 – MY05 – 11/3/09

PP#9 – MY05 – 11/3/09

PP#10 – MY05 – 11/3/09

PP#11 – MY05 – 11/3/09

PP#12 – MY05 – 11/3/09

PP#13 – MY05 – 11/3/09

PP#14 – MY05 – 11/3/09

PP#15 – MY05 – 11/3/09

PP#16 – MY05 – 11/3/09

PP#17 – MY05 – 11/3/09

PP#18 – MY05 – 11/3/09

PP#19A – MY05 – 11/3/09

PP#19B – MY05 – 11/3/09

PP#20A – MY05 – 11/3/09

PP#20B – MY05 – 11/3/09

PP#21A – MY05 – 11/3/09

PP#21B – MY05 – 11/3/09

PP#22 – MY05 – 11/3/09

PP#23 – MY05 – 11/3/09

PP#24 – MY05 – 11/3/09

PP#25 – MY05 – 11/3/09

PP#26 – MY05 – 11/3/09

PP#27 – MY05 – 11/3/09

PP#28 – MY05 – 11/3/09

PP#29A – MY05 – 11/3/09

PP#29B – MY05 – 11/3/09

PP#30 – MY05 – 11/3/09

PP#31 – MY05 – 11/3/09

PP#32 – MY05 – 11/3/09

PP#33 – MY05 – 11/3/09

PP#34 – MY05 – 11/3/09

PP#35 – MY05 – 11/3/09

PP#36 – MY05 – 11/3/09

PP#37 – MY05 – 11/3/09

PP#38 – MY05 – 11/3/09

PP#39 – MY05 – 11/3/09

PP#40 – MY05 – 11/3/09

PP#41 – MY05 – 11/3/09

PP#42 – MY05 – 11/3/09

Table 8. Visual Morphological 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?	44	52	N/A	85%	
	2. Armor stable (e.g. no displacement)?	44	52	N/A	85%	
	3. Facet grade appears stable?	44	52	N/A	85%	
	4. Minimal evidence of embedding/fining?	43	52	N/A	83%	
	5. Length appropriate?	37	52	N/A	71%	82%
B. Pools	1. Present? (e.g. no severe aggradation)	49	50	N/A	98%	
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)	49	50	N/A	98%	
	3. Length appropriate?	49	50	N/A	98%	98%
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	N/A	
	3. Apparent Rc within spec?	**	**	N/A	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	100%	99%
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	0/0	100%	100%
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?	17	18	N/A	94%	
	2. Footing stable?	17	18	N/A	94%	94%

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

Table 9. Verification of Bankfull Events
Project Number and Name: 52 – Brown Bark Park

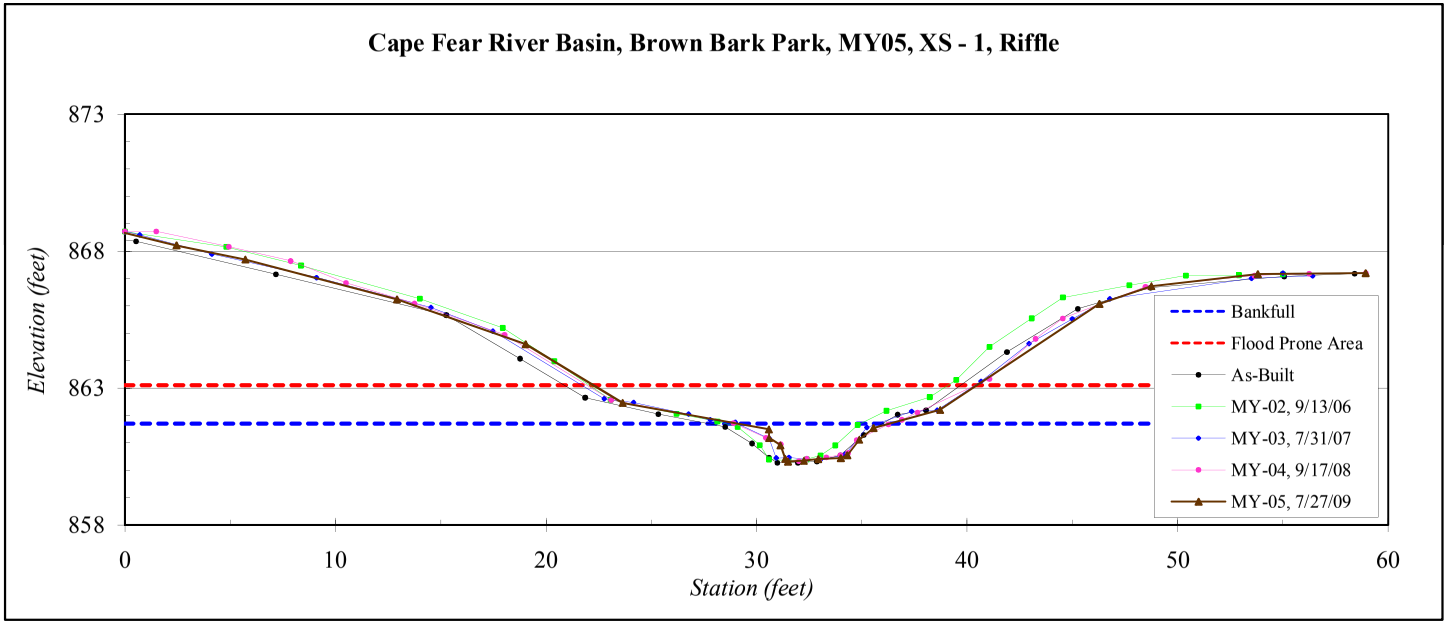
Date of Data Collection	Date of Occurrence	Method	Photo Number
9/18/2006	9/18/2006	On site	N/A
8/17/2007	4/15/2007	Crest gauge	N/A
11/15/2007	10/26/2007	Crest gauge	N/A
11/5/2008	8/27/2008	Crest gauge	N/A
11/9/2009	6/5/2009	Evaluation of rainfall data	N/A
11/25/2009	11/13/2009	Evaluation of rainfall data	N/A

Cross-Section Plots

River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY05
XS ID	XS - 1, Riffle
Drainage Area (sq mi):	0.3
Date:	7/27/2009
Field Crew:	B. Roberts, C. Carter

Station	Elevation
0.0	868.72
0.3	868.72
2.4	868.21
5.7	867.69
12.9	866.24
19.0	864.60
23.6	862.46
30.6	861.49
30.6	861.18
31.1	860.91
31.4	860.41
31.5	860.32
32.2	860.35
32.9	860.41
34.0	860.45
34.3	860.55
34.9	861.12
35.6	861.54
38.7	862.20
46.3	866.08
48.8	866.73
53.8	867.16
58.9	867.20

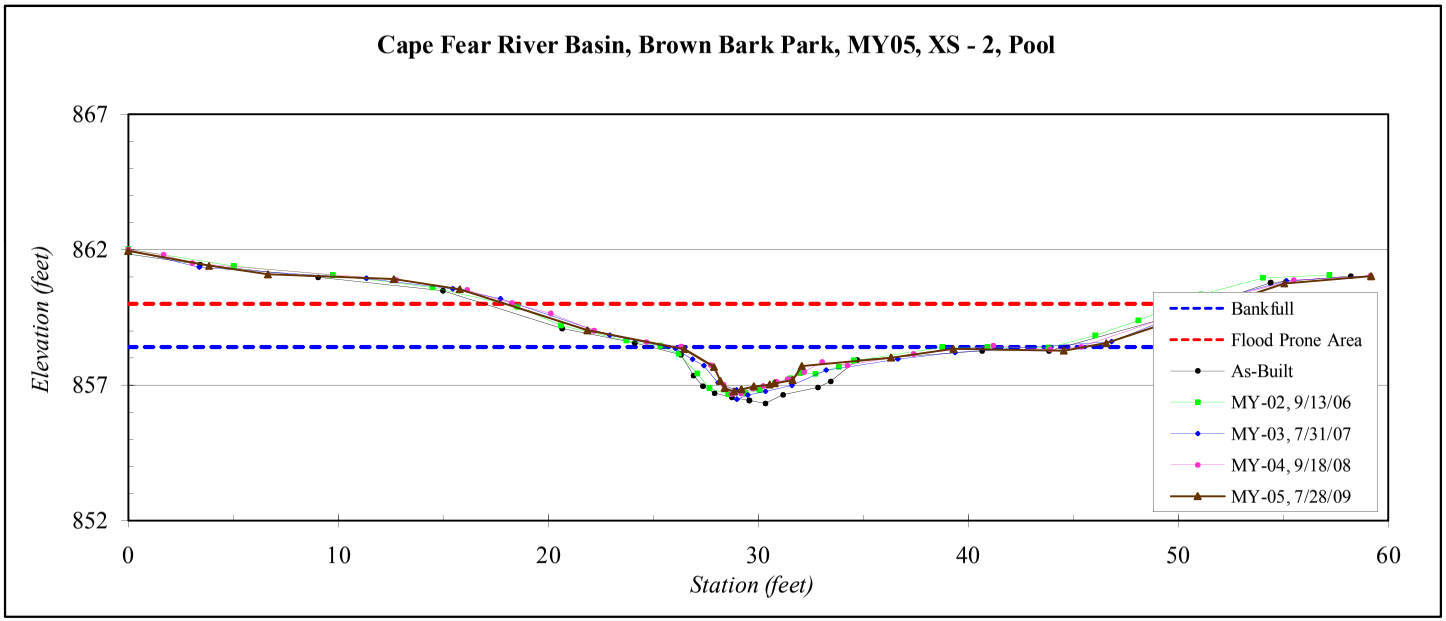
SUMMARY DATA	
Bankfull Elevation:	861.7
Bankfull Cross-Sectional Area:	5.4
Bankfull Width:	7.2
Flood Prone Area Elevation:	863.1
Flood Prone Width:	18
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.8
W / D Ratio:	9.8
Entrenchment Ratio:	2.5
Bank Height Ratio:	1.0



River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY05
XS ID	XS - 2, Pool
Drainage Area (sq mi):	0.3
Date:	7/28/2009
Field Crew:	B. Roberts, C. Carter

Station	Elevation
0.0	861.95
3.9	861.41
6.6	861.09
12.6	860.91
15.8	860.54
21.9	859.03
26.5	858.34
27.9	857.67
28.2	857.15
28.4	856.90
28.8	856.76
29.2	856.85
29.8	856.95
30.5	857.02
30.8	857.07
31.6	857.19
32.1	857.71
36.3	858.02
39.3	858.34
44.6	858.28
46.6	858.55
50.5	859.56
55.0	860.75
59.2	861.03

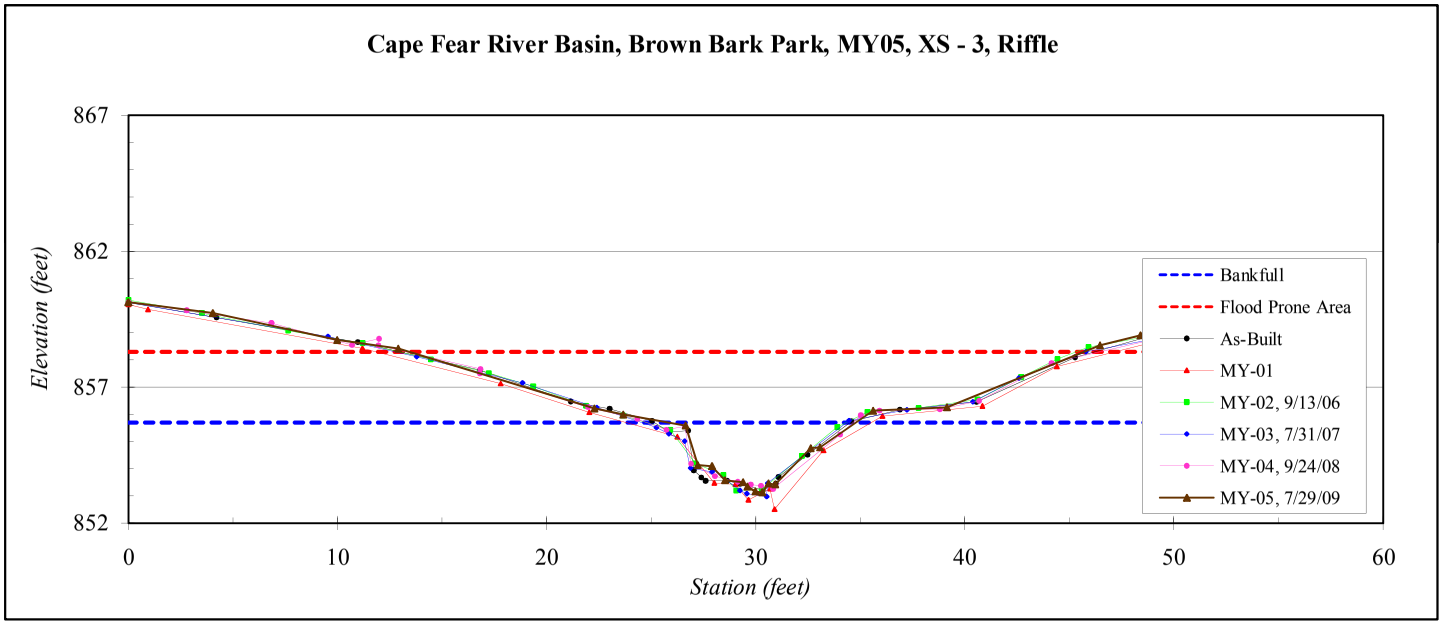
SUMMARY DATA	
Bankfull Elevation:	858.4
Bankfull Cross-Sectional Area:	9.2
Bankfull Width:	13.2
Flood Prone Area Elevation:	860.0
Flood Prone Width:	35
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	0.7
W / D Ratio:	19.2
Entrenchment Ratio:	2.6
Bank Height Ratio:	1.0



River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY05
XS ID	XS - 3, Riffle
Drainage Area (sq mi):	0.3
Date:	7/29/2009
Field Crew:	B. Roberts, C. Carter

Station	Elevation
0.0	860.12
4.0	859.72
10.0	858.74
12.9	858.42
22.3	856.22
23.7	855.99
26.6	855.59
27.2	854.13
27.9	854.09
28.5	853.58
29.4	853.50
29.6	853.34
30.0	853.16
30.3	853.13
30.6	853.46
30.9	853.42
32.6	854.76
33.1	854.78
35.6	856.13
39.1	856.25
46.5	858.54
48.4	858.90
50.8	859.03

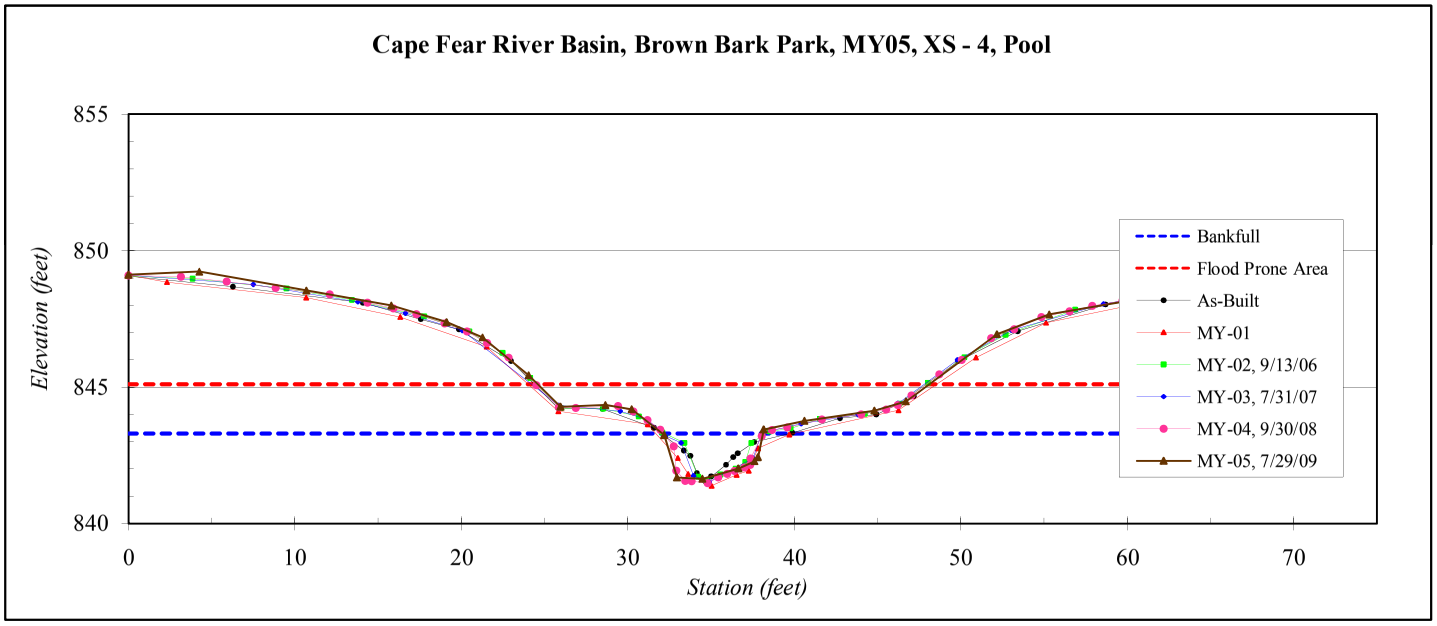
SUMMARY DATA	
Bankfull Elevation:	855.7
Bankfull Cross-Sectional Area:	12.3
Bankfull Width:	9.0
Flood Prone Area Elevation:	858.3
Flood Prone Width:	32
Max Depth at Bankfull:	2.6
Mean Depth at Bankfull:	1.4
W / D Ratio:	6.6
Entrenchment Ratio:	3.6
Bank Height Ratio:	1.0



River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY05
XS ID	XS - 4, Pool
Drainage Area (sq mi):	0.3
Date:	7/31/2009
Field Crew:	B. Roberts, K. Knight-Meng

Station	Elevation
0.0	849.12
4.3	849.23
10.7	848.54
15.8	847.99
19.1	847.38
21.3	846.82
24.0	845.43
26.0	844.28
28.7	844.34
30.2	844.19
32.2	843.24
33.0	841.68
34.5	841.64
36.6	842.02
37.6	842.28
37.8	842.43
38.2	843.44
40.6	843.76
44.8	844.13
46.7	844.47
52.2	846.94
55.3	847.66
65.7	848.74
71.3	849.23

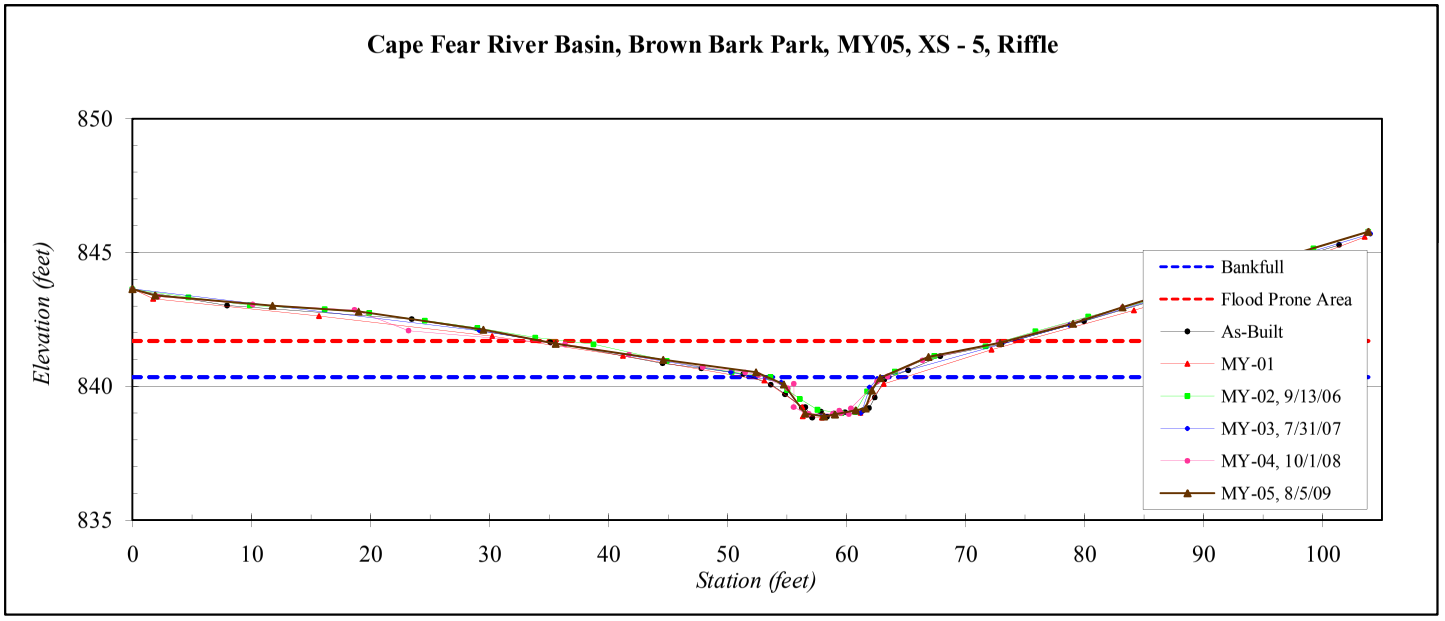
SUMMARY DATA	
Bankfull Elevation:	843.3
Bankfull Cross-Sectional Area:	7.8
Bankfull Width:	6.1
Flood Prone Area Elevation:	845.1
Flood Prone Width:	23
Max Depth at Bankfull:	1.7
Mean Depth at Bankfull:	1.3
W / D Ratio:	4.7
Entrenchment Ratio:	3.8
Bank Height Ratio:	1.0



River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY05
XS ID	XS - 5, Riffle
Drainage Area (sq mi):	0.3
Date:	8/5/2009
Field Crew:	B. Roberts, A. Davis

Station	Elevation
0.0	843.63
1.9	843.39
11.8	843.01
19.0	842.79
29.5	842.12
35.6	841.59
44.6	840.99
52.4	840.53
54.7	840.07
56.5	838.99
58.1	838.87
59.0	838.95
60.8	839.10
61.6	839.17
62.1	839.84
62.8	840.31
66.9	841.10
72.9	841.62
79.0	842.34
83.2	842.95
94.3	844.50
103.8	845.77

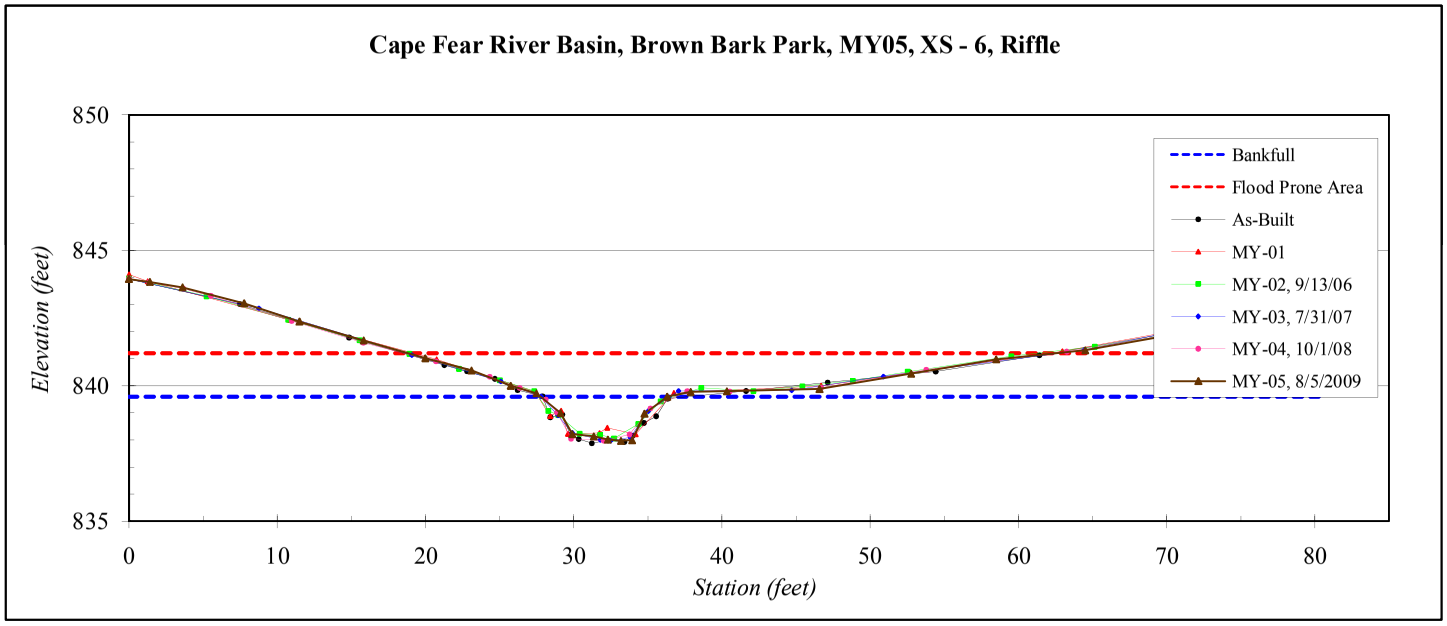
SUMMARY DATA	
Bankfull Elevation:	840.3
Bankfull Cross-Sectional Area:	8.7
Bankfull Width:	9.2
Flood Prone Area Elevation:	841.7
Flood Prone Width:	40
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.9
W / D Ratio:	9.8
Entrenchment Ratio:	4.3
Bank Height Ratio:	1.0



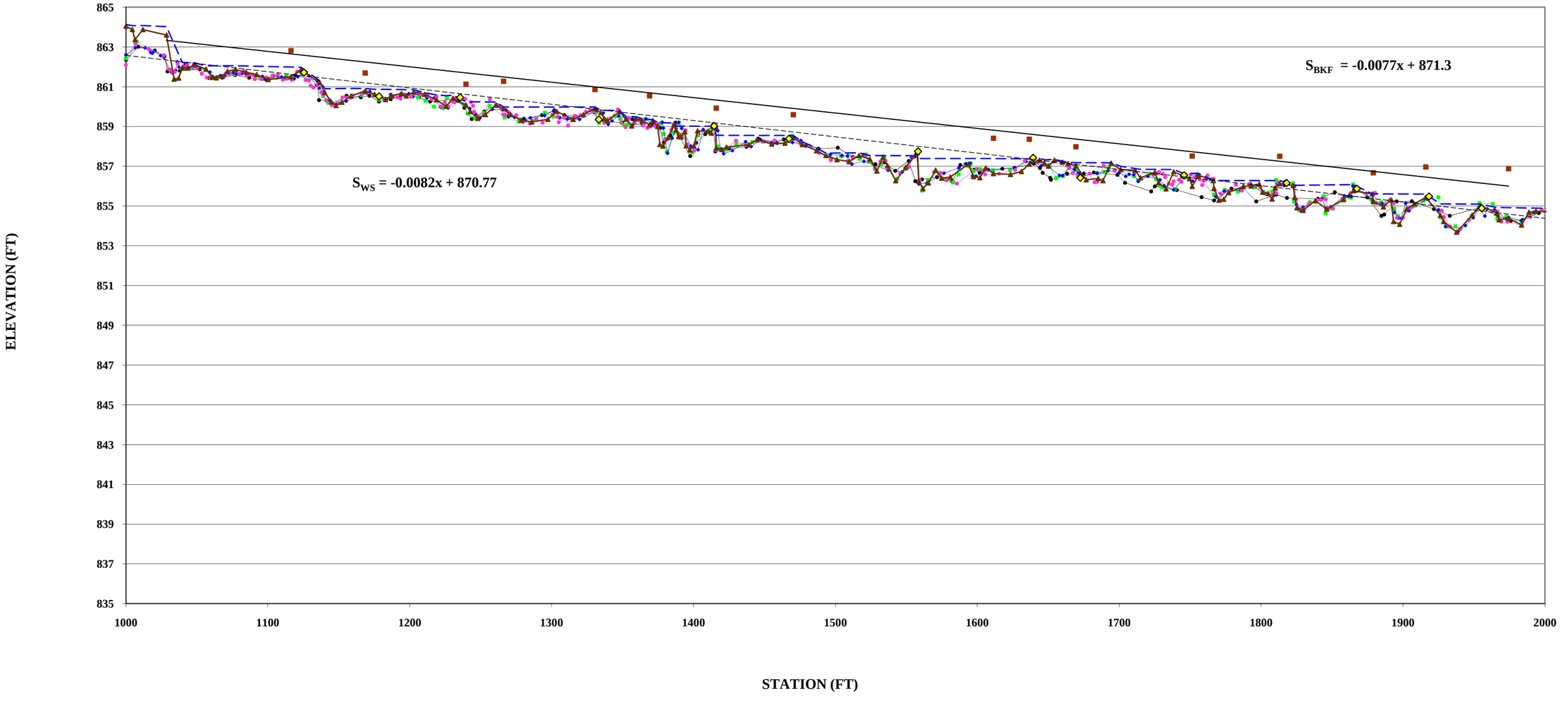
River Basin:	Cape Fear
Watershed:	Brown Bark Park, MY05
XS ID	XS - 6, Riffle
Drainage Area (sq mi):	0.3
Date:	8/5/2009
Field Crew:	B. Roberts, A. Davis

Station	Elevation
0.0	843.94
1.4	843.84
3.6	843.64
7.8	843.04
11.5	842.37
15.8	841.67
20.0	841.02
23.1	840.56
25.8	840.00
27.5	839.72
29.1	838.99
29.9	838.22
31.4	838.13
32.3	838.02
33.2	837.97
33.9	837.99
34.8	838.97
36.3	839.60
37.9	839.78
40.3	839.80
46.6	839.88
52.8	840.45
58.5	840.97
64.5	841.31
74.7	842.31
77.8	842.73
80.6	843.05

SUMMARY DATA	
Bankfull Elevation:	839.6
Bankfull Cross-Sectional Area:	8.8
Bankfull Width:	8.6
Flood Prone Area Elevation:	841.2
Flood Prone Width:	45
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.0
W / D Ratio:	8.4
Entrenchment Ratio:	5.2
Bank Height Ratio:	1.0



Longitudinal Profile
Brown Bark Park
EEP Project Number 52 - MY05
Stations 10+00 - 20+00



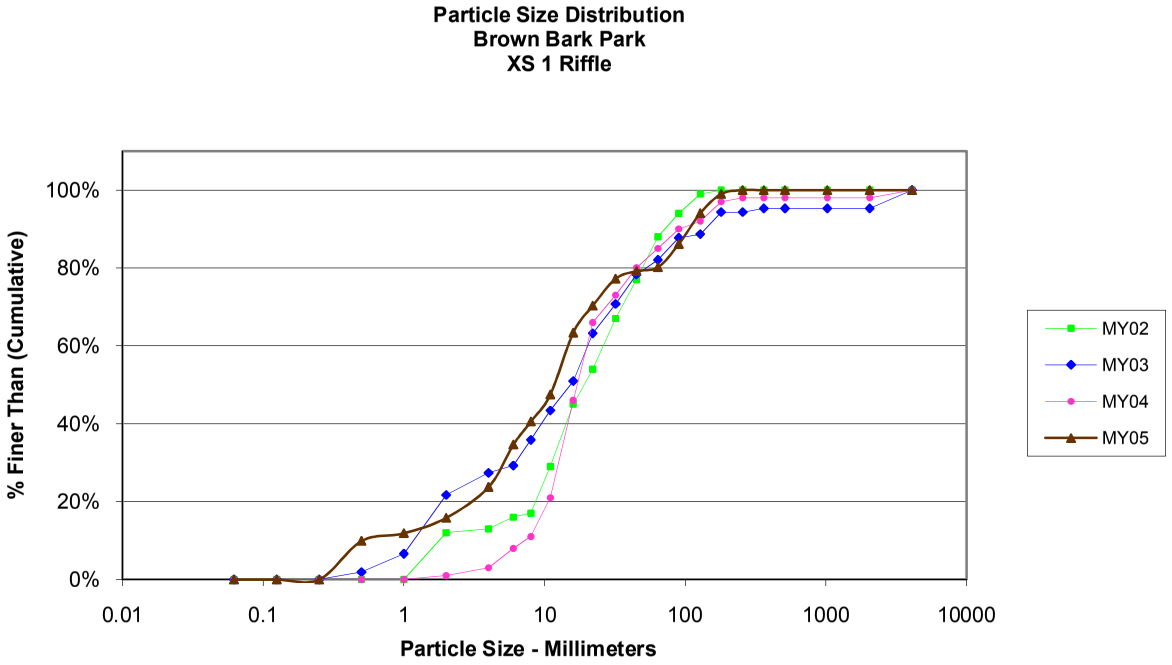
Longitudinal Profile
Brown Bark Park
EEP Project Number 52 - MY05
Stations 20+00 - 30+00

Longitudinal Profile
Brown Bark Park
EEP Project Number 52 - MY05
Stations 30+00 - 40+00

Pebble Count Plots

Cross-Section 1 Riffle - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	10
Coarse	.50 - 1	D	2
Very Coarse	1 - 2	S	4
Very Fine	2 - 4		8
Fine	4 - 5.7	G	11
Fine	5.7 - 8	R	6
Medium	8 - 11.3	A	7
Medium	11.3 - 16	V	16
Coarse	16 - 22.6	E	7
Coarse	22.6 - 32	L	7
Very Coarse	32 - 45	S	2
Very Coarse	45 - 64		1
Small	64 - 90	C	6
Small	90 - 128	O	8
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	
		Total	101

Note:



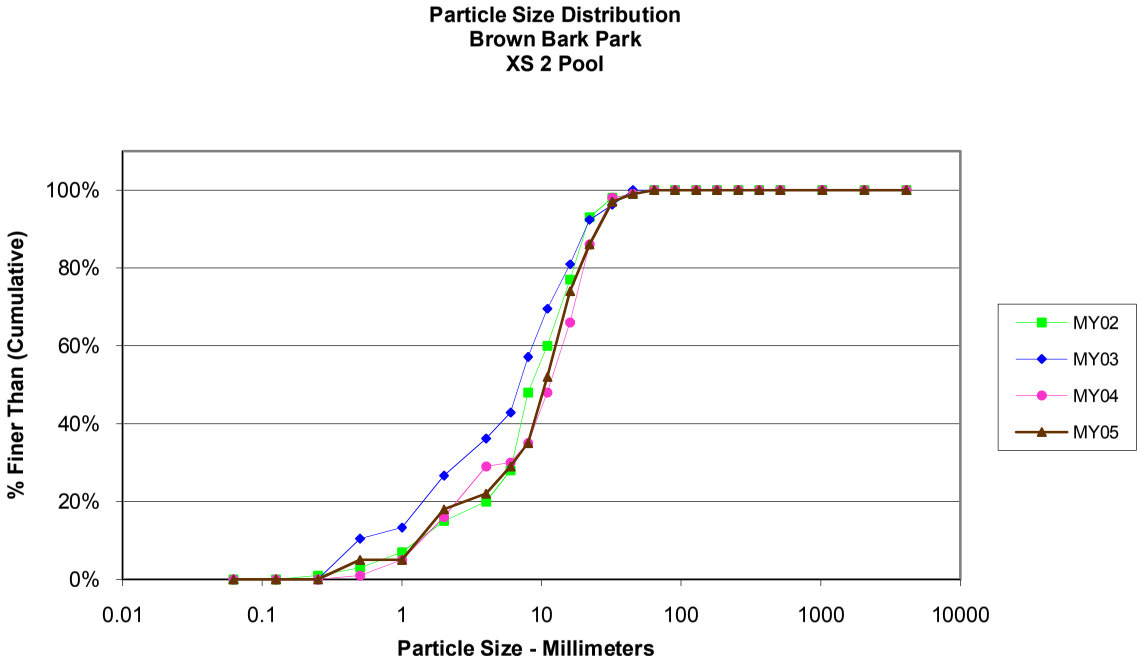
Size (mm)	
D16	2
D35	6.1
D50	12
D65	17
D84	80
D95	140

Size Distribution	
mean	12.6
dispersion	6.3
skewness	0.02

Type	
silt/clay	0%
sand	16%
gravel	64%
cobble	20%
boulder	0%
bedrock	
hardpan	
wood/det	
artificial	

Cross-Section 2 Pool - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	5
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	13
Very Fine	2 - 4		4
Fine	4 - 5.7	G	7
Fine	5.7 - 8	R	6
Medium	8 - 11.3	A	17
Medium	11.3 - 16	V	22
Coarse	16 - 22.6	E	12
Coarse	22.6 - 32	L	11
Very Coarse	32 - 45	S	2
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:



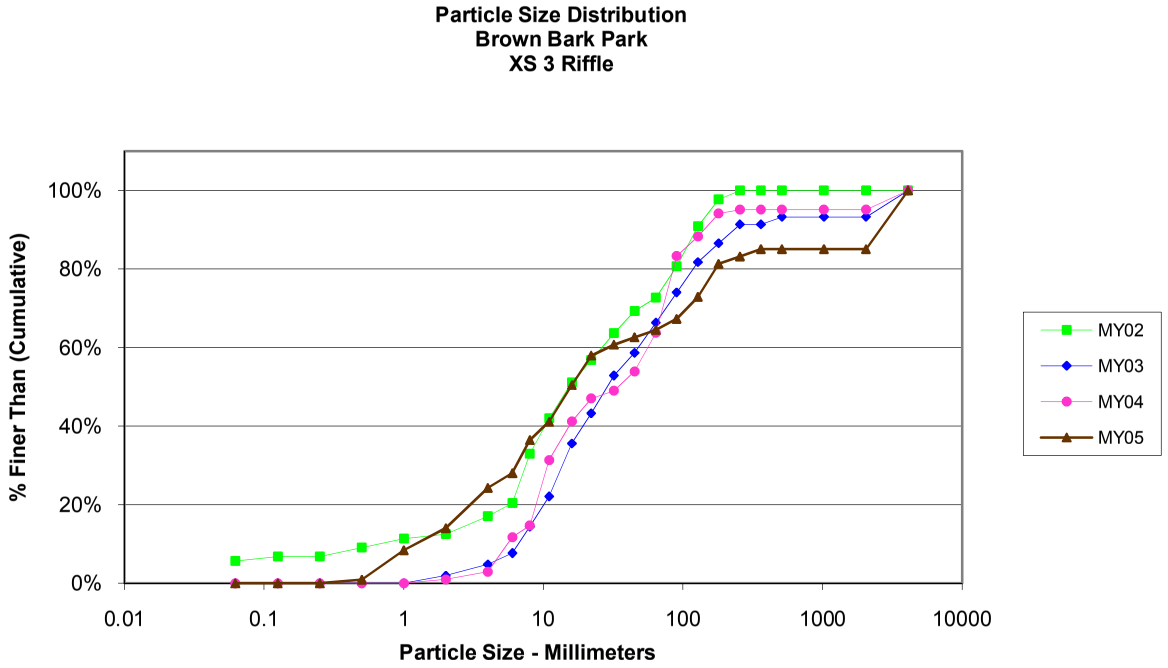
Size (mm)	
D16	1.8
D35	8
D50	11
D65	14
D84	21
D95	30

Size Distribution	
mean	6.1
dispersion	4.0
skewness	-0.24

Type	
silt/clay	0%
sand	18%
gravel	82%
cobble	0%
boulder	0%
bedrock	
hardpan	
wood/det	
artificial	

Cross-Section 3 Riffle - MY05			
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	8
Very Coarse	1 - 2	S	6
Very Fine	2 - 4		11
Fine	4 - 5.7	G	4
Fine	5.7 - 8	R	9
Medium	8 - 11.3	A	5
Medium	11.3 - 16	V	10
Coarse	16 - 22.6	E	8
Coarse	22.6 - 32	L	3
Very Coarse	32 - 45	S	2
Very Coarse	45 - 64		2
Small	64 - 90	C	3
Small	90 - 128	O	6
Large	128 - 180	B	9
Large	180 - 256	L	2
Small	256 - 362	B	2
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	16
		Total	107

Note:



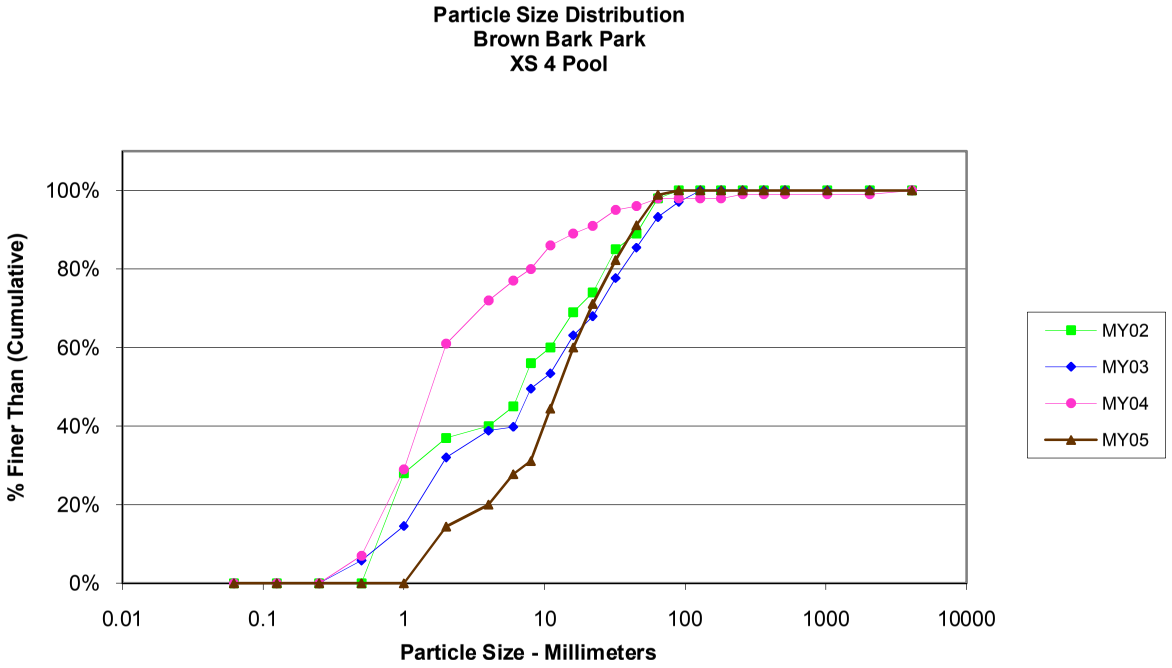
Size (mm)	
D16	1.9
D35	6.4
D50	12
D65	20
D84	120
D95	180

Size Distribution	
mean	15.1
dispersion	8.2
skewness	0.07

Type	
silt/clay	0%
sand	14%
gravel	50%
cobble	19%
boulder	2%
bedrock	15%
hardpan	
wood/det	
artificial	

Cross-Section 4 Pool - MY05			
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	13
Very Fine	2 - 4		5
Fine	4 - 5.7	G	7
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	12
Medium	11.3 - 16	V	14
Coarse	16 - 22.6	E	10
Coarse	22.6 - 32	L	10
Very Coarse	32 - 45	S	8
Very Coarse	45 - 64		7
Small	64 - 90	C	1
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	90

Note:



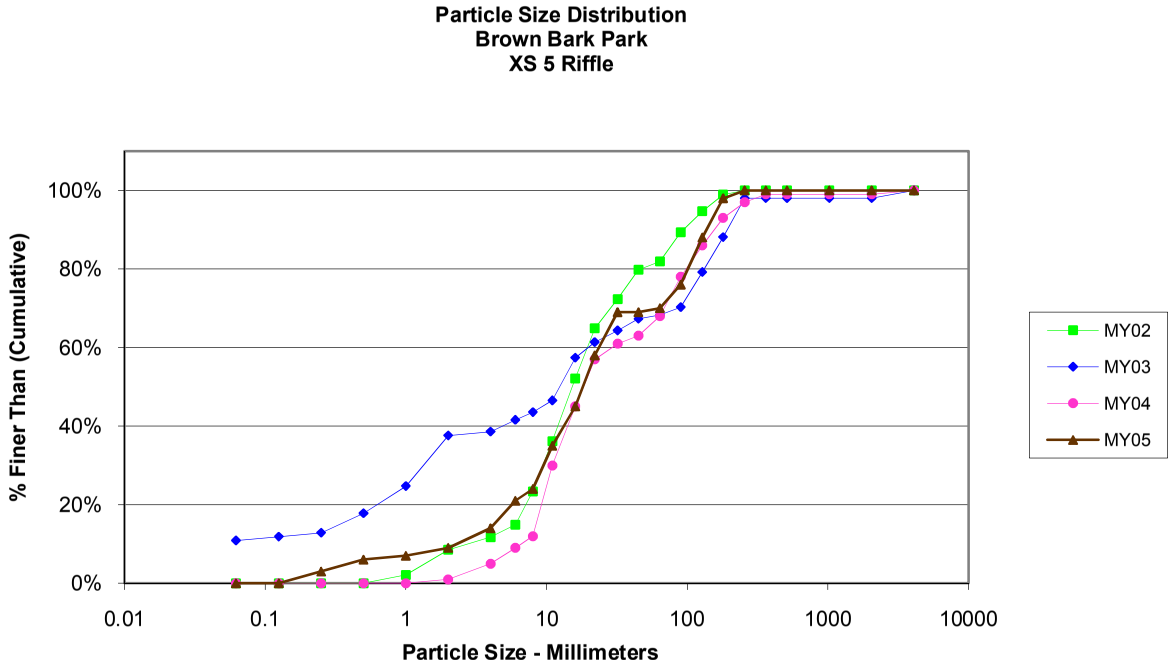
Size (mm)	
D16	2.4
D35	8.8
D50	13
D65	18
D84	34
D95	54

Size Distribution	
mean	9.0
dispersion	4.0
skewness	-0.15

Type	
silt/clay	0%
sand	14%
gravel	84%
cobble	1%
boulder	0%
bedrock	
hardpan	
wood/det	
artificial	

Cross-Section 5 Riffle - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	3
Medium	.25 - .50	N	3
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	2
Very Fine	2 - 4		5
Fine	4 - 5.7	G	7
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	11
Medium	11.3 - 16	V	10
Coarse	16 - 22.6	E	13
Coarse	22.6 - 32	L	11
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		1
Small	64 - 90	C	6
Small	90 - 128	O	12
Large	128 - 180	B	10
Large	180 - 256	L	2
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



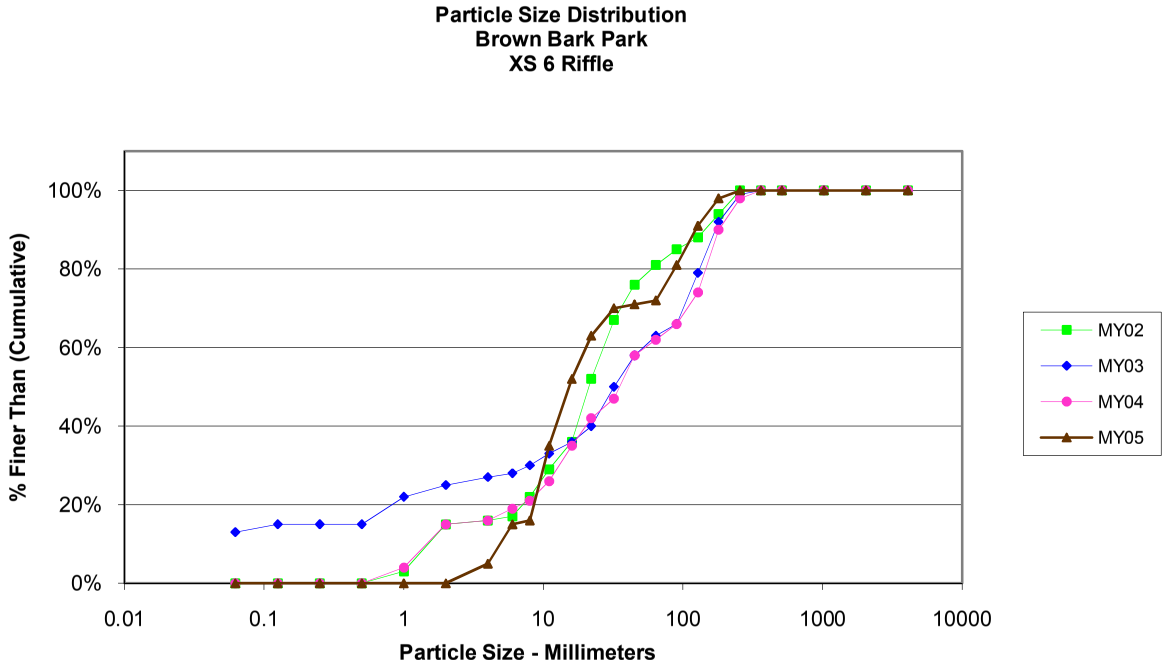
Size (mm)	
D16	4.5
D35	11
D50	18
D65	28
D84	110
D95	160

Size Distribution	
mean	28.3
dispersion	4.3
skewness	0.26

Type	
silt/clay	0%
sand	0%
gravel	72%
cobble	28%
boulder	0%
bedrock	
hardpan	
wood/det	
artificial	

Cross-Section 6 Riffle - MY05			
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	
Very Fine	2 - 4		5
Fine	4 - 5.7	G	10
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	19
Medium	11.3 - 16	V	17
Coarse	16 - 22.6	E	11
Coarse	22.6 - 32	L	7
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		1
Small	64 - 90	C	9
Small	90 - 128	O	10
Large	128 - 180	B	7
Large	180 - 256	L	2
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	8
D35	11
D50	15
D65	24
D84	100
D95	160

Size Distribution	
mean	28.3
dispersion	4.3
skewness	0.26

Type	
silt/clay	0%
sand	0%
gravel	72%
cobble	28%
boulder	0%
bedrock	
hardpan	
wood/det	
artificial	