ELLERBE CREEK STREAM RESTORATION – Project #127
Second Annual Monitoring Report - February 2007 - Final

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Submitted to:

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I. Executive Summary

The Ellerbe Creek stream restoration a project is located on the Hillandale Golf Course in Durham, North Carolina just east of the intersection of U.S. 15/501 and Interstate 85 (I-85). The project has restored 6,279 linear feet of the perennial stream in the Neuse River Basin (USGS HUC 03020201050010). The drainage area for the site covers approximately 5,635 acres. Several unnamed tributaries enter Ellerbe Creek upstream of the restoration site. Project construction began in January 2004 and was completed in December of the same year. First year monitoring was done in the fall of 2005. Second year monitoring was completed in November 2006.

As-built qualitative evaluation was conducted by RJG&A during early February 2006. Subsequent qualitative evaluation was conducted during early March, late June, September, and October 2006. The second annual vegetation monitoring data were collected during September 2006. The second annual geomorphological monitoring data were collected during October and December 2006.

The restoration project has met its design goals. No significant geomorphologic changes have occurred during the second monitoring year. Aquatic and semi-aquatic organisms have colonized most of the restoration area and the average woody stem density (942 per acre) has exceeded the vegetation restoration goal.

II. Project Background

A. Location and Setting

The Ellerbe Creek restoration is located in the City of Durham on the Hillandale Golf Course. The golf course and restoration area are located approximately 1,500 feet east of the I-85/U.S. 15/501 intersection, on the east and west sides of Hillandale Road. To access the site from I-85, travel south on exit 17a (Hillandale Road). Ellerbe Creek is at the bottom of the first hill. The restoration site begins where Ellerbe Creek emerges from a double box culvert under I-85, continues east under Belleview Avenue and Hillandale Road, and terminates approximately 300 west of Albany Street. Sprunt Avenue parallels most of the site to the south. Indian Trail parallels the Albany reach to the north (Figure 1). The Croasdaile reach is along an unnamed tributary to Ellerbe Creek that emerges from a double box culvert under I-85. It is paralleled by Belleview Avenue to the east.

Maintenance of the immediately surrounding golf course, channel straightening, and the large amount of impervious surface in the surrounding urban watershed were primarily responsible for the stream's instability. The golf course had intensively managed the vegetation adjacent to the stream and only a grass buffer existed along the banks. The result was an entrenched stream with low sinuosity. The channel was incised four to six feet and erosion and slumping affected large portions of the banks.

B. Structure and Objectives

A Priority 2 stream restoration was used for the most of project's length to establish a new floodplain, improve sediment transport capability, restore wildlife habitat, and improve water quality. Some stream enhancement was done in the Croasdaile, Hillandale, and Albany reaches, where utility rights-of-way were present. The Albany reach also included preservation. The project involved channel dimension adjustments, pattern alterations, in-stream structure (root wads, rock vanes, and woody debris) installation to provide grade control and channel stability, and riparian buffer restoration (woody vegetation planting and stock exclusion).

The areas where site constraints related to the golf course and utility rights-of-way are detailed in the As-Built Report.

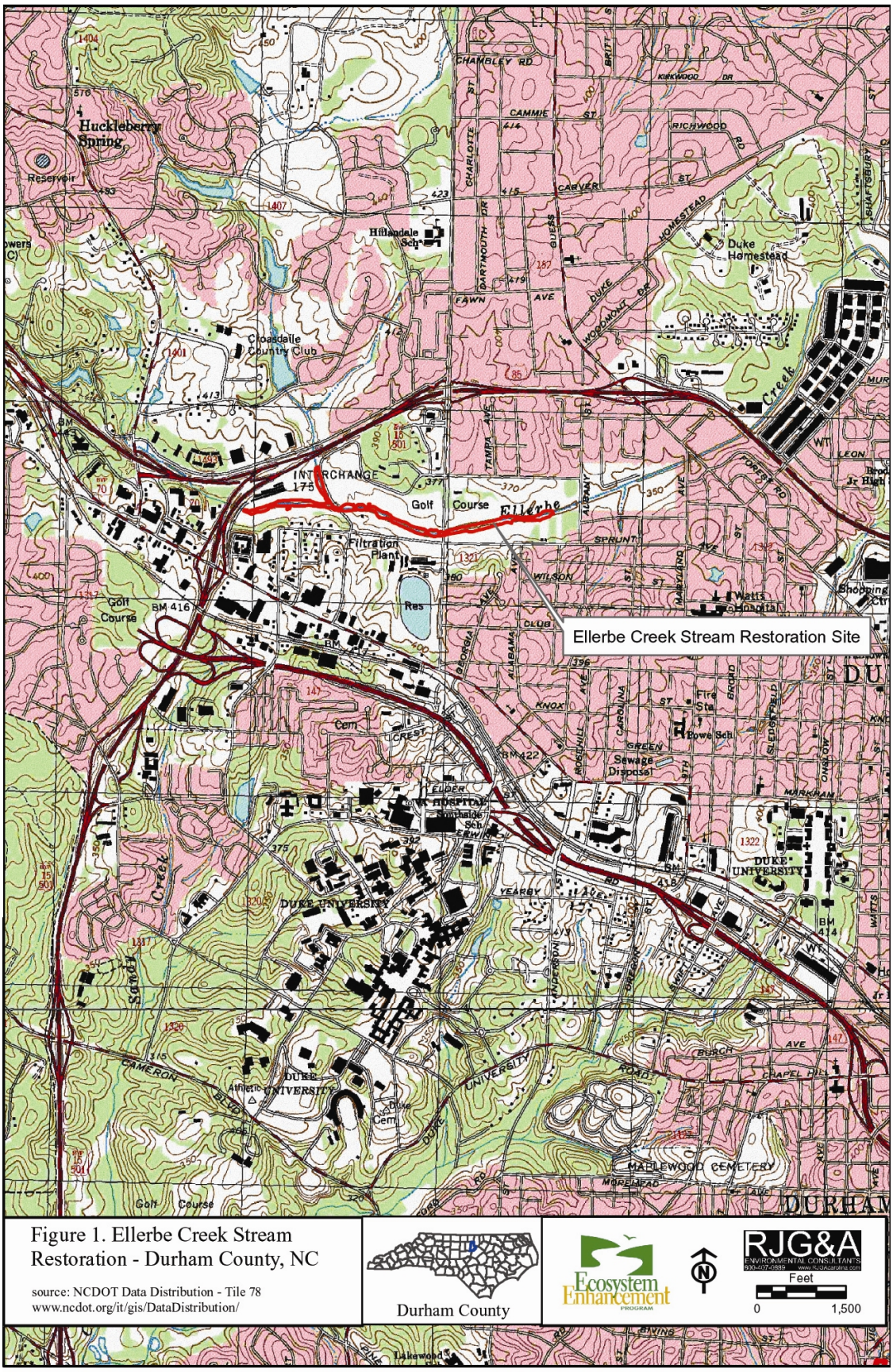

Figure 1. Ellerbe Creek Stream Restoration - Durham County, NC

source: NCDOT Data Distribution - Tile 78
www.ncdot.org/it/gis/DataDistribution/

Exhibit Table I. Project Objectives Table (from Ellerbe Creek Year One Monitoring Report) Ellerbe Creek Stream Restoration - Project #127			
Reach ID	Mitigation Type	Linear Feet or Acreage	Comment
Hillsborough	Restoration	1663 LF	Changed dimension, pattern, and profile
Croasdaile	Restoration	199 LF	Changed dimension, pattern, and profile
Croasdaile	Enhancement	504 LF	Changed dimension and profile
Hillandale	Restoration	1321 LF	Changed dimension, pattern, and profile
Hillandale	Enhancement	618 LF	Changed dimension and profile
Albany	Restoration	1207 LF	Changed dimension, pattern, and profile
Albany	Enhancement	391 LF	Changed dimension and profile
Albany	Preservation	376 LF	Protected existing stream
Buffer	Restoration	17.41 AC	Restored buffer area
Stormwater Wetland	Creation	0.15 AC	Created wetlands
Pocket Wetlands	Creation	0.23 AC	Created wetlands

C. History and Background

Exhibit Table II. Activity and Reporting History Ellerbe Creek Stream Restoration – Project #127		
Activity or Report	**Calendar Year of Completion or Planned Completion**	**Actual Completion Date**
Restoration Plan	2003	March 2003
Construction	2005	March 2005
Temporary S&E mix applied	2004	December 2004
Permanent seed mix applied	2004	December 2004
Bare Root Planting	2004	January 2004
Mitigation Plan	2005	May 2005
As-built	2004	May 2005
Year 1 Monitoring	2005	October 2005
Year 2 Monitoring		
Vegetation	2006	September 2006
Geomorphological	2006	October 2006
Report	2006	December 2006

Exhibit Table III. Project Contacts Ellerbe Creek Stream Restoration – Project #127
Design: Stantec Consulting, Inc. 801 Jones Franklin Road, Suite 300 Raleigh, North Carolina 27606 Mr. Brad Fairley (919) 851-6866
Construction Contractor: SEI Environmental, Inc. 130 Penmarc Drive Raleigh, NC 27603-2470 Ms. Jackie Utley (919) 832-2535
Monitoring Performers: RJG&A 1221 Corporation Parkway, Suite 100 Raleigh, NC 27616 Mr. Ward Marotti (919) 872-1174

Exhibit Table IV. Project Background - Ellerbe Creek Stream Restoration – Project #127	
County	Durham
Drainage Area	Hillsborough Reach – 1,140 Acres (1.78 sq. miles)
	Hillandale Reach – 1,810 Acres (2.83 sq. miles)
	Albany Reach – 2,150 Acres (3.36 sq. miles)
	Croasdaile Reach – 535 Acres (0.84 sq. miles)
Drainage Impervious Cover Estimate (%)	80% impervious; 20% forest and residential
Stream Order	Third Order
Physiographic Region	Piedmont
Ecoregion	Triassic Basins
Rosgen Classification of As-built	C4
Dominant Soil Types	Cartecay, Chewacla, and Congaree
Reference Site ID	SCO#010551001A
USGS HUC for Project and Reference	Ellerbe: 03020201; Cabin Branch: 03020201; Tributary to Marks Creek: 03020201
NCDWQ Sub-basin for Project and Reference	Ellerbe: 03-04-01; Cabin Branch: 03-04-01; Tributary to Marks Creek: 03-04-02
NCDWQ Classification for Project and Reference	Ellerbe: Impaired; Cabin Branch: Not Rated; Tributary to Marks Creek: Excellent
Any portion of the project segment 303d listed?	Yes
Any portion of the project segment upstream of a 303d listed segment?	Yes
Reasons for 303d Listing or Stressor	Urban runoff/storm sewers
% of Project Easement Fenced 0%	None

Figure 2. Monitoring Plan View

Vegetation Plot Coordinates: Hillsborough Reach			
Plot Side	HB-V1	HB-V2	HB-V3
Pin Coordinate	E 20115741.5610 N 827358.3480	E 20116120.1110 N 827428.6750	E 2016551.0870 N 827505.1970
A	19.5’	31.1’	31.9’
B	52.1’	35.4’	32.6’
C	23.2’	33.1’	31.3’
D	53’	36.2’	39.4’

Vegetation Plot Coordinates: Croasdaile Reach		
Plot Side	CR-V1	CR-V2
Pin Coordinate	E 2016811.8250 N 827741.1850	E 2016933.510 N 827520.8490
A	32.4’	18.3’
B	33.2’	65.5’
C	29.9’	21.7’
D	31.9’	64.1’

	Easting	Northing
Cross-sections		
HB1L	2015742.0022	827332.7693
HB1R	2015772.552	827290.9634
HB2L	2015799.2852	827350.0513
HB2R	2015803.356	827295.5714
HB3L	2016595.6390	827499.8180
HB3R	2016610.0550	827433.3600
HB4L	2015654.5640	827499.8920
HB4R	20116634.3500	827432.4490
CR1L	2016939.2680	827570.7490
CR1R	2016915.6680	827552.4340
CR2L	2016957.7640	827541.2870
CR2R	2016933.5100	827520.8490
Photopoints		
HB-P1	2015577.0052	827347.3258
HB-P2	2015623.7143	827314.4264
HB-P3	2015802.5285	827349.0571
HB-P4	2015961.3634	827401.3361
HB-P5	2016127.5574	827481.3197
HB-P6&P7	2016301.8430	827496.7037
HB-P8	2016523.1130	827464.0709
HB-P9	2016749.2114	827430.4392
HB-P10	2016966.4524	827439.7628
CR-P1	2016781.3114	828053.9579
CR-P2	2016818.9390	827855.0313
CR-P3	2016919.4678	827582.3480

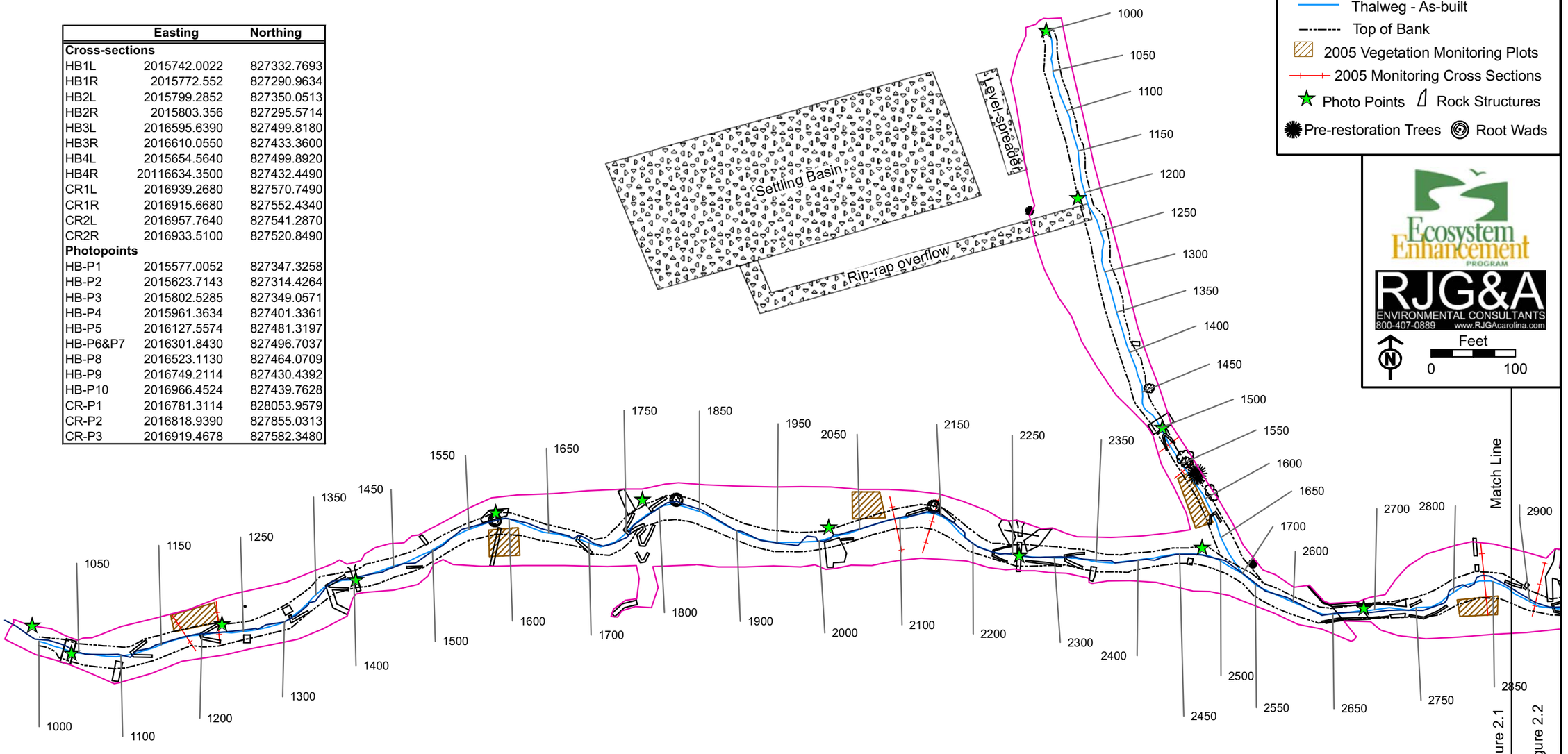

Figure 2.1 - 2006 Monitoring.
Plan View - Year 2
Ellerbe Creek Stream Restoration - Durham, NC

LEGEND

- Thalweg-2006 Survey
- NCDOT Stormwater Structures

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- 2005 Vegetation Monitoring Plots
- 2005 Monitoring Cross Sections
- Photo Points
- Rock Structures
- Pre-restoration Trees
- Root Wads

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800-407-0889 www.RJGAcarolina.com

N

Feet
0 100

Vegetation Plot Coordinates: Hillandale Reach			
Plot Side	HD-V1	HD-V2	HD-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.9'	30.8'	20'
B	48.4'	31.1'	44.6'
C	22.2'	34.2'	14.2'
D	44.7'	32'	46.1'

	Easting	Northing
Cross-sections		
HD1L	2017297.3510	827444.6380
HD1R	2017305.8250	827358.5730
HD2L	2017374.0400	827421.2960
HD2R	2017358.2570	827357.0970
HD3L	2017882.0380	827326.3380
HD3R	2017835.7280	827218.0475
HD4L	2017870.4020	827311.3050
HD4R	2017919.3160	827220.8030
Photopoints		
HD-P1	2017158.5527	827368.2372
HD-P2	2017423.2777	827370.9011
HD-P3	2017633.3927	827372.5660
HD-P4	2017780.9060	827327.6127
HD-P5	2018032.6444	827207.0713
HD-P6	2018319.0135	827067.8826
HD-P7	2018632.0216	826962.3256

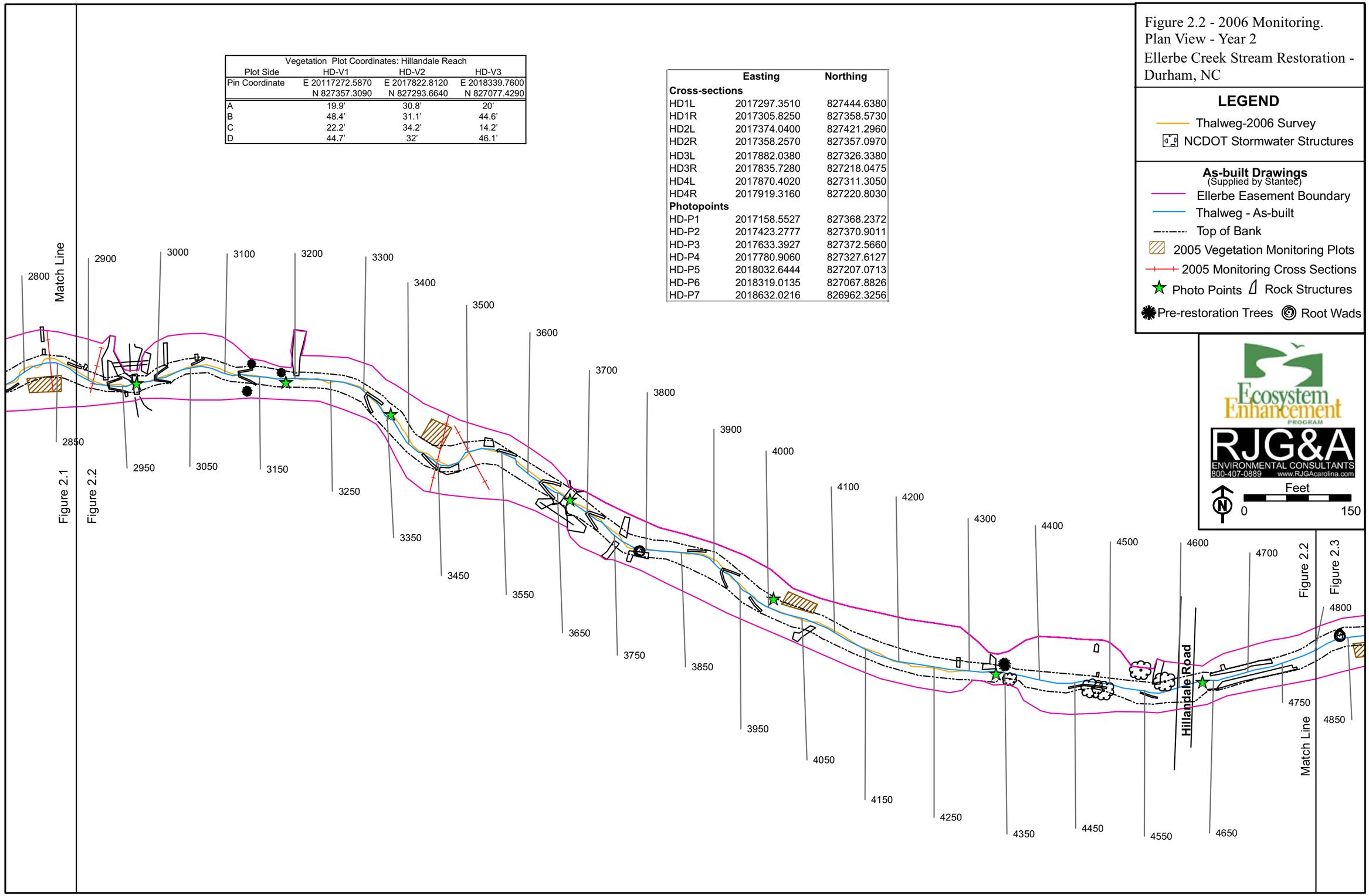

Figure 2.2 - 2006 Monitoring.
Plan View - Year 2
Ellerbe Creek Stream Restoration - Durham, NC

LEGEND

- Thalweg-2006 Survey
- NCDOT Stormwater Structures

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- 2005 Vegetation Monitoring Plots
- 2005 Monitoring Cross Sections
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- Root Wads

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Feet
0 150

Vegetation Plot Coordinates: Albany Reach			
Plot Side	AL-V1	AL-V2	AL-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.8'	33.1'	30.4'
B	54.7'	33.9'	45.8'
C	20.6'	36.1'	34.3'
D	51.5'	37.7'	45.8'

	Easting	Northing
Cross-sections		
AL1L	2019638.8850	827132.4120
AL1R	2019653.3780	827052.7850
AL2L	2019670.2730	827138.9190
AL2R	2019716.0120	827068.9910
AL3L	2019819.4940	827182.5337
AL3R	2019825.5310	827101.4830
AL4L	2019845.6470	827189.0390
AL4R	2019867.0530	827112.7780
Photopoints		
AL-P1	2018922.3866	826950.6711
AL-P2	2019315.6779	827040.2114
AL-P3	2019581.5016	827088.1615
AL-P4	2019822.0184	827155.9245
AL-P5	2020004.7951	827193.1524
AL-P6	2020248.1090	827221.4564
AL-P7	2020410.0740	827196.1493
AL-P8	2020545.5332	827244.7655

Match Line

Figure 2.2

Figure 2.3

4700 4750 4800 4850 4900 4950 5000 5050 5100 5150 5200 5250 5300 5350 5400 5450 5500 5550 5600 5650 5700 5750 5800 5850 5900 5950 6000 6050 6100 6150 6200 6250 6300 6350 6400 6450 6500 6550 6558

Figure 2.3 - 2006 Monitoring.
Plan View - Year 2
Ellerbe Creek Stream Restoration - Durham, NC

LEGEND

- Thalweg-2006 Survey
- NCDOT Stormwater Structures

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- 2005 Vegetation Monitoring Plots
- 2005 Monitoring Cross Sections
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- Rock Structures
- Pre-restoration Trees
- Root Wads

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Feet
0 150

III. Project Conditions and Monitoring Results

The site was initially evaluated in early February 2006 and appeared to be functioning as designed. Subsequent evaluations in March, June, September, and October 2006 also revealed relatively complete design compliance, with a few minor exceptions, detailed below.

A. Vegetation Assessment

1. Soil Data

Exhibit Table V. Preliminary Soil Data – Ellerbe Creek Stream Restoration – Project #127					
Series	Max Depth (in.)	% Clay on Surface	K	T	OM%
Altavista silt loam	41	12 to 27	0.24	5	1.75
Cartecay	80	12 to 27	0.32	5	2.50
Chewacla	60	12 to 27	0.28	5	2.50
Wahee	65	8 to 27	0.37	2	2.50
White Store	60	11.3	0.28	3	1.25

2. Vegetation Problem Areas

Overall, planted woody vegetation appeared to be successful when evaluated during September 2006, with only a few minor problem areas.

Exhibit Table VI. Vegetation Problem Areas – Ellerbe Creek Stream Restoration – Project #127			
Feature/Issue	**Station/Range**	**Probable Cause**	**Photo #**
Bare soil/eroded slopes	1110-1260	Compated soil/high runoff from golf course	VP1, VP2
Bare soil/eroded slopes	1800-1975	Compated soil/high runoff from golf course	VP1, VP2
Bare soil/eroded slopes	1850-2020	Compated soil/high runoff from golf course	VP1, VP2
Beaver browsing	2880-2910	Beaver dams in area	VP3
Bare soil/eroded slopes	3490-3560	Compated soil/high runoff from golf course	VP1, VP2
Bare soil/eroded slopes	6235-6470	Compated soil/high runoff from golf course	VP1, VP2
Beaver browsing	6355-6490	Beaver dams in area	VP3

2.1. Hillsborough Reach

Three vegetation problem areas were observed in the Hillsborough reach during the second growing season. Two of them are on the slopes between the terrace and the golf course. They are likely to have resulted from rill and gully erosion in compacted subsoil. The third, and largest, vegetation problem area is the result of beaver damage to planted woody stems in the floodplain and lower terrace, immediately adjacent to the beaver ponds.

Replanting, mulching, and installation of erosion control devices (e.g. coir matting) in the rill and gully areas is recommended. During the June qualitative evaluation, a beaver dam was observed. Several more dams were observed during the September evaluation and vegetation monitoring and planted woody stems appeared have been harvested. The beaver on the site was reported to have been killed by an automobile during late November 2006 (Roy Clark, Greenskeeper, Hillandale Golf Course, personal communication). The dams were subsequently removed by an EEP subcontractor. Because the impacted planted woody stems adjacent to the ponds were unlikely to have been killed and may recover during the 2007 growing season, no remedial action is recommended at this time. In addition to beaver harvest in this floodplain area, planted woody stem vigor in this floodplain area was relatively low. Because of the low slope in this floodplain area, the cause appears to be lack of and adequate growth medium (i.e. too compact/not enough organic material/nutrients).

2.2. Croasdaile Reach

The only vegetation problem area observed in the Croasdaile reach was where the NCDOT rip-rap spillway crosses the stream buffer. No remedial action is recommended/possible at this time.

2.3. Hillandale Reach

A small rill and gully vegetation problem area was observed on the slope from the golf coarse in the Hillandale reach, immediately downstream from cross section four. As described above, this vegetation problem area is likely to be the result of the lack of an adequate substrate.

Two small, relative narrow, beaver harvest areas were observed along both banks, immediately downstream of the Croasdaile Bridge. Like the areas described above, the impacted planted woody stems are unlikely to have been killed and, because of the beaver's death and removal of the dams, they are likely to re-sprout during the 2007 growing season.

2.4. Albany Reach

Two vegetation problem areas were observed in the Albany Reach. Both are on the left side of the stream, near the bottom (downstream end) of the restoration area. The rill and gully problem area is on the slope between the course and the floodplain and is very similar to those described above. The area that has resulted from beaver harvesting of

planted woody stems is immediately downhill (stream right) from the rill and gull site. No beaver dams were observed in the Albany Reach. The lower portion of the Albany reach has been "backwatered" since the June evaluation, presumably from downstream beaver impoundments. Because the animals impacting this area are offsite, remedial action in this area will be difficult.

3. Stem Counts

Prior to the first year of monitoring, eleven vegetation survey plots were installed at the Ellerbe Creek restoration site. The Hillsborough, Hillandale, and Albany reaches each contain three vegetation plots. The Croasdaile reach contains two. The length and width of each plot varies due to site constraints, but all plots are 100 square meters. In accordance with the vegetation monitoring methodology specified in the Restoration Plan, and the First Annual Monitoring Report, the number of planted live stems was recorded at each vegetation plot. Additionally, the height (cm) of each stem was recorded, and diameter at breast height (dbh) was recorded for stems taller than 137 cm (4.5 feet), and decimeter at decimeter height (ddh) was recorded for shorter stems.

The average live, planted woody stem density for all plots was 23.27 individuals per plot, (942 stems per acre). This exceeds the required 320 stems per acre in the second monitoring year by 290 percent, in spite of the 59.7 percent survival of planted woody stems (Table 7).

Exhibit Table VII. Stem Counts and Summary Data by Species and Plot - Ellerbe Creek Stream Restoration – Project #127

					Hillsborough			Croasdaile		Hillandale			Albany		
Species	**Total Planted**	**Year 2 Total Live (2006)**	**% Survival**	**Total Dead (all plots)**	**Plot HB - 1**	**Plot HB - 2**	**Plot HB - 3**	**Plot CR - 1**	**Plot CR - 2**	**Plot HD - 1**	**Plot HD - 2**	**Plot HD - 3**	**Plot AL - 1**	**Plot AL - 2**	**Plot AL - 3**
Aronia arbutifolia	33	20	60.6	0	0	0	2	0	0	0	11	3	2	2	0
Betula nigra	42	25	59.5	8	4	0	5	0	0	0	3	0	0	0	13
*Cephalanthus occidentalis**		8	*	0	0	0	0	0	0	4	0	0	2	2	0
Clethra alnifolia	8	4	50.0	0	0	2	0	1	0	0	0	0	0	1	0
Cornus amomum	93	78	83.9	7	6	13	12	16	6	4	0	5	3	9	4
Cornus florida	1	1	100.0	0	0	0	1	0	0	0	0	0	0	0	0
Fraxinus pennsylvanica	35	24	68.6	1	7	0	0	0	0	0	0	4	0	0	13
Ilex verticillata	3	2	66.7	0	2	0	0	0	0	0	0	0	0	0	0
Juniperus virginiana	5	3	60.0	0	0	0	0	0	0	0	3	0	0	0	0
Morella cerifera	2	1	50.0	0	0	0	1	0	0	0	0	0	0	0	0
Quercus coccinea	7	5	71.4	1	1	0	0	1	1	0	0	0	0	0	2
Quercus phellos	24	16	66.7	0	2	0	1	0	0	0	3	1	0	0	9
Salix sericea	23	34	100[a]	2	0	12	0	0	0	0	0	4	0	18	0
Sambucus canadensis	51	9	17.6	3	0	1	0	0	4	0	2	0	2	0	0
*Spirea tomentosa***		5	**	0	0	0	0	0	5	0	0	0	0	0	0
Symphoricarpos orbiculatus	4	8	100[a]	0	0	0	0	0	8	0	0	0	0	0	0
Vaccinium corymbosum	26	10	38.5	0	0	0	0	0	10	0	0	0	0	0	0
Viburnum nudum	7	3	42.9	0	0	0	0	0	0	0	0	0	3	0	0
Unknown spp.	0	0	0.0	3	0	0	0	0	0	0	0	0	0	0	0
Total per plot					**22**	**28**	**22**	**18**	**34**	**8**	**22**	**17**	**12**	**32**	**41**
All Plots	**364**	**256**	**59.7**												
Average woody stems per acre	**1,339**	**942**													

* *C. occidentalis* may have been identified as *V. nudum* during Year 1. There is no record of the plant in Year 1's vegetation plot data.
** *S. tomentosa* may have been identified as *C. alnifolia* during Year 1. There is no record of the plant in Year 1's vegetation plot data.
[a] = More individuals observed in monitoring Year 2 than Year 1.

4. Vegetation Plot Photos
Vegetation plot photos are in Appendix A.

B. Stream Assessment

RJG&A staff evaluated the Ellerbe Creek Stream Restoration site during February, March, June, September, and October 2006 and took photographs and notes regarding the condition and success of the project. Overall, the site is maintaining its as-built dimension, pattern, and profile, and planted woody stem density is high.

The RJG&A staff collected the second year monitoring quantitative geomorphological data (14 cross sections and approximately 3,400 linear stream feet) during October and November and December 2006, respectively. Photographs were taken at all cross sections, vegetation monitoring plots, and at the 28 permanent photo locations.

As the quantitative data and qualitative evaluations indicate, after the second growing season the structure and function of the entire restoration project very closely match the as built conditions (i.e. very little change has occurred).

Most structural problems observed were caused by the occupation of the site by one or more beavers. The constructed dams caused flooding throughout the restoration site. This eliminated a normal sediment transport regime and caused impacts to vegetation through flooded conditions and beaver harvest of planted woody stems. Other instream problems observed were flooding/burying of cross-vanes, which was presumably worsened by the presence of beaver dams causing excessive sediment collection in some areas and low flows and minimal deposition in others. In one area where the dam had failed, the stream was developing a new pattern by downcutting through the deposited sediment.

As noted above, the beaver and its dams have since been removed from the restoration site and therefore, immediate remedial action is not recommended.

A *wetted perimeter* bed material analysis was performed at each cross section. Silt and clay are by far the dominant bed material throughout the entire restoration site.

No crest gauges are installed at this site to document bankfull events. Potential occurrence was based on USGS stream gauge discharge data for Ellerbe Creek near Gorman (USGS 02086849). This gauge is located approximately 10 miles downstream of the restoration site and has a drainage area of 21.9 square miles. According to the urban piedmont regional curve, a stream with a drainage area of 21.9 square miles would reach a bankfull discharge at 2,144.5 cubic feet per second (cfs) (Doll et al., 2002). Based on USGS data for 2006 (Figure 3), there have been no bankfull events at this gauge. The highest flow event during 2006 was 1080 cfs on November 22th', which is less than half of the bankfull discharge predicted by the urban piedmont regional curve. Using the rural piedmont regional curve, bankfull discharge is 819.7 cfs, making the high

flow event on November 22nd the only bankfull event of the year. Although, the majority of the watershed upstream of this gauge is urban, the rural regional curve appears to more accurately describe the potential for bankfull events.

Qualitative evaluation (rack and drift lines, downed herbaceous and woody vegetation on the floodplain) indicated at least three high flow events during 2006 (April, June, and September (left photo)).

Exhibit Table VIII. Verification of Bankfull Events – Ellerbe Creek Stream Restoration – Project #127

Date of Data Collection	Date of Occurrence (mm/dd/yy)	Method	Photo # (if available)
30 April 2006	late-April 2006	On-site high water indicators observed	NA
28 June 2006	mid-June 2006	On-site high water indicators	NA
19 September 2006	early-September 2006	On-site high water indicators	above
2006	11/22/06	Proximal USGS gauge resource	NA

Figure 3. USGS 2006 stream gauge discharge data for Ellerbe Creek near Gorman, N.C.

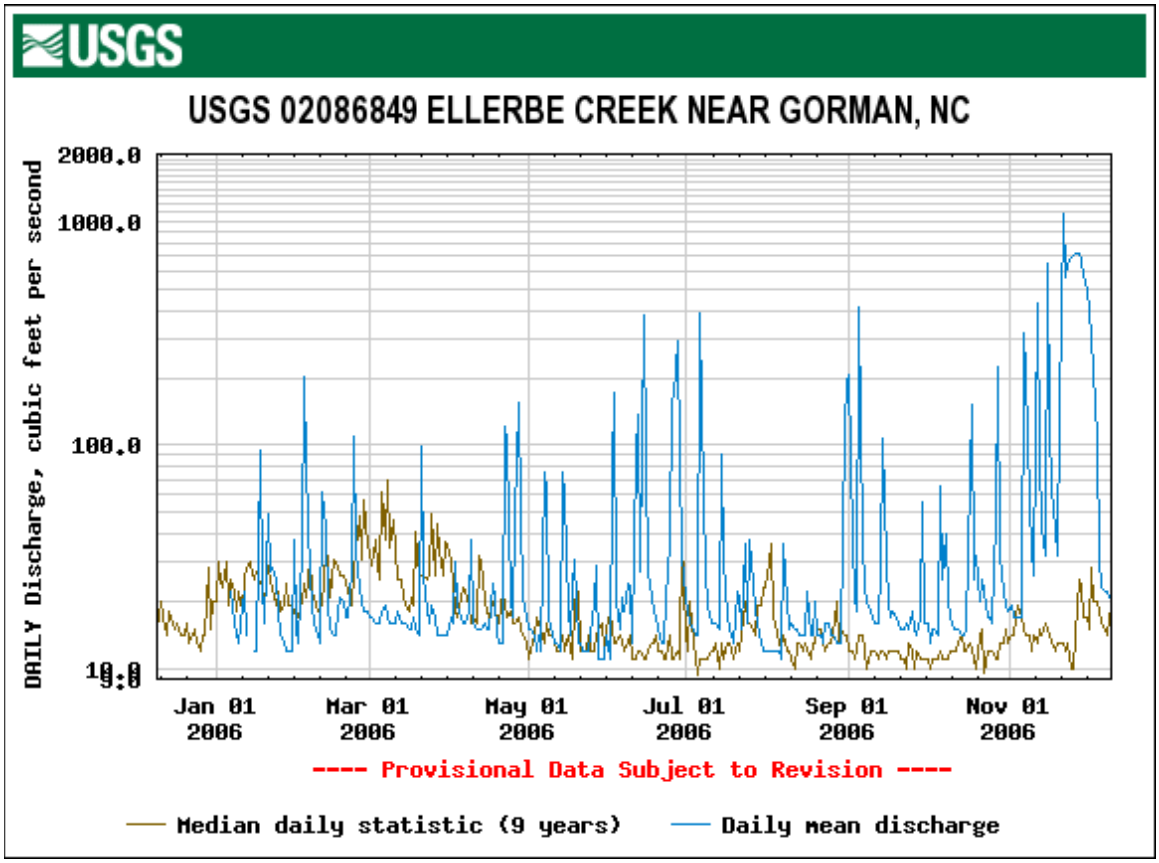

Table IX BEHI and Sediment Export Estimates only apply to Monitoring year 5 and were, therefore, not performed during 2006 (monitoring year 2).

Exhibit Table X. Stream Problem Areas – Ellerbe Stream Restoration – Project #127			
Feature/Issue	**Station**	**Probable Cause**	**Photo #**
Bank undercut	1010.5	Rootwad needed	SP6
Aggradation (bar)	1234	Unknown	SP1
Rill and gully	1291	Insufficient growth medium	SP5
Aggradation (pool)	1369.2	Beaverdam	SP2
Rill and gully	1496.2	Insufficient growth medium	SP5
Rill and gully	1596	Insufficient growth medium	SP5
Beaver dam	1682	Colonization from downstream	SP3,4
Rill and gully	1767	Insufficient growth medium	SP3,4
Aggradation (pool)	1791	Beaverdam	SP2
Rootwad undercut	1824	Unknown	SP7
Beaverdam	1985	Colonization from downstream	SP4

Exhibit Table X. Stream Problem Areas – Ellerbe Stream Restoration – Project #127			
Beaverdam	2189	Colonization from downstream	SP4
Bank undercut	2195	Rootwad/armoring	SP6
Bank undercut	2253	Insufficient rootwad/armoring	SP6
Beaverdam	2367	Colonization from downstream	SP3,4
Aggradation (bar)	2803	Unknown	SP1
Beaverdam	2905	Colonization from downstream	SP3,4
Bank undercut	2953	Insufficient rootwad/armoring	SP6
Bank undercut	3240	Insufficient rootwad/armoring	SP6
Bank undercut	3248	Insufficient rootwad/armoring	SP6
Bank undercut	3303	Insufficient rootwad/armoring	SP6
Vane undercut	3307	Insufficient coarse backfill	SP8
Aggradation (bar)	3384	Unknown	SP1
Vane undercut	3546	Insufficient coarse backfill	SP8
Bank undercut	3567	Insufficient rootwad/armoring	SP6
Bank undercut	3778	Insufficient rootwad/armoring	SP6
Rill and gully	4226	Insufficient growth medium	SP5
Bank undercut	4641	Insufficient rootwad/armoring	SP6
Root wad undercut	4848	Unknown	SP7
Bank undercut	4969	Insufficient rootwad/armoring	SP6
Vane undercut	5476	Insufficient coarse backfill	SP8
Aggradation (bar)	5675	Unknown	SP1
Bank undercut	5946	Insufficient rootwad/armoring	SP6
Bank undercut	6013	Insufficient rootwad/armoring	SP6
Bank undercut	6041	Insufficient rootwad/armoring	SP6
Bank undercut	6148	Insufficient rootwad/armoring	SP6
Bank undercut	6261	Insufficient rootwad/armoring	SP6

Exhibit Table XI. Categorical Stream Feature Visual Stability Assessment - Ellerbe Creek Stream Restoration – Project #127						
Hillsborough Reach (1,663 ft)						
Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	100%	95%	87%			
B. Pools	100%	80%	69%			
C. Thalweg	100%	95%	78%			
D. Meanders	100%	98%	94%			
E. Bed General	100%	85%	100%			
F. Vanes/J Hooks, etc.	100%	95%	89%			
G. Wads and Boulders	100%	95%	75%			
Croasdaile Reach (703 ft)						
A. Riffles	100%	95%	100%			
B. Pools	100%	95%	100%			
C. Thalweg	100%	95%	100%			
D. Meanders	100%	95%	100%			
E. Bed General	100%	95%	100%			
F. Vanes/J Hooks, etc.	100%	95%	100%			
G. Wads and Boulders	100%	95%	100%			
Hillandale Reach (1,939 ft)						
A. Riffles	100%	90%	93%			
B. Pools	100%	85%	89%			
C. Thalweg	100%	95%	80%			
D. Meanders	100%	95%	83%			
E. Bed General	100%	75%	100%			
F. Vanes/J Hooks, etc.	100%	95%	92%			
G. Wads and Boulders	100%	95%	50%			
Albany Reach (1,974 ft)						
A. Riffles	100%	60%	75%			
B. Pools	100%	60%	62%			
C. Thalweg	100%	80%	75%			
D. Meanders	100%	95%	77%			
E. Bed General	100%	50%	100%			
H. Vanes/J Hooks, etc.	100%	95%	79%			
I. Wads and Boulders	100%	95%	75%			

Exhibit Table XIIa. Baseline Morphology and Hydraulic Summary - Ellerbe Creek Stream Restoration – Project #127 Reaches: Hillsborough, Hillandale, Albany*

Parameters	USGS Data	Regional Curve Interval	Project Reference Stream		Pre-Existing Condition			Design			As-built		
Dimension			**Min**	**Max**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Floodprone Elevation (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bankfull Elevation (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Floodprone Width (ft)	NA	NA	47	59	25	40	NA	48	57	NA	50	100	NA
Bankfull Width (ft)	NA	NA	10.1	14.3	19.9	20.7	NA	22	26	NA	16.3	24.8	NA
Entrenchment Ratio	NA	NA	3.3	5.8	1.2	2.0	NA	2.2	2.2	NA	2.4	3.9	NA
Mean Depth (ft)	NA	NA	0.7	1.5	1.5	2.4	NA	1.8	2.2	NA	1.3	3.3	NA
Maximum Depth (ft)	NA	NA	1.3	2.2	37.*	4.0	NA	2.7	3.2	NA	2.2	4.8	NA
Width/Depth Ratio	NA	NA	10	14	8	13	NA	28.9*	42.3*	NA	12.7	19.2	NA
Bankfull Area (sq ft)	NA	NA	7.2	21.4	37.9	48.3	NA	28.9*	42.3*	NA	25.8	82.4	NA
Wetted Perimeter (ft)	NA	NA	11.61	17.25	28.28	24.77	NA	21.89	24.59	NA	19.9	38.4	NA
Hydraulic Radius (ft)	NA	NA	0.62	1.24	1.34	1.95	NA	1.32	1.72	NA	1.3	2.6	NA
Substrate													
d50 (mm)	NA	NA	NA	NA	NA	NA	8.3	NA	5	NA	0.01	4.4	NA
d84 (mm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5	49	NA
Pattern													
Channel Beltwidth (ft)	NA	NA	38	80	25	33	--	90	105	NA	11.6	55.38	36.7
Radius of Curvature (ft)	NA	NA	37.73	160	NA	19	15	45	95	NA	34.78	114	67
Meander Wavelength	NA	NA	32	105	NA	129	65	85	295	NA	103	304	185
Meander Width ratio	NA	NA	3.74	7.89	1.3	1.6	--	4.0	4.1	NA	0.47	2.41	1.48
Profile													
Riffle length (ft)	NA	NA	NA	NA	NA	NA	NA	2	103	NA	NA	NA	NA
Riffle slope (ft/ft)	NA	NA	NA	NA	0.906	1.091	0.011	0.001	0.002	NA	NA	NA	NA
Pool length (ft)	NA	NA	NA	NA	NA	NA	NA	2	27	NA	NA	NA	NA
Pool spacing (ft)	NA	NA	5	49	19	29	24	24	160	NA	NA	NA	NA
Additional Reach Parameters													
Valley Length (ft)	NA	NA	NA		NA			NA			5200		
Channel Length (ft)	NA	NA	NA		NA			NA			5576		
Sinuosity	NA	NA	1.2		1.03			1.11			1.05		
Water Surface Slope (ft/ft)	NA	NA	NA		0.994			NA			0.97		
BF slope (ft/ft)	NA	NA	NA		NA			NA			NA		
Rosgen Classification	NA	NA	C4b, C5		G4			C4			C4		
Habitat Index	NA	NA	NA		NA			NA			NA		
Macrobenthos	NA	NA	NA		NA			NA			NA		

* All numbers have been copied directly from the first year monitoring report. Numbers that seem questionable have been identified with an asterisk (*).

Exhibit Table XIIb. Baseline Morphology and Hydraulic Summary - Ellerbe Creek Stream Restoration – Project #127 - Reach: Croasdaile*

Parameters	USGS Data	Regional Curve Interval	Project Reference Stream		Pre-Existing Condition			Design			As-built		
Dimension			**Min**	**Max**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Floodprone Elevation (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bankfull Elevation (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Floodprone Width (ft)	NA	NA	47	59	25	40	NA	NA	NA	50	NA	NA	21.2
Bankfull Width (ft)	NA	NA	10.1	14.3	19.9	20.7	NA	NA	NA	17.5	9.1	11.5	NA
Entrenchment Ratio	NA	NA	3.3	5.8	1.2	2.0	NA	NA	NA	2.9	NA	NA	1.9
Mean Depth (ft)	NA	NA	0.7	1.5	1.5	2.4	NA	NA	NA	1.5	1.3	2.2	NA
Maximum Depth (ft)	NA	NA	1.3	2.2	37.*	4.0	NA	NA	NA	2.1	1.9	2.8	NA
Width/Depth Ratio	NA	NA	10	14	8	13	NA	NA	NA	12	NA	NA	9.0
Bankfull Area (sq ft)	NA	NA	7.2	21.4	37.9	48.3	NA	NA	NA	16.9	14.5	19.7	NA
Wetted Perimeter (ft)	NA	NA	11.61	17.25	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydraulic Radius (ft)	NA	NA	0.62	1.24	1.34	1.95	NA	NA	NA	1.01	1.1	1.6	NA
Substrate													
d50 (mm)	NA	NA	NA	NA	NA	NA	8.3	NA	NA	NA	NA	NA	NA
d84 (mm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pattern													
Channel Beltwidth (ft)	NA	NA	38	80	25	33	NA	NA	NA	82.63	NA	NA	NA
Radius of Curvature (ft)	NA	NA	37.73	160	NA	19	15	36	44	NA	NA	NA	NA
Meander Wavelength	NA	NA	32	105	NA	129	65	156	233	NA	NA	NA	NA
Meander Width ratio	NA	NA	3.74	7.89	1.3	1.6	NA	NA	NA	4.7	NA	NA	NA
Profile													
Riffle length (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Riffle slope (ft/ft)	NA	NA	NA	NA	0.906	1.091	0.011	NA	NA	0.002	NA	NA	NA
Pool length (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pool spacing (ft)	NA	NA	NA	NA	19	29	24	29.2	78	NA	NA	NA	NA
Additional Reach Parameters													
Valley Length (ft)	NA	NA	NA		NA			NA			687		
Channel Length (ft)	NA	NA	NA		NA			NA			703		
Sinuosity	NA	NA	1.20-1.23		1.03			1.05			1.02		
Water Surface Slope (ft/ft)	NA	NA	NA		0.994			NA			NA		
BF slope (ft/ft)	NA	NA	NA		NA			NA			NA		
Rosgen Classification	NA	NA	C4b, C5		G4			C4			B4		
Habitat Index	NA	NA	NA		NA			NA			NA		
Macrobenthos	NA	NA	NA		NA			NA			NA		

Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary - Ellerbe Creek Stream Restoration – Project #127 - Hillsborough Reach

	HB-XS1			HB-XS2			HB-XS3			HB-XS4		
Dimension	As-built	Mon 01	Mon 02	As-built	Mon 01	Mon 02	As-built	Mon 01	Mon 02	As-built	Mon 01	Mon 02
Floodprone Elevation (ft)	NA	NA	364.11	NA	NA	366.75	NA	NA	362.17	NA	NA	363.52
Bankfull Elevation (ft)	NA	NA	361.49	NA	NA	361.73	NA	NA	359.05	NA	NA	359.23
Floodprone Width (ft)	50	100	100.00	NA	100	100.00	85.0	100	100.00	NA	100	100.00
Bankfull Width (ft)	19.3	21.8	21.47	16.3	16.1	34.03	21.9	38	22.11	24.8	24.4	34.71
Entrenchment Ratio	2.6	4.6	4.66	NA	6.2	2.94	3.9	2.6	4.52	NA	4.1	2.88
Mean Depth (ft)	1.3	1.5	1.46	3.3	3.4	1.81	1.7	1.0	1.61	2.4	2.3	1.71
Maximum Depth (ft)	2.2	2.6	2.62	4.5	4.6	5.02	3.1	2.8	3.12	4.5	4.4	4.29
Width/Depth Ratio	14.5	14.3	14.75	NA	4.8	18.85	12.7	37.7	13.69	NA	10.6	20.36
Bankfull Area (sq ft)	25.8	33.1	31.26	54.2	54	61.43	37.7	38.2	35.71	59.1	56.3	59.18
Wetted Perimeter (ft)	19.9	22.8	22.45	21.1	21.5	39.30	23.2	38.7	23.28	28.0	27.3	37.72
Hydraulic Radius (ft)	1.3	1.5	1.39	2.6	2.5	1.56	1.6	1.0	1.53	2.1	2.1	1.57
Substrate												
d50 (mm)	11.7	12	4.0	11	9.6	0.06	NA	.062	0.04	4.4	0.83	1.56
d84 (mm)	49	30	39.8	23	41	15.53	NA	1200	3.0	11	13	13.65

Entire Longitudinal Profile (all HB and part of HD)						
	Mon 01			**Mon 02**		
Pattern	min	max	average	min	max	average
Channel Beltwidth (ft)	NA	NA	NA	9.57	57.91	35.66
Radius of Curvature (ft)	NA	NA	NA	39.10	126.49	69.60
Meander Wavelength	NA	NA	NA	155.44	384.31	384.31
Meander Width ratio	NA	NA	NA			1.21
Profile	min	max	average	min	max	average
Riffle length (ft)	NA	NA	NA	3.54	70.53	22.91
Riffle slope (ft/ft)	NA	NA	NA	0.001	0.175	0.042
Pool length (ft)	NA	NA	NA	18.18	425.86	118.60
Pool spacing (ft)	NA	NA	NA	0.77	51.72	18.78

Additional Reach Parameters	**Mon 01**	**Mon 02 (For entire longitudinal profile only)**
Valley Length (ft)	1586	3,050
Channel Length (ft)	1663	3,398
Sinuosity	1.05	1.11
Water Surface Slope (ft/ft)	0.97	0.0035
BF slope (ft/ft)	NA	0.0018
Rosgen Classification	C4	C5
Habitat Index	NA	NA

Macrobenthos	NA	NA

Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary - Ellerbe Creek Stream Restoration – Project #127 - Hillandale Reach

	HD-XS1			HD-XS2			HD-XS3			HD-XS4		
Dimension	**As-built**	**Mon 01**	**Mon 02**	**As-built**	**Mon 01**	**Mon 02**	**As-built**	**Mon 01**	**Mon 02**	**As-built**	**Mon 01**	**Mon 02**
Floodprone Elevation (ft)	NA	NA	358.69	NA	NA	358.94	NA	NA	360.01	NA	NA	358.66
Bankfull Elevation (ft)	NA	NA	355.67	NA	NA	356.11	NA	NA	355.38	NA	NA	354.92
Floodprone Width (ft)	NA	100	100.00	75.0	100	100.00	NA	100	100.00	100.0	105	105.00
Bankfull Width (ft)	37.1	30	31.09	23.9	41.9	36.08	40.4	45.2	45.08	34.7	39.2	38.71
Entrenchment Ratio	NA	3.3	3.22	3.1	2.4	2.77	NA	2.2	2.22	2.9	2.7	2.71
Mean Depth (ft)	1.3	1.2	1.17	1.4	0.9	0.93	2.2	2.2	2.23	1.8	1.8	1.66
Maximum Depth (ft)	3.2	3.0	3.02	3.0	2.9	2.83	4.2	4.5	4.63	3.2	4.0	3.74
Width/Depth Ratio	NA	24.2	26.52	17.2	45.1	38.62	NA	20.1	20.22	19.2	22.3	23.33
Bankfull Area (sq ft)	49.1	37.3	36.45	33.2	38.8	33.70	89.1	101.2	100.50	62.7	69.2	64.24
Wetted Perimeter (ft)	38.4	31.2	32.73	25.1	43.3	37.55	41.7	46.6	46.71	35.6	40.4	40.26
Hydraulic Radius (ft)	1.3	1.2	1.11	1.3	0.9	0.90	2.1	2.2	2.15	1.8	1.7	1.60
Substrate												
d50 (mm)	0.4	0.59	0.06	NA	0.062	0.13	1.7	7	9.57	1.8	0.062	0.05
d84 (mm)	5	8	6.36	10	0.062	0.84	10	18	15.46	6	0.062	7.49

Additional Reach Parameters	**Mon 01**
Valley Length (ft)	1804
Channel Length (ft)	1939
Sinuosity	1.07
Water Surface Slope (ft/ft)	NA
BF slope (ft/ft)	NA
Rosgen Classification	C4
Habitat Index	NA
Macrobenthos	NA

Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary - Ellerbe Creek Stream Restoration – Project #127 - Albany Reach

	AL-XS1			AL-XS2			AL-XS3			AL-XS4		
Dimension	**As-built**	**Mon 01**	**Mon 02**	**As-built**	**Mon 01**	**Mon 02**	**As-built**	**Mon 01**	**Mon 02**	**As-built**	**Mon 01**	**Mon 02**
Floodprone Elevation (ft)	NA	NA	354.70	NA	NA	355.28	NA	NA	354.15	NA	NA	352.92
Bankfull Elevation (ft)	NA	NA	350.58	NA	NA	350.61	NA	NA	349.75	NA	NA	349.60
Floodprone Width (ft)	NA	100	100.00	100.0	100	100.00	NA	100	100.00	70.0	71.9	100.00
Bankfull Width (ft)	29.0	31.7	53.05	27.0	28	45.36	27.4	21.3	23.99	28.6	28.9	35.88
Entrenchment Ratio	NA	3.2	1.89	3.7	3.6	2.21	NA	4.7	4.17	2.4	2.5	2.79
Mean Depth (ft)	2.1	2.2	1.60	2.5	2.5	1.62	3.0	3.3	2.75	1.9	1.9	1.34
Maximum Depth (ft)	3.5	3.9	4.12	4.8	4.6	4.67	5.1	4.4	4.40	3.2	3.3	3.32
Width/Depth Ratio	NA	14.5	33.16	10.7	11.2	28.04	NA	6.4	8.73	14.8	15	26.70
Bankfull Area (sq ft)	60.5	69.1	84.87	68.4	70.1	73.36	82.4	71.4	65.90	55.4	55.7	48.23
Wetted Perimeter (ft)	30.2	33.5	55.09	30.7	30.7	49.46	32.3	25.3	28.15	29.6	30	37.42
Hydraulic Radius (ft)	2.0	2.1	1.54	2.2	2.3	1.48	2.5	2.8	2.34	1.9	1.9	1.29
Substrate												
d50 (mm)	0.1	0.062	2.29	0.2	0.86	0.29	0.4	9.2	6.98	0.2	3.5	0.8
d84 (mm)	6	3.8	12.24	9	10	9.1	22	22	16.83	5	12	6.47

Additional Reach Parameters	**Mon 01**
Valley Length (ft)	1888
Channel Length (ft)	1974
Sinuosity	1.04
Water Surface Slope (ft/ft)	NA
BF slope (ft/ft)	NA
Rosgen Classification	C4
Habitat Index	NA
Macrobenthos	NA

Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary - Ellerbe Creek Stream Restoration – Project #127 - Croasdaile Reach

	CR-XS1			CR-XS2		
Dimension	As-built	Mon 01	Mon 02	As-built	Mon 01	Mon 02
Floodprone Elevation (ft)	NA	NA	360.35	NA	NA	359.40
Bankfull Elevation (ft)	NA	NA	357.76	NA	NA	357.67
Floodprone Width (ft)	NA	9.8	9.80	21.2	23.3	23.30
Bankfull Width (ft)	9.1	9.4	8.59	11.5	13.4	10.28
Entrenchment Ratio	NA	1.0	1.14	1.9	1.7	2.27
Mean Depth (ft)	2.2	2.2	2.10	1.3	1.3	1.14
Maximum Depth (ft)	2.8	2.5	2.59	1.9	2.1	1.73
Width/Depth Ratio	NA	4.4	4.02	9.0	10	9.06
Bankfull Area (sq ft)	19.7	20.4	18.36	14.5	17.9	11.67
Wetted Perimeter (ft)	12.7	11.1	12.05	12.8	14.8	11.36
Hydraulic Radius (ft)	1.6	1.8	1.52	1.1	1.2	1.03
Substrate						
d50 (mm)	9.9	12	13.85	14.0	12	9.47
d84 (mm)	19	24	23.85	27	20	27.3

Additional Reach Parameters	**Mon 01**
Valley Length (ft)	687
Channel Length (ft)	703
Sinuosity	1.02
Water Surface Slope (ft/ft)	NA
BF slope (ft/ft)	NA
Rosgen Classification	B4
Habitat Index	NA
Macrobenthos	NA

C. Wetland Assessment

As part of the project design, a stormwater wetland was built near the Hillandale Golf Course number 12 tee box and 11 pocket wetlands were created throughout the Ellerbe Creek floodplain. No monitoring wells were established in relation to any of these wetlands and EEP did not claim any mitigation credit for them. By all appearances, all of the wetlands appear to be functioning as designed. The NCDOT rip-rap stormwater spillway could negatively impact hydrology in the Croasdaile Reach's constructed wetland.

Ellerbe Creek Stream Restoration – Durham County, NC

Appendix A Vegetation Raw Data

A-1 Vegetation Problem Area Plan View

A-2 Vegetation Problem Area Photo

A-3 Vegetation Survey Summary Data

A-4 Vegetation Monitoring Plot Photos

A-5 Vegetation Raw Data

Vegetation Plot Coordinates: Hillsborough Reach			
Plot Side	HB-V1	HB-V2	HB-V3
Pin Coordinate	E 20115741.5610 N 827358.3480	E 20116120.1110 N 827428.6750	E 2016551.0870 N 827505.1970
A	19.5’	31.1’	31.9’
B	52.1’	35.4’	32.6’
C	23.2’	33.1’	31.3’
D	53’	36.2’	39.4’

Vegetation Plot Coordinates: Croasdaile Reach		
Plot Side	CR-V1	CR-V2
Pin Coordinate	E 2016811.8250 N 827741.1850	E 2016933.510 N 827520.8490
A	32.4’	18.3’
B	33.2’	65.5’
C	29.9’	21.7’
D	31.9’	64.1’

	Easting	Northing
Cross-sections		
HB1L	2015742.0022	827332.7693
HB1R	2015772.552	827290.9634
HB2L	2015799.2852	827350.0513
HB2R	2015803.356	827295.5714
HB3L	2016595.6390	827499.8180
HB3R	2016610.0550	827433.3600
HB4L	2015654.5640	827499.8920
HB4R	20116634.3500	827432.4490
CR1L	2016939.2680	827570.7490
CR1R	2016915.6680	827552.4340
CR2L	2016957.7640	827541.2870
CR2R	2016933.5100	827520.8490
Photopoints		
HB-P1	2015577.0052	827347.3258
HB-P2	2015623.7143	827314.4264
HB-P3	2015802.5285	827349.0571
HB-P4	2015961.3634	827401.3361
HB-P5	2016127.5574	827481.3197
HB-P6&P7	2016301.8430	827496.7037
HB-P8	2016523.1130	827464.0709
HB-P9	2016749.2114	827430.4392
HB-P10	2016966.4524	827439.7628
CR-P1	2016781.3114	828053.9579
CR-P2	2016818.9390	827855.0313
CR-P3	2016919.4678	827582.3480

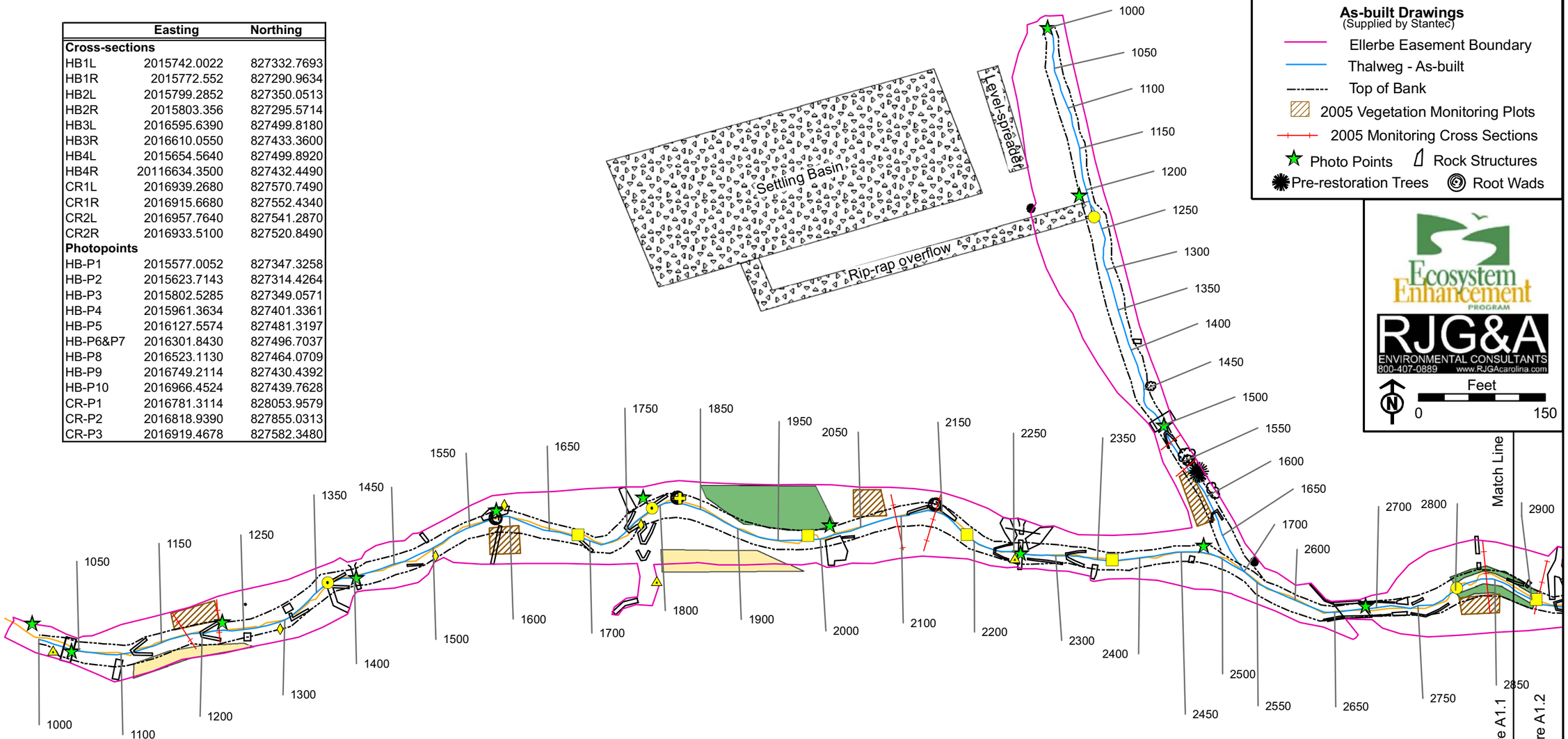

Figure A1.1 - Vegetation Problem Areas - 2006 Plan View - Year 2
Ellerbe Creek Stream Restoration - Durham, NC

LEGEND

Vegetation Problem Areas

- Bare/Eroded Soil (rill and gully)
- Beaver Harvest
- Thalweg-2006 Survey
- NCDOT Stormwater Structures

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- 2005 Vegetation Monitoring Plots
- 2005 Monitoring Cross Sections
- Photo Points
- Rock Structures
- Pre-restoration Trees
- Root Wads

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Feet
0 150

Vegetation Plot Coordinates: Hillandale Reach			
Plot Side	HD-V1	HD-V2	HD-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.9'	30.8'	20'
B	48.4'	31.1'	44.6'
C	22.2'	34.2'	14.2'
D	44.7'	32'	46.1'

	Easting	Northing
Cross-sections		
HD1L	2017297.3510	827444.6380
HD1R	2017305.8250	827358.5730
HD2L	2017374.0400	827421.2960
HD2R	2017358.2570	827357.0970
HD3L	2017882.0380	827326.3380
HD3R	2017835.7280	827218.0475
HD4L	2017870.4020	827311.3050
HD4R	2017919.3160	827220.8030
Photopoints		
HD-P1	2017158.5527	827368.2372
HD-P2	2017423.2777	827370.9011
HD-P3	2017633.3927	827372.5660
HD-P4	2017780.9060	827327.6127
HD-P5	2018032.6444	827207.0713
HD-P6	2018319.0135	827067.8826
HD-P7	2018632.0216	826962.3256

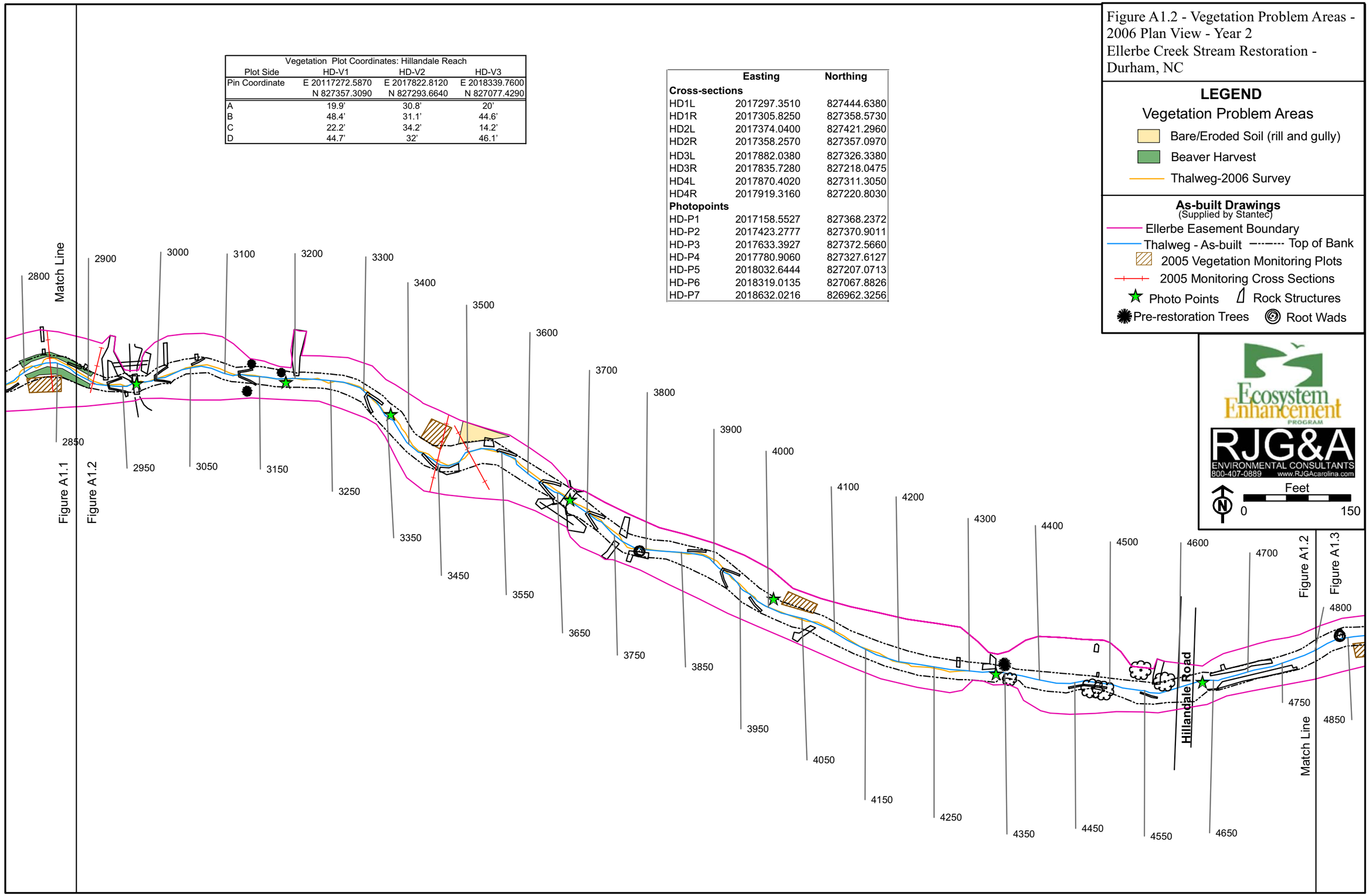

Figure A1.2 - Vegetation Problem Areas - 2006 Plan View - Year 2
Ellerbe Creek Stream Restoration - Durham, NC

LEGEND

Vegetation Problem Areas

- Bare/Eroded Soil (rill and gully)
- Beaver Harvest
- Thalweg-2006 Survey

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- 2005 Vegetation Monitoring Plots
- 2005 Monitoring Cross Sections
- Photo Points
- Rock Structures
- Pre-restoration Trees
- Root Wads

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Feet
0 150

Vegetation Plot Coordinates: Albany Reach			
Plot Side	AL-V1	AL-V2	AL-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.8'	33.1'	30.4'
B	54.7'	33.9'	45.8'
C	20.6'	36.1'	34.3'
D	51.5'	37.7'	45.8'

	Easting	Northing
Cross-sections		
AL1L	2019638.8850	827132.4120
AL1R	2019653.3780	827052.7850
AL2L	2019670.2730	827138.9190
AL2R	2019716.0120	827068.9910
AL3L	2019819.4940	827182.5337
AL3R	2019825.5310	827101.4830
AL4L	2019845.6470	827189.0390
AL4R	2019867.0530	827112.7780
Photopoints		
AL-P1	2018922.3866	826950.6711
AL-P2	2019315.6779	827040.2114
AL-P3	2019581.5016	827088.1615
AL-P4	2019822.0184	827155.9245
AL-P5	2020004.7951	827193.1524
AL-P6	2020248.1090	827221.4564
AL-P7	2020410.0740	827196.1493
AL-P8	2020545.5332	827244.7655

Match Line

Figure A1.2

Figure A1.3

4700 4750 4800 4850 4900 4950 5000 5050 5100 5150 5200 5250 5300 5350 5400 5450 5500 5550 5600 5650 5700 5750 5800 5850 5900 5950 6000 6050 6100 6150 6200 6250 6300 6350 6400 6450 6500 6550 6558

Figure A1.3 - Vegetation Problem Areas - 2006 Plan View - Year 2
Ellerbe Creek Stream Restoration - Durham, NC

LEGEND

Vegetation Problem Areas

- Bare/Eroded Soil (rill and gully)
- Beaver Harvest
- Thalweg-2006 Survey

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- 2005 Vegetation Monitoring Plots
- 2005 Monitoring Cross Sections
- Photo Points
- Rock Structures
- Pre-restoration Trees
- Root Wads

Ecosystem Enhancement Program

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Feet
0 150

Appendix A2. Vegetation Problem Area Photographs - 2006 - Ellerbe Creek Stream Restoration - Project #127

VP1. Bare / eroded soil

VP2. Bare / eroded soil

VP3. Beaver harvest

A-3 Stem Counts and Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - - Project #127

					Hillsborough Reach			Croasdaile Reach		Hillandale Reach			Albany Reach		
Species	**Total Planted**	**Year 2 Total Live (2006)**	**Total Dead (all plots)**	**% Survival**	**Plot HB - 1**	**Plot HB - 2**	**Plot HB - 3**	**Plot CR - 1**	**Plot CR - 2**	**Plot HD - 1**	**Plot HD - 2**	**Plot HD - 3**	**Plot AL - 1**	**Plot AL - 2**	**Plot AL - 3**
Aronia arbutifolia	33	20	0	60.61	0	0	2	0	0	0	11	3	2	2	0
Betula nigra	42	25	8	59.52	4	0	5	0	0	0	3	0	0	0	13
*Cephalanthus occidentalis**	NA	8	0	NA	0	0	0	0	0	4	0	0	2	2	0
Clethra alnifolia	8	4	0	50.00	0	2	0	1	0	0	0	0	0	1	0
Cornus amomum	93	78	7	83.87	6	13	12	16	6	4	0	5	3	9	4
Cornus florida	1	1	0	100.00	0	0	1	0	0	0	0	0	0	0	0
Fraxinus pennsylvanica	35	24	1	68.57	7	0	0	0	0	0	0	4	0	0	13
Ilex verticillata	3	2	0	66.67	2	0	0	0	0	0	0	0	0	0	0
Juniperus virginiana	5	3	0	60.00	0	0	0	0	0	0	3	0	0	0	0
Morella cerifera	2	1	0	50.00	0	0	1	0	0	0	0	0	0	0	0
Quercus coccinea	7	5	1	71.43	1	0	0	1	1	0	0	0	0	0	2
Quercus phellos	24	16	0	66.67	2	0	1	0	0	0	3	1	0	0	9
Salix sericea	23	34	2	100a	0	12	0	0	0	0	0	4	0	18	0
Sambucus canadensis	51	9	3	17.65	0	1	0	0	4	0	2	0	2	0	0
*Spirea tomentosa**	NA	5	0	NA	0	0	0	0	5	0	0	0	0	0	0
Symphoricarpos orbiculatus	4	8	0	100a	0	0	0	0	8	0	0	0	0	0	0
Vaccinium corymbosum	26	10	0	38.46	0	0	0	0	10	0	0	0	0	0	0
Viburnum nudum	7	3	0	42.86	0	0	0	0	0	0	0	0	3	0	0
Unknown spp	NA	0	3	NA	0	0	0	0	0	0	0	0	0	0	0
Total per plot					**22**	**28**	**22**	**18**	**34**	**8**	**22**	**17**	**12**	**32**	**41**
All Plots	**364**	**256**	**59.7**												
Average woody stems per acre	**1,339**	**942**													

* *C. occidentali* s may have been identified as *V. nudum* during Year 1. There is no record of the plant in Year 1's vegetation plot data.

** *S. tomentosa* may have been identified as *C. alnifolia* during Year 1. There is no record of the plant in Year 1's vegetation plot data.

a = More individuals observed in monitoring Year 2 than Year 1

A-3 Vegetation Survey Summary Data-Ellerbe Creek Stream Restoration - Project #127

		Hillsborough Reach			Croasdaile Reach		Hillandale Reach			Albany Reach		
Volunteer woody stems	**Total Live Stems**	**Plot HB - 1**	**Plot HB - 2**	**Plot HB - 3**	**Plot CR - 1**	**Plot CR - 2**	**Plot HD - 1**	**Plot HD - 2**	**Plot HD - 3**	**Plot AL - 1**	**Plot AL - 2**	**Plot AL - 3**
Acer rubrum	2	0	0	0	0	1	0	1	0	0	0	0
Albizzia julibrissin	2	1	0	0	0	0	0	0	1	0	0	0
Alnus serrulata	14	0	0	0	1	11	0	0	1	0	0	1
Aronia arbutifolia	0	0	0	0	0	0	0	0	0	0	0	0
Baccharis halimifolia	6	0	2	0	0	0	0	0	1	2	1	0
Ligustrum sinensis	2	2	0	0	0	0	0	0	0	0	0	0
Lindera benzoin	1	0	0	0	0	1	0	0	0	0	0	0
Liquidambar styraciflua	26	0	0	0	0	20	0	0	0	2	4	0
Myrica cerifera	3	0	0	0	0	3	0	0	0	0	0	0
Pinus taeda	14	5	0	0	0	0	0	8	0	1	0	0
Salix spp.	10	0	1	0	0	0	3	0	0	0	3	3
Volunteer stems per plot		8	3	0	1	36	3	9	3	5	8	4
Total volunteer stems	80											

Appendix A4. Vegetation Monitoring Plot Photographs - 2006 - Ellerbe Creek Stream Restoration - Project #127

HB-V1

HB-V2

Photo not available

HB-V3

CR-V1

Appendix A4. Vegetation Monitoring Plot Photographs - 2006 - Ellerbe Creek Stream Restoration - Project #127

CR-V2

Photo not available

HD-V1

HD-V2

HD-V3

Appendix A4. Vegetation Monitoring Plot Photographs - 2006 - Ellerbe Creek Stream Restoration - Project #127

AL-V1

AL-V2

AL-V3

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HB-1

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	0	0	0	NA														
Betula nigra	15	4	6	26.7	0.98	100.70	14	56.7		d	d		d	d		d	d	
*Cephalanthus occidentalis**	0	0	0	NA														
Clethra alnifolia	0	0	0	NA														
Cornus amomum	19	6	7	31.6	NA	28.85		29.9		d	d		d	d		d	d	
Cornus florida	0	0	0	NA														
Fraxinus pennsylvanica	5	7	0	140.0	0.90	43.06	9	37.8		8	45.7		16	101		7	48.2	
Ilex verticillata	3	2	0	66.7	0.80	55.47	8	43.3		8	67.7							
Juniperus virginiana	0	0	0	NA														
Myrica cerifera	0	0	0	NA														
Quercus coccinea	2	1	1	50.0	1.00	79.25	10	79.2		d	d							
Quercus phellos	2	2	0	100.0	0.70	76.50	7	84.1		7	68.9							
Salix sericea	1	0	0	0.0														
Sambucus canadensis	0	0	0	NA														
*Spirea tomentosa***	0	0	0	NA														
Symphoricarpos orbiculatus	0	0	0	NA														
Vaccinium corymbosum	0	0	0	NA														
Viburnum nudum	0	0	0	NA														
Unknown sp	0	0	1	NA			d	d										
Total planted stems per plot	**47**	**22**	**15**															
Total planted stems per acre		**890**																

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HB-1

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia																														
Betula nigra	7	64.5		d	d		10	166		d	d		d	d		8	115													
*Cephalanthus occidentalis**																														
Clethra alnifolia																														
Cornus amomum		26.8			18.3		d	d			28.7		d	d			36			33.5		d	d		d	d			
Cornus florida																														
Fraxinus pennsylvanica	8	24.4		7	19.2		8	25																						
Ilex verticillata																														
Juniperus virginiana																														
Myrica cerifera																														
Quercus coccinea																														
Quercus phellos																														
Salix sericea																														
Sambucus canadensis																														
*Spirea tomentosa***																														
Symphoricarpos orbiculatus																														
Vaccinium corymbosum																														
Viburnum nudum																														
Unknown sp																														
Total planted stems per plot																														
Total planted stems per acre																														

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HB-1

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum														
Albizzia julibrissin			1											
Alnus serrulata														
Aronia arbutifolia														
Baccharis halimifolia														
Ligustrum sinensis	2													
Lindera benzoin														
Liquidambar styraciflua														
Myrica cerifera														
Pinus taeda	4	1												
Salix spp.														
Total volunteer stems per plot	8													

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot HB-2

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	0	0	0.0											
Betula nigra	0	0	0	NA											
*Cephalanthus occidentalis**		0	0	DK											
Clethra alnifolia	1	2	0	200.0	0.50	101.19	5.00	146.91		5.00	55.47				
Cornus amomum	10	12	0	120.0	NA	173.94		182.27			155.45			182.88	
Cornus florida	0	0	0	NA											
Fraxinus pennsylvanica	0	0	0	NA											
Ilex verticillata	0	0	0	NA											
Juniperus virginiana	0	0	0	NA											
Myrica cerifera	0	0	0	NA											
Quercus coccinea	0	0	0	NA											
Quercus phellos	0	0	0	NA											
Salix sericea	13	12	0	92.3	NA	209.90		210.31			158.47			126.49	
Sambucus canadensis	1	1	0	100.0	0.80	164.59	8.00	164.59							
*Spirea tomentosa***	0	0	0	NA											
Symphoricarpos orbiculatus	0	0	0	NA											
Vaccinium corymbosum	1	0	0	0.0											
Viburnum nudum	0	0	0	NA											
Unknown sp.	0	0	0	NA											
Total planted stems per plot	**28**	**27**	**0.00**												
Total planted stems per acre		**1092.69**													

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot HB-2

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)
Aronia arbutifolia																											
Betula nigra																											
*Cephalanthus occidentalis**																											
Clethra alnifolia																											
Cornus amomum		146.30			179.83			146.30			153.92			155.45			167.64			192.02			248.41			176.78		
Cornus florida																											
Fraxinus pennsylvanica																											
Ilex verticillata																											
Juniperus virginiana																											
Myrica cerifera																											
Quercus coccinea																											
Quercus phellos																											
Salix sericea		179.22			243.84			221.28			201.17			304.80			243.84			234.70			214.88			179.83		
Sambucus canadensis																											
*Spirea tomentosa***																											
Symphoricarpos orbiculatus																											
Vaccinium corymbosum																											
Viburnum nudum																											
Unknown sp.																											
Total planted stems per plot																											
Total planted stems per acre																											

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot HB-2

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum														
Albizzia julibrissin														
Alnus serrulata														
Aronia arbutifolia														
Baccharis halimifolia	1	1												
Ligustrum sinensis														
Lindera benzoin														
Liquidambar styraciflua														
Myrica cerifera														
Pinus taeda														
Salix spp.			1											
Total volunteer stems per plot	3													

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - - Project #127

Plot: HB-3

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	2	0	100.0	0.55	46.63	8	63.4		3	29.87							
Betula nigra	0	5	0	NA	1.12	103.02	15	98.76		8	84.12		12	113.4		12	107.3	
*Cephalanthus occidentalis**		0	0	DK														
Clethra alnifolia	1	0	0	0.0														
Cornus amomum	10	12	0	120.0	NA	53.49		43.89			99.97			43.28			53.04	
Cornus florida	0	1	0	NA	0.80	79.25	8	79.25										
Fraxinus pennsylvanica	0	0	0	NA														
Ilex verticillata	0	0	0	NA														
Juniperus virginiana	0	0	0	NA														
Myrica cerifera	0	1	0	NA	1.90	106.68	19	106.7										
Quercus coccinea	0	0	0	NA														
Quercus phellos	0	1	0	NA	2.20	109.73	22	109.7										
Salix sericea	13	0	0	0.0														
Sambucus canadensis	1	0	0	0.0														
*Spirea tomentosa***	0	0	0	NA														
Symphoricarpos orbiculatus	0	0	0	NA														
Vaccinium corymbosum	1	0	0	0.0														
Viburnum nudum	0	0	0	NA														
Unknown sp	0	0	2	NA			d	d		d	d							
Total planted stems per plot	**28**	**22**	**2**															
Total planted stems per acre		**890**																

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

Natural Woody

none

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127C.

Plot: HB-3

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia																								
Betula nigra	9	111.6																						
*Cephalanthus occidentalis**																								
Clethra alnifolia																								
Cornus amomum		23.16			56.08			54.86			78.64			46.33			71.93			20.73			49.99	
Cornus florida																								
Fraxinus pennsylvanica																								
Ilex verticillata																								
Juniperus virginiana																								
Myrica cerifera																								
Quercus coccinea																								
Quercus phellos																								
Salix sericea																								
Sambucus canadensis																								
*Spirea tomentosa***																								
Symphoricarpos orbiculatus																								
Vaccinium corymbosum																								
Viburnum nudum																								
Unknown sp																								
Total planted stems per plot																								
Total planted stems per acre																								

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

Natural Woody

none

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: CR-1

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	0	0	0.0														
Betula nigra	0	0	0	NA														
*Cephalanthus occidentalis**		0	0	DK														
Clethra alnifolia	1	1	0	100.0	0.50	39.62	5	39.6										
Cornus amomum	10	16	0	160.0	NA	103.72		82.29			146			99.1			166	
Cornus florida	0	0	0	NA														
Fraxinus pennsylvanica	0	0	0	NA														
Ilex verticillata	0	0	0	NA														
Juniperus virginiana	0	0	0	NA														
Myrica cerifera	0	0	0	NA														
Quercus coccinea	0	1	0	NA	1.00	33.53	10	33.5										
Quercus phellos	0	0	0	NA														
Salix sericea	13	0	0	0.0														
Sambucus canadensis	1	0	0	0.0														
*Spirea tomentosa***	0	0	0	NA														
Symphoricarpos orbiculatus	0	0	0	NA														
Vaccinium corymbosum	1	0	0	0.0														
Viburnum nudum	0	0	0	NA														
Unknown sp.	0	0	0	NA														
Total planted stems per plot	**28**	**18**	**0**															
Total planted stems per acre		**728**	**0**															

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: CR-1

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia																					
Betula nigra																					
*Cephalanthus occidentalis**																					
Clethra alnifolia																					
Cornus amomum		64.9			50.3			54.9			103			75.6			142			47.2	
Cornus florida																					
Fraxinus pennsylvanica																					
Ilex verticillata																					
Juniperus virginiana																					
Myrica cerifera																					
Quercus coccinea																					
Quercus phellos																					
Salix sericea																					
Sambucus canadensis																					
*Spirea tomentosa***																					
Symphoricarpos orbiculatus																					
Vaccinium corymbosum																					
Viburnum nudum																					
Unknown sp.																					
Total planted stems per plot																					
Total planted stems per acre																					

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: CR-1

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia															
Betula nigra															
*Cephalanthus occidentalis**															
Clethra alnifolia															
Cornus amomum		126			157			137			89.9			143	
Cornus florida															
Fraxinus pennsylvanica															
Ilex verticillata															
Juniperus virginiana															
Myrica cerifera															
Quercus coccinea															
Quercus phellos															
Salix sericea															
Sambucus canadensis															
*Spirea tomentosa***															
Symphoricarpos orbiculatus															
Vaccinium corymbosum															
Viburnum nudum															
Unknown sp.															
Total planted stems per plot															
Total planted stems per acre															

d = dead

Source: Cornus amomum & Salix sericea = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot CR-1

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum														
Albizzia julibrissin														
Alnus serrulata		1												
Aronia arbutifolia														
Baccharis halimifolia														
Ligustrum sinensis														
Lindera benzoin														
Liquidambar styraciflua														
Myrica cerifera														
Pinus taeda														
Salix spp.														
Total volunteer stems per plot	1													

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: CR-2

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	0	0	0.0														
Betula nigra	0	0	0	NA														
*Cephalanthus occidentalis**		0	0	DK														
Clethra alnifolia	1	0	0	0.0														
Cornus amomum	10	6	0	60.0	NA	75.69		79.2			61			45.7			83.8	
Cornus florida	0	0	0	NA														
Fraxinus pennsylvanica	0	0	0	NA														
Ilex verticillata	0	0	0	NA														
Juniperus virginiana	0	0	0	NA														
Myrica cerifera	0	0	0	NA														
Quercus coccinea	0	1	0	NA	1.10	74.68	11	74.7										
Quercus phellos	0	0	0	NA														
Salix sericea	13	0	0	0.0														
Sambucus canadensis	1	4	3	400.0	NA	138.30	d	d		d	d			195			186	
*Spirea tomentosa***	0	5	0	NA	0.68	76.08	20	137	2	2	35.1		4	51.2		4	91.4	
Symphoricarpos orbiculatus	0	8	0	NA	0.38	52.39	3	68.6		5	88.4		5	48.8		4	42.7	
Vaccinium corymbosum	1	10	0	1000.0	0.34	36.27	3	22.9		3	30.5		4	28.3		4	35.1	
Viburnum nudum	0	0	0	NA														
Unknown sp.	0	0	0	NA														
Total planted stems per plot	**28**	**34**	**3**															
Total planted stems per acre		**1376**	**121**															

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: CR-2

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia																		
Betula nigra																		
*Cephalanthus occidentalis**																		
Clethra alnifolia																		
Cornus amomum		97.5			86.9													
Cornus florida																		
Fraxinus pennsylvanica																		
Ilex verticillata																		
Juniperus virginiana																		
Myrica cerifera																		
Quercus coccinea																		
Quercus phellos																		
Salix sericea																		
Sambucus canadensis		114			57.9		d	d										
*Spirea tomentosa***	4	65.5																
Symphoricarpos orbiculatus	4	33.5		4	61		2	24.4		3	51.8							
Vaccinium corymbosum	4	56.4		3	33.5		3	53.9		3	22.9		4	36.6		3	42.7	
Viburnum nudum																		
Unknown sp.																		
Total planted stems per plot																		
Total planted stems per acre																		

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: CR-2

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum	1													
Albizzia julibrissin														
Alnus serrulata	1	10												
Aronia arbutifolia														
Baccharis halimifolia														
Ligustrum sinensis														
Lindera benzoin	1													
Liquidambar styraciflua	20													
Myrica cerifera		3												
Pinus taeda														
Salix spp.														
Total volunteer stems per plot	36													

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HD-1

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	0	0	0.0														
Betula nigra	0	0	0	NA														
*Cephalanthus occidentalis**		4	0	DK	0.83	61.34	8	57.91		9	73.15		7	59.44		9	54.86	
Clethra alnifolia	1	0	0	0.0														
Cornus amomum	10	4	0	40.0	NA	82.30		60.96			79.25			143.3			45.72	
Cornus florida	0	0	0	NA														
Fraxinus pennsylvanica	0	0	0	NA														
Ilex verticillata	0	0	0	NA														
Juniperus virginiana	0	0	0	NA														
Myrica cerifera	0	0	0	NA														
Quercus coccinea	0	0	0	NA														
Quercus phellos	0	0	0	NA														
Salix sericea	13	0	0	0.0														
Sambucus canadensis	1	0	0	0.0														
*Spirea tomentosa***	0	0	0	NA														
Symphoricarpos orbiculatus	0	0	0	NA														
Vaccinium corymbosum	1	0	0	0.0														
Viburnum nudum	0	0	0	NA														
Unknown sp.	0	0	0	NA														
Total planted stems per plot	**28**	**8**	**0**															
Total planted stems per acre		**324**	**0**															

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HD-1

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum														
Albizzia julibrissin														
Alnus serrulata														
Aronia arbutifolia														
Baccharis halimifolia														
Ligustrum sinensis														
Lindera benzoin														
Liquidambar styraciflua														
Myrica cerifera														
Pinus taeda														
Salix spp.			3											
Total volunteer stems per plot	3													

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HD-2

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	11	0	550.0	0.64	73.62	3	46.33		6	54.25		5	74.98		7	86.87	
Betula nigra	0	3	0	NA	3.13	175.77	40	185.9	4	14	146.3		40	195.1	4			
*Cephalanthus occidentalis**		0	0	DK														
Clethra alnifolia	1	0	0	0.0														
Cornus amomum	10	0	0	0.0														
Cornus florida	0	0	0	NA														
Fraxinus pennsylvanica	0	0	0	NA														
Ilex verticillata	0	0	0	NA														
Juniperus virginiana	0	3	0	NA	2.00	134.82	19	134.7		24	156.4		17	113.4				
Myrica cerifera	0	0	0	NA														
Quercus coccinea	0	0	0	NA														
Quercus phellos	0	3	0	NA	1.33	95.00	10	88.39		17	107.3		13	89.31				
Salix sericea	13	0	0	0.0														
Sambucus canadensis	1	2	0	200.0	NA	124.67		62.79			186.5							
*Spirea tomentosa***	0	0	0	NA														
Symphoricarpos orbiculatus	0	0	0	NA														
Vaccinium corymbosum	1	0	0	0.0														
Viburnum nudum	0	0	0	NA														
Unknown sp.	0	0	0	NA														
Total planted stems per plot	**28**	**22**	**0**															
Total planted stems per acre		**890**	**0**															

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HD-2

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	6	92.96		5	82.3		4	30.48		5	74.68		8	78.03		11	79.25		10	109.7	
Betula nigra																					
*Cephalanthus occidentalis**																					
Clethra alnifolia																					
Cornus amomum																					
Cornus florida																					
Fraxinus pennsylvanica																					
Ilex verticillata																					
Juniperus virginiana																					
Myrica cerifera																					
Quercus coccinea																					
Quercus phellos																					
Salix sericea																					
Sambucus canadensis																					
*Spirea tomentosa***																					
Symphoricarpos orbiculatus																					
Vaccinium corymbosum																					
Viburnum nudum																					
Unknown sp.																					
Total planted stems per plot																					
Total planted stems per acre																					

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HD-2

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum	1													
Albizzia julibrissin														
Alnus serrulata														
Aronia arbutifolia														
Baccharis halimifolia														
Ligustrum sinensis														
Lindera benzoin														
Liquidambar styraciflua														
Myrica cerifera														
Pinus taeda	7	1												
Salix spp.														
Total volunteer stems per plot	9													

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HD-3

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	3	0	150.0	1.03	107.39	7	77.7		12	126		12	119										
Betula nigra	0	0	1	NA			d	d																
*Cephalanthus occidentalis**		0	0	DK																				
Clethra alnifolia	1	0	0	0.0																				
Cornus amomum	10	5	0	50.0	NA	112.96		64			116			116			143			126				
Cornus florida	0	0	0	NA																				
Fraxinus pennsylvanica	0	4	0	NA	0.83	61.95	8	64.9		13	111		7	41.8		5	30.5							
Ilex verticillata	0	0	0	NA																				
Juniperus virginiana	0	0	0	NA																				
Myrica cerifera	0	0	0	NA																				
Quercus coccinea	0	0	0	NA																				
Quercus phellos	0	1	0	NA	1.40	80.77	14	80.8																
Salix sericea	13	4	0	30.8	NA	100.36		141			73.2			120			67.1							
Sambucus canadensis	1	0	0	0.0																				
*Spirea tomentosa***	0	0	0	NA																				
Symphoricarpos orbiculatus	0	0	0	NA																				
Vaccinium corymbosum	1	0	0	0.0																				
Viburnum nudum	0	0	0	NA																				
Unknown sp	0	0	0	NA																				
Total planted stems per plot	**28**	**17**	**1**																					
Total planted stems per acre		**688**	**40**																					

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: HD-3

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum														
Albizzia julibrissin	1													
Alnus serrulata		1												
Aronia arbutifolia														
Baccharis halimifolia		1												
Ligustrum sinensis														
Lindera benzoin														
Liquidambar styraciflua														
Myrica cerifera														
Pinus taeda														
Salix spp.														
Total volunteer stems per plot	3													

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-1

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	2	0	100.0	0.50	55.17	5	57.91			52.43				
Betula nigra	0	0	0	NA											
*Cephalanthus occidentalis**		2	0	DK	1.20	108.21	11	106.7		13	109.7				
Clethra alnifolia	1	0	0	0.0											
Cornus amomum	10	3	0	30.0	NA	108.20		167.6			71.63			85.34	
Cornus florida	0	0	0	NA											
Fraxinus pennsylvanica	0	0	1	NA			d	d							
Ilex verticillata	0	0	0	NA											
Juniperus virginiana	0	0	0	NA											
Myrica cerifera	0	0	0	NA											
Quercus coccinea	0	0	0	NA											
Quercus phellos	0	0	0	NA											
Salix sericea	13	0	0	0.0											
Sambucus canadensis	1	2	0	200.0	NA	34.29		30.48			38.1				
*Spirea tomentosa***	0	0	0	NA											
Symphoricarpos orbiculatus	0	0	0	NA											
Vaccinium corymbosum	1	0	0	0.0											
Viburnum nudum	0	3	0	NA	0.53	50.60	6	40.54		6	56.39		4	54.86	
Unknown sp.	0	0	0	NA											
Total planted stems per plot	**28**	**12**	**1**												
Total planted stems per acre		**486**	**40**												

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-1

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum														
Albizzia julibrissin														
Alnus serrulata														
Aronia arbutifolia														
Baccharis halimifolia	1	1												
Ligustrum sinensis														
Lindera benzoin														
Liquidambar styraciflua	2													
Myrica cerifera														
Pinus taeda	1													
Salix spp.														
Total volunteer stems per plot	5													

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-2

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	2	0	100.0	0.55	56.85	5	54.3		6	59.4							
Betula nigra	0	0	0	NA														
*Cephalanthus occidentalis**		2	0	DK	1.40	25.15	20	16.8		8	33.5							
Clethra alnifolia	1	1	0	100.0	1.00	48.77	10	48.8										
Cornus amomum	10	9	0	90.0	NA	62.31		82.3			70.1			45.7			61	
Cornus florida	0	0	0	NA														
Fraxinus pennsylvanica	0	0	0	NA														
Ilex verticillata	0	0	0	NA														
Juniperus virginiana	0	0	0	NA														
Myrica cerifera	0	0	0	NA														
Quercus coccinea	0	0	0	NA														
Quercus phellos	0	0	0	NA														
Salix sericea	13	18	2	138.5	NA	56.91		70.7			86.9			67.7			57.9	
Sambucus canadensis	1	0	0	0.0														
*Spirea tomentosa***	0	0	0	NA														
Symphoricarpos orbiculatus	0	0	0	NA														
Vaccinium corymbosum	1	0	0	0.0														
Viburnum nudum	0	0	0	NA														
Unknown sp	0	0	0	NA														
Total planted stems per plot	**28**	**32**	**2**															
Total planted stems per acre		**1295**	**61**															

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-2

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia																					
Betula nigra																					
*Cephalanthus occidentalis**																					
Clethra alnifolia																					
Cornus amomum		67.1			71.6			61			55.5			46.6							
Cornus florida																					
Fraxinus pennsylvanica																					
Ilex verticillata																					
Juniperus virginiana																					
Myrica cerifera																					
Quercus coccinea																					
Quercus phellos																					
Salix sericea		61			47.2			64			d			d			44.2			35.1	
Sambucus canadensis																					
*Spirea tomentosa***																					
Symphoricarpos orbiculatus																					
Vaccinium corymbosum																					
Viburnum nudum																					
Unknown sp																					
Total planted stems per plot																					
Total planted stems per acre																					

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-2

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)
Aronia arbutifolia																																
Betula nigra																																
*Cephalanthus occidentalis**																																
Clethra alnifolia																																
Cornus amomum																																
Cornus florida																																
Fraxinus pennsylvanica																																
Ilex verticillata																																
Juniperus virginiana																																
Myrica cerifera																																
Quercus coccinea																																
Quercus phellos																																
Salix sericea		57.9			33.5			39.6			36.6			57.9			27.4			d			27.4			64			107		
Sambucus canadensis																																
*Spirea tomentosa***																																
Symphoricarpos orbiculatus																																
Vaccinium corymbosum																																
Viburnum nudum																																
Unknown sp																																
Total planted stems per plot																																
Total planted stems per acre																																

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-2

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum														
Albizzia julibrissin														
Alnus serrulata														
Aronia arbutifolia														
Baccharis halimifolia	1													
Ligustrum sinensis														
Lindera benzoin														
Liquidambar styraciflua	4													
Myrica cerifera														
Pinus taeda														
Salix spp.	3													
Total volunteer stems per plot	8													

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-3

Species	Total Planted	Year 2 Total Live (2006)	Total Dead	% Survival	Average Diameter (cm)	Average Height (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia	2	0	0	0.0														
Betula nigra	0	13	1	NA	0.67	92.38	4	68.6			42.7		9	104		9	119	
*Cephalanthus occidentalis**		0	0	DK														
Clethra alnifolia	1	0	0	0.0														
Cornus amomum	10	4	0	40.0	NA	59.05		93			45.7			47.2			50.3	
Cornus florida	0	0	0	NA														
Fraxinus pennsylvanica	0	13	0	NA	0.54	35.05	5	45.7		4	30.5		6	51.8		6	53.3	
Ilex verticillata	0	0	0	NA														
Juniperus virginiana	0	0	0	NA														
Myrica cerifera	0	0	0	NA														
Quercus coccinea	0	2	0	NA	1.05	70.10	12	77.7		9	62.5							
Quercus phellos	0	9	0	NA	0.76	56.49	8	54.9		3	24.4			48.8		13	101	
Salix sericea	13	0	0	0.0														
Sambucus canadensis	1	0	0	0.0														
*Spirea tomentosa***	0	0	0	NA														
Symphoricarpos orbiculatus	0	0	0	NA														
Vaccinium corymbosum	1	0	0	0.0														
Viburnum nudum	0	0	0	NA														
Unknown sp.	0	0	0	NA														
Total planted stems per plot	**28**	**41**	**1**															
Total planted stems per acre		**1659**	**40**															

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-3

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia																					
Betula nigra	5	68.6			171	5		159	2	8	83.8		4	52.4		2	36.6		10	108	
*Cephalanthus occidentalis**																					
Clethra alnifolia																					
Cornus amomum																					
Cornus florida																					
Fraxinus pennsylvanica	7	36.6		7	44.2		3	19.8		4	12.8		5	18.3		7	37.5		7	39.6	
Ilex verticillata																					
Juniperus virginiana																					
Myrica cerifera																					
Quercus coccinea																					
Quercus phellos	3	27.4		14	93		5	56.4		9	61		6	42.1							
Salix sericea																					
Sambucus canadensis																					
*Spirea tomentosa***																					
Symphoricarpos orbiculatus																					
Vaccinium corymbosum																					
Viburnum nudum																					
Unknown sp.																					
Total planted stems per plot																					
Total planted stems per acre																					

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-3

Species	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)	ddh (mm)	Height (cm)	DBH (cm)
Aronia arbutifolia									
Betula nigra	9	96		d	d		70	213	7
*Cephalanthus occidentalis**									
Clethra alnifolia									
Cornus amomum									
Cornus florida									
Fraxinus pennsylvanica	5	38.1		4	27.4				
Ilex verticillata									
Juniperus virginiana									
Myrica cerifera									
Quercus coccinea									
Quercus phellos									
Salix sericea									
Sambucus canadensis									
*Spirea tomentosa***									
Symphoricarpos orbiculatus									
Vaccinium corymbosum									
Viburnum nudum									
Unknown sp.									
Total planted stems per plot									
Total planted stems per acre									

d = dead

Source: Cornus amomum, Salix sericea, & Sambucus canadensis = LS, all others = R

* Last year may have been identified as *Viburnum nudum,* which also has opposite leaves.

** Last year may have been identified as *Clethra alnifolia,* which also has a terminal raceme.

A 3. Vegetation Monitoring Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Project #127

Plot: AL-3

	Seedling Ht Class (cm)			Saplings - DBH (cm)			Trees - DBH (cm)							
Volunteer woody stems	10-50	50-100	100-137	0-1	1-2.5	2.5	5	10	15	20	25	30	35	40
Acer rubrum														
Albizzia julibrissin														
Alnus serrulata		1												
Aronia arbutifolia														
Baccharis halimifolia														
Ligustrum sinensis														
Lindera benzoin														
Liquidambar styraciflua														
Myrica cerifera														
Pinus taeda														
Salix spp.		3												
Total volunteer stems per plot	4													

Ellerbe Creek Stream Restoration – Durham County, NC
Appendix B Geomorphologic Raw Data

B-1 Exhibit – Problem Areas Plan View
B-2 Representative Stream Problem Area Photos
B-3 Stream Photo-station Photos
B-4 Table B.1 Qualitative Visual Stability Assessment
B-5 Cross section Plots and Raw Data Tables
B-6 Longitudinal Plots and Raw Data Tables
B-7 Pebble Counts

Vegetation Plot Coordinates: Hillsborough Reach			
Plot Side	HB-V1	HB-V2	HB-V3
Pin Coordinate	E 20115741.5610 N 827358.3480	E 20116120.1110 N 827428.6750	E 2016551.0870 N 827505.1970
A	19.5’	31.1’	31.9’
B	52.1’	35.4’	32.6’
C	23.2’	33.1’	31.3’
D	53’	36.2’	39.4’

Vegetation Plot Coordinates: Croasdaile Reach		
Plot Side	CR-V1	CR-V2
Pin Coordinate	E 2016811.8250 N 827741.1850	E 2016933.510 N 827520.8490
A	32.4’	18.3’
B	33.2’	65.5’
C	29.9’	21.7’
D	31.9’	64.1’

	Easting	Northing
Cross-sections		
HB1L	2015742.0022	827332.7693
HB1R	2015772.552	827290.9634
HB2L	2015799.2852	827350.0513
HB2R	2015803.356	827295.5714
HB3L	2016595.6390	827499.8180
HB3R	2016610.0550	827433.3600
HB4L	2015654.5640	827499.8920
HB4R	20116634.3500	827432.4490
CR1L	2016939.2680	827570.7490
CR1R	2016915.6680	827552.4340
CR2L	2016957.7640	827541.2870
CR2R	2016933.5100	827520.8490
Photopoints		
HB-P1	2015577.0052	827347.3258
HB-P2	2015623.7143	827314.4264
HB-P3	2015802.5285	827349.0571
HB-P4	2015961.3634	827401.3361
HB-P5	2016127.5574	827481.3197
HB-P6&P7	2016301.8430	827496.7037
HB-P8	2016523.1130	827464.0709
HB-P9	2016749.2114	827430.4392
HB-P10	2016966.4524	827439.7628
CR-P1	2016781.3114	828053.9579
CR-P2	2016818.9390	827855.0313
CR-P3	2016919.4678	827582.3480

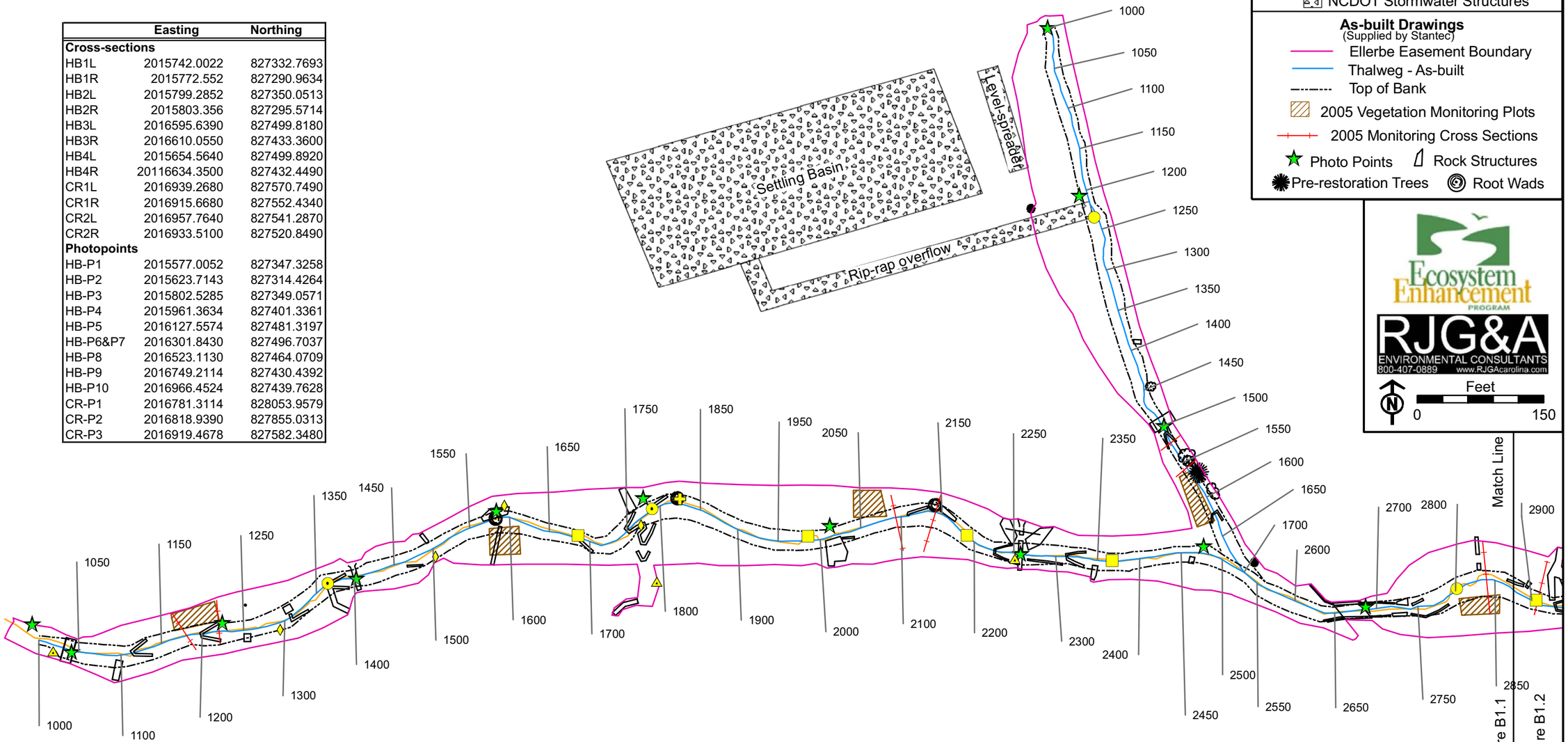

Figure B1.1 - Problem Areas - 2006
Plan View - Year 2
Ellerbe Creek Stream Restoration - Durham, NC

LEGEND

Stream Problem Areas

- Aggradation (bar)
- Aggradation (pool)
- Beaverdam
- Bank undercut/scour
- Rill and gully
- Root wad undercut
- Vane backcut/scour
- Thalweg-2006 Survey
- NCDOT Stormwater Structures

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- 2005 Vegetation Monitoring Plots
- 2005 Monitoring Cross Sections
- Photo Points
- Rock Structures
- Pre-restoration Trees
- Root Wads

Ecosystem Enhancement Program

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Feet
0 150

Vegetation Plot Coordinates: Hillandale Reach			
Plot Side	HD-V1	HD-V2	HD-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.9'	30.8'	20'
B	48.4'	31.1'	44.6'
C	22.2'	34.2'	14.2'
D	44.7'	32'	46.1'

	Easting	Northing
Cross-sections		
HD1L	2017297.3510	827444.6380
HD1R	2017305.8250	827358.5730
HD2L	2017374.0400	827421.2960
HD2R	2017358.2570	827357.0970
HD3L	2017882.0380	827326.3380
HD3R	2017835.7280	827218.0475
HD4L	2017870.4020	827311.3050
HD4R	2017919.3160	827220.8030
Photopoints		
HD-P1	2017158.5527	827368.2372
HD-P2	2017423.2777	827370.9011
HD-P3	2017633.3927	827372.5660
HD-P4	2017780.9060	827327.6127
HD-P5	2018032.6444	827207.0713
HD-P6	2018319.0135	827067.8826
HD-P7	2018632.0216	826962.3256

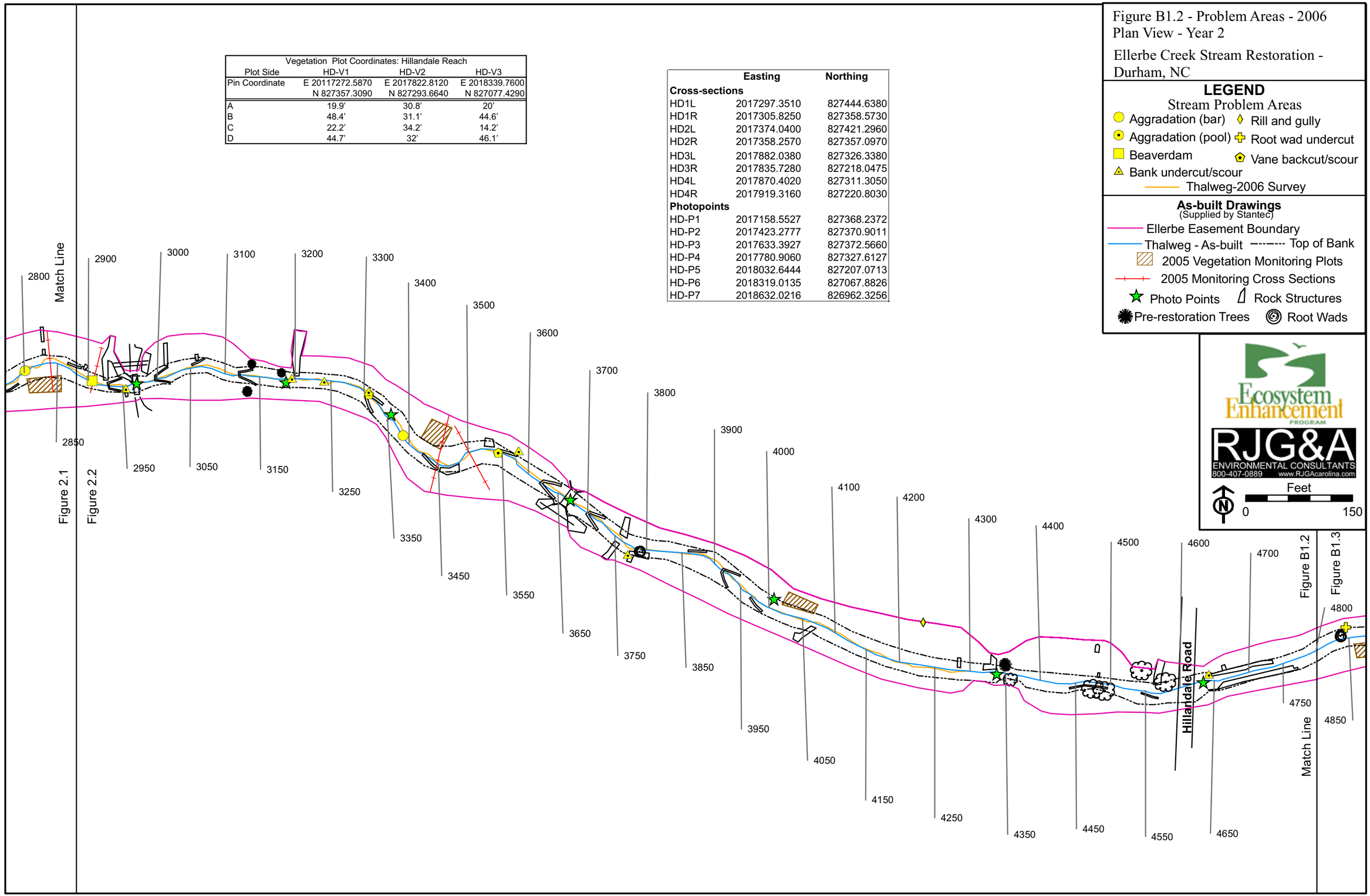

Figure B1.2 - Problem Areas - 2006
Plan View - Year 2

Ellerbe Creek Stream Restoration - Durham, NC

LEGEND

Stream Problem Areas

- Aggradation (bar)
- Aggradation (pool)
- Beaverdam
- Bank undercut/scour
- Rill and gully
- Root wad undercut
- Vane backcut/scour
- Thalweg-2006 Survey

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- 2005 Vegetation Monitoring Plots
- 2005 Monitoring Cross Sections
- Photo Points
- Rock Structures
- Pre-restoration Trees
- Root Wads

Ecosystem Enhancement Program

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Feet
0 150

Vegetation Plot Coordinates: Albany Reach			
Plot Side	AL-V1	AL-V2	AL-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.8'	33.1'	30.4'
B	54.7'	33.9'	45.8'
C	20.6'	36.1'	34.3'
D	51.5'	37.7'	45.8'

	Easting	Northing
Cross-sections		
AL1L	2019638.8850	827132.4120
AL1R	2019653.3780	827052.7850
AL2L	2019670.2730	827138.9190
AL2R	2019716.0120	827068.9910
AL3L	2019819.4940	827182.5337
AL3R	2019825.5310	827101.4830
AL4L	2019845.6470	827189.0390
AL4R	2019867.0530	827112.7780
Photopoints		
AL-P1	2018922.3866	826950.6711
AL-P2	2019315.6779	827040.2114
AL-P3	2019581.5016	827088.1615
AL-P4	2019822.0184	827155.9245
AL-P5	2020004.7951	827193.1524
AL-P6	2020248.1090	827221.4564
AL-P7	2020410.0740	827196.1493
AL-P8	2020545.5332	827244.7655

Match Line

Figure B1.2

Figure B1.3

4700 4750 4800 4850 4900 4950 5000 5050 5100 5150 5200 5250 5300 5350 5400 5450 5500 5550 5600 5650 5700 5750 5800 5850 5900 5950 6000 6050 6100 6150 6200 6250 6300 6350 6400 6450 6500 6550 6558

Figure B1.3 - Problem Areas - 2006
Plan View - Year 2

Ellerbe Creek Stream Restoration - Durham, NC

LEGEND

Stream Problem Areas

- Aggradation (bar)
- Aggradation (pool)
- Beaverdam
- Bank undercut/scour
- Rill and gully
- Root wad undercut
- Vane backcut/scour
- Thalweg-2006 Survey

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- 2005 Vegetation Monitoring Plots
- 2005 Monitoring Cross Sections
- Photo Points
- Rock Structures
- Pre-restoration Trees
- Root Wads

Ecosystem Enhancement Program

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Feet
0 150

Appendix B2. Stream Problem Area Photographs - 2006 - Ellerbe Creek Stream Restoration - Project 127

SP1. Aggradation (bar)

SP2. Aggradation (pool)

SP3. Beaverdam

SP4. Beaverdam

Appendix B2. Stream Problem Area Photographs - 2006 - Ellerbe Creek Stream Restoration- Project 127

SP5. Rill and gully

SP6. Bank undercut/scour

SP7. Root wad undercut

SP8. Vane backcut/scour

Appendix B3. Permanent Photopoint Photographs - 2006 - Ellerbe Creek Stream Restoration - Project 127

HB-P01 facing downstream (12/05/06)

HB-P02 facing downstream (12/05/06)

HB-P03 facing downstream (12/04/06)

HB-P04 facing downstream (12/04/06)

Appendix B3. Permanent Photopoint Photographs - 2006 - Ellerbe Creek Stream Restoration - Project 127

HB-P05 facing downstream (12/04/06)

HB-P06 looking south across stream (12/04/06)

HB-P07 facing downstream (12/04/06)

HB-P08 facing downstream (12/04/06)

Appendix B3. Permanent Photopoint Photographs - 2006 - Ellerbe Creek Stream Restoration - Project 127

HB-P09 facing downstream (12/04/06)

HB-P10 facing downstream (12/04/06)

CR-P01 facing downstream (12/04/06)

CR-P02 facing downstream (12/04/06)

Appendix B3. Permanent Photopoint Photographs - 2006 - Ellerbe Creek Stream Restoration - Project 127

CR-P03 facing downstream (12/04/06)

HD-P01 facing downstream (12/04/06)

HD-P02 facing downstream (12/04/06)

HD-P03 facing downstream (12/04/06)

Appendix B3. Permanent Photopoint Photographs - 2006 - Ellerbe Creek Stream Restoration - Project 127

HD-P04 facing downstream (12/04/06)

HD-P05 facing downstream (12/04/06)

HD-P06 facing downstream (12/04/06)

HD-P07 facing downstream (12/04/06)

Appendix B3. Permanent Photopoint Photographs - 2006 - Ellerbe Creek Stream Restoration - Project 127

AL-P01 facing downstream (12/05/06)

AL-P02 facing downstream (12/05/06)

AL-P03 facing downstream (12/05/06)

AL-P04 facing downstream (12/05/06)

Appendix B3. Permanent Photopoint Photographs - 2006 - Ellerbe Creek Stream Restoration - Project 127

AL-P05 facing downstream (12/05/06)

AL-P06 facing downstream (12/05/06)

AL-P07 facing downstream (12/05/06)

AL-P08 facing downstream (12/05/06)

Table B1. Visual Morphological Assessment Third Fork Stream Restoration Project - Hillsboro Reach - Project 127

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	Percent Performing in Stable Condition	Feature Performing Mean (%)
A. Riffles	1. Present	8	12	4/45	67	
	2. Armor stable	10	12	2/12	83	
	3. Facet grade appears stable	11	12	1/5	92	
	4. Minimal evidence of embedding/fining	11	12	1/6	92	
	5. Length appropriate	12	12	0/0	100	**87**
B. Pools	1. Present	8	12	4/135	67	
	2. Sufficiently deep	10	12	2/22	83	
	3. Length appropriate	7	12	5/28	58	**69**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	8	11	3/19	73	
	2. Downstream of meander (glide/inflection) centering	10	12	2/16	83	**78**
D. Meanders	1. Outer bend in state of limited/controlled erosion	10	12	2/16	83	
	2. Of those eroding, # w/concomitant point bar formation			NA	NA	
	3. Apparent Rc within spec	12	12	0/0	100	
	4. Sufficient floodplain access and relief	12	12	0/0	100	**94**
E. Bed (General)	1. General channel bed aggradation areas (bar formation)	1	1		NA	
	2. Channel bed degradation – areas of increasing downcutting or head cutting				NA	**100**
F. Vanes	1. Free of back or arm scour	5	7	2/6	71	
	2. Height appropriate	7	7	0/0	100	
	3. Angle and geometry appear appropriate	7	7	0/0	100	
	4. Free of piping or other structural failures	6	7	1/4	86	**89**
G. Wads/Bould	1. Free of scour	1	2	1/3	50	
	2. Footing stable	2	2	0/0	100	**75**

Table B1. Visual Morphological Assessment Third Fork Stream Restoration Project - Croasdaile Reach - Project 127

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	Percent Performing in Stable Condition	Feature Performing Mean (%)
A. Riffles	1. Present	4	4	0/0	100	
	2. Armor stable	2	2	0/0	100	
	3. Facet grade appears stable	4	4	0/0	100	
	4. Minimal evidence of embedding/fining	4	4		100	
	5. Length appropriate	4	4		100	**100**
B. Pools	1. Present	5	5	0/0	100	
	2. Sufficiently deep	5	5	0/0	100	
	3. Length appropriate	5	5	0/0	100	**100**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	4	4	0/0	100	
	2. Downstream of meander (glide/inflection) centering	4	4	0/0	100	**100**
D. Meanders	1. Outer bend in state of limited/controlled erosion	4	4	0/0	100	
	2. Of those eroding, # w/concomitant point bar formation	4	4	0/0	NA	
	3. Apparent Rc within spec	4	4	0/0	100	
	4. Sufficient floodplain access and relief	4	4	0/0	100	**100**
E. Bed (General)	1. General channel bed aggradation areas (bar formation)	1	NA	1/15	NA	
	2. Channel bed degradation – areas of increasing downcutting or head cutting	0		0/0	NA	**NA**
F. Vanes	1. Free of back or arm scour	2	2	0/0	100	
	2. Height appropriate	2	2	0/0	100	
	3. Angle and geometry appear appropriate	2	2	0/0	100	
	4. Free of piping or other structural failures	2	2	0/0	100	**100**
G. Wads/Bould	1. Free of scour	0	0	0/0	NA	
	2. Footing stable	0	0	0/0	NA	**NA**

Table B1. Visual Morphological Assessment Third Fork Stream Restoration Project - Hillandale Reach - Project 127

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	Percent Performing in Stable Condition	Feature Performing Mean (%)
A. Riffles	1. Present	8	8	0/0	100	
	2. Armor stable	7	8	1/6	88	
	3. Facet grade appears stable	8	8	0/0	100	
	4. Minimal evidence of embedding/fining	7	8	1/4	88	
	5. Length appropriate	7	8	1/7	88	**93**
B. Pools	1. Present	9	9	0/0	100	
	2. Sufficiently deep	7	9	2/14	78	
	3. Length appropriate	8	9	1/6	89	**89**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	6	8	2/13	75	
	2. Downstream of meander (glide/inflection) centering	6	7	1/7	86	**80**
D. Meanders	1. Outer bend in state of limited/controlled erosion	5	8	3/22	63	
	2. Of those eroding, # w/concomitant point bar formation			2/13	NA	
	3. Apparent Rc within spec	8	8	0/0	100	
	4. Sufficient floodplain access and relief	7	8	1/12	88	**83**
E. Bed (General)	1. General channel bed aggradation areas (bar formation)	2	2	NA	NA	
	2. Channel bed degradation – areas of increasing downcutting or head cutting	NA	NA	NA	NA	**NA**
F. Vanes	1. Free of back or arm scour	7	9	1/5	78	
	2. Height appropriate	9	9	0/0	100	
	3. Angle and geometry appear appropriate	8	9	1/15	89	
	4. Free of piping or other structural failures	9	9	0/0	100	**92**
G. Wads/Bould	1. Free of scour	0	1	1/4	0	
	2. Footing stable	1	1	0/0	100	**50**

Table B1. Visual Morphological Assessment Third Fork Stream Restoration Project - Albany Reach - Project 127

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	Percent Performing in Stable Condition	Feature Performing Mean (%)
A. Riffles	1. Present	3	4	1/5	75	
	2. Armor stable	3	3	1/6	100	
	3. Facet grade appears stable	2	3	1/4	67	
	4. Minimal evidence of embedding/fining	2	3	1/8	67	
	5. Length appropriate	2	3	1/12	67	**75**
B. Pools	1. Present	10	13	3/19	77	
	2. Sufficiently deep	6	10	4/24	60	
	3. Length appropriate	5	10	5/33	50	**62**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	8	10	2/9	80	
	2. Downstream of meander (glide/inflection) centering	7	10	3/22	70	**75**
D. Meanders	1. Outer bend in state of limited/controlled erosion	5	10	5/24	50	
	2. Of those eroding, # w/concomitant point bar formation	2	5	2/16	NA	
	3. Apparent Rc within spec	10	10	0/0	100	
	4. Sufficient floodplain access and relief	8	10	2/18	80	**77**
E. Bed (General)	1. General channel bed aggradation areas (bar formation)	22	2		NA	
	2. Channel bed degradation – areas of increasing downcutting or head cutting	0			NA	**NA**
F. Vanes	1. Free of back or arm scour	10	12	2/6	83	
	2. Height appropriate	9	12	3/26	75	
	3. Angle and geometry appear appropriate	9	12	3/26	75	
	4. Free of piping or other structural failures	10	12	2/8	83	**79**
G. Wads/Bould	1. Free of scour	1	2	1/4	50	
	2. Footing stable	2	2	0/0	100	**75**

River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	HB-1 (riffle)
Reach:	Hillsborough
Date:	10/25/2006
Field Crew:	J. O'Neal and N. Allen

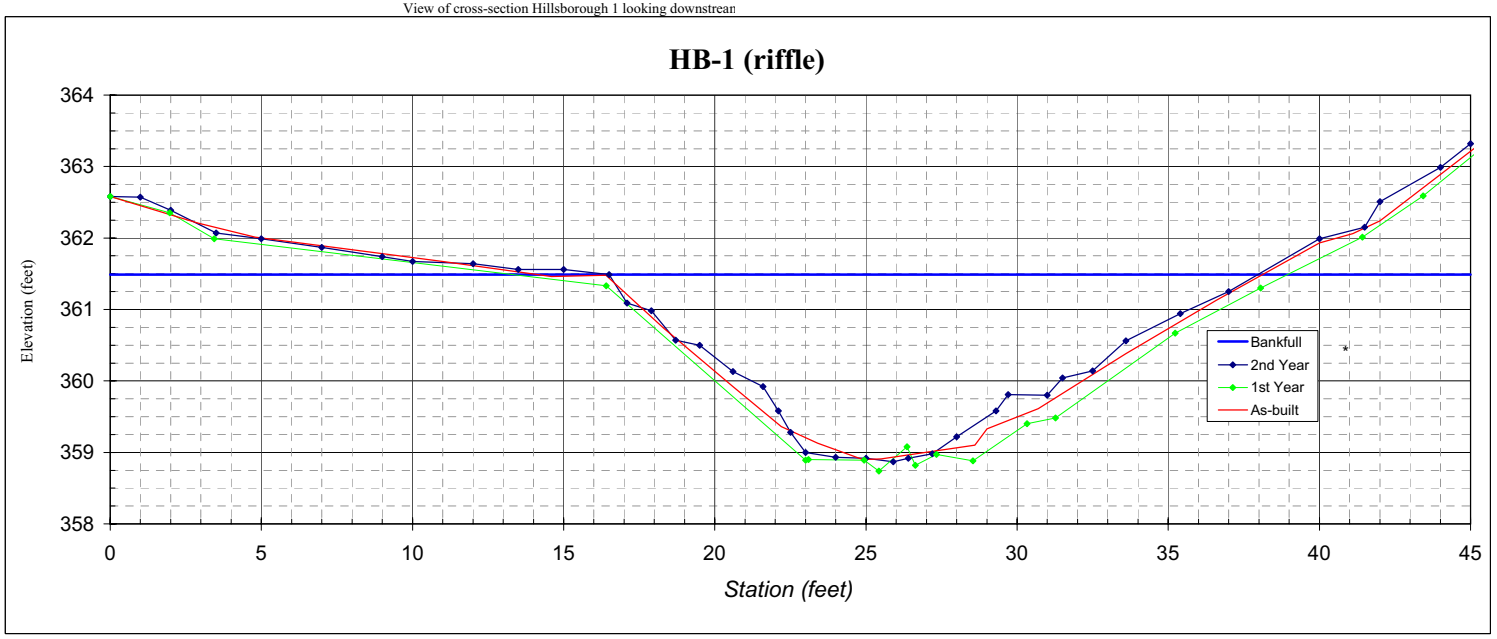
Station	Rod Ht.	Elevation
0		362.58
1		362.57
2		362.39
3.5		362.07
5		361.99
7		361.87
9		361.74
10		361.67
12		361.64
13.5		361.56
15		361.56
16.5		361.49
17.1		361.09
17.9		360.98
18.7		360.57
19.5		360.50
20.6		360.13
21.6		359.92
22.1		359.58
22.5		359.28
23		359.00
24		358.93
25		358.92
25.9		358.87
26.4		358.92
27.2		358.98
28		359.22
29.3		359.58
29.7		359.81
31		359.80
31.5		360.04
32.5		360.14
33.6		360.56
35.4		360.94
37		361.25
40		361.99
41.5		362.15
42		362.51
44		362.99
45		363.32

SUMMARY DATA

Floodprone Elevation (ft)	364.11
Bankfull Elevation (ft)	361.49
Floodprone Width (ft)	100.00
Bankfull Width (ft)	21.47
Entrenchment Ratio	4.66
Mean Depth (ft)	1.46
Maximum Depth (ft)	2.62
Width/Depth Ratio	14.75
Bankfull Area (sq ft)	31.26
Wetted Perimeter (ft)	22.45
Hydraulic Radius (ft)	1.39

Stream Type: C4

View of cross-section Hillsborough 1 looking downstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	HB-2 (pool)
Reach:	Hillsborough
Date:	10/25/2006
Field Crew:	J. O'Neal and N. Allen

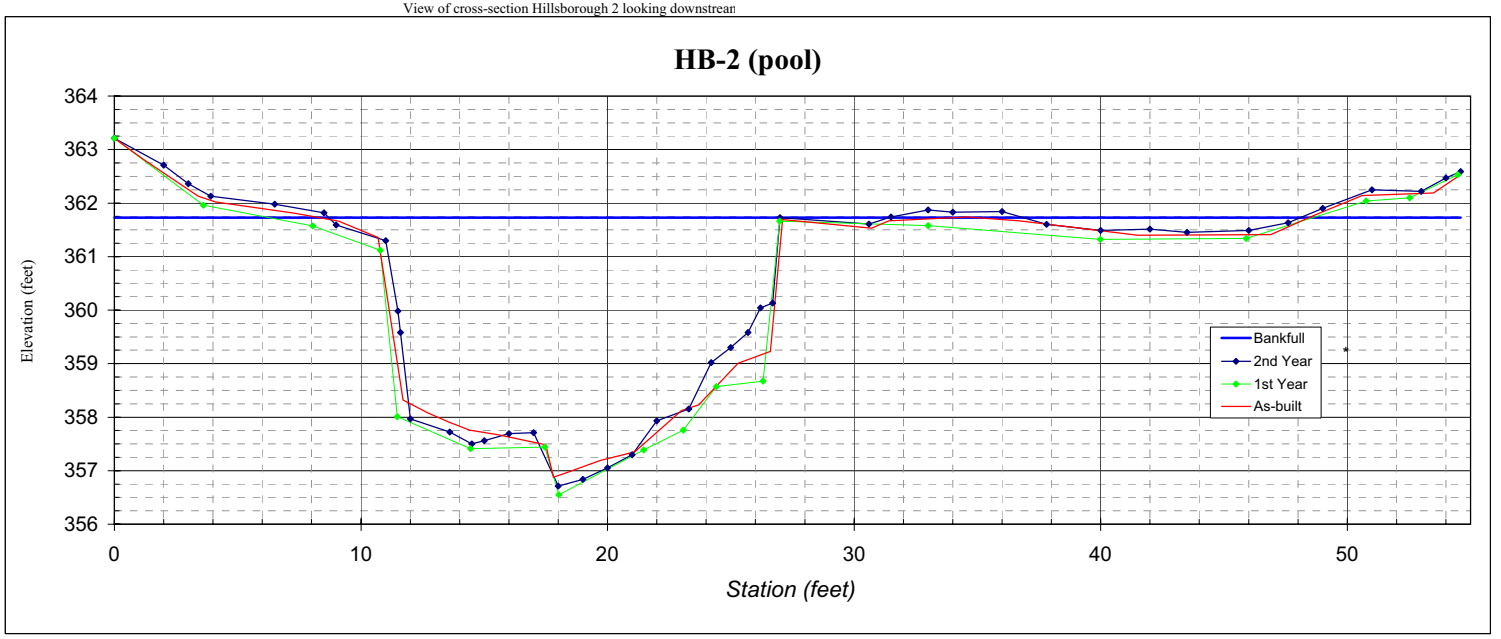
Station	Rod Ht.	Elevation
0	3.35	363.21
2	3.85	362.71
3	4.2	362.36
3.9	4.43	362.13
6.5	4.58	361.98
8.5	4.74	361.82
9	4.97	361.59
11	5.26	361.30
11.5	6.58	359.98
11.6	6.98	359.58
12	8.59	357.97
13.6	8.84	357.72
14.5	9.06	357.50
15	9	357.56
16	8.87	357.69
17	8.85	357.71
18	9.85	356.71
19	9.72	356.84
20	9.51	357.05
21	9.26	357.30
22	8.63	357.93
23.3	8.41	358.15
24.2	7.54	359.02
25	7.26	359.30
25.7	6.98	359.58
26.2	6.52	360.04
26.7	6.43	360.13
27	4.83	361.73
30.6	4.95	361.61
31.5	4.82	361.74
33	4.69	361.87
34	4.73	361.83
36	4.72	361.84
37.8	4.96	361.60
40	5.07	361.49
42	5.05	361.51
43.5	5.11	361.45
46	5.07	361.49
47.6	4.93	361.63
49	4.66	361.90
51	4.31	362.25
53	4.34	362.22
54	4.09	362.47
54.6	3.97	362.59

SUMMARY DATA

Floodprone Elevation (ft)	366.75
Bankfull Elevation (ft)	361.73
Floodprone Width (ft)	100.00
Bankfull Width (ft)	34.03
Entrenchment Ratio	2.94
Mean Depth (ft)	1.81
Maximum Depth (ft)	5.02
Width/Depth Ratio	18.85
Bankfull Area (sq ft)	61.43
Wetted Perimeter (ft)	39.30
Hydraulic Radius (ft)	1.56

Stream Type: C6

View of cross-section Hillsborough 2 looking downstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	HB-3 (riffle)
Reach:	Hillsborough
Date:	10/25/2006
Field Crew:	W. Marotti and S. Doig

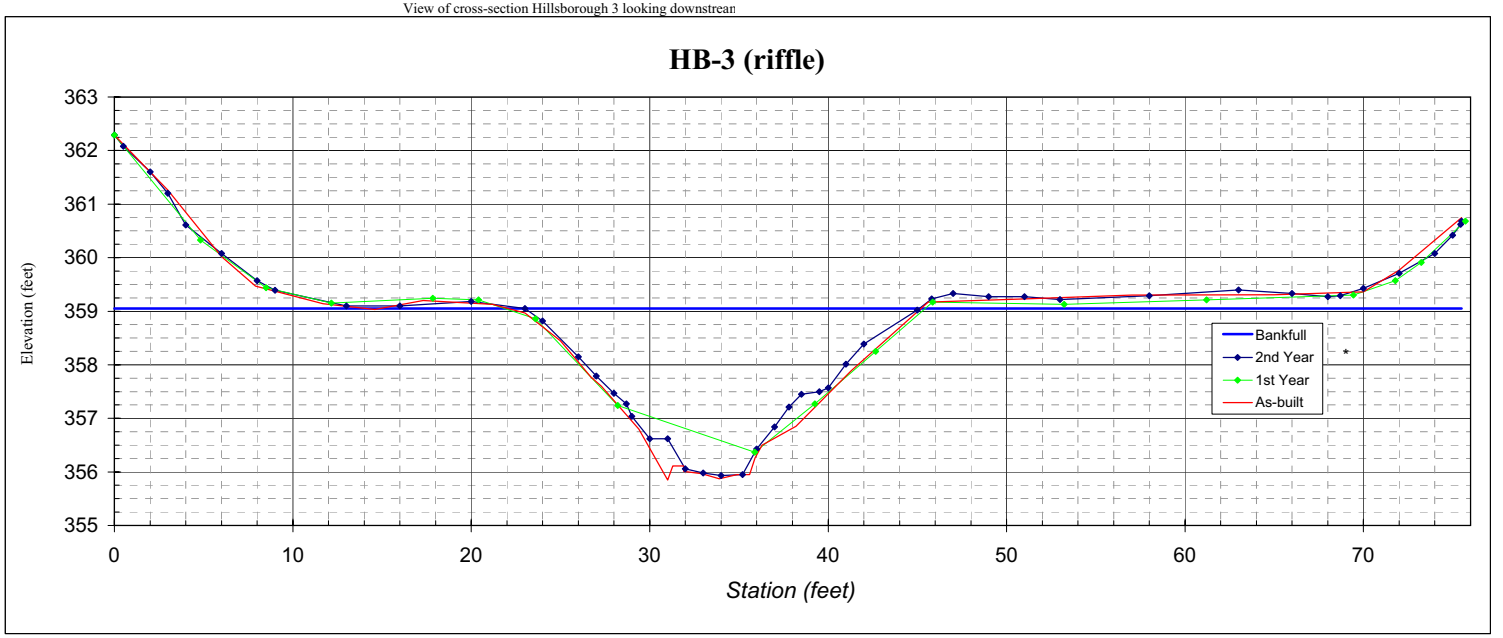
Station	Rod Ht.	Elevation
0		362.29
0.5		362.08
2		361.60
3		361.20
4		360.61
6		360.08
8		359.57
9		359.39
13		359.10
16		359.10
20		359.18
23		359.05
24		358.82
26		358.15
27		357.79
28		357.47
28.7		357.27
29		357.04
30		356.62
31		356.62
32		356.06
33		355.98
34		355.93
35.2		355.95
36		356.43
37		356.84
37.8		357.21
38.5		357.45
39.5		357.50
40		357.57
41		358.01
42		358.39
45		359.02
45.8		359.23
47		359.33
49		359.27
51		359.27
53		359.22
58		359.29
63		359.40
66		359.33
68		359.27
68.7		359.29
70		359.43
72		359.71
74		360.08
75		360.42
75.45		360.62
75.5		360.68

SUMMARY DATA

Floodprone Elevation (ft)	362.17
Bankfull Elevation (ft)	359.05
Floodprone Width (ft)	100.00
Bankfull Width (ft)	22.11
Entrenchment Ratio	4.52
Mean Depth (ft)	1.61
Maximum Depth (ft)	3.12
Width/Depth Ratio	13.69
Bankfull Area (sq ft)	35.71
Wetted Perimeter (ft)	23.28
Hydraulic Radius (ft)	1.53

Stream Type: C6

View of cross-section Hillsborough 3 looking downstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	HB-3 (pool)
Reach:	Hillsborough
Date:	10/25/2006
Field Crew:	W. Marotti and S. Doig

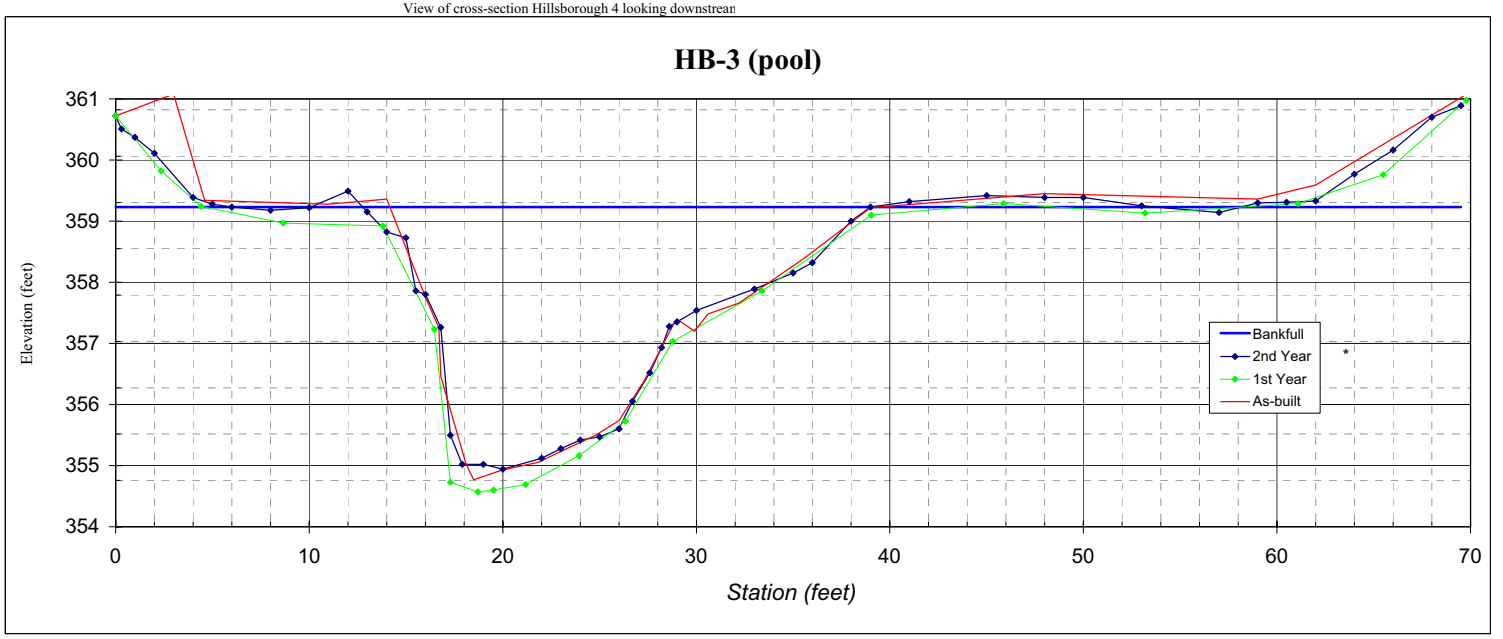
Station	Rod Ht.	Elevation
0		360.72
0.3		360.51
1		360.37
2		360.11
4		359.39
5		359.28
6		359.23
8		359.18
10		359.22
12		359.49
13		359.15
14		358.82
15		358.73
15.5		357.86
16		357.80
16.8		357.26
17.3		355.50
17.9		355.02
19		355.02
20		354.94
22		355.12
23		355.28
24		355.42
25		355.47
26		355.60
26.7		356.05
27.6		356.52
28.2		356.93
28.6		357.28
29		357.35
30		357.54
33		357.89
35		358.15
36		358.32
38		359.00
39		359.23
41		359.32
45		359.42
48		359.39
50		359.39
53		359.25
57		359.14
59		359.30
60.5		359.31
62		359.33
64		359.77
66		360.16
68		360.70
69.5		360.89
69.5		361.01

SUMMARY DATA

Floodprone Elevation (ft)	363.52
Bankfull Elevation (ft)	359.23
Floodprone Width (ft)	100.00
Bankfull Width (ft)	34.71
Entrenchment Ratio	2.88
Mean Depth (ft)	1.71
Maximum Depth (ft)	4.29
Width/Depth Ratio	20.36
Bankfull Area (sq ft)	59.18
Wetted Perimeter (ft)	37.72
Hydraulic Radius (ft)	1.57

Stream Type: C5

View of cross-section Hillsborough 4 looking downstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	HD-1 (pool)
Reach:	Hillandale
Date:	10/26/2006
Field Crew:	J. O'Neal and N. Allen

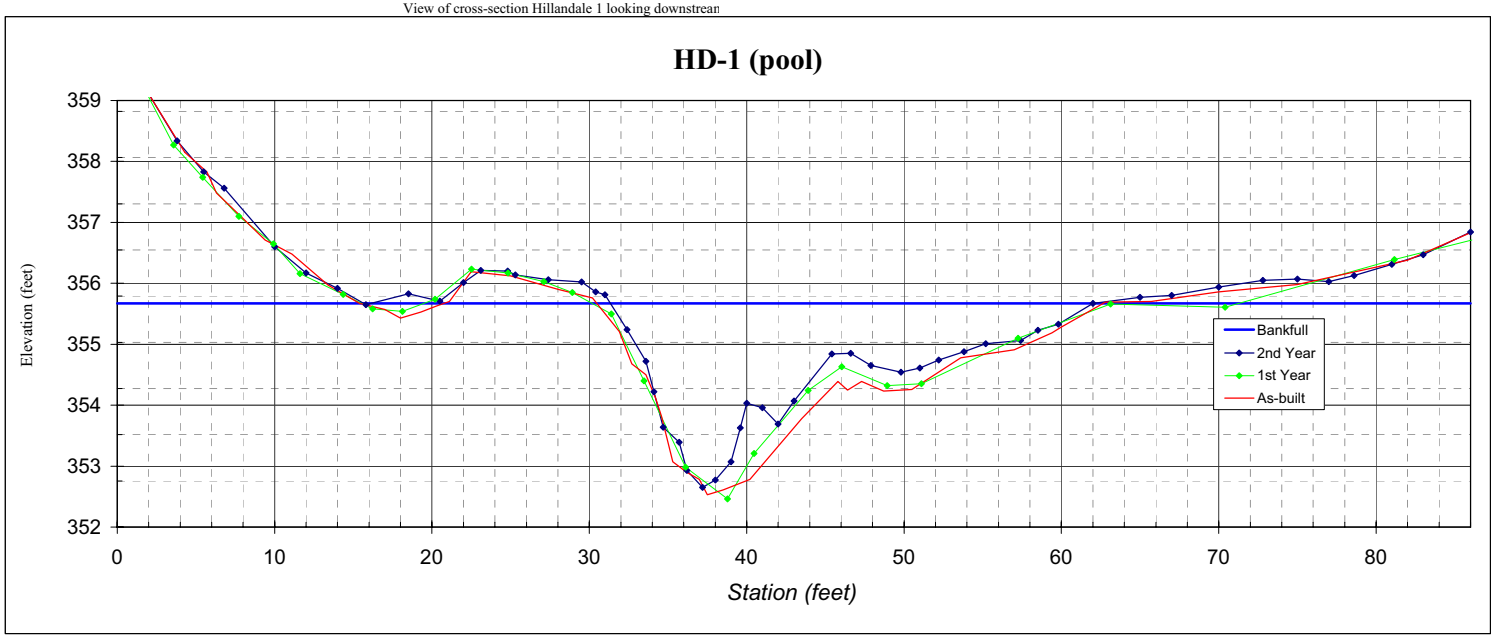
Station	Rod Ht.	Elevation
0	6.61	359.94
2	7.44	359.11
3.8	8.21	358.34
5.5	8.72	357.83
6.8	8.99	357.56
10	9.95	356.60
12	10.38	356.17
14	10.63	355.92
15.8	10.9	355.65
18.5	10.72	355.83
20.5	10.84	355.71
22	10.54	356.01
23.1	10.34	356.21
24.8	10.35	356.20
25.3	10.41	356.14
27.4	10.49	356.06
29.5	10.53	356.02
30.4	10.69	355.86
31	10.74	355.81
32.4	11.31	355.24
33.6	11.83	354.72
34.1	12.33	354.22
34.7	12.91	353.64
35.7	13.16	353.39
36.2	13.62	352.93
37.2	13.9	352.65
38	13.78	352.77
39	13.48	353.07
39.6	12.92	353.63
40	12.52	354.03
41	12.59	353.96
42	12.86	353.69
43	12.48	354.07
45.4	11.71	354.84
46.6	11.7	354.85
47.9	11.9	354.65
49.8	12.01	354.54
51	11.94	354.61
52.2	11.81	354.74
53.8	11.67	354.88
55.2	11.54	355.01
57.4	11.49	355.06
58.5	11.32	355.23
59.8	11.22	355.33
62	10.88	355.67
65	10.78	355.77
67	10.75	355.80
70	10.61	355.94
72.8	10.5	356.05
75	**10.48**	356.07
77	10.52	356.03
78.6	10.42	356.13
81	10.24	356.31
83	10.08	356.47
86	9.71	356.84

SUMMARY DATA

Floodprone Elevation (ft)	358.69
Bankfull Elevation (ft)	355.67
Floodprone Width (ft)	100.00
Bankfull Width (ft)	31.09
Entrenchment Ratio	3.22
Mean Depth (ft)	1.17
Maximum Depth (ft)	3.02
Width/Depth Ratio	26.52
Bankfull Area (sq ft)	36.45
Wetted Perimeter (ft)	32.73
Hydraulic Radius (ft)	1.11

Stream Type: C6

View of cross-section Hillandale 1 looking downstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	HD-2 (riffle)
Reach:	Hillandale
Date:	10/26/2006
Field Crew:	J. O'Neal and N. Allen

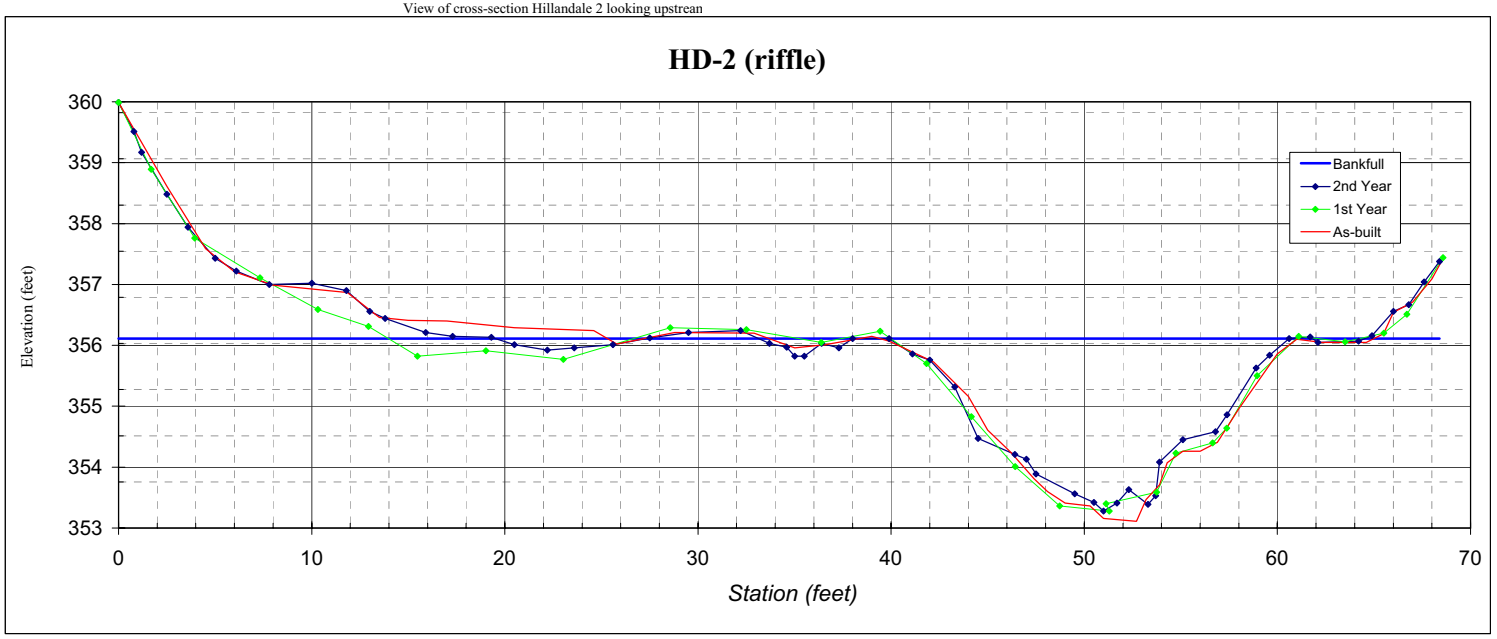
Station	Rod Ht.	Elevation
0	6.54	359.99
0.8	7.02	359.51
1.2	7.36	359.17
2.5	8.05	358.48
3.6	8.59	357.94
5	9.1	357.43
6.1	9.31	357.22
7.8	9.53	357.00
10	9.51	357.02
11.8	9.63	356.90
13	9.97	356.56
13.8	10.09	356.44
15.9	10.32	356.21
17.3	10.38	356.15
19.3	10.4	356.13
20.5	10.52	356.01
22.2	10.61	355.92
23.6	10.57	355.96
25.6	10.52	356.01
27.5	10.41	356.12
29.5	10.32	356.21
32.2	10.29	356.24
33.7	10.5	356.03
34.6	10.56	355.97
35	10.71	355.82
35.5	10.71	355.82
36.4	10.5	356.03
37.3	10.57	355.96
38	10.42	356.11
39.9	10.42	356.11
41.1	10.67	355.86
42	10.77	355.76
43.3	11.21	355.32
44.5	12.06	354.47
46.4	12.32	354.21
47	12.4	354.13
47.5	12.64	353.89
49.5	12.97	353.56
50.5	13.11	353.42
51	13.25	353.28
51.7	13.12	353.41
52.3	12.9	353.63
53.3	13.14	353.39
53.7	13	353.53
53.9	12.45	354.08
55.1	12.08	354.45
56.8	11.95	354.58
57.4	11.67	354.86
58.9	10.9	355.63
59.6	**10.69**	355.84
60.6	10.42	356.11
61.7	10.39	356.14
62.1	10.48	356.05
64.2	10.46	356.07
64.9	10.37	356.16
66	9.97	356.56
66.8	9.86	356.67
67.6	9.49	357.04
68.4	9.15	357.38

SUMMARY DATA

Floodprone Elevation (ft)	358.94
Bankfull Elevation (ft)	356.11
Floodprone Width (ft)	100.00
Bankfull Width (ft)	36.08
Entrenchment Ratio	2.77
Mean Depth (ft)	0.93
Maximum Depth (ft)	2.83
Width/Depth Ratio	38.62
Bankfull Area (sq ft)	33.70
Wetted Perimeter (ft)	37.55
Hydraulic Radius (ft)	0.90

Stream Type: C5

View of cross-section Hillandale 2 looking upstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	HD-3 (pool)
Reach:	Hillandale
Date:	10/26/2006
Field Crew:	J. O'Neal and N. Allen

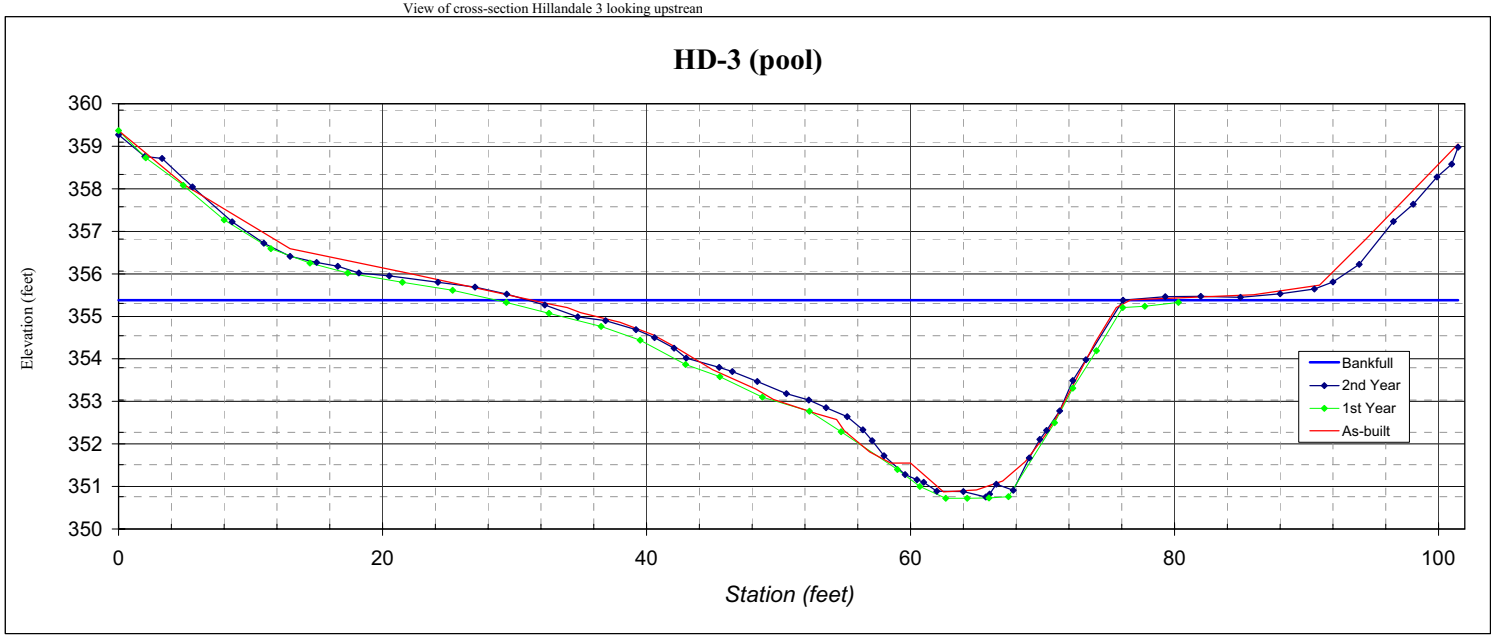
Station	Rod Ht.	Elevation
0	1.09	359.27
2	1.6	358.76
3.3	1.65	358.71
5.6	2.32	358.04
8.6	3.14	357.22
11	3.64	356.72
13	3.95	356.41
15	4.09	356.27
16.6	4.18	356.18
18.2	4.34	356.02
20.5	4.41	355.95
24.2	4.56	355.80
27	4.67	355.69
29.4	4.84	355.52
32.3	5.09	355.27
34.8	5.37	354.99
36.9	5.46	354.90
39.2	5.67	354.69
40.6	5.86	354.50
42.1	6.11	354.25
43	6.34	354.02
45.5	6.56	353.80
46.5	6.66	353.70
48.4	6.89	353.47
50.6	7.18	353.18
52.3	7.33	353.03
53.6	7.51	352.85
55.2	7.72	352.64
56.4	8.03	352.33
57.1	8.28	352.08
58	8.64	351.72
59.6	9.08	351.28
60.5	9.2	351.16
61	9.26	351.10
62	9.47	350.89
64	9.48	350.88
65.7	9.61	350.75
66	9.54	350.82
66.5	9.31	351.05
67.8	9.45	350.91
69	8.69	351.67
69.8	8.25	352.11
70.3	8.04	352.32
71.3	7.58	352.78
72.3	6.87	353.49
73.3	6.38	353.98
76.1	4.98	355.38
79.3	4.9	355.46
82	4.89	355.47
85	**4.91**	355.45
88	4.83	355.53
90.6	4.72	355.64
92	4.55	355.81
94	4.14	356.22
96.6	3.13	357.23
98.1	2.72	357.64
99.9	2.08	358.28
101	1.78	358.58
101.5	1.38	358.98

SUMMARY DATA

Floodprone Elevation (ft)	360.01
Bankfull Elevation (ft)	355.38
Floodprone Width (ft)	100.00
Bankfull Width (ft)	45.08
Entrenchment Ratio	2.22
Mean Depth (ft)	2.23
Maximum Depth (ft)	4.63
Width/Depth Ratio	20.22
Bankfull Area (sq ft)	100.50
Wetted Perimeter (ft)	46.71
Hydraulic Radius (ft)	2.15

Stream Type: C4

View of cross-section Hillandale 3 looking upstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	HD-4 (riffle)
Reach:	Hillandale
Date:	10/26/2006
Field Crew:	J. O'Neal and N. Allen

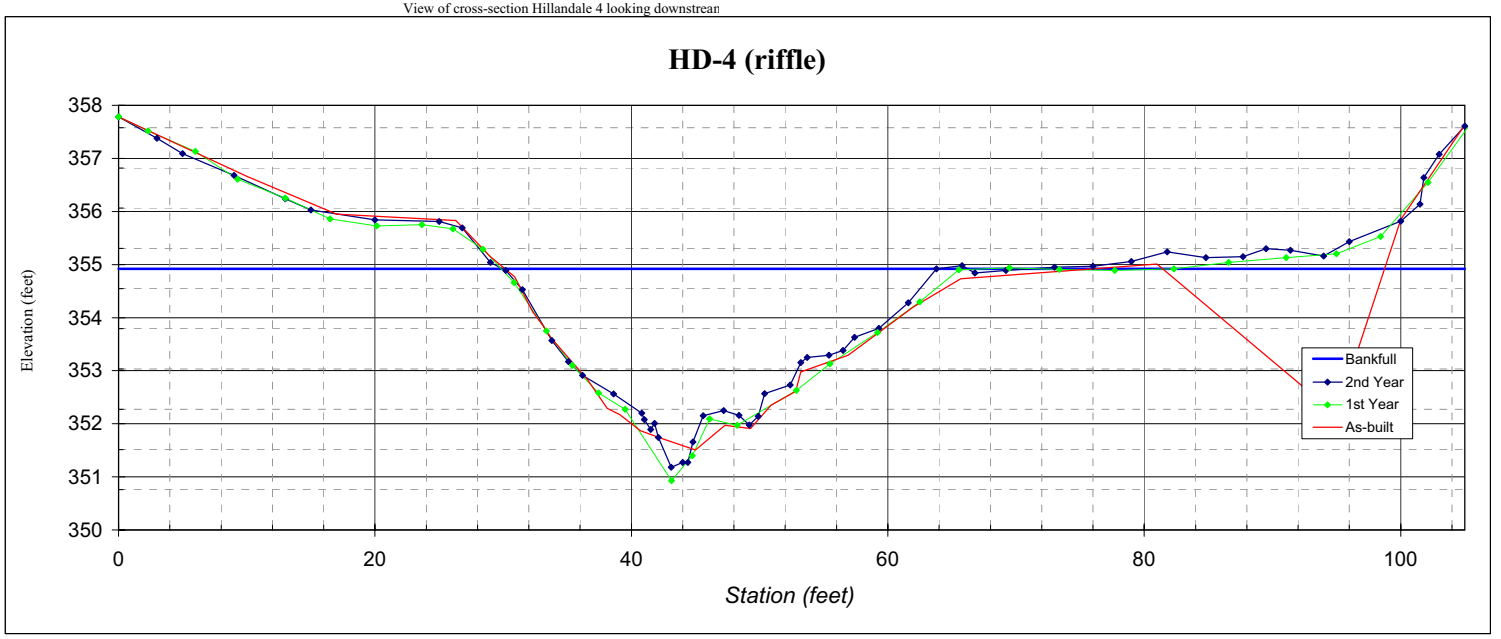
Station	Rod Ht.	Elevation
0	2.59	357.78
3	2.99	357.38
5	3.28	357.09
9	3.69	356.68
13	4.13	356.24
15	4.34	356.03
20	4.53	355.84
25	4.56	355.81
26.8	4.68	355.69
29	5.33	355.04
30.2	5.48	354.89
31.5	5.84	354.53
33.8	6.8	353.57
35.1	7.2	353.17
36.2	7.46	352.91
38.6	7.81	352.56
40.8	8.17	352.20
41	8.29	352.08
41.5	8.48	351.89
41.8	8.36	352.01
42.1	8.63	351.74
43.1	9.19	351.18
44	9.1	351.27
44.4	9.1	351.27
44.8	8.71	351.66
45.6	8.22	352.15
47.2	8.12	352.25
48.4	8.21	352.16
49.2	8.39	351.98
49.9	8.23	352.14
50.4	7.8	352.57
52.4	7.64	352.73
53.2	7.22	353.15
53.7	7.12	353.25
55.4	7.08	353.29
56.5	6.99	353.38
57.4	6.74	353.63
59.3	6.57	353.80
61.6	6.09	354.28
63.8	5.45	354.92
65.8	5.39	354.98
66.8	5.53	354.84
69.2	5.48	354.89
73	5.42	354.95
76	5.4	354.97
79	5.31	355.06
81.8	5.13	355.24
84.8	5.24	355.13
87.7	5.22	355.15
89.5	**5.07**	355.30
91.4	5.1	355.27
94	5.21	355.16
96	4.94	355.43
100	4.55	355.82
101.5	4.23	356.14
101.8	3.73	356.64
103	3.29	357.08
105	2.76	357.61

SUMMARY DATA

Floodprone Elevation (ft)	358.66
Bankfull Elevation (ft)	354.92
Floodprone Width (ft)	105.00
Bankfull Width (ft)	38.71
Entrenchment Ratio	2.71
Mean Depth (ft)	1.66
Maximum Depth (ft)	3.74
Width/Depth Ratio	23.33
Bankfull Area (sq ft)	64.24
Wetted Perimeter (ft)	40.26
Hydraulic Radius (ft)	1.60

Stream Type: C6

View of cross-section Hillandale 4 looking downstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	AL-1 (pool)
Reach:	Albany
Date:	10/25/2006
Field Crew:	W. Marotti and S. Doig

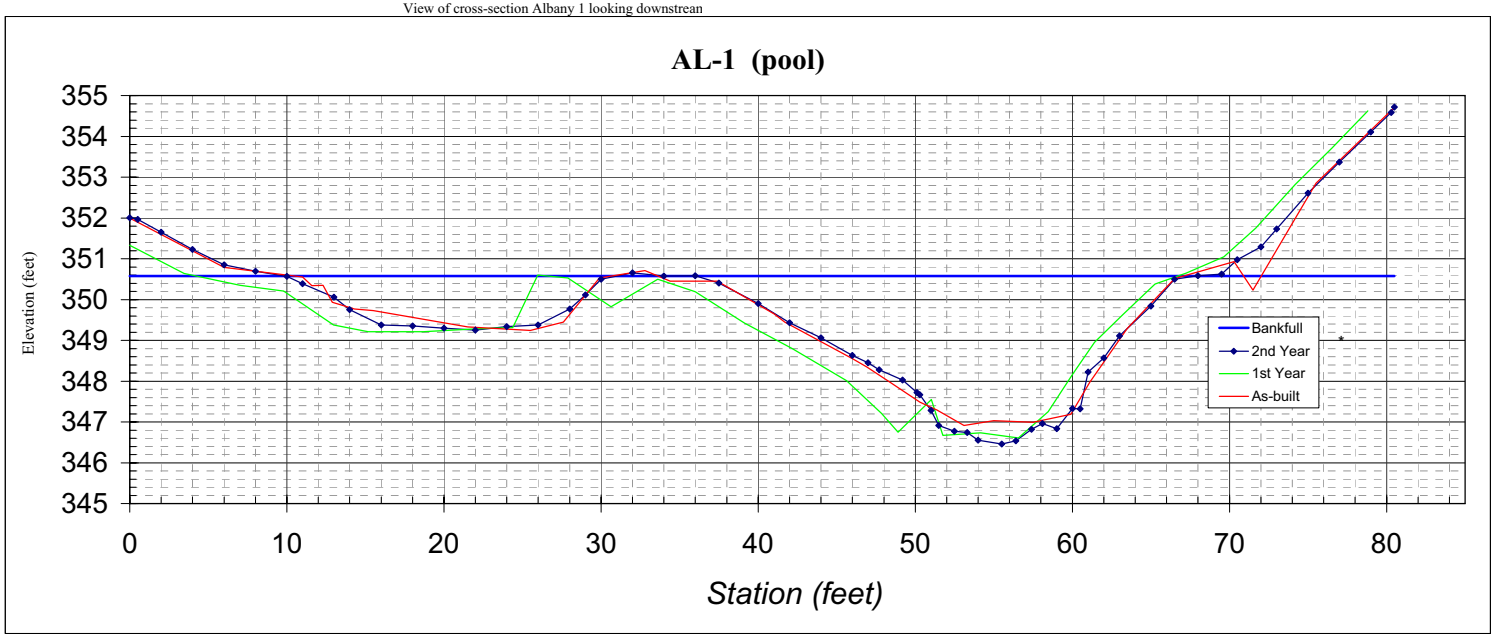
Station	Rod Ht.	Elevation
0		352.01
0.5		351.96
2		351.65
4		351.23
6		350.85
8		350.70
10		350.57
11		350.38
13		350.06
14		349.76
16		349.37
18		349.36
20		349.30
22		349.25
24		349.34
26		349.38
28		349.77
29		350.11
30		350.50
32		350.66
34		350.58
36		350.58
37.5		350.41
40		349.90
42		349.43
44		349.06
46		348.63
47		348.45
47.7		348.28
49.2		348.03
50.1		347.72
50.3		347.67
51		347.28
51.5		346.92
52.5		346.77
53.3		346.74
54		346.56
55.5		346.46
56.4		346.53
57.4		346.82
58.1		346.96
59		346.83
60		347.33
60.5		347.32
61		348.22
62		348.57
63		349.11
65		349.84
66.5		350.50
68		350.59
69.5		350.63
70.5		350.97
72		351.29
73		351.73
75		352.61
77		353.37
79		354.11
80.3		354.58
80.5		354.71

SUMMARY DATA

Floodprone Elevation (ft)	354.70
Bankfull Elevation (ft)	350.58
Floodprone Width (ft)	100.00
Bankfull Width (ft)	53.05
Entrenchment Ratio	1.89
Mean Depth (ft)	1.60
Maximum Depth (ft)	4.12
Width/Depth Ratio	33.16
Bankfull Area (sq ft)	84.87
Wetted Perimeter (ft)	55.09
Hydraulic Radius (ft)	1.54

Stream Type: C4

View of cross-section Albany 1 looking downstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	AL-2 (riffle)
Reach:	Albany
Date:	10/25/2006
Field Crew:	W. Marotti and S. Doig

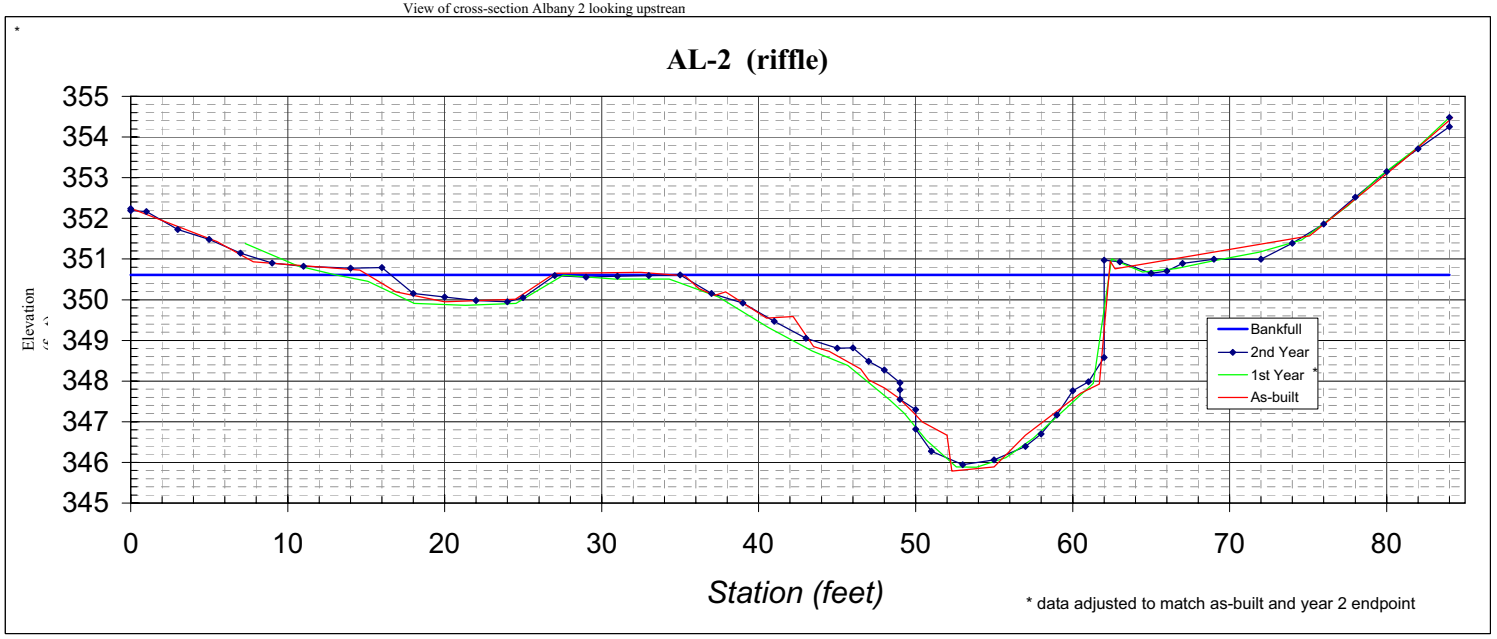
Station	Rod Ht.	Elevation
0		352.24
0		352.19
1		352.17
3		351.73
5		351.48
7		351.15
9		350.90
11		350.82
14		350.77
16		350.79
18		350.15
20		350.07
22		349.98
24		349.95
25		350.05
27		350.60
29		350.56
31		350.58
33		350.59
35		350.61
37		350.15
39		349.92
41		349.47
43		349.05
45		348.80
46		348.82
47		348.49
48		348.27
49		347.96
49		347.78
49		347.55
50		347.30
50		346.81
51		346.27
53		345.94
55		346.06
57		346.40
58		346.70
59		347.16
60		347.76
61		347.98
62		348.58
62		350.97
63		350.93
65		350.65
66		350.70
67		350.89
69		350.99
72		350.99
74		351.39
76		351.86
78		352.52
80		353.15
82		353.71
84		354.26
84		354.48

SUMMARY DATA

Floodprone Elevation (ft)	355.28
Bankfull Elevation (ft)	350.61
Floodprone Width (ft)	100.00
Bankfull Width (ft)	45.36
Entrenchment Ratio	2.21
Mean Depth (ft)	1.62
Maximum Depth (ft)	4.67
Width/Depth Ratio	28.04
Bankfull Area (sq ft)	73.36
Wetted Perimeter (ft)	49.46
Hydraulic Radius (ft)	1.48

Stream Type: C4

View of cross-section Albany 2 looking upstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	AL-3 (pool)
Reach:	Albany
Date:	10/25/2006
Field Crew:	W. Marotti and S. Doig

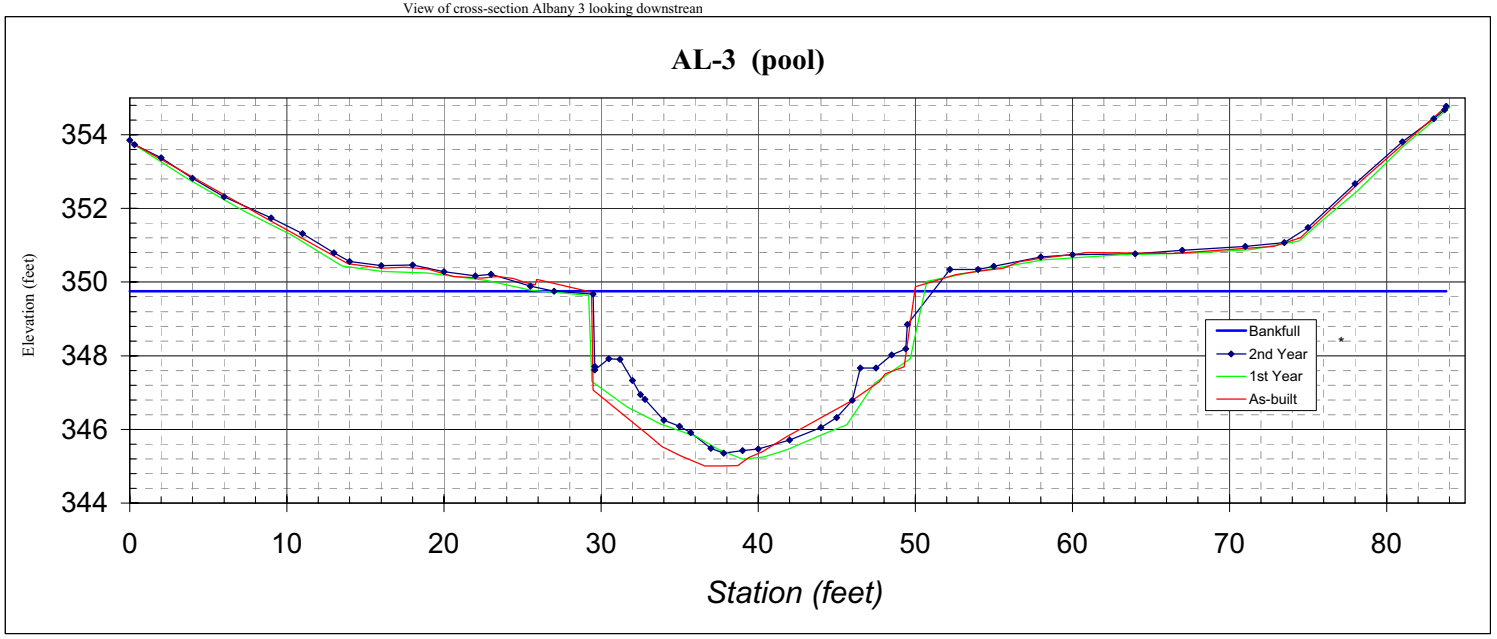
Station	Rod Ht.	Elevation
0		353.86
0.3		353.73
2		353.37
4		352.82
6		352.32
9		351.75
11		351.32
13		350.80
14		350.56
16		350.45
18		350.47
20		350.28
22		350.17
23		350.22
25.5		349.89
27		349.75
29.5		349.67
29.6		347.71
29.6		347.62
30.5		347.92
31.2		347.90
32		347.33
32.5		346.95
32.8		346.82
34		346.25
35		346.08
35.7		345.91
37		345.49
37.8		345.35
39		345.42
40		345.46
42		345.71
44		346.05
45		346.32
46		346.79
46.5		347.67
47.5		347.67
48.5		348.03
49.4		348.18
49.5		348.85
52.2		350.34
54		350.34
55		350.43
58		350.69
60		350.74
64		350.77
67		350.87
71		350.97
73.5		351.07
75		351.48
78		352.67
81		353.81
83		354.44
83.7		354.68
83.8		354.78

SUMMARY DATA

Floodprone Elevation (ft)	354.15
Bankfull Elevation (ft)	349.75
Floodprone Width (ft)	100.00
Bankfull Width (ft)	23.99
Entrenchment Ratio	4.17
Mean Depth (ft)	2.75
Maximum Depth (ft)	4.40
Width/Depth Ratio	8.73
Bankfull Area (sq ft)	65.90
Wetted Perimeter (ft)	28.15
Hydraulic Radius (ft)	2.34

Stream Type: C4

View of cross-section Albany 3 looking downstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	AL-4 (riffle)
Reach:	Albany
Date:	10/25/2006
Field Crew:	W. Marotti and S. Doig

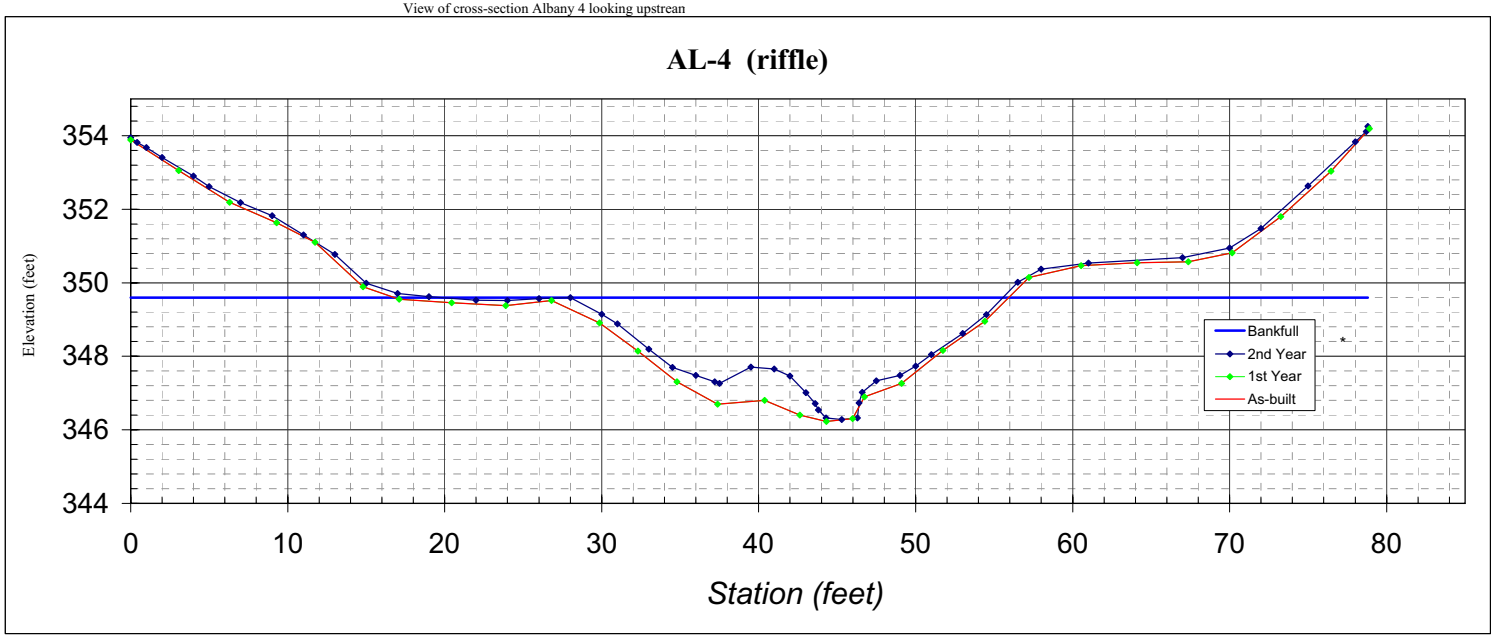
Station	Rod Ht.	Elevation
0		353.95
0.4		353.82
1		353.68
2		353.41
4		352.90
5		352.62
7		352.18
9		351.82
11		351.30
13		350.77
15		349.99
17		349.71
19		349.62
22		349.52
24		349.52
26		349.57
28		349.60
30		349.14
31		348.88
33		348.20
34.5		347.70
36		347.49
37.2		347.30
37.5		347.26
39.5		347.71
41		347.65
42		347.46
43		347.02
43.6		346.72
43.8		346.54
44.3		346.32
45.3		346.28
46.3		346.32
46.4		346.74
46.6		347.02
47.5		347.33
49		347.48
50		347.74
51		348.05
53		348.62
54.5		349.13
56.5		350.02
58		350.37
61		350.53
67		350.68
70		350.94
72		351.48
75		352.64
78		353.84
78.7		354.11
78.8		354.25

SUMMARY DATA

Floodprone Elevation (ft)	352.92
Bankfull Elevation (ft)	349.60
Floodprone Width (ft)	100.00
Bankfull Width (ft)	35.88
Entrenchment Ratio	2.79
Mean Depth (ft)	1.34
Maximum Depth (ft)	3.32
Width/Depth Ratio	26.70
Bankfull Area (sq ft)	48.23
Wetted Perimeter (ft)	37.42
Hydraulic Radius (ft)	1.29

Stream Type: C5

View of cross-section Albany 4 looking upstrean



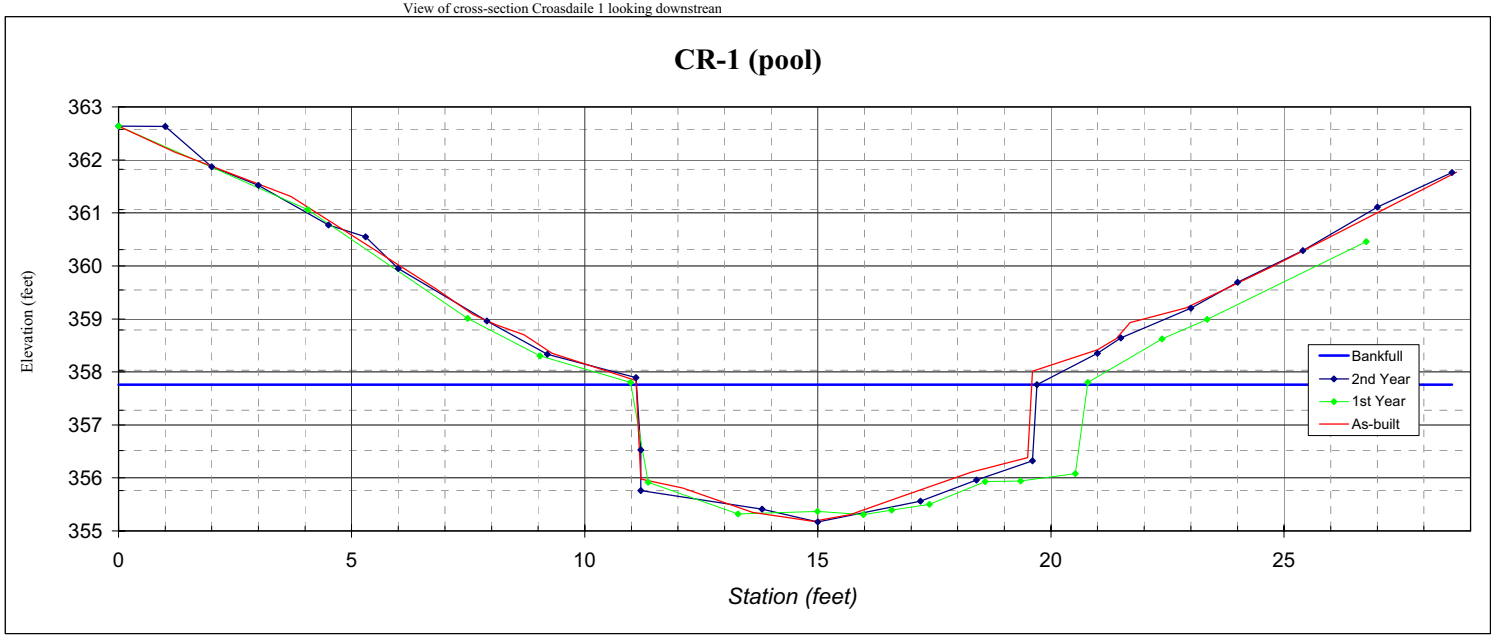
River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	CR-1 (pool)
Reach:	Croasdaile
Date:	10/25/2006
Field Crew:	J. O'Neal and N. Allen

Station	Rod Ht.	Elevation
0	3.04	362.64
1	3.05	362.63
2	3.81	361.87
3	4.16	361.52
4.5	4.91	360.77
5.3	5.13	360.55
6	5.73	359.95
7.9	6.72	358.96
9.2	7.35	358.33
11.1	7.79	357.89
11.2	9.15	356.53
11.2	9.92	355.76
13.8	10.27	355.41
15	10.51	355.17
17.2	10.12	355.56
18.4	9.72	355.96
19.6	9.36	356.32
19.7	7.92	357.76
21	7.33	358.35
21.5	7.04	358.64
23	6.48	359.20
24	5.99	359.69
25.4	5.39	360.29
27	4.57	361.11
28.6	3.92	361.76

SUMMARY DATA	
Floodprone Elevation (ft)	360.35
Bankfull Elevation (ft)	357.76
Floodprone Width (ft)	9.80
Bankfull Width (ft)	8.59
Entrenchment Ratio	1.14
Mean Depth (ft)	2.10
Maximum Depth (ft)	2.59
Width/Depth Ratio	4.02
Bankfull Area (sq ft)	18.36
Wetted Perimeter (ft)	12.05
Hydraulic Radius (ft)	1.52

Stream Type: C4

View of cross-section Croasdaile 1 looking downstrean



River Basin:	Neuse
Watershed:	Ellerbe Creek
XS ID	CR-2 (riffle)
Reach:	Croasdaile
Date:	10/25/2006
Field Crew:	J. O'Neal and N. Allen

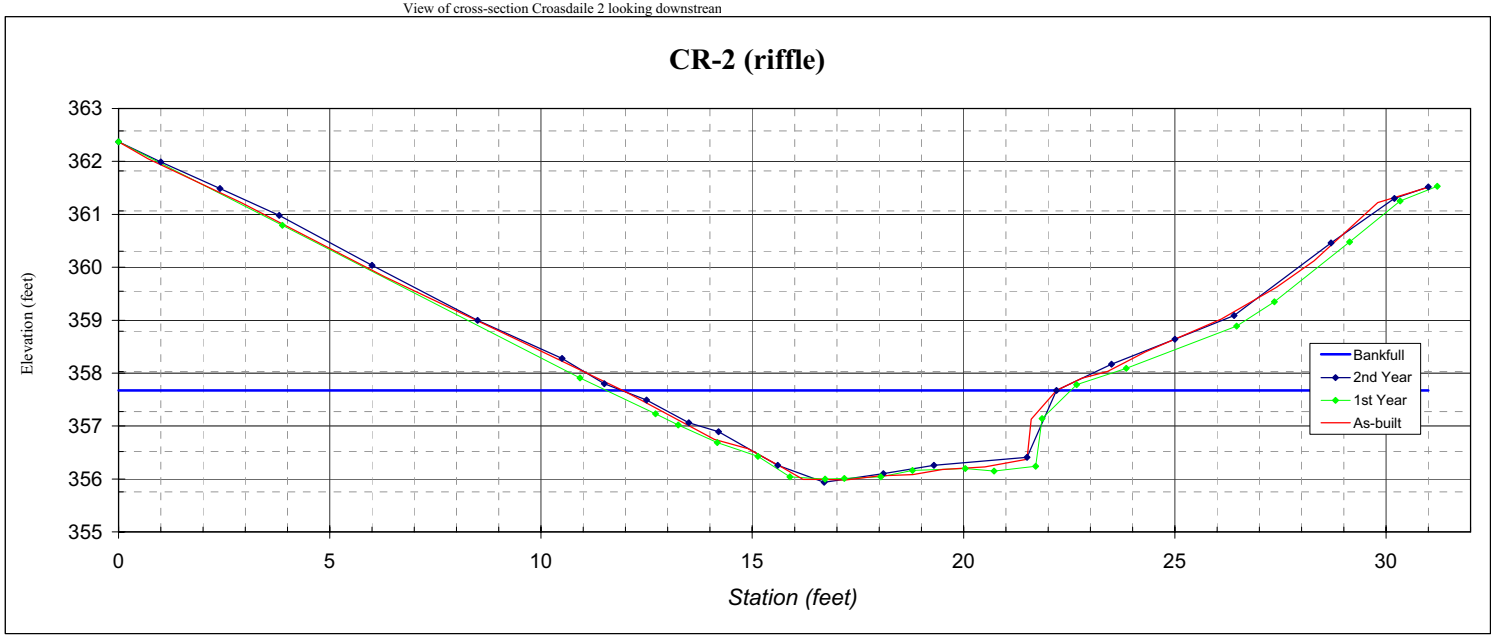
Station	Rod Ht.	Elevation
0	3.31	362.37
1	3.69	361.99
2.4	4.19	361.49
3.8	4.7	360.98
6	5.64	360.04
8.5	6.68	359.00
10.5	7.4	358.28
11.5	7.88	357.80
12.5	8.19	357.49
13.5	8.62	357.06
14.2	8.79	356.89
15.6	9.42	356.26
16.7	9.74	355.94
18.1	9.58	356.10
19.3	9.42	356.26
21.5	9.27	356.41
22.2	8.01	357.67
23.5	7.51	358.17
25	7.04	358.64
26.4	6.59	359.09
28.7	5.22	360.46
30.2	4.38	361.30
31	4.16	361.52

SUMMARY DATA

Floodprone Elevation (ft)	359.40
Bankfull Elevation (ft)	357.67
Floodprone Width (ft)	23.30
Bankfull Width (ft)	10.28
Entrenchment Ratio	2.27
Mean Depth (ft)	1.14
Maximum Depth (ft)	1.73
Width/Depth Ratio	9.06
Bankfull Area (sq ft)	11.67
Wetted Perimeter (ft)	11.36
Hydraulic Radius (ft)	1.03

Stream Type: C4

View of cross-section Croasdaile 2 looking downstrean

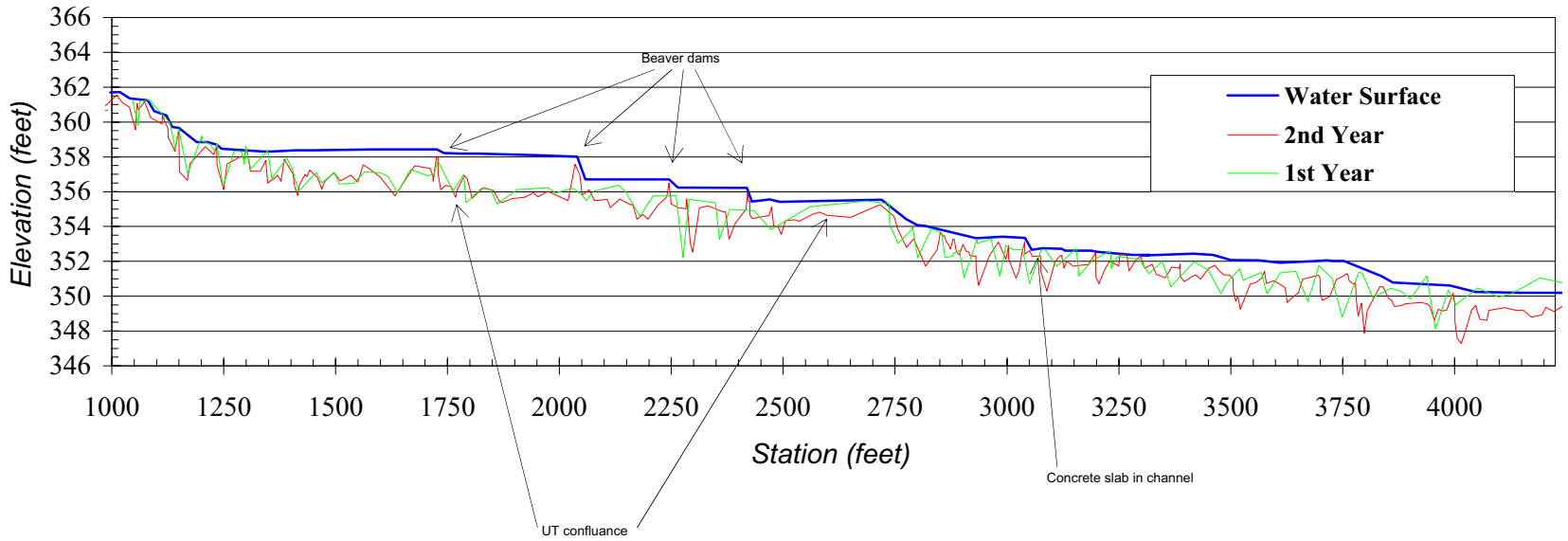


River Basin:	Neuse
Watershed:	Ellerbe Creek
Reach:	HB&HD
Profile ID:	Profile 1
Date:	7 December 2006
Field Crew:	J. O'Neal and S. Doig

Additional Reach Parameters	
Valley Length (ft)	3050
Channel Length (ft)	3398
Sinuosity	1.114098
Water Surface Slope (ft/ft)	0.003464
BF slope (ft/ft)	0.001757
Rosgen Classification	C5
Habitat Index	NA
Macrobenthos	NA

Pattern	min	max	average
Channel Beltwidth (ft)	22.64	42.87	33.88
Radius of Curvature (ft)	24.58	103.19	69.42
Meander Wavelength	161.93	200.76	177.65
Meander Width ratio			1.14
Profile	min	max	average
Riffle length (ft)	3.54	70.53	22.91
Riffle slope (ft/ft)	0.001	0.175	0.042
Pool length (ft)	18.18	425.86	118.60
Pool spacing (ft)	0.77	51.72	18.78

Ellerbe Creek Longitudinal Profile



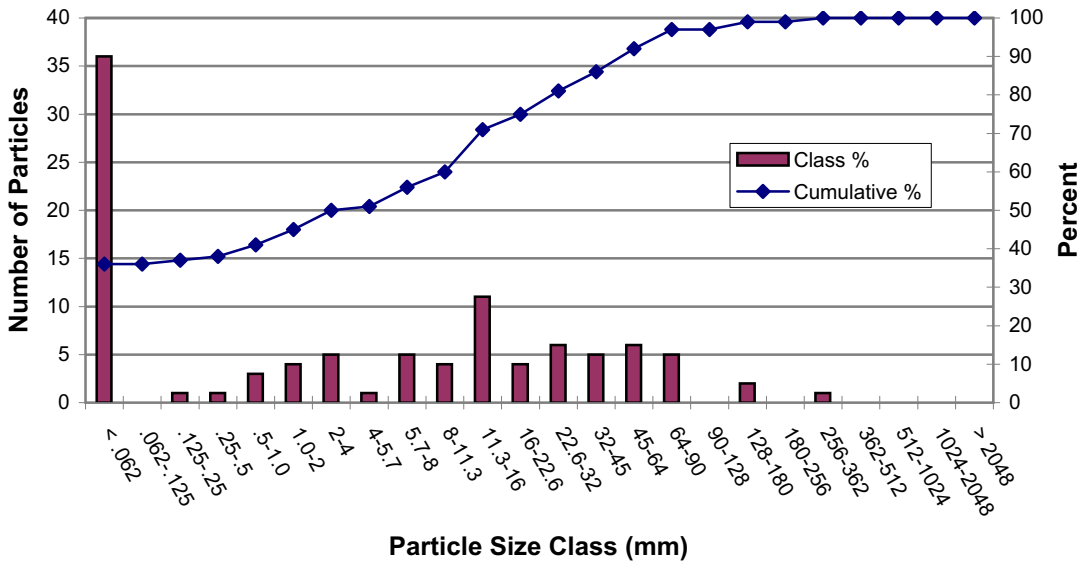
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006 - Project 127

Cross Section HB-XS1

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	36	36	36
Sand	Very Fine Sand	.062-.125	0	0	36
	Fine Sand	.125-.25	1	1	37
	Medium Sand	.25-.5	1	1	38
	Coarse Sand	.5-1.0	3	3	41
	Very Course Sand	1.0-2	4	4	45
Gravel	Very Fine Gravel	2-4	5	5	50
	Fine Gravel	4-5.7	1	1	51
	Fine Gravel	5.7-8	5	5	56
	Medium Gravel	8-11.3	4	4	60
	Medium Gravel	11.3-16	11	11	71
	Coarse Gravel	16-22.6	4	4	75
	Coarse Gravel	22.6-32	6	6	81
	Very Course Gravel	32-45	5	5	86
	Very Course Gravel	45-64	6	6	92
Cobble	Small Cobble	64-90	5	5	97
	Small Cobble	90-128	0	0	97
	Medium Cobble	128-180	2	2	99
	Large Cobble	180-256	0	0	99
Boulder	Small Boulders	256-362	1	1	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 4.0 mm

d_{84} = 39.8 mm



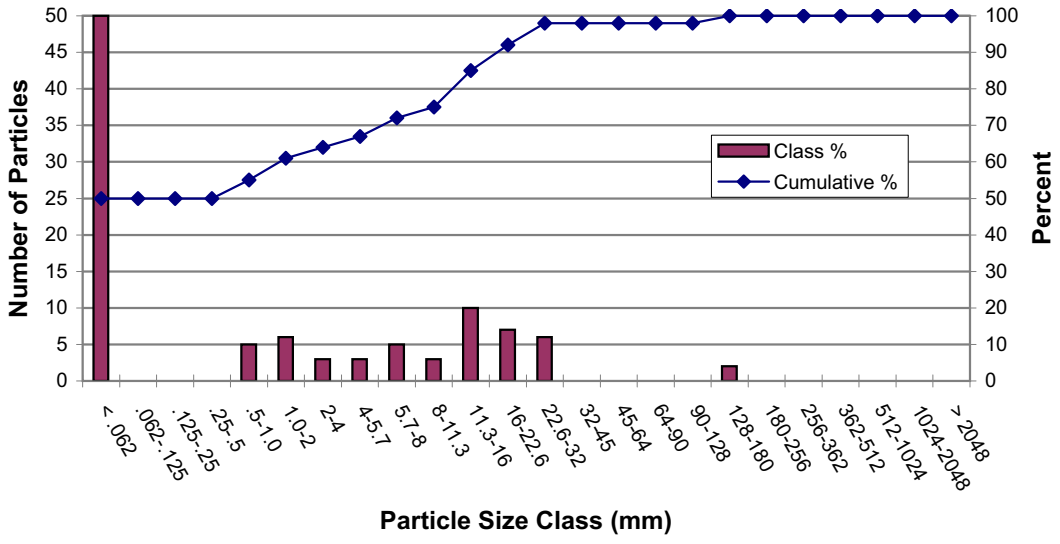
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section HB-XS2

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	50	50	50
Sand	Very Fine Sand	.062-.125	0	0	50
	Fine Sand	.125-.25	0	0	50
	Medium Sand	.25-.5	0	0	50
	Coarse Sand	.5-1.0	5	5	55
	Very Course Sand	1.0-2	6	6	61
Gravel	Very Fine Gravel	2-4	3	3	64
	Fine Gravel	4-5.7	3	3	67
	Fine Gravel	5.7-8	5	5	72
	Medium Gravel	8-11.3	3	3	75
	Medium Gravel	11.3-16	10	10	85
	Coarse Gravel	16-22.6	7	7	92
	Coarse Gravel	22.6-32	6	6	98
	Very Course Gravel	32-45	0	0	98
	Very Course Gravel	45-64	0	0	98
Cobble	Small Cobble	64-90	0	0	98
	Small Cobble	90-128	0	0	98
	Medium Cobble	128-180	2	2	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 0.06 mm

d_{84} = 15.53 mm



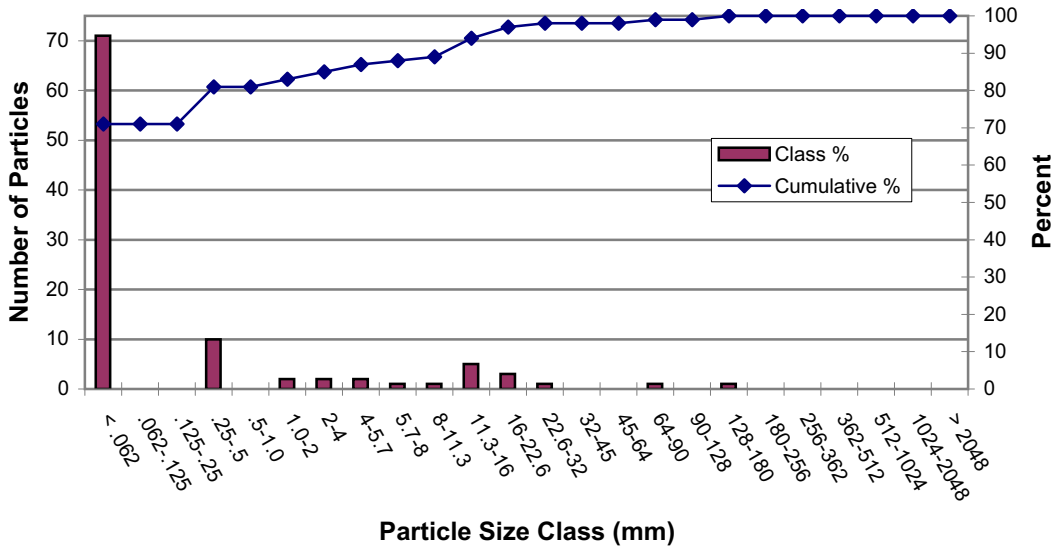
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section HB-XS3

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	71	71	71
Sand	Very Fine Sand	.062-.125	0	0	71
	Fine Sand	.125-.25	0	0	71
	Medium Sand	.25-.5	10	10	81
	Coarse Sand	.5-1.0	0	0	81
	Very Course Sand	1.0-2	2	2	83
Gravel	Very Fine Gravel	2-4	2	2	85
	Fine Gravel	4-5.7	2	2	87
	Fine Gravel	5.7-8	1	1	88
	Medium Gravel	8-11.3	1	1	89
	Medium Gravel	11.3-16	5	5	94
	Coarse Gravel	16-22.6	3	3	97
	Coarse Gravel	22.6-32	1	1	98
	Very Course Gravel	32-45	0	0	98
	Very Course Gravel	45-64	0	0	98
Cobble	Small Cobble	64-90	1	1	99
	Small Cobble	90-128	0	0	99
	Medium Cobble	128-180	1	1	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 0.04 mm

d_{84} = 3.0 mm



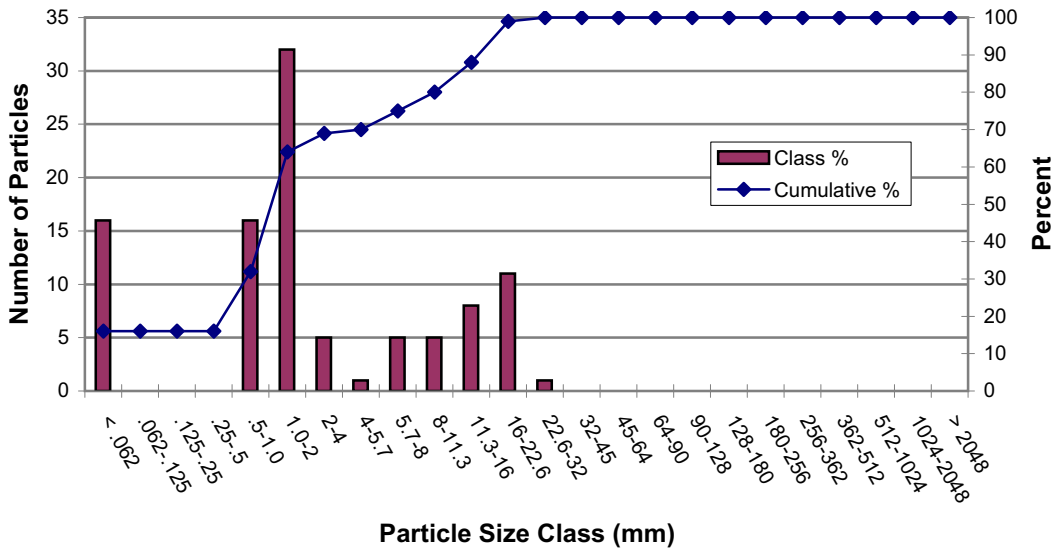
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section HB-XS4

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	16	16	16
Sand	Very Fine Sand	.062-.125	0	0	16
	Fine Sand	.125-.25	0	0	16
	Medium Sand	.25-.5	0	0	16
	Coarse Sand	.5-1.0	16	16	32
	Very Course Sand	1.0-2	32	32	64
Gravel	Very Fine Gravel	2-4	5	5	69
	Fine Gravel	4-5.7	1	1	70
	Fine Gravel	5.7-8	5	5	75
	Medium Gravel	8-11.3	5	5	80
	Medium Gravel	11.3-16	8	8	88
	Coarse Gravel	16-22.6	11	11	99
	Coarse Gravel	22.6-32	1	1	100
	Very Course Gravel	32-45	0	0	100
	Very Course Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 1.56 mm

d_{84} = 13.65 mm



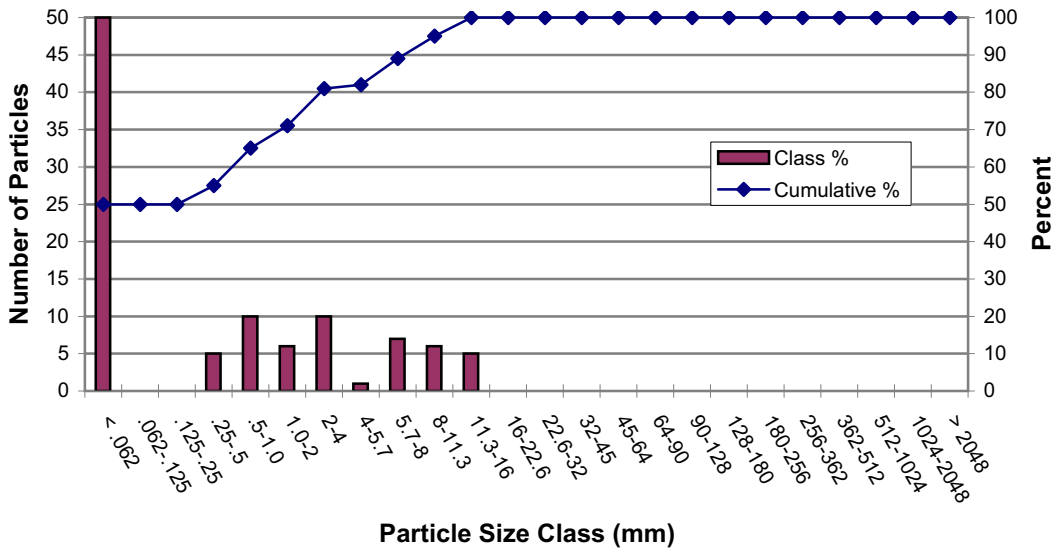
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section HD-XS1

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	50	50	50
Sand	Very Fine Sand	.062-.125	0	0	50
	Fine Sand	.125-.25	0	0	50
	Medium Sand	.25-.5	5	5	55
	Coarse Sand	.5-1.0	10	10	65
	Very Course Sand	1.0-2	6	6	71
Gravel	Very Fine Gravel	2-4	10	10	81
	Fine Gravel	4-5.7	1	1	82
	Fine Gravel	5.7-8	7	7	89
	Medium Gravel	8-11.3	6	6	95
	Medium Gravel	11.3-16	5	5	100
	Coarse Gravel	16-22.6	0	0	100
	Coarse Gravel	22.6-32	0	0	100
	Very Course Gravel	32-45	0	0	100
	Very Course Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 0.06 mm

d_{84} = 6.36 mm



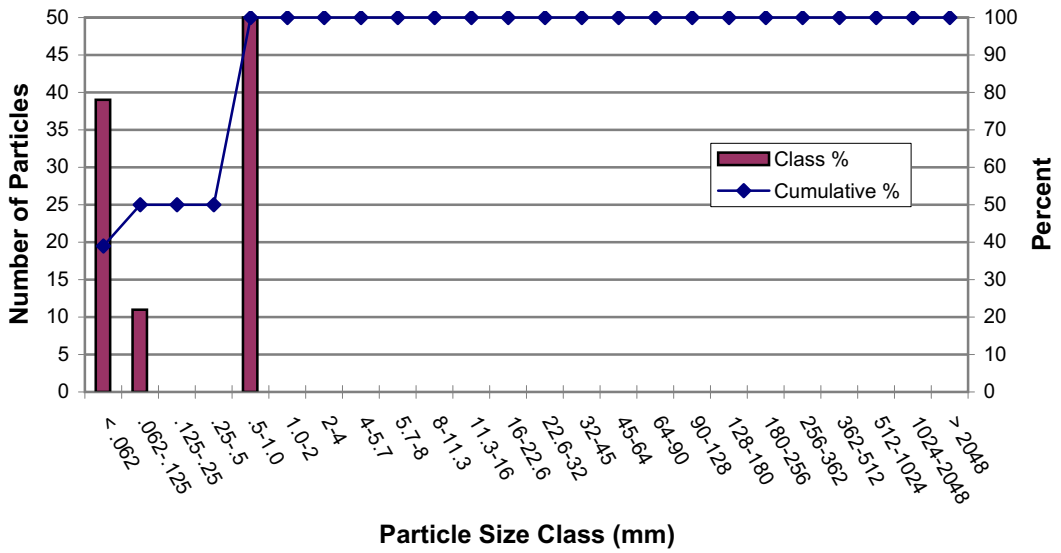
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section HD-XS2

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	39	39	39
Sand	Very Fine Sand	.062-.125	11	11	50
	Fine Sand	.125-.25	0	0	50
	Medium Sand	.25-.5	0	0	50
	Coarse Sand	.5-1.0	50	50	100
	Very Course Sand	1.0-2	0	0	100
Gravel	Very Fine Gravel	2-4	0	0	100
	Fine Gravel	4-5.7	0	0	100
	Fine Gravel	5.7-8	0	0	100
	Medium Gravel	8-11.3	0	0	100
	Medium Gravel	11.3-16	0	0	100
	Coarse Gravel	16-22.6	0	0	100
	Coarse Gravel	22.6-32	0	0	100
	Very Course Gravel	32-45	0	0	100
	Very Course Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 0.13 mm

d_{84} = 0.84 mm



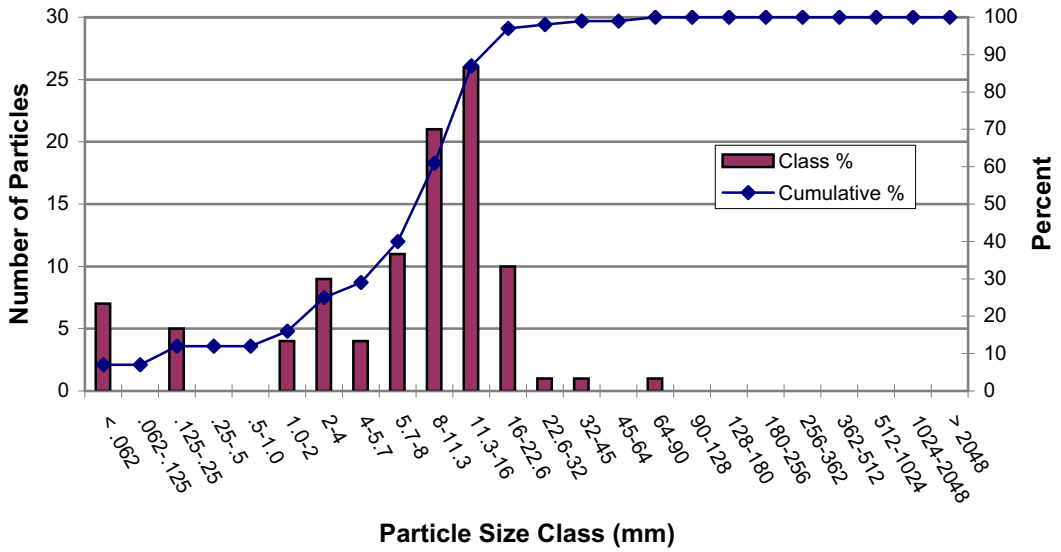
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section HD-XS3

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	7	7	7
Sand	Very Fine Sand	.062-.125	0	0	7
	Fine Sand	.125-.25	5	5	12
	Medium Sand	.25-.5	0	0	12
	Coarse Sand	.5-1.0	0	0	12
	Very Course Sand	1.0-2	4	4	16
Gravel	Very Fine Gravel	2-4	9	9	25
	Fine Gravel	4-5.7	4	4	29
	Fine Gravel	5.7-8	11	11	40
	Medium Gravel	8-11.3	21	21	61
	Medium Gravel	11.3-16	26	26	87
	Coarse Gravel	16-22.6	10	10	97
	Coarse Gravel	22.6-32	1	1	98
	Very Course Gravel	32-45	1	1	99
	Very Course Gravel	45-64	0	0	99
Cobble	Small Cobble	64-90	1	1	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} =9.57 mm

d_{84} = 15.46 mm



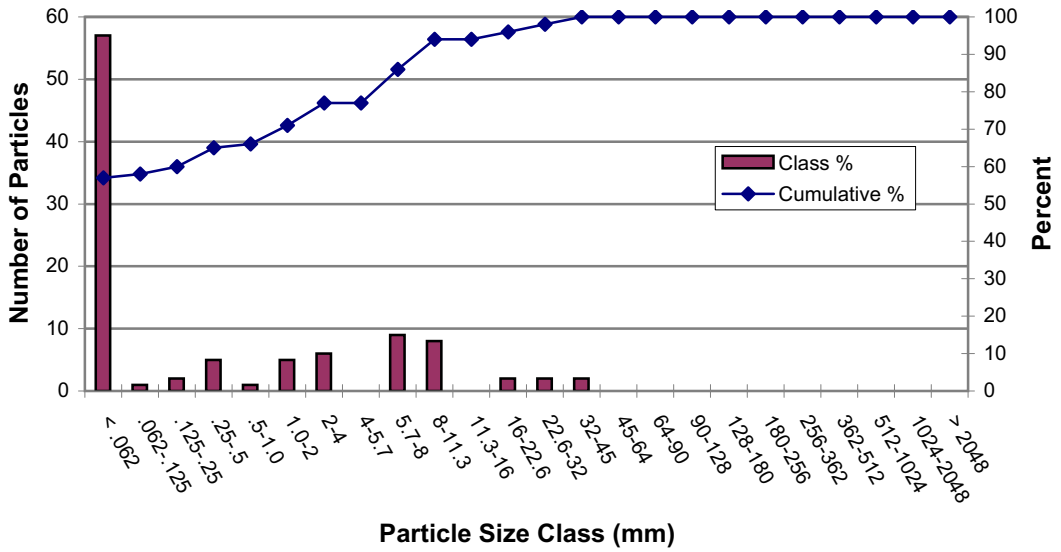
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section HD-XS4

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	57	57	57
Sand	Very Fine Sand	.062-.125	1	1	58
	Fine Sand	.125-.25	2	2	60
	Medium Sand	.25-.5	5	5	65
	Coarse Sand	.5-1.0	1	1	66
	Very Course Sand	1.0-2	5	5	71
Gravel	Very Fine Gravel	2-4	6	6	77
	Fine Gravel	4-5.7	0	0	77
	Fine Gravel	5.7-8	9	9	86
	Medium Gravel	8-11.3	8	8	94
	Medium Gravel	11.3-16	0	0	94
	Coarse Gravel	16-22.6	2	2	96
	Coarse Gravel	22.6-32	2	2	98
	Very Course Gravel	32-45	2	2	100
	Very Course Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 0.05 mm

d_{84} = 7.49 mm



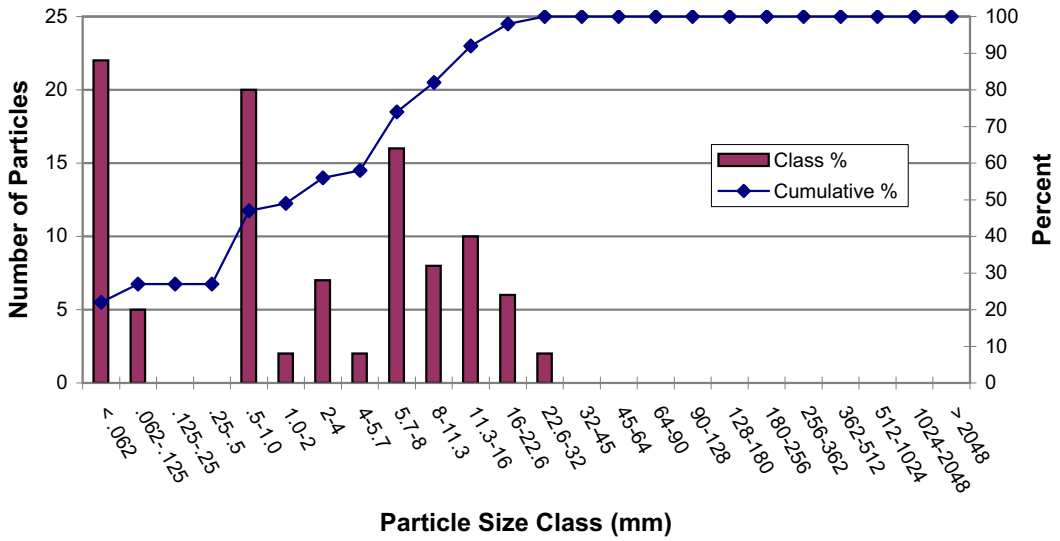
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section AL-XS1

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	22	22	22
Sand	Very Fine Sand	.062-.125	5	5	27
	Fine Sand	.125-.25	0	0	27
	Medium Sand	.25-.5	0	0	27
	Coarse Sand	.5-1.0	20	20	47
	Very Course Sand	1.0-2	2	2	49
Gravel	Very Fine Gravel	2-4	7	7	56
	Fine Gravel	4-5.7	2	2	58
	Fine Gravel	5.7-8	16	16	74
	Medium Gravel	8-11.3	8	8	82
	Medium Gravel	11.3-16	10	10	92
	Coarse Gravel	16-22.6	6	6	98
	Coarse Gravel	22.6-32	2	2	100
	Very Course Gravel	32-45	0	0	100
	Very Course Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 2.29 mm

d_{84} = 12.24 mm



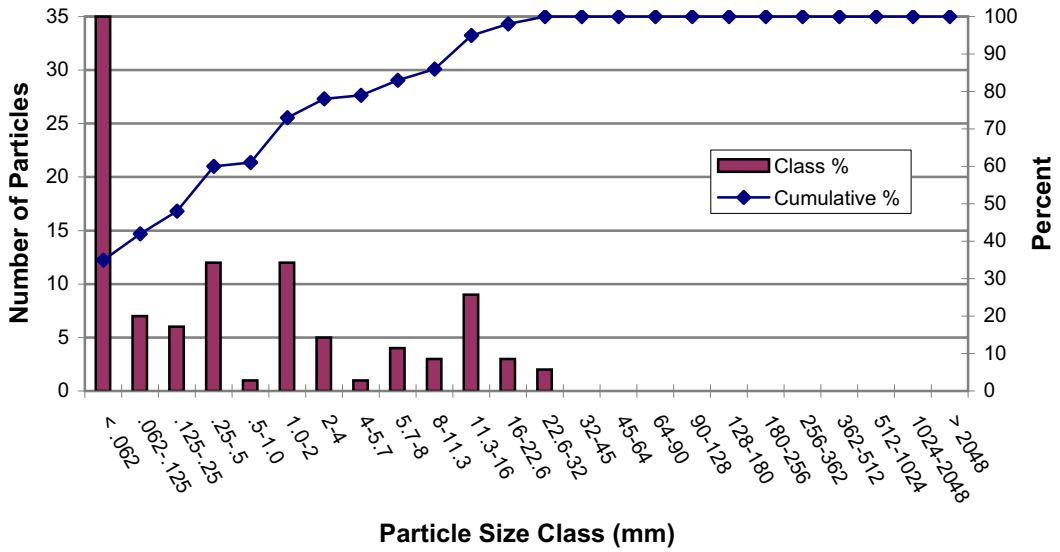
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section AL-XS2

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	35	35	35
Sand	Very Fine Sand	.062-.125	7	7	42
	Fine Sand	.125-.25	6	6	48
	Medium Sand	.25-.5	12	12	60
	Coarse Sand	.5-1.0	1	1	61
	Very Course Sand	1.0-2	12	12	73
Gravel	Very Fine Gravel	2-4	5	5	78
	Fine Gravel	4-5.7	1	1	79
	Fine Gravel	5.7-8	4	4	83
	Medium Gravel	8-11.3	3	3	86
	Medium Gravel	11.3-16	9	9	95
	Coarse Gravel	16-22.6	3	3	98
	Coarse Gravel	22.6-32	2	2	100
	Very Course Gravel	32-45	0	0	100
	Very Course Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 0.29 mm

d_{84} = 9.1 mm



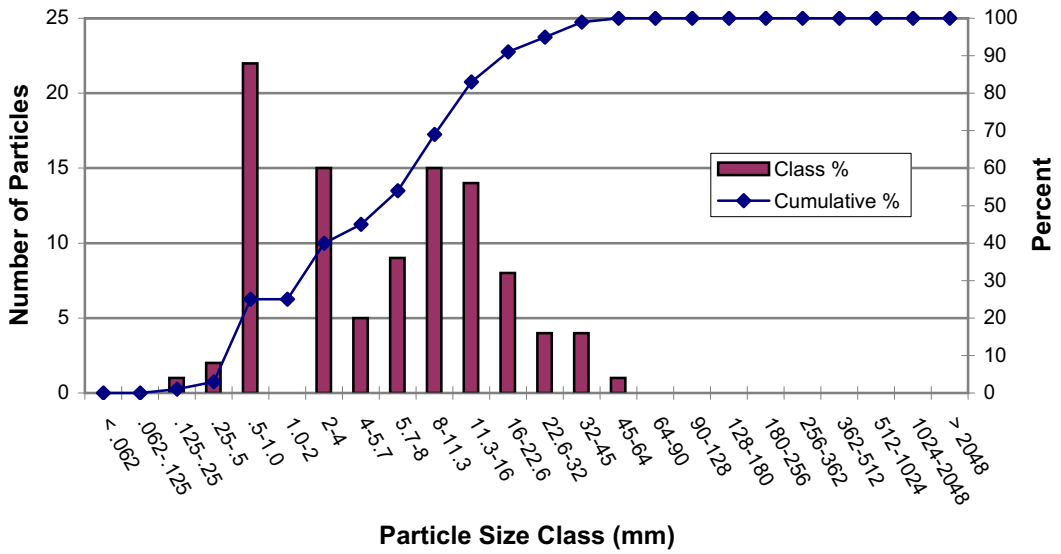
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section AL-XS3

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	0	0	0
Sand	Very Fine Sand	.062-.125	0	0	0
	Fine Sand	.125-.25	1	1	1
	Medium Sand	.25-.5	2	2	3
	Coarse Sand	.5-1.0	22	22	25
	Very Course Sand	1.0-2	0	0	25
Gravel	Very Fine Gravel	2-4	15	15	40
	Fine Gravel	4-5.7	5	5	45
	Fine Gravel	5.7-8	9	9	54
	Medium Gravel	8-11.3	15	15	69
	Medium Gravel	11.3-16	14	14	83
	Coarse Gravel	16-22.6	8	8	91
	Coarse Gravel	22.6-32	4	4	95
	Very Course Gravel	32-45	4	4	99
	Very Course Gravel	45-64	1	1	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 6.98 mm

d_{84} = 16.83 mm



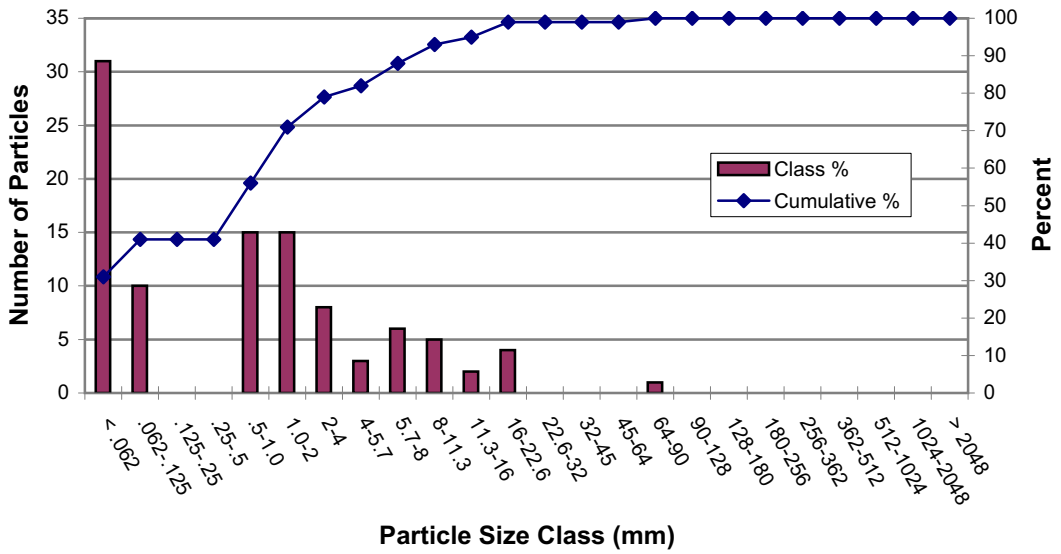
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section AL-XS4

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	31	31	31
Sand	Very Fine Sand	.062-.125	10	10	41
	Fine Sand	.125-.25	0	0	41
	Medium Sand	.25-.5	0	0	41
	Coarse Sand	.5-1.0	15	15	56
	Very Course Sand	1.0-2	15	15	71
Gravel	Very Fine Gravel	2-4	8	8	79
	Fine Gravel	4-5.7	3	3	82
	Fine Gravel	5.7-8	6	6	88
	Medium Gravel	8-11.3	5	5	93
	Medium Gravel	11.3-16	2	2	95
	Coarse Gravel	16-22.6	4	4	99
	Coarse Gravel	22.6-32	0	0	99
	Very Course Gravel	32-45	0	0	99
	Very Course Gravel	45-64	0	0	99
Cobble	Small Cobble	64-90	1	1	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 0.8 mm

d_{84} = 6.47 mm



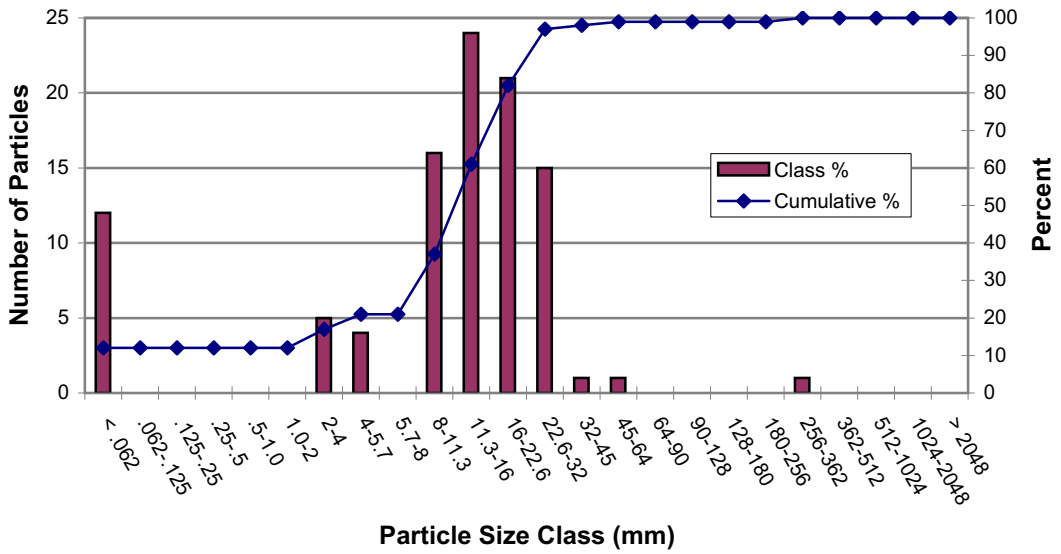
B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section CR-XS1

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	12	12	12
Sand	Very Fine Sand	.062-.125	0	0	12
	Fine Sand	.125-.25	0	0	12
	Medium Sand	.25-.5	0	0	12
	Coarse Sand	.5-1.0	0	0	12
	Very Course Sand	1.0-2	0	0	12
Gravel	Very Fine Gravel	2-4	5	5	17
	Fine Gravel	4-5.7	4	4	21
	Fine Gravel	5.7-8	0	0	21
	Medium Gravel	8-11.3	16	16	37
	Medium Gravel	11.3-16	24	24	61
	Coarse Gravel	16-22.6	21	21	82
	Coarse Gravel	22.6-32	15	15	97
	Very Course Gravel	32-45	1	1	98
	Very Course Gravel	45-64	1	1	99
Cobble	Small Cobble	64-90	0	0	99
	Small Cobble	90-128	0	0	99
	Medium Cobble	128-180	0	0	99
	Large Cobble	180-256	0	0	99
Boulder	Small Boulders	256-362	1	1	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 13.85 mm

d_{84} = 23.85 mm



B7. Pebble Count - Ellerbe Creek Stream Restoration Second Year Monitoring 11/1/2006- Project 127

Cross Section CR-XS2

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< .062	28	28	28
Sand	Very Fine Sand	.062-.125	1	1	29
	Fine Sand	.125-.25	0	0	29
	Medium Sand	.25-.5	0	0	29
	Coarse Sand	.5-1.0	2	2	31
	Very Course Sand	1.0-2	1	1	32
Gravel	Very Fine Gravel	2-4	6	6	38
	Fine Gravel	4-5.7	0	0	38
	Fine Gravel	5.7-8	8	8	46
	Medium Gravel	8-11.3	9	9	55
	Medium Gravel	11.3-16	13	13	68
	Coarse Gravel	16-22.6	9	9	77
	Coarse Gravel	22.6-32	14	14	91
	Very Course Gravel	32-45	1	1	92
	Very Course Gravel	45-64	2	2	94
Cobble	Small Cobble	64-90	1	1	95
	Small Cobble	90-128	3	3	98
	Medium Cobble	128-180	1	1	99
	Large Cobble	180-256	0	0	99
Boulder	Small Boulders	256-362	1	1	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
	Total		100		

d_{50} = 9.47 mm

d_{84} = 27.3 mm