

**Brown Bark Park Stream  
Restoration Monitoring Report  
EEP Project # 52  
Monitoring Year – 02  
2006**



Submitted to:



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

**January 2007**

## Monitoring Firm



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## Design Firm



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## 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<sup>2</sup> watershed is located within USGS 14-digit HUC 03030002020040 and NCDWQ Sub-basin 03-06-02 of the Cape Fear River Basin. The initial planning proposed to restore approximately 2,834 linear feet of channel. The design was developed to address vertical instability (incision) problems and lack of bed variability. The restoration plan called for correcting these problems by stabilizing stream banks, installing in-stream structures, adjusting stream planform, and clearing and replanting the riparian areas with native vegetation. Project construction occurred in 2004. This report is a description of the findings of the second year monitoring that took place in 2006.

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, approximately 25' x 100' and one live stake plot, approximately 175' x 5'. Data were collected from these three plots during the second year monitoring and their corners were surveyed and marked with metal conduit for future monitoring. The second year monitoring counted an average of 314 stems per acre in plots 1 and 2. The second year monitoring counted 3,186 stems per acre in the live stake plot. The vegetation monitoring for year two did not reveal any major problems with the restoration reach vegetation. The density of planted trees in the riparian buffer is low for the second year of monitoring, but there is consistent vegetative cover for the majority of the riparian buffer. Herbaceous competition with planted trees is a potential problem. It has not been included as an issue of concern in this second year report. Exotic vegetation was documented in the riparian buffer; however it was not so extensive to warrant immediate corrective actions.

The stream assessment completed during the second year monitoring found the stream to be functioning for the majority of the project. Channel dimensions have not changed drastically from the as-built conditions. The second year monitoring profile mirrors the as-built profile closely in many sections. The first year monitoring profile was unavailable for comparison. The majority of the in-stream structures are functioning. The stream banks have experienced localized erosion, but there are no large areas of bank instability.

## 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 through Brown Bark Park was restored using channel dimension, pattern, and profile modifications and the establishment of a vegetated riparian zone adjacent to the creek. 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<sup>2</sup> watershed is urban residential development. The watershed is completely built out with little potential for future development.

### 1.4 Project History and Background

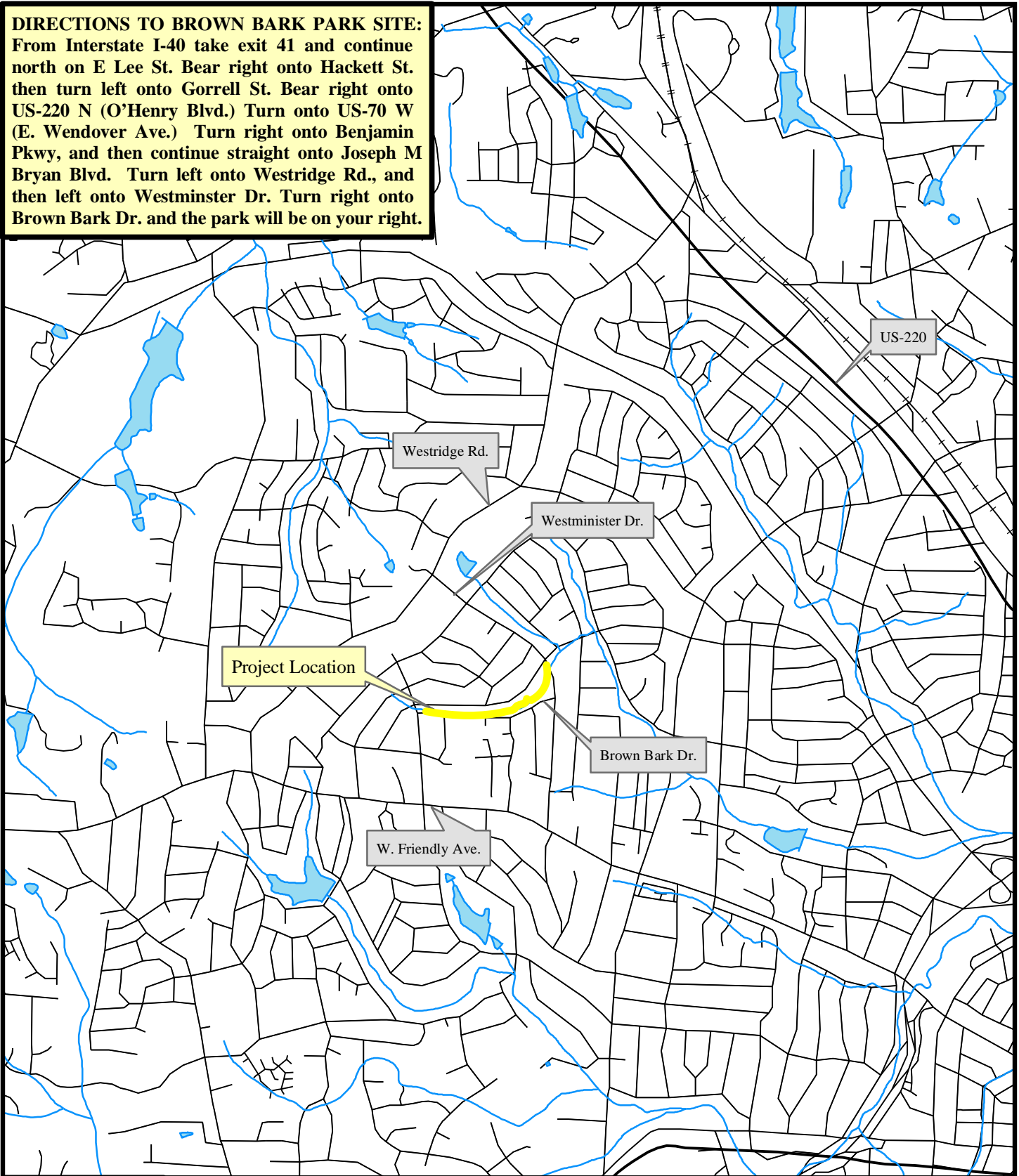
| Table 1. Project Mitigation Structure and Objectives |                       |                          |                    |             |                  |                  |               |         |
|--|-----------------------|--------------------------|--------------------|-------------|------------------|------------------|---------------|---------|
| Project Number and Name: 52 - Brown Bark Park        |                       |                          |                    |             |                  |                  |               |         |
| Segment / Reach ID                                   | Existing Linear Feet  | Type                     | Approach           | Linear Feet | Mitigation Ratio | Mitigation Units | Stationing    | Comment |
| Brown Bark Stream                                    | 2,748                 | R                        | P2/3               | 2,834       | 1.0              | 2,834            | 10+00 - 38+34 |         |
| Mitigation Unit Summations                           |                       |                          |                    |             |                  |                  |               |         |
| Stream (lf)  | Riparian Wetland (Ac) | Nonriparian Wetland (Ac) | Total Wetland (Ac) | Buffer (Ac) | Comment          |                  |               |         |
| 2,834  |                       |                          |                    |             |                  |                  |               |         |

R = Restoration

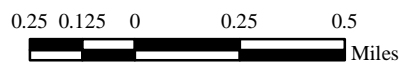
P2/3 = Combination of Priority II and III

P1 = Priority I

**DIRECTIONS TO BROWN BARK PARK SITE:**  
From Interstate I-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 Westminister Dr. Turn right onto Brown Bark Dr. and the park will be on your right.



**Figure 1. Site Vicinity Map**  
**Brown Bark Park, Guilford County, EEP Project # 52 - MY02**



Date: 01/02/07



| <b>Table 2. Project Activity and Reporting History</b> |                                 |                                      |
|--|---------------------------------|--------------------------------------|
| <b>Project Number and Name: 52 - Brown Bark Park</b>   |                                 |                                      |
| <b>Activity or Report</b>                              | <b>Data Collection Complete</b> | <b>Actual Completion or Delivery</b> |
| 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                               |

| <b>Table 3. Project Contact Table</b>                |   |
|--|---|
| <b>Project Number and Name: 52 – Brown Bark Park</b> |   |
| <b>Design Firm</b>                                   | Buck Engineering<br>8000 Regency Parkway, Suite 200<br>Cary, North Carolina 27511<br>Contact: Mr. Mike Rooney<br>Phone: (919) 463-5488<br>Fax: (919) 463-5490                 |
| <b>Construction Contractor</b>                       | Shamrock Construction<br>P.O. Box 14987<br>Greensboro, North Carolina 27415<br>Contact: Mr. Bill Wright<br>Phone: (336) 375-1989<br>Fax: (336) 375-1801                       |
| <b>Monitoring Performers</b>                         |   |
| <b>MY-01</b>   | Buck Engineering<br>8000 Regency Parkway, Suite 200<br>Cary, North Carolina 27511<br>Contact: Mr. Mike Rooney<br>Phone: (919) 463-5488<br>Fax: (919) 463-5490                 |
| <b>MY-02</b>   | KCI Associates of NC<br>Landmark Center, II Suite 220<br>4601 Six Forks Rd.<br>Raleigh, NC 27609<br>Contact: Mr. Adam Spiller<br>Phone: (919) 783-9214<br>Fax: (919) 783-9266 |



| <b>Table 4. Project Background Table</b>                              |                                       |
|---|---------------------------------------|
| <b>Project Number and Name: 52 – Brown Bark Park</b>                  |                                       |
| Project County  | Guilford County                       |
| Drainage Area   | 0.3 sq. mi.                           |
| Drainage Impervious Cover Estimate (%)                                | N/A                                   |
| 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 303d listed?                       | No - not rated                        |
| Any portion of the project segment upstream of a 303d listed segment? | N/A                                   |
| Reasons for 303d Listing or Stressor                                  | N/A                                   |
| % of Project Easement Fenced  | 0%                                    |
| % of Project Easement Demarcated with Bollards                        | approx. 100%                          |



REACH 1 STA 10+00  
 BEGIN PROFILE  
 N 854762.10  
 E 1746343.09

VEGETATION PLOT #1

LIVE STAKE PLOT

WATAUGA DR.

KEMP RD.









WINVIEW DR.

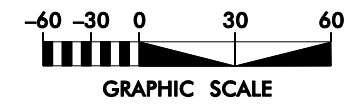
BROWN BARK DR. 198

MATCH LINE SEE SHEET 2

MATCH LINE SEE SHEET 2

**LEGEND**

- PHOTO POINT 
- THALWEG - MY02 
- AS-BUILT VEGETATIVE BUFFER BOUNDARY 
- CROSS SECTION 
- ROOT WAD 
- ROCK CROSS VANE 
- CONSTRUCTED RIFFLE 
- FILL IN OLD CHANNEL 



| NO. | DESCRIPTION | DATE |
|-----|-------------|------|
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|     |             |      |
|     |             |      |
|     |             |      |



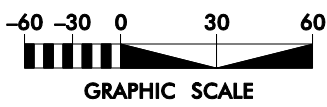
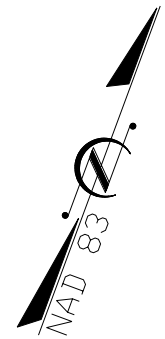
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 RALEIGH, NORTH CAROLINA 27609

**BROWN BARK PARK  
 MONITORING PLAN VIEW**  
 GUILFORD COUNTY, NORTH CAROLINA  
 EEP PROJECT NUMBER 52 - MY02  
 STATION 10+00.00 TO STATION 18+87

DATE: NOVEMBER 2006  
 SCALE: SEE SHEET  
**MONITORING  
 PLAN VIEW  
 SHEET 1**  
 SHEET 1 OF 3



| LEGEND                              |  |
|-------------------------------------|--|
| PHOTO POINT                         |  |
| THALWEG - MY02                      |  |
| AS-BUILT VEGETATIVE BUFFER BOUNDARY |  |
| CROSS SECTION                       |  |
| ROOT WAD                            |  |
| ROCK CROSS VANE                     |  |
| CONSTRUCTED RIFFLE                  |  |
| FILL IN OLD CHANNEL                 |  |



| NO. | DESCRIPTION | DATE |
|-----|-------------|------|
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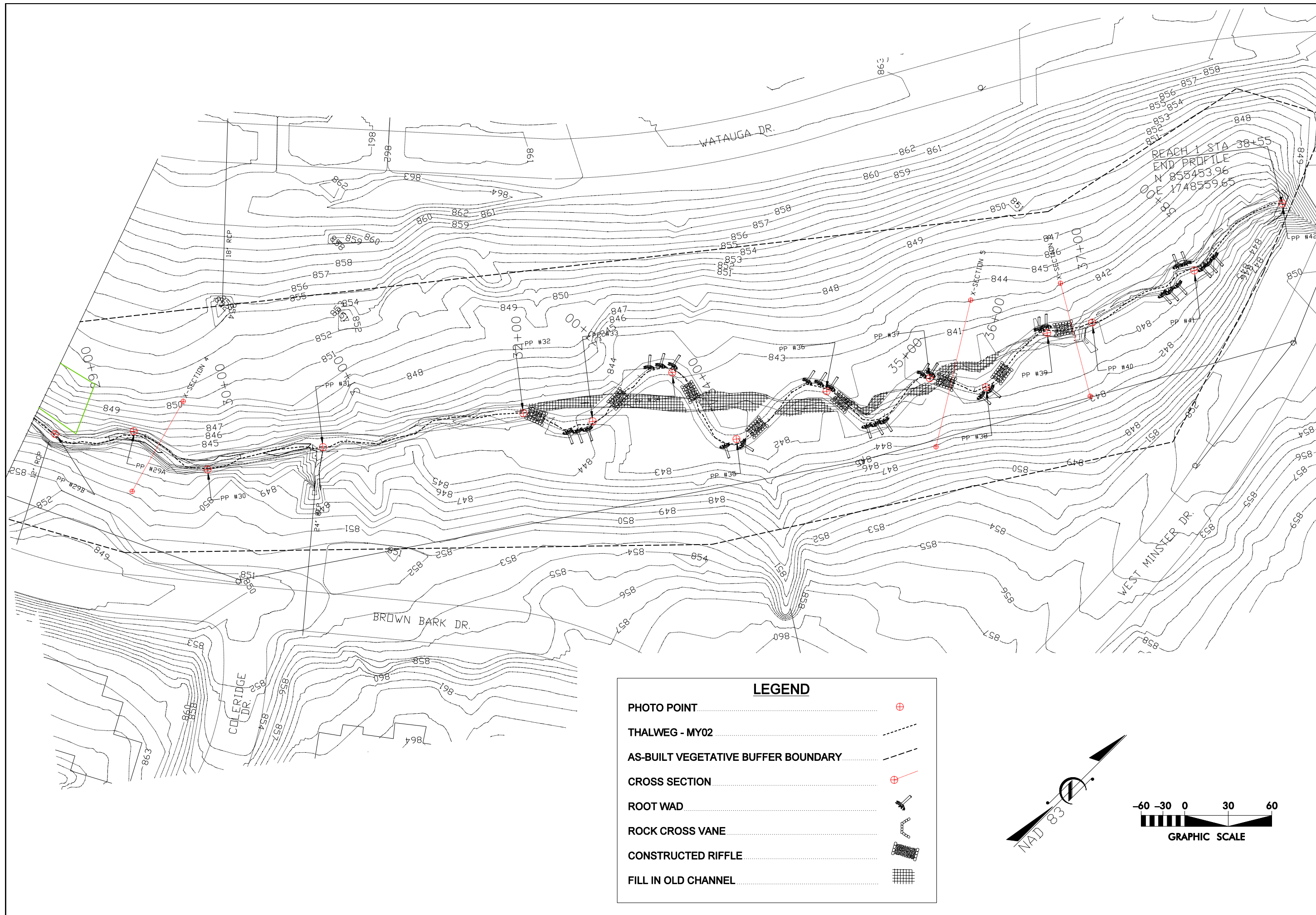


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**BROWN BARK PARK  
MONITORING PLAN VIEW**  
GUILFORD COUNTY, NORTH CAROLINA  
EEP PROJECT NUMBER 82 - MY02  
STATION 18+87 TO STATION 28+41

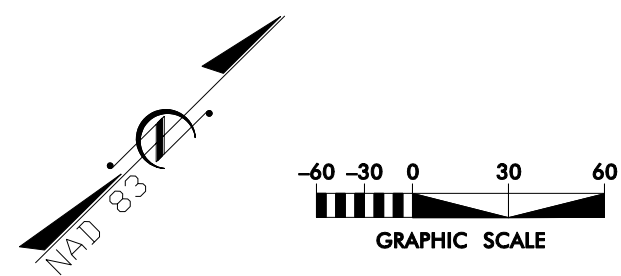
DATE: NOVEMBER 2006  
SCALE: SEE SHEET  
**MONITORING PLAN VIEW SHEET 2**  
SHEET 2 OF 3





**LEGEND**

|                                     |       |
|-------------------------------------|-------|
| PHOTO POINT                         | ⊕     |
| THALWEG - MY02                      | ---   |
| AS-BUILT VEGETATIVE BUFFER BOUNDARY | - - - |
| CROSS SECTION                       | ⊕     |
| ROOT WAD                            | ⌵     |
| ROCK CROSS VANE                     | ⌵     |
| CONSTRUCTED RIFFLE                  | ▒     |
| FILL IN OLD CHANNEL                 | ▒     |



| NO. | DESCRIPTION | DATE |
|-----|-------------|------|
|     |             |      |
|     |             |      |
|     |             |      |
|     |             |      |



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RALEIGH, NORTH CAROLINA 27609

**BROWN BARK PARK  
MONITORING PLAN VIEW**  
GUILFORD COUNTY, NORTH CAROLINA  
EEP PROJECT NUMBER 62 - MY02  
STATION 28+41 TO STATION 38+55

DATE: NOVEMBER 2006  
SCALE: SEE SHEET  
**MONITORING PLAN VIEW  
SHEET 2**  
SHEET 3 OF 3

REVISIONS

## 2.0 PROJECT CONDITIONS AND MONITORING RESULTS

### 2.1 Vegetation Assessment

See vegetation assessment in Appendix A.

#### 2.1.1 Vegetative Problem Areas

See Table A6. Vegetative Problem Areas in Appendix A.

#### 2.1.2 Vegetative Problem Area Plan View

See Vegetative Problem Area Plan View in Appendix A.

### 2.2 Stream Assessment

#### 2.2.1 Bankfull Event and Stability Assessment

##### 2.2.1.a Verification of Bankfull Events Table

| Table 5. Verification of Bankfull Events<br>Project Number and Name: 52 – Brown Bark Park |                    |                      |               |
|---|--------------------|----------------------|---------------|
| Date of Data Collection   | Date of Occurrence | Method               | Photo Number  |
| 9/18/06   | 9/18/06            | Photographed on-site | SP7 (page 28) |
|   |                    |                      |               |

##### 2.2.1.b BEHI and Sediment Export Table

| Table 6. BEHI and Sediment Export Estimates<br>Project Number and Name: 52 – Brown Bark Park |
|--|
| To Be Conducted During Monitoring Year 05  |

#### 2.2.2 Stream Problem Areas

See Stream Problem Areas Table, Plan View, and Photos in Appendix B.

#### 2.2.3 Stability Assessment Table

| Table 7. Categorical Stream Feature Visual Stability Assessment<br>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%     |         |         |         |
| B. Pools   | 100%    | N/A     | 94%     |         |         |         |
| C. Thalweg   | 100%    | N/A     | 68%     |         |         |         |
| D. Meanders  | 100%    | N/A     | 60%     |         |         |         |
| E. Bed General   | 100%    | N/A     | 99%     |         |         |         |
| F. Bank Condition  | 100%    | N/A     | 93%     |         |         |         |
| G. Vanes / J Hooks etc.  | 100%    | N/A     | 100%    |         |         |         |
| H. Wads and Boulders   | 100%    | N/A     | 83%     |         |         |         |

## 2.2.4 Quantitative Measures Summary Tables

| Table 8. Baseline Morphology and Hydraulic Summary |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
|--|----------------|-----|------|-------------------------|-----|-----|------------------------|-----|------|--------------------------|-----|------|--------|-----|------|----------|------|--------|
| Project Number and Name: 52 – Brown Bark Park      |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Parameter  | USGS Gage Data |     |      | Regional Curve Interval |     |     | Pre-Existing Condition |     |      | Project Reference Stream |     |      | Design |     |      | As-built |      |        |
| Dimension  | Min            | Max | Mean | Min                     | Max | Med | Min                    | Max | Mean | Min                      | Max | Mean | Min    | Max | Mean | Min      | Max  | Median |
| Bankfull Width (ft)                                |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      | 13.5     | 19.4 | 16.7   |
| Floodprone Width (ft)                              |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      | 23       | 59   | 49     |
| Bankfull Cross Sectional Area (ft <sup>2</sup> )   |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      | 12.2     | 23.2 | 14.2   |
| Bankfull Mean Depth (ft)                           |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      | 0.8      | 1.2  | 0.9    |
| Bankfull Maximum Depth (ft)                        |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      | 1.7      | 3.3  | 2.0    |
| Width/Depth Ratio                                  |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      | 15.0     | 23.4 | 16.1   |
| Entrenchment Ratio                                 |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      | 1.7      | 3.6  | 3.1    |
| Bank Height Ratio                                  |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      | 1.0      | 1.0  | 1.0    |
| Wetted Perimeter (ft)                              |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Hydraulic Radius (ft)                              |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| <b>Pattern</b>                                     |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Channel Beltwidth (ft)                             |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Radius of Curvature (ft)                           |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Meander Wavelength (ft)                            |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Meander Width Ratio                                |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| <b>Profile</b>                                     |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Riffle Length (ft)                                 |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Riffle Slope (ft/ft)                               |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Pool Length (ft)                                   |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Pool Spacing (ft)                                  |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| <b>Substrate</b>                                   |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| d50 (mm)   |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| d84 (mm)   |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| <b>Additional Reach Parameters</b>                 |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Valley Length (ft)                                 |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Channel Length (ft)                                |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Sinuosity  |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Water Surface Slope (ft/ft)                        |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| BF Slope (ft/ft)                                   |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      |        |
| Rosgen Classification                              |                |     |      |                         |     |     |                        |     |      |                          |     |      |        |     |      |          |      | B/C5c  |

| <b>Table 9a. Morphology and Hydraulic Monitoring Summary</b> |                        |      |     |     |     |     |                        |      |     |     |     |     |                        |      |     |     |     |     |
|--|------------------------|------|-----|-----|-----|-----|------------------------|------|-----|-----|-----|-----|------------------------|------|-----|-----|-----|-----|
| <b>Project Number and Name: 52 – Brown Bark Park</b>         |                        |      |     |     |     |     |                        |      |     |     |     |     |                        |      |     |     |     |     |
| <b>Parameter</b>   | <b>Cross Section 1</b> |      |     |     |     |     | <b>Cross Section 2</b> |      |     |     |     |     | <b>Cross Section 3</b> |      |     |     |     |     |
|  | <b>Riffle</b>          |      |     |     |     |     | <b>Pool</b>            |      |     |     |     |     | <b>Riffle</b>          |      |     |     |     |     |
| <b>Dimension</b>   | MY1                    | MY2  | MY3 | MY4 | MY5 | MY+ | MY1                    | MY2  | MY3 | MY4 | MY5 | MY+ | MY1                    | MY2  | MY3 | MY4 | MY5 | MY+ |
| Bankfull Width (ft)  | 14.9                   | 10.9 |     |     |     |     | 15.9                   | 15.3 |     |     |     |     | 19.2                   | 19.0 |     |     |     |     |
| Floodprone Width (ft)  | 23                     | 20.2 |     |     |     |     | 36.0                   | 36.3 |     |     |     |     | 48                     | 47.4 |     |     |     |     |
| Bankfull Cross Sectional Area (ft <sup>2</sup> )             | 13.0                   | 9.6  |     |     |     |     | 14.9                   | 11.0 |     |     |     |     | 24.9                   | 23.6 |     |     |     |     |
| Bankfull Mean Depth (ft)                                     | 0.9                    | 0.9  |     |     |     |     | 0.9                    | 0.7  |     |     |     |     | 1.3                    | 1.2  |     |     |     |     |
| Bankfull Maximum Depth (ft)                                  | 2.0                    | 1.8  |     |     |     |     | 2.8                    | 1.7  |     |     |     |     | 3.8                    | 3.3  |     |     |     |     |
| Width/Depth Ratio  | 17.2                   | 12.4 |     |     |     |     | 17.0                   | 21.3 |     |     |     |     | 14.9                   | 15.3 |     |     |     |     |
| Entrenchment Ratio   | 1.6                    | 1.9  |     |     |     |     | 3.3                    | 2.4  |     |     |     |     | 2.6                    | 2.5  |     |     |     |     |
| Bank Height Ratio  | 1.0                    | 1.0  |     |     |     |     | 1.0                    | 1.0  |     |     |     |     | 1.0                    | 1.0  |     |     |     |     |
| Wetted Perimeter (ft)  |                        | 11.9 |     |     |     |     |                        | 16.0 |     |     |     |     |                        | 20.7 |     |     |     |     |
| Hydraulic Radius (ft)  |                        | 0.8  |     |     |     |     |                        | 0.7  |     |     |     |     |                        | 0.7  |     |     |     |     |
| <b>Substrate</b>   |                        |      |     |     |     |     |                        |      |     |     |     |     |                        |      |     |     |     |     |
| d50 (mm)   |                        | 19.1 |     |     |     |     |                        | 8.4  |     |     |     |     |                        | 15.3 |     |     |     |     |
| d84 (mm)   |                        | 56   |     |     |     |     |                        | 18   |     |     |     |     |                        | 101  |     |     |     |     |

| <b>Table 9b. Morphology and Hydraulic Monitoring Summary</b> |                        |      |     |     |     |     |                        |      |     |     |     |     |                        |      |     |     |     |     |
|--|------------------------|------|-----|-----|-----|-----|------------------------|------|-----|-----|-----|-----|------------------------|------|-----|-----|-----|-----|
| <b>Project Number and Name: 52 – Brown Bark Park</b>         |                        |      |     |     |     |     |                        |      |     |     |     |     |                        |      |     |     |     |     |
| <b>Parameter</b>   | <b>Cross Section 4</b> |      |     |     |     |     | <b>Cross Section 5</b> |      |     |     |     |     | <b>Cross Section 6</b> |      |     |     |     |     |
|  | <b>Pool</b>            |      |     |     |     |     | <b>Riffle</b>          |      |     |     |     |     | <b>Riffle</b>          |      |     |     |     |     |
| <b>Dimension</b>   | MY1                    | MY2  | MY3 | MY4 | MY5 | MY+ | MY1                    | MY2  | MY3 | MY4 | MY5 | MY+ | MY1                    | MY2  | MY3 | MY4 | MY5 | MY+ |
| Bankfull Width (ft)  | 13.5                   | 12.2 |     |     |     |     | 15.7                   | 9.8  |     |     |     |     | 19.7                   | 11.7 |     |     |     |     |
| Floodprone Width (ft)  | 30                     | 27   |     |     |     |     | 50                     | 35.4 |     |     |     |     | 59                     | 53.4 |     |     |     |     |
| Bankfull Cross Sectional Area (ft <sup>2</sup> )             | 13.2                   | 11.1 |     |     |     |     | 12.5                   | 8.0  |     |     |     |     | 13.9                   | 11.5 |     |     |     |     |
| Bankfull Mean Depth (ft)                                     | 1.0                    | 0.9  |     |     |     |     | 0.8                    | 0.8  |     |     |     |     | 0.7                    | 1.0  |     |     |     |     |
| Bankfull Maximum Depth (ft)                                  | 2.4                    | 2.3  |     |     |     |     | 1.6                    | 1.3  |     |     |     |     | 1.8                    | 1.8  |     |     |     |     |
| Width/Depth Ratio  | 13.8                   | 13.4 |     |     |     |     | 19.6                   | 12.0 |     |     |     |     | 28.7                   | 11.9 |     |     |     |     |
| Entrenchment Ratio   | 2.1                    | 2.2  |     |     |     |     | 3.3                    | 3.7  |     |     |     |     | 2.6                    | 4.6  |     |     |     |     |
| Bank Height Ratio  | 1.0                    | 1.0  |     |     |     |     | 1.0                    | 1.0  |     |     |     |     | 1.0                    | 1.0  |     |     |     |     |
| Wetted Perimeter (ft)  |                        | 13.7 |     |     |     |     |                        | 10.3 |     |     |     |     |                        | 12.5 |     |     |     |     |
| Hydraulic Radius (ft)  |                        | 0.8  |     |     |     |     |                        | 0.8  |     |     |     |     |                        | 0.9  |     |     |     |     |
| <b>Substrate</b>   |                        |      |     |     |     |     |                        |      |     |     |     |     |                        |      |     |     |     |     |
| d50 (mm)   |                        | 6.8  |     |     |     |     |                        | 15.2 |     |     |     |     |                        | 21.1 |     |     |     |     |
| d84 (mm)   |                        | 31   |     |     |     |     |                        | 70   |     |     |     |     |                        | 83   |     |     |     |     |

| <b>Table 9c. Morphology and Hydraulic Monitoring Summary continued</b> |                       |     |       |                       |       |       |                       |     |     |                       |     |     |                       |     |     |
|--|-----------------------|-----|-------|-----------------------|-------|-------|-----------------------|-----|-----|-----------------------|-----|-----|-----------------------|-----|-----|
| <b>Project Number and Name: 52 – Brown Bark Park</b>                   |                       |     |       |                       |       |       |                       |     |     |                       |     |     |                       |     |     |
| <b>Parameter</b>   | <b>MY - 01 (2005)</b> |     |       | <b>MY - 02 (2006)</b> |       |       | <b>MY - 03 (2007)</b> |     |     | <b>MY - 04 (2008)</b> |     |     | <b>MY - 05 (2009)</b> |     |     |
| <b>Pattern</b>   | Min                   | Max | Med   | Min                   | Max   | Med   | Min                   | Max | Med | Min                   | Max | Med | Min                   | Max | Med |
| Channel Beltwidth (ft)   |                       |     |       | 22                    | 71    | 37    |                       |     |     |                       |     |     |                       |     |     |
| Radius of Curvature (ft)   |                       |     |       | 17                    | 33    | 19    |                       |     |     |                       |     |     |                       |     |     |
| Meander Wavelength (ft)  |                       |     |       | 79                    | 105   | 91    |                       |     |     |                       |     |     |                       |     |     |
| Meander Width Ratio  |                       |     |       | 1.7                   | 5.5   | 2.9   |                       |     |     |                       |     |     |                       |     |     |
| <b>Profile</b>   |                       |     |       |                       |       |       |                       |     |     |                       |     |     |                       |     |     |
| Riffle Length (ft)   |                       |     |       | 3                     | 60    | 13    |                       |     |     |                       |     |     |                       |     |     |
| Riffle Slope (ft/ft)   |                       |     |       | 0.003                 | 0.160 | 0.027 |                       |     |     |                       |     |     |                       |     |     |
| Pool Length (ft)   |                       |     |       | 4                     | 64    | 14    |                       |     |     |                       |     |     |                       |     |     |
| Pool Spacing (ft)  |                       |     |       | 13                    | 174   | 45    |                       |     |     |                       |     |     |                       |     |     |
| <b>Additional Reach Parameters</b>                                     |                       |     |       |                       |       |       |                       |     |     |                       |     |     |                       |     |     |
| Valley Length (ft)   |                       |     |       | 2,623                 |       |       |                       |     |     |                       |     |     |                       |     |     |
| Channel Length (ft)  |                       |     |       | 2,855                 |       |       |                       |     |     |                       |     |     |                       |     |     |
| Sinuosity  |                       |     |       | 1.1                   |       |       |                       |     |     |                       |     |     |                       |     |     |
| Water Surface Slope (ft/ft)  |                       |     |       | 0.009                 |       |       |                       |     |     |                       |     |     |                       |     |     |
| Rosgen Classification  |                       |     | B/C5c | B/C4c                 |       |       |                       |     |     |                       |     |     |                       |     |     |



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**Appendix A**

**Appendix B**