Little River Farm Site – Stream Enhancement, Restoration, and Preservation Project

Final Year 1 Monitoring Report (2010)

Montgomery County, North Carolina

EEP Contract Number 000623

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Montgomery County, North Carolina

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1.0 EXECUTIVE SUMMARY

This Annual Report details the monitoring activities during the 2010 growing season on the Little River Farm Stream Restoration site. Construction of the site, including the planting of woody and herbaceous vegetation and native grasses was completed in the winter of 2009/2010. In order to document project success, 17 vegetation monitoring plots, 2 permanent cross-sections, 515 linear feet of longitudinal profile, and 1 crest gauge were installed and assessed across the site. The 2010 data represents results from the first year of vegetation and hydrologic monitoring.

Historically, the site has been used for cattle and hog farming, as forest land, and as a rock quarry. The existing stream channels, located north of Black Ankle Rd, were relatively stable but each reach was experiencing some channel degradation due to unrestricted cattle access. UT4 experienced the highest rate of erosion and overall degradation, due to an almost complete lack of riparian buffer and subsequent channel incision. Vegetation within the site was comprised of a combination of pasture and wooded areas. Upon completion of construction, it was determined that 515 linear feet (LF) of an unnamed tributary to Little River was restored, 11,029 LF of stream was enhanced, and 2,409 LF of stream was preserved along Little River and its four unnamed tributaries (UT1, UT2, UT3, and UT4). In addition, 1,076 LF of Little River was enhanced on the right floodplain only; however mitigation credit was not sought for this reach. Approximately 30.9 acres (AC) of associated riparian buffer were restored and/or preserved within the site, while a conservation easement consisting of 44.5 AC was implemented to protect all stream reaches and riparian buffers in perpetuity

The 17 vegetation monitoring plots are 10 meters by 10 meters in size and are used to assess survivability of the woody vegetation planted on site. They are located to represent the different zones within the project as directed by EEP monitoring guidance. The vegetation monitoring indicated a survivability range of 155 stems per acre to 525 stems per acre with an overall average of 376 stems per acre. Supplemental planting of bare roots will be conducted during the winter of 2010/2011 to ensure that the site will meet final vegetative success criteria.

In general, dimension, pattern, profile and in-stream structures remained stable during the first growing season. One bankfull event was observed and documented during the month of November.

2.0 PROJECT GOALS, BACKGROUND, & ATTRIBUTES

2.1 Project Location and Description

The site is located in Montgomery County, NC (Figure 1, Appendix A) approximately three miles south of the Town of Seagrove and just east of the US-220 Bypass. The site is part of the Yadkin River Basin within NCDWQ sub-basin 03-07-15 and USGS hydrologic unit 03040104-030010.

The site is part of the Piedmont physiographic province. The site is located in an area of metavolcanic rocks; mainly felsic metavolcanic rocks of the Carolina Slate Belt (Geologic Map of North Carolina, NC Geological Survey, 1998). According to the Natural Resources Conservation Service (NRCS) in Montgomery County, soils found on site are primarily Herndon silt loam and Badin-Tarrus complex, with minor amounts of Georgeville silt loam and State silt loam. Badin soils are moderately deep and well drained and comprise the majority of the riparian corridor and floodplain along Little River, UT2, and UT4. The Herndon silt loam series are very deep, well drained soils and comprise the majority of the riparian corridor and floodplain in the project area along UT1 and UT3 (NRCS, 1930).

Little River drains approximately 51 square miles of predominately agricultural lands, while each of its tributaries, within the project boundaries, drain less than one square mile. Little River flows south through the project area and continues to its confluence with the Yadkin-Pee Dee River system. UT1 and UT4 flow southwest to Little River, while UT2 and UT3 flow northeast to Little River.

To access the site, travel west on US-64 from Raleigh to Asheboro. Take the US-220 South Bypass from Asheboro to the Black Ankle Road Exit (Exit 41). Turn west on Black Ankle Road. Black Ankle Road bisects the Little River reach of the project site.

2.2 Restoration Summary

2.2.1 Mitigation Goals and Objectives

The specific goals of this project include the enhancement of existing riparian buffer vegetation and the reforestation of the floodplain with native species along Little River and its four UTs within the conservation easement to:

- Maintain and increase channel bank stability,
- Reduce sedimentation,
- Filter and reduce pollutants, and
- Provide increased habitat for aquatic and terrestrial wildlife.

The primary goals for the Project were implemented by addressing areas of bank erosion and stream instability on UT4 and UT2, implementing and improving equipment and cattle crossings throughout the property, preserving plant community assemblages, and enhancing and restoring native riparian vegetation. Water quality improvements were made by fencing cattle out of the project reaches and by reducing bank erosion throughout the site. Aquatic habitat was improved by providing in-stream habitat structures. A conservation easement, along Little River and its UTs, has been implemented and lies within a fenced boundary on the site.

2.2.2 Project Description and Restoration Approach

The Project involved restoration of 515 LF of UT4 and enhancement and preservation of 11,029 LF and 2,409 LF, respectively, along Little River and its four unnamed tributaries (UT1, UT2, UT3, and UT4). As a result of this project a total of 5,326 Stream Mitigation Units (SMS's) are to be

generated. Approximately 30.9 AC of associated riparian buffer were restored/preserved throughout the site, while a conservation easement consisting of 44.5 AC will protect all stream reaches and riparian buffers in perpetuity.

For analysis purposes, Baker divided the Little River, UT1, UT2 UT3, and UT4 into seven reaches (As-built Plan Sheets, Appendix D). The Little River flows from north to south entering the site at the northern property line. Little River was divided into two reaches "M1" and "M2". "M1" begins at the northern property line and ends at Black Ankle Road. "M2" begins south of Black Ankle Road and continues to the site's southern property line. UT1 flows northeast to southwest entering the site along the northern property line. UT1 ends at its confluence with Little River. UT2 flows west to east starting along the western edge of the property and ending at its confluence with Little River. UT3 flows west to east and is separated mid-reach by a series of ponds. The portion of stream from the western property line to the upstream extent of the ponds is UT3A. Below the ponds to its confluence with Little River the channel is referred to as UT3. UT4 flows east to west starting at the eastern property line and ending at its confluence with Little River.

Baker performed visual stability assessments throughout the site. All streams within the site were partially degraded due to a lack of riparian buffer and unrestricted cattle access. Run-off containing nutrients and fecal loadings from cattle were major water quality impacts to the system. Based on field observations, the reaches targeted for enhancement and preservation were classified as "E," "B", or "C" stream types as defined by the Rosgen (1994, 1996) stream classification method. Bank height ratios rarely exceed 1.2 and most channels appear to be fairly stable.

However, UT4 was an exception. UT4 is an intermittent tributary that receives run-off from the US-220 Bypass. The reach consisted of a high angled slope and eroding banks and lacked a riparian buffer. Prior to restoration, the stream was highly incised with bank height ratios around 2.0, and classified as a Rosgen G type channel.

The area between reaches UT3A and UT3 originally ran through a series of ponds and lagoons. An adjacent channelized ditch acted as an overflow for the ponds and drains at the upper section of UT3. At the completion of construction of the full delivery project, this section of the farm was excluded from the easement because funding for this portion of the property had not been procured. Additional funding was later received from the NC Division of Water Resources to remove the lagoons and restore the stream. At the submittal of this Year 1 report, the lagoons have been removed and plans are underway to restore the section of stream that connected UT3A and UT3. Construction completion of the stream channel is scheduled for 2011, after which the work will be protected by a conservations easement.

UT4 was restored to a B type channel due to its slope and position in the landscape. The restoration approach for the upstream section of UT4 adjusted the pattern of the stream slightly, stabilized the stream banks, implemented grade control structures, provided floodplain access, and restored aquatic habitat. The design criteria were derived from the monitoring and evaluation of restored B streams and composite reference reach data.

The remaining reaches were relatively stable, with only minor areas of bank instability, usually associated with cattle access paths, past modifications, or loss of riparian buffer. Therefore, the majority of work involved excluding cattle from the streams, re-establishing 50-foot riparian buffers along all reaches, installing improved cattle/farm crossings, and stabilizing areas of localized bank erosion.

Permanent conservation easements have been established along each project reach to restrict cattle access to the stream. The easement boundaries were fenced and areas inside the easements were planted unless a mature tree canopy already existed. Watering tanks fed by well water are located in

several of the pastures, and additional watering tanks were installed as part of this project, so that cattle no longer need to access the streams for drinking water.

Four improved stream crossings were installed as part of the project. One crossing was installed on each of the four UTs (UT1, UT2, UT3a, and UT4). Three culvert crossings were installed (UT1, UT2, and UT3a), such that cattle and farm machinery no longer enter the stream channels when crossing. The UT4 crossing is an improved ford crossing.

Minor areas of bank erosion were stabilized by grading the banks to a 2:1 bank angle ratio and applying coir fiber matting, permanent seeding, and live staking. Cross vanes were used throughout the upstream section of UT4 to control streambed grade, reduce stream bank stress, and promote bedform sequences and habitat diversity. The site, with the exception of the riparian zone around UT4, was planted with native vegetation in the late winter/early spring of 2009 as shown in Table 8 (Appendix C). Buffer planting along UT4 was completed during January 2010. All planted areas are protected, in perpetuity, through a permanent conservation easement. Table 1 provides a summary of the project approach depicted in Figure 3 in Appendix A.

Table 1. Project Mitigation Approach

Little River Farm Site: EEP Contract No. 000623

Project Segment or Reach ID	Existing Footage (LF)	Mitigation Type *	Approach**	Linear Footage (LF)	Mitigation Ratio	Mitigation Units	Stationing	Comment
Little River – M1	4,089	E	EII	4,103	1:2.5	1,641	10+00 to 40+44 40+94 to 47+49 58+85 to 62+29	A 50-foot planted buffer was placed within a conservation easement. Cattle were excluded from the conservation easement by fencing. The right floodplain was enhanced from 47+95 to 58+25; however mitigation credit is not being sought.
Little River – M2	2,435	P	P	2,409	1:5	482	63+18 to 65+87 66+12 to 87+52	Preservation.
Unnamed Tributary 1	2,101	E	EII	2,120	1:2.5	848	10+00 to 16+88 17+19 to 31+51	A 50-foot planted buffer was placed within a conservation easement. Cattle were excluded from the conservation easement by fencing. The existing farm crossing (outside of easement) was stabilized.
Unnamed Tributary 2	2,402	E	EII	2,371	1:2.5	948	10+00 to 18+36 18+92 to 25+05	Two unstable meander bends were sloped and stabilized. A 50-foot planted buffer was placed within a conservation easement. Cattle were excluded from the conservation easement by fencing. The existing farm crossing (outside of easement) was stabilized

Table 1. Project Mitigation Approach								
Little River Farm Site: EEP Contract No. 000623								
Project Segment or Reach ID	**Existing Footage (LF)**	**Mitigation Type ***	**Approach****	**Linear Footage (LF)**	**Mitigation Ratio**	**Mitigation Units**	**Stationing**	**Comment**
Unnamed Tributary 3a	1,455	E	EII	1,449	1:2.5	580	10+00 to 18+36 18+92 to 25+05	A 50-foot planted buffer was placed within a conservation easement. Cattle were excluded from the conservation easement by fencing. The existing farm crossing (outside of easement) was stabilized.
Unnamed Tributary 3	719	E	EII	719	1:2.5	288	10+00 to 17+19	A 50-foot planted buffer was placed within a conservation easement. Cattle were excluded from the conservation easement by fencing.
Unnamed Tributary 4	550	R	P2	515	1:1	515	10+00 to 15+15	Installed in-stream structures to control grade and reduce bank erosion. Reestablished stable pattern and profile. A 50-foot planted buffer was placed within a conservation easement. Cattle were excluded from the conservation easement by fencing. The existing farm crossing (outside of easement) was stabilized.
Total linear ft of channel restored or preserved:				13,953				
Mitigation Unit Summation for Streams:				5,409				

* R = Restoration
E = Enhancement
P = Preservation

** P1 = Priority I
P2 = Priority II
P = Preservation
EII = Enhancement II

2.2.3 Project History, Contacts, and Attribute Data

The Little River Farm site was restored by Baker through a full delivery contract with NCEEP. The chronology of the Little River Stream Enhancement, Restoration, and Preservation Project is presented in Table 2. The contact information for all designers, contractors, and relevant suppliers is presented in Table 3. Relevant project background information is presented in Table 4.

Table 2. Project Activity and Reporting History			
Little River Farm Site: Project No. 000623			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan Prepared	N/A	N/A	Jul-07
Restoration Plan Amended	N/A	N/A	Jul-07

Table 2. Project Activity and Reporting History			
Little River Farm Site: Project No. 000623			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan Approved	N/A	N/A	Jul-07
Final Design – (at least 90% complete)	N/A	N/A	Jun-07
Construction Begins	N/A	N/A	Nov-07
Temporary S&E mix applied to entire project area	NA	N/A	Dec-08
Permanent seed mix applied to entire project area	N/A	N/A	Dec-08
Planting of live stakes	N/A	N/A	Feb-09
Planting of bare root trees	N/A	N/A	Feb-09
End of Construction	N/A	N/A	Feb-09
Survey of As-built conditions (Year 0 Monitoring-baseline)	N/A	Feb-09	May-09
Year 1 Monitoring	Dec-10	Nov-10	Dec-10
Year 2 Monitoring	Scheduled Dec-11	Scheduled Nov-11	N/A
Year 3 Monitoring	Scheduled Dec-12	Scheduled Nov-12	N/A
Year 4 Monitoring	Scheduled Dec-13	Scheduled Nov-13	N/A
Year 5 Monitoring	Scheduled Dec-14	Scheduled Nov-14	N/A

Table 3. Project Contact Table	
Little River Farm Site: Project No. 000623	
Designer	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Kevin Tweedy, Tel. 919-463-5488
Construction Contractor	
River Works, Inc.	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Will Pedersen, Tel. 919-459-9001
Planting Contractor	
River Works, Inc.	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Will Pedersen, Tel. 919-459-9001
Seeding Contractor	
River Works, Inc.	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Will Pedersen, Tel. 919-459-9001
Seed Mix Sources	Green Resources, Greensboro, NC Tel. 336-855-6363 Arbor Gen Blenheim, SC, Tel.843-528-3204
Nursery Stock Suppliers	Mellow Marsh Farm, Silk Hope, NC, Tel. 919-742-1800
Monitoring Performers	
Michael Baker Engineering, Inc.	1447 South Tryon Street, Suite 200 Charlotte, NC 28203

Table 3. Project Contact Table	
Little River Farm Site: Project No. 000623	
	Contact:
Stream Monitoring Point of Contact:	Ian Eckardt, Tel. 704-334-4454
Vegetation Monitoring Point of Contact:	Ian Eckardt, Tel. 704-334-4454

Table 4. Project Background Table	
Little River Farm Site: Project No. 000623	
Project County:	Montgomery, NC
Drainage Area:	
Little River M1	50.42 mi^2
Little River M2	51.03 mi^2
UT1	0.68 mi^2
UT2	0.16 mi^2
UT3a	0.1 mi^2
UT3	0.16 mi2
UT4	0.03 mi2
UT4	0.03 mi2
Estimated Drainage % Impervious Cover:	
Little River M1	N/A
Little River M2	N/A
UT1	N/A
UT2	N/A
UT3a	N/A
UT3	N/A
UT4	N/A
UT4	N/A
Stream Order:	
Little River M1	5th
Little River M2	5th
UT1	3rd
UT2	2nd
UT3a	1st
UT3	2nd
UT4	1st
UT4	1st
Physiographic Region:	Piedmont
Ecoregion:	Carolina Slate Belt Level IV

Table 4. Project Background Table	
Little River Farm Site: Project No. 000623	
Rosgen Classification of As-Built:	
Little River M1	E/B/C
Little River M2	E/B/C
UT1	E/B/C
UT2	E/B/C
UT3a	E/B/C
UT3	E/B/C
UT4	B4
UT4	E/B/C
Cowardin Classification	Riverine, Upper Perennial, Unconsolidated Bottom, Cobble-Gravel
Dominant Soil Types	
Little River M1	Hd, StB, BdD
Little River M2	GhC, GmE
UT1	Hd, BdD
UT2	BdD
UT3a	Hd
UT3	Hd, BdD
UT4	BdD
UT4	BdD
Reference site IDs	Silas Creek
USGS HUC for Project and Reference sites	03040105030010(Project); 03040101080010 (Reference)
NCDWQ Sub-basin for Project and Reference	03-07-15 (Project); 03-07-02 (Reference)
NCDWQ classification for Project and Reference	C
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor?	N/A
% of project easement fenced	83%

(NCDENR, 2006; NRCS, 1930; NC Geological Survey, 1998; Rosgen, 1994 & 1996)

3.0 MONITORING PLAN

Channel stability and vegetation survival will be monitored on the project site. Post-restoration monitoring will be conducted for five years following the completion of construction to document project success. Geomorphic monitoring of stream condition will be completed on UT4 where complete restoration was performed. For all other reaches, photo reference sites and vegetation monitoring will be used to monitor the success of enhancement reaches.

3.1 Stream Monitoring

Geomorphic monitoring of restored stream reach UT4 will be conducted for five years to evaluate the effectiveness of the restoration practices. Monitored stream parameters include bankfull events, stream dimension (cross-sections), profile (longitudinal profile survey), and photographic documentation. For

monitoring stream success criteria, two permanent cross-sections, one crest gauge, and 11 photo identification points were established on UT4. The specific locations of these monitoring features are represented on the as-built plan sheets in Appendix D.

3.1.1 Bankfull Events

The occurrence of bankfull events within the monitoring period will be documented by the use of crest gauges and photographs on each project reach. The crest gauge was installed on the floodplain within 10 feet of the restored channel. The crest gauge will record the highest watermark between site visits, and the gauge will be checked at each site visit to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Two bankfull flow events must be documented at the crest gauge within the 5-year monitoring period. The two bankfull events must occur in separate years; otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years.

3.1.2 Cross-sections

Two permanent cross-sections were installed along the restored stream reach for UT4, with both locations at riffle cross-sections. Each cross-section was marked on both banks with permanent pins to establish the exact transect used. A common benchmark will be used for cross-sections and consistently used to facilitate easy comparison of year-to-year data. The annual cross-sectional survey will include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg, if the features are present. Cross-sections will be classified using the Rosgen Stream Classification System.

There should be little change in as-built cross-sections. If changes do take place, they will be evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Riffle cross-sections will be classified using the Rosgen Stream Classification System, and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

3.1.3 Pattern

Annual measurements taken for the plan view of the site will include sinuosity and meander width ratio. Radius of curvature measurements will be taken on newly constructed meanders for the first year of monitoring only. Pattern measurements should show little adjustment over the five year monitoring period. If adjustments do occur, they will be evaluated to ensure that the new measurements fall within the quantitative parameters defined for channels of the design stream type.

3.1.4 Longitudinal Profile

A longitudinal profile will be completed annually during each year of the monitoring period along UT4. The profile will be conducted for the entire reach (approximately 515 LF). Measurements will include thalweg, water surface, inner berm, bankfull, and top of low bank. Each of these measurements will be taken at the head of each feature (e.g., riffle, run, pool, glide) and at the maximum pool depth. The survey will be tied to a permanent benchmark.

The longitudinal profiles should show that the bedform features are remaining stable (i.e., they are not aggrading or degrading). The pools should remain deep, with flat water surface slopes, and the riffles should remain steeper and shallower than the pools. Bedforms observed should be consistent with those observed for channels of the design stream type.

3.1.5 Watershed Observations

As part of the post-construction monitoring following construction, any observed activities or changes in the watershed will be noted and connections to onsite observations will be drawn, where appropriate.

3.1.6 Photo Reference Sites

Photographs will be used to document restoration success visually, by documenting stability and maturation of riparian vegetation over time. Reference stations will be photographed after construction and for five years following construction. Reference photos will be taken once a year, from a height of approximately five to six feet. Permanent markers will be established to ensure that the same locations (and view directions) on the site are monitored during each monitoring period. For enhancement reaches, photo points will be established in several locations along each reach with the intent of photographing areas of the stream that are representative of the reach. Photo points will also be established for each area of bank stabilization and at stream crossings. Photographs taken at cross sections are provided in Appendix B, while structure photographs are shown in Appendix E.

3.1.6.1 Lateral Reference Photos

Reference photo transects will be taken at each permanent cross-section. Photographs will be taken of both banks at each cross-section. The survey tape will be centered in the photographs of the bank. The water line will be located in the lower edge of the frame, and as much of the bank as possible will be included in each photo. Photographers will make an effort to consistently document the same view in each photo point over time. Lateral photos should not indicate excessive erosion or continuing degradation of the banks.

3.1.6.2 Structure Photos

Photographs will be taken at grade control structures along the restored reach of UT4, as well as at stream crossings. Photographs will be used to evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures subjectively. The position of each structure photo point is located on the as-built plan sheets in Appendix D.

3.2 Vegetation Monitoring

Successful restoration of the vegetation on a mitigation site is dependent upon hydrologic restoration, active planting of preferred canopy species, and volunteer regeneration of the native plant community. To evaluate vegetation success, vegetation-monitoring quadrants were installed and monitored across the restoration site in accordance with the CVS-NCEEP Protocol for Recording Vegetation, Version 4.1 (Lee, 2007). Seventeen permanent monitoring quadrants have been established within the enhancement and restored areas per Protocol Levels 1 and 2. The number of monitoring plots is based on canopy and understory planting of 20 acres on the north side of Black Ankle Road. Approximately 11 acres of existing forested areas within the enhancement reaches were planted with woody understory vegetation. The existing forested riparian areas within the enhancement and preservation areas do not contain monitoring plots. Monitoring quadrants have been established within the floodplain areas of UT1, UT2, UT3a, UT3, UT4 and the Little River (M1). The size of individual quadrants is 100 square meters for woody tree species. Vegetation monitoring will occur in the fall, prior to the loss of leaves. Individual quadrant data will be provided and will include diameter, height, density, and coverage quantities. Relative values will be calculated, and importance values will be determined. Individual seedlings will be marked such that they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

At the end of the first growing season, species composition, density, and survival will be evaluated. For each subsequent year, until the final success criteria are met, the site will be evaluated between July and November.

The interim measure of vegetative success for the site will be the survival of at least 320, 3-year old, planted woody stems (trees and shrubs) per acre at the end of year three of the monitoring period. The final vegetative success criteria will be the survival of 260, 5-year old, planted woody stems (trees and shrubs) per acre at the end of year five of the monitoring period.

Herbaceous vegetation, primarily native grasses, were planted at the site shall have at least 80 percent coverage of the seeded/planted area. Any herbaceous vegetation areas not meeting these criteria shall be replanted. At a minimum, at all times ground cover at the project site shall be in compliance with the North Carolina Erosion and Sedimentation Control Ordinance.

3.3 Maintenance and Contingency Plan

Maintenance requirements vary from site to site and are generally driven by the following conditions:

- Projects without established, woody floodplain vegetation are more susceptible to erosion from floods than those with a mature, hardwood forest.
- Alluvial valley channels with wide floodplains are less vulnerable than confined channels.
- Local wildlife can impact the rate at which the native buffer can be established,
- Wet weather during construction can make accurate channel and floodplain excavations difficult.
- Extreme and/or frequent flooding can cause floodplain and channel erosion.
- Extreme hot, cold, wet, or dry weather during and after construction can limit vegetation growth, particularly temporary and permanent seed.
- The presence and aggressiveness of invasive species can affect the extent to which a native buffer can be established.

Maintenance issues and recommended remediation measures will be detailed and documented in the monitoring reports. Factors that may have caused any maintenance needs, including any of the conditions listed above, shall be discussed. NCEEP approval will be obtained prior to any remedial action.

4.0 MONITORING RESULTS – 2010 YEAR 1 - MONITORING DATA

The five-year monitoring plan for the site includes criteria to evaluate the success of the vegetation and stream components of the project. The specific locations of vegetation plots, permanent cross-sections, and the crest gauge are shown on the as-built plan sheets. Photo points, located at each of the grade control structures along the restored stream channel, are also located on the as-built plan sheets in Appendix D.

4.1 Stream Data

First year monitoring dimension and profile data of UT4 were sampled in November 2010. Results from the first year monitoring samples were compared with the as-built data. Permanent cross-sections (with photos) and as-built longitudinal data, as well as the quantitative pre-construction, reference reach, and design data used to determine the restoration approach are provided in Appendix B. The locations of the permanent cross-sections are shown on the as-built plan sheets in Appendix D.

4.1.1 Cross-section and Longitudinal Profile Analysis and Monitoring Results

Cross Sections

The 2 permanent cross-sections along the restored portion of UT4 were re-surveyed to document stream dimension at the end of monitoring Year 1. The cross-sections documented that project reaches have experienced minor adjustment within the last year.

Riffle Cross-section X1 has aggraded slightly. The perceived aggradation reflects slight shifting of the coarse bed material rather than the deposition of fines. No deposition at these features was observed during Year 1 monitoring. Pool cross-section X2 has narrowed slightly within the channel bed. This type of adjustment is considered part of the normal fluvial process of the thalweg adjusting to flow velocities. Though both changes in channel geometry are normal, they will be monitored to assure the channel remains stable and functioning as designed.

Longitudinal Profile

The Year 1 longitudinal profile along UT4 was conducted during November 2010. The entire length (515 LF) was resurveyed along the restored channel. The longitudinal profiles were resurveyed to document stream profile at the end of monitoring Year 1. Pool – to – pool spacing on UT4 has changed very little since the as-built survey. Riffle slopes in these reaches also remained similar to as-built values. Due to the absence of water in the channel, the slopes where calculated using bed slope instead of water surface.

The longitudinal profile and a summary of parameters measured are provided in Appendix B.

4.1.2 Stream Problem Areas Plan View

The constructed sections of stream channel are functioning as designed. There were no observed vertical bed adjustments within the pools and only a minor adjustment in Riffle X1. During the field review, all rock step pool structures on UT4 were noted as stable. However, at Station 13+50, a boulder that ties the structure into the stream bank has shifted and is exposing a small area of bank at the tie-in point. This change in position allows for erosion to occur around the structure and will therefore be repaired.

Visual assessment scores are located in Table 5.

Table B.3 (Appendix B) provides a summary of problem areas. See Figure B1 in Appendix B for an overview of the stream problem areas. Table B.4 in Appendix B has additional data further explaining the visual assessment scores.

Table 5. Visual Morphological Stability Assessment

Little River Farm Site: Project No. 000623

UT4 (515 LF) Performance Percentage

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	100%	100%				
B. Pools	100%	100%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Bank Condition	100%	100%				
G. Vanes / J Hooks etc.	100%	100%				
H. Wads and Boulders	100%	99%				

4.2 Hydrology Data

The on-site crest gauge documented the occurrence of one bankfull event during the first year monitoring period. The highest stage recorded during the first year monitoring period was 2.6 feet. Bankfull verification summaries are included in Table 6. The crest gauge location is included in the as-built plan sheets in Appendix D. Bankfull verification photos are provided in Appendix E.

Table 6. Verification of Bankfull Events

Little River Farm Site: Project No. 000623

Location	Date of Data Collection	Date of Occurrence of Bankfull Event	Method of Data Collection	Gage Height (feet)	Photo # (If available)
UT4	11/1/2010	Unknown	Crest Gauge	2.6	UT4 CG

4.3 Vegetation Data

Bare-root trees and shrubs were planted within the conservation easement. A minimum 50-foot buffer was established along all stream reaches. In general, bare-root vegetation was planted at a target density of 564 stems per acre, in an 8-foot by 8-foot grid pattern. Planting of bare roots and live stakes for the majority of the site was completed in April 2009. At that time only a portion of the riparian zone along UT4 was planted with bare roots to accommodate the construction activities along UT4 which were completed in July 2009. Planting in the riparian zone along UT4 was completed during the winter of 2009/2010.

The restoration plan for the site specifies that the number of quadrants required is based on the CVS-NCEEP monitoring guidance (Lee, 2007). The number of quadrants required was determined using the plot number spreadsheet (07312006-2) provided by NCEEP that captures five percent of the total conservation easement. The sizes of individual quadrants are 100 square meters. A total of 17 vegetation plots were established across the restored site.

The average stem count per acre for Year 1 monitoring was 376. The vegetation monitoring indicated a survivability range of 155 stems per acre to 525 stems per acre with an overall average of 376 stems per acre. Three vegetation plots (4, 14, and 17) did not meet the projected Year 3 success criteria of 320 trees per acre; therefore, supplemental planting of bare roots will be conducted during the winter of 2010/2011 to ensure that the site will meet both the Year 3 vegetative success criteria and the final year's vegetative success criteria of 276 trees per acre.

No volunteer species were noted in any of the Site's vegetation plots, or were too small to verify. If any woody volunteer species are observed in subsequent monitoring years they will be flagged and added to the overall stems per acre assessment of the Site.

The average Year 1 density of planted bare root stems, based on the data from the 17 monitoring plots, is 376 stems per acre. The locations of the vegetation plots are shown on the as-built plan sheets in Appendix D.

Additional vegetation related information is listed below. Monitoring result tables and photos are located in Appendix C.

4.3.1 Growing Season Precipitation Data

Precipitation varied greatly throughout the growing season and may have played a considerable role in the establishment of the riparian vegetation. Though May and July were considerably wetter than average, April (time leaf out) was extremely dry, as was June. Lack of consistent rainfall during a plant's first year growing season is very important. The plant has just beginning to establish its root base; therefore, the root system is still shallow and does not have the capabilities to pull water from ground water reserves. The plant then becomes overly stressed, during times of drought, to degrees

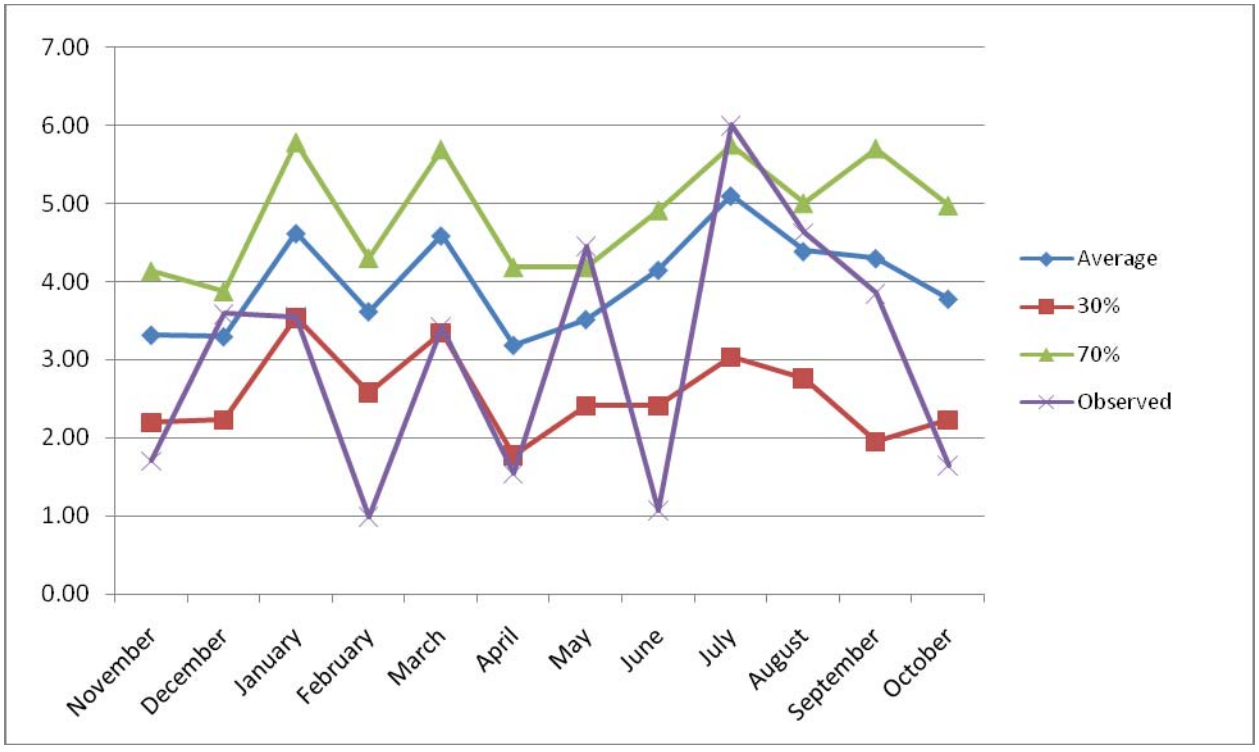
from which they cannot fully recover and resulting in mortality. See Table 7 and Figure 4 for a comparison in historic and observed rainfall averages.

Table 7. Comparison of Historic Rainfall to Observed Rainfall
Little River Creek Farm Site : Project No. 000623

Month	Average	30%	70%	Observed 2009 - 2010 Precipitation*
November	3.32	2.19	4.13	1.71
December	3.30	2.23	3.87	3.59
January	4.62	3.54	5.78	3.55
February	3.62	2.58	4.30	0.99
March	4.59	3.35	5.69	3.42
April	3.19	1.77	4.18	1.54
May	3.52	2.41	4.18	4.45
June	4.15	2.41	4.91	1.08
July	5.10	3.03	5.75	6.00
August	4.39	2.76	5.00	4.63
September	4.30	1.95	5.70	3.85
October	3.78	2.23	4.97	1.65

(NRCS National Climate and Water Center, 2000 and USGS, 2009-10)
* Monthly on-site rainfall data unavailable, so total monthly rainfall data was calculated using the nearest USGS rain gauge (USGS 354855080134201 Rain gage at NCDOT facility Lexington, NC) to the project site. (USGS, 2009 & 2010)

Figure 4. Comparison of Hitstoric Rainfall to Observed 2009-2010 Rainfall



4.3.2 Vegetation Plot Vegetation Problems

Vegetation plot counts were conducted in November 2010. During this assessment, damage to saplings in Veg Plot 13 by cutting was noted. In addition, evidence of herbicide overspray from an adjacent area outside of the easement was noted in Veg Plot 8. Neither incident should result in a significant loss of vegetation within the project area; however, these areas will be monitored to ensure their recovery and success. Supplemental planting may be required.

4.3.3 Vegetative Problem Areas

Though bare and/or areas of sparse vegetation are common along the floodplain bench and slide slopes of UT4, only a few small erosion rills are present. Observations of bare and/or sparse vegetation were noted in the left floodplain at Stations 10+60 to 11+00, 11+25 to 12+00, and 12+50 to 14+50 and in the right floodplain at Stations 10+00 to 13+50 and 13+75 to 14+60.

Currently these areas are not posing a threat to channel ability to move sediment through the system and remain stable. However, to ensure the project's success, maintenance of these areas, such as reseeding and additional plant installation, will be conducted within the dormant season and monitored for establishment.

No invasive species were observed within the project site during the field assessment. See Table C.6 in Appendix C for problem area categories, locations, descriptions, causes, and photo log.

4.3.4 Vegetative Problem Area Plan View

See Figure C1 in Appendix C for an overview of all vegetative problem areas.

4.4 Areas of Concern

Overall the restored channels are functioning as designed with no structural areas of concern. The only areas within the project site with any potential issues of concern are the presence of a few small erosion rills located along the top of slope of portions of the floodplain bench along UT4 and the unintentional vandalism damage of a few saplings in Veg Plot 8 and 13. Reseeding along UT4 as well as some additional live stakes and bare root plants are scheduled for completion prior to the onset of the Year 2 growing season. Damaged saplings in Veg Plots 8 and 13 will be monitored and will be replaced if needed.

5.0 References

Lee, M., Peet R., Roberts, S., Wentworth, T. CVS-NCEEP Protocol for Recording Vegetation, Version 4.1, 2007.

Natural Resources Conservation Council (NRCS), 1930. Soil Survey of Montgomery County. US Department of Agriculture, NRCS.

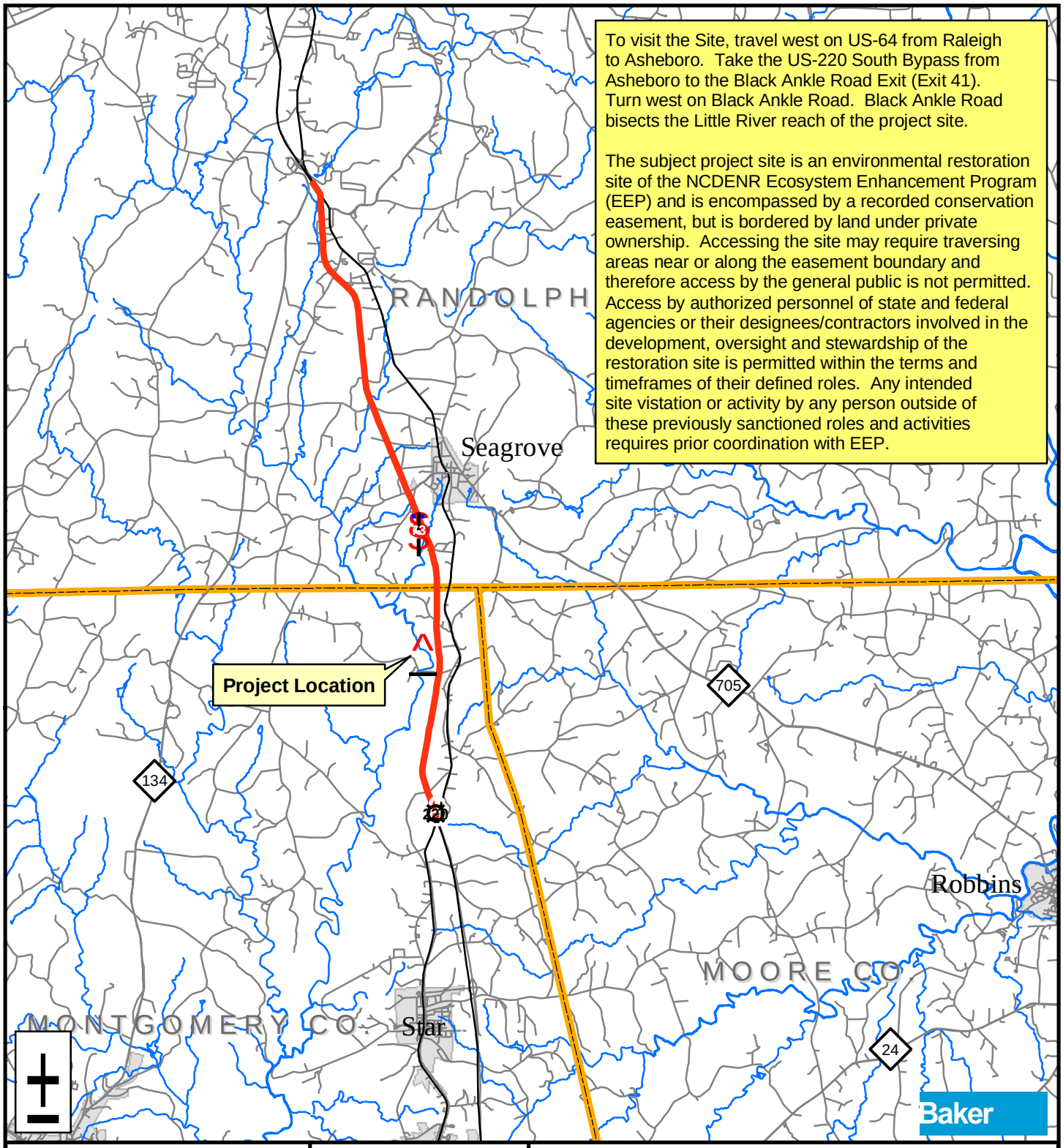
North Carolina Department of Environment and Natural Resources (NCDENR). 2006. Water Quality Stream Classifications for Streams in North Carolina. Water Quality Section, November 2006. Raleigh, NC.

North Carolina Geological Survey, 1998. North Carolina Geology. North Carolina Department of Environment and Natural Resources, Raleigh, NC.

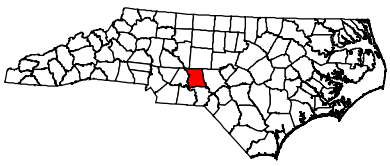
Rosgen, D. L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

Rosgen, D.L., 1996. Applied River Morphology. Wildland Hydrology Books, Pagosa Springs, Colo.

APPENDIX A:
FIGURES



Map Vicinity



Montgomery County, NC

Ecosystem Enhancement PROGRAM

EEP Project No.: 000623

December 2010

Figure 1. Project Vicinity Map

Little River Farm Site - Year 1 Monitoring

Montgomery County, NC

LEGEND

Location

County Boundaries

0 1.25 2.5 Miles

1 inch equals 2.5 miles

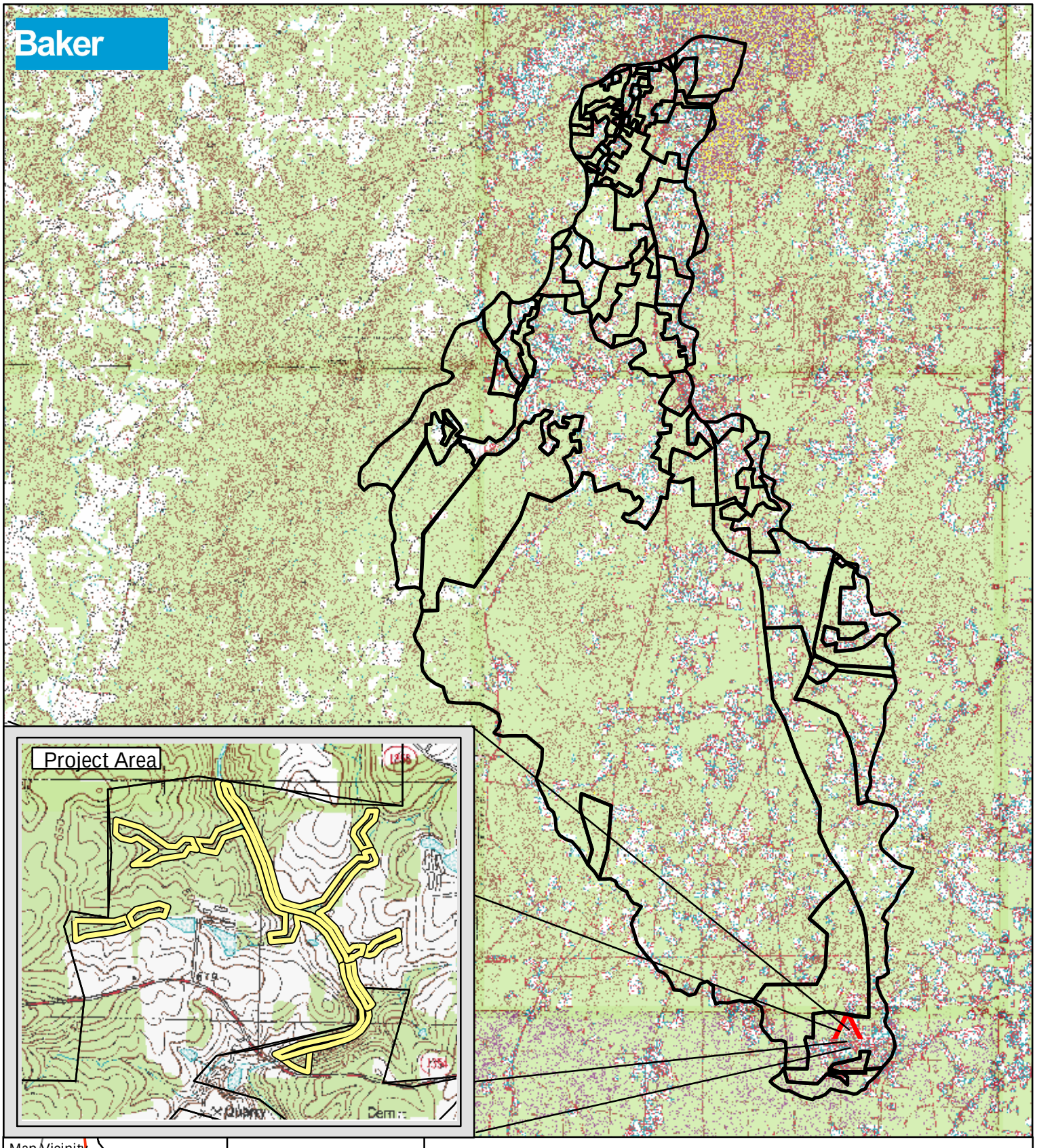
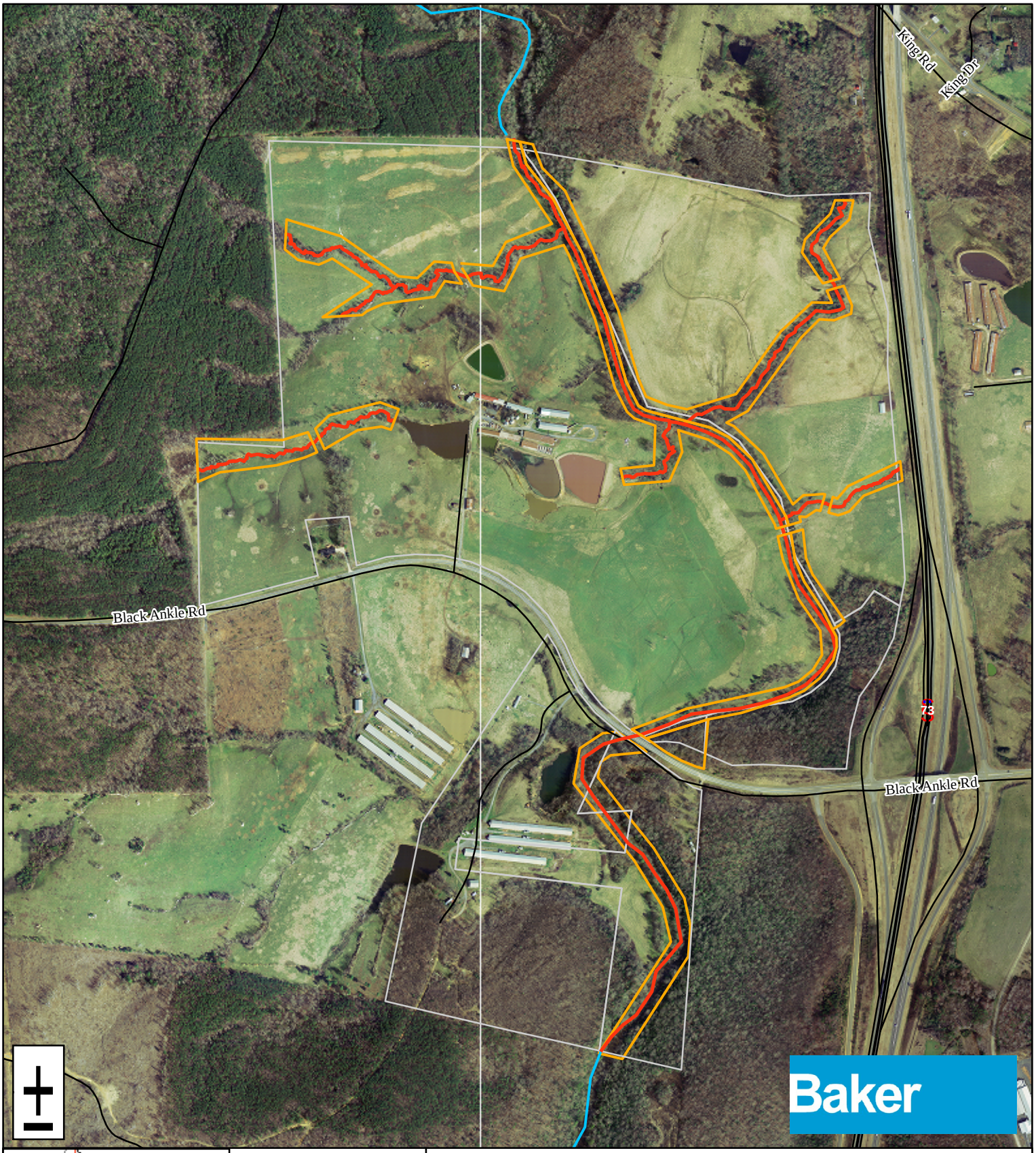


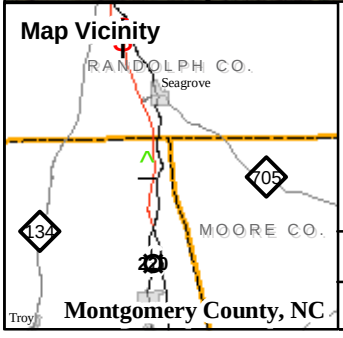
Figure 2. USGS Topographic & Watershed Map

Little River Farm Site - Year 1 Monitoring

Montgomery County, NC



Map Vicinity



Ecosystem Enhancement Program

EEP Project No.: 000623

December 2010

Figure 1. Project Vicinity Map

Little River Farm Site - Year 1 Monitoring

Montgomery County, NC

LEGEND

- Project Centerline
- Project Parcels
- Conservation Easement
- Streams
- Roads

0 200 400 800 Feet

1 inch equals 800 feet

APPENDIX B:
MORPHOLOGICAL DATA

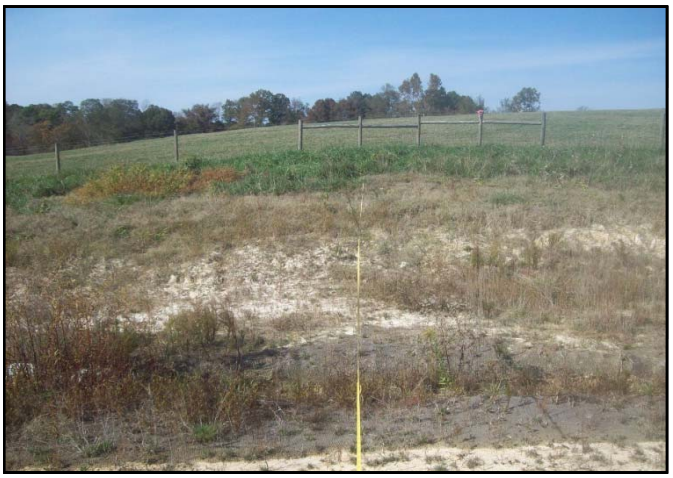
CROSS-SECTIONS

Permanent Cross-section X2

Little River Farm Site: Project No. 000623

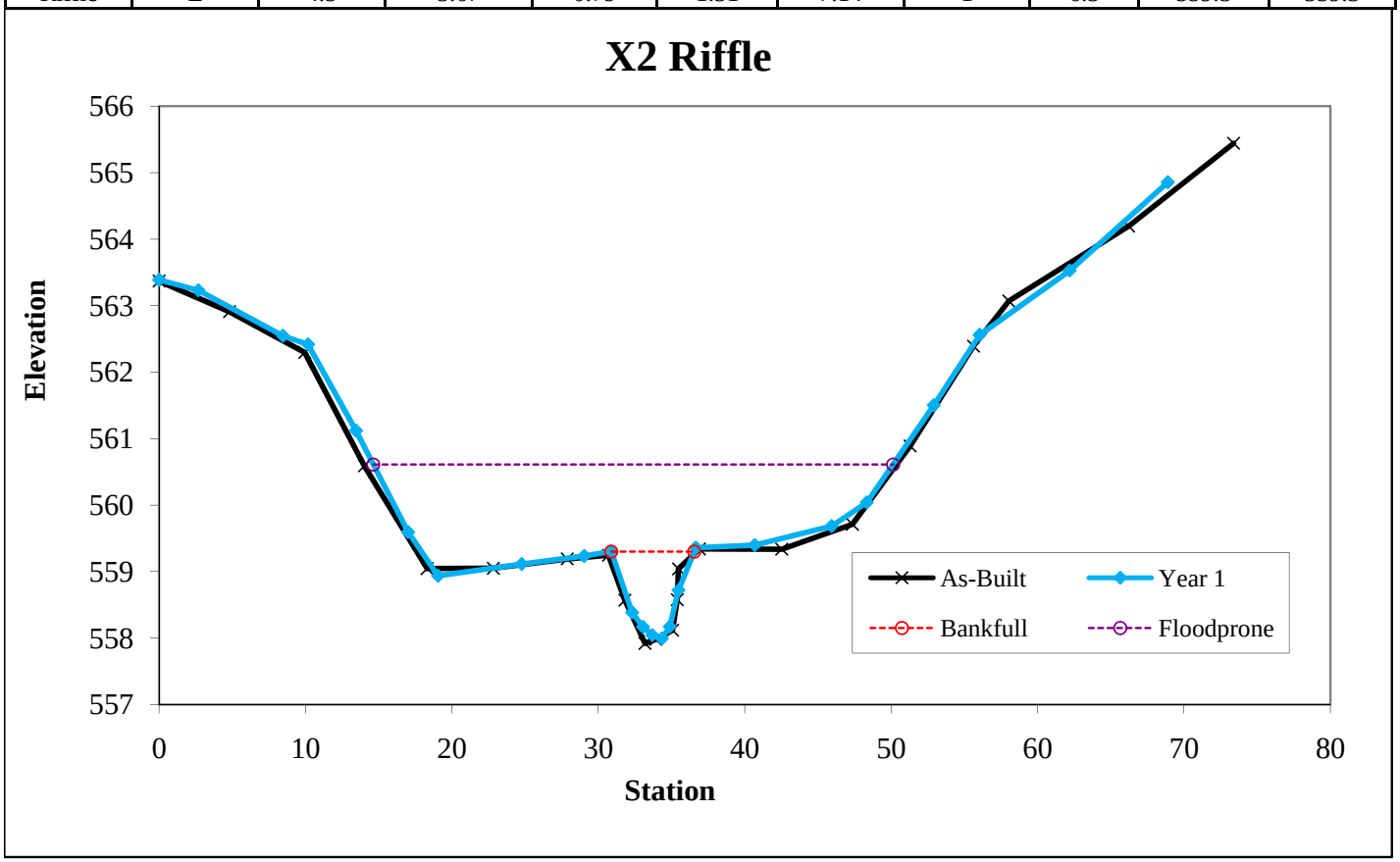
(Year 1 Monitoring Data - Collected November 2010)

Looking at Left Bank



Looking at Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	4.5	5.67	0.79	1.31	7.14	1	6.3	559.3	559.3



Permanent Cross-section X1

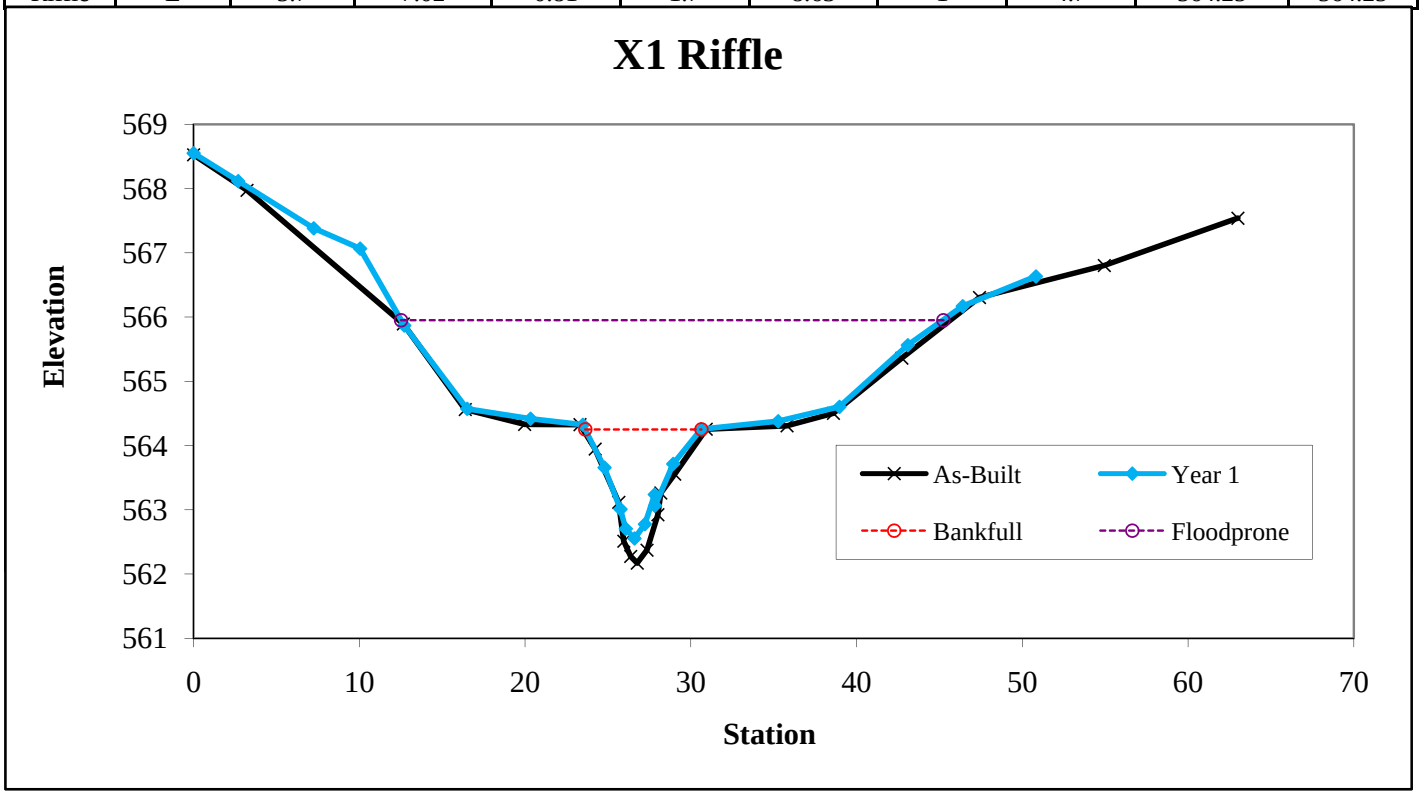
Little River Farm Site: Project No. 000623

(Year 1 Monitoring Data - Collected November 2010)

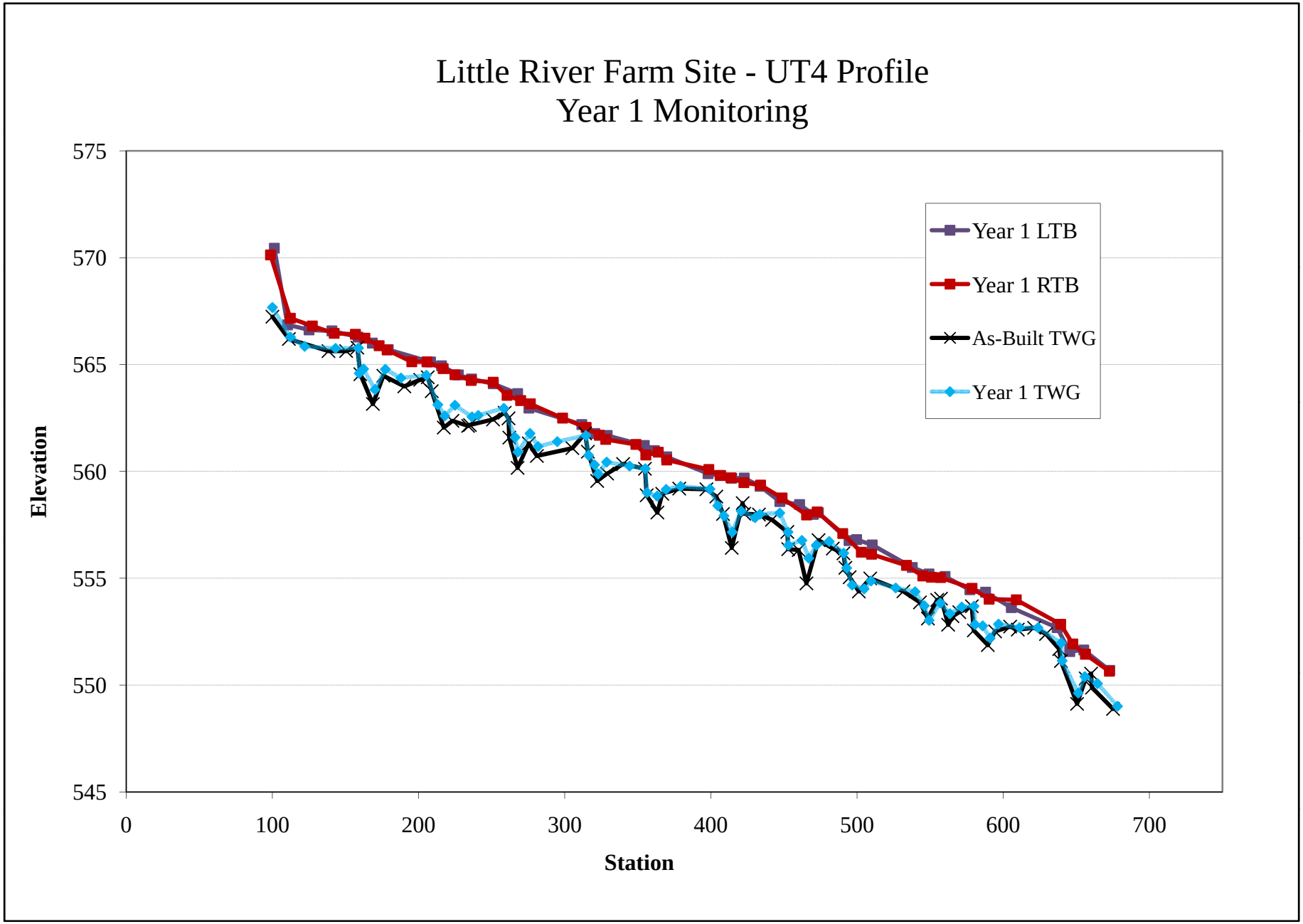
Looking at Left Bank

Looking at Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	5.7	7.02	0.81	1.7	8.63	1	4.7	564.25	564.25



LONGITUDINAL PROFILE


Little River Farm Site - UT4 Profile
Year 1 Monitoring
Elevation
575
570
565
560
555
550
545
0
100
200
300
400
500
600
700
Station
Year 1 LTB
Year 1 RTB
As-Built TWG
Year 1 TWG

SUMMARY TABLES

Table B.1. Baseline Stream Summary
Little River Farm Site: Project No. 000623

UT4 (515 LF)

Parameter	USGS Gauge	Regional Curve Interval			Pre-Existing Condition						Reference Reach(es) Data					
											Silas Creek					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	1.8	6.8	3.6	5.4	5.6	-----	5.7	-----	2	23	25.6	25.7	28.3	-----	5
Floodprone Width (ft)	-----	-----	-----	-----	8.7	12.0	-----	15.3	-----	2	33	36.3	35	41	-----	5
BF Mean Depth (ft)	-----	0.3	0.9	0.6	0.5	0.7	-----	0.9	-----	2	1.5	1.7	1.7	1.9	-----	5
BF Max Depth (ft)	-----	-----	-----	-----	1.5	1.8	-----	2.0	-----	2	2.4	2.8	2.9	3	-----	5
BF Cross-sectional Area (ft^2)	-----	0.9	3.8	2.0	2.98	4.0	-----	5.07	-----	2	38.5	43.7	43.1	48.9	-----	5
Width/Depth Ratio	-----	-----	-----	-----	5.76	8.4	-----	10.94	-----	2	121	15.1	-----	17.7	-----	5
Entrenchment Ratio	-----	-----	-----	-----	1.52	2.2	-----	2.83	-----	2	1.2	1.4	-----	1.8	-----	5
Bank Height Ratio	-----	-----	-----	-----	1.75	1.9	-----	2.1	-----	2	1.9	2.1	-----	2.3	-----	5
d50 (mm)	-----	-----	-----	-----	-----	-	-----	-----	-----	-----	-----	19.1	-----	-----	-----	1
Pattern																
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	43.7	-----	-----	-----	1
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	19.5	41.3	-----	54	-----	4
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.8	1.6		2.1	-----	4
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	168.3	-----	-----	-----	1
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.6	-----	-----	-----	1
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	0.09	0.25	0.14	0.75	-----	5	0.003	0.016	0.018	0.026	-----	3
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	62.4	-----	-----	-----	1
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-	-----	-----	-----	-----	4	4.5	4.5	5	-----	3
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----						0.283 / 0.83 / 19.1 / 157 / 300					
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.03	-----	-----	-----	-----	-----	3.3	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	G	-----	-----	-----	-----	-----	B4/1c	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.6	-----	-----	-----	-----
BF Discharge (cfs)	-----	2.4	20.9	7.1	-----	-----	-----	-----	-----	-----	-----	199.0	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----		740.0	-----	-----	-----	-----	-----	325	-----	-----	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	821.0	-----	-----	-----	-----	-----	349	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.11	-----	-----	-----	-----	-----	1.07	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)*	-----	-----	-----	-----		0.0400	-----	-----	-----	-----	-----	0.0082	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Values calculated using bed slope due to lack of water in channel

Table B.1. Baseline Stream Summary
Little River Farm Site: Project No. 000623

UT4 (515 LF)

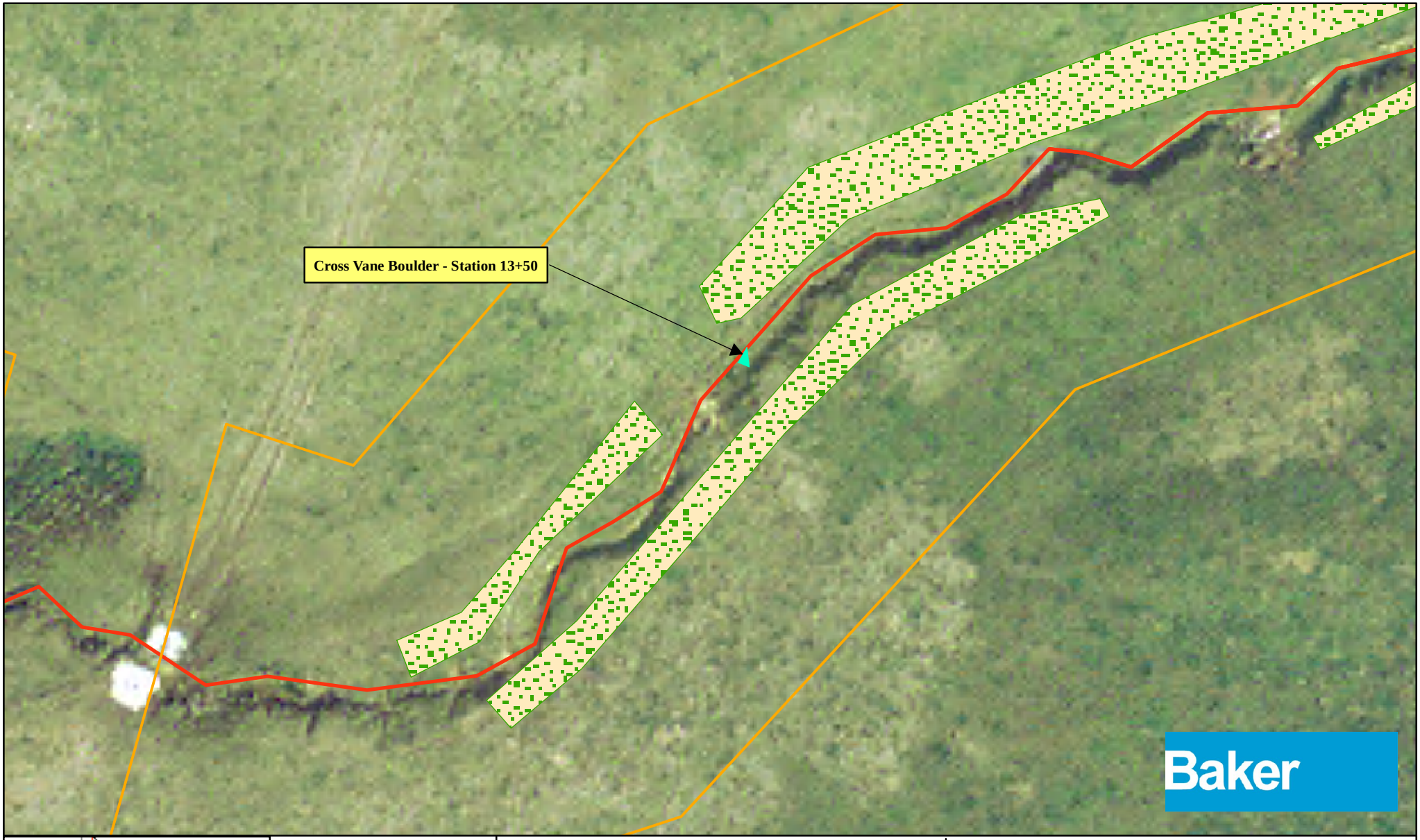
Parameter	Design						As-built						Year 1					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	6.5	-----	-----	-----	1	5.7	6.5	-----	7.2	-----	2	5.7	6.3	-----	7.0	-----	2
Floodprone Width (ft)	-----	-----	-----	-----	-----	1	35.9	36.0	-----	36.1	-----	2	32.7	34.1	-----	35.5	-----	2
BF Mean Depth (ft)	-----	0.80	-----	-----	-----	1	0.8	0.9	-----	0.9	-----	2	0.8	0.8	-----	0.8	-----	2
BF Max Depth (ft)	-----	0.6	-----	-----	-----	1	1.3	1.7	-----	2.0	-----	2	1.3	1.5	-----	1.7	-----	2
BF Cross-sectional Area (ft^2)	-----	3.8	-----	-----	-----	1	4.5	5.6	-----	6.6	-----	2	4.5	5.1	-----	5.7	-----	2
Width/Depth Ratio	-----	11.2	-----	-----	-----	1	7.3	7.6	-----	7.8	-----	2	7.1	7.9	-----	8.6	-----	2
Entrenchment Ratio	-----	2.0	-----	-----	-----	1	5.0	5.7	-----	6.3	-----	2	4.7	6.3	-----	6.3	-----	2
Bank Height Ratio	-----	1.0	-----	-----	-----	1	1.0	1.0	-----	1.0	-----	2	1.0	1.0	-----	1.0	-----	2
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																		
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																		
Riffle Length (ft)	10	26	20	70	-----	10	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	0.01	0.0201	0.0167	0.05	-----	10	0.02*	0.04*	0.04*	0.06*	-----	5	0.01*	0.05*	0.04*	0.11*	-----	7
Pool Length (ft)	20	20	20	20	-----	10	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	40.0	54.4	50.0	100.0	-----	8	35.9*	48.2*	48.5*	61.0*		10	38.4*	46.6*	47.8*	51.4*	-----	8
Pool Max Depth (ft)	-----	2.0	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																		
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	1
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	1
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	1
Additional Reach Parameters																		
Drainage Area (SM)	-----	-----	0.3	-----	-----	-----	-----	-----	-----	0.03	-----	-----	-----	-----	-----	0.03	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	B4	-----	-----	-----	-----	-----	E	-----	-----	-----	-----	-----	E	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	500.0	-----	-----	-----	-----	-----	532.4	-----	-----	-----	-----	-----	530.9	-----	-----	-----	-----
Channel length (ft)	-----	550.0	-----	-----	-----	-----	-----	575.0	-----	-----	-----	-----	-----	578.2	-----	-----	-----	-----
Sinuosity	-----	1.10	-----	-----	-----	-----	-----	1.08	-----	-----	-----	-----	-----	1.09	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)*	-----	0.0310	-----	-----	-----	-----	-----	0.03*	-----	-----	-----	-----	-----	0.03*	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

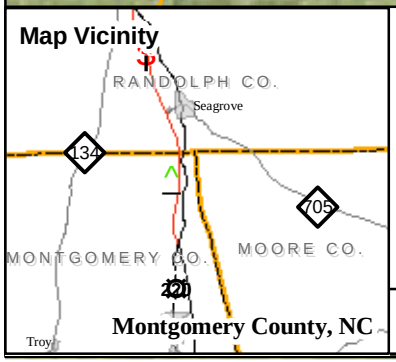
* Values calculated using bed slope due to lack of water in channel

Table B.2. Morphology and Hydraulic Monitoring Summary
Little River Farm Site: Project No. 000623

UT4 (515 LF)																							
	Cross-section 1 (Riffle)						Cross-section 2 (Riffle)																
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Based on fixed baseline bankfull elevation																								
BF Width (ft)	7.2	7.0					5.7	5.7																
BF Mean Depth (ft)	0.9	0.8					0.8	0.8																
Width/Depth Ratio	7.8	8.6					7.3	7.1																
BF Cross-sectional Area (ft²)	6.6	5.7					4.5	4.5																
BF Max Depth (ft)	2.0	1.7					1.3	1.3																
Width of Floodprone Area (ft)	35.9	32.7					36.1	35.5																
Entrenchment Ratio	5.0	4.7					6.3	6.3																
Bank Height Ratio	1.0	1.0					1.0	1.0																
Wetted Perimeter (ft)	9.0	8.6					7.3	7.3																
Hydraulic Radius (ft)	0.7	0.7					0.6	0.6																
Based on current/developing bankfull feature																								
BF Width (ft)	-	-					-	-																
BF Mean Depth (ft)	-	-					-	-																
Width/Depth Ratio	-	-					-	-																
BF Cross-sectional Area (ft²)	-	-					-	-																
BF Max Depth (ft)	-	-					-	-																
Width of Floodprone Area (ft)	-	-					-	-																
Entrenchment Ratio	-	-					-	-																
Bank Height Ratio	-	-					-	-																
Wetted Perimeter (ft)	-	-					-	-																
Hydraulic Radius (ft)	-	-					-	-																
Cross Sectional Area between end pins (ft²)	-	-					-	-																
d50 (mm)	-	-					-	-																
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Based on fixed baseline bankfull elevation																								
BF Width (ft)																								
BF Mean Depth (ft)																								
Width/Depth Ratio																								
BF Cross-sectional Area (ft²)																								
BF Max Depth (ft)																								
Width of Floodprone Area (ft)																								
Entrenchment Ratio																								
Bank Height Ratio																								
Wetted Perimeter (ft)																								
Hydraulic Radius (ft)																								
Based on current/developing bankfull feature																								
BF Width (ft)																								
BF Mean Depth (ft)																								
Width/Depth Ratio																								
BF Cross-sectional Area (ft²)																								
BF Max Depth (ft)																								
Width of Floodprone Area (ft)																								
Entrenchment Ratio																								
Bank Height Ratio																								
Wetted Perimeter (ft)																								
Hydraulic Radius (ft)																								
Cross Sectional Area between end pins (ft²)																								
d50 (mm)																								

STRUCTURAL PROBLEM AREA DATA





Ecosystem Enhancement PROGRAM

EEP Project No.: 000623

Figure B1. UT4 Structure Problem Area
Rock Cross Vane
Little River Farm Site - Year 1 Monitoring
Montgomery County, NC

December 2010

LEGEND

- Project Centerline
- Conservation Easement
- Project Parcels
- Streams
- Roads

Problem Area Type
- Structure
- Vegetation

1 inch equals 30 feet

0 7.5 15 30 Feet

Table B.3. Stream Problem Areas
Little River Farm Site: Project No. 000623

UT4			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Aggradation / Bar Formation	-	-	-
Bank Scour / Raw Bank	-	-	-
Bed Scour/Degradation	-	-	-
Engineered Structures - back or arm scour	13+50	Boulder along right bank has shifted/rotated creating a gap in bank armor of boulder step.	Structural Proble Area - 1
Engineered Structures - improper elevations	-	-	-

Table B4. Visual Morphological Stability Assessment
Little River Farm Site: Project No. 000623

UT4 (515 LF)

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	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	10	10	0	100	
	2. Armor stable (e.g. no displacement)?	10	10	0	100	
	3. Facet grades appears stable?	10	10	0	100	
	4. Minimal evidence of embedding/fining?	10	10	0	100	
	5. Length appropriate?	10	10	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	10	10	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	10	10	0	100	
	3. Length appropriate?	10	10	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	N/A	N/A	0	100	
	2. Downstream of meander (glide/inflection) centering?	N/A	N/A	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	N/A	N/A	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	N/A	N/A	0	100	
	3. Apparent Rc within spec?	N/A	N/A	0	100	
	4. Sufficient floodplain access and relief?	N/A	N/A	0	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	N/A	N/A	0	100	**100%**
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	0	100	**100%**
G. Vanes	1. Free of back or arm scour?	9	9	0	100	
	2. Height appropriate?	9	9	0	100	
	3. Angle and geometry appear appropriate?	9	9	0	100	
	4. Free of piping or other structural failures?	9	9	0	100	**100%**
H. Wads/Boulders	1. Free of scour?	8	9	5	1%	99%
	2. Footing stable?	9	9	0	0%	**99%**

STRUCTURAL PROBLEM AREA PHOTOS

Structural Problem Area-1
Shifted Bank Armor of Boulder Step
Station – 13+50

APPENDIX C:
VEGETATION RAW DATA

VEGETATION DATA

Planted Woody Stem Data: CVS Level 1

Leader: P. Lynch **Project:** Little River **Team:** PL **Plot:** 1 **Date:** 11/10/11 Page __ of __

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
1-1 Lt				9	61	–	2	
1-2 Lt				8	50	–	2	
1-3 Lt				6	49	–	1	
1-4 Ns				–	–	–	0	
1-5 C.ser				7	84	–	3	
1-6 Fp				6	47	–	1	
1-7 Ns				5	29	–	2	
1-8 Ns				5	47	–	2	
1-9 Lt				5	25	–	1	
1-10 Bn				4	31	–	1	Broken Stem
1-11 Qf				10	86	–	4	
1-12 Co				2	17	–	1	Broken Stem
1-13 Cl				2	21	–	1	Broken Stem

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: P. Lynch **Project:** Little River **Team:** P. L. **Plot:** 2 **Date:** 11/10/10 Page __ of __

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
2-1 Ca				9	83	–	4	
2-2 Ca				6	39	–	2	
2-3 Ca				10	107	–	3	Broken stem / new growth
2-4 Ca				6	69	–	4	
2-5 L.Cor				7	70	–	3	
2-6 Po				–	–	–	0	
2-7 Po				12	82	–	4	
2-8 Qf				23	125	–	4	
2-9 Ca				15	132	3	4	
2-10 Ca				18	169	5	4	
2-11 Ca				15	124	–	4	
2-12 Ca				7	95	–	4	
2-13 Ca				15	111	–	4	
2-14 Ca				13	121	–	3	Broken Limb
2-15 Ca				16	117	–	4	
2-16 Ca				13	116	–	4	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: I, Eckhardt **Project:** Little River **Team:** FF/A **Plot:** 3 **Date:** 11 / 9 / 10 Page __ of ____

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
3-1 Bn				8	54	–	3	
3-2 Lt				10	61	–	2	
3-3 Bn				13	75	–	3	
3-4 Lt				–	–	–	0	
3-5 Bn				9	63	–	2	
3-6 Bm				3	21	–	2	
3-7 QM				7	20	–	2	new growth
3-8 Po				5	48	–	2	
3-9 QM				8	45	–	2	
3-10 C.Cor				5	40	–	2	
3-11 C.Cor				4	56	–	2	new growth
3-12 C.Cor				5	32	–	2	new growth
3-13 C.Cor				8	23	–	1	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: P. Lynch **Project:** Little River **Team:** PL **Plot:** 4 **Date:** 11 / 11 / 12 Page __ of ____

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
4-1 CL				5	40	-	1	
4-2 Co				-	-	-	0	
4-3 Co				-	-	-	0	
4-4 Cocor				6	61	-	2	
4-5 Cocor				-	-	-	0	
4-6 QL				7	52	-	1	
4-7 Bn				-	-	-	0	
4-8 Bn				-	-	-	0	
4-9 Of				4	50	-	2	
4-10 QL				5	37	-	1	
4-11 QL				6	41	-	1	
4-12 QL				3	30	-	2	
4-13 QL				7	51	-	1	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: I. Eckardt **Project:** LR **Team:** IE/AL **Plot:** 5 **Date:** 11 / 9 / 10 Page 1 of 1

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
5-1 At				41	33	—	1	
5-2 Po				—	—	—	0	
5-3 Ns				—	—	—	0	
5-4 At				2	25	—	1	
5-5 Cf				5	165	—	4	
5-6 Cf				7	616	—	4	
5-7 Cf				8	78	—	4	
5-8 C.cor				5	60	—	2	
5-9 Qm				10	93	—	4	
5-10 Qm				8	76	—	4	
5-11 Qm				23	100	—	4	
5-12 Lt				9	59	—	1	
5-13 Cl				10	75	—	4	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

 Form PWS12, ver 8.3

Planted Woody Stem Data: CVS Level 1

Leader: I. Eckardt Project: LR Team: IE/PL Plot: 6 Date: 11 / 9 / 10 Page 1 of 1

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
6-1 Qm				3	15	–	1	Broken Stem
6-2 Qm				2	16	–	1	Broken Stem
6-3 Cl				–	–	–	0	
6-4 Po				–	–	–	0	
6-5 C.cor				5	25	–	2	
6-6 Fp				8	49	–	2	
6-7 Fp				10	77	–	3	
6-8 Bn				6	55	–	3	
6-9 Fp				6	46	–	2	
6-10 Po				7	68	–	2	
6-11 Bn				8	75	–	3	
6-12 Po				5	43	–	2	
6-13 Po				14	99	–	4	
6-14 Cc				5	37	–	2	
6-15 Fp				7	68	–	2	
6-16 Cc				4	60	–	3	
6-17 Po				7	71	–	2	
6-18 Cc				3	66	–	2	
6-19 Fp				8	76	–	2	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: J. Eckardt **Project:** Little R. **Team:** IE/R **Plot:** 7 **Date:** 11 / 9 / 10 Page __ of ____

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
7-1 QL				6	38	–	3	
7-2 QL				–	–	–	0	
7-3 Qf				–	–	–	0	
7-4 QM				9	45	–	2	
7-5 Qm				6	27	–	1	
7-6 QL				8	45	–	2	
7-7 Qm				8	43	–	2	
7-8 QL				6	44	–	1	
7-9 Lt				9	48	–	1	
7-10 Lt				9	87	–	1	
7-11 Lt				7	55	–	1	
7-12 Lt				12	92	–	2	
7-13 Lo				–	6	–	1	Broken stem
7-14 Lt				–	–	–	0	
7-15 Lt				N/A	N/A	–	1	Broken stem at Base
7-16 Lt				8	64	–	2	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: T. Eckardt **Project:** Little River **Team:** JE/TE **Plot:** 8 **Date:** 11/9/10 Page __ of __

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
8-1 Of				-	-	-	0	
8-2 Qm				8	72	-	4	
8-3 Qm				6	58	-	4	
8-4 Of				5	19	-	1	
8-5 Of				-	-	-	0	
8-6 QL				4	39	-	3	
8-7 QL				9	50	-	4	
8-8 Bn				8	95	-	4	
8-9 At				3	26	-	1	
8-10 Bn				13	153	3	4	
8-11 LT				-	-	-	0	
8-12 Po				13	139	4	4	
8-13 Fp				5	46	<	1	
8-14 Fp				4	69	-	1	
8-15 Po				6	61	-	1	
8-16 Fp				6	71	-	1	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: P. Lynch **Project:** Little River **Team:** PL **Plot:** 9 **Date:** 11/10/10 Page __ of __

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
9-1 QF				—	~	~	0	
9-2 QF				10	90	—	2	
9-3 QM				14	116	—	4	
9-4 QF				13	143	6	4	
9-5 Ca				12	80	~	3	
9-6 C.Cor				6	57	—	1	
9-7 Ca				19	102	—	4	
9-8 Ca				15	126	—	4	
9-9 C.Cor				7	74	—	1	
9-10 C.Cor				6	65	—	2	
9-11 Ca				11	96	—	3	
9-12 Ca				~	—	~	0	
9-13 PO				—	—	—	0	
9-14 PO				12	113	—	4	
9-15 PO				14	101	—	4	
9-16 FP				9	85	—	1	
9-17 PO				19	119	—	4	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: P. Lynch **Project:** Little River **Team:** PL **Plot:** 10 **Date:** 11 / 11 / 10 Page __ of __

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
10-1 Bn				11	91	—	3	
10-2 CL				5	51	—	3	
10-3 QL				7	72	~	3	
10-4 Qm				8	31	—	3	
10-5 Ca				10	132	3	4	
10-6 Qm				6	82	—	1	
10-7 NS				6	73	—	3	
10-8 NS				8	89	—	3	
10-9 Po				8	53	—	3	
10-10 Bn				9	100	~	3	
10-11 Po				11a	162	6	4	
10-12 CL				6	110	—	3	
10-13 Ca				5	67	—	3	
10-14 Ca				8	88	~	3	
10-15 NS				4	58	—	3	
10-16 Ca				3	35^	~	2	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

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Planted Woody Stem Data: CVS Level 1

Leader: P. Lynch **Project:** Little River **Team:** PL **Plot:** 11 **Date:** 11 / 12 / 10 Page 1 of

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
11-1 Qm				16	109	–	4	
11-2 Qn				4	40	–	2	
11-3 Qn				7	72	–	4	
11-4 Qf				10	88	–	4	
11-5 Qf				13	116	–	4	
11-6 QL				11	98	–	4	
11-7 QL				10	88	–	3	
11-8 Bn				12	102	–	3	
11-9 Cp				8	49	–	1	
11-10 Qf				10	89	–	4	
11-11 Qf				13	119	–	4	
11-12 Qm				17	148	6	4	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: P. Lynch **Project:** Little River **Team:** PL **Plot:** 12 **Date:** 11 / 12 / 10 Page __ of ____

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
12-1 Qf				7	63	–	4	
12-2 QL				10	116	–	4	
12-3 QL				8	96	–	4	
12-4 QL				13	144	5	4	
12-5 Lt				8	75	–	2	
12-6 Qf				6	73	–	3	
12-7 Qm				17	126	–	4	
12-8 Qm				5	61	–	3	
12-9 Bn				31	261	14	4	
12-10 Bn				29	153	4	4	
12-11 Bn				22	155	5	4	
12-12 Lt				19	99	–	4	
12-13 Qf				24	175	5	4	
12-14 Qf				–	–	–	0	
12-15 Qf				4	18	–	1	
12-16 Bn				19	109	–	4	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: Plynch **Project:** Little Alcove **Team:** PL **Plot:** 13 **Date:** 11 / 15 / 10 Page __ of __

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
13-1 Qf				—	60	—	1	CUT
13-2 Co				7	27	—	1	
13-3 C.Cas				6	10	—	1	CUT
13-4 Po				17	136	.5	3	
13-5 Qm				—	—	—	0	
13-6 Po				18	24	—	1	CUT
13-7 Qm				—	—	—	1	CUT
13-8 Qn				—	—	—	1	CUT
13-9 Qm				—	—	—	0	
13-10 Qf				9	73	—	4	
13-11 Lt				11	76	—	3	
13-12 Lt				8	29	—	1	
13-13 Po				15	73	—	2	
13-14 Qf				8	60	—	3	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: P. Lynch **Project:** Little River **Team:** P.L. **Plot:** 14 **Date:** 11/15/10 Page __ of ____

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
14-1 Ca				13	47	–	3	
14-2 Ca				6	46	–	1	
14-3 Ca				7	70	–	3	
14-4 QL				–	–	–	0	
14-5 QL				–	–	–	0	
14-6 QL				7	48	–	3	
14-7 QL				–	–	–	0	
14-8 Ca				12	41	–	1	
14-9 Ca				5	30	–	1	
14-10 Ca				5	30	–	1	
14-11 QF				6	36	–	1	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: P. Lynch **Project:** Little River **Team:** P.L. **Plot:** 15 **Date:** 11 / 12 / 10 Page __ of __

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
15-1 QL				—	—	—	0	
15-2 Lt				11	95	-	3	
15-3 Lt				5	47	-	2	
15-4 Lt				9	65	—	2	new growth
15-5 QL				6	33	-	1	
15-6 QL				—	—	—	0	
15-7 QL				0	0	0	0	
15-8 Qf				11	130	-	4	
15-9 Qf				6	51	-	3	
15-10 Qf				9	97	-	3	
15-11 2m				—	—	—	0	
15-12 Lt				—	—	—	0	
15-13 Lt				—	—	—	0	
15-14 Co				7	54	-	1	
15-15 Fp				16	130	-	3	
15-16 QL				6	85	-	3	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

Planted Woody Stem Data: CVS Level 1

Leader: P.Lynch **Project:** Little River **Team:** P.L. **Plot:** 16 **Date:** 11 / 12 / 10 Page __ of __

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
16-1 Ca				5	35	–	2	
16-2 CL				6	61	–	2	
16-3 Qm				20	173	13	4	
16-4 Qm				13	132	5	4	
16-5 Qf				18	214	10	4	
16-6 Ca				10	153	4	4	
16-7 Ca				12	136	5	4	
16-8 Ca				11	104	–	4	
16-9 Ca				6	59	–	3	
16-10 CL				2	32	–	2	
16-11 Ca				7	99	–	4	
16-12 Ca				8	88	–	4	
16-13 CL				3	45	–	2	
16-14 Qn				15	99	–	4	

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

All Quick Stakes have been removed.

Planted Woody Stem Data: CVS Level 1

Leader: P.Lynch **Project:** Little River **Team:** P.L. **Plot:** 17 **Date:** 11 / 15 / 10 Page __ of ____

Species Name	Source	Coordinates X (0.1 m)	Coordinates Y (0.1 m)	ddh (1 mm)	Height (1* cm)	DBH (1 cm)	Vigor	Damage
17-1 Vo				18	77	~~12~~	1	
17-2 Vo				—	—	—	0	
17-3 FP				18	103	—	1	
17-4 FP				22	130	—	1	
17-5 QM				—	~~0~~	—	0	
17-6 Po				29	209	13	4	
17-7 Po				—	—	—	—	N/A
17-8 BF				—	—	—	—	N/A
17-9 Co				—	—	—	0	
17-10 Po				—	—	—	—	N/A
17-11 QL				✓	—	—	—	N/A
17-12 QN				6	40	—	1	
~~17-13~~								

Source: Transplant, Live stake, Ball and burlap, Pot, Tubling, Bare Root, Mechanically planted, Unknown

Vigor: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=Dead, Missing.

Damage: Removal, Cut, Mowing, Beaver, Deer, Rodents, Insects, Game, Livestock, Other/Unknown Animal, Human Trampled, Site Too Wet, Site Too Dry, Flood, Drought, Storm, Hurricane, Diseased, Vine Strangulation, Unknown, specify other.

*Height precision drops to 10cm if >2.5m and 50cm if >4m.

148
27
29

TABLES C.1 THROUGH C.7

Table C.1. Vegetation Metadata

Little River Farm Site: Project No. 000623	
Report Prepared By	Kristi Suggs
Date Prepared	11/23/2010 9:30
database name	cvs-eep-entrytool-v2.2.7.mdb
database location	C:
computer name	CHABWKSUGGS2
file size	47611904
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.
PROJECT SUMMARY----------	
Project Code	92759
project Name	Little River Farm
Description	Stream Enhancement, Restoration, and Preservation Project
River Basin	Yadkin-Pee Dee
length(ft)	578 ft
stream-to-edge width (ft)	56 ft
area (sq m)	80937.13
Required Plots (calculated)	17
Sampled Plots	17

Table C.2. Vegetation Vigor by Species

Little River Farm Site: Project No. 000623									
	Species	**CommonName**	**4**	**3**	**2**	**1**	**0**	**Missing**	**Unknown**
	Asimina triloba	pawpaw				3			
	Betula nigra	river birch	6	7	1	1	2		
	Carya ovalis	red hickory					1		
	Carya ovata	shagbark hickory				4	2		
	Celtis laevigata	sugarberry	1	2	3	2	1		
	Cornus amomum	silky dogwood	17	9	3	4	1		
	Cornus florida	flowering dogwood	3						
	Fraxinus pennsylvanica	green ash		2	4	8			
	Nyssa sylvatica	blackgum		3	2		2		
	Quercus falcata	southern red oak	12	4	2	4	5	1	
	Quercus laurifolia	laurel oak	5	6	2	6	7	1	
	Quercus michauxii	swamp chestnut oak	11	2	5	5	4		
	Quercus nigra	water oak	2		1	2			
	Carpinus caroliniana	American hornbeam		1	2	1			
	Corylus cornuta	beaked hazelnut		2	7	3	1		
	Liriodendron tulipifera	tuliptree	1	2	8	8	5		
	Platanus occidentalis	American sycamore	8	2	5	2	4	2	
	Ulmus americana	American elm				1	1		
TOT:	**18**	**18**	**66**	**42**	**45**	**54**	**36**	**4**	

Table C.3. Vegetation Damage by Species

Little River Farm Site: Project No. 000623								
	Species	CommonName	Count of Damage Categories	(No damage)	(Other)	Cut	Unknown	
	Asimina triloba	pawpaw	0	3				
	Betula nigra	river birch	3	14	3			
	Carpinus caroliniana	American hornbeam	1	3		1		
	Carya ovalis	red hickory	1		1			
	Carya ovata	shagbark hickory	4	2	4			
	Celtis laevigata	sugarberry	2	7	2			
	Cornus amomum	silky dogwood	3	31	3			
	Cornus florida	flowering dogwood	0	3				
	Corylus cornuta	beaked hazelnut	3	10	3			
	Fraxinus pennsylvanica	green ash	0	14				
	Liriodendron tulipifera	tuliptree	6	18	6			
	Nyssa sylvatica	blackgum	2	5	2			
	Platanus occidentalis	American sycamore	7	16	4	1	2	
	Quercus falcata	southern red oak	7	21	5	1	1	
	Quercus laurifolia	laurel oak	8	19	7		1	
	Quercus michauxii	swamp chestnut oak	6	21	5	1		
	Quercus nigra	water oak	1	4		1		
	Ulmus americana	American elm	1	1	1			
TOT:	**18**	**18**	**55**	**192**	**46**	**5**	**4**	

Table C.4. Vegetation Damage by Plot

Little River Farm Site: Project No. 000623							
	Plot	Count of Damage Categories	(No damage)	(Other)	Cut	Unknown	
	92759-01-0001-year:1	4	9	4			
	92759-01-0002-year:1	3	13	3			
	92759-01-0003-year:1	4	9	4			
	92759-01-0004-year:1	5	8	5			
	92759-01-0005-year:1	2	11	2			
	92759-01-0006-year:1	2	17	2			
	92759-01-0007-year:1	5	11	5			
	92759-01-0008-year:1	3	13	3			
	92759-01-0009-year:1	3	14	3			
	92759-01-0010-year:1	0	16				
	92759-01-0011-year:1	0	12				
	92759-01-0012-year:1	1	15	1			
	92759-01-0013-year:1	7	7	2	5		
	92759-01-0014-year:1	3	8	3			
	92759-01-0015-year:1	6	10	6			
	92759-01-0016-year:1	0	14				
	92759-01-0017-year:1	7	5	3		4	
TOT:	**17**	**55**	**192**	**46**	**5**	**4**	

Table C.5. Vegetation Damage by Plot

Little River Farm Site: Project No. 000623																								
	Comment	Species	CommonName	Total Planted Stems	# Plots	Avg# stems	plot 92759-01-0001-year:1	plot 92759-01-0002-year:1	plot 92759-01-0003-year:1	plot 92759-01-0004-year:1	plot 92759-01-0005-year:1	plot 92759-01-0006-year:1	plot 92759-01-0007-year:1	plot 92759-01-0008-year:1	plot 92759-01-0009-year:1	plot 92759-01-0010-year:1	plot 92759-01-0011-year:1	plot 92759-01-0012-year:1	plot 92759-01-0013-year:1	plot 92759-01-0014-year:1	plot 92759-01-0015-year:1	plot 92759-01-0016-year:1	plot 92759-01-0017-year:1	
		Asimina triloba	pawpaw	3	2	2					2			1										
		Betula nigra	river birch	15	7	2	1		3			2		2		2	1	4						
		Carpinus caroliniana	American hornbeam	4	2	2						3							1					
		Carya ovata	shagbark hickory	4	4	1	1						1						1		1			
		Celtis laevigata	sugarberry	8	5	2	1			1	1					2						3		
		Cornus amomum	silky dogwood	33	5	7		12							4	4				6		7		
		Cornus florida	flowering dogwood	3	1	3					3													
		Corylus cornuta	beaked hazelnut	12	7	2	1	1	4	1	1	1			3									
		Fraxinus pennsylvanica	green ash	14	7	2	1					5		3	1		1				1		2	
		Liriodendron tulipifera	tuliptree	19	7	3	4		1		1		6					2	2		3			
		Nyssa sylvatica	blackgum	5	2	3	2									3								
		Platanus occidentalis	American sycamore	17	8	2		1	1			4		2	3	2			3					1
		Quercus falcata	southern red oak	22	11	2	1	1		1				1	2		4	4	3	1	3	1		
		Quercus laurifolia	laurel oak	19	8	2				5			3	2		1	2	3		1	2			
		Quercus michauxii	swamp chestnut oak	23	11	2			3		3	2	3	2	1	2	2	2	1			2		
		Quercus nigra	water oak	5	4	1											2		1			1	1	
		Ulmus americana	American elm	1	1	1																	1	
TOT:	**0**	**17**	**17**	**207**	**17**		**12**	**15**	**12**	**8**	**11**	**17**	**13**	**13**	**14**	**16**	**12**	**15**	**12**	**8**	**10**	**14**	**5**	

Table C.6. Vegetative Problem Areas

Little River Farm Site: Project No. 000623			
UT4			
Feature/Issue	Station # / Range	Probable Cause	Photo #
Bare Bank			
Bare Bench (Right)	10+00 - 13+50	Late Planting and Dry Sandy Soils	C.6-1 through C.6-4
	13+75 - 14+60	Late Planting and Dry Sandy Soils	
Bare Bench (Left)	10+60 - 11+00	Late Planting and Dry Sandy Soils	C.6-5 through C.6-10
	11+25 - 12+00	Late Planting and Dry Sandy Soils	
	12+50 - 14+50	Late Planting and Dry Sandy Soils	
Bare Floodplain (Right)	10+00 - 13+50	Late Planting and Dry Sandy Soils	C.6-1 through C.6-4
	13+75 - 14+60	Late Planting and Dry Sandy Soils	
Bare Floodplain (Left)	10+60 - 11+00	Late Planting and Dry Sandy Soils	C.6-5 through C.6-10
	11+25 - 12+00	Late Planting and Dry Sandy Soils	
	12+50 - 14+50	Late Planting and Dry Sandy Soils	
Invasive/Exotic Populations			

Table C.7 Plot Species and Densities

Little River Farm Site : Project No. 000623																				
	Plots																	Initial Totals	Year 1 Totals	Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
Asimina tuiloba					2			1										3	3	
Betula nigra	1		3			2		2		2	1	4						17	15	
Carpinus caroliniana						3							1					4	4	
Carya ovata	1						1						1		1			7	4	
Celtis laevigata	1			1	1					2						3		9	8	
Cornus amomum		12							4	4				6		7		34	33	
Cornus florida					3													3	3	
Corylus cornuta	1	1	4	1	1	1			3									13	12	
Fraxinus pennsylvanica	1					5		3	1		1				1		2	14	14	
Liriodendron tulipiferra	4		1		1		6					2	2		3			24	19	
Nyssa sylvatica	2									3								7	5	
Platanus occidentalis		1	1			4		2	3	2			3				1	23	17	
Quercus falcata var. *pagodifilia*	1	1		1				1	2		4	4	3	1	3	1		28	22	
Quercus laurifolia				5			3	2		1	2	3		1	2			27	19	
Quercus michauxii			3		3	2	3	2	1	2	2	2	1			2		27	23	
Quercus nigra											2		1			1	1	5	5	
Ulmus americana																	1	2	1	
Stems/plot	12	15	12	8	11	17	13	13	14	16	12	15	12	8	10	14	5	247	207	
Stems/Acre Year 1	371	464	371	247	340	525	402	402	433	494	371	464	371	247	309	433	155	N/A	N/A	**376**
Stems/Acre Initial	402	494	402	402	402	587	494	494	525	494	371	494	433	340	494	433	371			**449**

VEG PLOT PHOTOS

VP-1

VP-2

VP-3

VP-4

VP-5

VP-6

VP-7

VP-8

VP-9

VP-10

VP-11

VP-12

VP-13

VP-14

VP-15

VP-16

VP-17

VEG PROBLEM AREA PHOTOS

C.6-1. Station 10+00 – 13+50

C.6-2. Station 10+00 – 13+50

C.6-3 Station 13+00

C.6-4. Station 13+75 – 14+60

C.6-5. Station 10+60 – 11+00

C.6-6. Station 10+60 – 14+50

C.6-7. Station 10+60 – 14+50

C.6-8. Station 12+50 – 14+50

C.6-9. Station 11+25 – 12+00

C.6-10. Station 12+50 – 14+50

ADDITIONAL VEG PROBLEM PHOTOS

Sprayed Veg Plot 8

Cut Tree – Platanus occidentalis
Veg Plot 13-6

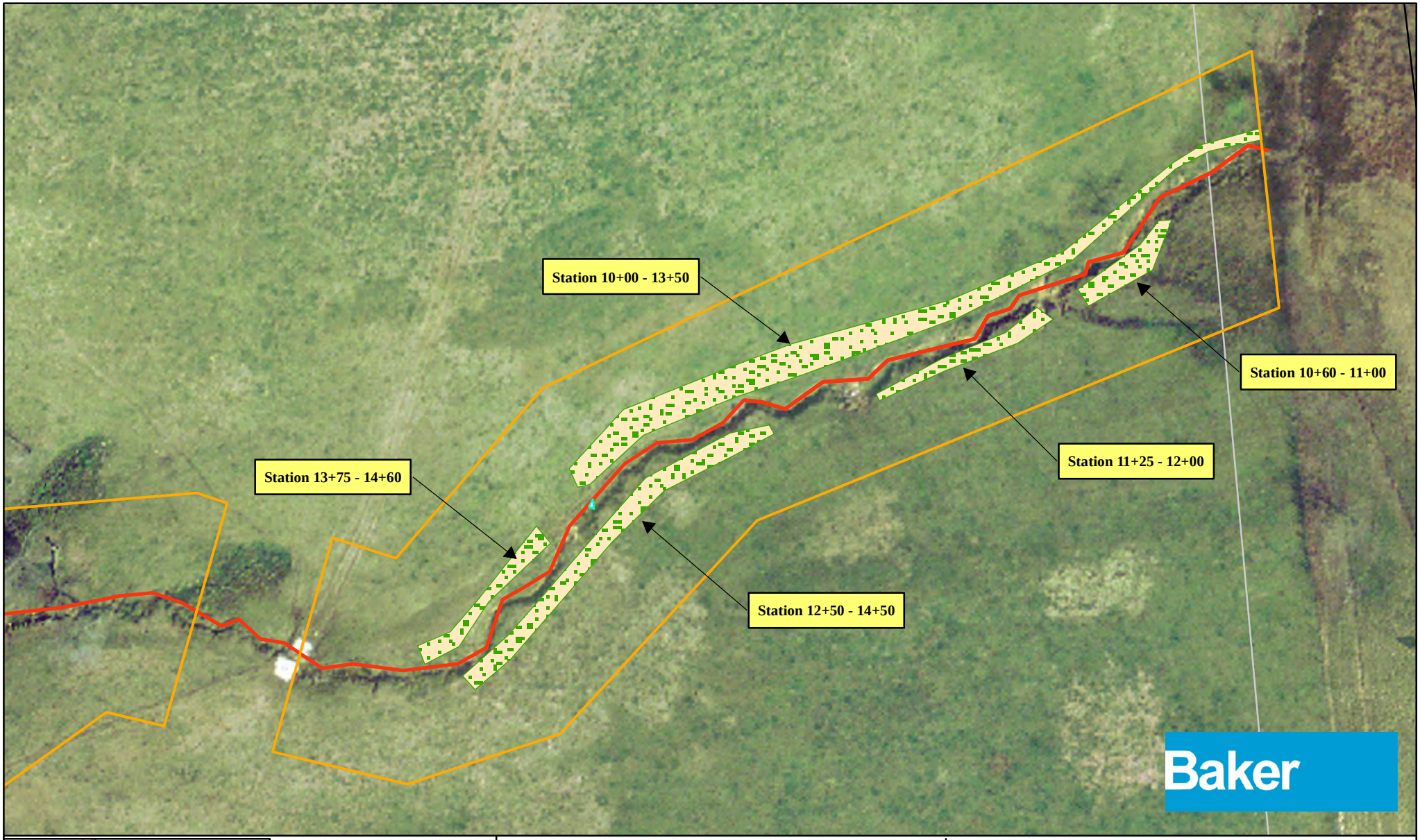
Cut Tree – Quercus falcata
Veg Plot 13-1

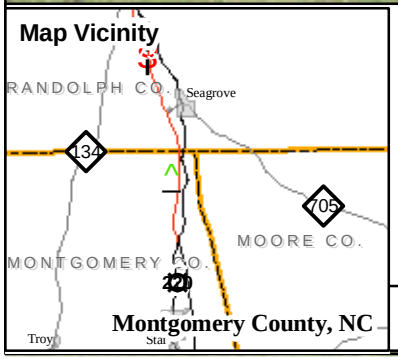
Cut Tree – Quercus nigra
Veg Plot 13-8

Cut Tree – Carpinus caroliniana
Veg Plot 13-3

Cut Tree – Quercus michauxii
Veg Plot 13-7

VEGETATION PROBLEM AREAS
FIGURE C1





Ecosystem Enhancement PROGRAM

EEP Project No.: 000623

Figure C1. UT4 Vegetation Problem Areas

Little River Farm Site - Year 1 Monitoring

Montgomery County, NC

December 2010

LEGEND

- Project Centerline
- Conservation Easement
- Project Parcels
- Streams
- Roads

Problem Area Type

- Structure
- Vegetation

1 inch equals 60 feet

0 15 30 60 Feet

APPENDIX D:
AS-BUILT PLAN SHEETS

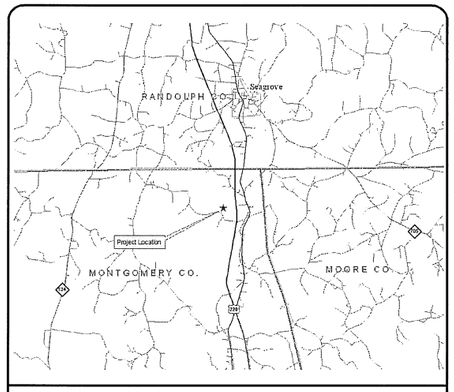
STATE	BUCK PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	113115	1	16

PROJECT: 113115 LITTLE RIVER FARM

ECOSYSTEM ENHANCEMENT PROGRAM

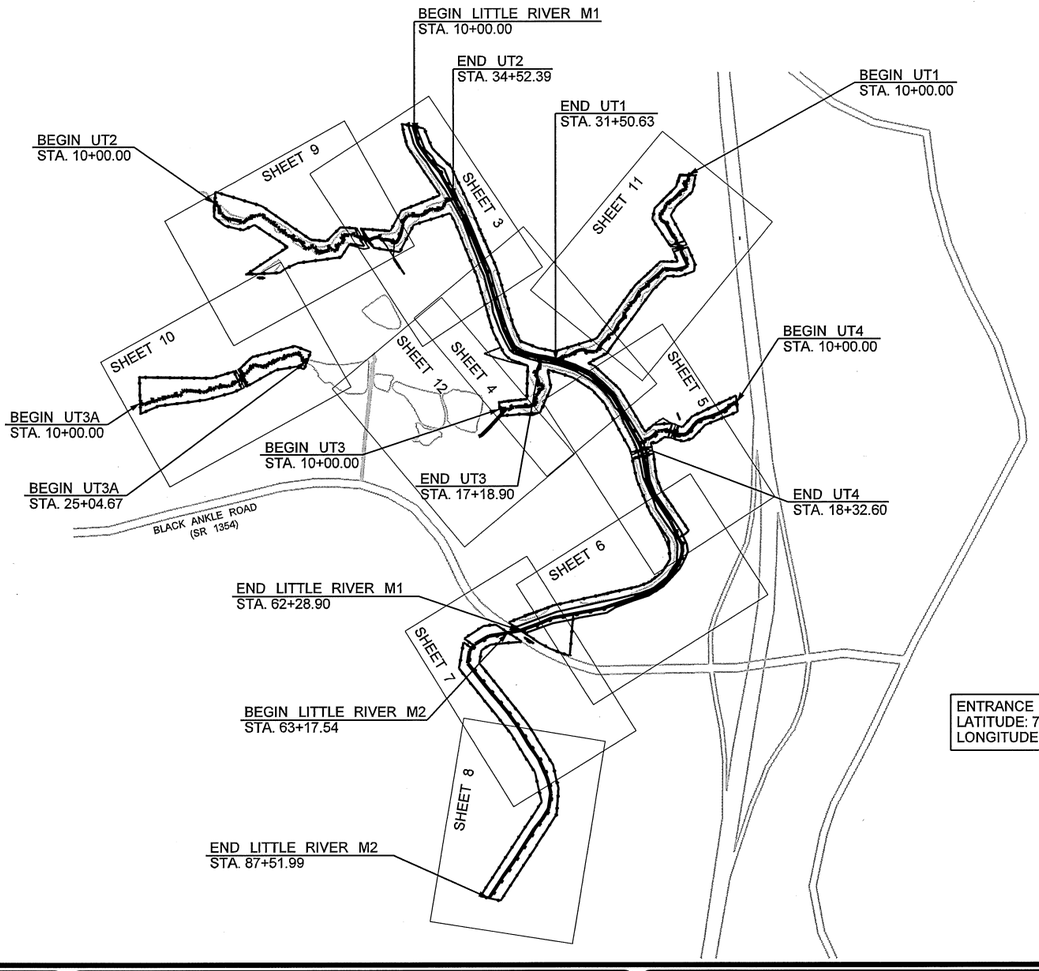
MONTGOMERY COUNTY

LOCATION: OFF US 220 AND BLACK ANKLE ROAD SR 1354
TYPE OF WORK: AS-BUILT FOR STREAM ENHANCEMENT, PRESERVATION, AND RESTORATION



VICINITY MAP

INDEX OF SHEETS



ENTRANCE ROAD OFF BLACK ANKLE ROAD LOCATED AT:
LATITUDE: 79.7900'
LONGITUDE: 35.4931'

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

5 0 5 10
PROFILE (VERTICAL)

PROJECT LENGTH

	LENGTH	TYPE
LITTLE RIVER (M1)	4,103′	ENHANCEMENT II
LITTLE RIVER (M2)	2,409′	PRESERVATION
UT1	2,120′	ENHANCEMENT II
UT2	2,371′	ENHANCEMENT II
UT3	719′	ENHANCEMENT II
UT3A	1,449′	ENHANCEMENT II
UT4	782′	ENHANCEMENT II/ RESTORATION

PREPARED FOR THE OFFICE OF:

Ecosystem Enhancement PROGRAM

CONTACT: GUY PEARCE, PROJECT MANAGER

PREPARED IN THE OFFICE OF:

Baker
Michael Baker Engineering Inc.
8000 Regency Parkway
Suite 200
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490

APRIL 2009 — COMPLETION DATE:

KEVIN TWEEDY, PE — PROJECT ENGINEER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L TWEEDY

10-20-09

SIGNATURE P.E.

2/26/03

STREAM CONVENTIONAL SYMBOLS

SUPERCEDES SHEET 1B

- ROCK J-HOOK
- ROCK VANE
- OUTLET PROTECTION
- ROCK CROSS VANE
- DOUBLE DROP ROCK CROSS VANE
- SINGLE WING DEFLECTOR
- DOUBLE WING DEFLECTOR
- TEMPORARY SILT CHECK
- ROOT WAD
- LOG J-HOOK
- LOG VANE
- LOG WEIR
- LOG CROSS VANE
- CONSTRUCTED RIFFLE
- BOULDER CLUSTER
- ROCK STEP POOL
- SAFETY FENCE
- TAPE FENCE
- 100 YEAR FLOOD PLAIN
- CONSERVATION EASEMENT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- PERMANENT STREAM CROSSING
- TRANSPLANTED VEGETATION
- TREE REMOVAL
- TREE PROTECTION
- DITCH PLUG
- TRANSPLANTS
- CHANNEL FILL
- LOG STEP POOL
- CROSS SECTIONS
- PHOTO POINT / CREST GAUGE

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

GENERAL NOTES

1. CONSTRUCTION WAS COMPLETED IN APRIL 2009.
2. CONTRACTOR SHOULD CALL NORTH CAROLINA "ONE-CALL" BEFORE EXCAVATION STARTS. (1-800-632-4949)

PROJECT REFERENCE NO.	SHEET NO.
113115	1-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

10-20-09

DATE:

Baker

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Phone: 919.463.5488
Fax: 919.463.5490

STANDARD SPECIFICATIONS

EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
JUNE 2006

6.06	TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
6.60	TEMPORARY SEDIMENT TRAP
6.62	SILT FENCE
6.63	TEMPORARY ROCK DAM
6.70	TEMPORARY STREAM CROSSING

VEGETATION SELECTION

Scientific Name	Common Name	Percent Planted by Species	Total Number of Stems
Bare Root Trees Species			
Betula nigra	River Birch	5%	403
Carya ovata	Shagbark Hickory	10%	806
Celtis lavigata	Sugarberry	5%	403
Fraxinus pennsylvanica	Green Ash	5%	403
Liriodendron tulipifera	Tulip Poplar	5%	403
Nyssa salvatica	Black Gum	5%	403
Platanus occidentalis	Sycamore	5%	403
Quercus falcata var. *pagodifolia*	Southern Red Oak	10%	806
Quercus laurifolia	Laurel Oak	10%	806
Quercus michauxii	Swamp Chestnut Oak	15%	1,209
Quercus nigra	Water Oak	10%	806
Ulmus americana	American Elm	15%	1,209
Shrub Species			
Asimina triloba	Paw Paw	20%	644
Carpinus carolinanum	Ironwood	20%	644
Cornus amomum	Silky Dogwood	20%	644
Cornus florida	Flowering Dogwood	10%	322
Corylus cornuta	Hazelnut	15%	483
Lindera benzoin	Spicebush	15%	483

Native Herbaceous Species			
Agrostis alba	Redtop	10%	N/A
Andropogon gerardii	Big blue stem	5%	N/A
Bindens aristosa	Tickseed	10%	N/A
Coreopsis lanceolata	Lance-leaved coreopsis	10%	N/A
Elymus virginicus	Virginia wildrye	15%	N/A
Juncus effusus	Soft rush	5%	N/A
Panicum clandestinum	Deer tongue	10%	N/A
Panicum virgatum	Switch grass	15%	N/A
Polygonum pennsylvanicum	Pennsylvanie smartweed	5%	N/A
Schizachyrium scoparium	Little blue stem	5%	N/A
Sorgastum nutans	Indian grass	5%	N/A
Tripsicum dactyloides	Gamma grass	5%	N/A

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*S.U.E = SUBSURFACE UTILITY ENGINEER

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL SYMBOLS

ROADS & RELATED ITEMS

Edge of Pavement
Curb
Prop. Slope Stakes Cut — C
Prop. Slope Stakes Fill — F
Prop. Woven Wire Fence
Prop. Chain Link Fence
Prop. Barbed Wire Fence
Prop. Wheelchair Ramp — WCR
Curb Cut for Future Wheelchair Ramp — CCFR
Exist. Guardrail
Prop. Guardrail
Equality Symbol
Pavement Removal

RIGHT OF WAY

Baseline Control Point
Existing Right of Way Marker
Exist. Right of Way Line w/Marker
Prop. Right of Way Line with Proposed R/W Marker (Iron Pin & Cap)
Prop. Right of Way Line with Proposed (Concrete or Granite) R/W Marker
Exist. Control of Access Line — CA
Prop. Control of Access Line — CA
Exist. Easement Line — E
Prop. Temp. Construction Easement Line — E
Prop. Temp. Drainage Easement Line — TDE
Prop. Perm. Drainage Easement Line — PDE

HYDROLOGY

Stream or Body of Water
River Basin Buffer — RBB
Flow Arrow
Disappearing Stream
Spring
Swamp Marsh
Shoreline
Falls, Rapids
Prop Lateral, Tail, Head Ditches — FLOW

STRUCTURES

MAJOR
Bridge, Tunnel, or Box Culvert — CONC
Bridge Wing Wall, Head Wall and End Wall — CONC WW

MINOR
Head & End Wall — CONC HW
Pipe Culvert
Footbridge
Drainage Boxes — CB
Paved Ditch Gutter

UTILITIES

Exist. Pole
Exist. Power Pole
Prop. Power Pole
Exist. Telephone Pole
Prop. Telephone Pole
Exist. Joint Use Pole
Prop. Joint Use Pole
Telephone Pedestal — T
U/G Telephone Cable Hand Hold — TH
Cable TV Pedestal — C
U/G TV Cable Hand Hold — TH
U/G Power Cable Hand Hold — TH
Hydrant
Satellite Dish
Exist. Water Valve
Sewer Clean Out
Power Manhole
Telephone Booth — P
Cellular Telephone Tower
Water Manhole — W
Light Pole
H-Frame Pole
Power Line Tower
Pole with Base
Gas Valve
Gas Meter
Telephone Manhole — T
Power Transformer
Sanitary Sewer Manhole
Storm Sewer Manhole — S
Tank; Water, Gas, Oil
Water Tank With Legs
Traffic Signal Junction Box — S
Fiber Optic Splice Box — F
Television or Radio Tower
Utility Power Line Connects to Traffic Signal Lines Cut Into the Pavement — TS — TS

Recorded Water Line — W — W
Designated Water Line (S.U.E.*) — W — W
Sanitary Sewer — SS — SS
Recorded Sanitary Sewer Force Main — FSS — FSS
Designated Sanitary Sewer Force Main(S.U.E.*) — FSS — FSS
Recorded Gas Line — G — G
Designated Gas Line (S.U.E.*) — G — G
Storm Sewer — S — S
Recorded Power Line — P — P
Designated Power Line (S.U.E.*) — P — P
Recorded Telephone Cable — T — T
Designated Telephone Cable (S.U.E.*) — T — T
Recorded U/G Telephone Conduit — TC — TC
Designated U/G Telephone Conduit (S.U.E.*) — TC — TC
Unknown Utility (S.U.E.*) — ?UTL — ?UTL
Recorded Television Cable — TV — TV
Designated Television Cable (S.U.E.*) — TV — TV
Recorded Fiber Optics Cable — FO — FO
Designated Fiber Optics Cable (S.U.E.*) — FO — FO
Exist. Water Meter — 0
U/G Test Hole (S.U.E.*) — ATTUR
Abandoned According to U/G Record — E.O.I.
End of Information

BOUNDARIES & PROPERTIES

State Line
County Line
Township Line
City Line
Reservation Line
Property Line
Property Line Symbol — PL
Exist. Iron Pin — EIP
Property Corner
Property Monument — ECM
Property Number — 123
Parcel Number — 6
Fence Line — WW & ISBW
Existing Wetland Boundaries — WLB
High Quality Wetland Boundary — HQ WLB
Medium Quality Wetland Boundaries — MQ WLB
Low Quality Wetland Boundaries — LQ WLB
Proposed Wetland Boundaries — WLB
Existing Endangered Animal Boundaries — EAB
Existing Endangered Plant Boundaries — EPB

BUILDINGS & OTHER CULTURE

Buildings
Foundations
Area Outline
Gate
Gas Pump Vent or U/G Tank Cap
Church
School
Park
Cemetery
Dam
Sign — S
Well — W
Small Mine
Swimming Pool

TOPOGRAPHY

Loose Surface
Hard Surface
Change in Road Surface
Curb
Right of Way Symbol — R/W
Guard Post — GP
Paved Walk
Bridge
Box Culvert or Tunnel
Ferry
Culvert
Footbridge
Trail, Footpath
Light House

VEGETATION

Single Tree
Single Shrub
Hedge
Woods Line
Orchard
Vineyard — VINEYARD

RAILROADS

Standard Gauge — CSX TRANSPORTATION
RR Signal Milepost — MILEPOST 35
Switch — SWITCH

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PROJECT REFERENCE NO.	SHEET NO.
113115	2

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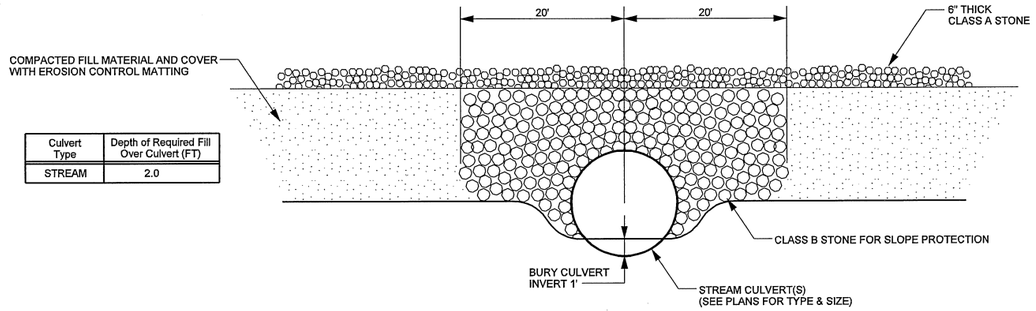
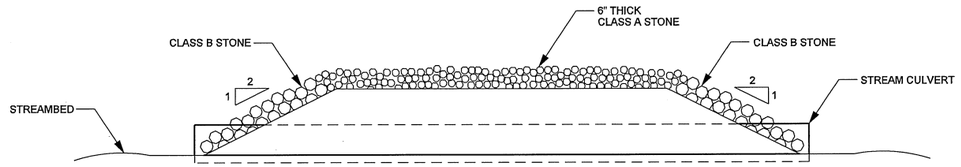
PERMANENT ROAD CULVERT CROSSING



Culvert Type	Depth of Required Fill Over Culvert (FT)
STREAM	2.0

PROFILE VIEW ALONG ROAD



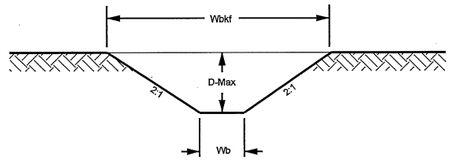
CROSS SECTION

NOTES:

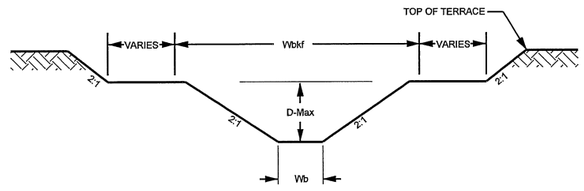
1. APPLY SUFFICIENT FILL OVER CULVERTS TO PREVENT CULVERT COLLAPSE.
2. PLACE CLASS B STONE ON SIDE SLOPES OF ROAD FILL WITH 20' OF COVER. STABILIZE REMAINING ROAD SIDE SLOPES WITH EROSION MATTING ACCORDING TO SPECIFICATIONS.

CROSS SECTION

TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS SECTIONS - REACH UT4



RIFFLE/ POOL



RIFFLE/ POOL WITH BANKFULL BENCH

NOTES:

1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.

UT4		
RIFFLE	POOL	
6.5	9.0	WIDTH OF BANKFULL (Wbkf)
0.8	2.0	MAXIMUM DEPTH (D-Max)
12.0	10.0	WIDTH TO DEPTH RATIO (Wbkf / D)
3.5	7.0	BANKFULL AREA (Abkf)
3.0	2.0	BOTTOM WIDTH (Wb)

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113115	2-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

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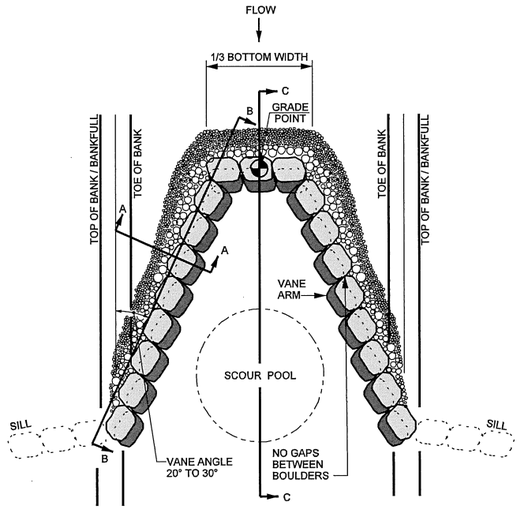
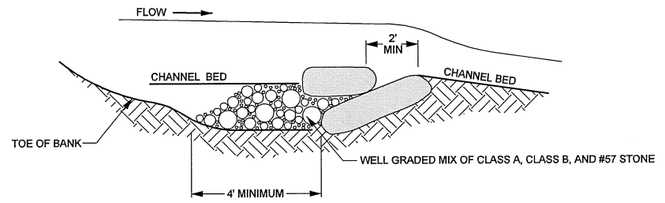
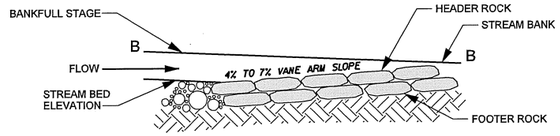
ROCK CROSS VANE

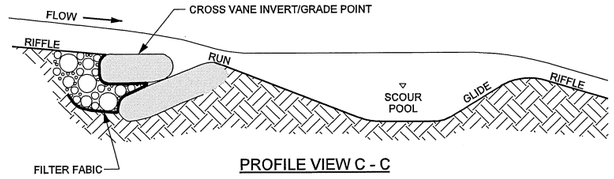




SECTION A - A



PROFILE VIEW B - B
VANE ARM

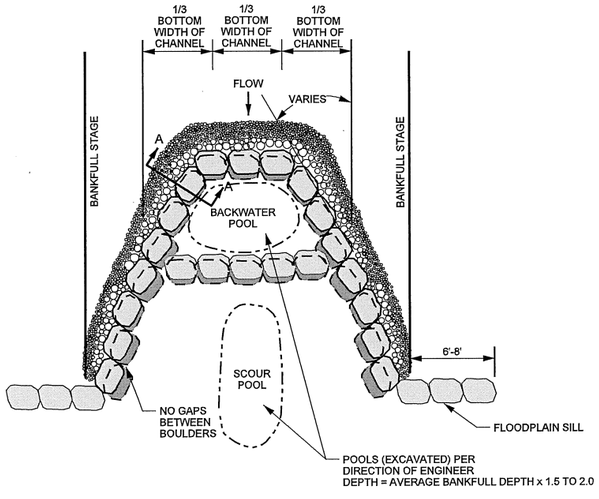


PROFILE VIEW C - C

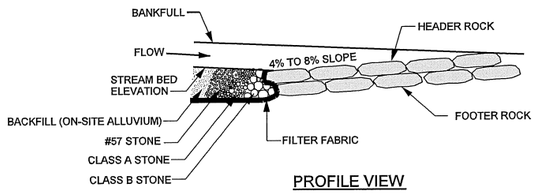
NOTES FOR ALL VANE STRUCTURES:

1. BOULDERS MUST BE AT LEAST 4' x 3' x 2'.
2. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
4. CONSTRUCT FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
5. USE CLASS B STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS, CLASS A, AND #57 STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS B STONE.
6. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF ONE HALF THE HEADER ROCK.

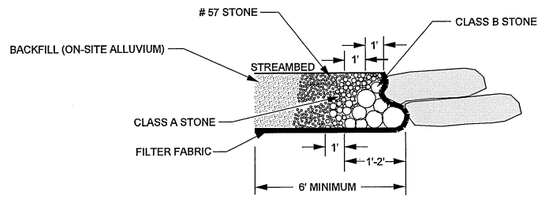
DOUBLE DROP ROCK CROSS VANE



PLAN VIEW



PROFILE VIEW



SECTION A - A

NOTES FOR ALL VANE STRUCTURES:

1. BOULDERS MUST BE AT LEAST 4' x 3' x 2'.
2. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAM BANK.
4. START AT BANKFULL AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
5. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. AN EXTRA BOULDER CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
7. USE CLASS B STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS, CLASS A, AND #57 STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS B STONE.
8. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

10/20/2009
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2/26/03

PROJECT REFERENCE NO.	SHEET NO.
113115	2-B

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEDDY

APPROVED BY:

10-20-09

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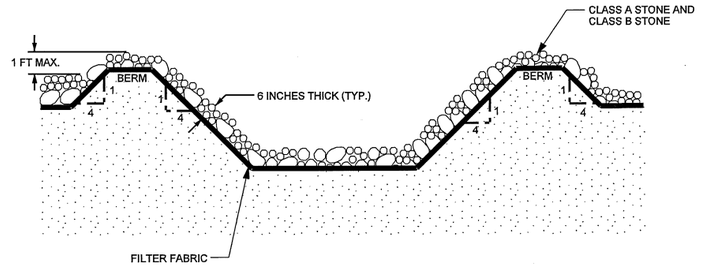
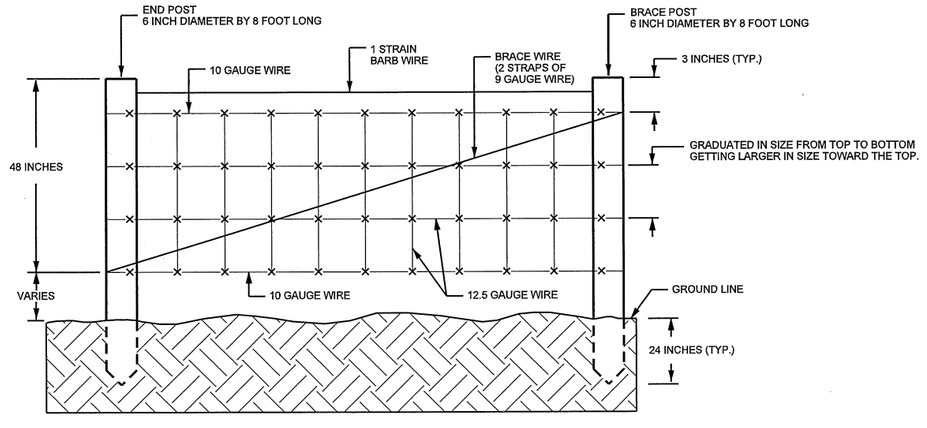
PERMANENT FORD STREAM CROSSING



NOTES:

1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.
3. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM. COMPLETE ONE SIDE BEFORE STARTING ON THE OTHER SIDE.
4. INSTALL STREAM CROSSING AT RIGHT ANGLE TO THE FLOW.
5. GRADE SLOPES ACCORDING TO DETAIL. TRANSPLANT SOD FROM ORIGINAL STREAMBANK ONTO SIDE SLOPES IF AVAILABLE.
6. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
7. A STABILIZED PAD OF CLASS A AND CLASS B STONE, 1 FOOT THICK, LINED WITH FILTER FABRIC FOR DRAINAGE SHALL BE USED OVER THE BERM AND ACCESS SLOPES.
8. WIDTH OF THE CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE THE LARGEST VEHICLE CROSSING THE CHANNEL.
9. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.

WOVEN FIELD FENCE



NOTE:

1. END POSTS SHALL BE INSTALLED AT A SPACING OF 10-15 FEET.

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PROJECT REFERENCE NO.	SHEET NO.
113115	3

PROJECT ENGINEER

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END UT2
STA. 34+52.39

BEGIN LITTLE RIVER M1
STA. 10+00.00

VEG PLOT #4

VEG PLOT #13

VEG PLOT #14

UT2 CROSSING PHOTO POINT

SLOPED, SEEDED, MATTED BANK, AND APPLIED LIVE STAKES

MATCHLINE SHEET 4 LITTLE RIVER STA. 22+00.00

MATCHLINE SHEET 9 UT2 STA. 26+50.00

NAD 83

BUFFER PLANTING ZONE

NOTE:
SPARSE AREAS OF EXISTING TREES WERE SUPPLEMENTALLY PLANTED NORTH OF BLACK ANKLE ROAD TO REACH A DENSITY OF APPROXIMATLY 320 TREES PER ACRES.

LITTLE RIVER FARM PLAN VIEW

50 25 0 50 100
SCALE (FT)

2/26/03

10/20/2009
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PROJECT REFERENCE NO.	SHEET NO.
113115	4

PROJECT ENGINEER

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NAD 83

MATCHLINE SHEET 11 UT1 STA. 27+00.00

MATCHLINE SHEET 3 LITTLE RIVER STA. 22+00.00

MATCHLINE SHEET 5 LITTLE RIVER STA. 36+00.00

VEG PLOT #7

END UT1
STA. 31+50.63

VEG PLOT #3

END UT3
STA. 17+18.90

VEG PLOT #9

BEGIN UT3
STA. 10+00.00

MATCHLINE SHEET 12

REGRADED GULLY TO A 10' BOTTOM WIDTH WITH 3:1 SIDE SLOPES, APPLIED EROSION CONTROL MATTING AND SEEDING ALONG BOTTOM AND SIDE SLOPES.

BUFFER PLANTING ZONE

NOTE:
SPARSE AREAS OF EXISTING TREES WERE SUPPLEMENTALLY PLANTED NORTH OF BLACK ANKLE ROAD TO REACH A DENSITY OF APPROXIMATLY 320 TREES PER ACRES.

LITTLE RIVER FARM
PLAN VIEW

50 25 0 50 100
SCALE (FT)

10/20/2009
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PROJECT REFERENCE NO.	SHEET NO.
113115	5

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BEGIN UT4
STA. 10+00.00

PHOTO POINT #1

PHOTO POINT #2

PHOTO POINT #3

CROSS SECTION 1
RIFFLE
STA. 11+35.00

PHOTO POINT #4

PHOTO POINT #5

PHOTO POINT #6

PHOTO POINT #7

CROSS SECTION 2
POOL
STA. 13+33.00

PHOTO POINT #8

PHOTO POINT #9

PHOTO POINT #10

CREST GAUGE

INSTALLED 16' GATE

UT4 CROSSING
PHOTO POINT

INSTALLED 16' GATE

REMOVED CONCRETE CROSSING AND
INSTALLED PERMANENT FORD CROSSING

PHOTO POINT #11

INSTALLED 16' GATE

INSTALLED 16' GATE

END UT4
STA. 18+82.00

VEG PLOT #6

VEG PLOT #5

VEG PLOT #2

NAD 83

MATCHLINE SHEET 4 LITTLE RIVER STA. 36+00.00

MATCHLINE SHEET 6 LITTLE RIVER STA. 47+00.00

BUFFER PLANTING ZONE

NOTE:
SPARSE AREAS OF EXISTING TREES WERE SUPPLEMENTALLY PLANTED NORTH OF BLACK ANKLE ROAD TO REACH A DENSITY OF APPROXIMATLY 320 TREES PER ACRES.

LITTLE RIVER FARM
PLAN VIEW

50 25 0 50 100
SCALE (FT)

10/20/2009
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BUCK PROJECT REFERENCE NO.	SHEET NO.
113115	6

PROJECT ENGINEER

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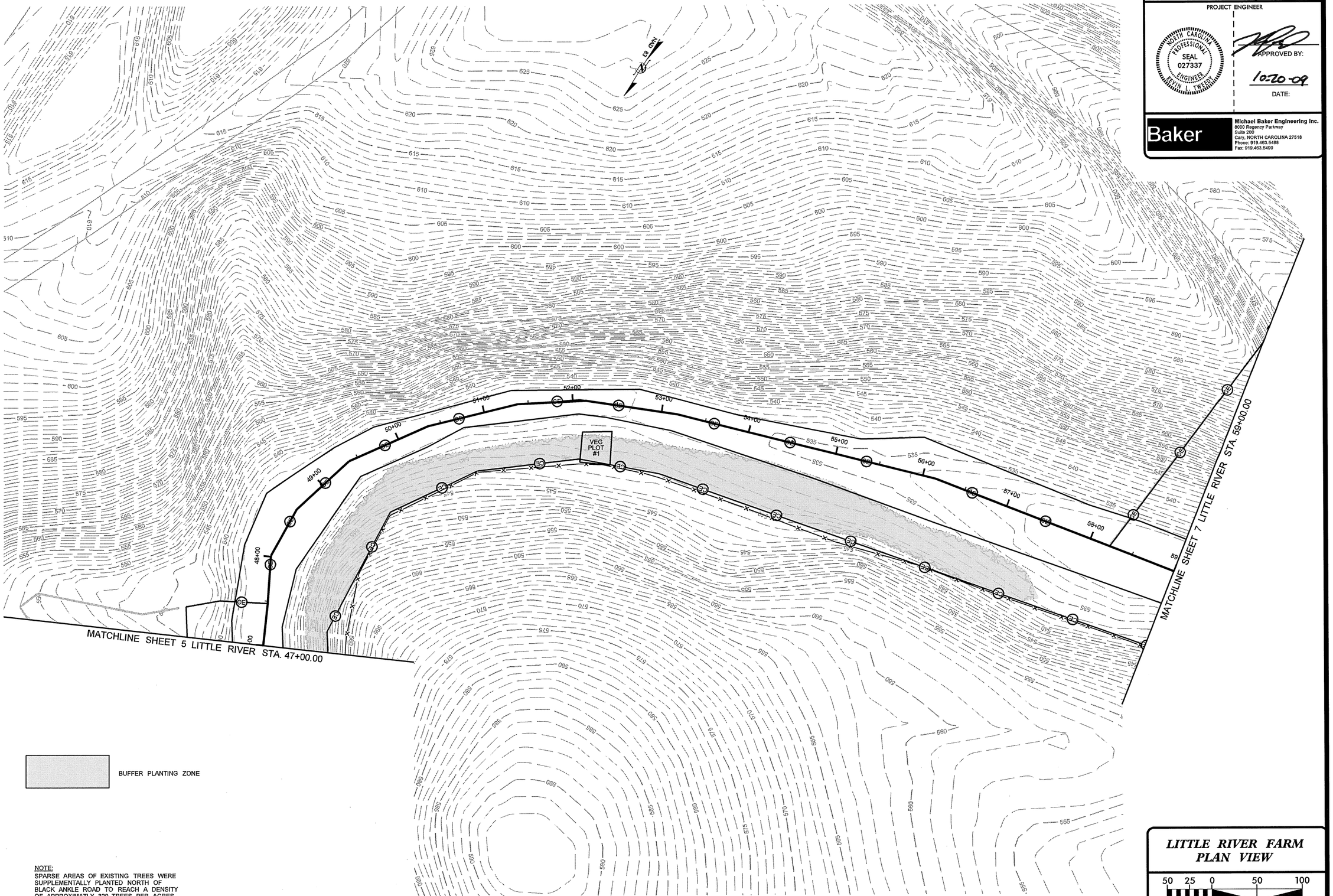

BUFFER PLANTING ZONE

NOTE:
SPARSE AREAS OF EXISTING TREES WERE SUPPLEMENTALLY PLANTED NORTH OF BLACK ANKLE ROAD TO REACH A DENSITY OF APPROXIMATLY 320 TREES PER ACRES.

LITTLE RIVER FARM PLAN VIEW

50 25 0 50 100
SCALE (FT)

10/20/2009
R:\113115\Design\as-built\113115_asb_06.dgn

PROJECT REFERENCE NO.	SHEET NO.
113115	7

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEDDY

APPROVED BY:

10-20-09

DATE:

Baker

Michael Baker Engineering Inc.
8000 Regency Parkway
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Phone: 919.463.5488
Fax: 919.463.5490

NAD 83

MATCHLINE SHEET 6 LITTLE RIVER STA. 59+00.00

END LITTLE RIVER M1
STA. 62+28.90

BLACK ANKLE ROAD
SR 1354

BEGIN LITTLE RIVER M2
STA. 63+17.54

NO CONSTRUCTION OR PLANTING ACTIVITIES OCCURRED ON LITTLE RIVER REACH M2

EXCLUDED AREA FROM EASEMENT FOR MARTIN MARIETTA

MATCHLINE SHEET 8 LITTLE RIVER STA. 76+50.00

BUFFER PLANTING ZONE

NOTE:
SPARSE AREAS OF EXISTING TREES WERE SUPPLEMENTALLY PLANTED NORTH OF BLACK ANKLE ROAD TO REACH A DENSITY OF APPROXIMATLY 320 TREES PER ACRES.

LITTLE RIVER FARM
PLAN VIEW

50 25 0 50 100
SCALE (FT)

10/20/2009
R:\113115\Design\as-built\113115_asb_07.dgn

PROJECT REFERENCE NO.	SHEET NO.
113115	8

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEDT

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MATCHLINE SHEET 7 LITTLE RIVER STA. 76+50.00

77+00 78+00 79+00 80+00 81+00 82+00 83+00 84+00 85+00 86+00 87+00

NO CONSTRUCTION OR PLANTING ACTIVITIES OCCURRED ON LITTLE RIVER REACH M2

END LITTLE RIVER M2
STA. 87+51.99

NAD 83

LITTLE RIVER FARM
PLAN VIEW

50 25 0 50 100
SCALE (FT)

2/26/03

10/20/2009
R:\113115\Design\as-built\113115_asb_08.dgn

PROJECT REFERENCE NO.	SHEET NO.
113115	9

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEDT

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BEGIN UT2
STA. 10+00.00

VEG PLOT #17

VEG PLOT #16

VEG PLOT #15

EPHEMERAL TRIBUTARY

UT2A CROSSING PHOTO POINT

INSTALLED PERMANENT FORD CROSSING

INSTALLED 16' GATE

IMPROVED 30" RCP CULVERT CROSSING BY CLEARING DEBRIS AND ADDING ADDTIONAL CLASS B STONE TO SIDE SLOPES

INSTALLED 16' GATE

MATCHLINE SHEET 3 UT2 STA. 26+50.00

NAD 83

BUFFER PLANTING ZONE

NOTE:
SPARSE AREAS OF EXISTING TREES WERE SUPPLEMENTALLY PLANTED NORTH OF BLACK ANKLE ROAD TO REACH A DENSITY OF APPROXIMATLY 320 TREES PER ACRES.

LITTLE RIVER FARM PLAN VIEW

50 25 0 50 100
SCALE (FT)

2/26/03

10/20/2009
R:\113115\Design\as-built\113115_asb_09.dgn

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
113115	10

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

10-20-09

DATE:

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Fax: 919.463.5490

NAD 83

BEGIN UT3A
STA. 10+00.00

VEG PLOT #12

VEG PLOT #11

UT3A CROSSING PHOTO POINT

INSTALLED 16' GATE

INSTALLED 30" RCP CULVERT - 20' LONG
UPSTREAM INVERT = 616.01'
DOWNSTREAM INVERT = 615.73

INSTALLED 16' GATE

VEG PLOT #10

END UT3A
STA. 25+04.67

BUFFER PLANTING ZONE

LITTLE RIVER FARM
PLAN VIEW

50 25 0 50 100
SCALE (FT)

10/29/2009
R:\113115\Design\as-built\113115_asb_10.dgn

PROJECT REFERENCE NO.	SHEET NO.
113115	11

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEDT

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10-20-09

DATE:

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Phone: 919.463.5488
Fax: 919.463.5490

US ROUTE 220

INSET A

DETENTION BASIN

NAD 83

MATCHLINE SHEET 4 UT1 STA. 27+00.00

INSTALLED 60" RCP CULVERT = 20' LONG
UPSTREAM INVERT = 563.85'
DOWNSTREAM INVERT = 563.42'

INSTALLED 16' GATE

UT1 CROSSING
PHOTO POINT

INSTALLED 16' GATE

VEG PLOT #8

VEG PLOT #7

BEGIN UT1
STA. 10+00.00

10+00
11+00
12+00
13+00
14+00
15+00
16+00
18+00
19+00
20+00
21+00
22+00
23+00
24+00
25+00
26+00

BUFFER PLANTING ZONE

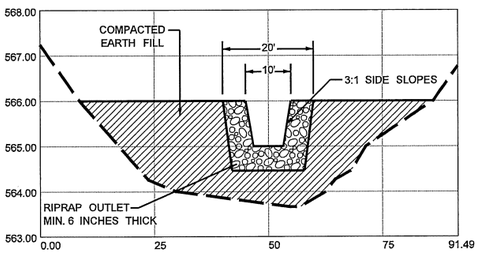
INSET A

FLOW

DETENTION BASIN

RIPRAP OUTLET
ELEV. = 565.0'
TIED RIPRAP OUTLET
INTO BEDROCK
ALONG STREAMBANK

COMPACTED EARTH FILL
MINIMUM 3:1 SLOPES



SECTION A-A'

LITTLE RIVER FARM
PLAN VIEW

50 25 0 50 100
SCALE (FT)

10/20/2009
H:\113115\design\as-built\113115_asb_11.dgn

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
113115	12

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

10-20-09

DATE:

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Fax: 919.463.5490

NAD 83

MATCHLINE SHEET 4

REGRADED GULLY TO A 10' BOTTOM WIDTH WITH 3:1 SIDE SLOPES. APPLIED EROSION CONTROL MATTING AND SEEDING ALONG BOTTOM AND SIDE SLOPES.

LAGOON

LAGOON

LITTLE RIVER FARM
PLAN VIEW

50 25 0 50 100

SCALE (FT)

10/20/2009
M:\113115\Design\as-built\113115_eab_12.dgn

APPENDIX E:
PHOTO LOG

UT4 PID PHOTOS

UT4 – PID 1 (North-east)

UT4 – PID 2 (North-east)

UT4 – PID 3 (North-west)

UT4 – PID 4 (South-west)

UT4 – PID 5 (South-west)

UT4 – PID 6 (North-east)

UT4 – PID 7 (North-east)

UT4 – PID 8 (North-east)

UT4 – PID 9 (West)

UT4 – PID 10 (North-east)

UT4 – PID 11 (East)

CROSSING PHOTOS

UT1 Crossing PID – Station 17+00

UT2 Crossing PID – Station 25+50

UT2A Crossing PID – Station 00+00

UT3A Crossing PID – Station 18+50

UT4 Crossing PID – Station 15+25

CREST GAUGE PHOTOS

UT4 Crest Gauge – 11/1/2010