BASELINE MONITORING DOCUMENT & AS-BUILT BASELINE REPORT

UT ROCKY RIVER – HARRIS ROAD MIDDLE

Cabarrus County, North Carolina
EEP Project # 92383

Prepared for:

NCDENR-Ecosystem Enhancement Program
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I HEREBY CERTIFY THAT THE DOCUMENTS CONTAINED HEREIN, UT TO ROCKY RIVER BASELINE MONITORING DOCUMENT & AS-BUILT BASELINE REPORT, WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

SIGNED SEALED, AND DATED THIS _____ DAY OF _____ 2012.

_____

Chris L. Smith, PE

EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (NCEEP) has completed restoration of 2,715 linear feet of stream and enhanced 8.7 acres of riparian wetland at the UT to Rocky River – Harris Road Middle site (hereafter referred to as the "Site") to assist in fulfilling stream and wetland mitigation goals in the area. The Site is located in northwest Cabarrus County approximately 6 miles southwest of the town of Kannapolis (Figure 1). The Site has a latitude and longitude of 035º 25' 32" N and 080º 44' 26'' W. The Site is situated in the northeast quadrant of the intersection of Harris Road and the Rocky River, between Harris Middle School and Odell Elementary School, approximately 1.5 miles south of Highway 73. The Site is located within United States Geological Survey (USGS) Hydrologic Unit (HU) and Targeted Local Watershed 03040105010010 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-07-11) of the Yadkin-Pee Dee River Basin, and will service the USGS 8-digit Cataloging Unit (CU) 03040105.

The primary goals of this stream restoration project focused on improving water quality, enhancing aquatic and terrestrial habitat within the UT to Rocky River watershed, establishing wildlife corridors within the Site, enhancing riparian wetlands adjacent to the UT to Rocky River, and providing an educational opportunity for students at grade schools adjacent to the Site. These goals were accomplished by:

- Improving water quality and stabilizing the UT to Rocky River by restoring a more natural pattern, profile, and dimension that transports its sediment and flow without aggrading (as seen in areas affected by beavers and erosion control devices), or degrading (as seen in gully reaches on-site)
- Improving water quality by establishing a natural vegetative buffer adjacent to the UT to Rocky River that filters runoff from adjacent development.
- Improving aquatic habitat by enhancing stream bed variability, providing shading/cover areas within the stream channel, and introducing woody debris in the form of rootwads, log vanes, and log sills.
- Enhancing terrestrial habitat by removing existing invasive vegetative species and planting the buffer (floodplain) with native trees, shrubs, herbs and grasses.
- Creating a wildlife corridor through the Site that connects habitat areas along the Rocky River with habitat areas at the upstream end of the Site. The corridors provide connectivity to a diversity of habitats including mature forest, early successional forest, stream-side forest, riparian wetlands, and uplands.
- Enhancing wetlands by removing existing invasive species and planting native vegetative species.
- Providing an educational benefit to children who can utilize the pedestrian footpath crossing the floodplain, and can view the stream channel from adjacent terraces where schools are located.

Prior to construction, much of the channel was influenced by backwater effects from beaver dams, sediment control fence, and an in-line erosion control BMP. The remaining portions of the Site were deeply eroded gullies caused by head cuts through the Site. The floodplain of the Site was dominated by low lying brush and shrubs indicative of early successional re-growth. A portion of the floodplain in the upper third of the Site contained a mature canopy with little to no underbrush. Until recently, the Site watershed was characterized primarily by agricultural land and pine plantation/forested land. However, high density residential housing, including two schools adjacent to the Site, has been and is continuing to be constructed within the majority of the watershed. It is anticipated that land uses will continue to trend towards residential and business development in the years to come.

Site construction was completed on August 30, 2010, Site planting was completed on February 15, 2011, and final inspection repairs were completed on March 23, 2011. The Site restored 2,450 linear feet of stream using Priority I restoration by reconnecting the stream with the historic floodplain, establishing a meandering stream, incorporating in-stream structures, and planting with native forest species. Priority II restoration was used to restore 265 linear feet of stream by building a bankfull bench as the invert elevation of the UT to Rocky River drops near its confluence with the Rocky River. Restoration efforts increased the stream length of the UT from a length of 2,350 linear feet to 2,715 linear feet. Mitigation efforts enhanced approximately 8.2 acres of riverine wetlands adjacent to the UT to Rocky River by eradicating invasive species and replanting native species. Planting occurred within approximately 15 acres of the 22-acre conservation easement including stream banks, floodplain, and wetlands. Initial stem count measurements indicate an average of 463 planted stems per acre (excluding live stakes) across the Site. Site activities provide 2,615 Stream Mitigation Credits (1:1 ratio, excluding stream within sewer line easement) and 4.1 Wetland Mitigation Credits (2:1 ratio). The Stream Mitigation Credits produced are less than the restored length of stream because 100 linear feet of restored stream flows through sewer line easements and were excluded from the credit calculation. Wetlands located within the sewer line easements were not planted during the construction phase of this project are not included as part of the enhanced wetland acreage or Wetland Mitigation Credits. The Site will be protected by a permanent conservation easement held by the State of North Carolina.

Monitoring Components and Duration

The first year monitoring report will be submitted in November 2012. Monitoring will continue for five years or until agreed upon success criteria are achieved, with a report submitted by the end of December for each monitoring year. Monitoring will include a survey of representative stream profiles and cross-sections, representative surveys of vegetation, and an annual monitoring report verifying that the Site has remained relatively unchanged.

Issues or Mitigating Factors

Delays in the preparation and submittal of the Baseline Monitoring Document are a result of the time required to obtain a fully executed contract under the new 2011 RFQ for monitoring services. Due to this delay, the baseline monitoring field data collection occurred at three separate times; stream morphological surveys were conducted in March 2011, eight (8) vegetation plots were installed and surveyed in May 2011 and six (6) vegetation plots were installed and surveyed in April 2012. To avoid future delays in project milestone deliverables, F&H conducted Year 1 stream morphological surveys in March 2012 and anticipates conducting Year 1 vegetation surveys in September 2012.

During the stream surveys in March 2012, F&H observed a beaver dam near station 33+50 on top of a log sill structure. F&H provided EEP the location and photographs of the beaver dam on March 9, 2012. The dam was backing water up in the channel and floodplain but at that time the channel was not significantly altered by the dam. EEP coordinated with a beaver control specialist and the dam was removed in May 2012.

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1.0 PROJECT GOALS, BACKGROUND AND ATTRIBUTES

1.1 Location and Setting

UT Rocky River – Harris Road Middle Site (hereafter referred to as the "Site") is located in northwest Cabarrus County approximately 6 miles southwest of the town of Kannapolis (Figure 1). The center of the Site has a latitude and longitude of 035º 25' 32" N and 080º 44' 26'' W. The Site is situated in the northeast quadrant of the intersection of Harris Road and the Rocky River between Harris Middle School and Odell Elementary School, approximately 1.5 miles from Highway 73. The Site is located in Cabarrus County, North Carolina within United States Geological Survey (USGS) Hydrologic Unit (HU) and Targeted Local Watershed 03040105010010 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-07-11) of the Yadkin-Pee Dee River Basin and will service the USGS 8-digit Cataloging Unit (CU) 03040105 (USGS 1974, NCEEP 2007). The Site is located in the Piedmont physiographic province of North Carolina.

1.2 Project Goals and Objectives

The primary goals of this stream restoration project focused on:

1. Improving water quality
2. Enhancing aquatic and terrestrial habitat within the Site watershed
3. Establishing wildlife corridors within the Site boundaries
4. Enhancing riparian wetlands adjacent to UT to Rocky River
5. Providing educational opportunities for students at grade schools adjacent to the Site

These goals were accomplished by:

1. Improving water quality and stabilizing the UT to Rocky River on-site by restoring a more natural pattern, profile, and dimension that transports its sediment and flow without aggrading (as seen in areas effected by beavers and erosion control devices), or degrading (as seen in gully reaches on-site)
2. Improving water quality by establishing a natural vegetative buffer adjacent to the UT to Rocky River that filters runoff from adjacent development.
3. Improving water quality and enhancing semi-aquatic habitat by enhancing existing wetlands with native tree and shrub plantings.
4. Improving aquatic habitat by enhancing stream bed variability, providing shading/cover areas within the stream channel, and introducing woody debris in the form of rootwads, log vanes, and log sills.
5. Enhancing terrestrial habitat by planting the adjacent buffer (floodplain) with native trees, shrubs, herbs and grasses.
6. Creating a wildlife corridor through the Site that connects habitat areas along the Rocky River with habitat areas at the upstream end of the Site. The corridors provide connectivity to a diversity of habitats including mature forest, early successional forest, stream-side forest, riparian wetlands, and uplands.

7. Enhancing terrestrial habitat by removing existing invasive vegetative species and planting the buffer (floodplain) with native trees, shrubs, herbs and grasses.
8. Providing an educational benefit to children who can utilize the pedestrian footpath crossing the floodplain, and can view the stream channel from adjacent terraces where schools are located.

1.3 Project Structure, Restoration Type and Approach

1.3.1 Project Structure

The Project restored 2,715 linear feet of UT to Rocky River and enhanced 8.2 acres of riparian wetland between Moss Farm Street and Harris Road in Cabarrus County, NC. Table 1 provides a summary of the Project components and mitigation credits (Appendix A). The location of each Site component is depicted in Figure 2 (Appendix A).

1.3.2 Restoration Type and Approach

The UT to Rocky River was channelized and ditched prior to August 4th, 2000. In addition, the channel was heavily influenced by beaver activity and remnant erosion control devices. Backwater from the beaver dams and erosion control devices caused several portions of the channel bed to aggrade and reduced the stream's ability to transport bankfull flows within the channel. The channelized portion of the UT to Rocky River classified as a G5 stream type, while the reach influenced by beaver and erosion control devices classified as a C5 stream type transitioning to a D5 stream type.

Priority I and Priority II restoration were implemented along the UT to Rocky River. The majority of the channel (2,450 linear feet) was restored using Priority I restoration. This restoration took place at the upstream end of the Site and consisted of restoring a meandering channel and reconnecting the bankfull discharge to the historic floodplain. The restored locations of the channel utilized existing trees and root masses to add stability to the channel side slopes, and add shading to the channel for water temperature regulation. The mature trees will also add critical biomass which aquatic biota can forage upon. Impermeable plugs were installed in the abandoned channel and the abandoned channel was filled and compacted to prevent the stream from accessing the old channel. In-stream structures consisting of log and rock vanes, log sills, and soil lifts were utilized to stabilize the stream banks, provide grade control, and improve habitat. The restored channel is straight for 50 feet near Station 20+00 to account for a future bridge crossing.

The downstream portion of the Site (265 linear feet) was restored using Priority II restoration. A bankfull bench was constructed through this reach because the UT to Rocky River's channel invert has to drop through the floodplain to meet the existing invert of the Rocky River. The pool-pool spacing was decreased to promote a step-pool system similar to a B-type channel, with numerous pools to dissipate energy through each step. Whereas energy is primarily dissipated through plan form (i.e. meanders) in the upstream reach, it will be dissipated through bed form

(i.e. pools) which should decrease stress on the channel banks in this lower reach. This concept was deemed critical rather than keeping a highly meandering channel through this section because of the overall increase in the slope of the UT to Rocky River's Valley at this point. Additionally, each drop structure was kept at approximately 0.25 feet, so as to not have large continuous steps at one point within the system. This design concept should ensure long-term stability through the downstream section of the UT to Rocky River.

On-site wetlands were enhanced by eradicating exotic/nuisance species, such as blackberry, and replanting the wetlands with native, hydrophytic vegetation. Restoration of the floodplains, side slopes, and stream-side habitats was completed by planting species characteristic of a Piedmont Alluvial Forest community (Schafale and Weakley 1990) and a stream-side assemblage (Appendix C). Reference Forest Ecosystem (RFE) data, onsite observations, and community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) were used to develop primary plant community associations that were promoted during community restoration activities. Bare-root seedlings of tree species were planted within the Piedmont Alluvial Forest at a density of approximately 680 stems per acre on 8-foot centers, including supplemental planting areas and roadside planting areas. Shrub species in the stream-side assemblage were planted at a density of 2720 stems per acre on 4-foot centers.

In addition, larger, containerized trees were planted throughout areas of the Piedmont Alluvial Forest adjacent to the roadside targeted for aesthetic appeal. Containerized trees were interspersed within bare-root seedlings at a density of 340 trees per acre on 16-foot centers and were concentrated along the perimeter of the planting zone. A list of the species planted within each community is presented in Appendix C.

Site activities provide 2,615 Stream Mitigation Credits (1:1 ratio, excluding stream within sewer line easement) and 4.1 Wetland Mitigation Credits (2:1 ratio). The Stream Mitigation Credits produced are less than the restored length of stream because 100 linear feet of restored stream flows through sewer line easements and were excluded from the credit calculation. Wetlands located within the sewer line easements were not planted during the construction phase of this project are not included as part of the enhanced wetland acreage or Wetland Mitigation Credits. The Site will be protected by a permanent conservation easement held by the State of North Carolina.

Planting occurred within approximately 15 acres of the 22-acre conservation easement including stream banks, floodplain, and wetlands. Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4 (Appendix A).

1.4 Project History, Contacts and Attribute Data

The Site contains a perennial stream, the UT to Rocky River, and is located within the 03040105010010 14-digti Hydrologic Unit, which is also an EEP Targeted Hydrologic Unit for Cataloging Unit 03040105 of the Yadkin-Pee Dee River Basin. Until recently, the Site watershed

was characterized primarily by agricultural land and pine plantation/forested land. However, high density residential housing, including two schools adjacent to the Site, has been and is continuing to be constructed within the majority of the watershed. It is anticipated that land uses will continue to trend towards residential and business development in the years to come.

Florence & Hutcheson (F&H) provided engineering, design, and construction oversight services to the EEP for the Site. Construction began in June 2010 and all grading and planting was completed by March 23, 2011. Delays in the preparation and submittal of the Baseline Monitoring Document are a result of the time required to obtain a fully executed contract under the new 2011 RFQ for monitoring services. Due to this delay, the baseline monitoring field data collection occurred at three separate times; stream morphological surveys were conducted in March 2011, eight (8) vegetation plots were installed and surveyed in May 2011 and six (6) vegetation plots were installed and surveyed in April 2012. To avoid future delays in project milestone deliverables, F&H conducted Year 1 stream morphological surveys in March 2012 and anticipates conducting Year 1 vegetation surveys in September 2012.

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4 (Appendix A).

2.0 SUCCESS CRITERIA

Monitoring of restoration efforts will be performed until success criteria are fulfilled. Monitoring is proposed for the stream channel and vegetation. In general, the restoration success criteria, and required remediation actions, are based on the *Stream Mitigation Guidelines* (USACE et al. 2003).

2.1 Streams

Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996) and 2) channel variables indicative of a stable stream system.

A longitudinal profile will be completed on the entire restored section of the UT to collect invert, surface water and bankfull elevation data. A total of six cross-sections (four riffles and two pools) have been installed. Permanent photo stations have been established at each permanent cross-section. These data will be utilized to determine the success in restoring stream channel stability. Specifically, the width-to-depth ratio and bank-height ratios should be indicative of a stable or moderately unstable channel with minimal changes in cross-sectional area, channel width, and/or bank erosion along the monitoring reach. In addition, channel abandonment and/or shoot cutoffs must not occur and sinuosity values must remain relatively constant. Visual assessment of in-stream structures will be conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, stream flow around the structure, and/or stream flow beneath the structure.

2.1.1 Stream Dimension

General maintenance of a stable cross-section and hydrologic access to the floodplain features over the course of the monitoring period will generally represent success in dimensional stability. Some changes in dimension (such as lowering of bankfull width) should be expected. Key parameters such as cross-sectional area and the channel's width to depth ratio should demonstrate modes of overall change. Riffle sections should generally maintain a Bank Height Ratio of 1.0 – 1.5, with some variation in this ratio naturally occurring. Pool sections naturally adjust based on recent flows and time between flows, therefore more variation on pool section geometry is expected.

2.1.2 Stream Pattern and Profile

The profile should not demonstrate significant trends towards degradation or aggradation over a significant portion of a reach. Additionally, bed form variables should remain noticeably intact and consistent with original design parameters that were based off of reference conditions. Pattern features should show little adjustment over the standard 5 year monitoring period.

2.1.3 Substrate

Sampling of the substrate distribution will not be completed because the restored section of the UT to Rocky River is composed of a sand substrate. Coarsening of the substrate is not anticipated.

2.1.5 Sediment Transport

There should be an absence of any significant trend in the aggradational or depositional potential of the channel.

2.2 Vegetation

Restoration monitoring procedures for vegetation will monitor plant survival and species diversity. Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon density and growth of "Character Tree Species." Character Tree Species are defined as those species included in the Planting Plan (Appendix C) or species that were identified in Table 8 –Reference Forest Ecosystem (Appendix C).

Success criteria dictate that an average density of 320 stems per acre of Character Tree Species must be surviving in the first three monitoring years. Subsequently, 290 Character Tree Species per acre must be surviving in year 4 and 260 Character Tree Species per acre in year 5.

One goal of the project is to remove exotic/nuisance vegetative species. Exotic/nuisance species shall not comprise more than 20 percent of the total surveyed species. If exotic/nuisance species comprise more than 20 percent of the total surveyed species then success criteria may not be met and removal of these species may be required.

2.3 Hydrology

A minimum of two bankfull events must be documented within the standard 5 year monitoring period. The two bankfull events shall occur within separate years.

2.4 Scheduling and Reporting

The first year monitoring report will be submitted in November 2012. Monitoring will continue for five years or until agreed upon success criteria are achieved, with a report submitted by the end of November for each monitoring year.

3.0 MONITORING PLAN GUIDLINES

3.1 Stream Hydrology

To ensure accuracy and make note of any site changes, all data collected for monitoring purposes will be taken manually and in the field.

Verification of bankfull events and changes in stream hydrology will be recorded by crest gauges installed in the stream as well as visual evidence of above bankfull flows. Evidence of above bankfull flows may include trash/debris lines in or above the floodplain, vegetation pushed over towards the downstream direction in the floodplain, terrace slope scour, and staining of vegetation. Early monitoring of crest gauges will allow for additional verification of bankfull design targets.

All visits to the site for purposes of data collection will be documented by the monitoring performer and will describe in detail: weather conditions; physical appearance of the site; highest stage for that monitoring interval as recorded on the crest gauge; a reset of the crest gauge; photo documentation. Data collected for the purposes of bankfull verification will be compiled and summarized in each annual version of the monitoring report.

3.2 Stream Channel Stability and Geomorphology

Assessment of the UT to the Rocky River dimension, pattern and profile is necessary to ensure that the reach maintains reference geomorphology. Visual based assessments, photographic documentation, and surveys of profiles and representative cross-sections will be used to monitor channel stability. Vegetation will be monitored annually to document plant survival and community composition. This section serves as the general guide to the extent and type of monitoring of different stream features.

3.2.1 Dimension

Six permanent cross-sections have been established and will be used to evaluate stream dimension (4 riffles and 2 pools). Cross-sections are permanently monumented with 2-foot rebar posts at each end point. Cross-sections will be measured to provide a detailed evaluation of the stream and banks including points on the adjacent floodplain, top of bank, bankfull, breaks in slope, edge of water, and thalweg. Data will be used to calculate bankfull dimensions, width-depth ratios, entrenchment ratios, and bank height ratios for each cross-section. In addition, photographs will be taken at each permanent cross-section location annually. These cross sections meet the EEP recommendations for a reach of between 2,501 and 3,000 linear feet.

3.2.2 Profile

The entire length of the restored channel will be surveyed for geomorphological changes to the profile for as-built and monitoring purposes. Stream parameters surveyed will include top of bank, thalweg, water surface, bankfull, and low flow benches, if present. The profile data will be used to calculate water surface slopes, riffle/pool lengths and depths, and pool-to-pool spacing.

3.2.3 Pattern

Stream parameters such as channel beltwidth, radius of curvature, and meander wavelength will be collected in monitoring year five if profile and dimensional data indicate that significant geo-morphological adjustments have occurred.

3.2.4 Visual Assessment

Visual stream morphology stability assessments will be completed annually in accordance with the most current version of the EEP document entitled *Monitoring Requirements and performance Standards for Stream and/or Wetland Mitigation (November 7, 2011).* The visual assessment data will be used to assess the channel bed, banks, and in-stream structures.

3.2.5 Bank Stability Assessments

Bank stability should be assessed as part of the annual visual assessment. Recording linear feet of unstable or collapsed banks will help guide repairs in the future, should they be necessary. This will be accomplished visually during all walkthroughs of the site. Near Bank Stress (NBS) and Bank Erosion Hazard Index (BEHI) assessments were not part of the pre-construction existing conditions surveys, therefore they will not be completed in year 5 unless substantial lengths of channel display degradation.

3.3 Vegetation

Fourteen sample vegetation plots (10-meter by 10-meter) were installed within the Site as per guidelines established in CVS-EEP Protocol for Recording Vegetation, Version 4.2 (Lee et al. 2008). Vegetation plots are permanently monumented with 4-foot metal garden posts at each corner. In each sample plot, vegetation parameters to be monitored will conform to Level 2 Standards and include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph.

3.4 Digital Photos

Permanent photo stations were established at each of the six cross-sections and at every vegetation plot. Photos of the stream will be taken annually when vegetation is minimal. Vegetation photos will be taken on the same day that vegetative cover surveys take place. All digital photo records will indicate location, date and monitoring year.

3.5 Watershed

Any changes to the project watershed will be monitored and recorded. In the event that a change to the watershed might introduce new sediment or changes in water flow to the site, such as a new development upstream, it will be closely monitored and analyzed. Any significant effects to site streams will be documented so that action can be taken, if necessary. Additionally, rare or significant hydrologic and weather events will be recorded in detail so that changes to site streams can be accounted for.

4.0 MAINTENANCE AND CONTINGENCY PLANS

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented.

4.1 Stream

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented. Stream contingency may include, but may not be limited to 1) structure repair and/or installation; 2) repair of dimension, pattern, and/or profile variables; and 3) bank stabilization. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success, include 1) structure failure, 2) headcut migration through the Site, and/or 3) bank erosion.

4.1.1 Structure Failure

In the event that structures are compromised, the affected structure will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function to stabilize adjacent stream banks and/or maintain grade control within the channel. Structures which remain intact, but exhibit flow around, beneath, or through the header/footer logs or rocks will be repaired by excavating a trench on the upstream side of the structure and reinstalling filter fabric in front of the logs or rock. Structures which have been compromised, resulting in shifting or collapse of header/footer logs or rocks, will be removed and replaced with a structure suitable for Site flows.

4.1.2 Headcut Migration through the Site

In the event that a headcut occurs within the Site (identified visually or through measurements [i.e. bank-height ratios exceeding 1.4]), provisions for impeding headcut migration and repairing damage caused by the headcut will be implemented. Headcut migration may be impeded through the installation of in-stream grade control structures (log sill and/or log cross-vane) and/or restoring stream geometry variables until channel stability is achieved. Channel repairs to stream geometry may include channel backfill with coarse material and stabilizing the material with erosion control matting, vegetative transplants, and/or willow stakes.

4.1.3 Bank Erosion

In the event that severe bank erosion occurs at the Site resulting in elevated width-to-depth ratios, contingency measures to reduce bank erosion and width-to-depth ratio will be implemented. Bank erosion contingency measures may include the installation of soil lifts and/or other bank stabilization measures. If the resultant bank erosion induces shoot cutoffs or channel abandonment, a channel may be excavated which will reduce shear stress to stable values.

4.2 Vegetation

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with

tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

5.0 AS-BUILT STATE

This section documents the as-built/baseline condition. Appendices B & C include Tables 5, 6, and 7 which detail specific geomorphic and vegetative data in relation to the as-built conditions. As-built/baseline drawings are included in Appendix D.

5.1 As-built/Record Drawings

The As-built/Record Drawings are attached in Appendix D.

5.2 Morphologic State of the Channel

Upon completion of grading and structure installation, a baseline survey was performed for the entire restored length of stream and included six cross-sections. Baseline morphologic data is summarized in Table 5 and Table 6 in Appendix B. Plots of the profiles are shown in Figures B.1-B.3 in Appendix B. Cross-section plots and photos can also be found in Appendix B. Cross-section photos were taken facing in the downstream direction.

5.3 Sediment Transport in the As-built State

As-built capacity (unit stream power) values are depicted in Table 5 and can be compared with design and existing values for each reach. For sand based systems, such as UT to Rocky River, capacity is the primary tool for assessing the channel's ability to transport sediment through the system.

5.4 Verification of Plantings

After planting was completed, an initial evaluation was performed per guidelines established in CVS-EEP Protocol for Recording Vegetation, Version 4.2 (Lee et al. 2008) to verify planting methods were successful and to determine initial species composition and density. Baseline vegetation plot data can be found in Table 7 in Appendix C. Plot photos are also located in Appendix C. Initial stem count measurements indicate an average of 463 planted stems per acre (excluding live stakes) across the Site. In addition, each individual plot met success criteria based on planted stems alone, with the exception of Plot 10. Plot 10 had a stem density of 283 planted stems per acre; however, the stem density increased to 2,024 stems per acre when volunteer species were included. Volunteer species in Plot 10 consisted of red maple, sweetgum, black willow, and elm. A Final Planting List can be found in Appendix C.

5.4 Stream Gauges

Crest gauges were built and installed in two representative riffles throughout the Site and are being monitored regularly to track any large storm events that affect the Site. Crest gauge locations have been documented in the Monitoring Plan sheets located in Appendix A.

6.0 REFERENCES

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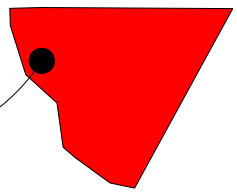
APPENDIX A
General Tables and Figures

Cabarrus County
North Carolina

PROJECT AREA



Vicinity Map

UT Rocky River – Harris Road Middle
Baseline Monitoring Document
Cabarrus County, North Carolina

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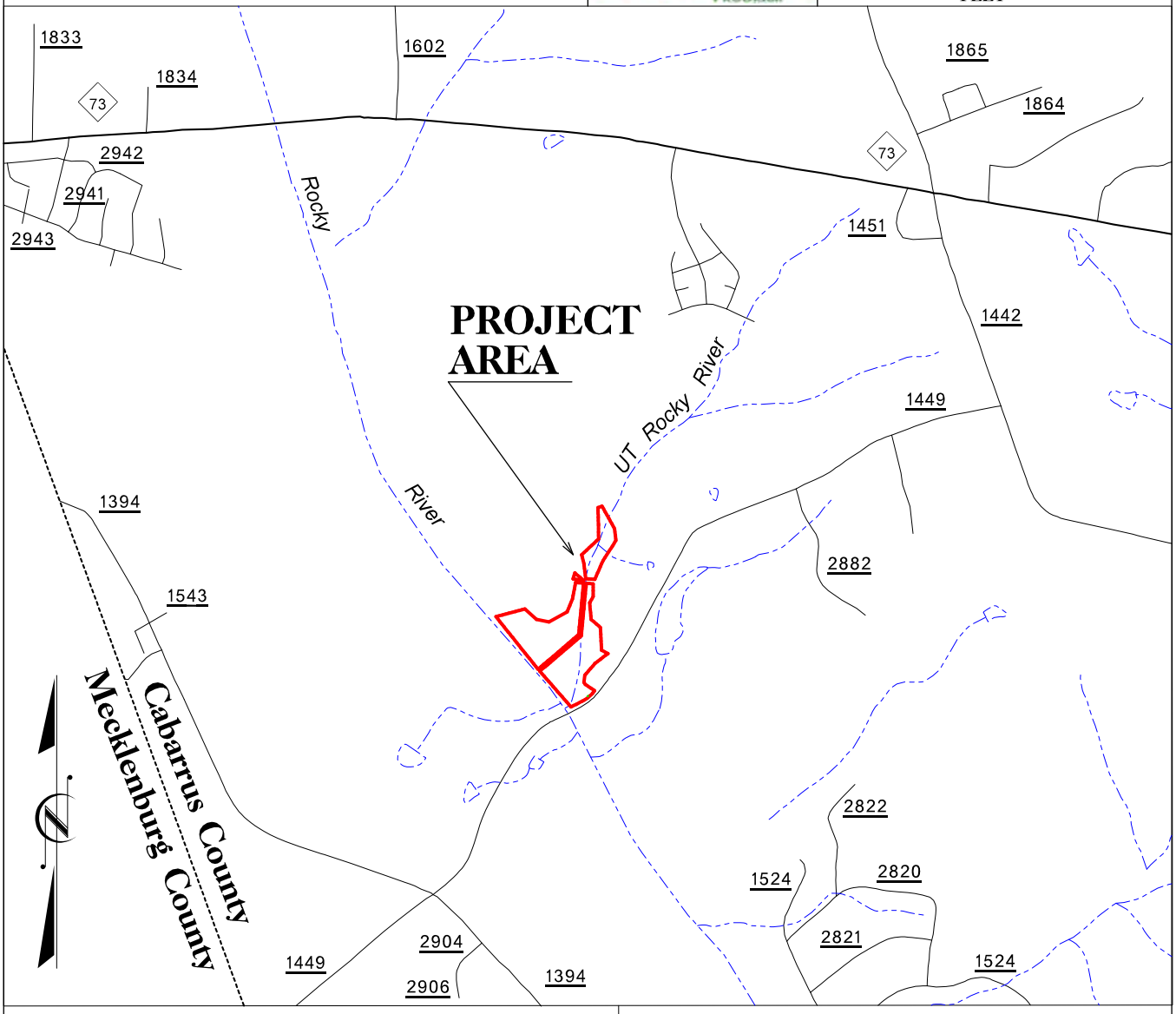
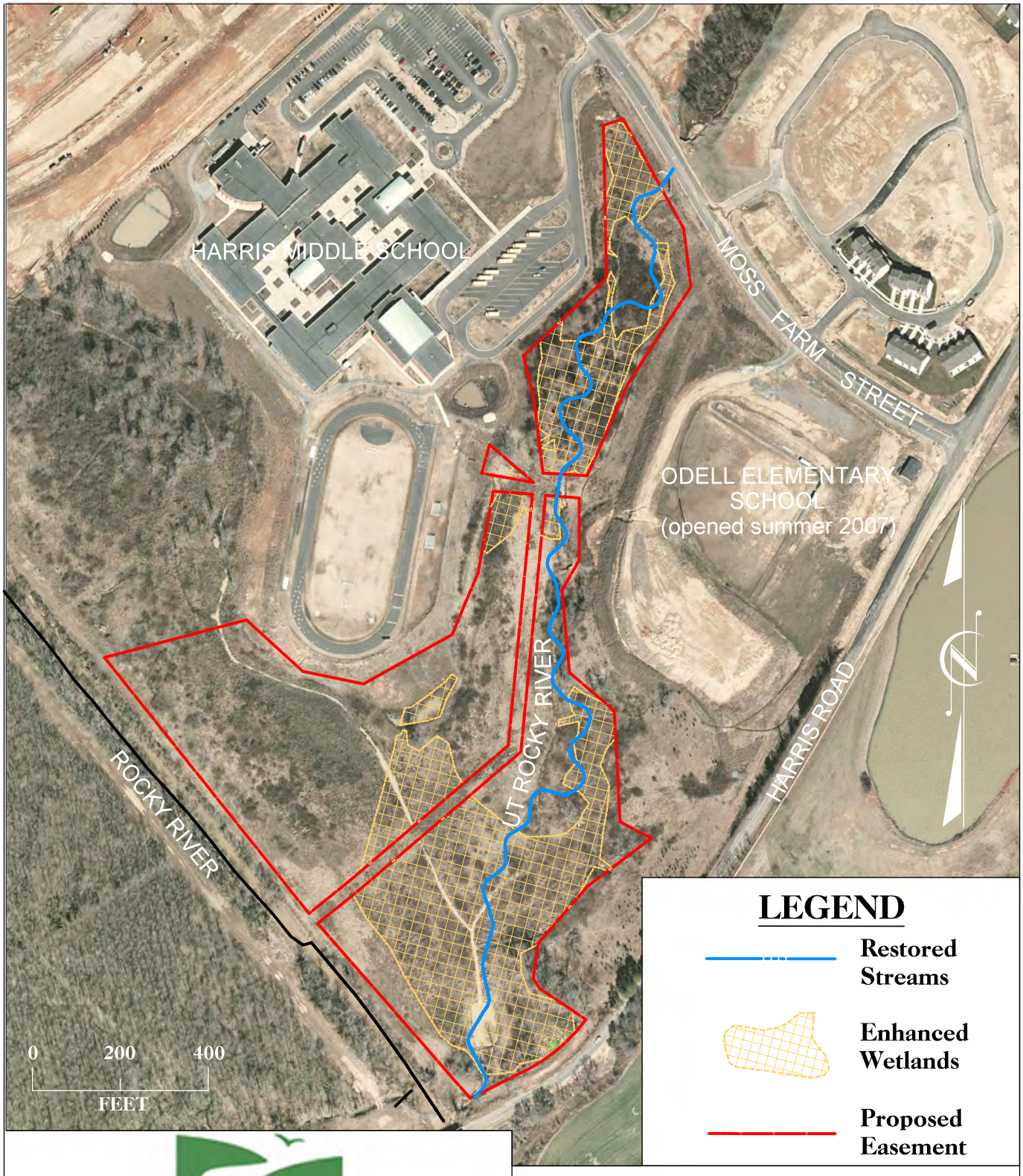


Directions to the Site are as follows:

- Take I-40 West to I-85 South
- Take I-85 South to Exit 55 (NC 73 West)
- Travel west on NC 73 for approximately 3.9 miles
- Take a left on Odell School Road and travel for 0.5 miles.
- Take a right onto Harris Road and travel approximately 0.8 mile following signs to Harris Middle School
- Turn right onto Moss Farm Street. The UT to Rocky River flows southwest under Moss Farm Street in approximately 0.18 miles

"The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/ contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP."



Ecosystem Enhancement Program

Florence & Hutcheson

An ICA Company

5121 Kingdom Way, Suite 100 Raleigh, NC 27607

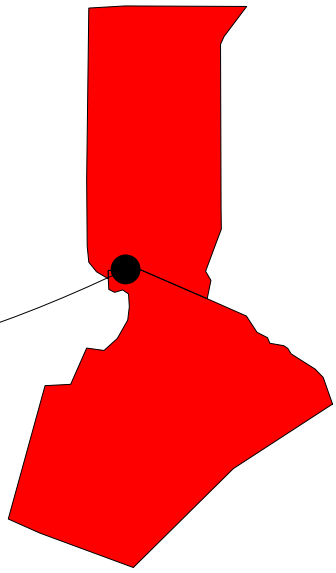
NC License No: F-0258

Project Asset Map

UT Rocky River – Harris Road Middle Baseline Monitoring Document Cabarrus County, North Carolina

Date: 5/24/12	Figure: 2

Wake /Granville Counties North Carolina



REFERENCE SITE

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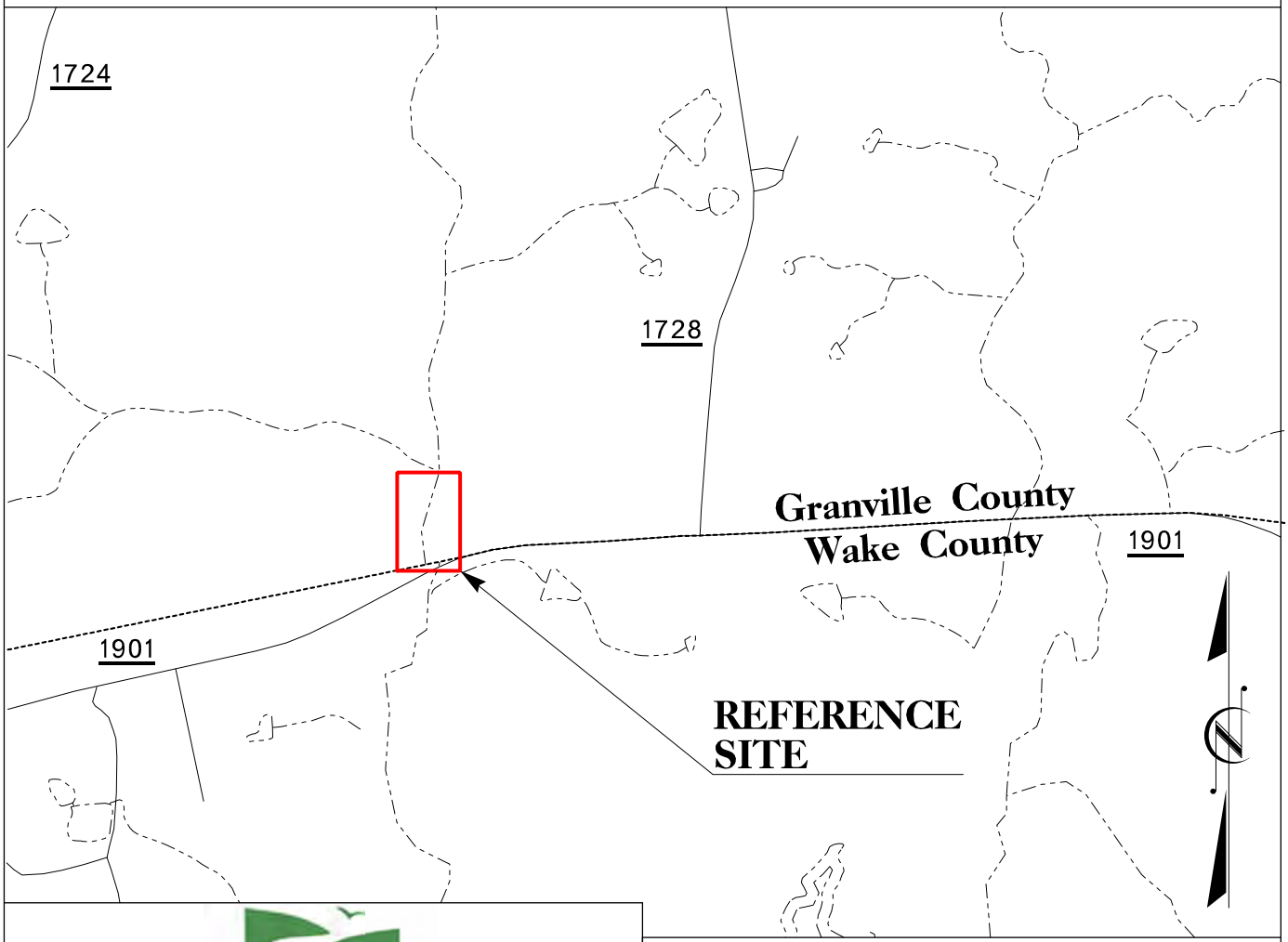
FEET



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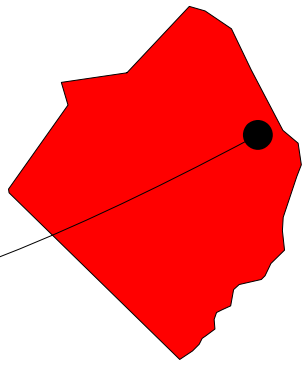
UT to Ledge Creek Reference Site Vicinity Map

UT Rocky River – Harris Road Middle
Baseline Monitoring Document
Cabarrus County, North Carolina

Date: 5/24/12	Figure: 3

Robeson County
North Carolina



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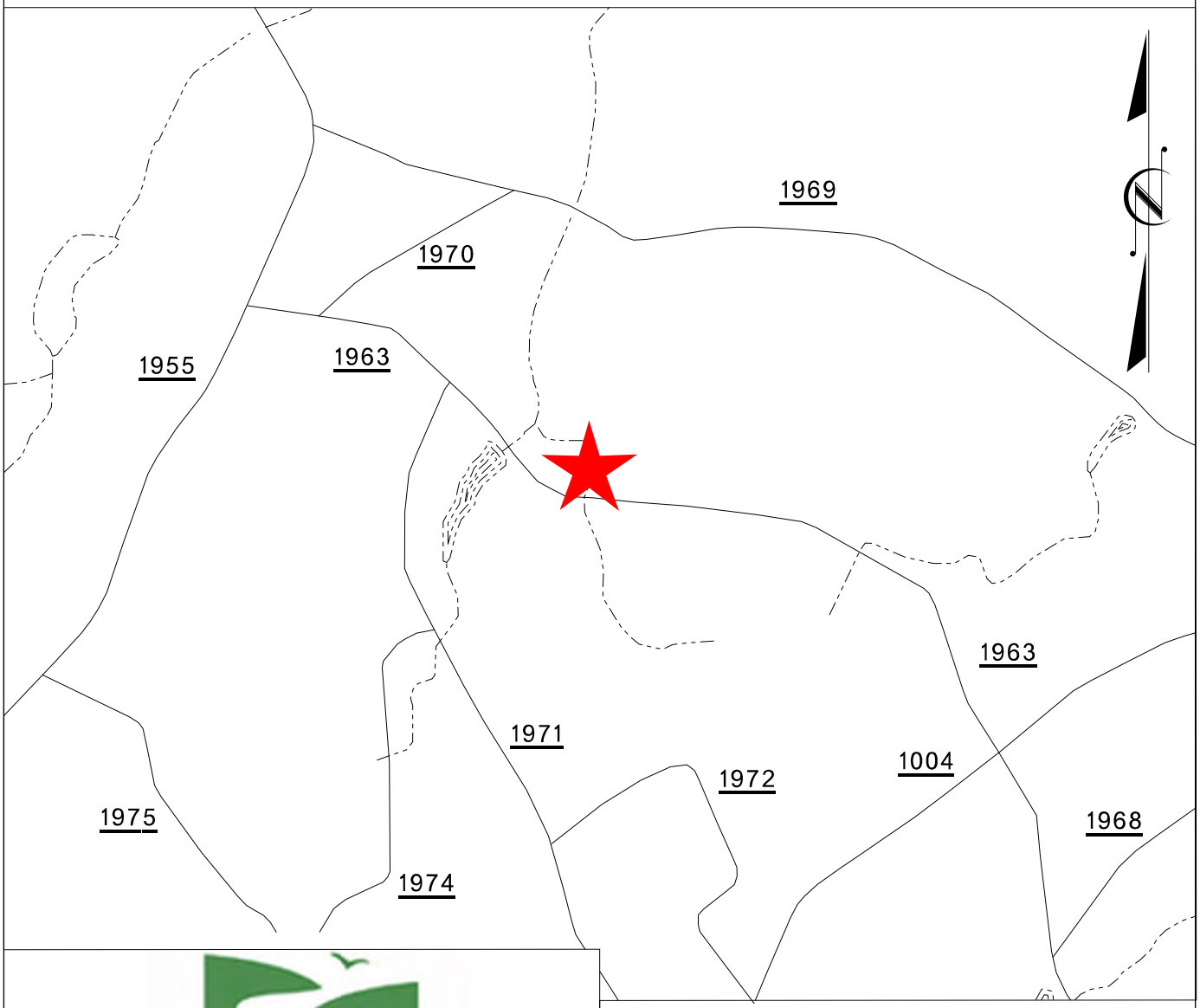

Ecosystem Enhancement PROGRAM

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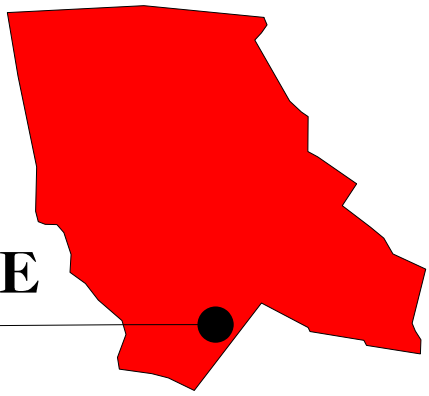
NC License No: F-0258

UT to Wildcat Branch Reference Site Vicinity Map

UT Rocky River – Harris Road Middle
Baseline Monitoring Document
Cabarrus County, North Carolina

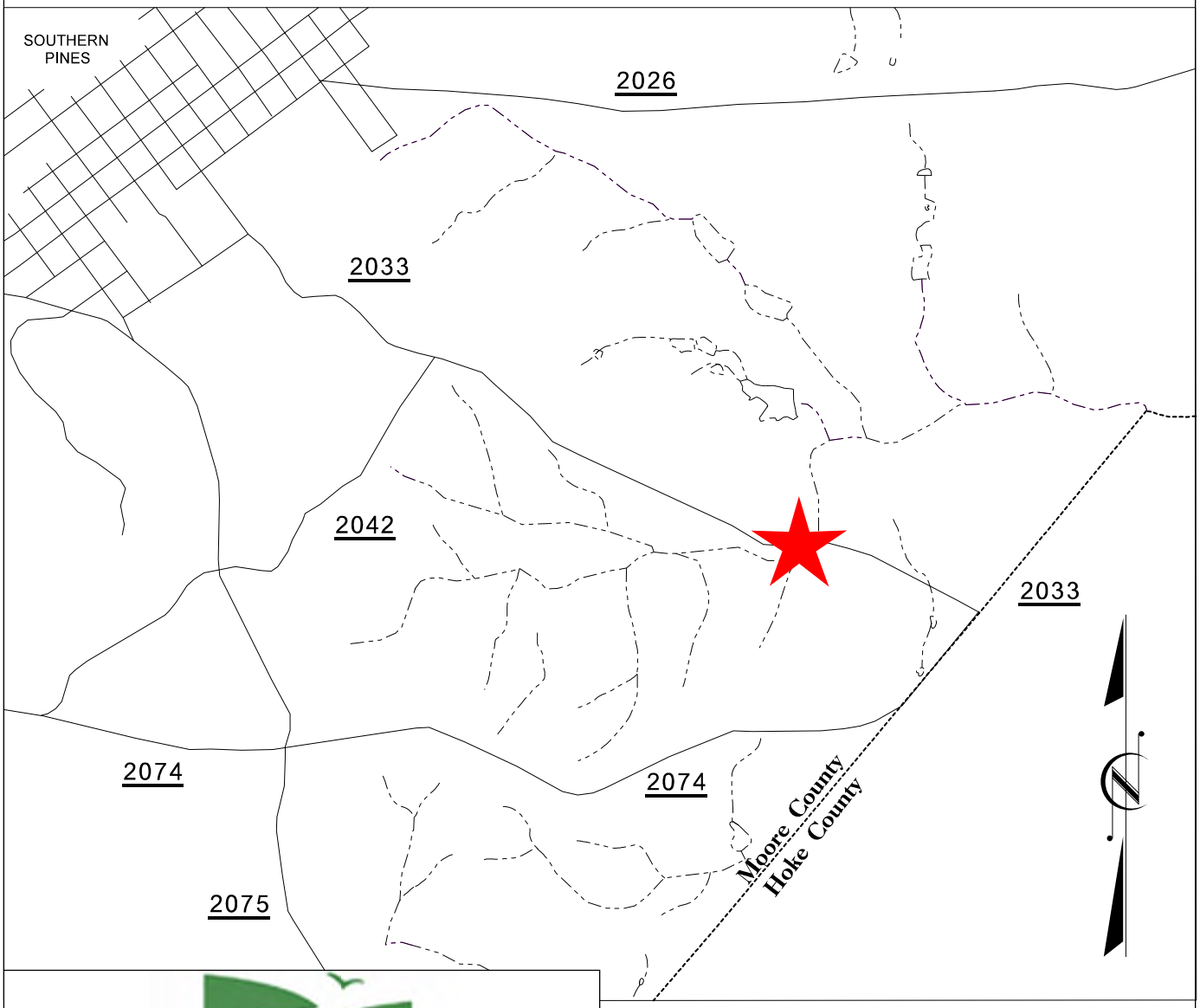
Date: 05/24/12	Figure: 4

Moore County
North Carolina



0 2000 4000
FEET

REFERENCE SITE



Ecosystem Enhancement PROGRAM

Florence & Hutcheson

An ICA Company

5121 Kingdom Way, Suite 100 Raleigh, NC 27607

NC License No: F-0258

Mill Creek Reference Site Vicinity Map

UT Rocky River – Harris Road Middle
Baseline Monitoring Document
Cabarrus County, North Carolina

Date: 05/24/12

Figure: 5

Table 1. Project Components and Mitigation Credits
UT Rocky River – Harris Road Middle (EEP Project ID No. 92383)

Mitigation Credits		
	Stream*	**Riparian Wetland**
Type	R	R
Total	2,615	4.1

Project Components						
Restoration Segment/ Reach ID	**Station Range**	**Existing LF/AC**	**Approach**	**Restoration or Restoration Equivalent**	**Restored LF/AC**	**Mitigation Ratio**
UT to Rocky River	10+00 – 34+50	2,020	PI	R	2,450	1:1
UT to Rocky River	34+50 – 37+15	330	PII	R	265	1:1
Wetland	-	8.7	Invasive Removal & Planting	R	8.2	2:1

Component Summation		
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)
		Riverine
Restoration	2,715	
Enhancement		8.2

*Stream credits are less than the linear feet restored because 100 feet of the restored stream flows through sewer line easements and was not included as part of the stream credit calculations.

*Wetlands located within the sewer line easements were not planted during the construction phase of this project and are not included as part of the enhanced wetland acreage or Wetland Mitigation Credits

Table 2. Project Activity and Reporting History
UT Rocky River – Harris Road Middle (EEP Project ID No. 92383)

Activity or Report	Data Collection Complete	Completion or Delivery
Restoration Plan	April 2008	September 2008
Final Design – Construction Plans	September 2008	October 2008
Construction	June 11, 2010	March 23, 2011
Temporary S&E Mix Applied to Entire Project Area	August 30, 2010	March 23, 2011
Permanent Seed Mix Applied to Entire Project Area	August 30, 2010	March 23, 2011
Bare Root, Containerized, and B&B plantings for Entire Project Area	February 14, 2011	February 15, 2011
Mitigation Plan/As-built (Year 0 Monitoring-Baseline)	April 11, 2012	June 27, 2012
Year 1 Monitoring		
Year 2 Monitoring		
Structural maintenance (bench expansion, vane, etc.)		
Year 3 Monitoring		
Supplemental planting of containerized material		
Year 4 Monitoring		

Table 3. Project Contacts Table
UT Rocky River – Harris Road Middle (EEP Project ID No. 92383)

Designer Primary project design POC	Florence & Hutcheson 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Kevin Williams (919) 851-6066
Construction Contractor Construction Contractor POC	Vaughn Contracting, Inc. Tommy Vaughn P.O. Box 796 Wadesboro, NC 28170 (704) 694-6450
Planting Contractor Planting Contractor POC	Bruton Natural Systems Charlie Bruton PO Box 1197 Fremont, NC 27830 (919) 242-6555
Seeding Contractor Seeding Contractor POC	Vaughn Contracting, Inc. Tommy Vaughn P.O. Box 796 Wadesboro, NC 28170 (704) 694-6450
Seed Mix Sources	Green Resources – Triad Office
Nursery Stock Suppliers	1) ArborGen - South Carolina SuperTree Nursery 2) Dykes & Son Nursery 3) NC Division of Forest Resources 4) Carolina Wetland Services
Monitoring Performers	Florence & Hutcheson 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Stream Monitoring POC	Florence & Hutcheson 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Vegetation Monitoring POC	Florence & Hutcheson 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066

Table 4. Project Information
UT Rocky River – Harris Road Middle (EEP Project ID No. 92383)

Project Information	
Project Name	UT Rocky River – Harris Road Middle
Project County	Cabarrus
Project Area (acres)	20
Project Coordinates	035º 25’ 32” N, 080º 44’ 26’’ W
Project Watershed Summary Information	
Physiographic Region	Southern Piedmont
Ecoregion	Southern Outer Piedmont
Project River Basin	Yadkin-Pee Dee
USGS 8-digit HUC	03040105
USGS 14-digit HUC	03040105010010
NCDWQ Subbasin	03-07-11
Project Drainage Area	0.77 sq. mi (at end of restoration reach)
Watershed Land Use	Forested = 15% Residential/Commerical = 85%

Reach Summary Information	
Parameters	**UT Rocky River**
Restored length	2,715
Drainage Area	0.77 sq. mi.
NCDWQ Index Number	14-(7)
NCDWQ Classification	C
Valley Type/Morphological Description	VIII/C5
Dominant Soil Series	Chewacla
Drainage Class	Somewhat poorly drained
Soil Hydric Status	Hydric
Slope	0.0060
FEMA Classification	AE & X
Native Vegetation Community	Piedmont Alluvial Forest
Percent Composition of Exotic Invasives	0%
Wetland Summary Information	
Parameters	**Wetland 1**
Size of Wetland (acres)	8.2
Wetland Type	Riparian Riverine
Mapped Soil Series	Chewacla
Drainage Class	Somewhat poorly drained
Soil Hydric Status	Hydric
Source of Hyrdrology	Groundwater and Floodwater
Hydrologic Impairment	No
Native Vegetation Community	Piedmont Alluvial Forest
Percent Composition of Exotic Invasive Veg.	0%

Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**
Waters of the U.S. –Sections 404 and 401	Yes	Yes	Restoration Plan
Endangered Species Act	Yes	Yes	Restoration Plan
Historic Preservation Act	Yes	Yes	Restoration Plan
CZMA/CAMA	No	--	--
FEMA Floodplain Compliance	Yes	Yes	Restoration Plan
Essential Fisheries Habitat	No	--	--

09/08/99

CONTRACT: UT ROCKY RIVER – HARRIS ROAD MIDDLE SCO# 07070800 1

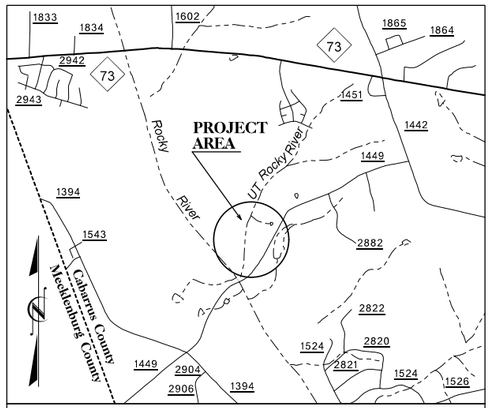
MONITORING PLANS
UT ROCKY RIVER – HARRIS ROAD MIDDLE

STATE		SHEET NO.	TOTAL SHEETS
N.C.	UT ROCKY RIVER – HARRIS ROAD MIDDLE	1	5

LOCATION: CABARRUS COUNTY, NORTH CAROLINA

LAT: 35°25'34.52" N ***LONG: 80°44'25.53" W***

TYPE OF WORK: MONITORING PLANS

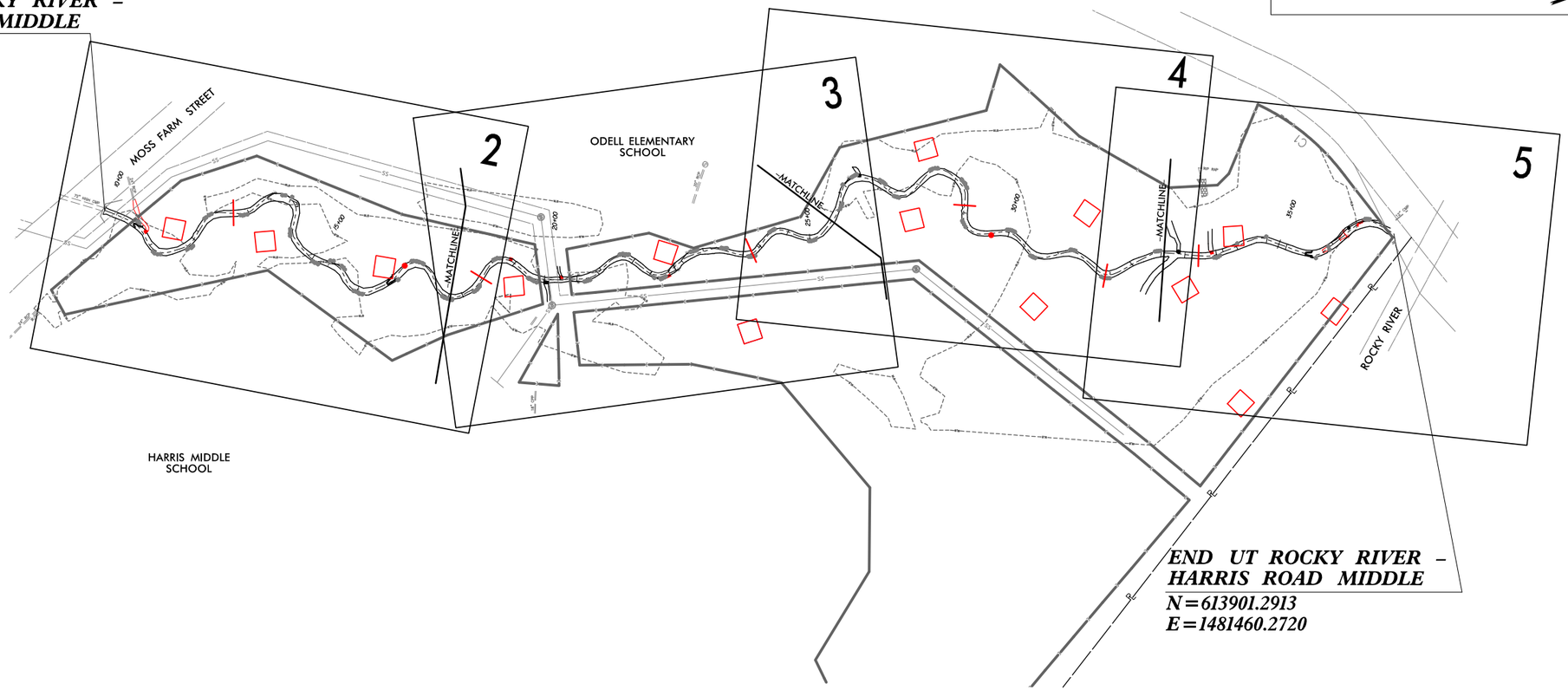


VICINITY MAP

LEGEND

- MONITORING CROSS SECTION (XS–)
- CREST GAUGE
- WLB — WETLAND BOUNDARY
- PL — EXISTING PROPERTY LINE
- EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- FPI – FLOODPLAIN INTERCEPTOR
- ROCK L-VANE
- ROCK CROSS VANE
- LOG VANE W/SILL
- LOG CROSS VANE
- DOUBLE STEP LOG CROSS VANE
- TRANSPLANTS
- LOG SILL

BEGIN UT ROCKY RIVER – HARRIS ROAD MIDDLE
N=616015.2714
E=1481909.5722



END UT ROCKY RIVER – HARRIS ROAD MIDDLE
N=613901.2913
E=1481460.2720

INDEX OF SHEETS

GRAPHIC SCALES

50 25 0 50 100
PLANS

10 5 0 10 20
PROFILE (HORIZONTAL)

20 10 0 20 40
PROFILE (VERTICAL)

DESIGN DATA

DESIGN STREAM TYPE	=	C5/E5
BANKFULL AREA (FT^2) CROSS-SECTIONED	=	9.0
BANKFULL WIDTH (FT)	=	9.5
MAX DEPTH (FT)	=	1.4
WIDTH /DEPTH RATIO	=	10
DRAINAGE AREA (MI^2)	=	0.8
BANKFULL SLOPE(FT/FT)	=	0.002

PROJECT LENGTH

EXISTING STREAM LENGTH	=	2,350 FT
PROPOSED DESIGN STREAM LENGTH	=	2,715 FT
WETLAND ENHANCEMENT AREA	=	8.20 AC.

Ecosystem Enhancement PROGRAM

OWNER CONTACT:

PAUL WIESNER
EEP PROJECT MANAGER

LIN XU
REVIEW COORDINATOR

Prepared In the Office of:

Florence & Hutcheson

An ICA Company

5121 Kingdom Way, Suite 100 Raleigh, NC 27607

NC License No: F-0258

R. KEVIN WILLIAMS
PROJECT ENGINEER

RYAN V. SMITH
PROJECT DESIGNER

6/26/2012
R:\stream\Proj\Monitoring\RockyRiver_Monitoring_psh_1.dgn
Florence & Hutcheson, Inc.

PROJECT REFERENCE NO.	SHEET NO.
UT ROCKY RIVER – HARRIS ROAD MIDDLE	2

Florence & Hutcheson
An ICA Company
3121 Kingdom Way, Suite 100 Raleigh, NC 27607
NC License No: P-0258

25 0 50
SCALE

MONITORING PLANS

LEGEND

- MONITORING CROSS SECTION (XS–)
- CREST GAUGE
- WETLAND BOUNDARY (WLB)
- EXISTING PROPERTY LINE (PL)
- EASEMENT BOUNDARY (E)
- BANKFULL
- THALWEG
- TOE OF SLOPE
- FPI – FLOODPLAIN INTERCEPTOR
- ROCK L–VANE
- ROCK CROSS VANE
- LOG VANE W/SILL
- LOG CROSS VANE
- DOUBLE STEP LOG CROSS VANE
- TRANSPLANTS
- LOG SILL

MOSS FARM STREET

CP–3
N = 616053.1140
E = 1481902.6200
ELEV = 633.910

10+00

24" RCP

72" HIGH CMP

24" RCP W/FES

XS-1

VEG 9

VEG 1

VEG 2

15+00

Flow Direction

CREST GAUGE 1

BASIN

–MATCHLINE– SEE SHEET 3

UT ROCKY RIVER –
HARRIS ROAD MIDDLE
N = 616015.2714
E = 1481909.5722

HARRIS MIDDLE SCHOOL

CP–4
N = 615583.8840
E = 1481538.7100
ELEV = 636.439

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR MONITORING PLAN SHEETS SEE SHEETS 2 THRU 5

MONITORING PLANS UT ROCKY RIVER – HARRIS ROAD MIDDLE	
SCO #: 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 05/12

6/26/2012
P:\stream\Proj\Monitoring\RockyRiver_Monitoring_psh_2.dgn
Florence & Hutcheson, Inc.

MONITORING PLANS

PROJECT REFERENCE NO.	SHEET NO.
UT ROCKY RIVER – HARRIS ROAD MIDDLE	3

Florence & Hutcheson
An ICA Company
5121 Kingdom Way, Suite 100 Raleigh, NC 27607
NC License No: P-0238

25 0 50
SCALE

LEGEND

- MONITORING CROSS SECTION (XS–)
- CREST GAUGE
- WLB — WETLAND BOUNDARY
- PL — EXISTING PROPERTY LINE
- E — EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- FPI – FLOODPLAIN INTERCEPTOR
- ROCK L–VANE
- ROCK CROSS VANE
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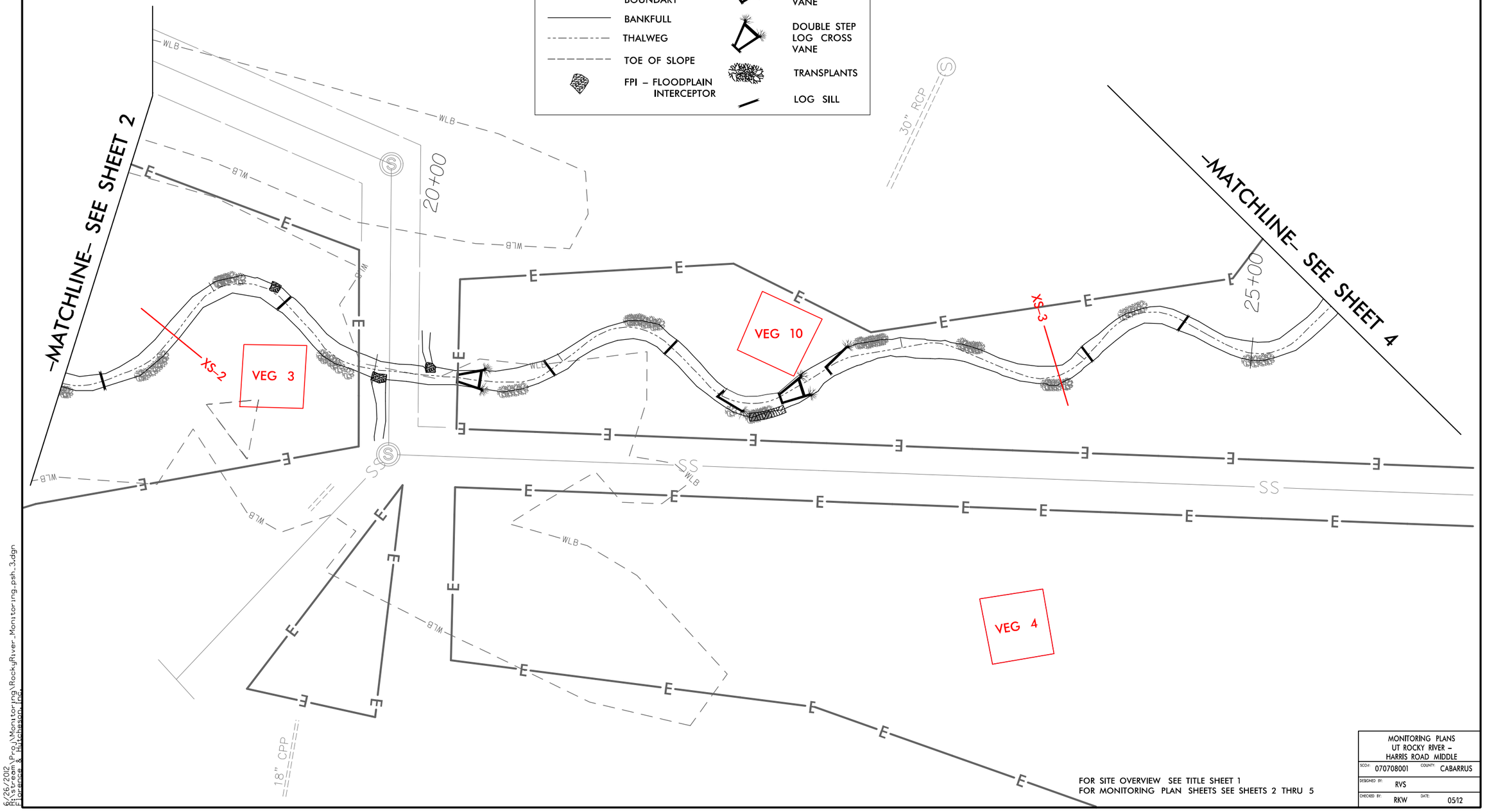

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR MONITORING PLAN SHEETS SEE SHEETS 2 THRU 5

MONITORING PLANS
UT ROCKY RIVER –
HARRIS ROAD MIDDLE

SCO#:	070708001	COUNTY:	CABARRUS
DESIGNED BY:	RVS		
CHECKED BY:	RKW	DATE:	05/12

6/26/2012
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Florence & Hutcheson, Inc.

MONITORING PLANS

PROJECT REFERENCE NO.	SHEET NO.
UT ROCKY RIVER – HARRIS ROAD MIDDLE	4

Florence & Hutcheson
An ICA Company
3121 Kingdom Way, Suite 100 Raleigh, NC 27607
NC License No: P-0288

25 0 50
SCALE

LEGEND

- MONITORING CROSS SECTION (XS–)
- CREST GAUGE
- WLB — WETLAND BOUNDARY
- EXISTING PROPERTY LINE
- E — EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- FPI – FLOODPLAIN INTERCEPTOR
- ROCK L–VANE
- ROCK CROSS VANE
- LOG VANE W/SILL
- LOG CROSS VANE
- DOUBLE STEP LOG CROSS VANE
- TRANSPLANTS
- LOG SILL

CP–5
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E = 1481797.3510
ELEV = 635.892

CP–6
N = 614257.9240
E = 1481738.0020
ELEV = 635.892

VEG 5
VEG 11
VEG 12
VEG 6
XS–4
XS–5
CREST GAUGE 2
30+00
E
WLB
SS

–MATCHLINE– SEE SHEET 3

–MATCHLINE– SEE SHEET 5

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR MONITORING PLAN SHEETS SEE SHEETS 2 THRU 5

MONITORING PLANS UT ROCKY RIVER – HARRIS ROAD MIDDLE	
SCO #: 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 05/12

6/26/2012
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Florence & Hutcheson, Inc.

MONITORING PLANS

PROJECT REFERENCE NO.	SHEET NO.
UT ROCKY RIVER – HARRIS ROAD MIDDLE	5

Florence & Hutcheson
An ICA Company
5121 Kingsford Way, Suite 100 Raleigh, NC 27607
NC License No: P0258

25 0 50
SCALE

HARRIS ROAD

RIP RAP

WLB

E

35+00

12" CMP

VEG 13

XS-6

Flow Direction

VEG 7

VEG 14

VEG 8

–MATCHLINE– SEE SHEET 4

END UT ROCKY RIVER – HARRIS ROAD MIDDLE
N = 613901.2913
E = 1481460.2720

25' ACCESS, USE AND CONSTRUCTION EASEMENT
DB 3159 PG 65

LEGEND

- MONITORING CROSS SECTION (XS–)
- CREST GAUGE
- WETLAND BOUNDARY (WLB)
- EXISTING PROPERTY LINE (PL)
- EASEMENT BOUNDARY (E)
- BANKFULL
- THALWEG
- TOE OF SLOPE
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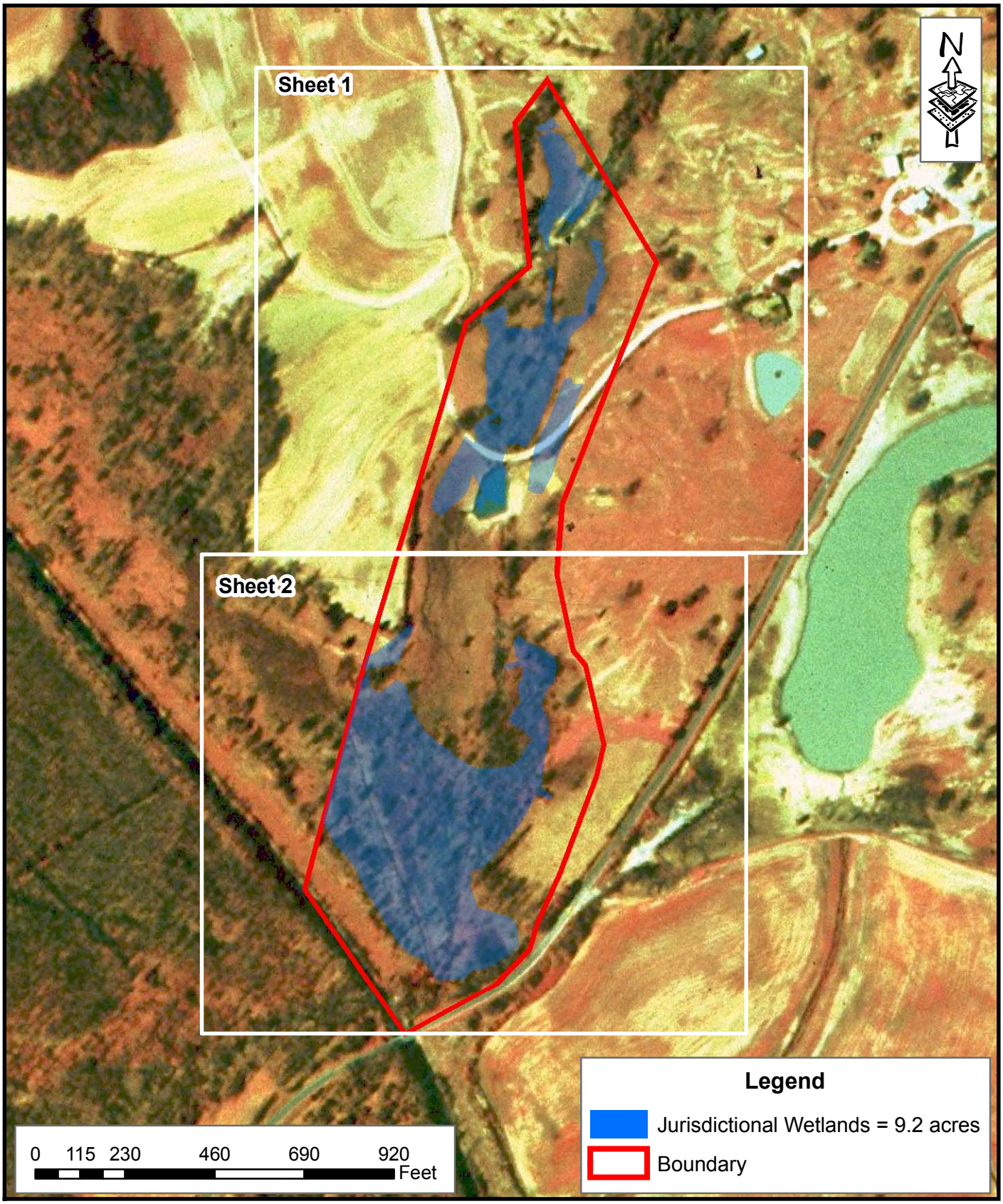
- LOG CROSS VANE
- DOUBLE STEP LOG CROSS VANE
- TRANSPLANTS
- LOG SILL

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR MONITORING PLAN SHEETS SEE SHEETS 2 THRU 5

MONITORING PLANS
UT ROCKY RIVER – HARRIS ROAD MIDDLE

SCO #: 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 05/12

6/26/2012

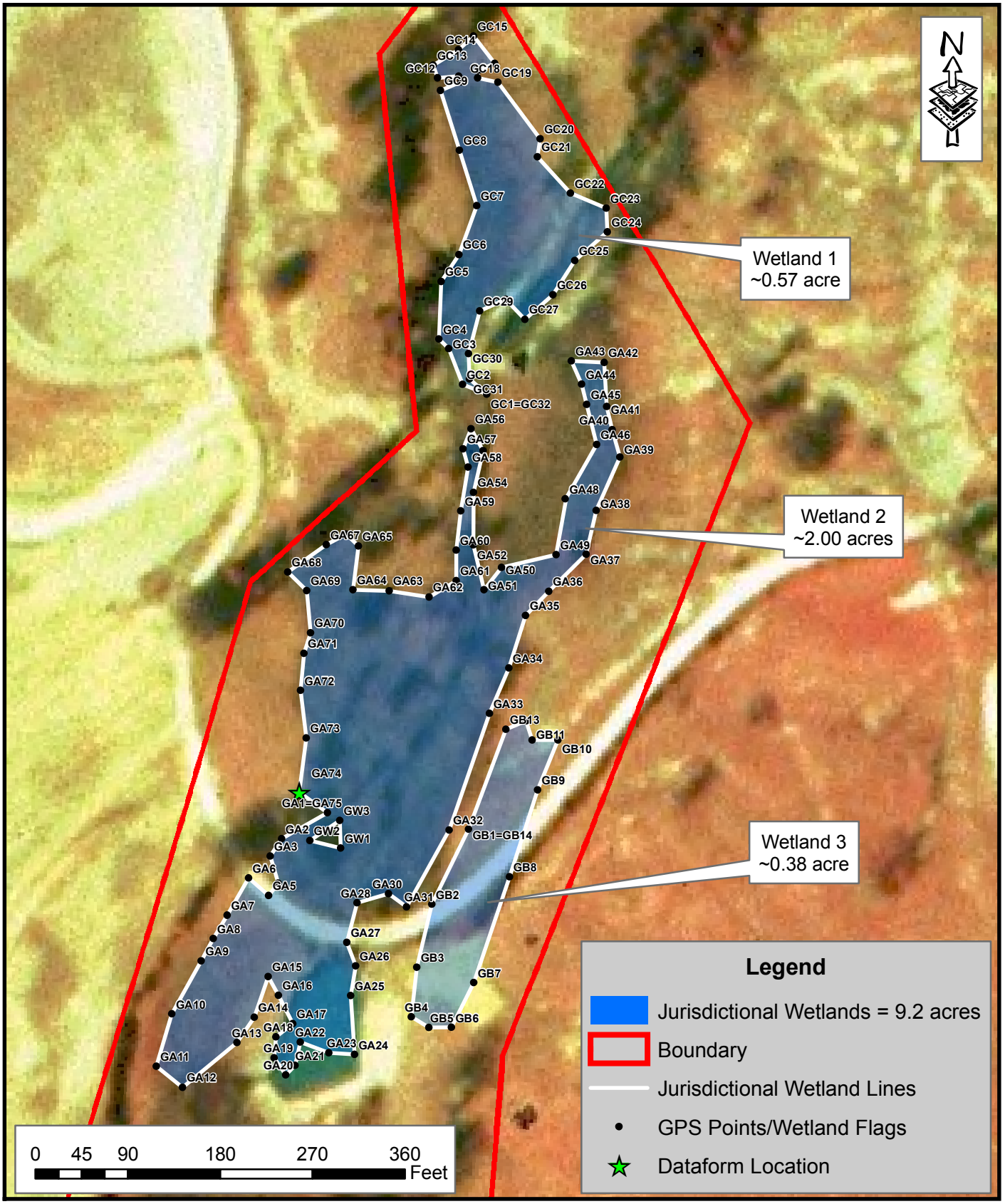


Axiom Environmental, Inc.
2126 Rowland Pond Drive
Willow Spring, NC 27592
(919) 215-1693
(919) 3413839 fax

KEY TO SHEETS
JURISDICTIONAL WETLAND DELINEATION
UT TO THE ROCKY RIVER
Cabarrus County, North Carolina

Dwn. by: CLF
Date: March 2008
Project: 07-015

KEY TO SHEETS

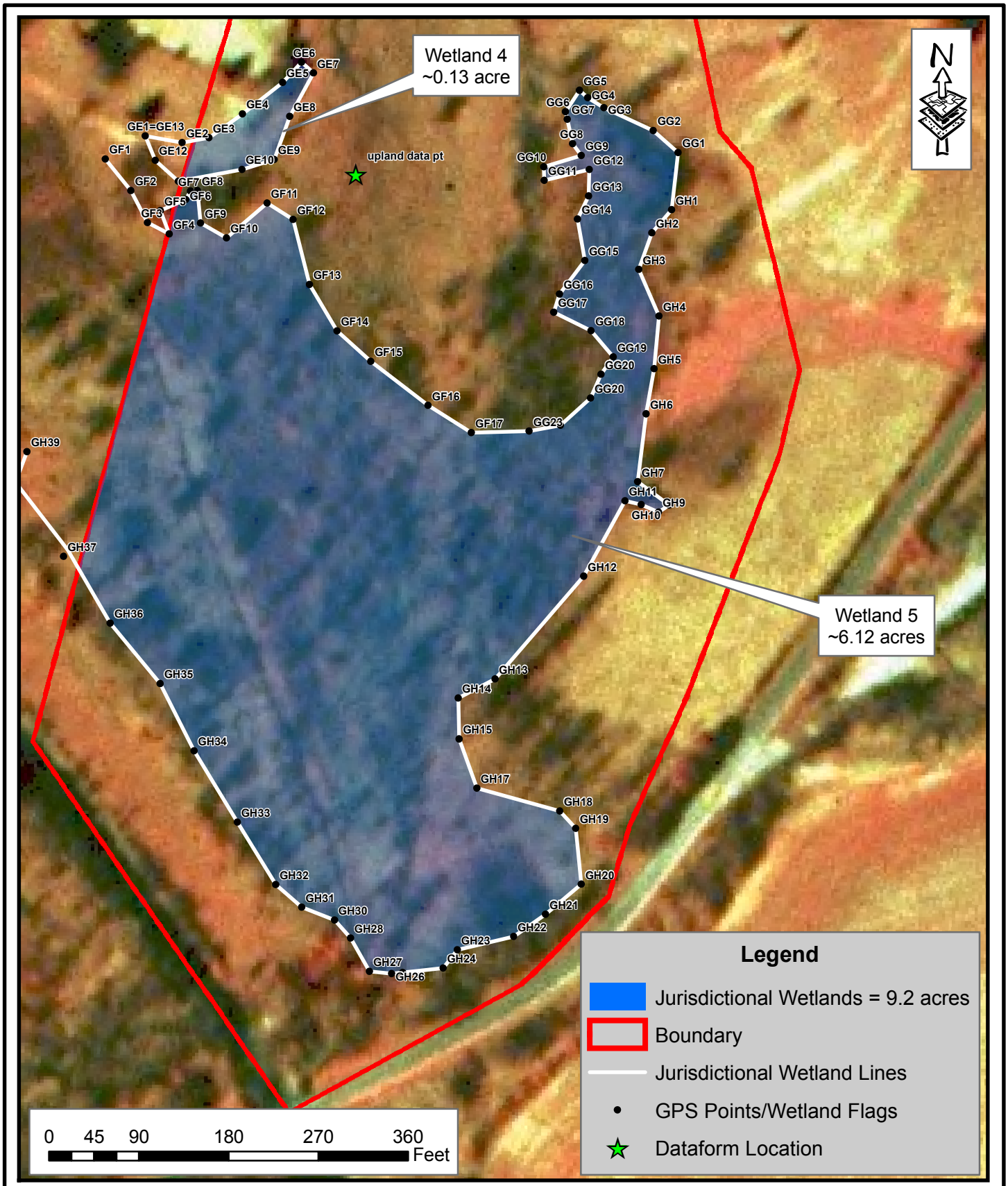


Axiom Environmental, Inc.
2126 Rowland Pond Drive
Willow Spring, NC 27592
(919) 215-1693
(919) 3413839 fax

SHEET 1
JURISDICTIONAL WETLAND DELINEATION
UT TO THE ROCKY RIVER
Cabarrus County, North Carolina

Dwn. by: CLF
Date: March 2008
Project: 07-015

SHEET 1



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2126 Rowland Pond Drive
Willow Spring, NC 27592
(919) 215-1693
(919) 3413839 fax

SHEET 2
JURISDICTIONAL WETLAND DELINEATION
UT TO THE ROCKY RIVER
Cabarrus County, North Carolina

Dwn. by: CLF
Date: March 2008
Project: 07-015

SHEET 2

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action ID. **SAW-2008-2809** County: **Cabarrus** USGS Quad: **Cornelius**

GENERAL PERMIT (REGIONAL AND NATIONWIDE) VERIFICATION

Property Owner / Authorized Agent: **NC Ecosystem Enhancement Program, Attn: Lin Xu**
Address: **1652 Mail Service Center**
Raleigh, NC 27699-1619

Telephone No.: **919-715-7571**
Size and location of property (water body, road name/number, town, etc.): **UT to Rocky River Stream Restoration Project incorporating approximately 2350 linear feet of stream channel and adjacent wetlands on approximately 18 acres located northeast of the Harris Road (SR 1449) crossing of the Rocky River west of Kannapolis.**
Description of projects area and activity: **Restore 2703 linear feet of stream channel and enhance 8.7 acres of riverine wetlands. Channel restoration work will impact approximately 1.05 acres of existing wetlands.**

Applicable Law: X Section 404 (Clean Water Act, 33 USC 1344)
☐ Section 10 (Rivers and Harbors Act, 33 USC 403)
Authorization: Regional General Permit Number: _____
Nationwide Permit Numbers: **27**

Your work is authorized by the above referenced permit provided it is accomplished in strict accordance with the attached conditions and your submitted plans. Any violation of the attached conditions or deviation from your submitted plans may subject the permittee to a stop work order, a restoration order and/or appropriate legal action.

This verification will remain valid until the expiration date identified below unless the nationwide authorization is modified, suspended or revoked. If, prior to the expiration date identified below, the nationwide permit authorization is reissued and/or modified, this verification will remain valid until the expiration date identified below, provided it complies with all requirements of the modified nationwide permit. If the nationwide permit authorization expires or is suspended, revoked, or is modified, such that the activity would no longer comply with the terms and conditions of the nationwide permit, activities which have commenced (i.e., are under construction) or are under contract to commence in reliance upon the nationwide permit, will remain authorized provided the activity is completed within twelve months of the date of the nationwide permit's expiration, modification or revocation, unless discretionary authority has been exercised on a case-by-case basis to modify, suspend or revoke the authorization.

Activities subject to Section 404 (as indicated above) may also require an individual Section 401 Water Quality Certification. You should contact the NC Division of Water Quality (telephone (919) 733-1786) to determine Section 401 requirements.

For activities occurring within the twenty coastal counties subject to regulation under the Coastal Area Management Act (CAMA), prior to beginning work you must contact the N.C. Division of Coastal Management .

This Department of the Army verification does not relieve the permittee of the responsibility to obtain any other required Federal, State or local approvals/permits.

If there are any questions regarding this verification, any of the conditions of the Permit, or the Corps of Engineers regulatory program, please contact Steven Lund at telephone 828-271-7980.

Corps Regulatory Official: Steven Lund SWL Date: **December 1, 2008**

Expiration Date of Verification: **December 1, 2010**

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete the attached customer Satisfaction Survey or visit http://www.saw.usace.army.mil/WETLANDS/index.html to complete the survey online.

Determination of Jurisdiction:

☐ Based on preliminary information, there appear to be waters of the US including wetlands within the above described project area. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331).

☐ There are Navigable Waters of the United States within the above described project area subject to the permit requirements of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

X There are waters of the US and/or wetlands within the above described project area subject to the permit requirements of Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐ The jurisdictional areas within the above described project area have been identified under a previous action. Please reference jurisdictional determination issued _____. Action ID _____

Basis of Jurisdictional Determination: **The unnamed tributary is a perennial stream (RPWs) flowing to the Rocky River, a traditionally navigable water (TNW).**

Appeals Information (This information applies only to approved jurisdictional determinations.)

Attached to this verification is an approved jurisdictional determination. If you are not in agreement with that approved jurisdictional determination, you can make an administrative appeal under 33 CFR 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

District Engineer, Wilmington Regulatory Division
Attn: Steven W. Lund, Project Manager
Asheville Regulatory Field Office
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the District Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address within 60 days of the date of this permit.

It is not necessary to submit an RFA form to the District Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: Steven Lund SWL

Date **December 1, 2008**

SURVEY PLATS, FIELD SKETCH, WETLAND DELINEATION FORMS, PROJECT PLANS, ETC., MUST BE ATTACHED TO THE FILE COPY OF THIS FORM, IF REQUIRED OR AVAILABLE.

Copy Furnished: Grant Lewis, Axiom Environmental, Inc., 2126 Rowland Pond Drive, Willow Spring, NC 27592

Action ID Number: SAW-2008-2809 **County:** Cabarrus

Permittee: NC Ecosystem Enhancement Program, Attn: Lin Xu
NW 27, UT Rocky River Stream Restoration

Date Permit Issued: December 1, 2008

Project Manager: Lund

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

US ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT
ASHEVILLE REGULATORY FIELD OFFICE
151 PATTON AVENUE, ROOM 208
ASHEVILLE, NORTH CAROLINA 28801-5006

Please note that your permitted activity is subject to a compliance inspection by a U. S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and condition of the said permit, and required mitigation was completed in accordance with the permit conditions.

_____ _____

Signature of Permittee **Date**

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL		
Applicant: NC Ecosystem Enhancement	File Number: 2008-2809	Date: Dec 1, 2008
Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
X	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact:
Mr. Steven Lund, Project Manager CESAW-RG-A US Army Corps of Engineers, Wilmington District 151 Patton Avenue, Room 208 Asheville, North Carolina 28801-5006	

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

	Date:	Telephone number:
_____ Signature of appellant or agent.		

DIVISION ENGINEER:
Commander
U.S. Army Engineer Division, South Atlantic
60 Forsyth Street, Room 9M15
Atlanta, Georgia 30303-3490

APPENDIX B
Morphological Summary Data and Plots

Figure B.1 UT Rocky River - Longitudinal Profile

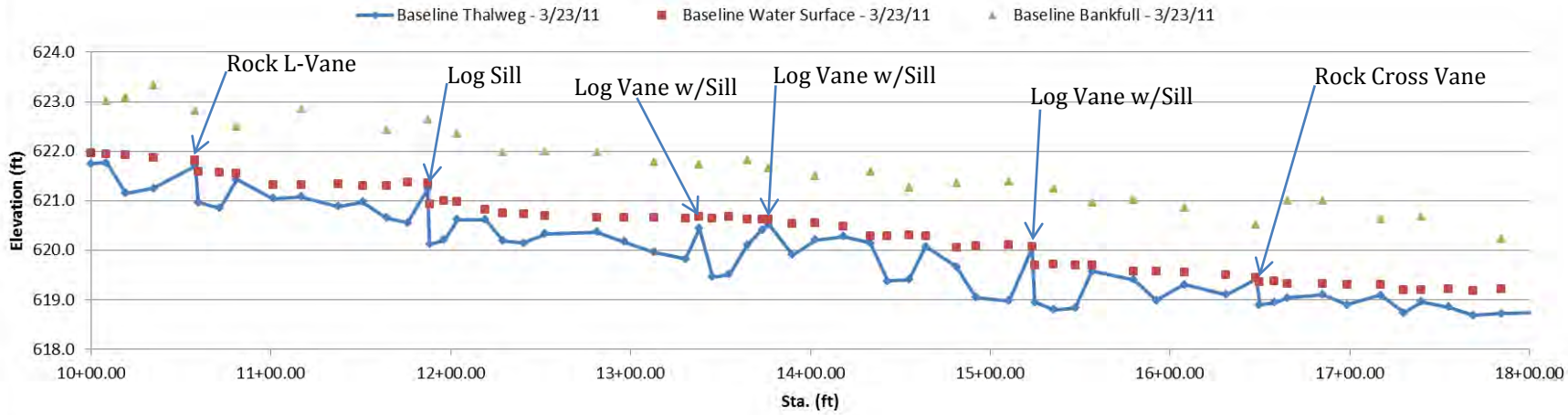


Figure B.2 UT Rocky River - Longitudinal Profile

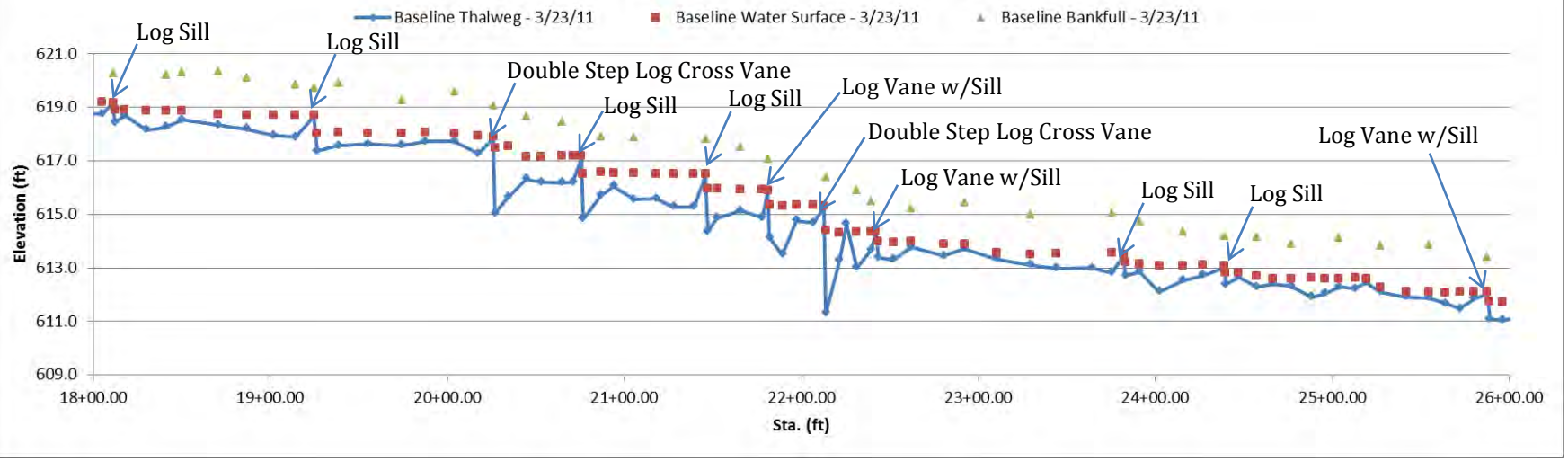
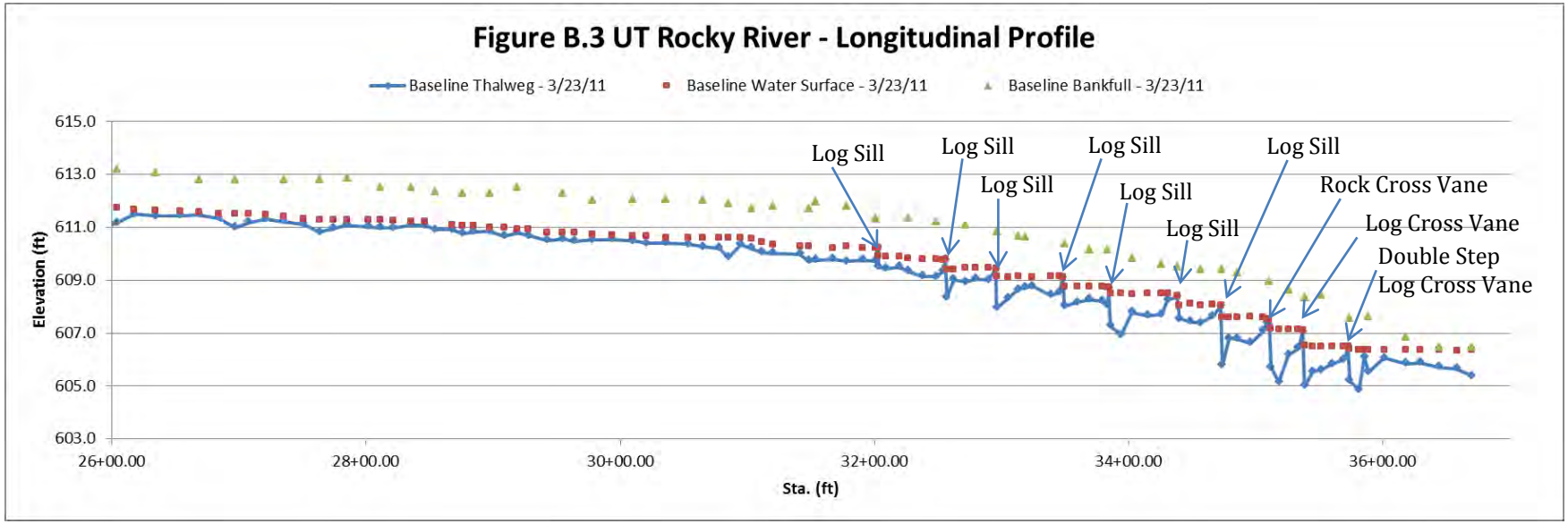
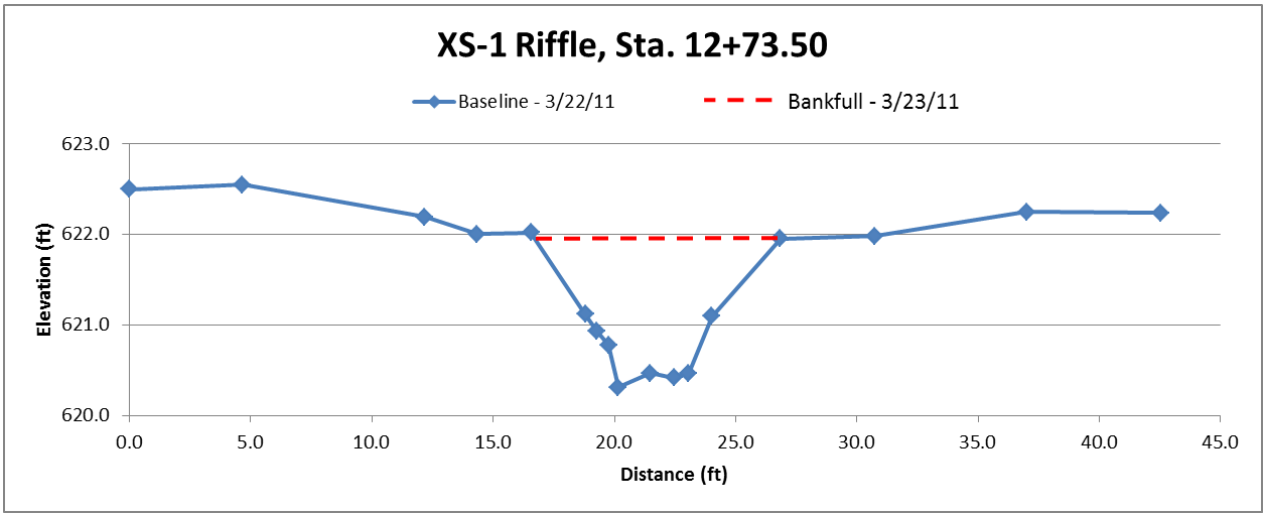
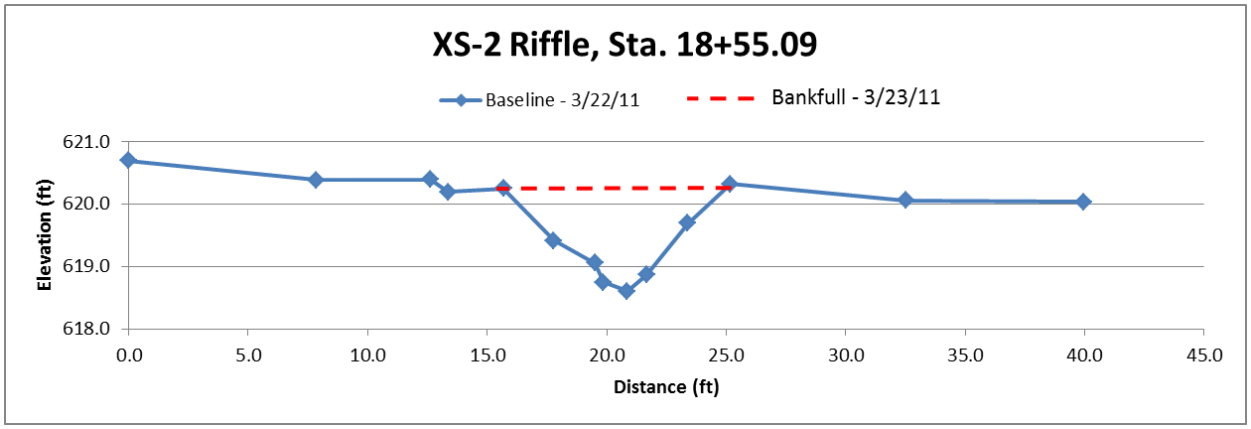


Figure B.3 UT Rocky River - Longitudinal Profile

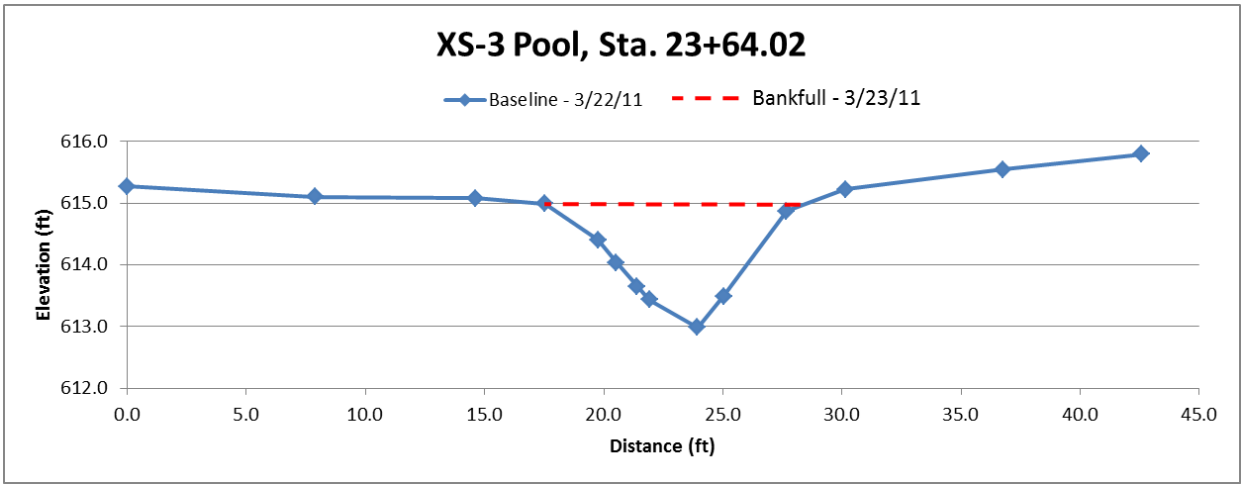




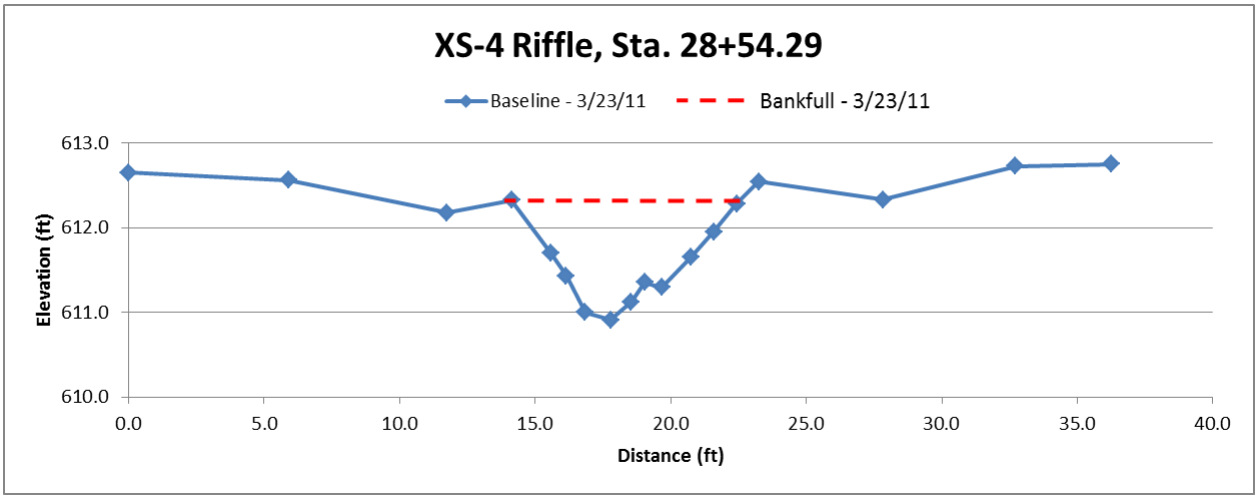
Bankfull Width (ft)	10.1
Floodprone Width (ft)	185.0
Bankfull Mean Depth (ft)	0.9
Bankfull Max Depth (ft)	1.6
Bankfull Cross Sectional Area (ft2)	9.2
Bankfull Width/Depth Ratio	11.1
Bankfull Entrenchment Ratio	18.3
Bankfull Bank Height Ratio	1.0



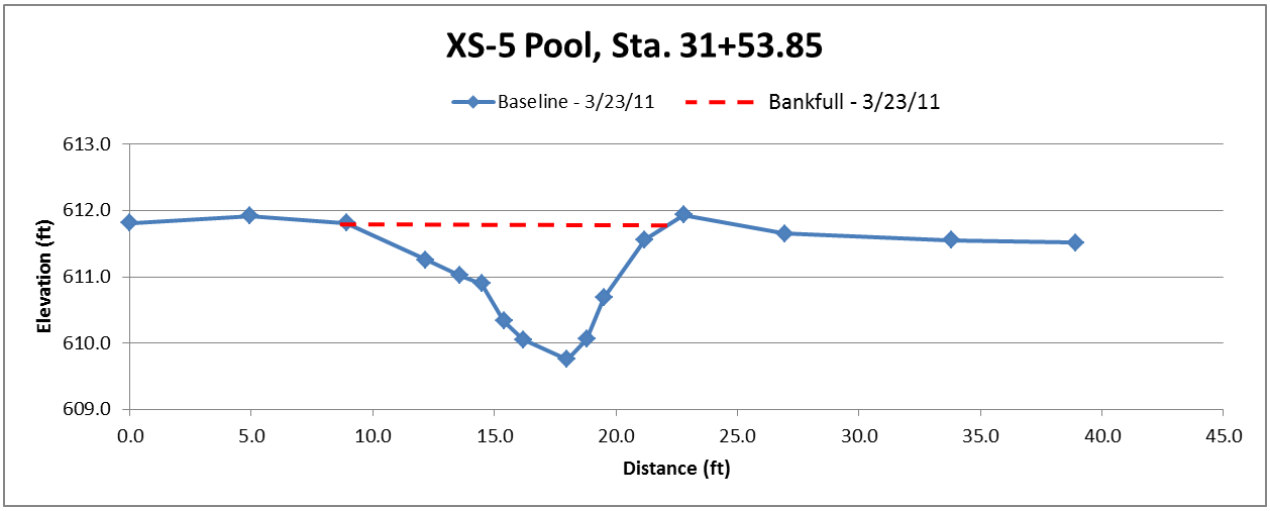
Bankfull Width (ft)	9.3
Floodprone Width (ft)	175.0
Bankfull Mean Depth (ft)	0.9
Bankfull Max Depth (ft)	1.7
Bankfull Cross Sectional Area (ft2)	8.0
Bankfull Width/Depth Ratio	10.8
Bankfull Entrenchment Ratio	18.8
Bankfull Bank Height Ratio	1.0



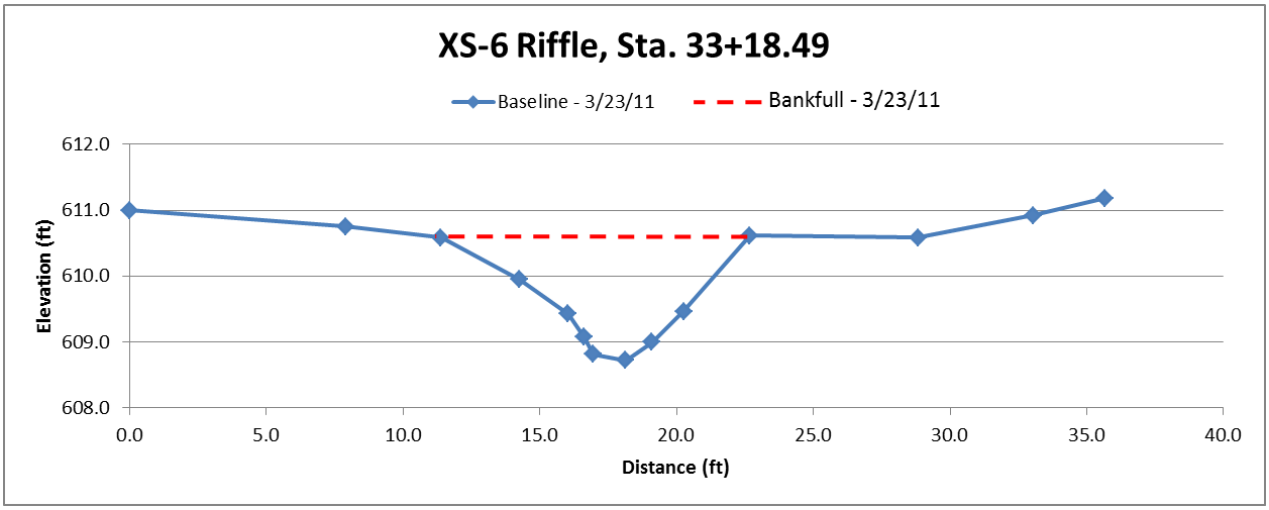
Bankfull Width (ft)	11.02
Floodprone Width (ft)	132.0
Bankfull Mean Depth (ft)	1.0
Bankfull Max Depth (ft)	2.0
Bankfull Cross Sectional Area (ft2)	10.7
Bankfull Width/Depth Ratio	11.4
Bankfull Entrenchment Ratio	12.0
Bankfull Bank Height Ratio	1.0



Bankfull Width (ft)	8.5
Floodprone Width (ft)	292.0
Bankfull Mean Depth (ft)	0.8
Bankfull Max Depth (ft)	1.4
Bankfull Cross Sectional Area (ft2)	6.7
Bankfull Width/Depth Ratio	10.7
Bankfull Entrenchment Ratio	34.3
Bankfull Bank Height Ratio	1.0



Bankfull Width (ft)	13.3
Floodprone Width (ft)	300.0
Bankfull Mean Depth (ft)	0.9
Bankfull Max Depth (ft)	2.1
Bankfull Cross Sectional Area (ft2)	12.3
Bankfull Width/Depth Ratio	14.5
Bankfull Entrenchment Ratio	22.6
Bankfull Bank Height Ratio	1



Bankfull Width (ft)	11.6
Floodprone Width (ft)	250.0
Bankfull Mean Depth (ft)	0.9
Bankfull Max Depth (ft)	1.9
Bankfull Cross Sectional Area (ft2)	10.7
Bankfull Width/Depth Ratio	12.6
Bankfull Entrenchment Ratio	21.6
Bankfull Bank Height Ratio	1.0

Table 5. Baseline Stream Data Summary
UT Rocky River - Harris Road Middle, EEP Project ID No. 92383
UT to Rocky River: 2,715 lf

Parameter	Regional Curve			Pre-Existing Condition (Beaver Influence Reach)	Pre-Existing Condition (Gully Reach)	Reference - UT Ledge Creek	Reference Reach - UT Wildcat Branch	Reference Reach - Mill Creek	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Eq.			Mean	Mean	Mean	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	9.10			5.10	4.70	14.70	8.20	11.3	9.50	8.50	9.88	9.70	11.60	1.32	4
Floodprone Width (ft)				270.00	9.70	63.00	130.00	300	300.00	175.00	225.50	217.50	292.00	55.42	4
Bankfull Mean Depth (ft)	1.16			0.20	0.89	1.25	1.03	1.85	0.95	0.80	0.88	0.90	0.90	0.05	4
Bankfull Max Depth (ft)				0.40	1.06	1.75	1.57	2.58	1.43	1.40	1.64	1.63	1.90	0.21	4
Bankfull Cross Sectional Area (ft^2)	10.68			0.90	4.20	18.30	8.50	21	9.00	6.70	8.65	8.60	10.70	1.71	4
Width/Depth Ratio				29.80	5.30	11.70	8.00	6.1	10.00	10.70	11.30	10.95	12.60	0.88	4
Entrenchment Ratio				53.30	2.00	4.30	15.90	26.5	31.60	18.30	23.25	20.20	34.30	7.51	4
Bank Height Ratio				1.00	2.12	1.54	1.09	1.09	1.00	1.00	1.00	1.00	1.00	0.00	4
d50 (mm)				sand	sand	sand	sand	sand	sand						
Profile															
Riffle Length (ft)										9.05	45.88	46.41	88.46	24.23	32
Riffle Slope (ft/ft)				0.0184	0.0553	0.0010	0.0022	0.0037	0.0033	0.0006	0.0038	0.0033	0.0126	0.0023	32
Pool Length (ft)										3.94	15.98	14.75	32.84	7.40	46
Pool Max depth (ft)				1.38	2.32	2.67	1.75	3.12	1.90	1.48	2.23	2.07	4.85	0.56	46
Pool Spacing (ft)				7.16-42.49	11.43-54.09	12.0-72.0	14.0-16.6	11.4-61.0	9.5-57.0	13.31	45.43	37.86	98.34	24.40	45
Pool Cross Sectional Area (ft^2)										10.68	11.49	11.49	12.30	1.15	2
Pattern															
Channel Beltwidth (ft)				41.00	41.00	48.0-55.0	13.8-19.4	15.1-27.0	19.0-57.0						
Radius of Curvature (ft)				6.0-15.0	6.0-15.0	14.9-22.2	10.9-15.3	9.7-29.8	28.5-38.0						
Rc: Bankfull Width (ft/ft)				1.2-2.9	1.3-3.1	1.0-1.5	1.3-1.9	0.9-2.6	3.0-4.0						
Meander Wavelength (ft)				83.00	83.00	134-140	22.5-29.0	37.7-72.6	57.0-133.0						
Meander Width Ratio				8.09	8.70	3.3-3.8	1.7-2.4	1.3-2.4	2.0-6.0						
Substrate, bed and transport parameters															
Ri% / Ru% / P% / G% / S%															
SC% / Sa% / G% / C% / B% / Be%															
d16 / d35 / d50 / d84 / d95/ di^{p} / di^{sp} (mm)															
Reach Shear Stress (competency) lb/ft^2				0.164	2.499	0.033	0.122	0.230	0.126						
Max part size (mm) mobilized at bankfull															
Stream Power (transport capacity) W/m^2					21.416	0.700	1.300	5.000	2.450						
Additional Reach Parameters															
Drainage Area (SM)				0.64	0.64	3.77	0.44	1.92	0.77						
Impervious cover estimate (%)															
Rosgen Classification				C5/D5	G5	C5	E5	E5	C5/E5	C5					
Bankfull Velocity (fps)					3.80	1.20	1.00	1.50	1.90	2.08					
Bankfull Discharge (cfs)					15.70	22.30	8.50	30.60	18.00	18.00					
Valley length (ft)				2238	2238				2180.00	2180.00					
Channel Thalweg length (ft)				2350	2350				2703.00	2715.00					
Sinuosity (ft)				1.05	1.05	1.26	1.15	1.18	1.24	1.25					
Water Surface Slope (Channel) (ft/ft)				0.0066	0.0219	0.0005	0.0024	0.0026	0.0022	0.0060					
BF slope (ft/ft)									0.0022	0.0060					
Bankfull Floodplain Area (acres)															
Proportion over wide (%)															
Entrenchment Class (ER Range)															
Incision Class (BHR Range)															
BEHI VL% / L% / M% / H% / VH% / E%															
Channel Stability or Habitat Metric															
Biological or Other															

Table 6. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)

UT Rocky River - Harris Road Middle (EEP Project No. 92383)

UT to Rocky River: 2,715 lf

	Cross Section 1 (Riffle)							**Cross Section 2 (Riffle)**						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation[1]														
Bankfull Width (ft)	10.1							9.3						
Floodprone Width (ft)	185							175						
Bankfull Mean Depth (ft)	0.9							0.9						
Bankfull Max Depth (ft)	1.6							1.65						
Bankfull Cross Sectional Area (ft^2)	9.2							8.0						
Bankfull Width/Depth Ratio	11.1							10.8						
Bankfull Entrenchment Ratio	18.3							18.8						
Bankfull Bank Height Ratio	1							1						
	Cross Section 3 (Pool)							**Cross Section 4 (Riffle)**						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation[1]														
Bankfull Width (ft)	11.02							8.5						
Floodprone Width (ft)	132							292						
Bankfull Mean Depth (ft)	0.97							0.8						
Bankfull Max Depth (ft)	2							1.4						
Bankfull Cross Sectional Area (ft^2)	10.68							6.7						
Bankfull Width/Depth Ratio	11.36							10.7						
Bankfull Entrenchment Ratio	12							34.3						
Bankfull Bank Height Ratio	1							1						
	Cross Section 5 (Pool)							**Cross Section 6 (Riffle)**						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation[1]														
Bankfull Width (ft)	13.3							11.6						
Floodprone Width (ft)	300							250						
Bankfull Mean Depth (ft)	0.9							0.9						
Bankfull Max Depth (ft)	2.05							1.9						
Bankfull Cross Sectional Area (ft^2)	12.3							10.7						
Bankfull Width/Depth Ratio	14.5							12.6						
Bankfull Entrenchment Ratio	22.6							21.6						
Bankfull Bank Height Ratio	1							1						

1 = Widths and depths for each resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development.

APPENDIX C
Vegetation Data

Vegetation Plot #1 (5 May 2011, Baseline)

Vegetation Plot #2 (5 May 2011, Baseline)

Vegetation Plot #3 (14 June 2012, Baseline)

Vegetation Plot #4 (5 May 2011, Baseline)

Vegetation Plot #5 (5 May 2011, Baseline)

Vegetation Plot #6 (5 May 2011, Baseline)

Vegetation Plot #7 (5 May 2011, Baseline)

Vegetation Plot #8 (5 May 2011, Baseline)

Vegetation Plot #9 (11 April 2012, Baseline)

Vegetation Plot #10 (11 April 2012, Baseline)

Vegetation Plot #11 (11 April 2012, Baseline)

Vegetation Plot #12 (11 April 2012, Baseline)

Vegetation Plot #13 (11 April 2012, Baseline)

Vegetation Plot #14 (11 April 2012, Baseline)

Table 7. Planted and Total Stem Counts (Species by Plot with Annual Means)																															
UT Rocky River – Harris Road Middle (EEP Project ID No. 92383) (As-Built Baseline 2011/2012)																														Annual Means	
			Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Plot 12		Plot 13		Plot 14		AB (2011/2012)	
Scientific Name	Common Name	Type	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
Acer rubrum	Red maple	Tree		99		10						2								1		18						20		3	0.0	21.9
Alnus serrulata	Tag alder	Shrub																			1	1									1.0	1.0
Asimina triloba	Paw-paw	Shrub			1	1			4	4	1	1			3	3					1	1							2	2	2.0	2.0
Baccharis halimifolia	Eastern baccharis	Shrub				6				1																					0.0	3.5
Betula nigra	River birch	Tree											1	1													2	2			1.5	1.5
Carya sp.	Hickory	Tree		1																											0.0	1.0
Carya ovata	Shagbark hickory	Tree							1	1							4	4													2.5	2.5
Celtis laevigata	Hackberry	Tree							1	1																					1.0	1.0
Cornus amomum	Silky dogwood	Shrub		5		2	4	6							2	2				1	1	1									2.3	2.8
Cornus florida	Flowering dogwood	Tree	3	3	2	2											1	1													2.0	2.0
Diospyros virginiana	Common persimmon	Tree								1																					0.0	1.0
Fraxinus pennsylvanica	Green ash	Tree	4	4	3	13			5	5	7	7			1	1		1	1	1			5	5	1	1	5	7			3.6	4.5
Liquidambar styraciflua	Sweetgum	Tree				20						1										16						8		5	0.0	10.0
Liriodendron tulipifera	Yellow poplar	Tree					1	1																							1.0	1.0
Platanus occidentalis	Sycamore	Tree					5	7			1	1					8	8	6	6	3	3	6	6				1	1	1	4.3	4.1
Quercus sp.	Oak	Tree	2	2	1	1																									1.5	1.5
Quercus falcata	Southern red oak	Tree	4	4							1	1							6	6	1	1	2	2					7	7	3.5	3.5
Quercus michauxii	Swamp chesnut oak	Tree									2	2	4	4											4	4	2	2			3.0	3.0
Quercus phellos	Willow oak	Tree			3	3							4	4	3	3									5	5					3.8	3.8
Rosa multiflora	Multiflora rose	Shrub						3																								
Salix nigra	Black willow	Tree																		1		6						2			0.0	3.0
Ulmus sp.	Elm	Tree				5																3					2	3	3	10	2.5	5.3
Ulmus americana	American elm	Tree			1	1	1	1					4	4																	2.0	2.0
Unknown				1																											0.0	1.0
Plot Area (acres)			0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247			
Species Count			4	8	6	11	5	7	4	6	5	7	4	4	4	4	3	4	3	6	5	9	3	3	3	3	4	8	4	6	4.1	6.1
Stem Count			13	119	11	64	11	18	11	13	12	15	13	13	9	9	13	14	13	16	7	50	13	13	10	10	11	45	13	28	11.4	30.5
Stems per Acre			526	4818	445	2591	445	729	445	526	486	607	526	526	364	364	526	567	526	648	283	2024	526	526	405	405	445	1822	526	1134	463	1235

Table 8. Reference Forest Ecosystem
UT Rocky River – Harris Road Middle (EEP Project ID No. 92383)

Reference Forest Ecosystem Character Tree Species
Box elder (*Acer negundo*)
Red maple (*Acer rubrum*)
Ironwood (*Carpinus caroliniana*)
Shagbark hickory (*Carya ovata*)
Hackberry (*Celtis laevigata*)
American beech (*Fagus grandifolia*)
Green ash (*Fraxinus pennsylvanica*)
Black walnut (*Juglans nigra*)
Sweetgum (*Liquidambar styraciflua*)
Tulip poplar (*Liriodendron tulipifera*)
Red mulberry (*Morus rubra*)
Black gum (*Nyssa sylvatica*)
Sycamore (*Platanus occidentalis*)
White oak (*Quercus alba*)
Swamp chestnut oak (*Quercus michauxii*)
Willow oak (*Quercus phellos*)
Northern red oak (*Quercus rubra*)
American elm (*Ulmus americana*)

Planting Plan
UT Rocky River – Harris Road Middle (EEP Project ID No. 92383)

Piedmont Alluvial Forest (riverine wetland areas)

1. Sycamore (*Platanus occidentalis*)
2. American elm (*Ulmus americana*)
3. Hackberry (*Celtis laevigata*)
4. Green ash (*Fraxinus pennsylvanica*)
5. Willow oak (*Quercus phellos*)
6. Swamp chestnut oak (*Quercus michauxii*)
7. Tulip poplar (*Liriodendron tulipifera*)
8. River birch (*Betula nigra*)
9. Silky dogwood (*Cornus amomum*)
10. Pawpaw (*Asimina triloba*)
11. Shagbark hickory (*Cary ovata*)
12. Emergent herbaceous seed mixture (20 pounds/acre)
    a. Fox sedge (*Carex vulpinoidea*) 20% of mixture
    b. Big bluestem (*Andropogon gerardii*) 20% of mixture
    c. Virginia wildrye (*Elymus virgatum*) 15% of mixture
    d. Switchgrass (*Panicum virgatum*) 15% of mixture
    e. Soft rush (*Juncus effusus*) 10% of mixture
    f. Deertongue (*Dichanthelium clandestinum*) 20% of mixture

Piedmont Alluvial Forest (nonwetland areas)

1. Sycamore (*Platanus occidentalis*)
2. White ash (*Fraxinus americana*)
3. Shagbark hickory (*Carya ovata*)
4. Southern red oak (*Quercus falcata*)
5. Shingle oak (*Quercus imbricaria*)
6. Flowering dogwood (*Cornus florida*)
7. Pawpaw (*Asimina triloba*)
8. Shagbark hickory (*Cary ovata*)
9. Emergent herbaceous seed mixture (30 pounds/acre)
    a. Switchgrass (*Panicum virgatum*) 15% of mixture
    b. Indiangrass (*Sorghastum nutans*) 20% of mixture
    c. Big bluestem (*Andropogon gerardii*) 15% of mixture
    d. Broomsedge bluestem (*Andropogon virginicus*) 15% of mixture
    e. Gamagrass (*Tripsicum dactyloides*) 15% of mixture
    f. Purpletop (*Tridens flavus*) 20% of mixture

Piedmont Alluvial Forest (supplemental planting in forested areas)

1. American elm (*Ulmus americana*)
2. Green ash (*Fraxinus pennsylvanica*)
3. Willow oak (*Quercus phellos*)
4. Tulip poplar (*Liriodendron tulipifera*)
5. Silky dogwood (*Cornus amomum*)

6. Pawpaw (*Asimina triloba*)

Piedmont Alluvial Forest (roadside planting areas with containerized trees for aesthetic appeal)

1. Sycamore (*Platanus occidentalis*)
2. White ash (*Fraxinus americana*)
3. Shagbark hickory (*Carya ovata*)
4. Southern red oak (*Quercus falcata* var. *falcata*)
5. Shingle oak (*Quercus imbricaria*)
6. Flowering dogwood (*Cornus florida*)
7. Pawpaw (*Asimina triloba*)
8. Containerized trees with stems greater than or equal to 2 inches in diameter
    a. White ash (*Fraxinus americana*)
    b. Southern red oak (*Quercus falcata* var. *falcata*)
    c. Red maple (*Acer rubrum*)
    d. Flowering dogwood (*Cornus florida*)
9. Emergent herbaceous seed mixture (30 pounds/acre)
    a. Switchgrass (*Panicum virgatum*) 15% of mixture
    b. Indiangrass (*Sorghastum nutans*) 20% of mixture
    c. Big bluestem (*Andropogon gerardii*) 15% of mixture
    d. Broomsedge bluestem (*Andropogon virginicus*) 15% of mixture
    e. Gamagrass (*Tripsicum dactyloides*) 15% of mixture
    f. Purpletop (*Tridens flavus*) 20% of mixture

Stream-Side Assemblage

1. Black willow (*Salix nigra*)
2. Tag alder (*Alnus serrulata*)
3. Buttonbush (*Cephalanthus occidentalis*)
4. Emergent herbaceous seed mixture (20 pounds/acre)
    a. Fox sedge (*Carex vulpinoidea*) 20% of mixture
    b. Big bluestem (*Andropogon gerardii*) 20% of mixture
    c. Virginia wildrye (*Elymus virgatum*) 15% of mixture
    d. Switchgrass (*Panicum virgatum*) 15% of mixture
    e. Soft rush (*Juncus effusus*) 10% of mixture
    f. Deertongue (*Dichanthelium clandestinum*) 20% of mixture

Report Prepared By	Ben Furr
Date Prepared	6/27/2012 12:51
database name	cvs-eep-entrytool-v2.2.7.mdb
database location	R:\Docs\Monitoring\CVS Data
computer name	NC10465
file size	48230400

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------

Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------

Project Code	RR
project Name	UT to Rocky River
Description	Stream and Wetland Restoration Project
River Basin	Yadkin-Pee Dee
length(ft)	2715
stream-to-edge width (ft)	50
area (sq m)	25220.62
Required Plots (calculated)	14
Sampled Plots	14

Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.

Project Code	Project Name	River Basin	Year 0 (baseline)
RR	UT to Rocky River	Yadkin-Pee Dee	462.50

Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:

Project Code	Project Name	River Basin	Year 0 (baseline)
RR	UT to Rocky River	Yadkin-Pee Dee	1292.103446

plot	Plot Level	Year	Latitude/Northing	Longitude/Easting	Zone	Datum	Date Sampled	Planted Living Stems
RR-F&H-VP1	2	0	35.42436	-80.73707	17N	NAD83/WGS84	5/4/2011	13
RR-F&H-VP2	2	0	35.42405	-80.73728	17N	NAD83/WGS84	5/4/2011	11
RR-F&H-VP3	2	0	35.42364	-80.73744	17N	NAD83/WGS84	6/14/2012	11
RR-F&H-VP4	2	0	35.42308	-80.73766	17N	NAD83/WGS84	5/4/2011	11
RR-F&H-VP5	2	0	35.422509	-80.737219	17N	NAD83/WGS84	5/4/2011	12
RR-F&H-VP6	2	0	35.422301	-80.737764	17N	NAD83/WGS84	5/4/2011	13
RR-F&H-VP7	2	0	35.421880	-80.737787	17N	NAD83/WGS84	5/4/2011	9
RR-F&H-VP8	2	0	35.421770	-80.738214	17N	NAD83/WGS84	5/4/2011	13
RR-F&H-VP9	2	0	35.429890	-80.739501	17N	NAD83/WGS84	4/11/2012	13
RR-F&H-VP10	2	0	35.427594	-80.740170	17N	NAD83/WGS84	4/11/2012	7
RR-F&H-VP11	2	0	35.426521	-80.740094	17N	NAD83/WGS84	4/11/2012	13
RR-F&H-VP12	2	0	35.425745	-80.740274	17N	NAD83/WGS84	4/11/2012	10
RR-F&H-VP13	2	0	35.425077	-80.740591	17N	NAD83/WGS84	4/11/2012	11
RR-F&H-VP14	2	0	35.424688	-80.741059	17N	NAD83/WGS84	4/11/2012	13

Planted Living Stems EXCLUDING Live Stakes	Dead/Missing Stems	Natural (Volunteer) Stems	Total Living Stems
13	1	125	138
11	0	54	65
11	0	7	18
11	0	2	13
12	0	3	15
13	0	0	13
9	0	0	9
13	0	1	14
13	0	3	16
7	0	43	50
13	0	0	13
10	0	0	10
11	0	34	45
13	0	15	28

Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE
138	526.0913359	526.0913359
65	445.1542073	445.1542073
18	445.1542073	445.1542073
13	445.1542073	445.1542073
15	485.6227716	485.6227716
13	526.0913359	526.0913359
9	364.2170787	364.2170787
14	526.0913359	526.0913359
16	526.0913359	526.0913359
50	283.2799501	283.2799501
13	526.0913359	526.0913359
10	404.685643	404.685643
45	445.1542073	445.1542073
28	526.0913359	526.0913359

Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
5058.570538	5584.661873	5584.661873	4
2185.302472	2630.45668	2630.45668	6
283.2799501	728.4341574	728.4341574	4
80.9371286	526.0913359	526.0913359	4
121.4056929	607.0284645	607.0284645	5
0	526.0913359	526.0913359	4
0	364.2170787	364.2170787	4
40.4685643	566.5599002	566.5599002	3
121.4056929	647.4970288	647.4970288	3
1740.148265	2023.428215	2023.428215	5
0	526.0913359	526.0913359	3
0	404.685643	404.685643	3
1375.931186	1821.085394	1821.085394	4
607.0284645	1133.1198	1133.1198	4

Vigor

vigor	Count	Percent
0	1	0.6
1	3	1.9
2	5	3.1
3	46	28.6
4	106	65.8

Vigor by Species

	Species	CommonName	4	3	2	1	0	Missing	Unknown
	Alnus serrulata	hazel alder	1						
	Asimina triloba	pawpaw	7	4		1			
	Betula nigra	river birch	3						
	Carya ovata	shagbark hickory	5						
	Celtis laevigata	sugarberry	1						
	Cornus amomum	silky dogwood	6	1					
	Cornus florida	flowering dogwood	5		1				
	Fraxinus pennsylvanica	green ash	21	8	2	1			
	Quercus falcata	southern red oak	11	9	1				
	Quercus michauxii	swamp chestnut oak	5	7					
	Quercus phellos	willow oak	9	4	1	1			
	Quercus	oak		3					
	Liriodendron tulipifera	tuliptree	1						
	Platanus occidentalis	American sycamore	23	7					
	Ulmus	elm	3	2					
	Ulmus americana	American elm	5	1					
	Unknown						1		
TOT:	**17**	**16**	**106**	**46**	**5**	**3**	**1**		

Damage

Damage	Count	Percent Of Stems
(no damage)	161	100

Damage by Species

	Species	CommonName	Count of Damage Categories	(no damage)
	Alnus serrulata	hazel alder	0	1
	Asimina triloba	pawpaw	0	12
	Betula nigra	river birch	0	3
	Carya ovata	shagbark hickory	0	5
	Celtis laevigata	sugarberry	0	1
	Cornus amomum	silky dogwood	0	7
	Cornus florida	flowering dogwood	0	6
	Fraxinus pennsylvanica	green ash	0	32
	Liriodendron tulipifera	tuliptree	0	1
	Platanus occidentalis	American sycamore	0	30
	Quercus	oak	0	3
	Quercus falcata	southern red oak	0	21
	Quercus michauxii	swamp chestnut oak	0	12
	Quercus phellos	willow oak	0	15
	Ulmus	elm	0	5
	Ulmus americana	American elm	0	6
	Unknown		0	1
TOT:	**17**	**16**	**0**	**161**

Damage by Plot

	plot	Count of Damage Categories	(no damage)
	RR-F&H-VP1	0	14
	RR-F&H-VP2	0	11
	RR-F&H-VP3	0	11
	RR-F&H-VP4	0	11
	RR-F&H-VP5	0	12
	RR-F&H-VP6	0	13
	RR-F&H-VP7	0	9
	RR-F&H-VP8	0	13
	RR-F&H-VP9	0	13
	RR-F&H-VP10	0	7
	RR-F&H-VP11	0	13
	RR-F&H-VP12	0	10
	RR-F&H-VP13	0	11
	RR-F&H-VP14	0	13
TOT:	**14**	**0**	**161**

Planted Stems by Plot and Spp

	Comment	Species	CommonName	Total Planted Stems	# plots	avg# stems	plot RR-F&H-VP1	plot RR-F&H-VP2	plot RR-F&H-VP3	plot RR-F&H-VP4	plot RR-F&H-VP5	plot RR-F&H-VP6	plot RR-F&H-VP7	plot RR-F&H-VP8	plot RR-F&H-VP9	plot RR-F&H-VP10	plot RR-F&H-VP11	plot RR-F&H-VP12	plot RR-F&H-VP13	plot RR-F&H-VP14
		Alnus serrulata	hazel alder	1	1	1									1					
		Asimina triloba	pawpaw	12	6	2		1		4	1		3			1				2
		Betula nigra	river birch	3	2	1.5						1							2	
		Carya ovata	shagbark hickory	5	2	2.5				1				4						
		Celtis laevigata	sugarberry	1	1	1				1										
		Cornus amomum	silky dogwood	7	3	2.33			4				2			1				
		Cornus florida	flowering dogwood	6	3	2	3	2						1						
		Fraxinus pennsylvanica	green ash	32	9	3.56	4	3		5	7		1		1		5	1	5	
		Liriodendron tulipifera	tuliptree	1	1	1			1											
		Platanus occidentalis	American sycamore	30	7	4.29			5		1			8	6	3	6			1
		Quercus	oak	3	2	1.5	2	1												
		Quercus falcata	southern red oak	21	6	3.5	4				1				6	1	2			7
		Quercus michauxii	swamp chestnut oak	12	4	3					2	4						4	2	
		Quercus phellos	willow oak	15	4	3.75		3				4	3					5		
		Ulmus	elm	5	2	2.5													2	3
		Ulmus americana	American elm	6	3	2		1	1			4								
TOT:	**0**	**16**	**16**	**160**	**16**		**13**	**11**	**11**	**11**	**12**	**13**	**9**	**13**	**13**	**7**	**13**	**10**	**11**	**13**

All Stems by Plot and ssp.

	Comment	Species	CommonName	Total Stems	# plots	avg# stems	RR-F&H-VP1	RR-F&H-VP2	RR-F&H-VP3	RR-F&H-VP4	RR-F&H-VP5	RR-F&H-VP6	RR-F&H-VP7	RR-F&H-VP8	RR-F&H-VP9	RR-F&H-VP10	RR-F&H-VP11	RR-F&H-VP12	RR-F&H-VP13	RR-F&H-VP14
		Acer rubrum	red maple	153	7	21.86	99	10			2				1	18			20	3
		Alnus serrulata	hazel alder	1	1	1										1				
		Asimina triloba	pawpaw	12	6	2		1		4	1		3			1				2
		Baccharis halimifolia	eastern baccharis	7	2	3.5		6		1										
		Betula nigra	river birch	3	2	1.5						1							2	
		Carya	hickory	1	1	1	1													
		Carya ovata	shagbark hickory	5	2	2.5				1				4						
		Celtis laevigata	sugarberry	1	1	1				1										
		Cornus amomum	silky dogwood	17	6	2.83	5	2	6				2		1	1				
		Cornus florida	flowering dogwood	6	3	2	3	2						1						
		Diospyros virginiana	common persimmon	21	2	10.5	20			1										
		Fraxinus pennsylvanica	green ash	45	10	4.5	4	13		5	7		1	1	1		5	1	7	
		Juniperus virginiana	eastern redcedar	1	1	1		1												
		Liquidambar styraciflua	sweetgum	50	5	10		20			1					16			8	5
		Liriodendron tulipifera	tuliptree	1	1	1			1											
		Platanus occidentalis	American sycamore	33	8	4.12			7		1			8	6	3	6		1	1
		Quercus	oak	3	2	1.5	2	1												
		Quercus falcata	southern red oak	21	6	3.5	4				1				6	1	2			7
		Quercus michauxii	swamp chestnut oak	12	4	3					2	4						4	2	
		Quercus phellos	willow oak	15	4	3.75		3				4	3					5		
		Rosa multiflora	multiflora rose	3	1	3			3											
		Salix nigra	black willow	9	3	3									1	6			2	
		Ulmus	elm	21	4	5.25		5								3			3	10
		Ulmus americana	American elm	6	3	2		1	1			4								
		Unknown		1	1	1	1													
TOT:	**0**	**25**	**24**	**448**	**25**		**139**	**65**	**18**	**13**	**15**	**13**	**9**	**14**	**16**	**50**	**13**	**10**	**45**	**28**

APPENDIX D
As-Built Plan Sheets

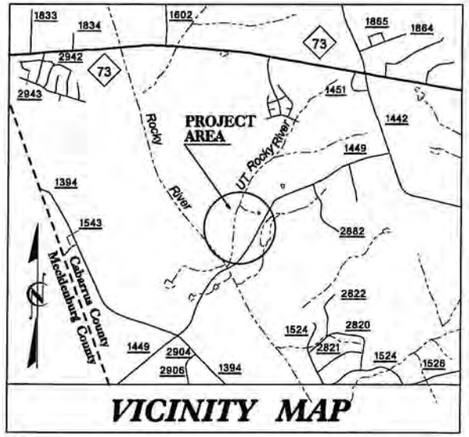
STATE		SHEET NO	TOTAL SHEETS
N.C.	UT TO ROCKY RIVER	1	5

AS-BUILT PLANS
UT TO ROCKY RIVER

LOCATION: CABARRUS COUNTY, NORTH CAROLINA

LAT: 35°25'34.52" N **LONG: 80°44'25.53" W**

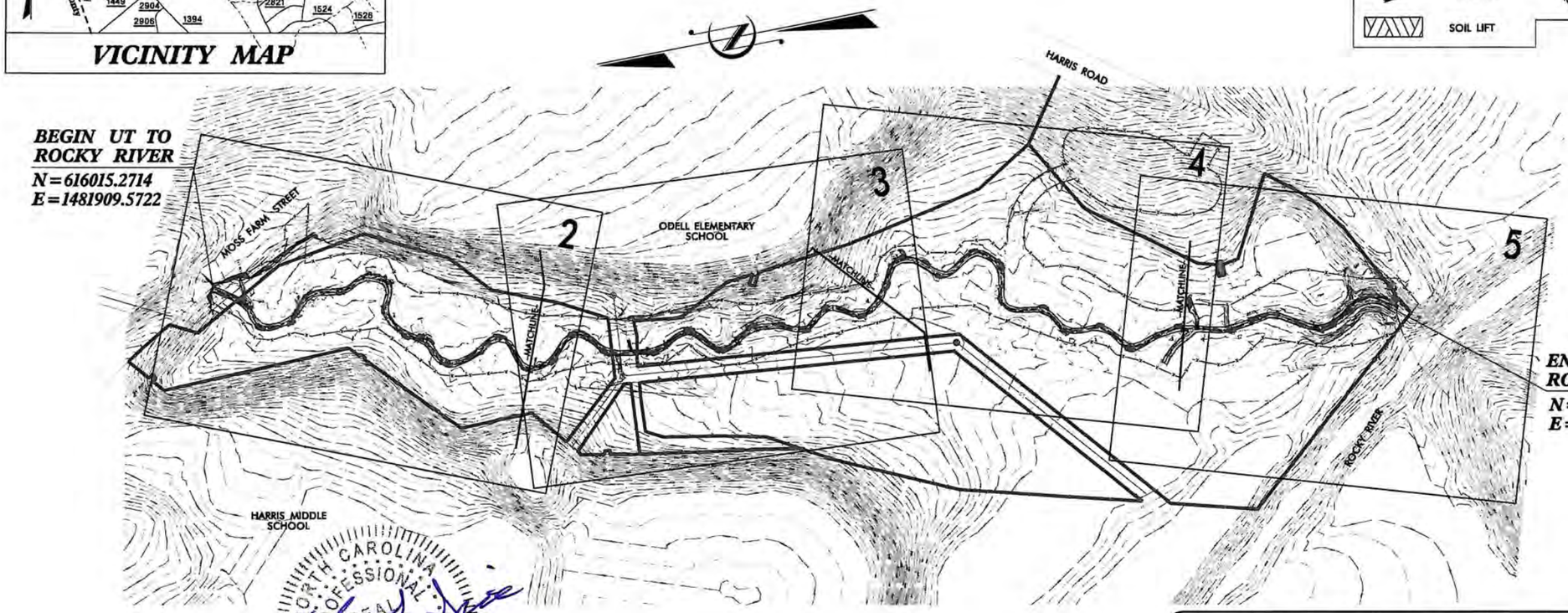
TYPE OF WORK: AS-BUILT PLANS



VICINITY MAP

LEGEND

- CONSTRUCTION REVISIONS
- EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- FPI – FLOODPLAIN INTERCEPTOR
- ROCK L-VANE
- LOG SILL
- SOIL LIFT
- ROCK CROSS VANE
- LOG VANE W/SILL
- LOG CROSS VANE
- DOUBLE STEP LOG CROSS VANE
- TRANSPLANTS



BEGIN UT TO ROCKY RIVER
N = 616015.2714
E = 1481909.5722

END UT TO ROCKY RIVER
N = 613897.5867
E = 1481456.8104

INDEX OF SHEETS

TITLE SHEET.....1
PLAN SHEETS.....2 - 5

TOTAL LIMITS OF DISTURBANCE

GRAPHIC SCALES

50 25 0 50 100
PLANS

10 5 0 10 20
PROFILE (HORIZONTAL)

20 10 0 20 40
PROFILE (VERTICAL)

DESIGN DATA

DESIGN STREAM TYPE	=	C5/E5
BANKFULL AREA (FT^2) CROSS-SECTIONED	=	9.0
BANKFULL WIDTH (FT)	=	9.5
MAX DEPTH (FT)	=	1.4
WIDTH /DEPTH RATIO	=	10
DRAINAGE AREA (MI^2)	=	0.8
BANKFULL SLOPE(FT/FT)	=	0.002

PROJECT LENGTH

EXISTING STREAM LENGTH	=	2,350 FT
PROPOSED DESIGN STREAM LENGTH	=	2,715 FT

WETLAND ENHANCEMENT AREA = 8.40 AC.

Ecosystem Enhancement Program

OWNER CONTACT:

ROBIN DOLIN
EEP PROJECT MANAGER

LIN XU
REVIEW COORDINATOR

Constructed By:

Vaughn Contracting, INC.
P.O. Box 796
Wadesboro N.C. 278170
(704) 694-6450

Prepared In the Office of:

Florence & Hutcheson
CONSULTING ENGINEERS
5121 KINGDOM WAY, SUITE 100
RALEIGH, N.C. 27607
(919) 851-6066
License No: F-0258

R. KEVIN WILLIAMS
PROJECT ENGINEER

RYAN V. SMITH
PROJECT DESIGNER

NORTH CAROLINA PROFESSIONAL SEAL 035 ENGINEER CHRISTOPHER L. SMITH
4/13/11

CONTRACT: UT TO ROCKY RIVER SCO# 07070001

4/4/2011
R:\Construction\As-Built\RockyRiver_Asbuilt_psh.dgn
Florence & Hutcheson, Inc.

AS–BUILT PLANS

LEGEND

- CONSTRUCTION REVISIONS
- EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- LIMITS OF DISTURBANCE
- FPI – FLOODPLAIN INTERCEPTOR
- ROCK L–VANE
- LOG SILL
- LOG VANE W/SILL
- ROCK CROSS VANE
- TRANSPLANTS

MOSS FARM STREET

CP–3
N = 616053.1140
E = 1481902.6200
ELEV = 633.910

Flow Direction

UT TO ROCKY RIVER
N = 616015.2714
E = 1481909.5722

HARRIS MIDDLE SCHOOL

CP–4
N = 615583.8840
E = 1481538.7100
ELEV = 636.439

–MATCHLINE– SEE SHEET 3

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR ASBUILT PLAN SHEETS SEE SHEETS 2 THRU 5

Florence & Hutcheson
CONSULTING ENGINEERS
5121 KINGDOM WAY, SUITE 100
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25 0 50
SCALE

PROJECT REFERENCE NO.	SHEET NO.
UT TO ROCKY RIVER	2

PROJECT ENGINEER

AS BUILT

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NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER

BASIN

AS-BUILT PLANS UT TO ROCKY RIVER	
SCM: 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 01/11

8/4/2011
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Florence & Hutcheson

AS–BUILT PLANS

LEGEND

- CONSTRUCTION REVISIONS
- EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- LIMITS OF DISTURBANCE
- FPI – FLOODPLAIN INTERCEPTOR
- ROCK L–VANE
- LOG SILL
- LOG VANE W/SILL
- ROCK CROSS VANE
- TRANSPLANTS

Florence & Hutcheson
CONSULTING ENGINEERS
5121 KINGDOM WAY, SUITE 100
RALEIGH, N.C. 27607
(919) 851–6066
License No: P-0251

25 0 50
SCALE

PROJECT REFERENCE NO.	SHEET NO.
UT TO ROCKY RIVER	2A

PROJECT ENGINEER

AS BUILT

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NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH
Date: 4/13/16

MOSS FARM STREET

CP–3
N = 616053.1140
E = 1481902.6200
ELEV = 633.910

Flow Direction

TB
TB

BASIN

–MATCHLINE– SEE SHEET 3A

UT TO ROCKY RIVER
N = 616015.2714
E = 1481909.5722

HARRIS MIDDLE SCHOOL

CP–4
N = 615583.8840
E = 1481538.7100
ELEV = 636.439

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR ASBUILT PLAN SHEETS SEE SHEETS 2 THRU 5

AS-BUILT PLANS UT TO ROCKY RIVER		
EEOR: 070708001	COUNTY: CABARRUS	
DESIGNED BY: RVS		
CHECKED BY: RKW	DATE: 01/11	

4/4/2011
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AS-BUILT PLANS

LEGEND

- CONSTRUCTION REVISIONS
- EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- LIMITS OF DISTURBANCE
- SOIL LIFT
- FPI – FLOODPLAIN INTERCEPTOR
- LOG SILL
- LOG VANE W/SILL
- DOUBLE STEP LOG CROSS VANE
- TRANSPLANTS

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SCALE

PROJECT REFERENCE NO.	SHEET NO.
UT TO ROCKY RIVER	3

PROJECT ENGINEER

AS BUILT

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NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH
4/15/11

-MATCHLINE- SEE SHEET 2

-MATCHLINE- SEE SHEET 4

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR ASBUILT PLAN SHEETS SEE SHEETS 2 THRU 5

AS-BUILT PLANS UT TO ROCKY RIVER		
SCM: 070708001	COUNTY: CABARRUS	
DESIGNED BY: RVS		
CHECKED BY: RKW	DATE: 01/11	

4/4/2011
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AS-BUILT PLANS

LEGEND

- CONSTRUCTION REVISIONS
- EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- LIMITS OF DISTURBANCE
- SOIL LIFT
- FPI – FLOODPLAIN INTERCEPTOR
- LOG SILL
- LOG VANE W/SILL
- DOUBLE STEP LOG CROSS VANE
- TRANSPLANTS

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SCALE

PROJECT REFERENCE NO.	SHEET NO.
UT TO ROCKY RIVER	3A

PROJECT ENGINEER

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NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH 4/15/16

-MATCHLINE- SEE SHEET 2A

-MATCHLINE- SEE SHEET 4A

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR ASBUILT PLAN SHEETS SEE SHEETS 2 THRU 5

AS-BUILT PLANS UT TO ROCKY RIVER		
SCM: 070708001	COUNTY: CABARRUS	
DESIGNED BY: RVS		
CHECKED BY: RKW	DATE: 01/11	

4/4/2016
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AS-BUILT PLANS

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25 0 50
SCALE

PROJECT REFERENCE NO.	SHEET NO.
UT TO ROCKY RIVER	4

PROJECT ENGINEER

AS BUILT

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NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH
1/13/16

CP-5
N=614891.8620
E=1481797.3510
ELEV=635.892

CP-6
N=614257.9240
E=1481738.0020
ELEV=635.892

-MATCHLINE- SEE SHEET 3

-MATCHLINE- SEE SHEET 5

LEGEND

- CONSTRUCTION REVISIONS
- EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- LIMITS OF DISTURBANCE
- FPI – FLOODPLAIN INTERCEPTOR
- LOG SILL
- LOG VANE W/SILL
- TRANSPLANTS

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR ASBUILT PLAN SHEETS SEE SHEETS 2 THRU 5

AS-BUILT PLANS UT TO ROCKY RIVER	
SCM: 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 01/11

4/4/2011
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25 0 50
SCALE

PROJECT REFERENCE NO.	SHEET NO.
UT TO ROCKY RIVER	4A

PROJECT ENGINEER

AS BUILT

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NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L SMITH
4/13/11

CP-5
N=614891.8620
E=1481797.3510
ELEV=635.892

CP-6
N=614257.9240
E=1481738.0020
ELEV=635.892

-MATCHLINE- SEE SHEET 3A

-MATCHLINE- SEE SHEET 5A

LEGEND

- CONSTRUCTION REVISIONS
- E — EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- X — LIMITS OF DISTURBANCE
- FPI – FLOODPLAIN INTERCEPTOR
- LOG SILL
- LOG VANE W/SILL
- TRANSPLANTS

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR ASBUILT PLAN SHEETS SEE SHEETS 2 THRU 5

AS-BUILT PLANS UT TO ROCKY RIVER	
SCM# 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 01/11

4/4/2011
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25 0 50
SCALE

PROJECT REFERENCE NO.	SHEET NO.
UT TO ROCKY RIVER	5
PROJECT ENGINEER	

AS BUILT

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NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH

HARRIS ROAD

Flow Direction

–MATCHLINE– SEE SHEET 4

END UT TO ROCKY RIVER
N = 613897.5867
E = 1481456.8104

LEGEND

- CONSTRUCTION REVISIONS
- EASEMENT BOUNDARY
- BANKFULL
- THALWEG
- TOE OF SLOPE
- LIMITS OF DISTURBANCE
- FPI – FLOODPLAIN INTERCEPTOR
- ROCK L–VANE
- LOG SILL
- ROCK CROSS VANE
- LOG CROSS VANE
- DOUBLE STEP LOG CROSS VANE
- TRANSPLANTS

FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR ASBUILT PLAN SHEETS SEE SHEETS 2 THRU 5

AS-BUILT PLANS
UT TO ROCKY RIVER

EEP:	070708001	COUNTY:	CABARRUS
DESIGNED BY:	RVS		
CHECKED BY:	RKW	DATE:	01/11

6/4/2011
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License No: F-0258

PROJECT REFERENCE NO.	SHEET NO.
UT TO ROCKY RIVER	5A

PROJECT ENGINEER

AS BUILT

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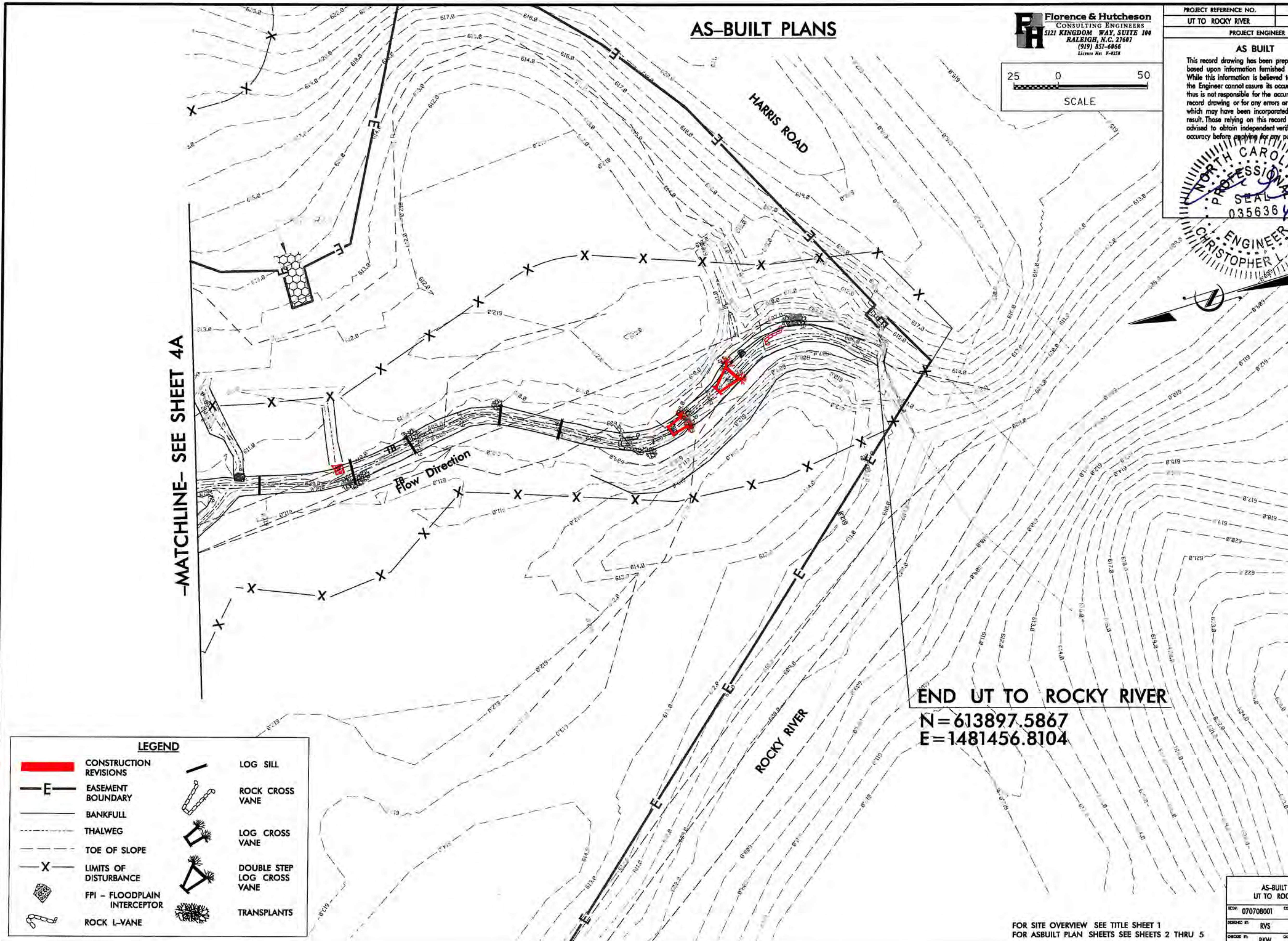
NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH 4/13/14



FOR SITE OVERVIEW SEE TITLE SHEET 1
FOR ASBUILT PLAN SHEETS SEE SHEETS 2 THRU 5

AS-BUILT PLANS UT TO ROCKY RIVER	
ECOM: 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 01/11