

BROCK STREAM RESTORATION SITE Monitoring Year 5 (2013)

**Jones County, North Carolina
EEP Project No. 92333**



**Prepared for the
NC Department of Environment and Natural Resources
Ecosystem Enhancement Program**



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Final Monitoring Report

December 2013

Prepared by:



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A handwritten signature in black ink, appearing to read "G. Lane Sauls, Jr.", is positioned above a horizontal line.

G. Lane Sauls, Jr., Principal

*This report follows methodologies consistent with the Content, Format and Data Requirements
for EEP Monitoring Reports, Version 1.2 (11/16/06)*

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SECTION I. EXECUTIVE SUMMARY/ PROJECT ABSTRACT

Ecological Engineering, LLP (Ecological Engineering) entered into contract with the NC Department of Environment and Natural Resources, Ecosystem Enhancement Program (EEP) in October 2009 to conduct annual monitoring assessments at the Brock Site in Jones County, North Carolina. The following document depicts our findings and recommendations with regard to the Year 5 (2013) monitoring assessment.

The Brock Stream Restoration Project was implemented using methodologies consistent with Coastal Plain headwater stream and buffer restoration. The stream, an unnamed tributary (UT) to Chinquapin Branch, was restored using a modified Priority 3 level of restoration. Specifically, the project involved the excavation of a floodplain along the entire 1,850 linear-foot stream reach. Excavation was limited to the right side of the channel facing downstream due to a cemetery and other constraints occurring along the left stream bank.

Vegetation Monitoring

Monitoring Year (MY) 5 vegetation monitoring assessments were performed using Carolina Vegetation Survey (CVS) Level II Assessment Protocols. Four permanent plot locations were established and located during the as-built surveys. Each plot covers 100 square meters and is shaped in the form of a 10-meter by 10-meter square. The number of plots was determined by CVS software and individual locations were randomly selected based on the planned community types.

All planted areas at the Brock Site are associated with either the generation of Stream Mitigation Unit (SMU), Buffer Mitigation Unit (BMU) or Nutrient Offset Nitrogen Reduction Buffer Restoration. Based on the MY 5 findings, all three vegetation plots met the vegetation success criteria for stream mitigation credit and three of four vegetation plots met the success criteria for BMU or Nutrient Offset Buffer Restoration mitigation credit. Planted stem count averages for SMU and BMU calculations across the Site were 768 and 637 stems/acre, respectively. These averages exceeded the required mitigation thresholds.

Stream Restoration Monitoring

Stream monitoring assessments were conducted using surveys and comparisons of three existing cross sections along the unnamed tributary. No problems were noted. Bankfull dimensions differed only minimally from last year's results; however, no erosion, entrenchment or incision was observed. Based on the data collected and visual observations, the Brock Site is functioning similar to that of a Coastal Plain headwater stream system.

A bankfull event has been measured each of the past five years of monitoring, thus exceeding the minimum success criteria established for hydrology.

SECTION II. PROJECT BACKGROUND

A. Project Objectives

According to EEP (2010), the project specific goals at the Brock Site needed to achieve desired ecological function include:

- Improvement of water quality by limiting bank erosion;
- Enhance 1,850 linear feet of stable stream channel (Stream Enhancement category II);
- Restoration of 6.2 acres of riparian buffer along the project reach (4.23 acres associated with the 50-foot buffer and 1.97 acres associated with the buffer beyond 50 feet);
- Improvement of aquatic and terrestrial habitat within the UT to Big Chinquapin Branch; and,
- The 40-foot wide floodplain bench will dissipate the flow and maintain channel stability during moderate to high discharge events.

The Project Site is located in Jones County and surrounded by areas of intense agricultural land use (Figure 1). As part of project implementation, the riparian buffer was reforested along the restored floodplain. This buffer restoration reconnects existing forested buffers along Big Chinquapin Branch and provides a wooded, although very narrow, corridor for wildlife. The buffer also intercepts overland flow from agricultural fields on the Brock property (EEP, 2006). In addition, EEP (2006) states that buffer reforestation at this site will reduce the input of nutrients from the fields to the waters downstream of the unnamed tributary to Big Chinquapin Branch, designated as nutrient sensitive waters by the NC Division of Water Resources (NCDWR). A project asset map is depicted in Figure 2.

B. Project Structure, Restoration Type and Approach

The watershed encompassing the Project Site is located in the eastern portion of the Coastal Plain Physiographic Province. Slopes are generally less than four percent. Elevations on the Brock Site range from approximately 39 to 52 feet above mean sea level. The soil survey for Jones County (Barnhill, 1981) indicates that the area is underlain by Goldsboro loamy sand, Grifton fine sandy loam, Lynchburg fine sandy loam, Muckalee loam, and Norfolk loamy sand (EEP, 2006).

The watershed is a mixture of forested lands, agricultural row crops, two-lane roadways, farm roads, cemeteries, minor culverts, and a few single-family homes. Agricultural drainage features, including ditches and drain tiles, have been constructed and maintained on the Brock and neighboring properties. The Brock Site and adjacent properties are utilized primarily for agricultural purposes (EEP, 2006).

According to EEP (2010), the project reach was designed using a Priority III approach which qualifies for Stream Enhancement Level II mitigation credit. Prior to restoration, the UT to Big Chinquapin Branch was incised and could not easily access its floodplain. Pre-restoration existing shear stress and stream power were compared with the design in order to evaluate aggradation and degradation. The state of the channel before restoration was shown to be capable of handling the system's flow and sediment supply. Buffer reforestation was conducted along the restoration reaches extending beyond 50 feet on either side of the channel to the limits of the conservation easement. The planting plan was based on the hydrology of the site, the surrounding vegetative communities, and available supply of native species. The plan is modeled after mature, unaltered systems as outlined in the *Natural Communities of North Carolina* (Schafale and Weakley,

1990). The newly excavated floodplain was planted with a Coastal Plain Bottomland Hardwood Forest community. Remaining areas outside the floodplain, excluding a small cemetery along the left bank, were planted as a Mesic Mixed Hardwood Forest Coastal Plain Subtype (EEP, 2010).

The US Army Corps of Engineers and NC Division of Water Quality (USACE, 2005) released a draft mitigation guidance document related to stream restoration in the outer Coastal Plain of North Carolina in 2005. This guidance, developed in cooperation with NCDWQ, addresses mitigation credits for headwater streams. Many natural headwater streams and wetlands in the Coastal Plain were historically channelized for agricultural purposes. A number of these channels, including the UT associated with the Brock Site, are eroding and lack functionality and habitat. While many of these areas would benefit from restoration, traditional natural channel design with pattern and profile has been determined to be inappropriate for all coastal headwater streams. The driving factor behind this guidance is that it is difficult to discern the original condition of these first order channels: whether they were historically intermittent streams or headwater wetlands. Emphasis is now being placed on restoring habitat and floodplain functionality to these types of channels. The Brock Site is one of the pioneer EEP projects utilizing these updated guidelines. As a result, traditional yearly monitoring activities have been revised to better address this type of restoration.

The health of a watershed is dependent on the quality of the headwater system(s), individual tributaries, and major channels. High quality tributaries with vegetated buffers filter contaminants, maintain moderate water temperatures, provide high quality aquatic and terrestrial habitat and regulate flows downstream. Big Chinquapin Branch is a major tributary to the Trent River, and both water bodies are nutrient sensitive (NCDWQ, 1998). In addition, Big Chinquapin Branch is managed by a Drainage District. Agricultural land use practices have narrowed or removed many natural, vegetated buffers along streams within the Trent River watershed as well as draining and converting non-riverine wet hardwood forests to cropland (EEP, 2006).

According to EEP (2006), this restoration will enhance functional elements of the unnamed tributary. The Brock Restoration Plan outlines the restoration of the UT to Chinquapin Branch and the reforestation of the associated riparian buffer. This involves the creation of a stable channel, riverine floodplain, and associated riparian buffer. Priority 3 stream restoration was implemented on the unnamed tributary. This involved reconnecting the stream channel to its floodplain, allowing for periodic overbank flooding. To reduce construction costs and avoid disturbing the cemetery, a bankfull bench was excavated along east side of the existing channel. Water quality functions will be improved due to the creation of more storage for floodwaters and increased filtering of pollutants. Wetlands are expected to form within portions of the newly created bankfull bench, especially in the downstream section of the project where backwater from Chinquapin Branch will affect the stream. Barring water quality issues outside of the Brock Site, the restoration should improve aquatic species diversity and abundance in the stream channel. The restoration of riparian buffers along the restored stream channel will improve water quality. The reestablishment of the riparian buffers with hardwood species will also improve wildlife habitat on the property. These measures will improve the physical, chemical, and biological components of the unnamed tributary and the Brock property, as well as Big Chinquapin Branch and other downstream waters (EEP, 2006).

C. Location and Setting

The Project Site is situated in Jones County, approximately 12 miles southeast of Kinston and eight miles west-northwest of Trenton (Figure 1) along an unnamed tributary to Big Chinquapin Branch. Its watershed is part of the Coastal Plain physiographic province, covering approximately 315 acres.

The following directions are provided for accessing the Brock Project Site:

- From US 70 in Kinston, Proceed east on NC 58 approximately 12 miles.
- Turn left onto the gravel farm road approximately one-third mile after passing the intersection with the second loop of Pine Street on the left.
- Proceed approximately 800 feet along the gravel farm road.
- Project Site is located to the immediate east (right side) of road.

D. History and Background

The Project Site is undergoing its fifth year of post-construction monitoring. The following exhibit tables depict the components for restoration, project activity and reporting, contact information for all individuals responsible for implementation and project background information.

Exhibit Table I. Project Restoration Components Brock Site (EEP Project No. 92333)							
Project Segment or Reach ID	Existing Feet	Type	Approach	Mitigation Ratio	Mitigation Units	Stationing	Comment
Reach 1 – UT to Big Chinquapin Branch	1,850	EII	P3	1.5:1	1,233	0+00 - 28+50.16	
Nutrient Offset Nitrogen Reduction Credit (>50' from Top of Bank)	n/a	n/a	n/a	n/a	149.27 lbs/year	n/a	Calculated by 77.57N lbs/ac/yr x 1.97 acres
Neuse Buffer (<50' from Top of Bank)	n/a	R	n/a	1:1	4.23	n/a	
Nutrient Offset Buffer (>50' from Top of Bank)	n/a	R	n/a	1:1	1.97	n/a	
Mitigation Unit Summations							
Stream (lf)	Riparian Wetland (ac)	Non-riparian Wetland (ac)	Total Wetland (ac)	Buffer (ac)	Nutrient Offset Nitrogen Reduction Credit		
1,233				6.20*	149.27 lbs/yr for 30 years		

EII = Enhancement II

R = Restoration

P3 = Priority Level III

Source: EEP, 2010

Nutrient Offset calculations are per NCDWR recommendation.

Exhibit Table II. Project Activity and Reporting History
Brock Site (EEP Project No. 92333)

Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	May 2006	May 2006
Final Design (90%)	n/a	April 2008
Construction	n/a	June 2009
Temporary S&E Mix Applied	n/a	June 2009
Permanent Seed Mix Applied	n/a	June 2009
Bare Root Seedling Installation	n/a	Unknown
Mitigation Plan/ As-Built (Year 0 Monitoring- baseline)	n/a	August 2010
Year 1 Monitoring	December 2009	January 2011
Planting required to meet original construction specification	n/a	February 2010
Year 2 Monitoring	July 2010	January 2011
Year 3 Monitoring	August 2011	September 2011
Year 4 Monitoring	August 2012	December 2012
Year 5 Monitoring	November 2013	December 2013

Exhibit Table III. Project Contact Table
Brock Site (EEP Project No. 92333)

Designer	Stantec Consulting Services, Inc. 801 Jones Franklin Road Suite 300 Raleigh, NC 27606 Nathan Jean (919) 865-7387	
Primary Project Design POC		
Construction Contractor	Shamrock Environmental Corporation 6106 Corporate Park Drive Browns Summit, NC 27214 Unknown	
Construction Contractor POC		
Planting Contractor	Natives 550 E. Westinghouse Blvd. Charlotte, NC 28273 (704) 527-1177	Supplemental (2013) - HARP 301 McCullough Drive, 4 th floor Charlotte, NC 28262 (704) 841-2841
Planting Contractor POC		
Seeding Contractor	Seal Brothers Contracting P.O Box 86 Dobson, NC 27017 Mari Seal (336) 786-2263	
Planting Contractor POC		
Seed Mix Source	Unknown	
Nursery Stock Suppliers	Natives 550 E. Westinghouse Blvd. Charlotte, NC 28273 (704) 527-1177	
Monitoring Performer	Ecological Engineering, LLP 1151 SE Cary Parkway, Suite 101 Cary, NC 27518	
Stream Monitoring POC	Lane Sauls (919) 557-0929	
Vegetation Monitoring POC	Lane Sauls (919) 557-0929	

Exhibit Table IV. Project Background Table
Brock Site (EEP Project No. 92333)

Project County	Jones County
Drainage Area	315 acres (0.5 sq. miles) – Unnamed Tributary
Impervious Cover Estimate	Less than 5%
Stream Order	1 – Unnamed Tributary
Physiographic Region	Coastal Plain
Ecoregion (Griffith and Omernik)	Carolina Flatwoods
Rosgen Classification of As-built	E5
Cowardin Classification	n/a
Dominant Soil Types	Goldsboro loamy sand, Grifton fine sandy loam, Lynchburg fine sandy loam, Muckalee loam and Norfolk loamy sand
Reference Site ID	Unknown/ Not Applicable
USGS HUC for Project and Reference	03020204010060
NCDWQ Sub-basin for Project and Reference	03-04-11
Any Portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment.	No
Reason for 303d listing or stressor	Not Applicable
Percent of project easement fenced	0%

Source: EEP, 2010

E. Monitoring Plan View

The Monitoring Plan View drawings associated with the project are provided as part of Figure 3.

SECTION III. PROJECT CONDITION AND MONITORING RESULTS

As previously mentioned, monitoring activities at the Brock Site are tailored to assessing Coastal Plain headwater stream systems and their corresponding buffers. Ecological Engineering conducted vegetation assessments and stream assessments as part of yearly monitoring requirements.

A. Vegetation Assessment

Four 100 meter² vegetation plots were monitored using Carolina Vegetation Survey (CVS) protocol Level II assessments. The remaining portions of the Project Site were visually assessed.

1. Stem Counts

Stem counts were conducted within four strategically placed 10 meter by 10 meter plots. The plots were located based on a representative sample of the entire area of disturbance. They are scattered throughout the Project Site in order to cover the majority of the habitat variations. Vegetation Plots #1, #2 and #4 are related to stream and buffer mitigation credit and occur within the 50-foot buffer of the channel. Vegetation Plot #3 is outside of the 50-foot zone and falls under either buffer mitigation credit or Nutrient Offset Nitrogen Reduction credit. The success criteria for stream mitigation credit (Vegetation Plots #1, #2 and #4) is a minimum of 260 stems per acre after five years. The success criteria for buffer mitigation and Nutrient Offset Nitrogen Reduction credits however, is a minimum of 320 planted, hardwood, native stems per acre after five years.

Planted stem count viability decreased from 2012 to 2013. Based on our data, the approximate mean for planted stems per acre in 2013 was 404 versus 465 in 2012 and 505 in 2011. Reasons for mortality were not obvious. The chart below provides a summary of the MY 5 counts.

<u>Vegetation Plot No.</u>	<u>Total Stem Count/ Acre (SMU Credit)</u>	<u>Planted Stem Count/ Acre</u>	<u>Planted, Hardwood Stem Count/ Acre (BMU or Nutrient Offset N Credit)</u>
1	1,295	688	688
2	364	364	364
3	n/a	242	242
4	647	323	323

Vegetation Plots #1, #2 and #4 met the success criteria required for buffer mitigation or Nutrient Offset Nitrogen credit, as well as the success criteria for stream mitigation credit. Vegetation Plot #3 failed to meet the criteria for buffer mitigation or Nutrient Offset Nitrogen credit. A complete breakdown of this information is provided in Appendix A along with photographs of each vegetation plot taken during the assessment.

2. Vegetative Problem Areas

Vegetative problem areas are defined as those areas either lacking vegetation or containing exotic vegetation and are generally categorized within the following categories: Bare Bank, Bare Bench, Bare Floodplain or Invasive Population. Based on the monitoring site assessment, vegetation problem areas currently exist within the Project Site from a stem count basis. Visual assessments however, did not reveal any previous areas void of vegetation. The majority of the bare floodplain areas that were observed during 2009 filled in with vegetation prior to the MY 2 assessment and have remained consistent through MY 3, MY 4 and MY 5.

During the early summers of 2012 and 2013, both vegetation and boundary signage was partially destroyed along the eastern portion of the easement adjacent to the agricultural field. This destruction was caused by the mowing of an approximately 15-foot corridor immediately inside the easement area adjacent to the reach. Many of the trees throughout this area were severely impacted. Easement encroachment was also noted along the western side of the Project Site. Recent visits to the Project Site have not revealed any additional mowing or maintenance activities. Vegetation problem areas are summarized in Appendix A - Table 7 and are depicted on Figure 4.

As mentioned in previous reports, a supplemental planting was conducted during February 2010 as part of the contractor's vegetation warranty. A second supplemental planting occurred on March 18, 2013 to augment trees in areas exhibiting low planted stem densities. Little to no increase in planted stem counts was discovered however, during MY 5 vegetation assessments. Vegetation Plot #2 was the only plot exhibiting an increase in planted stems. As per the MY 5 assessment, Vegetation Plot #3 remains below the required mitigation threshold.

Invasive plant species were observed along the western side of the Project Site in the vicinity of the historical cemetery, as well as near the downstream end within the riparian corridor associated with Big Chinquapin Branch. Chinaberry tree (*Melia azedarach*), Chinese privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*) were observed within the cemetery while mainly Chinese privet was noted near the downstream end of the Project Site. A contract is currently in place with HARP for four consecutive invasive treatments within these areas.

B. Stream Assessment

1. Procedural Items

Under normal circumstances, stream monitoring includes collection of morphometric criteria, specifically dimension and profile measurements. The recommended procedures follow protocol depicted within the USACE Draft Stream Mitigation Guidelines (2003) document. The Brock Site however, offers a method of mitigation that is not consistent with these guidelines. Therefore, monitoring protocols have been updated to better address the monitoring issues at the Project Site.

Morphometric Criteria

Three cross sections were established along the unnamed tributary. These cross sections are situated at Stations 11+00, 15+00 and 23+00. Appendix B depicts the data, which provides a year-by-year comparison. Exhibit Table V provides baseline data of cross section values with regard to bankfull and dimensions. According to the data collected, the average bankfull area along the stream reach is approximately 5.4 square feet; a decrease in approximately 0.5 square feet from the previous year. This can be attributed to several possible situations: (1) vegetation within the channel; (2) variable flow rates; and, (3) survey differences. Since this is a first order channel, the dimension is expected to vary based on flow rates. The data below denotes a qualitative comparison of the channel characteristics. Based on visual observations, this channel appears stable. No erosion is present. The numbers reveal differences in several of the attributes; however, this data is only a snapshot and does not account for the ever-changing conditions of this type of channel.

Exhibit Table V. Cross Section Comparison
Brock Site (EEP Project No. 92333)

Attribute	Cross Section #1 Station 11+00					Cross Section #2 Station 15+00					Cross Section #3 Station 23+00				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Monitoring Year															
Bankfull area (sq. feet)	7.2	4.6	5.7	6.4	6.2	6.9	6.4	7.7	7.5	6.7	7.2	4.6	3.7	3.7	3.3
Bankfull width (feet)	8.7	7.8	7.8	8.2	7.7	8.3	8.0	8.8	9.6	7.5	29.0	9.3	7.9	7.9	7.9
Bankfull mean depth (feet)	0.8	0.6	0.7	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.4	0.5	0.5	0.5	0.4
Bankfull max depth (feet)	1.4	0.9	1.0	1.1	1.1	1.4	1.4	1.5	1.6	1.5	0.7	0.9	0.8	0.7	0.7
Width-depth ratio	10.5	13.2	10.8	10.5	9.5	9.9	10.0	10.0	12.3	8.4	82.3	18.6	17.0	16.7	19.3
Flood prone area width (feet)	52.4	44.3	48.0	49.9	48.3	49.9	49.2	49.8	50.0	49.5	51.0	52.1	50.6	49.7	49.3
Entrenchment ratio	6.0	5.7	6.1	6.1	6.3	6.0	6.2	5.6	5.2	6.6	1.8	5.6	6.4	6.3	6.2
Low bank height ratio	1.0	1.0	1.4	1.3	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Hydrologic Criteria

Bankfull events during the monitoring period are being documented via a crest gage located in the vicinity of Station No. 18+65. In order to meet hydrologic success criteria, a minimum of two events must occur during the five-year monitoring period. In addition, the events must occur in separate monitoring years. The gage is being visited approximately three times per year. Based on our findings, at least one bankfull event has occurred in 2013. Approximately 4.13 inches of rain were associated with a storm event in July 2013, 3.52 inches of rain between August 2 and 4, 2013 and an additional 3.84 inches of rain between August 11 and 18, 2013. This information is depicted in Exhibit Table VI below. In addition, actual precipitation data from a nearby weather station is provided in Appendix C. Based on these results and the data captured during the previous years' monitoring, at least two bankfull events have been recorded during separate years at the Project Site. Therefore, the hydrologic criteria associated with stream restoration have been satisfied for the project.

Exhibit Table VI. Verification of Bankfull Events
Brock Site (EEP Project No. 92333)

Date of Data Collection	Date(s) of Occurrence	Method	Calculated Bankfull Elevation	Measured High Water Elevation	Photo # (if available)
10/24/2009	Unknown	Crest gage	14 inches	35 inches	Not available
11/13/2010	7/4/10, 9/27/10 thru 10/1/10	Crest gage	14 inches	40 inches	Not available
7/7/2011	4/27/11 thru 4/29/11 (assumed)	Crest gage	14 inches	15 inches	Not available
8/16/2012	7/21/12 thru 7/25/12 (assumed)	Crest gage	14 inches	30 inches	Not available
11/22/2013	7/9/13 thru 7/14/13 8/2/13 through 8/4/13 8/11/13 through 8/18/13 (assumed)	Crest gage	14 inches	18 inches	Not available

2. Stream Problem Areas

No significant changes to the dimension were observed during MY 5 monitoring activities. A visual assessment of the channel was conducted throughout its length and no problem areas were noted. Although elevation changes were observed based on the data collected, the visual assessments did not locate any obvious areas of instability and/or erosion.

A visual inspection was completed during the monitoring assessment to locate and/or identify areas of inadequate performance. This inspection generally includes an assessment and mental judgment of physical conditions, including structural features. Bank condition was the only feature assessed at the Brock Site. Results of the assessment are depicted below in Exhibit Table VII.

Exhibit Table VII. Categorical Stream Feature Visual Stability Assessment Brock Site (EEP Project No. 92333) Segment/Reach: Entire (1,850 linear feet)						
Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
Bank Condition	100%	100%	100%	100%	100%	100%

3. Fixed Station Photographs

Photographic documentation was taken at 16 permanent photo stations, established during the as-built survey. The documentation ranges between views of the channel and buffer, to vegetation plots and cross sections. Appendix D provides an ongoing comparison of yearly photographs for each station.

SECTION IV. Methodology Section

This document employs methodologies according to the post-construction monitoring plan and standard regulatory guidance and procedures documents. References are provided below.

Barnhill, W.L., 1981. Soil Survey of Jones County, North Carolina. US Department of Agriculture, Soil Conservation Service.

NC Department of Environment and Natural Resources (NCDENR), Ecosystem Enhancement Program (EEP), 2012. Brock Stream Restoration Site Monitoring Year 4 Report, dated December 2012. Prepared by Ecological Engineering, LLP.

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Lee, M.T., R.K. Peet, S.D. Roberts and T.R. Wentworth, 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. Available: <http://cvs.bio.unc.edu/methods.htm>.

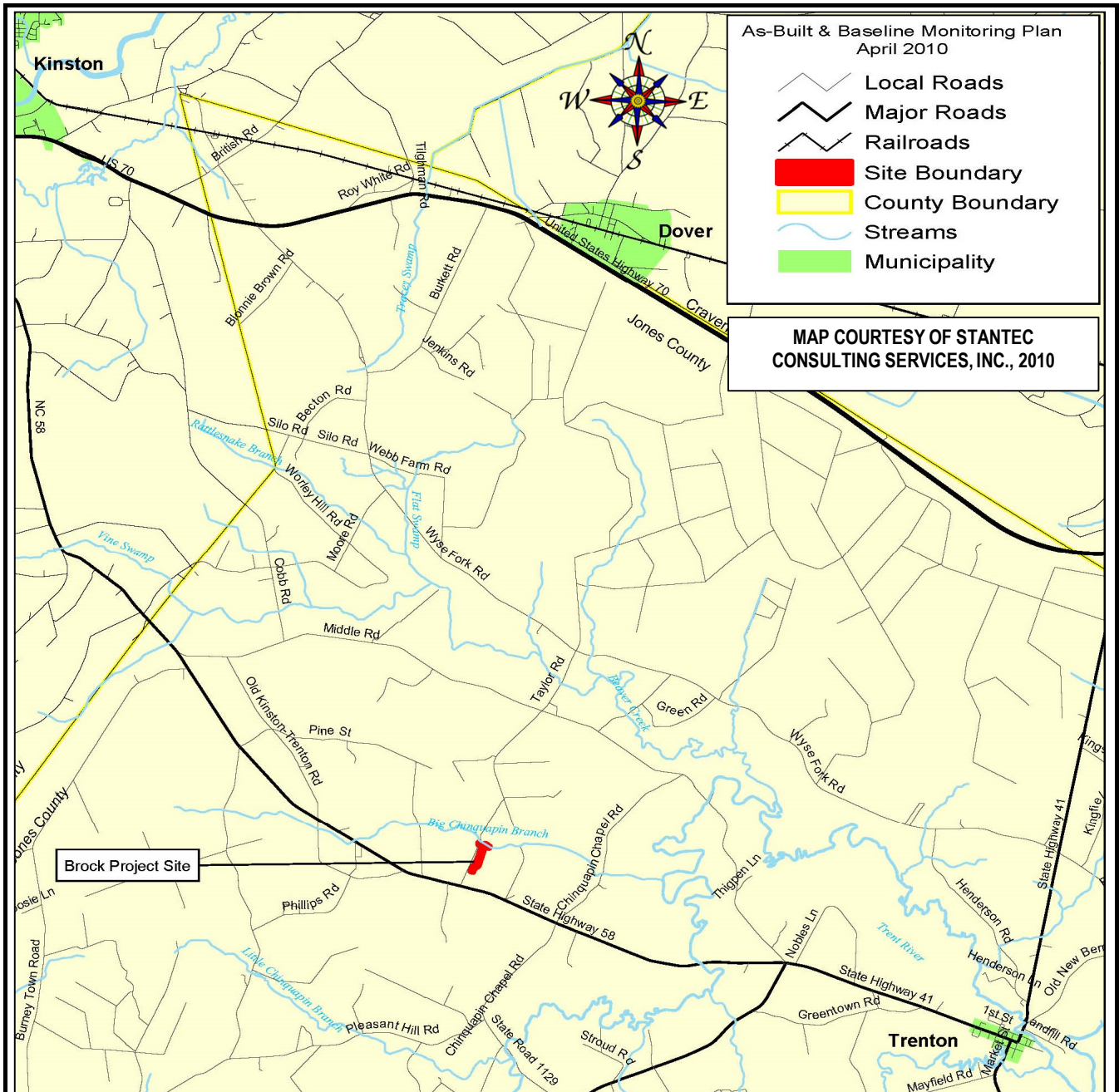
Rosgen, David L., 1996. Applied River Morphology. Wildland Hydrology Books, Inc. Pagosa Springs, CO. 385 pp.

Shafale, M.P. and A.S. Weakley, 1990. Classification of the Natural Communities of North Carolina. Third Approximation. NC Natural Heritage Program. Raleigh, NC.

US Army Corps of Engineers (USACE) and NC Division of Water Quality (NCDWQ), 2005. Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina. Wilmington, NC. November 28, 2005. Available via: <http://h2o.enr.state.nc.us/ncwetlands/documents/CoastalPlainStreamMitigationFinalDraftPolicyNov28.doc>.

US Army Corps of Engineers (USACE), US Environmental Protection Agency (USEPA), NC Wildlife Resources Commission (NCWRC) and NC Division of Water Quality (NCDWQ), 2003. Draft Stream Mitigation Guidelines, April 2003.

US Environmental Protection Agency (USEPA), US Department of Agriculture, Natural Resources Conservation Service and NC Department of Environment and Natural Resources, 2002. Level III and Level IV Ecoregions of North Carolina Map.

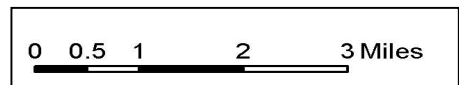


As-Built & Baseline Monitoring Plan
April 2010

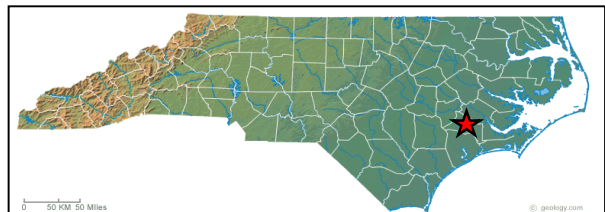
- Local Roads
- Major Roads
- Railroads
- Site Boundary
- County Boundary
- Streams
- Municipality

MAP COURTESY OF STANTEC
CONSULTING SERVICES, INC., 2010

Brock Project Site



Directions to the Brock Stream Restoration Site:
From Raleigh, take HWY 70 East to Kinston, NC. The Brock Restoration Site is located approximately 12 miles southeast of Kinston, North Carolina and lies in northern Jones County. From US 70 East in Kinston turn right on NC 58 and travel approximately 12 miles. The site is located on the left approximately three miles past the beginning of the Pine Street loop (SR 1301).



VICINITY MAP
Brock Stream Restoration Site, Jones County, NC
EEP Project No. 92333
November 19, 2013

FIGURE 1

Figure 2A

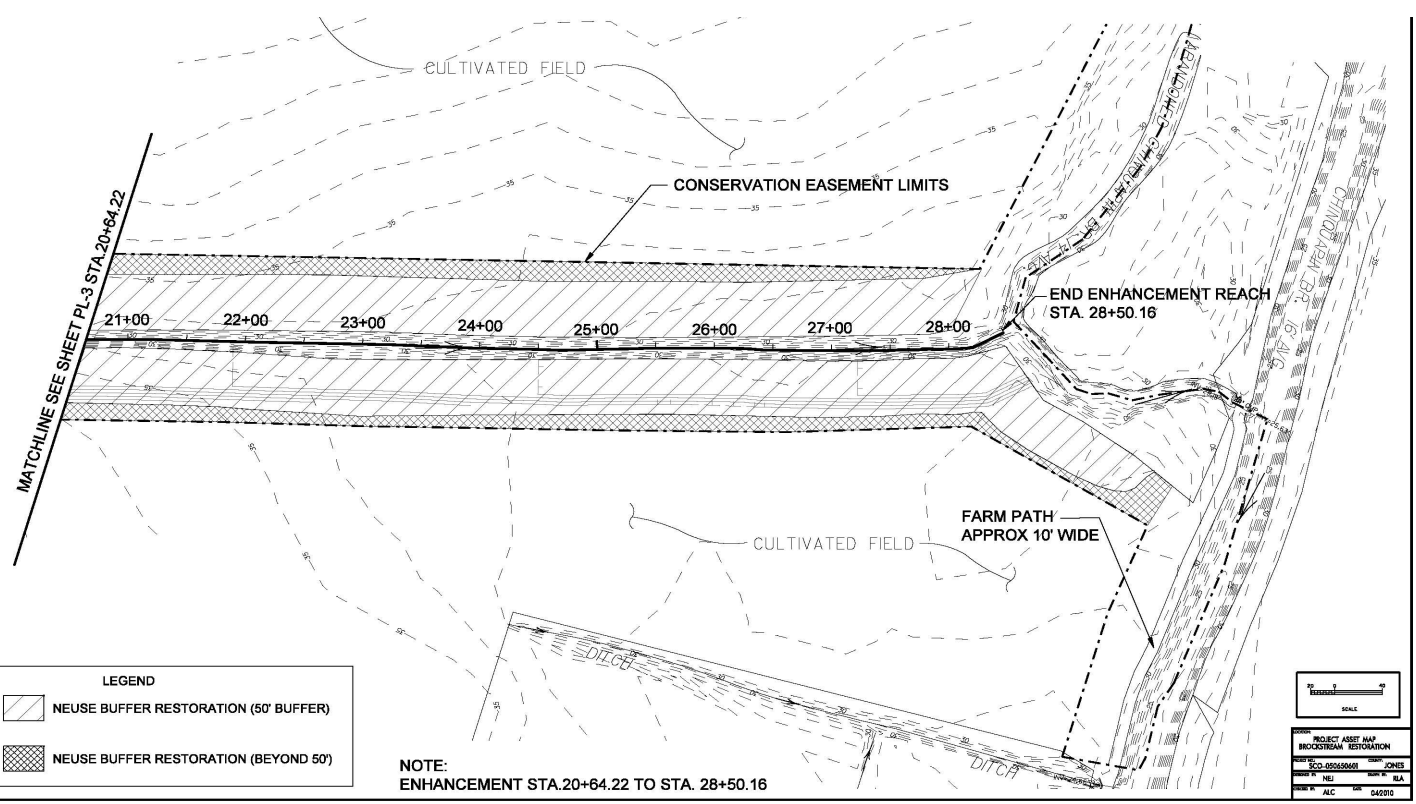
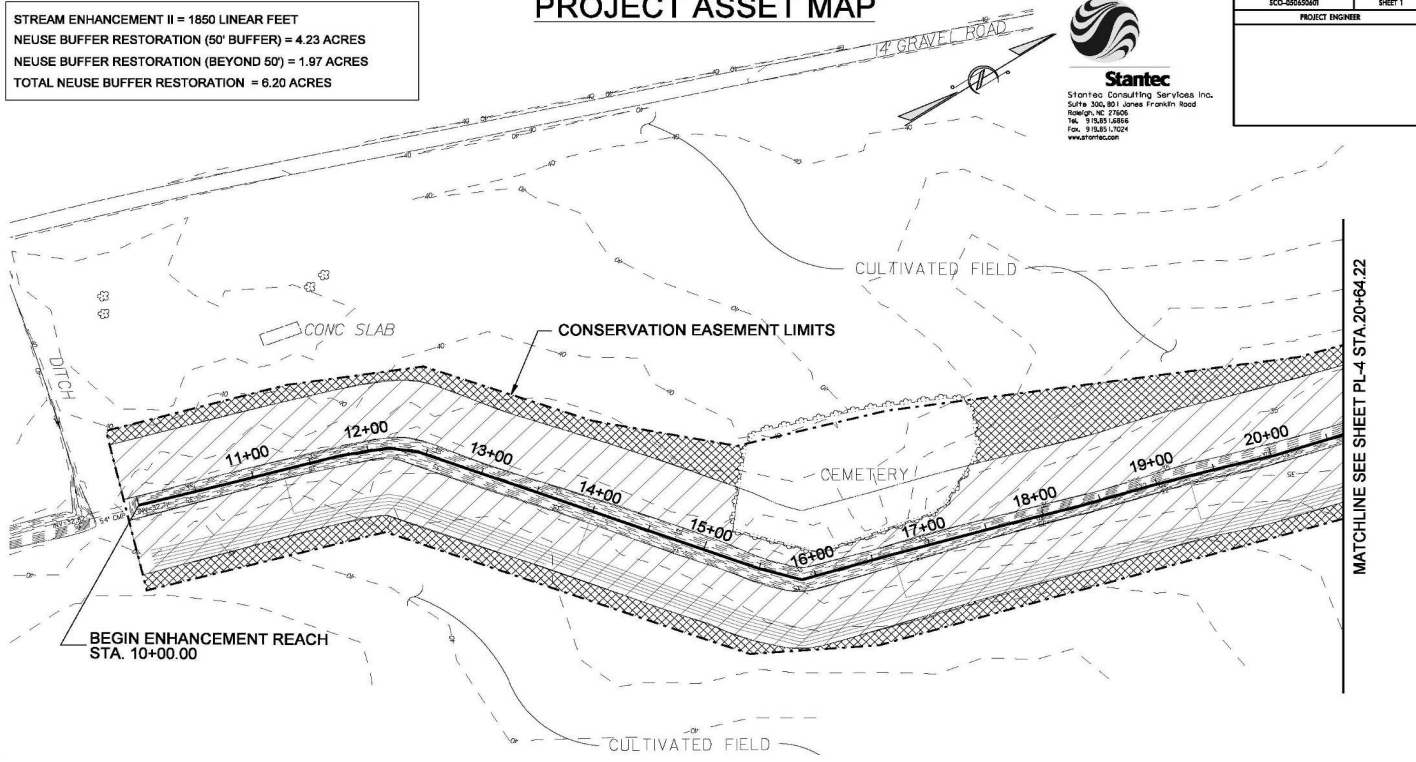
STREAM ENHANCEMENT II = 1850 LINEAR FEET
 NEUSE BUFFER RESTORATION (50' BUFFER) = 4.23 ACRES
 NEUSE BUFFER RESTORATION (BEYOND 50') = 1.97 ACRES
 TOTAL NEUSE BUFFER RESTORATION = 6.20 ACRES

PROJECT ASSET MAP



Stantec Consulting Services Inc.
 Suite 300, 801 Jones Franklin Road
 Raleigh, NC 27606
 Tel. 919.286.6886
 Fax. 919.286.1704
 www.stantec.com

PROJECT REFERENCE NO.	SHEET NO.
SC0-05062901	SHEET 1
PROJECT ENGINEER	



LEGEND

- NEUSE BUFFER RESTORATION (50' BUFFER)
- NEUSE BUFFER RESTORATION (BEYOND 50')

NOTE:
 ENHANCEMENT STA.20+64.22 TO STA. 28+50.16

SCALE: 1" = 50'

PROJECT ASSET MAP	PROJECT NO.
BROCKSTREAM RESTORATION	SC0-05062901
DATE	NOV 19 2013
DRAWN BY	NEI
CHECKED BY	SLA
SCALE	AS SHOWN
PROJECT NO.	92333
DATE	NOV 19 2013

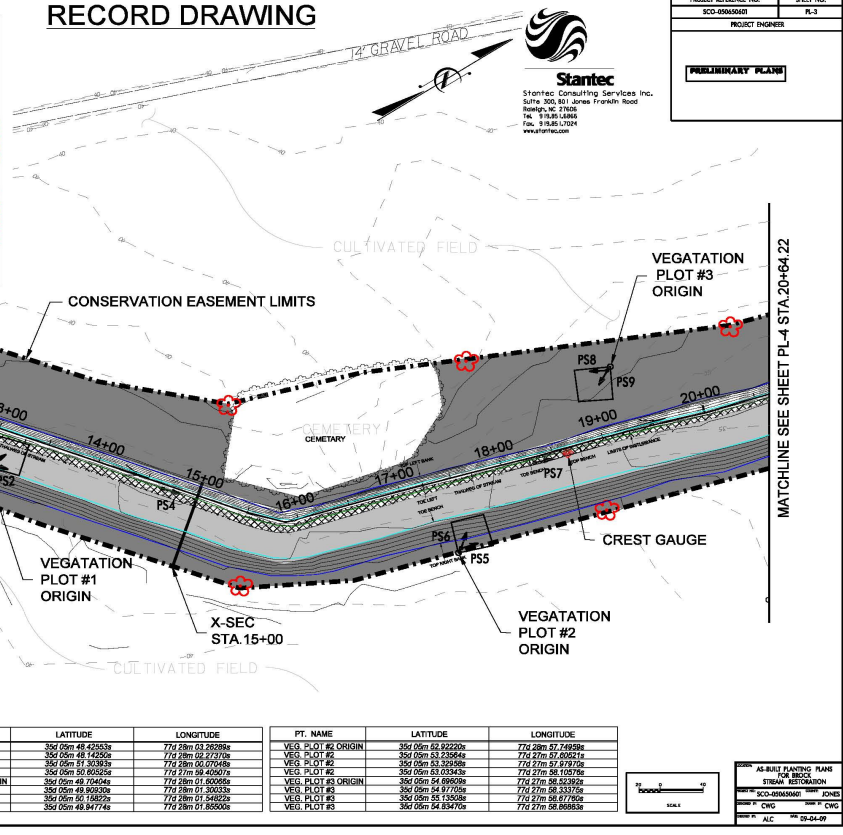


PROJECT ASSET MAP
 Brock Stream Restoration Site, Jones County, NC
 EEP Project No. 92333
 November 19, 2013

FIGURE 2

RECORD DRAWING

COMMON NAME	SCIENTIFIC NAME	SOUTH-EAST REGION INDICATOR	SIZE
STREAMBANK PLANTING			
SMOOTH ALDER	<i>Alnus incana</i>	FACULTATIVE WETLAND -	0.5" - 1" DIAMETER
SWAMP DOGWOOD	<i>Cornus stricta</i>	FACULTATIVE WETLAND -	0.5" - 1" DIAMETER
VIRGINIA WILLOW	<i>Salix virginica</i>	FACULTATIVE WETLAND -	0.5" - 1" DIAMETER
RED BERRY	<i>Sambucus canadensis</i>	FACULTATIVE WETLAND -	0.5" - 1" DIAMETER
FLOODPLAIN BUFFER PLANTING - COASTAL PLAIN BOTTOMLAND HARDWOOD FOREST			
GREEN ASH	<i>Fraxinus pennsylvanica</i>	FACULTATIVE WETLAND -	0.25" ROOT TUBULINGS
AMERICAN SYCAMORE	<i>Platanus occidentalis</i>	FACULTATIVE WETLAND -	0.25" ROOT TUBULINGS
SWAMP CHESTNUT OAK	<i>Quercus michauxii</i>	FACULTATIVE WETLAND -	0.25" ROOT TUBULINGS
WATER OAK	<i>Quercus nigra</i>	FACULTATIVE WETLAND -	0.25" ROOT TUBULINGS
WILLOW OAK	<i>Quercus phellos</i>	FACULTATIVE WETLAND -	0.25" ROOT TUBULINGS
UPLAND BUFFER PLANTING - MIXED MESIC HARDWOOD FOREST COASTAL PLAIN SUBTYPE			
BITTERNUT HICKORY	<i>Carya cordifolia</i>	FACULTATIVE	4" CONTAINER
SWEET PEPPERBUSH	<i>Clethra alnifolia</i>	FACULTATIVE WETLAND	4" CONTAINER
AMERICAN SYCAMORE	<i>Platanus occidentalis</i>	FACULTATIVE WETLAND -	0.25" ROOT TUBULINGS
CHERRYBARK OAK	<i>Quercus alleghaniensis</i>	FACULTATIVE	0.25" ROOT TUBULINGS
WHITE OAK	<i>Quercus alba</i>	FACULTATIVE UPLAND	0.25" ROOT TUBULINGS
SWAMP CHESTNUT OAK	<i>Quercus michauxii</i>	FACULTATIVE WETLAND -	0.25" ROOT TUBULINGS
AMERICAN BEECH	<i>Fagus grandifolia</i>	FACULTATIVE UPLAND	0.25" ROOT TUBULINGS
SPECIMEN BOUNDARY TREES			
AMERICAN SYCAMORE	<i>Platanus occidentalis</i>	FACULTATIVE WETLAND -	1.5" DBH BAB
WHITE OAK	<i>Quercus alba</i>	FACULTATIVE UPLAND	1.5" DBH BAB



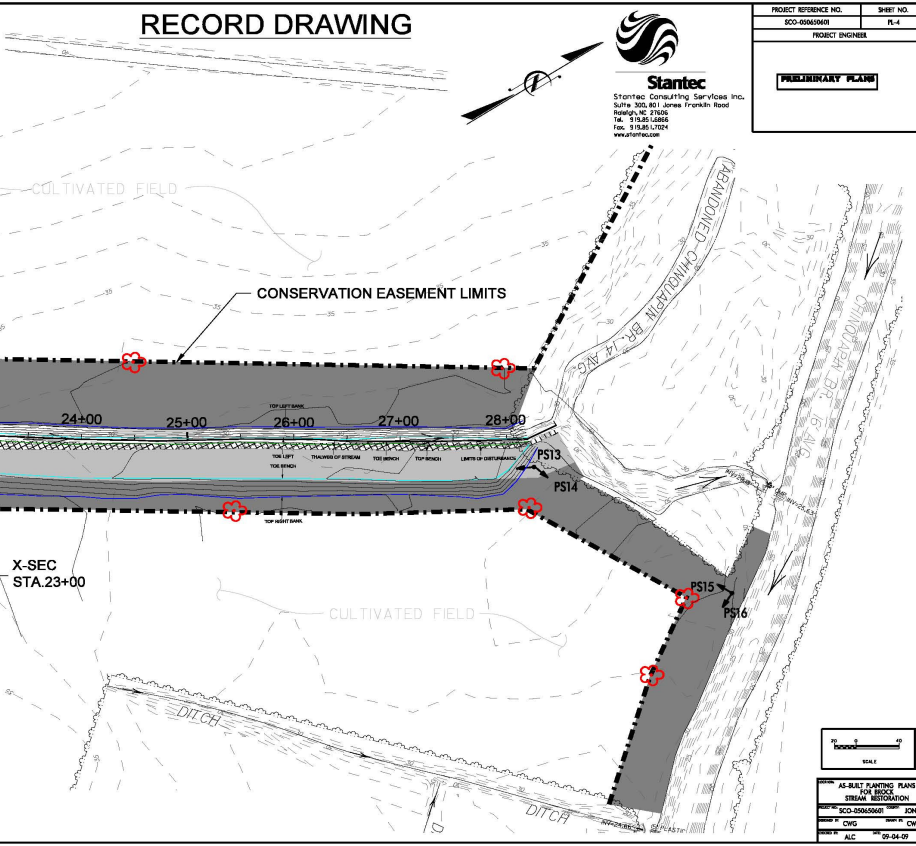
LEGEND

- STREAMBANK PLANTING
- FLOODPLAIN BUFFER PLANTING
- UPLAND BUFFER PLANTING
- SPECIMEN BOUNDARY TREE
- PHOTOSTATION

PT. NAME	LATITUDE	LONGITUDE	PT. NAME	LATITUDE	LONGITUDE
X-SEC 11+00 LT	35d 05m 48.42553e	77d 28m 03.28288e	VEG. PLOT #2 ORIGIN	35d 05m 52.82220e	77d 28m 57.78959e
X-SEC 11+00 RT	35d 05m 48.14250e	77d 28m 02.77108e	VEG. PLOT #2	35d 05m 53.23844e	77d 27m 57.88041e
X-SEC 12+00 LT	35d 05m 57.36383e	77d 28m 02.77108e	VEG. PLOT #3	35d 05m 53.39398e	77d 27m 57.87979e
X-SEC 12+00 RT	35d 05m 57.86026e	77d 27m 58.40687e	VEG. PLOT #4	35d 05m 53.02638e	77d 27m 58.10276e
VEG. PLOT #1 ORIGIN	35d 05m 49.17450e	77d 28m 01.80069e	VEG. PLOT #5 ORIGIN	35d 05m 54.88028e	77d 27m 58.85322e
VEG. PLOT #1	35d 05m 49.90930e	77d 28m 01.39033e	VEG. PLOT #5	35d 05m 54.97705e	77d 27m 58.33375e
VEG. PLOT #2	35d 05m 52.15822e	77d 28m 01.54822e	VEG. PLOT #6	35d 05m 55.13508e	77d 27m 58.67702e
VEG. PLOT #3	35d 05m 49.84774e	77d 28m 01.85006e	VEG. PLOT #7	35d 05m 54.83470e	77d 27m 58.86853e

RECORD DRAWING

PT. NAME	LATITUDE	LONGITUDE
VEG. PLOT #4 ORIGIN	35d 05m 57.84814e	77d 27m 58.29211e
VEG. PLOT #4	35d 05m 58.12825e	77d 27m 58.14830e
VEG. PLOT #4	35d 05m 58.28544e	77d 27m 58.54230e
VEG. PLOT #4	35d 05m 57.85154e	77d 27m 58.98096e
X-SEC 23+00 LT	35d 05m 58.69527e	77d 27m 58.70047e
X-SEC 23+00 RT	35d 05m 58.23482e	77d 27m 58.70590e



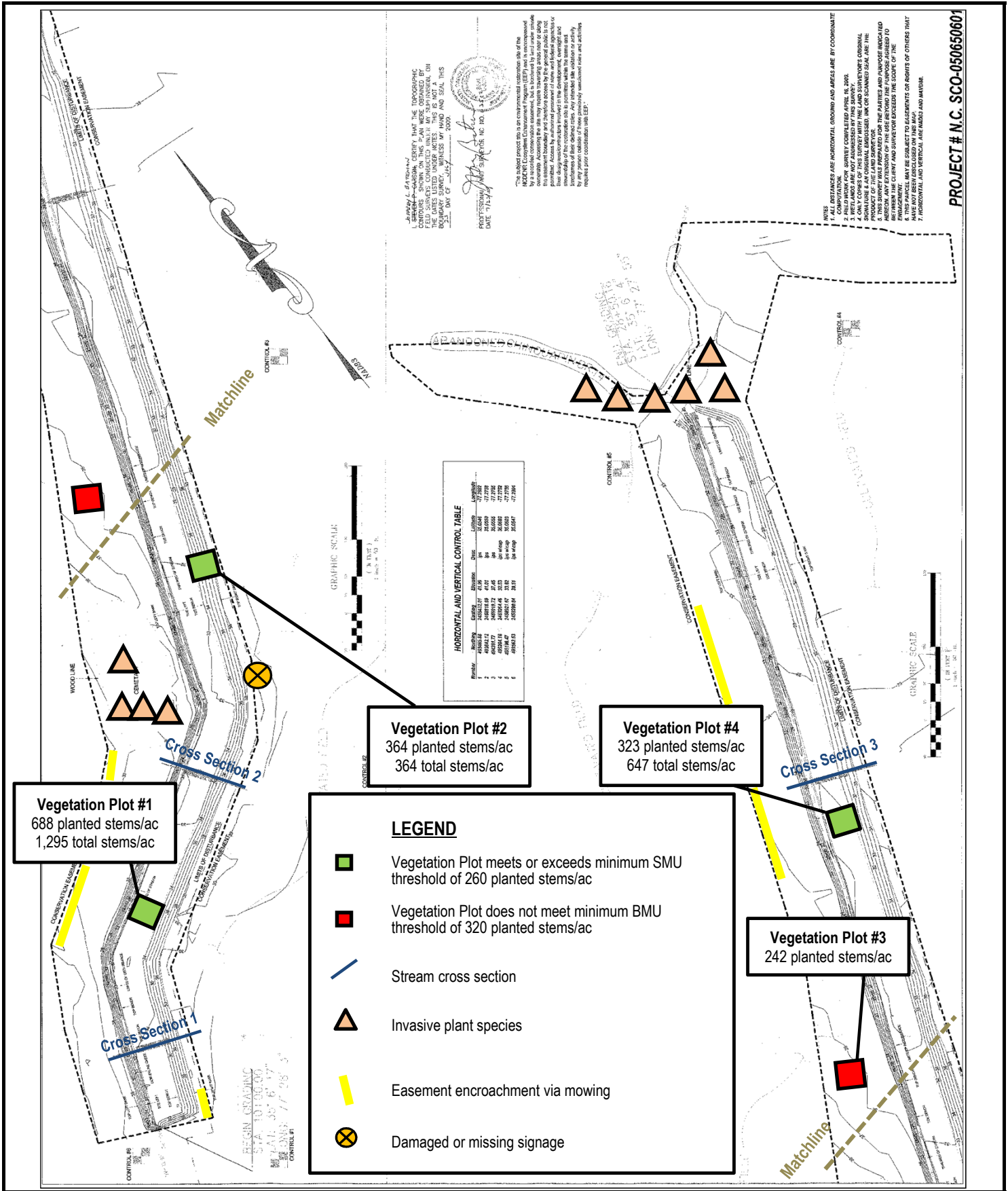
LEGEND

- STREAMBANK PLANTING
- FLOODPLAIN BUFFER PLANTING
- UPLAND BUFFER PLANTING
- SPECIMEN BOUNDARY TREE
- PHOTOSTATION



MONITORING PLAN VIEW
 Brock Stream Restoration Site, Jones County, NC
 EEP Project No. 92333
 November 19, 2013

FIGURE 3



CURRENT CONDITIONS PLAN VIEW
 Brock Stream Restoration Site, Jones County, NC
 EEP Project No. 92333
 November 19, 2013

FIGURE 4

APPENDIX A

Vegetation Raw Data and Monitoring Plot Photographs

Appendix A provides a series of tables (Table 1, 2, 3, 4, 5 and 6) automatically generated by the Data Entry Tool designed in conjunction with the CVS-EEP Protocol for Recording Vegetation Version 4.0 (Lee et. al., 2006). Tables 7 and 8 are based on visual observation during the monitoring assessment and comparison with minimum success criteria numbers, respectively. Table 9 provides year-end stem counts.

APPENDIX A. Table 1. CVS Vegetation Metadata	
Brock Site (EEP Project No. 92333)	
Report Prepared By	Lane Sauls
Date Prepared	8/15/2013 13:28
database name	cv5-eep-entry tool-v2.3.1.mdb
database location	P:\50000 State\EEP 50512\50512-004 EEP Brock Site\Brock 2013 Year 5 Monitoring\CVS Information
computer name	LANE
file size	37494784
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT -----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	92333
project Name	Brock Stream Restoration
Description	EEP Brock Stream Restoration, Jones County, NC
River Basin	Neuse
Sampled Plots	4

APPENDIX A. Table 2. CVS Vigor by Species									
Brock Site (EEP Project No. 92333)									
	Species	Common Name	4	3	2	1	0	Missing	Unknown
	<i>Fraxinus pennsylvanica</i>	green ash		10	6				
	<i>Quercus michauxii</i>	swamp chestnut oak		2		1		2	
	<i>Quercus nigra</i>	water oak						2	
	<i>Quercus pagoda</i>	cherry bark oak			2			3	
	<i>Quercus phellos</i>	willow oak			4			8	
	<i>Salix nigra</i>	black willow			2				
	<i>Liriodendron tulipifera</i>	tuliptree		2					
	<i>Platanus occidentalis</i>	American sycamore		2	10				
TOTALS:	8	8		16	24	1		15	

APPENDIX A. Table 3. CVS Damage by Species

Brock Site (EEP Project No. 92333)

	Species	Common Name	Count of Damage Categories						
			(no damage)	Deer	Insects	Mowing	Unknown	Vine Strangulation	
	<i>Fraxinus pennsylvanica</i>	green ash	12	4	1	3	1	1	6
	<i>Liriodendron tulipifera</i>	tuliptree	1	1		1			
	<i>Platanus occidentalis</i>	American sycamore	11	1		9			2
	<i>Quercus michauxii</i>	swamp chestnut oak	1	4				1	
	<i>Quercus nigra</i>	water oak	0	2					
	<i>Quercus pagoda</i>	cherry bark oak	2	3		2			
	<i>Quercus phellos</i>	willow oak	3	9		2	1		
	<i>Salix nigra</i>	black willow	2			2			
TOTALS:	8	8	32	24	1	19	2	2	8

APPENDIX A. Table 4. CVS Damage by Plot

Brock Site (EEP Project No. 92333)

	Plot	Count of Damage Categories						
		(no damage)	Deer	Insects	Mowing	Unknown	Vine Strangulation	
	92333-ALC-0001-year:5	13	11	1	4		1	7
	92333-ALC-0002-year:5	7	2		5	2		
	92333-ALC-0003-year:5	5	4		4		1	
	92333-ALC-0004-year:5	7	7		6			1
TOTALS:	4	32	24	1	19	2	2	8

APPENDIX A. Table 5. CVS Planted Stems by Plot

Brock Site (EEP Project No. 92333)

Comment	Species	Sp Type	CommonName	Total Planted Stems						
				# plots	avg# stems	plot 92333-ALC-0001-year:5	plot 92333-ALC-0002-year:5	plot 92333-ALC-0003-year:5	plot 92333-ALC-0004-year:5	plot 92333-ALC-0005-year:5
	<i>Fraxinus pennsylvanica</i>	Tree	green ash	16	2	8	14	2		
	<i>Liriodendron tulipifera</i>	Tree	tuliptree	2	1	2			2	
	<i>Platanus occidentalis</i>	Tree	American sycamore	12	4	3	3	4	1	4
	<i>Quercus michauxii</i>	Tree	swamp chestnut oak	3	2	1.5			1	2
	<i>Quercus pagoda</i>	Tree	cherrybark oak	2	1	2			2	
	<i>Quercus phellos</i>	Tree	willow oak	4	2	2		3		1
	<i>Salix nigra</i>	Tree	black willow	2	1	2				2
TOTALS:	0	7	7	41	7		17	9	6	9

APPENDIX A. Table 6. CVS All Stems by Plot

Brock Site (EEP Project No. 92333)

Comment	Species	CommonName	Total Stems							
			# plots	avg# stems	92333-ALC-0001-year:5	92333-ALC-0002-year:5	92333-ALC-0003-year:5	92333-ALC-0004-year:5	92333-ALC-0005-year:5	
	<i>Fraxinus pennsylvanica</i>	green ash	16	2	8	14	2			
	<i>Liriodendron tulipifera</i>	tuliptree	2	1	2			2		
	<i>Morella cerifera</i>	wax myrtle	2	1	2				2	
	<i>Platanus occidentalis</i>	American sycamore	12	4	3	3	4	1	4	
	<i>Quercus michauxii</i>	swamp chestnut oak	3	2	1.5			1	2	
	<i>Quercus pagoda</i>	cherrybark oak	2	1	2			2		
	<i>Quercus phellos</i>	willow oak	4	2	2		3		1	
	<i>Salix nigra</i>	black willow	20	2	10	13			7	
	<i>Ulmus americana</i>	American elm	2	1	2	2				
TOTALS:	0	9	9	63	9		32	9	6	16

APPENDIX A. Table 7. Vegetative Problem Areas Brock Site (EEP Project No. 92333)			
Feature/Issue	Station #/ Range	Probable Cause	Photo #
Bare Bank	n/a	n/a	n/a
Bare Bench	n/a	n/a	n/a
Bare Floodplain	n/a	n/a	n/a
Bare Buffer	n/a	n/a	n/a
Invasive/Exotic Populations	Existing cemetery area and downstream end of Project Site	Wind and/or animal dispersion	n/a

APPENDIX A - Table 8. Vegetation Plot Criteria Attainment Brock Site (EEP Project No. 92333)			
Stream Criteria			
Tract	Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
UT	VP 1	Yes	75%
UT	VP 2	Yes	
UT	VP 4	Yes	
Buffer Criteria			
Tract	Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
UT	VP 1	Yes	100%
UT	VP 2	Yes	
UT	VP 3	No	
UT	VP 4	Yes	

APPENDIX A. Table 9. CVS Plot Summary Data

EEP Project Code 92333. Project Name: Brock Stream Restoration

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2013)												Annual Means																	
			92333-ALC-0001			92333-ALC-0002			92333-ALC-0003			92333-ALC-0004			MY5 (2013)			MY4 (2012)			MY3 (2011)			MY2 (2010)			MY1 (2009)			MY0 (2009)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Acer negundo</i>	box elder	Tree																1			1			1								
<i>Baccharis halimifolia</i>	eastern baccharis	Shrub																						1								
<i>Clethra alnifolia</i>	coastal sweetpepperbush	Shrub																									2	2	2			
<i>Comus foemina</i>	stiff dogwood	Shrub Tree																									4	4				
<i>Fraxinus pennsylvanica</i>	green ash	Tree	14	14	14	2	2	2							16	16	16	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
<i>Liriodendron tulipifera</i>	tuliptree	Tree							2	2	2				2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
<i>Morella cerifera</i>	wax myrtle	shrub											2			2																
<i>Platanus occidentalis</i>	American sycamore	Tree	3	3	3	4	4	4	1	1	1	4	4	4	12	12	12	12	12	12	11	11	11	11	11	11	9	9	9	14	14	14
<i>Quercus</i>	oak	Tree																									1	1	1	1	1	1
<i>Quercus michauxii</i>	swamp chestnut oak	Tree							1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	7
<i>Quercus nigra</i>	water oak	Tree																1	1	1	4	4	4	4	4	4	4	4	4	4	4	4
<i>Quercus pagoda</i>	cherrybark oak	Tree							2	2	2				2	2	2	3	3	3	5	5	5	4	4	4	1	1	1	1	1	1
<i>Quercus phellos</i>	willow oak	Tree				3	3	3				1	1	1	4	4	4	9	10	10	8	9	9	6	7	7	6	7	7	9	10	10
<i>Salix nigra</i>	black willow	Tree			13							1	2	7	1	2	20	1	2	48	1	2	26	1	2	20			4			
<i>Ulmus</i>	elm	Tree																					1									
<i>Ulmus americana</i>	American elm	Tree			2												2															
<i>Unknown</i>		Shrub or Tree																												3	3	
Stem count			17	17	32	9	9	9	6	6	6	8	9	16	40	41	63	46	48	95	50	52	78	48	50	70	45	46	50	55	63	63
size (ares)			1			1			1			1			4			4			4			4			4			4		
size (ACRES)			0.02			0.02			0.02			0.02			0.10			0.10			0.10			0.10			0.10			0.10		
Species count			2	2	4	3	3	3	4	4	4	4	4	5	7	7	9	8	8	9	8	8	10	8	8	10	8	8	9	9	11	11
Stems per ACRE			687.966	687.966	1294.99	364.217	364.217	364.217	242.811	242.811	242.811	323.749	364.217	647.497	404.686	414.803	637.38	465.388	485.623	961.128	505.857	526.091	789.137	485.623	505.857	708.2	455.271	465.388	505.857	556.443	637.38	637.38

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Monitoring Plot Photographs

Vegetation Plot #1



Photostation 2.
Facing northeast across Vegetation Plot #1.
Taken August 2013.



Photostation 3.
Facing north across Vegetation Plot #1.
Taken August 2013.

Vegetation Plot #2



Photostation 5.
Facing north across Vegetation Plot #2.
Taken August 2013.



Photostation 6.
Facing northwest across Vegetation Plot #2.
Taken August 2013.

Vegetation Plot #3



Photostation 8.
Facing southwest across Vegetation Plot #3.
Taken August 2013.



Photostation 9.
Facing southeast across Vegetation Plot #3.
Taken August 2013.

Vegetation Plot #4



Photostation 11.
Facing northeast across Vegetation Plot #4.
Taken August 2013.

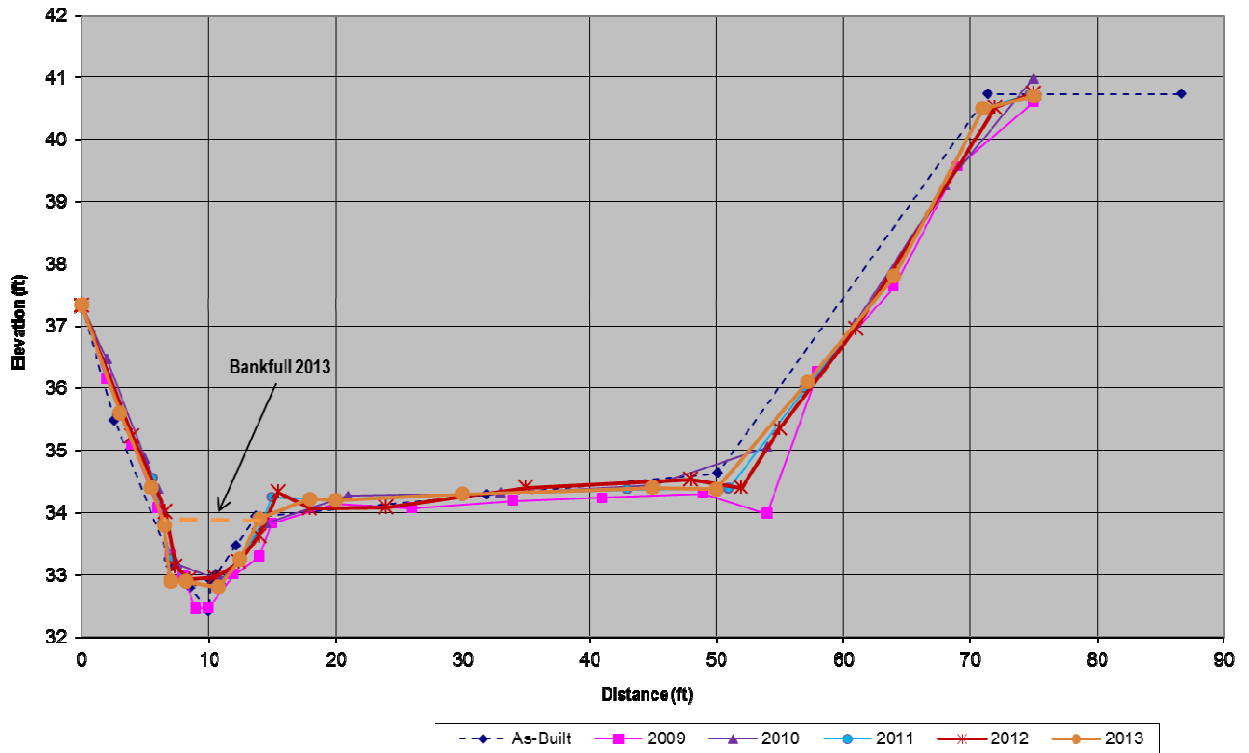


Photostation 12.
Facing north across Vegetation Plot #4.
Taken August 2013.

APPENDIX B

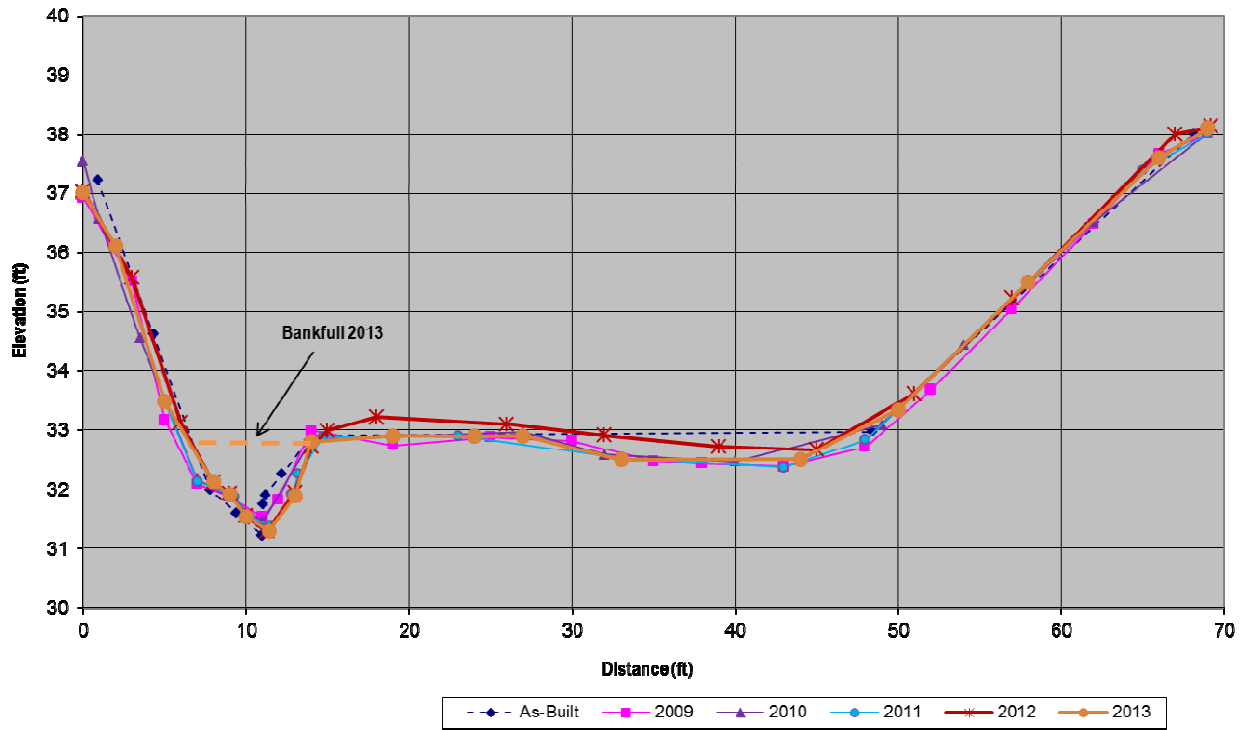
Geomorphic Raw Data

XSC #1 - Brock Site Sta. 11+00



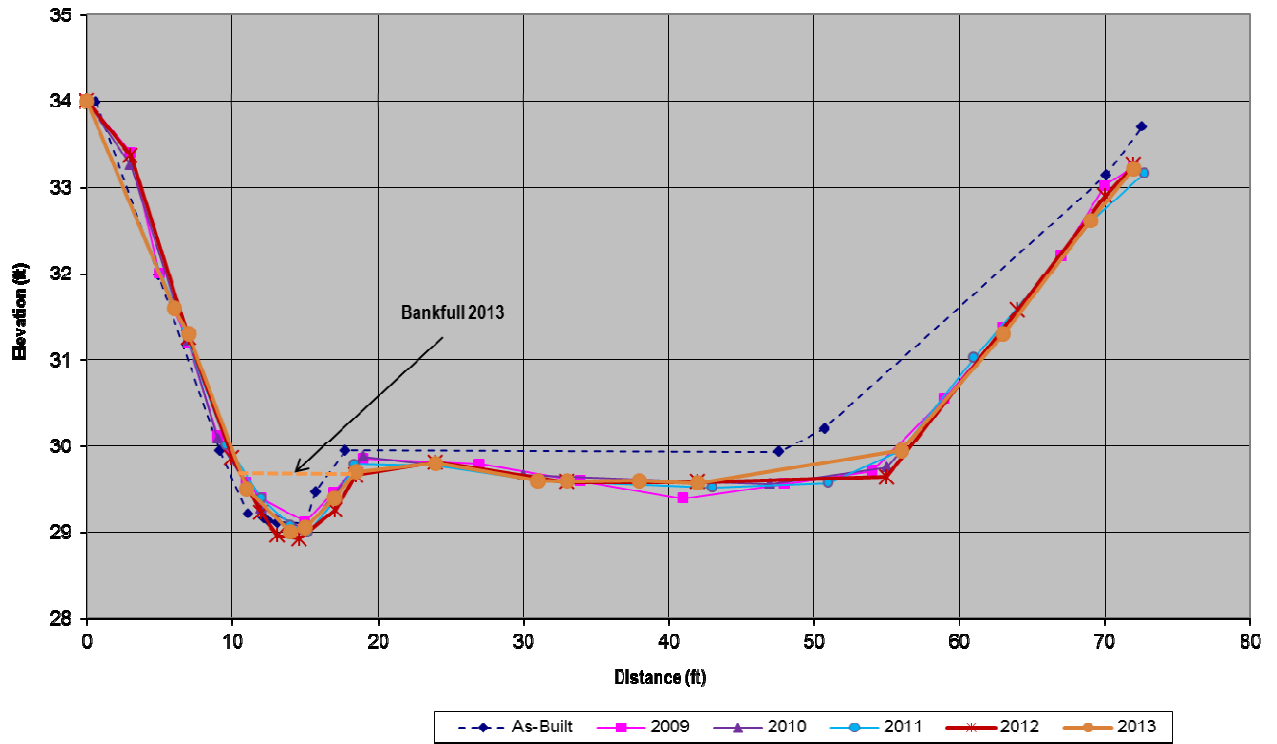
BROCK SITE CROSS SECTION NO. 1 STATION 11+00											
As-built		Year 1		Year 2		Year 3		Year 4		Year 5	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
0	37.33	0	37.33	0	37.33	0	37.33	0	37.33	0	37.34
2.58	35.48	2	36.15	2	36.47	3	35.62	4	35.23	3	35.6
6.9	33.25	4	35.1	5	34.87	5.6	34.55	6.6	34.01	5.5	34.4
7.09	33.13	6	34.07	6	34.38	6.4	33.82	7.4	33.14	6.5	33.8
8.55	32.78	7	33.31	7.5	33.17	7	33.25	8.5	32.93	7	32.9
10	32.43	8	32.99	11	32.91	8.3	32.86	10.5	32.96	8.2	32.9
10.14	32.92	9	32.45	14.5	33.83	10.7	32.82	12.4	33.2	10.8	32.8
10.57	33	10	32.47	21	34.26	12.6	33.24	14	33.63	12.5	33.25
12.16	33.47	12	33	33	34.31	14.2	33.85	15.5	34.33	14	33.9
13.75	33.94	14	33.29	45	34.44	15	34.24	18	34.07	18	34.22
31.93	34.28	15	33.83	54	35.05	20	34.21	24	34.08	20	34.2
50.11	34.63	20	34.14	61	37.06	30	34.29	35	34.4	30	34.3
71.44	40.73	26	34.07	68	39.26	43	34.37	48	34.53	45	34.4
86.69	40.73	34	34.18	75	40.98	51	34.39	52	34.4	50	34.38
		41	34.23			57	36	55	35.35	57.2	36.1
		49	34.3			64	37.82	61	36.96	64	37.8
		54	33.98			71	40.51	72	40.52	71	40.5
		58	36.26			74.7	40.72	75	40.74	75	40.7
		64	37.63								
		69	39.56								
		75	40.6								
HI		HI	45.73	HI	45.24	HI	45.29	HI	45.61	HI	45.3

XSC #2 - Brock Site Sta. 15+00



BROCK SITE CROSS SECTION NO. 2 STATION NO. 15+00											
As-built		Year 1		Year 2		Year 3		Year 4		Year 5	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
0.9	37.23	0	36.93	0	37.55	0	37.03	0	37.03	0	37.01
4.31	34.62	3	35.51	1	36.56	2	36.09	3	35.58	2	36.11
7.79	31.99	5	33.17	3.5	34.55	5	33.48	6	33.12	5	33.48
9.39	31.6	7	32.08	7	32.17	7	32.13	8	32.11	8	32.12
10.96	31.22	9	31.88	9	31.88	9.3	31.87	9	31.93	9	31.91
11	31.22	11	31.53	11	31.44	10.2	31.54	10	31.55	10	31.54
11.01	31.22	12	31.83	14	32.83	11.5	31.38	11.3	31.29	11.4	31.3
11.06	31.74	14	32.99	27	32.96	12.8	31.91	13	31.95	13	31.88
11.19	31.9	19	32.74	32	32.58	13.2	32.26	14	32.71	14	32.8
12.2	32.26	25	32.88	40	32.47	14.7	32.88	15	32.99	19	32.9
14.04	32.9	30	32.82	49	33.08	23	32.9	18	33.22	24	32.89
48.44	32.97	35	32.48	54	34.44	33	32.53	26	33.1	27	32.9
68.13	38.01	38	32.44	62	36.52	43	32.37	32	32.91	33	32.5
		43	32.39	69	38.02	48	32.83	39	32.72	44	32.51
		48	32.71			58	35.53	45	32.67	50	33.34
		52	33.68			65	37.39	51	33.61	58	35.5
		57	35.05			69	38.01	57	35.22	66	37.6
		62	36.49					67	38	69	38.1
		66	37.66					69.2	38.13		
		69	38.01								
HI		HI	43.12	HI	42.37	HI	43.13	HI	43.23	HI	43.21

XSC#3 - Brock Site Sta. 23+00

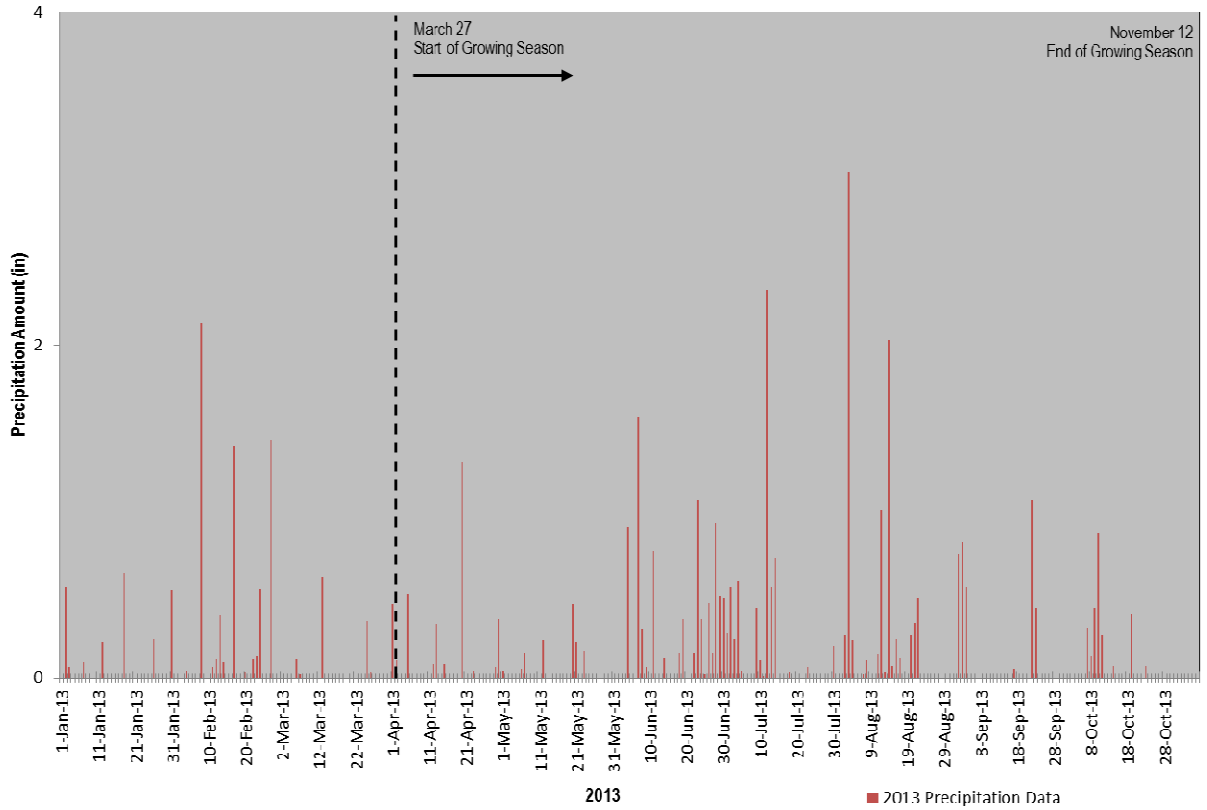


BROCK SITE CROSS SECTION NO. 3 STATION NO. 23+00											
As-built		Year 1		Year 2		Year 3		Year 4		Year 5	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
0.63	33.99	0	34.01	0	34	0	34	0	34	0	34
4.94	31.98	3	33.4	3	33.26	6	31.64	3	33.37	6	31.6
9.13	29.95	5	32	6	31.7	9.6	30.01	7	31.26	7	31.3
11.08	29.21	7	31.19	7	31.22	12	29.39	10	29.86	11	29.5
12.15	29.16	9	30.11	9	30.08	14	29.08	12	29.22	14	29
12.49	29.13	11	29.57	12	29.28	15.2	29	13.1	28.96	15	29.05
13.13	29.11	12	29.39	15	29.03	17.1	29.38	14.6	28.92	17	29.39
15	29.1	15	29.12	17	29.43	18.4	29.79	17.1	29.26	18.5	29.7
15.72	29.47	17	29.46	19	29.88	24	29.77	18.5	29.66	24	29.8
17.77	29.95	19	29.85	30	29.66	31	29.6	24	29.81	31	29.6
47.62	29.93	27	29.79	38	29.61	43	29.52	33	29.58	33	29.59
50.74	30.2	34	29.59	47	29.56	51	29.57	42	29.58	38	29.6
70.09	33.14	41	29.39	55	29.75	56	29.95	55	29.64	42	29.57
72.56	33.7	48	29.56	63	31.31	61	31.02	64	31.58	56	29.95
		54	29.71	72	33.24	69	32.6	70	32.9	63	31.3
		59	30.55			72.7	33.16	72	33.26	69	32.61
		63	31.36							72	33.22
		67	32.2								
		70	33.02								
		72	33.24								
HI		HI	38.37	HI	37.88	HI	38.2	HI	37.98	HI	38.1

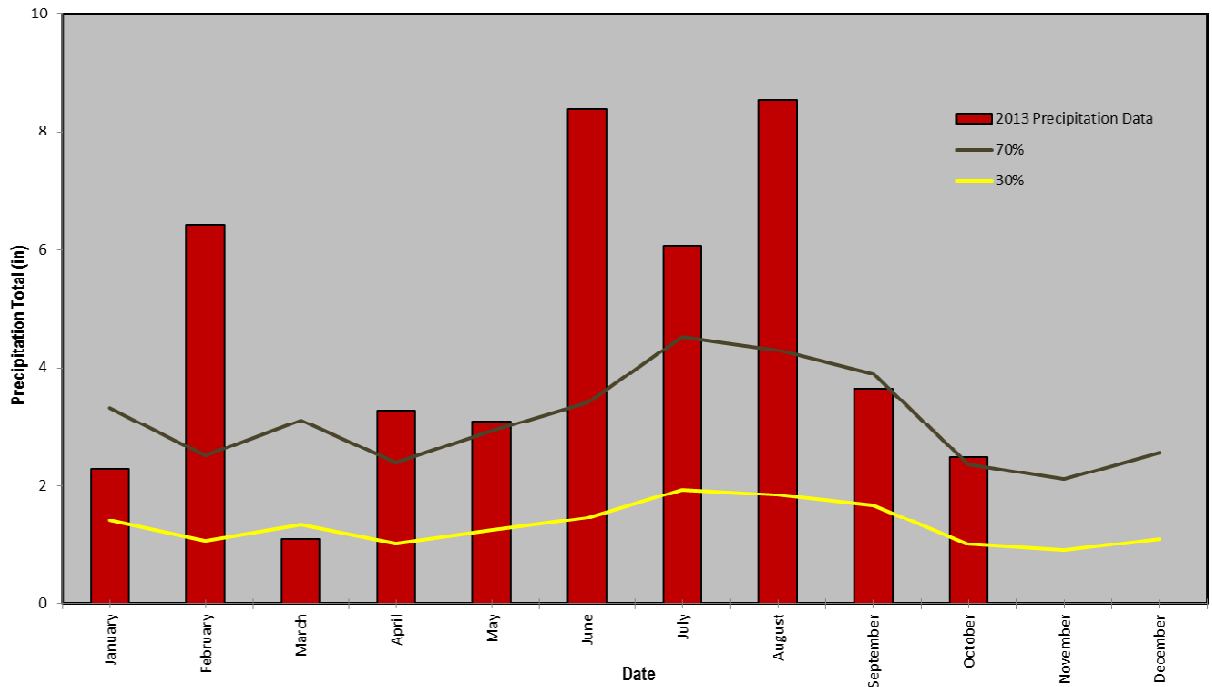
APPENDIX C

Rainfall Data Summary

Annual Precipitation Data - Brock Site, Jones County, NC



2013 Precipitation Data (through November 6, 2013)



APPENDIX D

Photograph Comparison

APPENDIX D: MONITORING PHOTOGRAPH SUMMARY

Photostation
Number and
Location

Year 0 Baseline - Taken July 2009

Year 1 - Taken November 2009

Year 2 - Taken July 2010

Year 3 - Taken July 2011

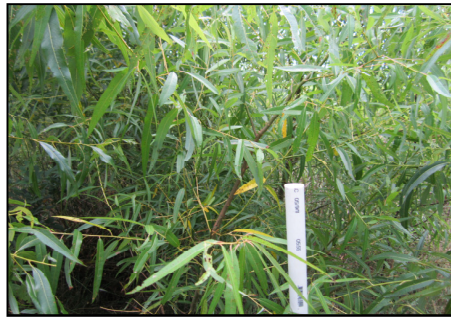
Year 4 - Taken July 2012

Year 5 - Taken August 2013

#1 Facing north
from beginning
of project at
Station 10+00



#2 Facing
northeast along
the eastern side
of Vegetation
Plot #1



#3 Facing north
across Vegetation
Plot #1



#4 Facing
downstream at
Cross Section #1



#5 Facing
northeast along
the east side of
Vegetation Plot
#2



APPENDIX D: MONITORING PHOTOGRAPH SUMMARY CONTINUED

Photostation Number and Location	Year 0 Baseline - Taken July 2009	Year 1 - Taken November 2009	Year 2 - Taken July 2010	Year 3 - Taken July 2011	Year 4 - Taken July 2012	Year 5 - Taken August 2013
#6 Facing northwest across Vegetation Plot #2						
#7 Facing north-northeast at Crest Gage situated near Station 18+65						
#8 Facing southwest along western axis of Vegetation Plot #3						
#9 Facing southeast across Vegetation Plot #3						
#10 Facing northeast along tributary in the vicinity of Station 22+50						

APPENDIX D: MONITORING PHOTOGRAPH SUMMARY CONTINUED

**Photostation
Number and
Location**

Year 0 Baseline - Taken July 2009

Year 1 - Taken November 2009

Year 2 - Taken July 2010

Year 3 - Taken July 2011

Year 4 - Taken July 2012

Year 5 - Taken August 2013

#11 Facing
northeast along
the eastern axis
of Vegetation
Plot #4



#12 Facing
northwest
across
Vegetation Plot
#4



#13 Facing
southwest
(upstream)
along the
tributary from
Station 28+25



#14 Facing
northeast along
buffer area
associated with
tributary from
Station 28+25



APPENDIX D: MONITORING PHOTOGRAPH SUMMARY CONTINUED

**Photostation
Number and
Location**

Year 0 Baseline - Taken July 2009

Year 1 - Taken November 2009

Year 2 - Taken July 2010

Year 3 - Taken July 2011

Year 4 - Taken July 2012

Year 5 - Taken August 2013

#15 Facing
southwest from
Chinquapin
Branch



#16 Facing
southeast at
buffer area
along
Chinquapin
Branch

