NORTH FORK MOUNTAIN CREEK
STREAM AND WETLAND RESTORATION

RESTORATION PLAN

Catawba County, North Carolina

Prepared for:

Environmental Banc and Exchange, LLC
909 Capability Drive, Suite 3100
Raleigh, NC 27606

NC Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699

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Prepared by:

Stantec Consulting Services Inc
801 Jones Franklin Road, Suite 300
Raleigh, NC 27606
(919)851-6866
F(919)851-7024

Project Manager: Brad Fairley, brad.fairley@stantec.com
Project Engineer: Brian Mazzochi, PE, CFM brian.mazzochi@stantec.com

EXECUTIVE SUMMARY

The North Fork Mountain Creek Stream and Wetland Restoration Project has been initiated to restore ecological function to impaired sections of North Fork Mountain Creek and associated tributaries in Catawba County, North Carolina. The project will provide in-kind mitigation and generate stream and wetland mitigation credit in the Catawba River Basin. Restoration will encompass approximately 3,316 linear feet of Priority I stream restoration, 1,864 linear feet of Priority II stream restoration, 1.16 acres of wetland restoration, and 3.03 acres of wetland creation. The project will generate 5,180 SMU and 2.68 WMU for use by the North Carolina Ecosystem Enhancement Program. Restoration of the riparian buffers and stream channels using the principles of natural channel design will greatly benefit the stream system by improving biological integrity, increasing dissolved oxygen, stabilizing stream banks, and reducing sediment and nutrient loads. The exclusion of livestock from the restoration reaches is also included in the restoration design.

The North Fork Mountain Creek Site is located in Catawba County, approximately 6.5 miles east of Newton, NC in the Catawba River Basin (Figure 12.1). The site lies within the 03050101150030 14-digit hydrologic unit. It is in the full delivery service area and outside of the applicable excluded zones of the Catawba River Basin. Elevations on the project site range from 870 feet to 1038 feet above mean sea level. The recent land use of the site has been hay and pasture for cattle production. The ongoing livestock operations in combination with past land use practices have resulted in highly degraded stream systems and present an opportunity for substantial water quality and riparian ecosystem improvements. Land use in the remainder of the project watershed is a combination of forest, pasture, and low-density residential dwellings.

Stream restoration is proposed on one reach of North Fork Mountain Creek and three reaches on two unnamed tributaries of North Fork Mountain Creek. Riparian wetland restoration and creation is proposed along Reaches 2, 3, and 4, where existing and former wetlands have been impacted by livestock and drained via lowering of the water table due to channel incision. The proposed wetland restoration and creation area no longer receives normal overbank flow from the stream. As a result, it no longer performs many of the hydrological functions and values associated with riparian wetland systems. Hoof shear is a major cause of the wetland degradation and floodplain erosion in this area. Restoration of the channels, their buffers and riparian wetlands would reduce the amount of sediment, nutrients, and fecal coliform bacteria flowing from the adjacent pastures, improving the overall water quality of North Fork Mountain Creek which is a tributary of the Catawba River and Lake Norman.

Restoration is part of a broad, watershed-based approach for the re-establishment of physical, chemical, and biological components of an aquatic ecosystem. This physiographic province has lost a significant portion of the historic wetland systems, including nonriverine wet flats and riparian wetlands, and stream habitat through intensive agricultural practices. North Fork Mountain Creek is a major tributary of the Catawba River. The restoration of North Fork Mountain Creek and its tributaries will improve physical, chemical and biological components of the North Fork Mountain Creek watershed and downstream waters.

The proposed stream and wetland project will provide numerous ecological and water quality benefits within the Catawba River Basin. While many of these benefits are limited to the project area, others, such as pollutant removal and improved aquatic and terrestrial habitat, have more far-reaching effects.

Restoration of the stream channels and riparian buffers using the principles of natural channel design will greatly benefit the stream system by improving biological integrity, increasing dissolved oxygen, and moderating the pH level and water temperature.

The design of the restoration reaches will create stable channel morphology appropriate for the flood flows in the system. The design will also significantly reduce sediment loads in the restoration reaches by reconnecting streams to their floodplain and reducing shear stress on the stream banks. Additionally, several different types of in-stream structures will be used in the design to significantly improve fish and benthic habitat throughout the project area. In addition to the required 50 foot stream buffer, the entire floodplain of North Fork Mountain Creek and its tributaries will be protected by a permanent conservation easement. These areas will also be planted, adding to the ecological benefit of the project by protecting riparian habitat and function.

A total of 1.08 acres of existing wetlands are located within the conservation easement in six different locations. A total of 0.64 acres will be impacted due to mitigation activities. A portion of the wetland area, 0.09 acres, will be permanently impacted by the restoration project, because the new channel will be constructed through it. The remaining impacts (0.55 acres) will be temporary. Minimal grading (less than 6 inches) will take place within these wetlands to lower the floodplain, but this activity will enhance the function of these wetland features by improving overbank flooding.

Project Components Summation for the North Fork Mountain Creek Restoration Site

Restoration Level/Type	Existing Feet/Acres	Restoration Level	Footage or Acreage	Mitigation Ratio	Mitigation Units	Comments
Reach 1	1,176	P1	1,000	1	1,000	Upper end of Unnamed Tributary 1 (UT1)
		P2	430	1	430	
Reach 2	1,064	P1	949	1	949	Downstream portion of UT1, flows into Reach 4
		P2	90	1	90	
Reach 3	598	P2	639	1	639	Small stream (UT2) draining from onsite farm pond, flows into Reach 1
Reach 4	2,305	P1	1,367	1	1,367	North Fork Mountain Creek main channel
		P2	705	1	705	
Wetland Restoration	NA	R	1.16	1	1.16	Along Reaches 2, 3 and 4
Wetland Creation	NA	R	3.03	2	1.52	Along Reaches 2 and 4

Component Summations						
Restoration Level	Stream (lf)	Riparian Wetland (ac)		Non-Riparian (ac)	Upland (ac)	Buffer (ac)
		Riverine	Non-riverine			
Restoration	5,180	1.16	0	0	0	0
Creation	0	3.03	0	0	0	0
Totals (lf/ac)	**5,180**	**4.19**	**0**	**0**	**0**	**0**
Totals (mitigation units)	**5,180**	**2.68**	**0**	**0**	**0**	**0**

Restoration Level: P1 = Priority 1; P2 = Priority 2; R = Restoration

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1.0 Project Site Identification and Location

1.1 DIRECTIONS TO PROJECT SITE

Traveling west from Raleigh on I-40 after passing through Statesville, NC, take exit 138 south on NC-10/Oxford School Road. After driving approximately 3 miles and upon entering the town of Catawba, turn right onto 3rd Avenue SW/NC-10. Continue on NC-10 and after traveling approximately 2.3 miles, turn left onto Murray's Mill Road. Travel approximately 1.4 miles on Murray's Mill Road. Murray's Mill Road then becomes Buffalo Shoals Road. After passing through Bandy Crossroads, travel approximately 0.25 miles, and the restoration reaches are located on a cattle farm on the left side of the road.

1.2 USGS HUC & NCDWQ RIVER BASIN DESIGNATIONS

The project reaches are located within the USGS 14-digit Hydrologic Unit 03050101150030 (Lower Catawba watershed) of the Catawba River Basin and in the North Carolina Division of Water Quality (NCDWQ) sub-basin 03-08-32 (Catawba River and tributaries). This Hydrologic Unit is not designated as a targeted local watershed by the NC Ecosystem Enhancement Program (NCEEP 2007). However, North Fork Mountain Creek is classified as WS-IV (water supply watershed) by NCDWQ and is part of a watershed protection area designated by Catawba County (2007).

1.3 PROJECT VICINITY MAP

See Figure 12.1 for a vicinity map.

1.4 PROJECT COMPONENTS AND STRUCTURE

More than 5,180 linear feet of stream and 4.19 acres of wetland are being restored or created in the North Fork Mountain Creek restoration project. Segmenting the project into individual components resulted in four distinct restoration reaches. These reaches were determined based on existing stream type (intermittent or perennial), existing primary stream stressor, change in valley type, restoration level (Priority I, Priority II), existing and design stream classification (e.g. B4, C4), and several other design considerations. Examples of existing stream stressors include, hoof shear, active headcut, base level shift, buffer disturbance, and high sediment load.

The restoration areas are outlined in the Project Components Table (Table 11.1) and are also depicted in the Project Components Map (Figure 12.2).

2.0 Watershed Characterization

2.1 DRAINAGE AREA, PROJECT AREA, AND EASEMENT ACREAGE

North Fork Mountain Creek encompasses a local watershed of approximately 960 acres in size at the downstream end of the project (Figure 12.3). The project will occur within one parcel owned by Hunsucker Farms, LLC. A conservation easement has been obtained by EBX for a total easement area of approximately 17.3 acres (Figure 12.2).

2.2 SURFACE WATER CLASSIFICATION / WATER QUALITY

North Fork Mountain Creek is classified as WS-IV throughout the project site. WS-IV is a water supply watershed designation. North Fork Mountain Creek drains to Lake Norman which provides drinking water to a number of municipalities including Charlotte.

2.3 PHYSIOGRAPHY, GEOLOGY, AND SOILS

The project watershed is located in the western-most portion of the Piedmont Physiographic Province of North Carolina. The ecoregion is the Southern Outer Piedmont, which is characterized by pine (shortleaf, Virginia, and loblolly) dominating on old field sites and pine plantations, while mixed oak forest is found in less heavily altered areas. Elevations in the watershed range from approximately 870 to 1065 feet above mean sea level.

The North Fork Mountain Creek Site is located in Catawba County, in both the Kings Mountain Belt and Inner Piedmont geologic regions of North Carolina, according to the Geologic Map of North Carolina (NCDLR 1985). The Kings Mountain Belt consists of moderately deformed metamorphosed volcanic and sedimentary rocks with lithium deposits. The Inner Piedmont Belt is the most intensely deformed and metamorphosed segment of the Piedmont. The metamorphic rocks include gneiss and schist that have been intruded by younger granitic rocks.

The Catawba County Soil Survey (USDA-NRCS, 2010) identifies one primary soil series within the North Fork Mountain Creek Site (Figure 12.5a). Chewacla loam (ChA) is mapped along the riparian corridor of the entire project site. Chewacla is listed as Hydric B, a soil map unit with hydric inclusions, by the Natural Resource Conservation Service (NRCS) and is identified as a somewhat poorly drained soil that occurs in floodplains. In the area of the proposed wetland restoration (Figure 12.5b), soil borings taken during field investigations revealed hydric soil indicators at or within 12 inches below the surface. The surface texture at the surface is loam that grades to clays and silty clay loams deeper in the soil profile. In some locations gravel was found around 14 inches below the surface indicating that this may have been the former level of the stream channel. Wetland creation areas exhibit a low chroma matrix within 18-30” of the surface. A more in depth discussion of on-site soils is included in Section 5.

Upland areas within the site include Lloyd loam (Lc), Lloyd clay loam (Ld), Pacolet clay loam (Pa) and Madison-Bethlehem complex (Mh). The Lloyd soil series is described by the NRCS as very deep, well drained soils forming on residuum. Lloyd soils can be found on either side of Reaches 1 and 2 and the

right side of Reach 4. The Pacolet series consists of very deep and well drained soils, a lower (color) value than Lloyd and less mica than Madison. Pacolet is found primarily along the left side of Reach 4. The Madison series is comprised of well drained, very deep soils that occur on gently sloping to steep uplands. They are very deep to bedrock and moderately deep to saprolite. The Bethlehem series consists of well drained, moderately deep soils on ridgetops and side slopes. The two soil series are similar with Madison being deeper. The Madison-Bethlehem complex occurs primarily along Reach 3 and the upper end of Reach 2.

2.4 HISTORICAL LAND USE AND DEVELOPMENT TRENDS

Historic aerial photos (1961, 1976, 1983, 1993, and 2006) were reviewed. Historically the area was used almost exclusively for agriculture as it continues to be today. One of the more destructive present day agricultural practices to watersheds is livestock foraging in the stream channels, which causes hoof shear to the beds and banks.

Today approximately 50% of the watershed consists of agricultural pasture/hay, and approximately 40% is comprised of mixed forest. The remaining area is comprised of scattered single-family homes, herbaceous land, and two-lane roadways. Buffalo Shoals Road (SR 1003) borders the watershed to the west while Little Mountain Road (SR 1815) borders the watershed to the south. In general, the surrounding land use creates desirable restoration conditions due to the low amount of impervious surfaces and the unlikelihood of future development in the watershed as described below.

This portion of Catawba County is zoned 'R – 40' which is intended to accommodate low-density single-family detached dwellings and duplexes, at a maximum density of one dwelling units per acre. Agricultural activities are also allowed within this zone (Catawba County 2007). The Hunsucker Farms, LLC parcel is also listed as participating in the Voluntary Agricultural District Program (Catawba County 2010). Given the high level of agricultural activity in the area, land use within the watershed is not expected to change, and development is not expected to increase enough to cause significant changes in the stream hydrograph. If development does occur in the future, the streams will be protected to some degree by the restored buffers onsite.

2.5 ENDANGERED / THREATENED SPECIES

Some populations of flora and fauna have been in, or are in, the process of decline either due to natural forces or their inability to coexist with human activities. Federal law (under the provisions of the Endangered Species Act of 1973, as amended) requires that any action, likely to adversely affect a species classified as federally protected, be subject to review by the United States Fish and Wildlife Service (USFWS). Other species may receive additional protection under separate state laws.

The US Fish and Wildlife Service (USFWS) lists one federally protected species, three federal species of concern, and the bald eagle (as protected under the Bald and Golden Eagle Protection Act) as occurring in Catawba County (USFWS, September 2010).

As part of the Categorical Exclusion completed for this project, a scoping letter was sent to the Asheville USFWS field office and the NC Wildlife Resources Commission Division of Inland Fisheries (NCWRC) requesting any information regarding issues with endangered or threatened plant or animal species. The

only threatened or endangered species identified as possibly present at the site is the threatened dwarf-flowered heartleaf (*Hexastylis naniflora).* The species is listed on the USFWS threatened and endangered plant species database (USFWS 2010). According to the NCWRC, there are no listed animal species in the area (Stantec 2009).

2.5.1 Dwarf-flowered Heartleaf (*Hexastylis naniflora)*

The dwarf-flowered heartleaf is in the Birthwort Family (family Aristolochiaceae). The preferred habitat is acidic sandy loam soils along bluffs and nearby slopes, hillsides, and ravines. It also prefers boggy areas adjacent to creek heads and streams. Soil series is a very important distinguishing characteristic for locating this species. It prefers Pacolet, Madison, and Musella series. The plant is usually associated with mountain laurel (*Kalmia latifolia*) or pawpaw (*Asimina triloba*) (USFWS 2010).

Site evaluation resulted in visual observation of a *Hexastylis* sp. exhibiting morphological characteristics of both the *Hexastylis naniflora* and the more common, non-threatened *Hexastylis virginica.* Due to high similarity between the two species, determination of exact species could not be assessed upon field observation (Appendix 14.1). These plants occurred on the hillslope along the right bank of Reach 4.

Both the NC Natural Heritage Program and the US Fish and Wildlife Service list the *Hexastylis naniflora* as a threatened species in Catawba County. *Hexastylis* species were observed outside of the project easement. In a letter addressed to USFWS on Oct. 26, 2009, it was stated that during field reconnaissance *Hexastylis* species were observed in a small, confined area on a steep northwest-facing slope in a mature forest community outside this project easement. Appropriate soil characteristics were not present in this area for *Hexastylis naniflora*; however, it was not possible to determine whether the *Hexastylis* species found were in fact *H. naniflora* or one of the more common species due to the lack of fruits or flowers at the time of the field visit. Following the guidelines outlined by the U.S. Fish and Wildlife Service, the project will be implemented without disturbing the area containing the plants; therefore, the biological conclusion for *Hexastylis naniflora* (dwarf-flowered heartleaf) is "no effect".

A November 9th, 2009 letter of concurrence from the NC Wildlife Resources Commission stated that based on their in-office review; they had no reason to object to the project.

A categorical exclusion analysis was performed utilizing the above information regarding protected species. A copy of the categorical exclusion form and its approval is included in Appendix 14.11.

2.6 CULTURAL RESOURCES

No archeological artifacts or historically significant structures have been observed or noted during preliminary surveys of the site for restoration purposes. The majority of this site has historically been disturbed by livestock. A visit to the N.C. Office of State Archaeology on October 20, 2009 was conducted to verify the possible existence of any archaeological site within the project easement or parcel boundary. No sites were found during the visit. On November 10th, 2009, Stantec received a letter from the NC State Historic Preservation Office confirming the absence of any known significant cultural resources at the site. The Eastern Band of Cherokee Indians has been contacted regarding the project. A scoping letter was sent to them on Oct. 26, 2009. To date, they have not responded to the letter.

EBX has conducted a full environmental screening of the site using the Categorical Exclusion Action Classification Form. This will prevent adverse impacts to protected species or cultural resources from the proposed restoration actions.

2.7 POTENTIAL CONSTRAINTS

2.7.1 Property Ownership and Boundary

Only one property owner, Hunsucker Farms, LLC owns the parcel surrounding the conservation easement. A conservation easement has been obtained by EBX as described in Section 2.1.

2.7.2 Site Access

During construction, monitoring, and maintenance activities, site access will be granted through Hunsucker Farms, LLC from Buffalo Shoals Road. Four permanent 35' crossings will be installed; two ford crossings on North Fork Mountain Creek, and two culvert crossings at or near existing crossings on Reaches 1 and 3.

2.7.3 Utilities

There are no known utilities within the project area. However, water lines will be installed on the Hunsucker property to provide livestock watering

2.7.4 FEMA / Hydrologic Trespass

A check of FEMA flood zone mapping for Catawba County indicates that the project is not located within the 100-year flood hazard zone (FEMA 2007). A HEC-RAS study was performed on the reaches and is discussed further in Section 7.4. The restoration project is not expected to create hydrologic trespass outside of the easement area onto adjacent properties or at roadway crossings.

3.0 Project Site Streams

3.1 INTRODUCTION

The North Fork Mountain Creek project involves the restoration of approximately 5,180 linear feet of North Fork Mountain Creek and a tributary. The project site watershed has been extensively used for agriculture both currently and in the past. Agricultural disturbance in the watershed led to high sediment loads and increased overland flow to the reaches, causing significant channel incision in the upstream reaches and sediment deposition in the downstream, flatter reaches. After conservation efforts began in the mid- twentieth century, water flows and sediment supply from the watershed to the project reaches were reduced. However, the dimensions of the existing reaches are now larger than necessary for the current flows. As a result, sediment supply for the flows in the system now comes from the stream itself.

In other words, bank erosion is occurring in order for the existing streams to achieve their equilibrium state of sediment transport. The level of bank erosion within the system is causing high sediment loads and the degradation of in-stream habitat in the North Fork Mountain Creek watershed.

The project area encompasses over 5,100 linear feet of existing stream length. North Fork Mountain Creek and a tributary were segmented into 4 individual restoration reaches. Reach 1 flows north to south through the northern side of the project area. It begins approximately 500 feet upstream of the confluence of Reach 2 and ends approximately 800 feet downstream of the confluence of Reach 2, where the grade flattens. Reach 2 flows from north to south, begins at the end of Reach 1, and ends at the confluence with Reach 4. Reach 3 flows from north to south, begins downstream of a breached and drained farm pond, and ends at the confluence with Reach 1. Reach 4 flows from southeast to northwest and ends at the confluence with Reach 2. See Figure 12.2 for reach locations.

Reach 4 (North Fork Mountain Creek) is a third order stream with an approximate drainage area of 777 acres. Reach 1 (UT1) is an unnamed tributary to North Fork Mountain Creek and a second order stream with a drainage area of 96 acres. Reach 2 (UT1) is a UT to North Fork Mountain Creek and is a second order stream with a drainage area of 177 acres. Reach 3 (UT2) is a UT to North Fork Mountain Creek and is a first order stream with a drainage area of 41 acres.

The NCDWQ 2010 Catawba River Basin Plan currently shows no impaired waters within the Lower Lake Norman Watershed (0305010112). UT1 is a perennial stream on the USGS topographic quadrangle (Figure 2). Headwaters of Reaches 1-3 originate within the property while the headwaters of North Fork Mountain Creek originate beyond the property boundary to the southwest. NCDWQ Stream Classification Forms were completed for all reaches (Appendix 14.3).

UT2 begins at the farm pond and is currently perennial. UT2 has been impacted by agricultural land use and has degraded from a Rosgen stream type “B” to a stream type “G”. UT1 begins at the northern portion of the property and flows from north to south into North Fork Mountain Creek. It is currently a degraded “C” or “F” stream type and would be a “B” type stream under natural conditions. The transition of the land from forest to pasture has led to increased runoff. The stream exhibits bank and bed scour from hoof shear, where it has been used for watering cattle. It also has been damaged structurally due to the relocation and artificial straightening of some sections. These disturbances have caused an increase in overland flow and a decrease in groundwater supply for base flow. UT 1 flows into North Fork Mountain Creek near the southeastern corner of the site.

All reaches have been impacted by agricultural land use, specifically cattle access and the clearing of much of the watershed, leading to increased overland flow and decreased groundwater supply for base flow. Wetland areas adjacent to the stream have been impacted by livestock and drained due to channel incision. The proposed wetland restoration area no longer receives normal overbank flow from the stream. As a result, it no longer performs many of the hydrological functions and values associated with riparian wetland systems. Degraded, existing wetland areas within the proposed project limits are found near the left bank of Reaches 2 and 4 (Figure 12.5).

Riparian wetland restoration is proposed along Reaches 2 and 4, where existing and former wetlands have been impacted by livestock and drained due to channel incision. Hoof shear is a major cause of the wetland degradation and floodplain erosion in this area. Restoration of the channels and their buffers and riparian wetlands will reduce the amount of sediment, nutrients, and fecal coliform bacteria flowing from

the adjacent pastures, improving the overall water quality of North Fork Mountain Creek which is a tributary of the Catawba River and Lake Norman. Additionally, planting of the entire floodplain area of the creek and its tributaries, in addition to the required 50 foot buffer, will increase the ecological benefit of the project by protecting riparian habitat and function.

When examining this system it is necessary to understand the causes of instability responsible for the loss of the streams' physical and biological functions. Instability in this stream system is due to agricultural modification of both the stream hydraulics and riparian buffer. These streams are currently in a successional stage of channel evolution that has been accelerated by agricultural modifications.

3.2 EXISTING CONDITIONS SURVEY

A field assessment of stream type was conducted in January 2010. In addition, a jurisdictional waters delineation was conducted in August 2010. The delineation was conducted using sub-meter accuracy GPS equipment.

In January 2010, field survey measurements were gathered using proper surveying techniques (Harrelson *et al.* 1994). Measurements included, but were not limited to, longitudinal profile of the thalweg, water surface, bankfull, low bank, and terrace; cross section of riffle and pool including bank slope, water depth and width of flood-prone area; valley length; belt width; straight length; pool-to-pool spacing and channel material. Survey data were collected throughout the project area and the detailed stream survey and watershed data provided existing condition information that was used to identify design constraints. Additionally, a detailed topographic survey was conducted on the entire project area and was used for the restoration design. Senior water resource engineer staff determined stream classification and valley type in addition to performing a geomorphic departure analysis. The data collected for all reaches is presented in Table 11.5A. Photographs of the site and restoration reaches are included in Appendix 14.1.

3.3 CHANNEL CLASSIFICATION

North Fork Mountain Creek and associated tributaries are shown on the USGS Catawba topographic quadrangle. Determination of intermittent/perennial streams was performed according to the NCDWQ protocol for stream classification (NCDWQ 2005). Utilizing the NCDWQ methodology and presence of key benthic macroinvertebrate taxa, the streams onsite were classified as perennial. Reaches 1-4 are experiencing severe erosion and incision. NCDWQ Stream Classification Forms for project reaches are included in Appendix 14.3.

Stream classification of the restoration reaches was determined by field observation and visual assessment as described in the Section 3.2. A variety of channel classifications are present within the project area. The restoration reaches are currently classified F, G or E channels. (Table 11.5A).

The F channels in the project area can be further classified as F4 and F4/F5. F channels are generally wide, straight, and entrenched systems resulting from G channels which have undergone horizontal migration. F types are deeply incised with very high width-to-depth ratios and accelerated channel aggradation and/or degradation. The '4' refers to gravel bed material, and '5' refers to sand bed material. It should be noted that the /5 scenario denotes the presence of embeddedness in the stream channel due to sand content from upstream bank erosion. The /5 scenario very rarely exists naturally without the

presence of massive bank failure in upstream reaches. For this reason, it is important to note that while the reaches in the project area may appear to be sand bed systems, they are in fact gravel bed reaches with a high degree of embeddedness.

The G channels in the project area can be further classified as, G4 G4c and G4/5 in the project area. The G stream type is an entrenched, narrow, deep channel, with low to moderate sinuosity. Generally, G streams have very high bank erosion rates and exhibit moderate to steep channel slopes, low width-to-depth ratios, and high sediment supply. The '4' refers to gravel bed material and '5' refers to sand bed material. The 'c' refers to a slope of less than 2 percent. In general, the average slope for G channels is 2-4%. At this slope range, the channel can generally be described as a gully formed downstream of a headcut. G5 systems (sand material) are a good indication of a channel which is currently eroding. In G4c channels (where the slope is less than 2%), the flatter slopes do not allow for the complete passage of sediment through the system. This will lead to eventual horizontal migration which leads to the formation of F channels.

The E channels in the project area can be further classified as E4 and E4/E5. The E stream type has entrenchment values greater than 2.2 and has a low width-to-depth ratio. Typically E channels are stable but the E reaches on the North Fort Mountain Creek project area are incised and are working toward Gc channel types. The '4' refers to gravel bed material, and '5' refers to sand bed material. It should be noted that the /5 scenario denotes the presence of embeddedness in the stream channel due to sand content from upstream bank erosion. The /5 scenario very rarely exists naturally without the presence of massive bank failure in upstream reaches. For this reason, it is important to note that while the reaches in the project area may appear to be sand bed systems, they are in fact gravel bed reaches with a high degree of embeddedness.

3.4 VALLEY CLASSIFICATION

The determination of valley classification is important in order to understand how the valley confines each restoration reach and potential for sediment transport within the reaches. The valley type for the restoration reaches was visually assessed during field investigations.

Two different valley types exist within the project area. These include valley types II, and VIII. Valley type II is a confined valley, while type VIII is a terraced valley. Valley floor slopes are often less than 4 percent.

The valley type classification for each restoration reach can be found in Table 11.4.

3.5 DISCHARGE

Bankfull discharge is defined as the dominant channel forming flow that moves the most sediment over time (Rosgen 1994). This generally equates to a 1.1 to 1.3 year storm event in North Carolina. Bankfull discharge for the restoration reaches of the North Fork Mountain Creek project area was calculated using the North Carolina Piedmont Regional Curve.

Regional curves provide a graphical representation of the relationship between bankfull discharge and drainage area. Bankfull indicators are present on some of the North Fork Mountain Creek restoration

reaches, primarily in the F and B channels (Section 3.9). Eroding G channels that are vertically unstable rarely have sandy depositional surfaces that can be used as a bankfull indicator. Additionally, USGS regional regression methods for determining peak discharge were examined (Pope *et al.* 2001). This method employs long-term gauge data to develop equations based on hydro-physiographic region. Piedmont regression equations were used to calculate various peak discharges for 2, 5, 10, 50 and 100-year events. The 25, 50, and 100-year storm events were used to model the floodplain interaction on confined reaches and to analyze the risk of flood-produced failures.

Due to the absence of bankfull indicators on many of the restoration reaches, drainage area and the Piedmont regional curves were used for the calculation of design discharges for reaches in the project area. The USGS method was used in the HEC-RAS modeling described in Section 7.4. The calculated discharge for each restoration reach is presented in Appendix 14.9.

3.6 CHANNEL MORPHOLOGY

Morphological data were collected from the restoration reaches in the project area. A morphological table of the existing conditions is presented in Table 11.5B. Streams in the North Fork Mountain Creek restoration project are G, F and E type channels as described in Section 3.3.

The G type channels had widths ranging from 4.1 feet to 9.3 feet and depths ranging from 0.5 feet to 1.3 feet. Width-to-depth ratio ranged from 7.1 to 8.1, which is typical for G type streams. Entrenchment ratios generally ranged from 1.1 to 1.4, indicating the reaches are entrenched, as expected for a G type stream. The bed material for the G type reaches ranged from gravel to silt with the majority of reaches having a high degree of sand embeddedness in the bed. This is not surprising considering that G type channels are very unstable due to high sediment supply from channel sources. The bank height ratios also vary between the G reaches. Bank height ratios note the difference between the bankfull elevation and the lowest stream bank. Commonly, stable channels exhibit bank height ratios between 1.0 and 1.3; however, these numbers may increase based on stream classification and overall entrenchment. The G channels are generally located higher in the watershed and are all transitioning into horizontally unstable F channels.

The E/F type channels had widths ranging from 8.7 feet to 15.9 feet and depths ranging from 1.4 feet to 1.6 feet. Width-to-depth ratios ranged from 6.3 to 9.9, which is typical for E type streams. Entrenchment ratios showed that the reaches were entrenched, as expected for an F type stream. The bed material for the F type reaches ranged from gravel to silt with the majority of reaches having a sand bed. Although the channels are currently sand bed, there is a large gravel supply buried beneath the sand. F type channels form in alluvial valleys which results in the abandonment of former floodplains (Rosgen 1996) and the formation of central and transverse bars which cause high stream bank wasting. The F channels are generally located downstream of unstable G channels. As the F channels horizontally migrate and erode, the flows carve a new floodplain at a lower datum.

The E type channels had widths ranging from 12 feet to 16 feet and depths ranging from 1.5 feet to 3.0 feet. Width-to-depth ratios ranged from 6 to 10, which is typical for E type streams. Entrenchment ratios varied from moderately entrenched to entrenched. Many of the E type reaches were in a highly unstable state and moving primarily toward G type channels. The bed material for the E type reaches were gravel and sand. As with the G and F type reaches, the E reaches had actively eroding banks, which made the

bed material smaller than if the channel were stable. Again bank height ratios were high due to the previously discussed instability.

Currently, sediment supply to the reaches is primarily from massive bank erosion in the system which is occurring as a result of a base level shift caused by historic agricultural disturbance and subsequent conservation efforts (see Section 3.7). As the banks have eroded, the system has been overwhelmed with a sediment load it is unable to transport, resulting in sand particles becoming embedded between larger gravel particles. The restoration reaches have the potential for being a medium gravel bed system which provides valuable benthic habitat. However, being embedded with sand, benthic habitat in the reaches is significantly degraded.

3.7 CHANNEL EVOLUTION

It is important to determine the channel trajectory of restoration reaches in order to determine if any benefit to the system can be achieved through restoration, or if natural stream processes are sufficient to restore the stream system to a stable state. All restoration reaches on the North Fork Mountain Creek site are currently at an intermediate point along their channel evolution, with varying degrees of horizontal and/or vertical instability. Three succession scenarios as defined by Rosgen (2008) are present on-site. 1.) E to Gc to F to C to E, 2.) B to G to Fb to B and 3.) C to G to G to C. These succession scenarios represent the central tendencies of an eroding and unstable reach to transition from a stable state to a new stable state. The stream succession scenarios are triggered by a disturbance to the morphology of the channel, the flow regime, and/or the sediment supply rates to the channel.

In general, the reaches on-site were historically E or C channels. Elevated sediment loads and overland flows due to historic agricultural practices resulted in enlarged channels and fine legacy agricultural sediments being deposited on the floodplain. Land conservation methods have been successful at both lowering the peak flow rates and the sediment supply from overland agricultural sources. This shift in land use and conservation has resulted in reduced streamflow rates that are now confined within the large channels carved out during the agricultural period. Some G channels have experienced horizontal migration to form F channels. A few reaches have experienced further bank erosion, forming B channels, primarily due to cattle hoof shear. Many reaches are currently embedded with fine sand particles. The upstream channels are vertically unstable and have large headcuts due to the downstream instabilities. These active headcuts are a significant source of sediment within the downstream reaches.

The streams began a recovery period once the historic agricultural practices were discontinued. All reaches on site are currently in an intermediate stage of channel succession. Most are still deeply incised and actively eroding. Since the mid-twentieth century, agricultural practices have included a number of conservation efforts. These efforts have resulted in limited overland sediment supply to the channels. This has resulted in more energy available for erosion which is cutting down through the soft agriculture deposition sediments and causing bank erosion. Restoration of these reaches will allow for a stable system with current conservation practices in place.

Generally, stability of the restoration reaches will only be achieved when access to their floodplain is re-established such that shear stress is reduced during high storm events and there is no further significant erosion. If left to evolve naturally, it may be decades to a century before streams on the North Fork Mountain Creek site can achieve a stable endpoint, even if cattle are fenced out of the reaches.

Restoration is needed if the adverse impacts of bank erosion are to be avoided over the next several decades.

3.8 CHANNEL STABILITY ASSESSMENT

The existing reaches of the restoration site were visually assessed during field investigations for causes of instability. Reaches were noted to be experiencing severe bank erosion, with horizontal and/or vertical instability. Several causes of instability were noted, including active headcuts, base level shifts, cattle hoof shear, high sediment loads, and buffer disturbance. More than one cause of instability was observed on several reaches.

3.9 BANKFULL VERIFICATION

In degraded systems bankfull indicators are often not present or are unreliable due to the stream's degrading processes. For example, G channels are incised and actively degrading. As a result, confined flows in the channel do not allow for the deposition of material which could be used as a bankfull indicator. F channels, on the other hand, are wider channels with active horizontal migration. Terraces which form within the F channels allow for slower flows through which sediments can be deposited. During field visits in January 2010 most bankfull indicators were observed in F channels for the existing reaches in the project area. In surveyed typical reaches consisting of G channels, bankfull indicators were observed by investigating wider valleys immediately upstream or downstream where meanders had been previously blown out. The primary bankfull indicator that was observed in the restoration reaches included sandy deposition immediately adjacent to the active channel on the edge of the floodplain.

3.10 VEGETATION COMMUNITIES AND DISTURBANCE HISTORY

In general, the North Fork Mountain Creek restoration site has a mix of two natural communities, Mesic Mixed Hardwood Forest (Piedmont subtype) and Piedmont/Low Mountain Alluvial Forest (Schafale & Weakley 1990). However, it should be noted that the vegetation communities are predominantly made up of pasture grass and are sparsely populated with hardwood trees and shrubs along the riparian corridors. Cattle have access to the majority of the project site and have destroyed much of the natural vegetation strata.

Piedmont/Low Mountain Alluvial Forests are found on floodplains along rivers and streams where, if levees and sloughs are present, they are small and do not contain distinct vegetative communities. This community is found onsite along the floodplain of North Fork Mountain Creek (Reach 4) and includes both the non-wetland riparian areas and existing wetland areas. Dominant woody species onsite include ironwood (*Carpinus caroliniana*), sweetgum (*Liquidambar styraciflua*), black walnut (*Juglans nigra*), red maple (*Acer rubrum*), flowering dogwood (*Cornus florida*), eastern red cedar (*Juniperus virginiana*) and spicebush (*Lindera benzoin*). Primary herbaceous species include pasture grasses, Japanese stiltgrass (*Microstegium vimineum*), joe-pye weed (Eutrochium *purpureum*), jewelweed (*Impatiens capensis*), boneset (*Eupatorium perfoliatum*), false nettle (*Boehmeria cylindrica*), yellow crownbeard (*Verbesina occidentalis*) and dogfennel (*Eupatorium capillifolium*). The wetland plant community is discussed in Section 5.0 of this report. A few large trees (>2ft DBH) are left within the easement including a few tulip poplars (*Liriodendron tulipifera*), black walnut and white oak (*Quercus alba*).

Mesic Mixed Hardwood Forests are typically found on slopes and sometimes on well-drained small stream bottoms. This vegetation community is present on the UT to North Fork Mountain Creek (Reaches 1-3) due to the severe stream incision and resultant lowering of the water table along these reaches. This community is also present on the higher slopes above the floodplain along the right bank of North Fork Mountain Creek (Reach 4). The predominant woody species in this community is red maple. Black walnut, red cedar, American beech (*Fagus grandifolia*), water oak (*Quercus nigra*), persimmon (*Diospyros virginiana*), Virginia pine (*Pinus virginiana*), sourwood (*Oxydendrum arboreum*), black cherry (*Prunus serotina*), and sycamore (*Platanus occidentalis*) are also present in sparse populations along the tributary. Black willow (*Salix nigra*) and tag alder (*Alnus serrulata*) are present in some of the more depressional areas. A few areas of the invasive Chinese privet (*Ligustrum sinense*), Japanese stiltgrass, and Japanese honeysuckle (*Lonicera japonica*) were noted along the tributary.

4.0 Reference Streams

Restoration designs utilize reaches of stable channel morphology and natural stable riparian zones and floodplains as references for design. These reference reaches provide natural channel design dimensionless ratios that are based on quantitative morphological relationships.

Typically, reaches upstream and downstream of a restoration reach are analyzed to determine if they provide a stable dimension, pattern, and profile that can be used as a reference for design. However, in this project most of the streams in the watershed, including the headwaters, are unstable and in need of restoration, thereby excluding them from serving as references. North Fork Mountain Creek downstream of the lowest restoration reach has a drainage area that is too large to qualify as an appropriate reference reach. Instead, a search for reference reaches which were suitable for use in the design of the restoration reaches in the North Fork Mountain Creek Restoration Project was conducted using a number of factors as guidelines. These factors included: current land use and stream condition, size of the drainage area, stream order, the absence of man-made alterations within the immediate reach, the absence of beaver dams, and stream classification. Vegetative cover, bank stability, and channel condition were also evaluated during site visits. An on-site inspection was performed to ensure that the reference reaches were appropriate and applicable to the different types of restoration reaches.

The three identified reference reaches included Thickety Creek and an unnamed tributary to Thickety Creek in Montgomery County (B3c) and Morgan Creek in Orange County (C4) (Figure 12.6). The two reaches in Montgomery County were surveyed December 12, 2008. Morgan Creek in Orange County was surveyed on January 9, 2009. While the reference reaches are not physically adjacent to the project area, they are in the same hydrophysiographic region. The stream flow for the both references reaches and the project site are rainfall driven. The total amount of annual rainfall is very similar, with the Catawba County receiving approximately 49 inches annually and each of the reference reaches receiving approximately 48 inches annually. The rainfall distribution throughout the year for the project site also matches very closely with that of each of the reference reaches. Other important factors which are similar between the reference reaches and the project site include sediment size, stream type, valley type and vegetation.

Reference reaches were identified and surveyed to provide guidance in designing the restoration reaches and ensuring proper dimension, pattern, and profile based on bankfull stage (Rosgen 2001). Measurements included, but were not limited to, longitudinal profile and cross-section of a riffle and a pool detailing the following data: thalweg, water surface, bankfull, low bank, and terrace elevation; bank slope; width of flood-prone area; belt width; valley length; straight length; pool-to-pool spacing and channel materials. The data were utilized to calculate dimensionless ratios for natural channel design. NCDWQ Stream Classification Forms for each reference channel are included in Appendix 14.6. Morphological parameters of the reference reaches are presented in Table 11.7C. Photographs are included in Appendix 14.4.

4.1 REFERENCE WATERSHED CHARACTERIZATION

Two reaches were investigated in Montgomery County: Thickety Creek and an unnamed tributary (UT) to Thickety Creek. The survey of both reaches began at the confluence of the unnamed tributary with Thickety Creek and proceeded upstream along both reaches. Upstream of the confluence both reaches are second order streams and are shown as blue-line streams on the USGS Biscoe Quadrangle (Figure 12.6). The reaches are located approximately 4 miles west of Candor, NC. The watershed area of Thickety Creek is approximately 840 acres, while the watershed of the unnamed tributary is approximately 280 acres. Both watersheds are predominantly forested with some agricultural land use. The watershed of the unnamed tributary to Thickety Creek also has a small amount of herbaceous land cover. The dominant soil in the watershed is Herndon silt loam. Floodplain soils for the UT to Thickety Creek are comprised of the Badin-Tarrus complex while the floodplain for Thickety Creek is made up of Herndon silt loam and Chenneby silt loam (Figure 12.7). None of these soils are hydric or have hydric inclusions.

The Morgan Creek reference reach is a third order stream and is depicted as a blue-line stream on the USGS White Cross and Chapel Hill Quadrangles (Figure 12.6). Located just northwest of Carrboro, North Carolina Morgan Creek flows south into University Lake. The drainage area of the reference reach is approximately 5300 acres (>8 square miles). A significant portion of the watershed, around a thousand acres, is used for agriculture. The reference reach begins upstream (north) of the NC Hwy 54 stream crossing. No roads cross the reference reach; however several road crossings are present in the reference reach watershed. Major road crossings include Bethel Hickory Grove Church Road (SR 1104) which bisects the watershed from west to east, and Dairyland Road (SR 1113) which bisects the northern portion of the watershed from north to south. Several residential neighborhood roads also cross tributaries within the watershed (Figure 12.6). The dominant soils in the watershed include Georgeville silt loam and Herndon silt loam. Floodplain soils are comprised of Wedowee sandy loam and the predominant soil along the sideslopes is Appling sandy loam (Figure 12.7).

4.2 CHANNEL CLASSIFICATION

Both Thickety Creek and UT to Thickety Creek in Montgomery County are classified as B3c channels using the Rosgen classification system. B3 channels are characterized by a moderate entrenchment ratio, a width-to-depth ratio greater than 12, and a relatively low sinuosity. The ‘c’ indicates that this channel has a slope more in line with a C channel type, but still acts like a B channel in energy dissipation. The ‘3’ in the classification type indicates that the channel substrate is predominantly comprised of cobble.

Morgan Creek in Orange County has a Rosgen classification of C4. The C4 stream is characterized as a slightly entrenched, meandering riffle/pool channel. The '4' indicates that the channel substrate is predominantly comprised of gravel.

4.3 DISCHARGE

Bankfull discharge and velocity for each reference reach were calculated utilizing Manning's equation and estimating a roughness coefficient by stream type (Rosgen 2001). The bankfull velocity and discharge in Thickety Creek was measured to be 3.94 ft/s and 56 cfs respectively, while UT to Thickety Creek had a velocity of 3.5 ft/s and a discharge of 28 cfs. The bankfull velocity and discharge in Morgan Creek in Orange County was measured to be 5.94 ft/s and 570 cfs, respectively.

4.4 CHANNEL MORPHOLOGY

Thickety Creek in Montgomery County demonstrated a bankfull width of 12 ft with a width-to-depth ratio of 10.05. The bankfull maximum depth was 1.19 ft and the entrenchment ratio was 2.49. Additionally, the reach had an average meander wavelength of 72 ft and an average belt width of 31 ft. The UT to Thickety Creek had a bankfull width of 17.17 ft, width-to-depth ratio of 6.52, bankfull maximum depth of 1.1 ft, entrenchment ratio of 2.79, average meander wavelength of 135 ft, and average belt width of 37 ft. Both of these reference reaches showed lower than normal width-to-depth ratios than would be expected in a B type channel, but the channels were dominated by step-pool sequences which indicate that energy dissipation takes place in the bed of the reaches and not in the banks. This is typical for B type channels.

Morgan Creek in Orange County had a bankfull width of 45.2 ft and width-to-depth ratio of 21. Its bankfull maximum depth was 3.1 ft and the entrenchment ratio was 2.2. The reach had an average meander wavelength of 280 ft and average belt width of 51 ft. This reach had a slightly higher than typical width-to-depth ratio, but exhibited lateral scour typical of C type channels. The banks and meander pattern were stable with good riffle pool complexes.

4.5 CHANNEL STABILITY ASSESSMENT

Riparian vegetation for both Thickety Creek and UT to Thickety Creek in Montgomery County consisted of mature hardwood forest. Both reaches had excellent access to their floodplain, stable banks, well spaced step pools, and a classic bowl shaped valley. The vegetation surrounding Morgan Creek in Orange County consisted of mature hardwood forest. Due to the dense riparian vegetation, the banks on all reference reaches showed no signs of significant erosion.

4.6 BANKFULL VERIFICATION

In reference systems, bankfull is typically the top of bank or very near to it. The existing bankfull elevations and bankfull cross-sectional areas were determined in the field by locating the top of bank or back of point bars. These bankfull dimensions were then compared to NC Regional Curves for verification (NCSRP 2008). Morgan Creek in Orange County and Thickety Creek and UT to Thickety Creek in Montgomery County and demonstrated bankfull indicators slightly below top of bank. Bankfull indicators at slightly below top of bank are common in stable channels and are indicative of a stream

which is not entrenched. The morphological data, including bankfull dimensions, for each reference reach are presented in Table 11.7C.

4.7 VEGETATION

Ideally, reference vegetation communities are found on or in the vicinity of the project site. As described in Section 3.9, there are two main community types on the project site: Piedmont/Low Mountain Alluvial Forest and Mesic Mixed Hardwood Forest. The reference streams described above did not have the appropriate community makeup or age to serve as reference vegetation. Therefore a search was conducted for other reference areas as described below. Photos of reference vegetation communities can be found in Appendix 14.4. Refer to Figure 12.5 and 12.6 for reference vegetation community location maps.

4.7.1 Upstream Reference Vegetation

The adjacent property to the west contains a riparian forest community more than 50 years old. This vegetation community was used as the primary vegetation reference for the riparian zones on the project site. The stream is moderately incised and there are minimal invasive species present.

The canopy is made up of black walnut, hackberry (*Celtis occidentalis*), sweetgum, sycamore, willow oak (*Quercus phellos*), American beech, white oak, and various hickories. The beech, white oak and hickories are more predominant on the drier slopes. The midstory is dominated with spicebush and ironwood. Additional species include black cherry, flowering dogwood, and red maple. The herbaceous layer includes Christmas fern (*Polystichum acrostichoides*), giant cane (*Arundinaria gigantea*), cinnamon fern (*Osmunda cinnamomea*), grape (*Vitis* sp.), and even a few Jack in the pulpits (*Arisaema triphyllum*). The invasive Japanese stiltgrass was also observed.

4.7.2 Wetland Reference Vegetation

Existing vegetation within the onsite wetlands is disturbed due to livestock access. Additional reference wetlands were needed to provide a more appropriate vegetative community. No acceptable wetland communities were found on the adjacent parcels. The reference wetlands used for this project are located at the South Fork Catawba River restoration site in Newton, North Carolina. Existing wetlands within that site were analyzed and are discussed in detail in Section 6.0.

5.0 Project Site Wetlands

Existing jurisdictional wetlands were assessed for the project area. Wetlands will be restored and created as a result of the stream restoration as described in Section 7. In addition, approximately 0.64 acres of existing wetland will be impacted by the stream restoration activities. Approximately 0.09 acres of the impacts will be permanent, because the new channel will be constructed through the existing wetlands. The majority of the impacts (0.55 acres) will be temporary. Necessary floodplain grading will take place within these wetlands, but is expected to enhance their function by providing overbank flooding.

5.1 JURISDICTIONAL WETLANDS

The National Wetland Inventory (NWI) map, Catawba County Soil Survey, USGS Topoquad, 2005 high resolution aerial photography, and 2-foot contour data were reviewed prior to an on-site visit to determine the possible presence of streams and wetlands within the project area. Partially hydric (Hydric B) soils mapped on-site include Chewacla loam. No Hydric A soils are mapped within the project area (Figure 12.4a).

Determination of jurisdictional wetlands was performed in accordance with the U.S. Army Corps of Engineers 1987 Wetland Delineation Manual (USACE 1987). The field inspection verified the presence of six wetland areas of various sizes within the project easement. The locations of these wetlands are depicted in Figure 12.5. The wetlands consist of toeslope depressional areas and seeps located on the floodplain of North Fork Mountain Creek and its tributary. Due to their presence in the floodplain, none of the wetland areas are isolated from surface waters. Soils and vegetation found in the wetland areas are described below. Important wetland hydrology indicators include oxidized rhizospheres and saturation in the upper twelve inches.

A total of 1.08 acres of existing wetlands are located within the conservation easement in six different locations along the project site (Figure 12.5). Tyler Crumbley of the USACE visited the site on August 31, 2010. The JD is included in Appendix 14.2.

Wetland data forms for the delineated wetlands are provided in Appendix 14.2 and demonstrate that the existing wetlands support hydrophytic vegetation, wetland hydrology, and display hydric soil conditions.

5.2 HYDROLOGICAL CHARACTERIZATION

As mentioned in the previous section, wetlands are present in the project area. The wetlands along Reach 4 are located in the floodplain and are hydrologically fed by seeps. During field assessments, these wetlands were somewhat dry but had a few sediment deposits and oxidized root channels. The three wetlands located along both banks of Reach 2 are also fed by seeps and were noted to be saturated to within 12 inches. Finally, two small wetlands are located in floodplain the along Reach 3. At the time of assessment these wetlands were saturated nearly to the surface. No standing water was observed in any of these wetlands during the delineation.

5.3 SOIL CHARACTERIZATION

Most of the jurisdictional wetland areas consist of gray sandy loams to clay loams with redoximorphic features. All of the wetlands are located in areas mapped as Chewacla loam. The Chewacla loam mapunit, which is a Hydric B soil (non-hydric with hydric inclusions), is located on 0 to 2 percent slopes on floodplains and is occasionally flooded. The soils are very deep, somewhat poorly drained with moderate permeability. The Chewacla loam is found in depressions and low lying positions. In general, soils observed in the jurisdictional wetlands exhibit low chroma matrices, lower than those noted for Chewacla soils. The wetlands along Reach 4 are also sandier than the mapped soil series.

Soils were also analyzed onsite for wetland restoration purposes. There is no clear definition in the regulations outlining what timeline constitutes “historical disturbance” or “former wetlands.” The site was

believed to be altered well in advance of the mapping of the soil survey (1975) and as such hydric soils would not be mapped in the areas proposed for restoration as they are not mapped in the areas that are currently supporting jurisdictional wetlands. As soils dried out from a lowering of the water table due to increases in agricultural land use and subsequent stream incision, many of the hydric features, especially those associated with iron oxidation and reduction, disappeared. Much of the soil proposed for restoration and creation in this mitigation plan does technically fall into the ranges for a Chewacla soil as mapped for Catawba County. It should be noted that Chewacla has historically been used as a "catch-all" piedmont floodplain soil and the ranges are based on statistical averages across the whole county. The area was historically able to support a larger wetland than is currently located on site. There is on-site evidence in the form of cobbles and other stream bed material in the soil profile that the stream bed previously existed at a higher elevation. There is also evidence in the form of abrupt textural changes and buried organic material that the surface of the floodplain was at a lower elevation. As discussed during an on-site meeting with Todd Tugwell, USACE, in January 2011, the acreage of wetland restoration being requested has been reduced to areas that have stronger and more recent indications of hydric indicators. A more in-depth soil analysis was undertaken in February 2011. The remaining area that could support wetlands, including and extending beyond the original restoration area, have been deemed wetland creation. Soil profile descriptions are included in Appendix 14.12 and a map is included in section 12.4.

5.4 VEGETATION COMMUNITY TYPE(S) DESCRIPTIONS AND DISTURBANCE HISTORY

The wetlands on site are dominated by herbaceous species with very little shrubs or trees present. Herbaceous species include smartweed (*Polygonum pennsylvanicum*), ironweed (*Vernonia noveboracensis*), arrowhead (*Sagittaria latifolia*), cardinal flower (*Lobelia cardinalis*), trumpetweed (*Eupatoriadelphus fistulosus*), seedbox (*Ludwigia* sp.), sedges (*Carex* sp.), rush (*Juncus effusus*), marsh dayflower (*Murdannia keisak*), netted chainfern (*Woodwardia areolata*), clearweed (*Pilea pumila*), false nettle, jewelweed, boneset, Japanese stiltgrass, and arrowleaf tearthumb (*Polygonum sagittatum*). Woody plants within the wetlands include green ash (*Fraxinus pennsylvanica*), tag alder (*Alnus serrulata*), swamp rose (*Rosa palustris*), and red maple (*Acer rubrum*).

The existing wetlands on-site are small and are part of the surrounding riparian buffer community type. These wetlands most likely would have vegetation characteristic of a Piedmont/Low Mountain Alluvial Forest but they are heavily disturbed from grazing and trampling. This regular disturbance and open canopy has allowed for a healthy establishment of an herb layer. The wetlands are all located within the stream riparian zone described in Section 3.10.

6.0 Reference Wetlands

Approximately 1.16 acres of wetland will be restored and 3.03 acres created along the floodplain. The streams on-site will be reconnected to their floodplains providing hydrology to support the creation of floodplain wetlands, oxbows, and backwater sloughs. In addition to the onsite wetlands, reference wetlands located on the South Fork Catawba River restoration site in Newton, North Carolina, were utilized to provide vegetation community information and hydrologic goals. The data presented in this

section was provided by NCEEP (KCI 2009). A visit was made to the site to verify that these wetlands would be appropriate for use in this project.

6.1 HYRDOLOGICAL CHARACTERIZATION

6.1.1 Gauge Data Summary

Monitoring gauge data collected during the growing season of 2009 showed groundwater levels in the existing wetlands to be within 12 inches of the surface for at least 43% of the growing season (Appendix 14.8). This hydroperiod is high due to the presence of beavers in the reference wetlands. Since the beaver dams have since been removed, it is expected that the South Fork Catawba River wetlands will be similar in hydroperiod to the project site. Currently, the onsite wetlands exhibit a more appropriate hydroperiod of 8% of the growing season.

6.2 SOIL CHARACTERIZATION

6.2.1 Taxonomic Classification

Like the project site, the reference site is also underlain by Chewacla. This series consists of somewhat poorly drained soils that formed on loamy alluvial material. These soils are located on level to nearly level piedmont and coastal plain river valleys. Slope ranges from 0 to 2 percent. Permeability is moderate. The depth to the water table ranges between 6 inches to 2 feet below the surface. This soil is subject to a range of flooding conditions from frequent to rare and ranging from brief to long duration. Chewacla is listed as a Fine-loamy, mixed, active, thermic Fluvaquentic Dystrudept by the USDA-NRCS. The Chewacla mapunit in Catawba County is classified as partially hydric, meaning that it contains inclusions of other soil series that are hydric.

6.2.2 Profile Description

Soils within the wetlands were fine sandy loams and exhibited varying amounts of clay within the subsoil. The wetter soils exhibited a low chroma matrix extending to the surface.

6.3 VEGETATION COMMUNITY TYPE DESCRIPTION AND DISTURBANCE HISTORY

6.3.1 Community Description

The reference wetlands are existing wetlands located within a nearby restoration site. Prior to construction of the restoration site in 2005 they were part of an agricultural property. The site was visited in early October 2010 to verify the vegetative community. The wetland reference area is similar to the area used for the riparian buffer reference (Section 4.7). Typical plants included sycamore, river birch, black walnut, red maple, green ash, and willow oak.

7.0 Project Site Restoration Plan

7.1 INTRODUCTION (NOTES ON STREAM DESIGN)

The streams in the North Fork Mountain Creek restoration project area are deeply incised with varying degrees of horizontal and/or vertical instability. The streams are slowly working towards recovery, but are currently experiencing massive amounts of bank erosion and sediment loads to the system as a result. Without restoration, it will be decades to a century before the streams reach a stable endpoint. During this time large amounts of sediment will continue to degrade water quality and habitat. Therefore, restoration would improve water quality both within the restoration reaches and downstream of the project area, and improve aquatic habitat.

The size of the project area and the degree of incision makes it vital that the design consider constructability. The restoration design significantly incorporates construction accessibility and the balance of cut/fill within the reaches in order to minimize construction costs. In doing so, haul time, materials, and fuel consumption will be minimized during the construction process and costs can be minimized. Additionally, stream constructability was considered in the design. The design also incorporates the use of readily available materials onsite in order to minimize construction costs and to make it appear more natural.

The design of the restoration reaches will create stable channel morphology appropriate for the flood flows in the system. The restoration design will significantly reduce sediment loads in the restoration reaches by reconnecting streams to their floodplain and reducing shear stress on the stream banks. Additionally, several different types of structures will be used in the design to provide significant fish and benthic habitat throughout the project area.

7.2 RESTORATION PROJECT GOALS AND OBJECTIVES

The goals and objectives of the North Fork Mountain Creek Stream Restoration Project include restoration of stream channel dimension, pattern, and profile, and wetland restoration and creation. Restoration of stream morphology and subsequent connectivity of the stream channel to its adjacent floodplain and riparian zone will reduce sediment-related water quality impacts and reduce scour and incision. Construction of in-stream structures and riffle-pool sequences will improve aquatic habitat diversity. Restoration of floodplain wetlands will improve water quality and provide important habitat. Planting of native riparian vegetation will restore wetland and riparian buffer function as well as stabilize the banks. In addition to the required 50 foot stream buffer, the entire floodplain will be protected by a permanent conservation easement. Protection of the entire floodplain of North Fork Mountain Creek and the onsite tributaries will add to the ecological benefit of the project by protecting riparian habitat and function. Restoration of full ecological potential will create stream and wetland mitigation credit in the Catawba River Basin.

The objective of a Priority I project is to replace the incised channel with a new, stable stream at a higher elevation. This is accomplished by excavating a new channel with the appropriate dimension, pattern and profile (based on reference-reach data) to fit the watershed and valley type (NCSRI 2004). The

reconnection of the channel to its original floodplain will raise the water table at the site and likely restore hydrology to additional wetland areas.

Other reaches will be restored using Priority II natural channel design. The objective of a Priority II project is to create a new, stable stream and floodplain at the existing channel-bed elevation. This is accomplished by excavating a new floodplain and stream channel at the elevation of the existing incised stream. The new channel is designed with the appropriate dimension, pattern and profile (based on reference reach data) to fit the floodplain (NCSRI 2004).

The restoration goals address water quality, habitat, and hydrology. Some of these goals are primary and their achievement will be used to measure the success of the project for mitigation credit. Other goals are secondary. The achievement of these secondary goals may not be monitored.

Specific primary project goals:

- Provide stable stream channels throughout 5,180 linear feet of channel restoration.
- Restore riparian buffers throughout the project site
- Restore 1.16 acres of riparian wetland
- Create 3.03 acres of riparian wetland
- Provide permanent protection through conservation easement for the entire floodplain of North Fork Mountain Creek and its tributaries within the project area.
- Improve water quality by significantly reducing sediment loads from bank erosion and fencing out cattle

Specific secondary project goals:

- Increase the diversity and quantity of macrobenthos, salamanders, and fish by improving habitat and coarsening of the stream bed
- Improve vegetative communities and terrestrial habitat diversity
- Improve hydrology by increasing groundwater recharge, groundwater and surface water storage, and groundwater/surface water interaction

7.2.1 Designed Channel Classification and Wetland Type

The proposed stream channels are designed using Rosgen's Natural Channel Design Methodology (Rosgen 1996). Bankfull cross-sectional areas observed in the field were used as the basis for the design. Where bankfull indicators were not present, Piedmont regional curves were used. Bed roughness was assumed to be equal for all reaches within the design process. Manning's equation was utilized to calculate mean velocities and then multiplied by channel area to estimate design discharges for the restoration reaches. Shear stress and stream power were design constraints; flow velocity was set to a maximum of 3 to 5 ft/s in all reaches. Typical morphological characteristics from stable reference reaches

were also used in determining design dimension, pattern, and profile parameters. Additionally, all design reach parameters (geomorphology, slopes, etc.) were determined with cut/fill balance in mind, and then verified with hydraulic analysis for shear stress, stream power, and flood hydraulics (Sections 7.3 and 7.4).

Reaches have been designed to remain in, or be relocated to, the lowest part of the valley. In some cases, the lowest part of the valley will be regraded as necessary to meet restoration goals, while maintaining stable morphology of the associated reach. Valley type was an important factor in reach design. For example, many of the existing reaches are in very confined valleys. Reaches have been designed in such a way as to work with the valley type in which they are located, including confined valleys such as the VIII/II type. These reaches are within type VIII valleys, but the degree of incision has caused the reach to behave as if it were in a type II valley. These reaches cannot be raised back up to a valley type VIII. Instead the design works with the existing valley; channels will still be confined, but not as much as currently exhibited. Due to the confinement of these reaches, floodplain interaction was carefully considered so that shear stress did not become too high on the floodplain and that the bankfull channel had adequate grade control.

A combination of Priority I (PI) and Priority II (PII) restoration techniques are proposed for the restoration reaches in order to work with existing valley confinements in addition to optimizing cut/fill requirements and reducing construction costs. Priority I restoration will be constructed as C, Bc and B channels. The Priority II channels will C and B channels. These channels will not be restored to have broad floodplains, but will remain somewhat confined and in type II valleys. The bed elevation of these B channels will be raised slightly, in addition to cutting a larger floodplain and grading the channels to change flood geometry. These reaches will require specific pool-to-pool spacing to generate step pool energy dissipation and maintain stable stream geometry.

In general, three channel types have been used for the design of the restoration reaches: B4, B4c, and C4. The B4 channels are steeper, moderately entrenched streams, designed as step pool systems in type II valleys. Energy dissipation in these channels occurs as a result of dropping and churning water over structures. The B4c channel is a flatter system, but the valley is still confined. The C4 design channels are alluvial streams with large beltwidths and meander wavelengths on flatter slopes. Some of these channels may eventually evolve into E type channels, which are slightly entrenched, exhibit very low width depth ratios, and display very high channel sinuosity.

Structures are included in the design to provide grade control, bank stability, redirection of flows, and stream habitat improvement. Primary structures include woody debris toe sod mats, log step pools, constructed log/rock riffles, rock cross vanes, brush mattresses and J-hooks. The structures are simple, easy to build, and can be constructed with local materials. Structure quantity can be adjusted according to the availability of materials. The purpose of each structure is described below.

Woody debris toe sod mats are innovative structures that can incorporate readily available onsite materials that would otherwise be sent offsite for disposal. Woody debris toe sod mats will be used for both temporary and permanent bank stabilization on the outside of meanders. The tops of the woody debris toe sod mats will primarily be made of fescue grass, which is readily available throughout the site. The woody debris toe sod mats will be planted with live stakes, bare roots, and transplants, which will eventually shade the fescue grass, causing it to die off and make way for volunteer species. Large woody

debris will be placed under the sod mats at an elevation such that they remain submerged, providing important fish habitat.

Log step pool structures will be used for energy dissipation in some of the restoration reaches. These structures allow for vertical grade control where fish passage is not a critical design goal. Woody debris and leaf matter will be installed in the riffles of these structures to enhance habitat. These structures will also help to create a large range of velocity and depth combinations throughout the project site, promoting an increase in biodiversity.

Constructed riffles have also been designed to improve fish and benthic habitat. They will be constructed in such a way that there is a sharp gradation of d50 and d84 bed material. The d100 will be based on the available materials (i.e. logs or boulders) for grade control within the riffles. Low flow channels have been designed to have a slight meander capable of passing some gravel, but leaving the larger base materials used to construct the riffle. The result is a natural looking system with a wide range of depths and velocities. The micropools created by the woody debris will provide valuable fish and benthic habitat.

Rock cross vane structures will be used for energy dissipation and creation of downstream scour in some of the restoration reaches. These structures allow for vertical grade control where fish passage is not a critical design goal. These structures will also help to create a large range of velocity and depth combinations throughout the project site, promoting an increase in biodiversity.

Brush mattresses utilize layers of live cuttings. These layers are placed around meander bends and provide stream bank stability, habitat and a carbon source for the streams.

J-hooks will be used in some reaches for energy dissipation, hydraulically turning flows and creation of downstream scour. These structures allow for vertical grade control where fish passage is not a critical design goal. These structures will also help to create a large range of velocity and depth combinations throughout the project site, increasing biodiversity.

Wetlands on the North Fork Mountain Creek project site will be significantly increased through the restoration and creation of riverine floodplain wetlands along the restored stream channel and the enhancement of existing wetland areas through the selective planting of hardwood species. Additionally, the entire floodplain of North Fork Mountain Creek and its tributaries will be protected by a permanent conservation easement, increasing the functional uplift of the entire system. Re-connecting the stream channel to its floodplain by raising the stream bed elevation will allow more frequent overbank flooding to occur within the stream valley. This overbank flooding along with natural seeps will provide the hydrology needed to support the wetland community within the project area. A few existing swales will be removed and the site will be graded such that water will be allowed to pool in the floodplain.

Approximately 0.64 acres of existing jurisdictional wetland will be impacted by the stream restoration activities. A small portion of the impacts (0.09 acres) will be permanent, because the new channel will be constructed through the existing wetlands. The remaining impacts (0.55 acres) will be temporary. Floodplain grading will take place within these wetlands, and is expected to enhance the function of these wetlands by providing overbank flooding.

7.2.2 Target Wetland and Buffer Communities

The project site is currently heavily impacted with livestock and exhibits a poor natural vegetative community. The entire conservation easement will be planted with native hardwood species and seeded with native herbaceous plants to improve habitat and stability. As the streams and floodplains are reconnected along the site, wetlands will be restored and created. The wetlands will play a large role in improving the ecology and functional uplift of the entire system. Typical plant species identified in the reference areas, as well as those identified in the Schafale and Weakley (1990) descriptions for the target communities were utilized as a guide in developing the planting scheme (Table 11.6). Refer to Section 7.8 of this report for more detail.

7.3 SEDIMENT TRANSPORT ANALYSIS

7.3.1 Methodology

A stable stream has the ability to transfer its sediment load without aggrading (depositing sediment) or degrading (scouring sediment) over long periods of time. Typically, the stream design is based on a comparison of the existing channel's sediment transport rates and adjustment of the proposed channel's shear stress and stream power such that the channel has the ability to transfer its sediment load in a stable manner. The existing sediment supply is based on the annual tons of sediment that is exported from the system and the number of bankfull events which are estimated using a rainfall data and field observations. These two variables can be used to estimate the existing sediment transport rates.

7.3.2 Calculations and Discussion

Currently, the streams in the North Fork Mountain Creek project area are highly unstable and are transporting large amounts of sediment from eroding banks and bed scour. However, this load is expected to be greatly reduced once the channels are restored. This major reduction in sediment means it would not be a useful design tool to use the existing sediment load when adjusting the proposed channel's shear stress and stream power. Instead, the unit stream power is used as a design constraint. The design will not drastically increase or decrease the unit stream power at bankfull flow. There will be a slight increase from upstream to downstream as there will be slightly more sediment at the downstream end of the project area. This will create a uniform distribution of energy defined by the system's ability to transport sediment.

7.4 HEC-RAS ANALYSIS

7.4.1 No-rise, LOMR, CLOMR

None of the streams in the North Fork Mountain Creek project area are FEMA mapped and therefore this type of study is not needed.

7.4.2 Hydrologic Trespass

Given that the project involves modifications to a stream channel, it is important to analyze the effect of these changes on flood elevations. HEC-RAS is a software package that is designed to perform one-dimensional, steady flow, hydraulic calculations for water surface profiles for a network of natural and constructed channels (USACE 1997). The model is based on the energy equation, and the energy losses are evaluated by friction (Manning's equation) and contraction/expansion (coefficient multiplied by the change in velocity head). The momentum equation is used in situations where the water surface profile rapidly varies, such as hydraulic jumps and stream junctions. The HEC-RAS analysis was executed several times utilizing USGS and regional/local curve discharge values. The USGS Rural Piedmont flood-frequency equations (Pope *et al.* 2001) were used to estimate the low recurrence (5, 10, 25, 50, 100-year) storm events.

Special consideration was given to Reach 4 because it lacks an upstream conservation easement. While a no-rise certification was not required in this instance, it was important to establish that nuisance flooding would not occur on properties upstream of the conservation easement as a result of the restoration design.

It should be noted that flood flows, roughness, and the use of inflective flows was comparable in the HEC-RAS analysis between the design and existing conditions. Sound engineering judgment and conservative estimates were used in the analysis such that flood stages predicted by the HEC-RAS model for the design conditions are the maximum flood stage. Flood elevations will probably be lower than those predicted. The results predict no hydrologic trespass will occur as a result of the design for the restoration reach 4.

7.5 STORMWATER BEST MANAGEMENT PRACTICES

As this is a rural project, stormwater management practices (BMPs) are not included in this project.

7.6 HYDROLOGIC MODIFICATIONS

As described in section 7.2.1 the Priority I stream restoration reaches will restore much of the natural hydrology within the conservation easement. Increased overbank flooding and higher groundwater levels should result from the stream restoration.

7.7 SOIL RESTORATION

The recommended construction sequence will include removing the existing 1 to 2 inches of topsoil within the areas to be restored prior to construction. The excavated material will be stockpiled and then spread across the disturbed areas to help jumpstart the vegetation and provide a more nutrient rich substrate for the establishment of planted vegetation. Compacted areas of the subsoil will be "deep ripped" prior to planting. With the exception of the wetlands and streambank, 10-10-10 pellet fertilizer will be added to the planting area at an approximate rate of 100 lbs/acre. Temporary seeding and erosion control measures are outlined in Tables 11.8 and 11.9.

7.8 NATURAL PLANT COMMUNITY RESTORATION

As previously discussed, the target vegetative community is a Piedmont/Low Mountain Alluvial Forest along the restored stream channel and Mesic Mixed Hardwood Forest on the side slopes as described by Schafale and Weakley's Classification of the Natural Communities of North Carolina (1990). It is anticipated with the restoration that much of the area within the conservation easement will have periodic flooding after bankfull events. Plant species will be selected appropriate to their location in the moisture gradient of the site. The seeding summary for permanent vegetation is presented in Table 11.8A (non-wetland areas) and Table 11.8B (wetland areas).

Based on the grading plans, site elevations, predicted flooding, stream type, local seed source and best professional judgment, the North Fork Mountain Creek Site has been divided into four planting zones (Table 11.6). The planting plan is presented within the design sheets in Section 13.

Zone 1 is a streamside zone in which fast growing woody shrubs will be live staked to quickly stabilize the newly created streambanks. Planting Zone 2 will be the wetland restoration, wetland creation and existing wetland areas and will be made up of wetter species from the Piedmont/Low Mountain Alluvial Forest community. Zone 3 will make up the remainder of the floodplain areas and will contain the range of species present in the Piedmont/Low Mountain Alluvial Forest community. Zone 4 will make up the drier areas within the easement and contain species typically found in the Mesic Mixed Hardwood Forest communities. Zones 2, 3 and 4 will be planted with bare root seedlings. Zones 2 through 4 will also be planted with a native herbaceous seed mix. As noted in sections above, the entire floodplain of North Fork Mountain Creek and its tributaries will be protected by a permanent conservation easement. This additional buffer planting will enhance the ecological uplift of the project.

7.8.1 On-site Invasive Species Management

It is not anticipated that invasive plant species will be a significant problem on the North Fork Mountain Creek Restoration Site. A few small areas of Chinese privet, Japanese honeysuckle, marsh dayflower and Japanese stiltgrass were observed on-site during site assessments and surveys. These plants will be removed and/or deeply buried during construction to minimize the risk of them re-establishing within the project area. Microstegium is notoriously difficult to eradicate as its seed source is easily dispersed by water and remains viable for an extended period of time. It will be controlled to the maximum extent possible to ensure that it doesn't negatively affect the establishment of native hardwood species.

Pre-construction invasive plant management activities are not planned for this project. During the 5 years of post-construction monitoring any occurrence of invasive species will be noted and adaptive measures will be carried out as necessary. Adaptive measures may include chemical treatment or manual removal. Invasive species management will not be undertaken outside the conservation easement.

8.0 Performance Criteria

8.1 STREAMS

Success criteria pertain to the stability of the restored channel's dimension, pattern, and sediment transport. The restored channel must demonstrate the general maintenance of a stable cross-section and have hydrologic access to the floodplain over the monitoring period. The restoration reach should mimic reference reach conditions and the channel will be considered stable if there are little or insignificant changes from the as-built dimensions. Some change in stream dimension is natural and expected.

Traditionally, the success of a stream's pattern and dimension is determined utilizing the dimensionless ratios of reference reaches. The range of values for the dimensionless ratios of the reference reaches are applied to the design reaches. In this case, design reaches are deemed successful if the variability of its pattern and dimension remain within the range of the dimensionless ratios taken from the reference reaches, plus or minus one-half the value of that range. For the North Fork Mountain Creek restoration project, dimensionless ratios of the design reaches vary slightly from the dimensionless ratios of the reference reaches. As a result, the restoration will be determined to be successful if the dimensionless ratios of the pattern and dimension of the restoration reaches remain within their 'as-built' range, plus or minus one-half the value of the range of the dimensionless ratios of the reference reaches.

Pattern features (bedform distributions and riffle/pool lengths and slopes) should demonstrate little adjustment within the 5-year monitoring period. In terms of sediment transport, no significant trend in the aggradational or depositional potential of the restoration reaches should occur over the monitoring period. A minimum of two-bankfull events must be documented by crest gage within the standard monitoring period.

8.2 STORMWATER MANAGEMENT DEVICES

Stormwater management devices are not being installed as part of this project. Therefore, Section 8.2 is not applicable.

8.3 WETLANDS

As per USACE guidelines, wetlands exhibiting water within 12 inches of the surface consecutively between 5% and 12.5% of the growing season in most years may be considered wetlands (April 8 to October 30). Restored wetland hydrology will also be compared to the reference wetland hydrology (USACE 1987 and 1992). Based on data collected onsite, an 8% hydroperiod will be used as success criteria for this project.

8.4 VEGETATION

The vegetative success of the Piedmont/Low Mountain Alluvial Forest and the Mesic Mixed Hardwood Forest will be evaluated based on the species density and survival rates. Vegetation monitoring will be considered successful if at least 210 woody stems/acre are surviving at the end of seven years. Seven year old desirable native volunteer species will be counted towards the 210 woody stems/acre threshold. Red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*) and pine (*Pinus* sp.) will be excluded from the desirable species list.

9.0 Preliminary Monitoring

9.1 STREAMS

The stability of the stream channel will be monitored annually for five years or until success criteria are met. A visual assessment of stream stability will be conducted along all reaches yearly. Visual assessment will include observations of problem areas, documented by photos and location display on aerial photos.

The entire project will be monitored in depth for dimension, pattern and bed material as detailed below. Cross-sections will be established on the reaches to monitor stream dimensions. As vegetation establishes and the channels stabilize, the channels' cross-sections are expected to tighten slightly; however, the cross-sections should not indicate down-cutting or widening. Monitoring efforts will evaluate any changes by overlaying each year's cross-sections with the previous years' for comparison.

9.1.1 Longitudinal Profile

As per the recent guidance, longitudinal profile will not be monitored. Extra cross-sections will be added in its place.

9.1.2 Pattern

As per the recent guidance, pattern will not be monitored. Extra cross-sections will be added in its place.

9.1.3 Dimension

After construction, permanent cross-sections will be established. In each reach, cross-sections will be established in 4 riffles and 2 pools, for a total of 16 riffle and 8 pool cross-sections. Data collected will include, at a minimum, cross-sectional area, bankfull width, bankfull mean depth, bankfull max depth, flood-prone width, width-to-depth ratio, and entrenchment ratio. Stream type will be determined in riffle cross-sections only. Success will be measured based on whether the channel features stay within the natural variability of the dimensionless ratios of the reference reaches, as discussed Section 8.1. The "as-built" cross-sections will be selected and established once construction is completed.

9.1.4 Bed Material

Reach-wide pebble counts and riffle pebble counts in the riffle cross-sections will be completed each monitoring year using the modified Wolman Pebble Count procedure (Rosgen 1994). Data reported will include the d50 and d84 particle sizes. The first pebble count will be conducted after construction is completed during the as-built survey. Note that pebble count particle size is not expected to remain the same before and after restoration. The system is currently embedded with sand and will be restored to a medium gravel system. Pebble counts will be used to ensure that bed particle size remains consistent over the monitoring period.

9.1.5 BEHI

Post-restoration, BEHI and near bank shear stress will not be monitored.

9.1.6 Hydrology

Four crest gages will be installed on the site post-restoration. The crest gages will be monitored to verify that at least two bankfull events occur over the 5-year monitoring period. In order for the monitoring to be considered complete, the two verification events must occur in separate monitoring years. The placement of gauges will be determined following construction.

9.2 STORMWATER MANAGEMENT DEVICES

Stormwater management devices are not being installed as part of this project. Therefore, Section 9.2 is not applicable.

9.3 WETLANDS

The wetland restoration areas will be monitored annually for seven years following construction or longer until success criteria are met. Groundwater within typical wetlands of each type will be monitored using four automated groundwater gauges. The placement of gauges will be determined following construction. Manual and automatic rain gauges will also be installed onsite to collect rainfall data.

9.4 VEGETATION

Vegetative sample plots will be quantitatively monitored during the growing season. Based on the approximate areas of the restored vegetative communities, six 100-square meter vegetation plots will be established on the North Fork Mountain Creek Site. Vegetation will be monitored using the Carolina Vegetative Survey (CVS) methodology version 4.2 (Lee 2008). In each plot, species composition, density, and survival of the installed vegetation will be monitored. Information on volunteer species will also be collected using the CVS Level 2 methodology established for volunteers as they will be counted in vegetative success determinations. All four plot corners in each of the six plots will be located using a sub-meter Global Positioning System (GPS), permanently located with metal conduit stakes or rebar as well as a PVC marker to facilitate plot location, and included in the “as-built” report for the North Fork

Mountain Creek Site. Within each plot, each planted tree will be tagged and will be marked with a 3' piece of 1" PVC.

9.5 SCHEDULE AND REPORTING

A monitoring report of the project's ability to meet performance criteria with regards to the wetland, stream and vegetation will be submitted yearly for a period of five years. A monitoring report for wetlands and vegetation will be submitted yearly for an additional two years, for a total of seven years.

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10.0 References

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11.0 Tables

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Table 11.1 Project Components						
Restoration Level/Type	**Existing Feet/Acres**	**Restoration Level**	**Footage or Acreage**	**Mitigation Ratio**	**Mitigation Units**	**Comments**
Reach 1	1,176	P1	1,000	1	1,000	Upper end of Unnamed Tributary 1 (UT1)
		P2	430	1	430	
Reach 2	1,064	P1	949	1	949	Downstream portion of UT1, flows into Reach 4
		P2	90	1	90	
Reach 3	598	P2	639	1	639	Small stream (UT2) draining from onsite farm pond, flows into Reach 1
Reach 4	2,305	P1	1,367	1	1,367	North Fork Mountain Creek main channel
		P2	705	1	705	
Wetland Restoration	NA	R	1.16	1	1.16	Along Reaches 2, 3 and 4
Wetland Creation	NA	R	3.03	2	1.52	Along Reaches 2 and 4

Component Summations						
Restoration Level	Stream (lf)	Riparian Wetland (ac)		Non-Riparian (ac)	Upland (ac)	Buffer (ac)
		Riverine	Non-riverine			
Restoration	5,180	1.16	0	0	0	0
Creation	0	3.03	0	0	0	0
Totals (lf/ac)	**5,180**	**4.19**	**0**	**0**	**0**	**0**
Totals (mitigation units)	**5,180**	**2.68**	**0**	**0**	**0**	**0**

Restoration Level: P1 = Priority 1; P2 = Priority 2; R = Restoration

Table 11.2 Project Activity and Reporting History North Fork Mountain Creek		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Restoration Plan	Winter 2011	Spring 2011
Final Design - Construction Plans		Spring 2011
Construction		Spring/Summer 2011
Temporary S&E mix applied to entire project area		Summer 2011
Permanent seed mix applied to entire project area		Summer 2011
Bareroot / Containerized plantings		Summer 2011
As-built/Baseline Report (Year 0 Monitoring)		Summer/Fall 2011
Year 1 Monitoring		Fall/Winter 2012
Year 2 Monitoring		Fall/Winter 2013
Year 3 Monitoring		Fall/Winter 2014
Year 4 Monitoring		Fall/Winter 2015
Year 5 Monitoring		Fall/Winter 2016
Year 6 Monitoring		Fall/Winter 2017
Year 7 Monitoring		Fall/Winter 2018
**Dates are estimated*		

Table 11.3 Project Contacts North Fork Mountain Creek	
Role	**Firm Information/Address**
Designer	Stantec 801 Jones Franklin Road Suite 300 Raleigh, NC 27606 POC: Brian Mazzochi, PE, CFM 919-851-6866
Construction Contractor	unknown at this time
Planting Contractor	unknown at this time
Seeding Contractor	unknown at this time
Seed Mix Sources	unknown at this time
Nursery Stock Suppliers	unknown at this time
Monitoring Performers	unknown at this time
Stream Monitoring POC	unknown at this time
Vegetation Monitoring POC	unknown at this time
Wetland Monitoring POC	unknown at this time

Table 11.4 Project Attribute Table North Fork Mountain Creek				
Project County	Catawba County			
Physiographic Region	Piedmont			
Ecoregion	Southern Outer Piedmont			
Project River Basin	Catawba			
USGS HUC for Project (14 digit)	03050101150030			
NCDWQ Sub-basin for Project	03-08-32			
Within extent of EEP Watershed Plan?	None			
WRC Class (Warm, Cool, Cold)	Warm			
% of project easement fenced or demarcated	85% will be fenced; 100% will be demarcated			
Beaver activity observed during design phase?	None			
Restoration Component Attribute Table				
Representative Reach	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**
Drainage Area (acres)	96	177	41.4	776.8
Stream order	2	2	1	3
Restored length (ft)	1430	1039	639	2072
Perennial or Intermittent	P	P	P	P
Watershed type (Rural, Urban, Developing, etc)	Rural	Rural	Rural	Rural
Watershed LULC Distribution				
Residential	3%	2%	10%	11%
Ag-Row Crop	0%	0%	0%	0%
Ag-Livestock	95%	97%	85%	49%
Forested	2%	1%	5%	41%
Barren	0%	0%	0%	0%
Watershed impervious cover (%)	<1%	<1%	<1%	<1%
NCDWQ AU/Index number	11-97-(0.5)	11-97-(0.5)	11-97-(0.5)	11-97-(0.5)
NCDWQ classification	WS-IV	WS-IV	WS-IV	WS-IV
303d listed?	No	No	No	No
Upstream of a 303d listed segment?	No	No	No	No
Reasons for 303d listing or stressor*	n/a			
Total acreage of easement	3.24	2.67	1.61	7.76
Total existing vegetated acreage within easement	3.24	2.67	1.61	7.76
Total planted acreage as part of the restoration	3.24	2.67	1.61	5.54
Rosgen classification of pre-existing	G	E/F	G	E/F
Rosgen classification of design	B4	B4	B4	C4
Valley type	II	II/VIII	II	VIII
Valley slope	2.20%	1.70%	4.80%	1%
Cowardin classification	n/a	n/a	n/a	n/a
Trout waters designation	No	No	No	No
Species of concern, endangered etc? (Y/N)	No	No	No	No
Dominant soil series characteristics				
Series	ChA	ChA	ChA	ChA
Depth	>80	>80	>80	>80
Clay %	35	35	35	35
K	0.28	0.28	0.28	0.28
T	5	5	5	5

Table 11.5A. Existing Conditions Morphological Table				
North Fork Mountian Creek				
Item	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**
LOCATION	UT 1 to North Fork Mountain	UT 1 to North Fork Mountain Creek	UT 2 to North Fork Mountain Creek	North Fork Mountain Creek
STREAMS TYPE	G	E/F	G	E/F
DRAINAGE AREA, Ac	96.0	177.0	41.4	776.8
BANKFULL WIDTH (W_{bkf}), ft	9.3	8.7	4.1	15.9
BANKFULL MEAN DEPTH (d_{bkf}), ft	1.3	1.4	0.5	1.6
WIDTH/DEPTH RATIO (W_{bkf}/d_{bkf})	7.1	6.3	8.1	9.9
BANKFULL X-SECTION AREA (A_{bkf}), ft^2	12.0	11.9	2.1	25.3
BANKFULL MEAN VELOCITY, fps	8.1	8.0	3.5	7.6
BANKFULL DISCHARGE, cfs	23.8	36.8	13.1	105.1
BANKFULL MAX DEPTH (d_{max}), ft	1.5	1.7	0.8	2.9
WIDTH Flood-Prone Area (W_{fpa}), ft	11	21	6	180
ENTRENCHMENT RATIO (ER)	1.1	2.4	1.4	11.4
MEANDER LENGTH (Lm), ft	NA	NA	NA	NA

Table 11.5B. Proposed Conditions Morphological Table				
North Fork Mountian Creek				
Item	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**
LOCATION	UT 1 to North Fork Mountain Creek	UT 1 to North Fork Mountain Creek	UT 2 to North Fork Mountain Creek	North Fork Mountain Creek
STREAMS TYPE	B4	B4	B4	C4
DRAINAGE AREA, Ac	96	177	41.4	776.8
BANKFULL WIDTH (W_{bkf}), ft	10	12.2	7	18
BANKFULL MEAN DEPTH (d_{bkf}), ft	0.4	0.6	0.3	1.8
WIDTH/DEPTH RATIO (W_{bkf}/d_{bkf})	16	16	14	13.5
BANKFULL X-SECTION AREA (A_{bkf}), ft^2	6.2	9.3	3.5	24
BANKFULL MEAN VELOCITY, fps	3.0	3.9	2.5	11.0
BANKFULL DISCHARGE, cfs	23.8	36.8	13.1	105.1
BANKFULL MAX DEPTH (d_{max}), ft	0.8	1.2	0.7	2.1
WIDTH Flood-Prone Area (W_{fpa}), ft	18	23	12	190-281
ENTRENCHMENT RATIO (ER)	1.8	1.9	1.7	8-12
MEANDER LENGTH (Lm), ft	50-84	62-82	76-100	144-216

Table 11.5C. Reference Reach Morphological Table			
Project North Fork Mountain Creek			
Item	**Reference Reach**	**Reference Reach**	**Reference Reach**
LOCATION	Thickety Creek, Montgomery County	UT to Thickety Creek, Montgomery County	Morgan Creek, Organge County
STREAMS TYPE	B3c	B3c	C4
DRAINAGE AREA, Ac	840	276	5248
BANKFULL WIDTH (W_{bkf}), ft	12	7.17	45.2
BANKFULL MEAN DEPTH (d_{bkf}), ft	1.19	1.1	2.1
WIDTH/DEPTH RATIO (W_{bkf}/d_{bkf})	10.05	6.52	21.3
BANKFULL X-SECTION AREA (A_{bkf}), ft^2	14.27	7.92	95.85
BANKFULL MEAN VELOCITY, fps	3.9	3.5	5.9
BANKFULL DISCHARGE, cfs	111	50.4	408.1
BANKFULL MAX DEPTH (d_{max}), ft	1.99	1.3	3.1
WIDTH Flood-Prone Area (W_{fpa}), ft	30	20	100
ENTRENCHMENT RATIO (ER)	2.49	2.79	2.2
MEANDER LENGTH RATIO (Lm/Wbkf)	6	18	6

Table 11.6 Planting Summary for Vegetative Communities and Zones
North Fork Mountain Creek

***Streambank* (Zone 1), Total Acreage**									**Acres**	1.75
Species	**Common Name**	**Max Spacing**	**Unit Type***	**Size**	**Stratum**	**Spacing**	**# of Stems**	**Lbs/ac**	**Total Lbs**	
Cephalanthus occidentalis	Buttonbush	3'	L	2-3'	Shrub	3'	2113			
Cornus amomum	Silky Dogwood	3'	L	2-3'	Shrub	3'	2113			
Salix nigra	Black Willow	3'	L	2-3'	Shrub	3'	2113			
Populus deltoides	Eastern Cottonwood	3'	L	2-3'	Canopy	3'	2113			
						Subtotal	**8450**			
***Existing and Proposed Wetlands*, (Zone 2), Total Acreage**									**Acres**	5.28
Species	**Common Name**	**Max Spacing**	**Unit Type***	**Size**	**Stratum**	**Indiv Spacing**	**# of Stems**	**Lbs/ac**	**Total Lbs**	
Alnus serrulata	Tag alder	8'	R	1/4" RCD	Shrub	8'	449			
Betula nigra	River birch	8'	R	1/4" RCD	Subcanopy	8'	449			
Fraxinus pennsylvanica	Green ash	8'	R	1/4" RCD	Canopy	8'	449			
Liriodendron tulipifera	Tulip poplar	8'	R	1/4" RCD	Canopy	8'	449			
Quercus phellos	Willow oak	8'	R	1/4" RCD	Canopy	8'	449			
Platanus occidentalis	Sycamore	8'	R	1/4" RCD	Canopy	8'	449			
Populus deltoides	Eastern Cottonwood	3'	R	1/4" RCD	Canopy	8'	449			
Ulmus americana	American elm	8'	R	1/4" RCD	Canopy	8'	449			
						Subtotal	**3140**			
***Piedmont/Low Mountain Alluvial Forest (Floodplain)*, (Zone 3), Total Acreage**									**Acres**	4.4
Species	**Common Name**	**Max Spacing**	**Unit Type***	**Size**	**Stratum**	**Indiv Spacing**	**# of Stems**	**Lbs/ac**	**Total Lbs**	
Betula nigra	River birch	12'	R	1/4" RCD	Subcanopy	8'	187			
Carpinus caroliniana	Ironwood	12'	R	1/4" RCD	Subcanopy	8'	187			
Liriodendron tulipifera	Tulip poplar	12'	R	1/4" RCD	Canopy	8'	187			
Quercus phellos	Willow oak	8'	R	1/4" RCD	Canopy	8'	187			
Platanus occidentalis	Sycamore	12'	R	1/4" RCD	Canopy	8'	187			
Populus deltoides	Eastern Cottonwood	3'	R	1/4" RCD	Canopy	8'	187			
Ulmus americana	American elm	12'	R	1/4" RCD	Canopy	8'	187			
						Subtotal	**1307**			
***Mesic Mixed Hardwood Forest (Sideslopes & Upland Buffer)*, (Zone 4), Total Acreage**									**Acres**	5.16
Species	**Common Name**	**Max Spacing**	**Unit Type***	**Size**	**Stratum**	**Indiv Spacing**	**# of Stems**	**Lbs/ac**	**Total Lbs**	
Carpinus caroliniana	Ironwood	8'	R	1/4" RCD	Subcanopy	8'	321			
Cornus florida	Flowering dogwood	8'	R	1/4" RCD	Subcanopy	8'	321			
Fagus grandifolia	American beech	8'	R	1/4" RCD	Canopy	8'	321			
Juglans nigra	Black walnut	8'	R	1/4" RCD	Canopy	8'	321			
Liriodendron tulipifera	Tulip poplar	8'	R	1/4" RCD	Canopy	8'	321			
Quercus alba	White oak	8'	R	1/4" RCD	Canopy	8'	321			
Quercus rubra	N. red oak	8'	R	1/4" RCD	Canopy	8'	321			
						Subtotal	**2250**			
						Total	**15,148**			**16.5**

*L = Live stake; R = Bare root; T = Tubling; S = Seed

Table 11.7A Seeding summary for Permanent Vegetation (Non-wetlands) (North Fork Mountain Creek)						
Total Acreage				**Acres**		**17.49**
Approved Date	**Species Name**	**Stratum**	**Common Name**	**Lbs/ac**	**Total Lbs**	
12/1 - 4/1	*Panicum virgatum*	herb	Switchgrass	3	52.47	
5/1 - 4/1	*Dichanthelium clandestinum*	herb	Deertongue	5	87.45	
12/1 - 4/1	*Andropogon gerardii*	herb	Big Bluestem	6	104.94	
12/1 - 4/1	*Schizachyrium scoparium*	herb	Little Bluestem	6	104.94	
12/1 - 4/1	*Sorghastrum nutans*	herb	Indian Grass	6	104.94	
			Subtotal	26	**454.74**	17.49

Table 11.7B Seeding Sumary for Permanent Vegetation (Wetlands) (North Fork Mountain Creek)						
Wetland Seed Mix					**Acres**	5.28
Species	**Common Name**	**Stratum**	**Indiv Spacing**	**Lbs/ac**	**Total Lbs**	
Lobelia cardinalis	Cardinal Flower	Herb	NA	2	10.554	
Polygonum pennsylvanicum	Smartweed	Herb	NA	2	10.554	
Polygonum sagittatum	Tearthumb	Herb	NA	2	10.554	
Saururus cernuus	Lizard's Tail	Herb	NA	2	11.8	
Impatiens capensis	Jewelweed	Herb	NA	2	11.8	
Boehmeria cylindrica	False Nettle	Herb	NA	2	11.8	
Juncus coriaceus	Leathery Rush	Herb	NA	2	11.8	
Juncus effusus	Soft Rush	Herb	NA	4	23.6	
Carex lurida	Shallow Sedge	Herb	NA	4	23.6	
Carex lupulina	Hop Sedge	Herb	NA	4	23.6	
Eleocharis obtusa	Blunt Spikerush	Herb	NA	2	11.8	
Rhynchospora glomerata	Clustered Beaksedge	Herb	NA	2	11.8	
			Total	30	**173.262**	

Table 11.8 Planting summary for Temporary Seeding (North Fork Mountain Creek)						
***All Planting Zones*, Total Acreage**				**Acres**		**24.36**
Approved Date	**Species Name**	**Stratum**	**Common Name**	**Lbs/ac**	**Total Lbs**	
8/15 - 4/15	*Secale cereale*	herb	Rye grain			
8/15 - 5/15	*Triticum aestivum*	herb	Wheat			
5/15 - 8/15	*Setaria italica*	herb	German Millet			
5/15 - 8/16	*Urochloa ramosa*	herb	Browntop Millet			
			Total	**50**	**1218**	**24.36**
One of the species, depending on the season, may be chosen and planted at 50 lbs/ac.						

Table 11.9 Soil Preparation and Amedment Summary per Community Type (or Zone) (North Fork Mountain Creek)							
Streambank **(Zone 1)**						**Acres**	**1.75**
Mechanical Treatment	**Approx. Date**	**Ground Cover Fabric**	**Mulch Type**	**Mulch Density/Thickness**	**Nutrient Amendments**	**Nutrient Total lbs**	
none		coir	wheat straw	80%	none		
					Subtotal		
Floodplain and Upland Buffer **(Zones 3 & 4)**						**Acres**	**9.52**
Mechanical Treatment	**Approx. Date**	**Ground Cover Fabric**	**Mulch Type**	**Mulch Density/Thickness**	**Nutrient Amendments**	**Nutrient Total lbs**	
deep rip if compacted		none	wheat straw	80%	10-10-10 Pellet Fertilizer @ 100 lbs / ac	951.93	
					Subtotal	951.93	
Wetland Enhancement, Creation and Restoration **(Zone 2)**						**Acres**	**5.28**
Mechanical Treatment	**Approx. Date**	**Ground Cover Fabric**	**Mulch Type**	**Mulch Density/Thickness**	**Nutrient Amendments**	**Nutrient Total lbs**	
deep rip if compacted		none	wheat straw	80%	none	0	
					Subtotal	0	
					Total	**951.93**	**16.55**

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12.0 Figures

Figure 12.1. Vicinity Map

Figure 12.2. Project Components Map

Figure 12.3. Watershed Map

Figure 12.4a. NRCS Soils Map

Figure 12.4b. Onsite Soil Survey Map

Figure 12.5. Hydrological Features and Wetland Delineation Map

Figure 12.6. Reference Sites Watershed Map

Figure 12.7. Reference Sites Soils Map

Figure 12.8a. Reference Site Wetland Locations with Gauge Locations (Map 1) (prepared by KCI)

Figure 12.8b. Reference Site Wetland Locations with Gauge Locations (Map 2) (prepared by KCI)

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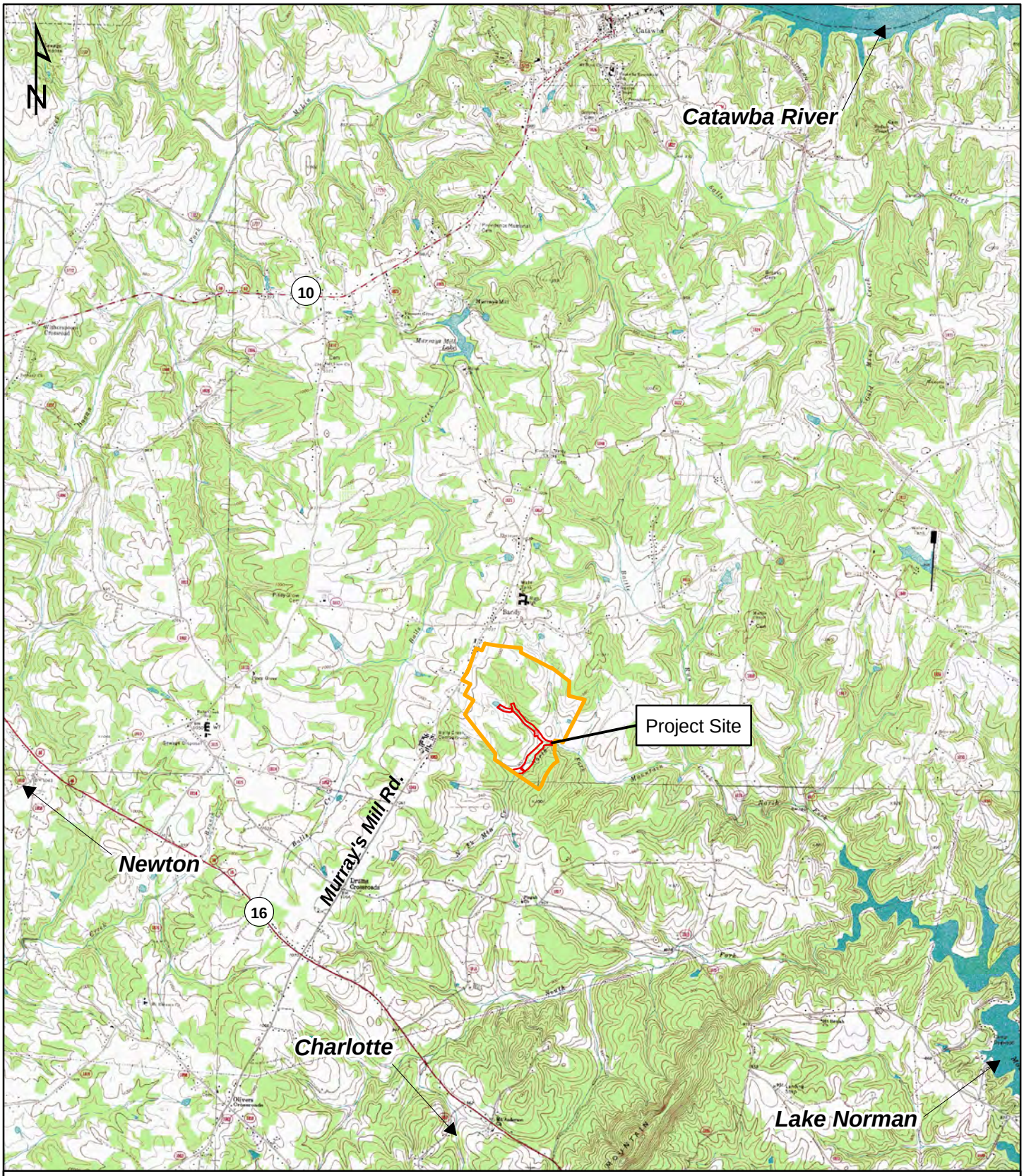

Proposed easement

Property boundary

0 0.5 1 2 Miles

Figure 12.1 - Vicinity Map
North Fork Mountain Creek
Stream Restoration Project
Catawba County, NC

USGS 7.5 Min Quadragles:
Denver, Catawba, Newton, Maiden

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EBX

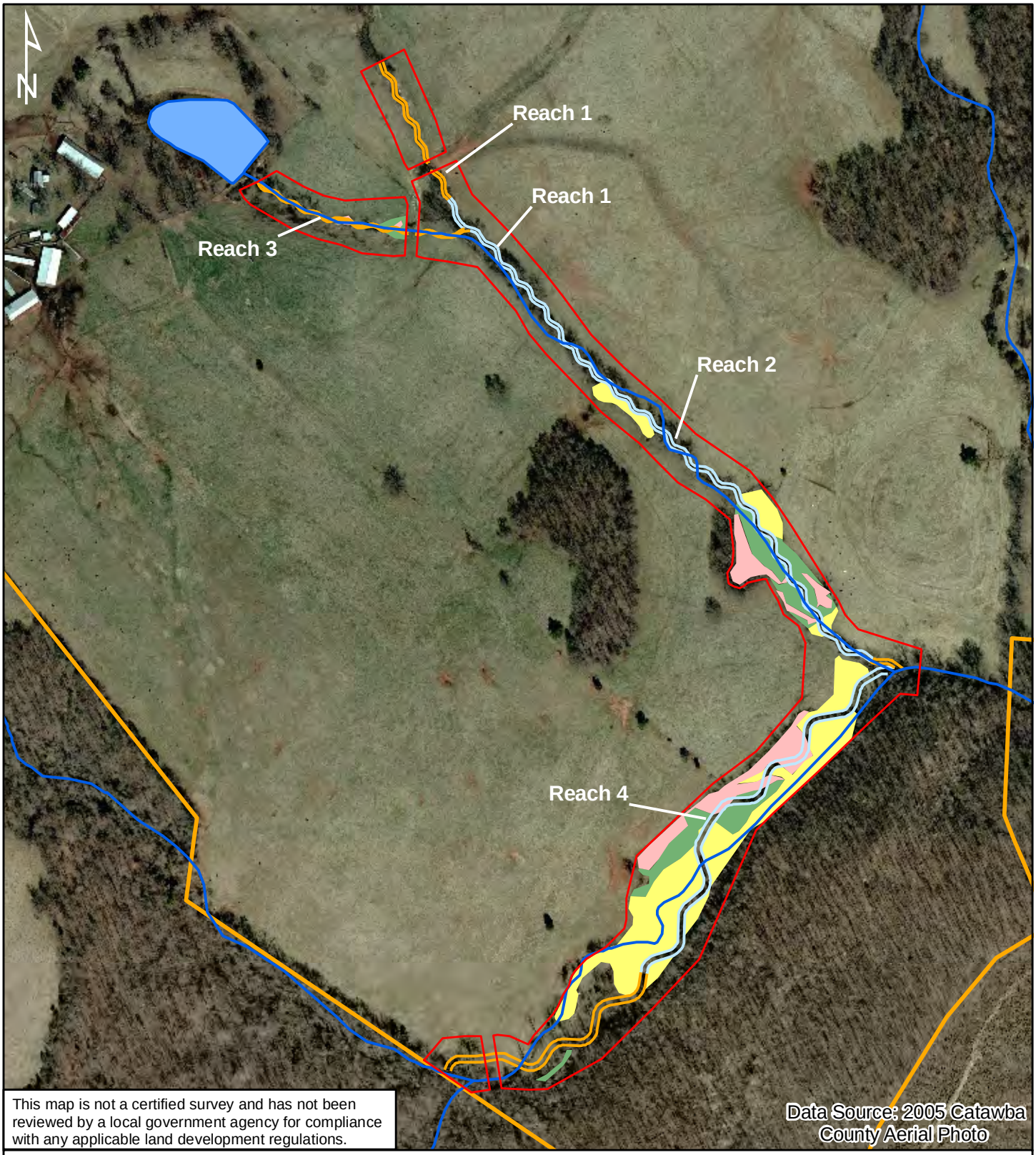

Figure 12.2 - Project Components Map
North Fork Mountain Creek Stream Restoration Project
Catawba County, NC

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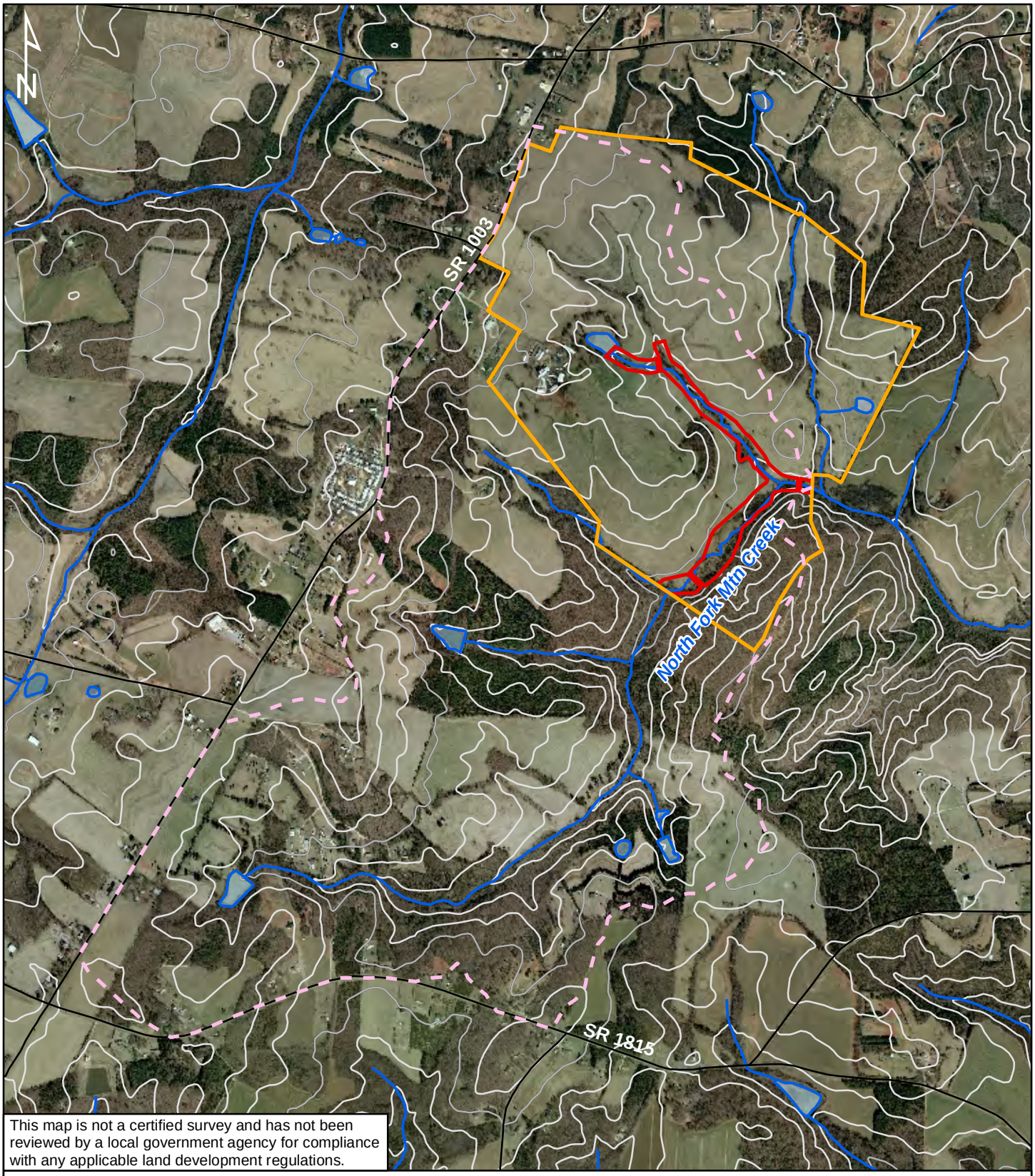
EBX



This map is not a certified survey and has not been reviewed by a local government agency for compliance with any applicable land development regulations.

- Watershed boundary (960 ac)
- Property boundary
- Proposed easement
- Roads
- 1:24,000 Hydrography
- Contours (20ft)

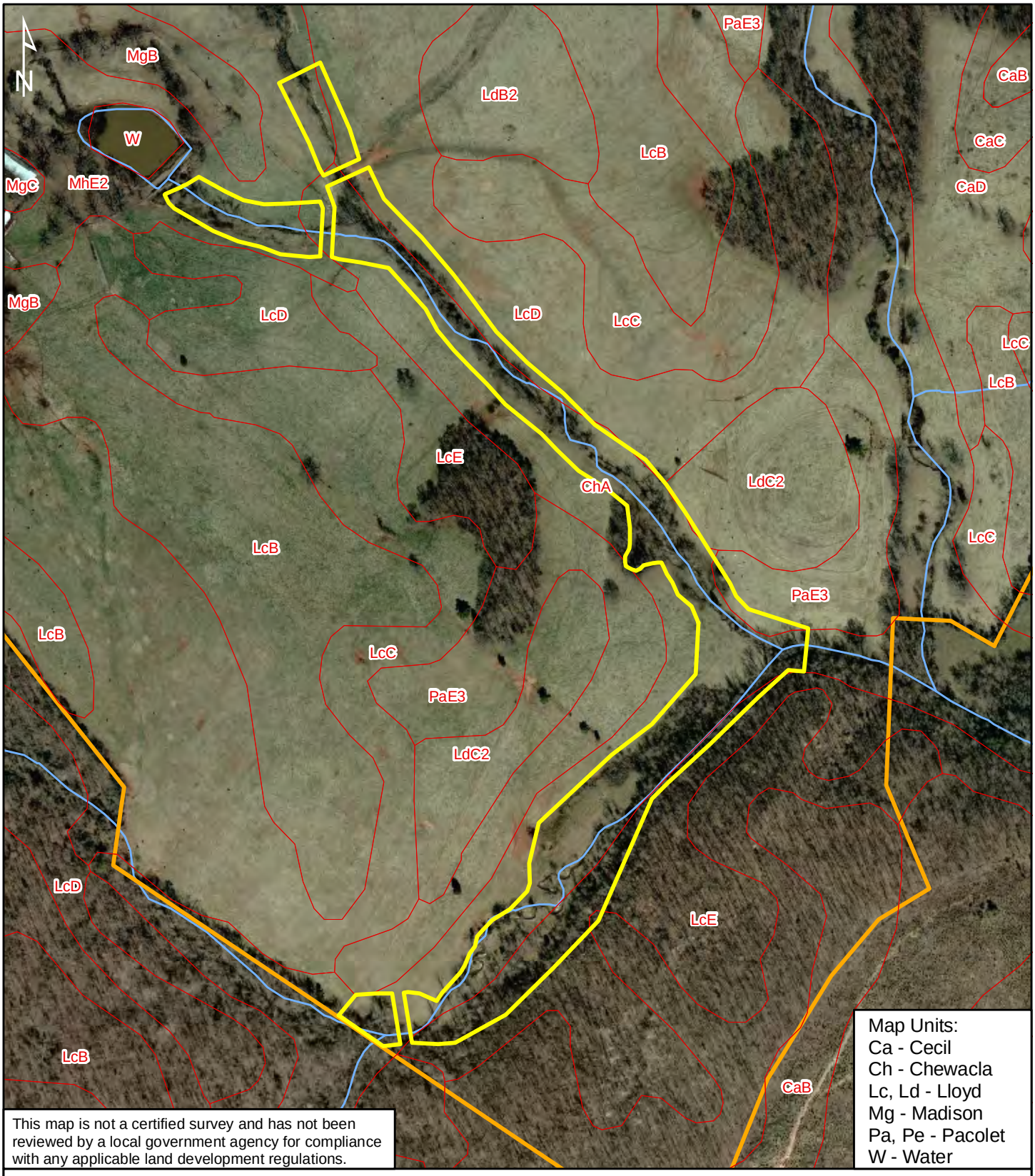
Figure 12.3 - Watershed Map
North Fork Mountain Creek
Stream Restoration Project
Catawba County, NC

Data Source: 2005 Catawba County Aerial Photo

Stantec

EBX

0 1,000 2,000 Feet



Soil mapunit boundaries
Property boundary
Proposed easement
1:24,000 Hydrography

0 250 500 Feet

Figure 12.4a - NRCS Soils Map
North Fork Mountain Creek
Stream Restoration Project
Catawba County, NC

Data Source: 2005 Catawba County Aerial Photo

Stantec

EBX

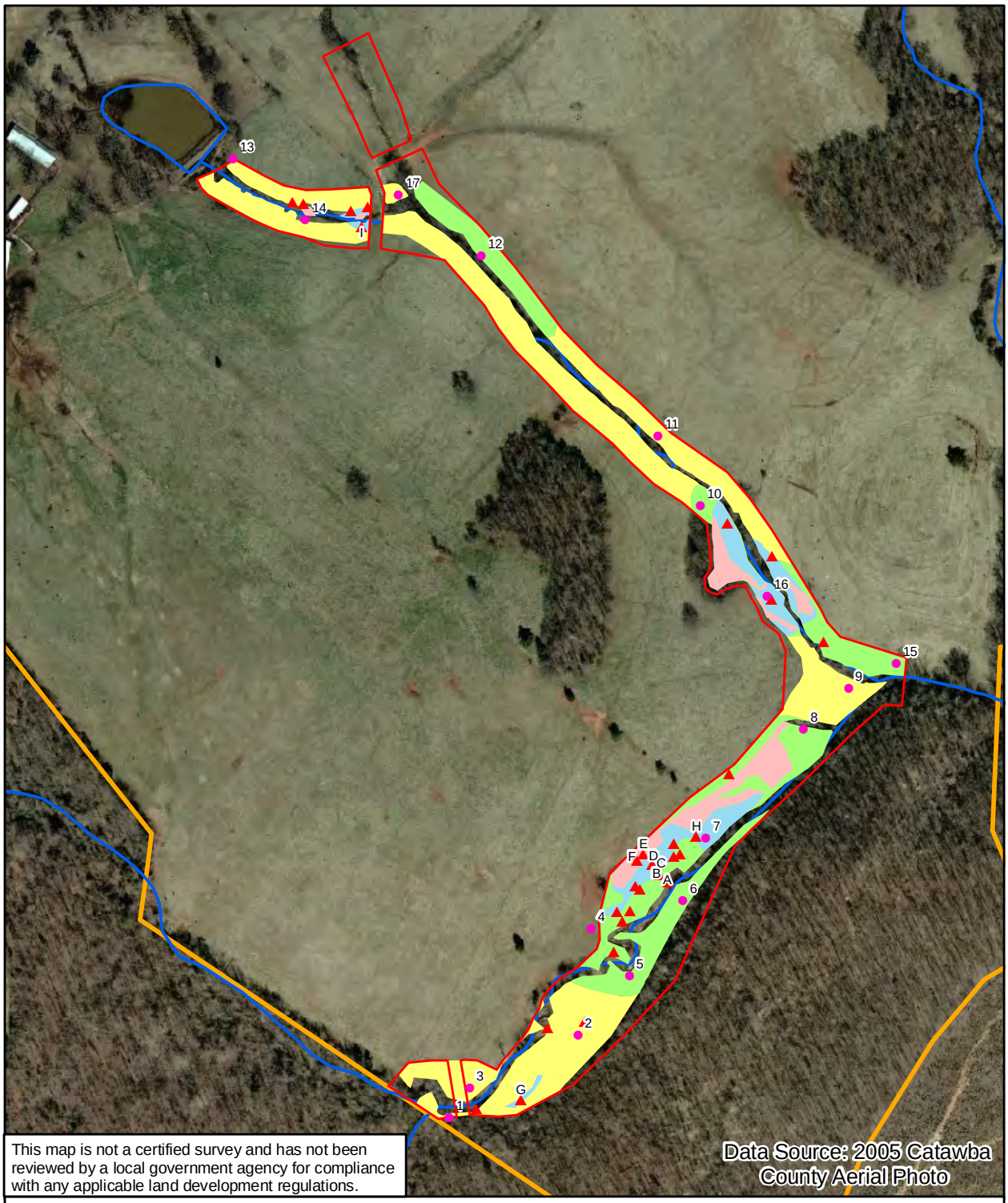


Figure 12.4b - Onsite Soil Survey Map
North Fork Mountain Creek
Stream Restoration Project
Catawba County, NC

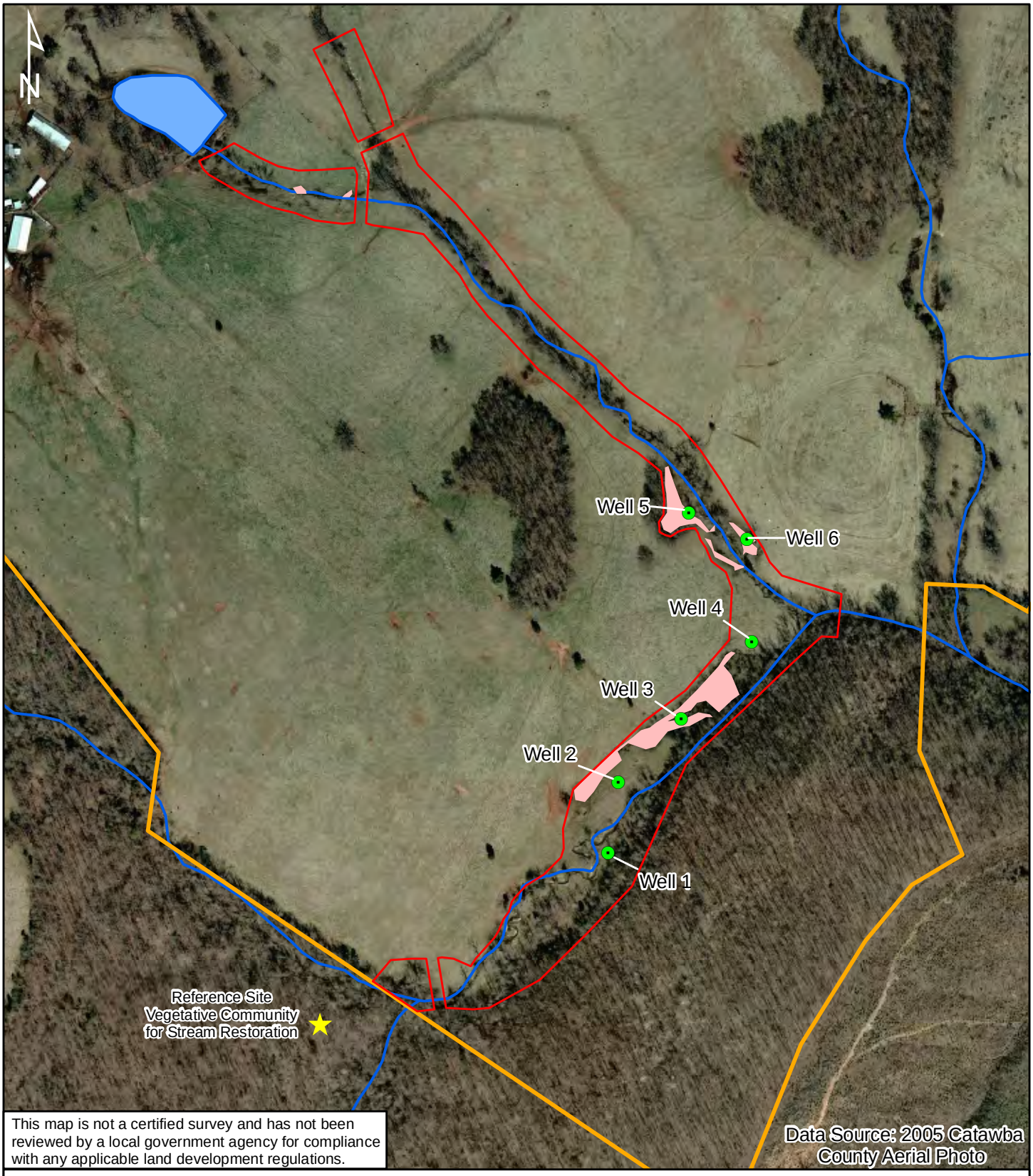


Figure 12.5 - Hydrologic Features and Wetland Delineation Map
North Fork Mountain Creek Stream Restoration Project
Catawba County, NC

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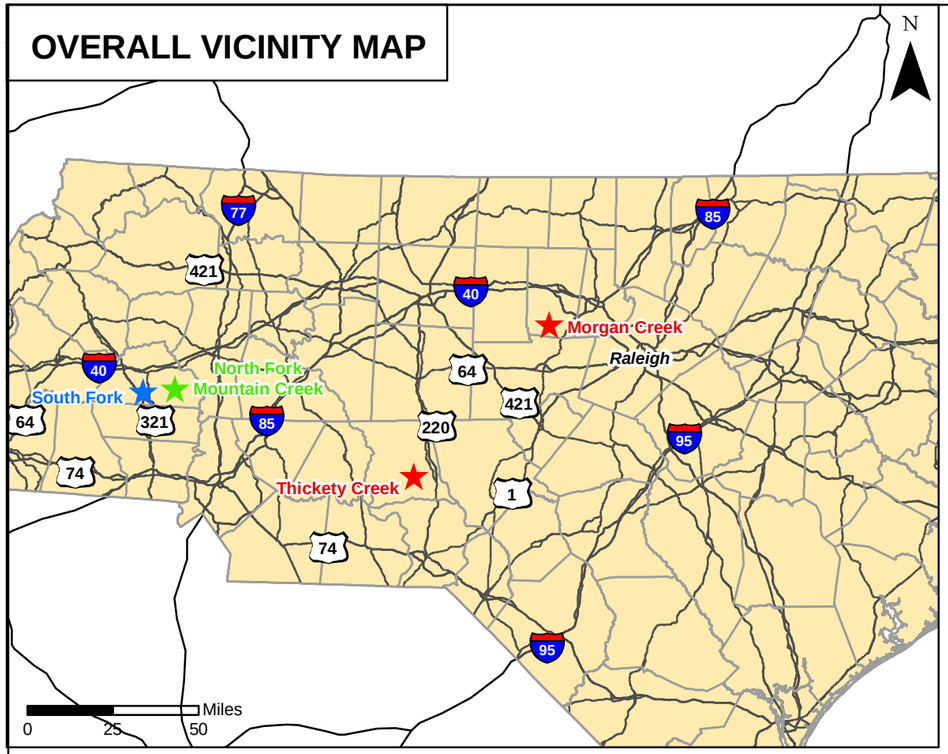
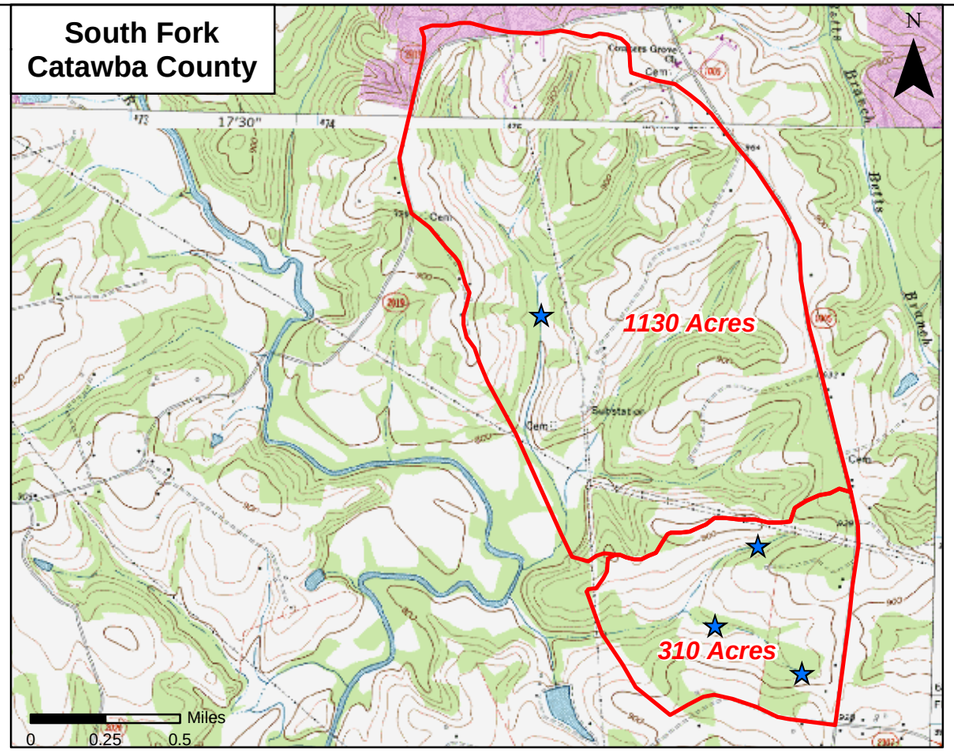
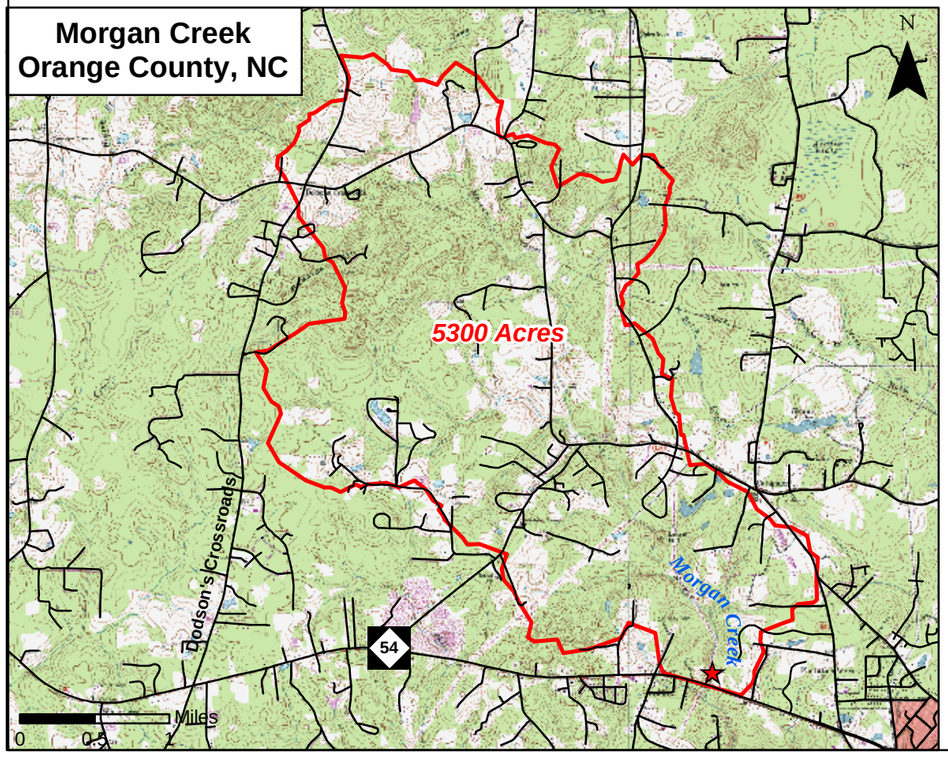
EBX







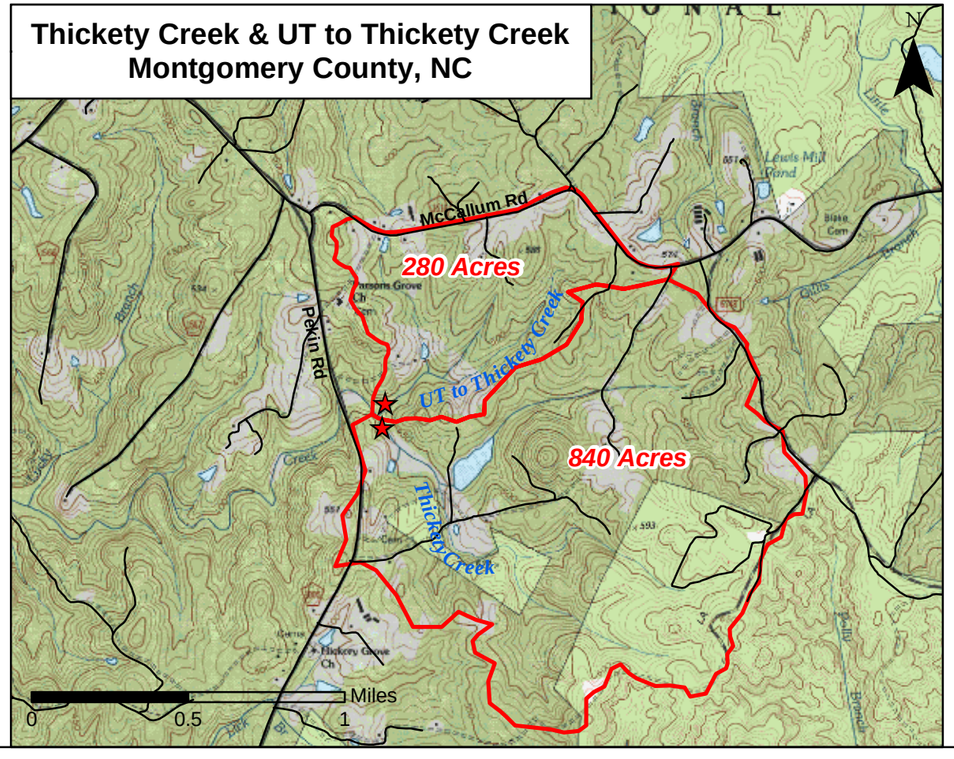


Figure 12.6 - Reference Sites Vicinity & Watershed Map

North Fork Mountain Creek
Stream Restoration Project
Catawba County, NC

Overall Vicinity Map

- County Boundaries
- Roads
- Project Site

Watershed Delineation Maps

- Reference Watersheds
- Reference Streams
- Reference Wetlands

USGS 7.5' Topographic Quadrangles

South Fork: Hickory, Reepsville
Morgan Creek: White Cross, Chapel Hill
Thickety Creek: Biscoe

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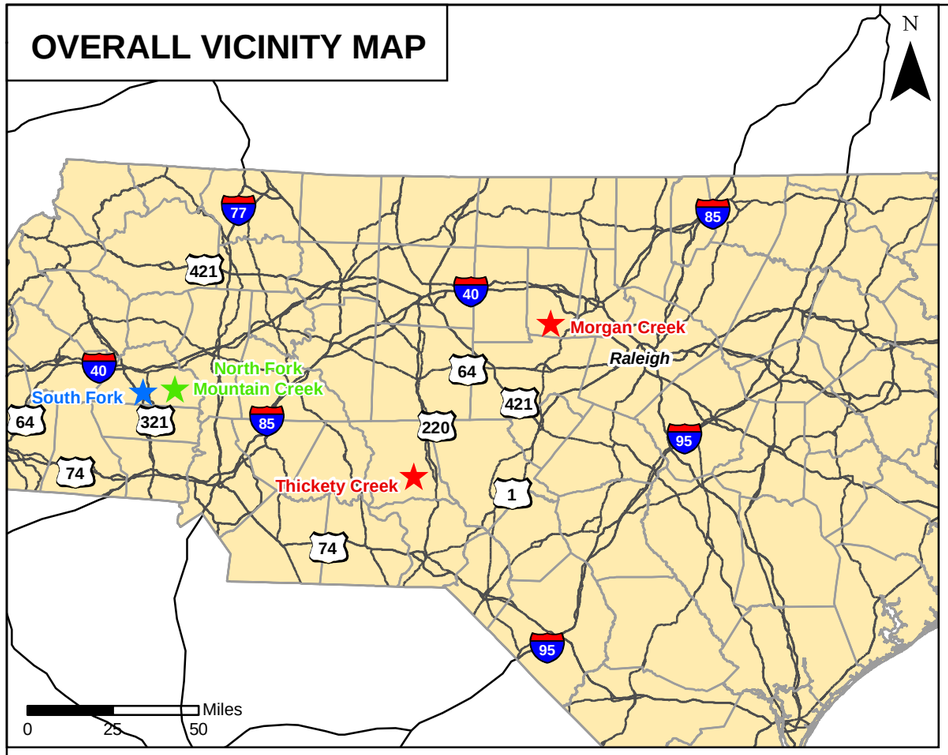

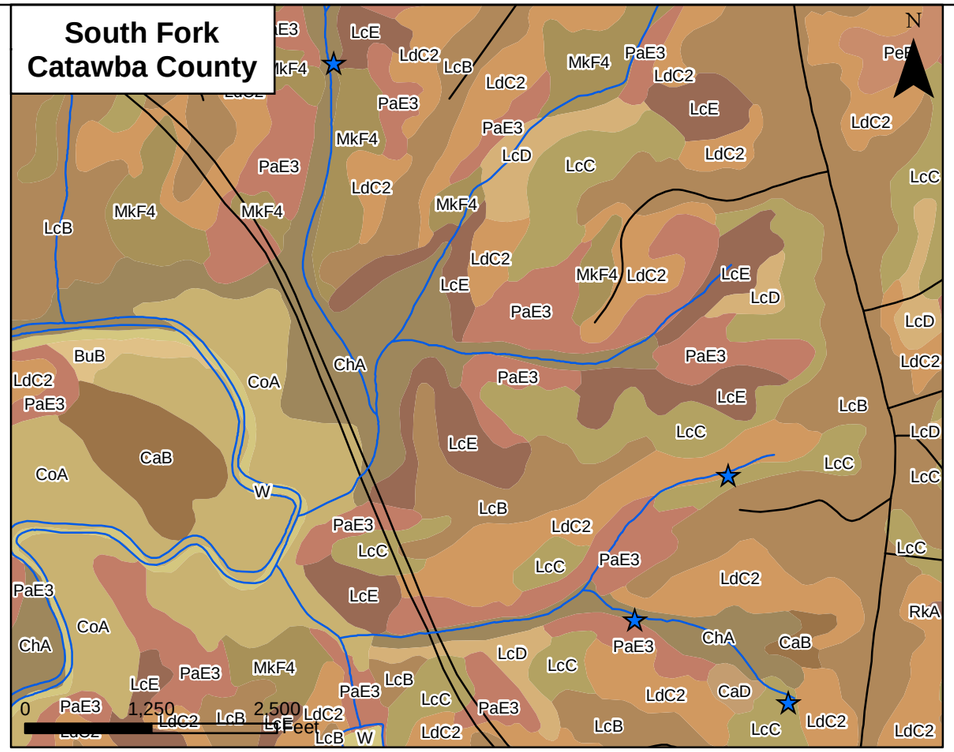

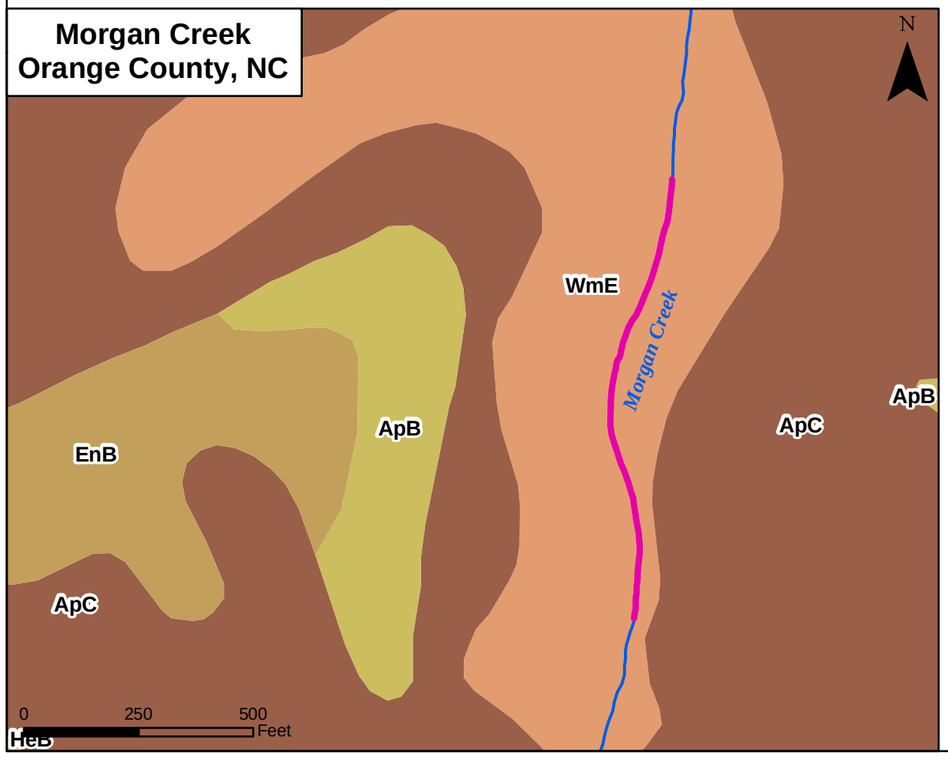

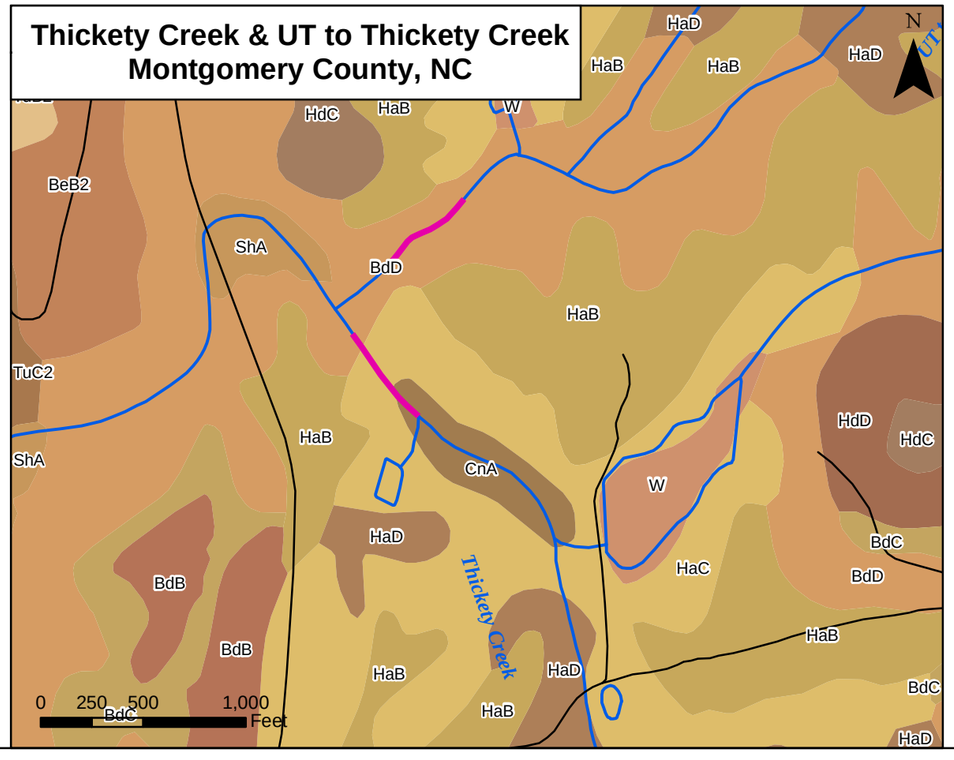

Figure 12.7 - Reference Sites Soils Map

North Fork Mountain Creek
Stream Restoration Project
Catawba County, NC

Overall Vicinity Map

- County Boundaries
- Roads
- Project Site

Soils Maps

- Roads
- 1:24,000 Hydrography
- Surveyed Reference Reach
- Reference Wetlands

Bd - Badin-Tarrus Complex
ChA - Chewacla loam
Cn - Chenneby silt loam
HaC - Herndon silt loam
Lc - Lloyd loam
Ld - Lloyd clay loam
Pa, Pe - Pacolet
Wm - Wedowee sandy loam

Soil Surveys:

Catawba County (2010)
Orange County (1977)
Montgomery County (2002)

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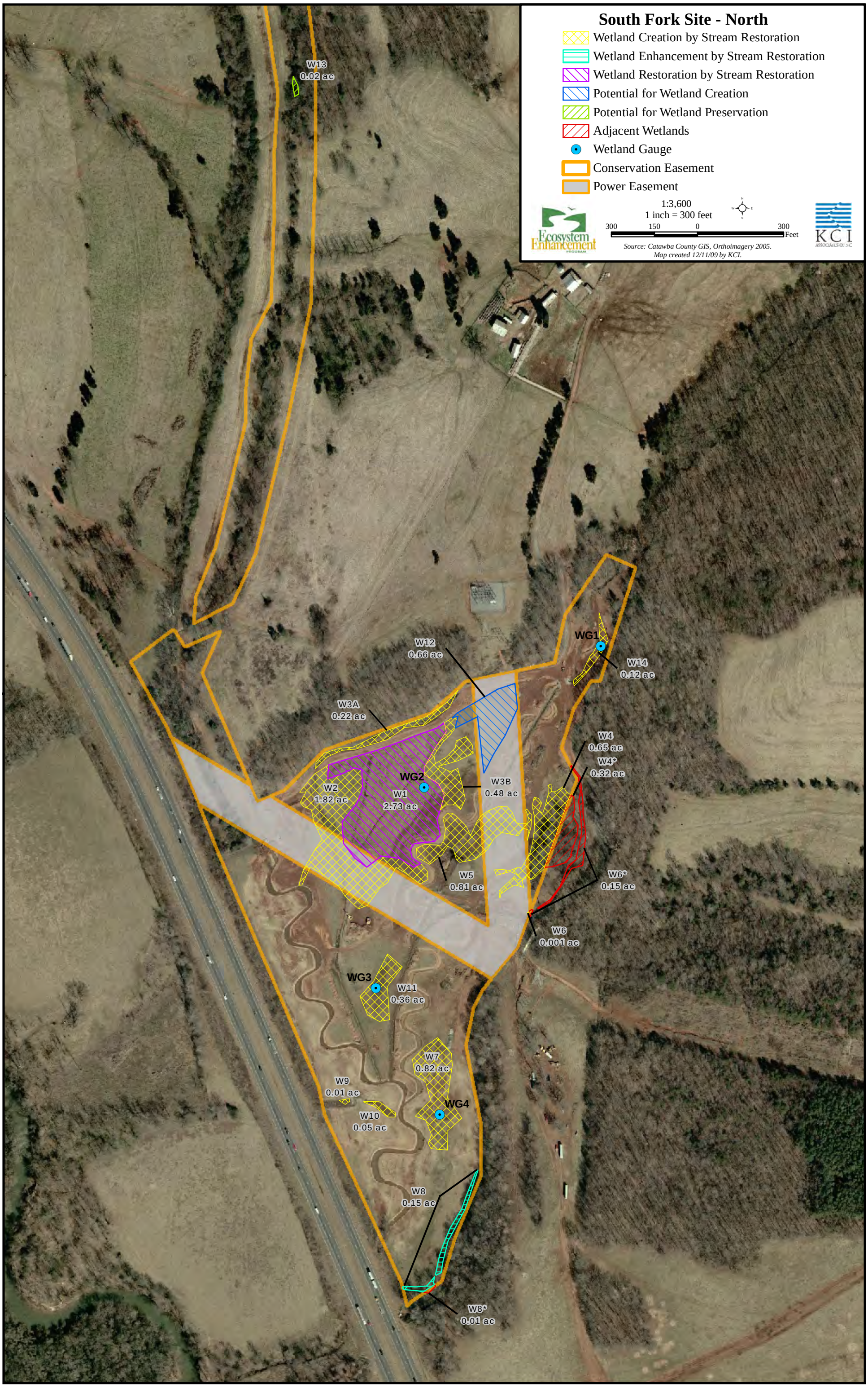
Figure 12.8a - Reference Site Wetland Locations with Gauge Locations (see Wetland Preservation areas)



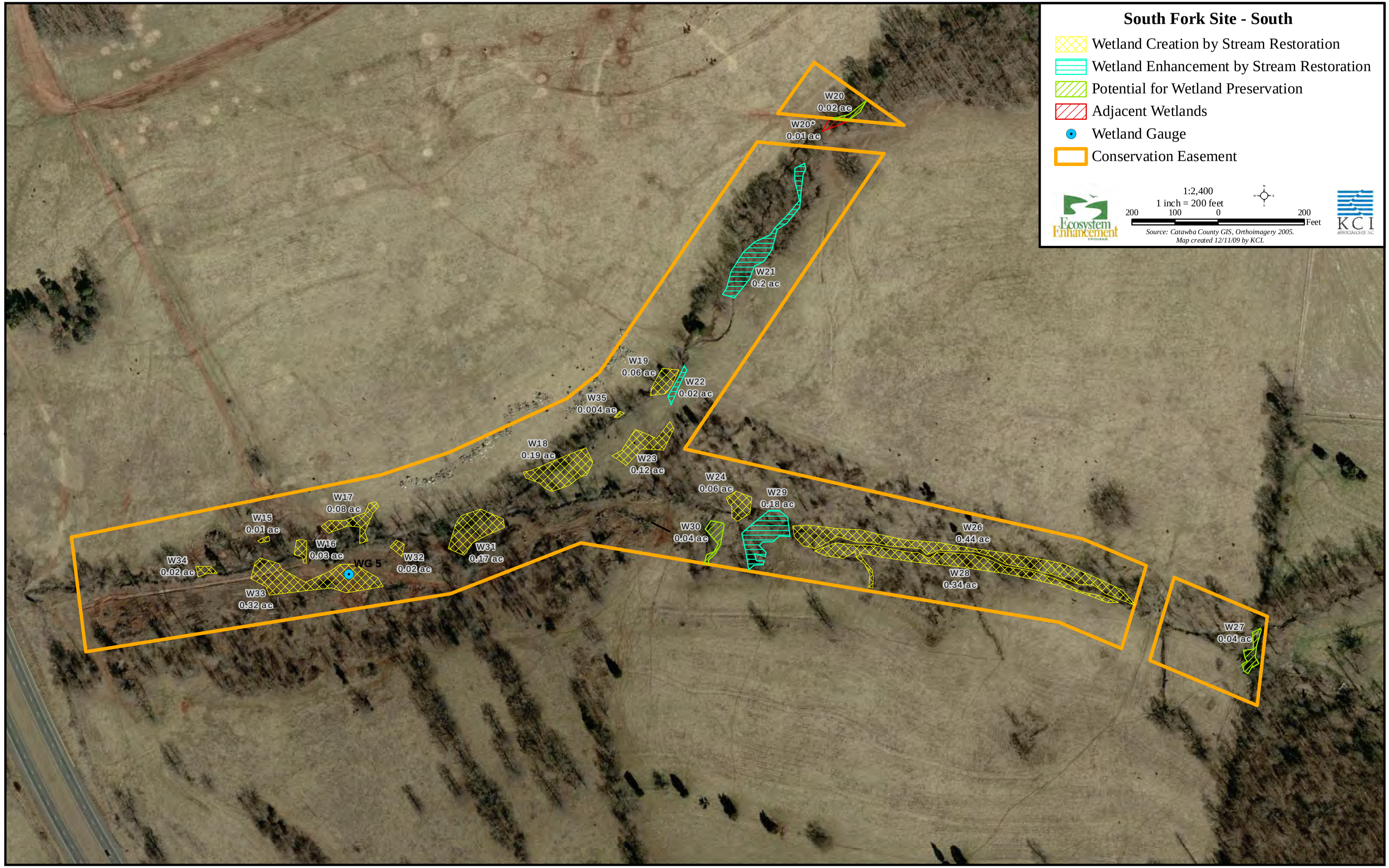


Figure 12.8b - Reference Site Wetland Locations with Gauge Locations

13.0 Design Sheets

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Stantec

801 JONES FRANKLIN ROAD
SUITE 300
RALEIGH, NC 27606
(P) 919-851-6866
(F) 919-851-7024
www.stantec.com
License No. F-0672

CLIENT:

ENVIRONMENTAL BANC & EXCHANGE, LLC
909 CAPABILITY DR.
RALEIGH, NC 27606
(P) 919-829-9909

NORTH FORK MOUNTAIN CREEK STREAM AND WETLAND RESTORATION CATAWBA COUNTY, NC.

ENVIRONMENTAL BANC & EXCHANGE, LLC
RALEIGH, NORTH CAROLINA
APRIL 4, 2011
PROJECT NUMBER: 171300307

SHEET DESCRIPTION

SITE LOCATION

VICINITY MAP NOT TO SCALE

NOT FOR CONSTRUCTION

Revision	By	Appd.	YY.MM.DD

File Name: Plan Set.dwg	CTM	BAM	BAM	11.04.29
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

CONVENTIONAL SYMBOLS

PARCEL LIMITS

FLOODPLAIN LIMITS

GRADING LIMITS

EASEMENT

LIMITS OF DISTURBANCE

WOVEN WIRE FENCE

EXISTING WETLAND

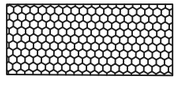
100.00 PROPOSED SPOT ELEVATION

PROPOSED CHANNEL

DOUBLE STEP ROCK CROSS VANE

LOG VANE W/ ROCK J-HOOK

WOODY DEBRIS TOE PROTECTION / BRUSH MATT.



BOULDER CONSTRUCTED RIFFLE

IMPERVIOUS STREAM CHANNEL PLUG

LOG STEP POOL

Stantec Consulting Services Inc.
801 Jones Franklin Rd., Suite 300
Raleigh NC U.S.A.
27606
Tel. 919.851.6866
Fax. 919.851.7024
www.stantec.com
License No. F-0672

REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
CONVENTIONAL SYMBOLS

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION:

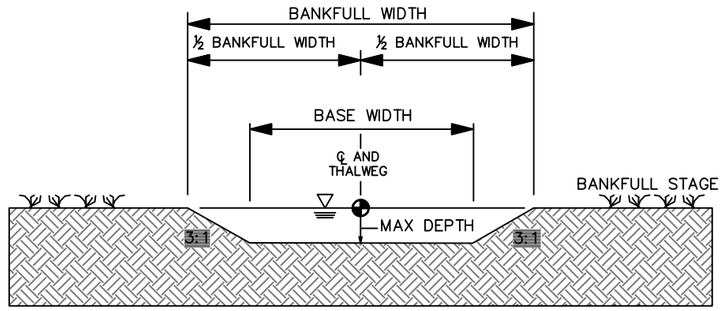
SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
1.1

UT 1 REACH 1
TYPICAL SECTION – RIFFLE
STA 0+00 TO STA 11+50

SCALE: NTS

DIMENSION	LENGTH (FT)
BANKFULL WIDTH	10.0
BASE WIDTH	4.8
MAXIMUM DEPTH	0.8



THALWEG (DEEPEST POINT IN CROSS SECTION) IS LOCATED IN CENTER OF CHANNEL IN A RIFFLE.

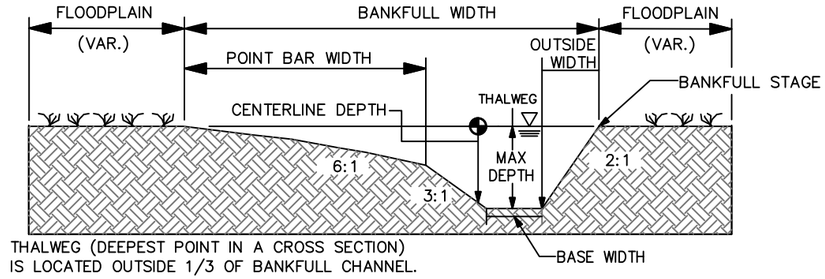
NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– ⊕ – GRADE POINT IS THE CENTERLINE OF THE STREAM
– ALL SHARP CORNERS SHOULD BE ROUNDED

UT 1 REACH 1
TYPICAL SECTION – POOL RIGHT
STA 0+00 TO STA 11+50

SCALE: NTS

MIRROR ABOUT CENTERLINE FOR POOL LEFT

DIMENSION	LENGTH (FT)
BANKFULL WIDTH	12.9
POINT BAR WIDTH	5.0
MAX DEPTH (THALWEG)	1.6
BASE WIDTH	3.4
CENTERLINE DEPTH	1.3



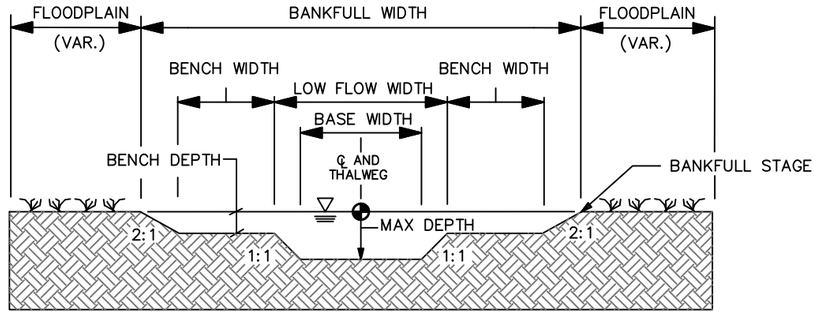
THALWEG (DEEPEST POINT IN A CROSS SECTION)
IS LOCATED OUTSIDE 1/3 OF BANKFULL CHANNEL.

NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– ⊕ – GRADE POINT IS THE CENTERLINE OF THE STREAM
– ALL SHARP CORNERS SHOULD BE ROUNDED

UT 1 REACH 2
TYPICAL SECTION – RIFFLE
STA 11+36 TO STA 21+95

SCALE: NTS

DIMENSION	LENGTH (FT)
BANKFULL WIDTH	12.2
BASE WIDTH	4.2
MAXIMUM DEPTH	1.2
BENCH DEPTH	0.6
LOW FLOW WIDTH	5.4
BENCH WIDTH	1.5



THALWEG (DEEPEST POINT IN CROSS SECTION) IS LOCATED IN CENTER OF CHANNEL IN A RIFFLE.

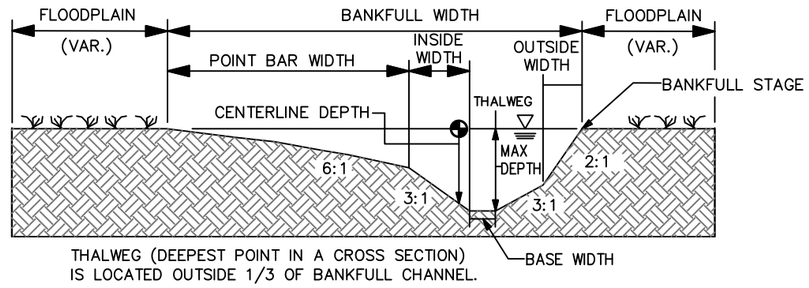
NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– ⊕ – GRADE POINT IS THE CENTERLINE OF THE STREAM
– ALL SHARP CORNERS SHOULD BE ROUNDED

UT 1 REACH 2
TYPICAL SECTION – POOL RIGHT
STA 11+36 TO STA 21+95

SCALE: NTS

MIRROR ABOUT CENTERLINE FOR POOL LEFT

DIMENSION	LENGTH (FT)
BANKFULL WIDTH	15.9
POINT BAR WIDTH	5.5
MAX DEPTH (THALWEG)	1.8
OUTSIDE WIDTH	4.4
CENTERLINE DEPTH	1.7
BASE WIDTH	3.35
INSIDE WIDTH	2.4



THALWEG (DEEPEST POINT IN A CROSS SECTION)
IS LOCATED OUTSIDE 1/3 OF BANKFULL CHANNEL.

NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– ⊕ – GRADE POINT IS THE CENTERLINE OF THE STREAM
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801 Jones Franklin Rd., Suite 300
Raleigh NC U.S.A.
27606
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REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

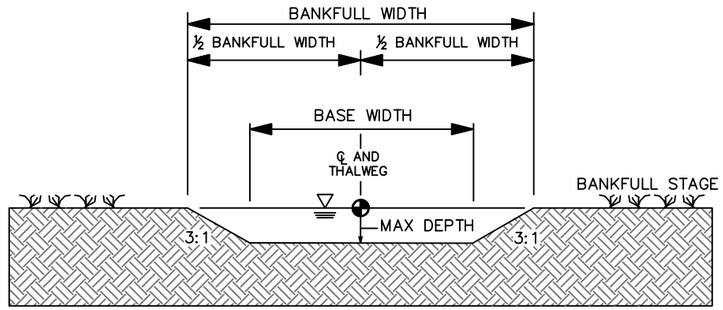
DRAWING TITLE
TYPICAL CROSS-SECTIONS

CADD PLOT:	SCALE: N/A	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	2.1
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

UT 2 REACH 3
TYPICAL SECTION – RIFFLE
STA 0+00 TO STA 7+26

SCALE: NTS

DIMENSION	LENGTH (FT)
BANKFULL WIDTH	7.0
BASE WIDTH	2.6
MAXIMUM DEPTH	0.7



THALWEG (DEEPEST POINT IN CROSS SECTION) IS LOCATED IN CENTER OF CHANNEL IN A RIFFLE.

NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– ⊕ – GRADE POINT IS THE CENTERLINE OF THE STREAM
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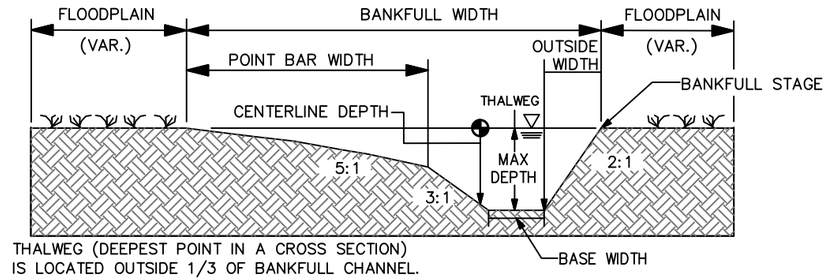
UT 2 REACH 3
TYPICAL SECTION – POOL RIGHT
STA 0+00 TO STA 7+26

SCALE: NTS

MIRROR ABOUT CENTERLINE FOR POOL LEFT

DIMENSION	LENGTH (FT)
BANKFULL WIDTH	9.0
POINT BAR WIDTH	2.5
MAX DEPTH (THALWEG)	1.2
BASE WIDTH	2.0
CENTERLINE DEPTH	1.17



THALWEG (DEEPEST POINT IN A CROSS SECTION)
IS LOCATED OUTSIDE 1/3 OF BANKFULL CHANNEL.

NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
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REVISIONS

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CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
TYPICAL CROSS-SECTIONS

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

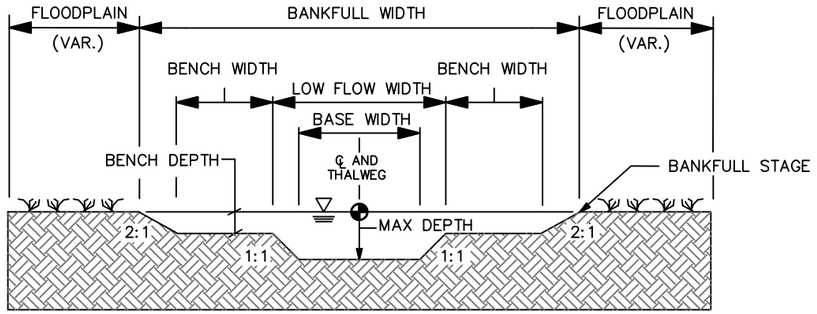
SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
2.2

NORTH FORK MOUNTAIN CREEK REACH 4
TYPICAL SECTION – RIFFLE
STA 0+00 TO STA 21+07

SCALE: NTS

DIMENSION	LENGTH (FT)
BANKFULL WIDTH	18.0
BASE WIDTH	6.0
MAXIMUM DEPTH	2.1
BENCH DEPTH	1.0
LOW FLOW WIDTH	8.2
BENCH WIDTH	2.9



THALWEG (DEEPEST POINT IN CROSS SECTION) IS LOCATED IN CENTER OF CHANNEL IN A RIFFLE.

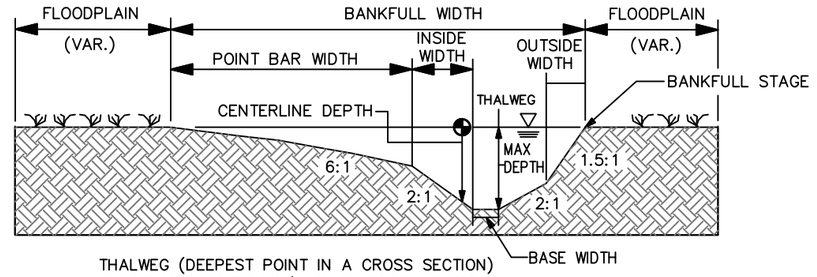
NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– ⊕ – GRADE POINT IS THE CENTERLINE OF THE STREAM
– ALL SHARP CORNERS SHOULD BE ROUNDED

NORTH FORK MOUNTAIN CREEK REACH 4
TYPICAL SECTION – POOL RIGHT
STA 0+00 TO STA 7+26

SCALE: NTS

MIRROR ABOUT CENTERLINE FOR POOL LEFT

DIMENSION	LENGTH (FT)
BANKFULL WIDTH	23.4
POINT BAR WIDTH	8.1
MAX DEPTH (THALWEG)	3.5
OUTSIDE WIDTH	3.0
CENTERLINE DEPTH	3.15
BASE WIDTH	5.0
INSIDE WIDTH	4.3



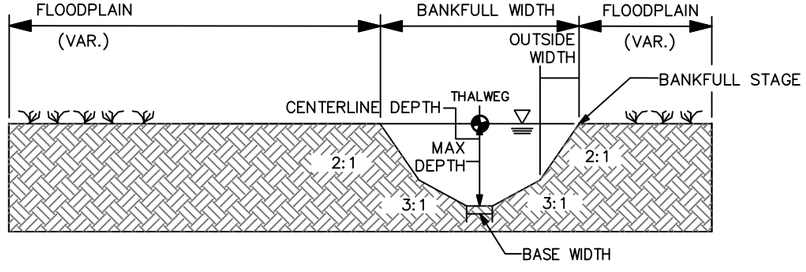
THALWEG (DEEPEST POINT IN A CROSS SECTION)
IS LOCATED OUTSIDE 1/3 OF BANKFULL CHANNEL.

NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– ⊕ – GRADE POINT IS THE CENTERLINE OF THE STREAM
– ALL SHARP CORNERS SHOULD BE ROUNDED

NORTH FORK MOUNTAIN CREEK REACH 4
TYPICAL SECTION – ALTERNATE POOL RIGHT
STA 0+00 TO STA 21+07

SCALE: NTS

DIMENSION	LENGTH (FT)
BANKFULL WIDTH	22.0
MAX DEPTH (THALWEG)	3.5
OUTSIDE WIDTH	3.0
CENTERLINE DEPTH	3.5
BASE WIDTH	4.0



NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
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SCALE: NTS

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REVISIONS

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CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
TYPICAL CROSS-SECTIONS

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
2.3

RADIUS TABLE - REACH 1 AND 2

REACHES 1 & 2						
PC	PT	PC BKF ELEV	PT BKF ELEV	RADIUS	CL RADIUS	POOL
-	+		818.38	-	-	-
0+25.16	0+37.80	818.13	817.53	R1	22.00	RIGHT
0+54.11	0+73.28	817.37	816.87	R2	22.00	LEFT
0+99.52	1+18.76	816.60	816.10	R3	21.00	RIGHT
1+34.13	1+52.89	815.95	815.45	R4	21.00	LEFT
1+72.94	1+93.35	815.25	814.75	R5	23.00	RIGHT
2+08.37	2+31.11	814.59	813.99	R6	24.00	LEFT
2+51.00	2+66.18	813.81	813.21	R7	23.00	RIGHT
2+88.02	2+99.11	813.00	812.40	R8	20.00	LEFT
3+18.08	3+33.90	812.19	811.39	R9	36.00	RIGHT
3+59.24	3+70.12	810.52	809.72	R10	30.00	RIGHT
3+87.79	4+08.42	808.93	808.13	R11	24.00	LEFT
4+28.41	4+49.10	807.03	806.23	R12	30.00	RIGHT
4+70.37	4+88.46	804.95	804.15	R13	30.00	LEFT
5+10.27	5+29.62	803.91	803.41	R14	35.00	RIGHT
5+42.54	5+62.23	803.27	802.77	R15	35.00	RIGHT
5+85.04	6+02.69	802.52	802.02	R16	24.00	LEFT
6+23.75	6+37.99	801.18	800.38	R17	22.00	RIGHT
6+57.07	6+78.74	799.62	798.82	R18	22.00	LEFT
7+00.33	7+24.79	797.95	797.15	R19	25.00	RIGHT
7+39.47	7+60.98	797.08	796.88	R20	24.00	LEFT
7+75.99	7+97.31	796.80	796.60	R21	23.00	RIGHT
8+13.11	8+36.50	796.48	795.88	R22	26.00	LEFT
8+53.46	8+72.25	795.72	795.12	R23	24.00	RIGHT
8+93.79	9+15.51	794.90	794.50	R24	22.00	LEFT
9+32.37	9+50.89	794.33	793.93	R25	20.00	RIGHT
9+74.11	9+92.60	793.70	793.30	R26	20.00	LEFT
10+11.22	10+32.61	793.11	792.71	R27	20.00	RIGHT
10+50.12	10+70.38	792.54	792.14	R28	23.00	LEFT

REACH 1 & 2 (CONTINUED)						
PC	PT	PC BKF ELEV	PT BKF ELEV	RADIUS	CL RADIUS	POOL
10+87.37	11+07.82	791.97	791.37	R29	22.00	RIGHT
11+24.26	11+42.46	791.20	790.60	R30	22.00	LEFT
11+58.89	11+78.75	790.44	789.84	R31	24.00	RIGHT
12+03.38	12+23.16	789.59	789.19	R32	24.00	LEFT
12+42.58	12+60.44	789.00	788.60	R33	20.00	RIGHT
12+80.36	12+97.60	788.40	787.80	R34	20.00	LEFT
13+14.83	13+36.10	787.63	787.03	R35	22.00	RIGHT
13+55.85	13+78.30	786.83	786.23	R36	22.00	LEFT
13+98.04	14+18.79	786.03	785.63	R37	26.00	RIGHT
14+38.80	14+57.37	785.43	785.23	R38	22.00	LEFT
14+75.53	14+96.84	785.05	784.85	R39	23.00	RIGHT
15+12.93	15+36.73	784.69	784.49	R40	25.00	LEFT
15+56.50	15+86.32	784.29	783.79	R41	26.00	RIGHT
16+11.74	16+37.61	783.54	782.94	R42	28.00	LEFT
16+59.00	16+85.12	782.70	782.10	R43	28.00	RIGHT
17+06.35	17+34.62	781.86	781.26	R44	24.00	LEFT
17+56.97	17+80.63	781.01	780.41	R45	28.00	RIGHT
18+01.00	18+28.37	780.18	779.78	R46	25.00	LEFT
18+49.34	18+77.00	779.59	779.19	R47	25.00	RIGHT
19+00.28	19+30.52	778.95	778.15	R48	27.00	LEFT
19+51.53	19+76.01	777.31	776.71	R49	24.00	RIGHT
19+95.24	20+21.19	776.52	775.92	R50	26.00	LEFT
20+40.09	20+68.20	775.73	775.13	R51	27.00	RIGHT
20+87.31	21+13.92	774.94	774.34	R52	26.00	LEFT
21+34.42	21+58.73	774.14	773.74	R53	25.00	RIGHT
21+80.48	22+02.59	773.53	773.33	R54	25.00	LEFT
22+27.07	22+51.47	773.10	772.90	R55	24.00	RIGHT
22+80.09	22+98.54	772.63	772.23	R56	25.00	LEFT
23+18.07	23+46.90	772.04	771.64	R57	25.00	RIGHT
23+71.74	23+90.90	771.39	770.99	R58	30.00	LEFT
24+15.02	24+32.98	770.78	770.38	R59	28.00	RIGHT
24+58.69	24+80.56	770.17	769.77	R60	32.00	LEFT
25+04.17	-	769.58			-	-

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REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
DESIGN TABLES

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
2.4

STRUCTURE TABLE - REACH 1 AND 2

STRUCTURE TABLE REACHES 1 & 2			
STATION	STRUCTURE	INVERT	DROP
0+00.00	BOULDER CONSTRUCTED RIFFLE	817.58	N/A
0+25.16	LOG STEP	817.33	0.60
0+54.11	LOG STEP	816.57	0.50
0+99.52	LOG STEP	815.80	0.50
1+34.13	LOG STEP	815.15	0.50
1+72.94	LOG STEP	814.45	0.50
2+08.37	LOG STEP	813.79	0.60
2+51.00	LOG STEP	813.01	0.60
2+88.02	LOG STEP	812.20	0.60
3+18.08	LOG STEP	811.39	0.80
3+33.90	BOULDER CONSTRUCTED RIFFLE	810.59	N/A
3+59.24	LOG STEP	809.72	0.80
3+70.12	BOULDER CONSTRUCTED RIFFLE	808.92	N/A
3+87.79	LOG STEP	808.13	0.80
4+08.42	BOULDER CONSTRUCTED RIFFLE	807.33	N/A
4+28.41	LOG STEP	806.23	0.80
4+49.10	BOULDER CONSTRUCTED RIFFLE	805.43	N/A
4+70.37	LOG STEP	804.15	0.80
4+88.46	BOULDER CONSTRUCTED RIFFLE	803.35	N/A
5+10.27	LOG STEP	803.11	0.50
5+42.54	ROCK AND LOG STEP	802.47	0.50
5+85.04	LOG STEP	801.72	0.50
6+02.69	BOULDER CONSTRUCTED RIFFLE	801.22	N/A
6+23.75	LOG STEP	800.38	0.80
6+37.99	BOULDER CONSTRUCTED RIFFLE	799.58	N/A
6+57.07	LOG STEP	798.82	0.80
6+78.74	BOULDER CONSTRUCTED RIFFLE	798.02	N/A
7+00.33	LOG STEP	797.15	0.80
7+39.47	LOG STEP	796.28	0.20
7+75.99	LOG STEP	796.00	0.20
8+13.11	LOG STEP	795.68	0.60
8+53.46	LOG STEP	794.92	0.60
8+93.79	LOG STEP	794.10	0.40
9+32.37	LOG STEP	793.53	0.40
9+74.11	LOG STEP	792.90	0.40
10+11.22	LOG STEP	792.31	0.40

STRUCTURE TABLE REACHES 1 & 2 (CONTINUED)			
STATION	STRUCTURE	INVERT	DROP
10+50.12	LOG STEP	791.74	0.40
10+87.37	LOG STEP	791.17	0.60
11+24.26	LOG STEP	790.40	0.60
11+58.89	LOG STEP	789.64	0.60
12+03.38	LOG STEP	788.79	0.40
12+42.58	LOG STEP	788.20	0.40
12+80.36	LOG STEP	787.60	0.60
13+14.83	LOG STEP	786.83	0.60
13+55.85	LOG STEP	786.03	0.60
13+98.04	LOG STEP	785.23	0.40
14+38.80	LOG STEP	784.63	0.20
14+57.37	BOULDER CONSTRUCTED RIFFLE	784.43	N/A
14+75.53	LOG STEP	783.45	0.20
15+12.93	LOG STEP	783.09	0.20
15+56.50	LOG STEP	782.69	0.50
16+11.74	LOG STEP	781.94	0.60
16+59.00	LOG STEP	781.10	0.60
17+06.35	LOG STEP	780.26	0.60
17+56.97	LOG STEP	779.41	0.60
18+01.00	LOG STEP	778.58	0.40
18+49.34	LOG STEP	777.99	0.40
19+00.28	LOG STEP	777.35	0.80
19+30.52	BOULDER CONSTRUCTED RIFFLE	776.95	N/A
19+51.53	LOG STEP	775.71	0.60
19+95.24	LOG STEP	774.92	0.60
20+40.09	LOG STEP	774.13	0.60
20+87.31	LOG STEP	773.34	0.60
21+34.42	LOG STEP	772.54	0.40
21+80.48	LOG STEP	771.93	0.20
22+27.07	LOG STEP	771.50	0.20
22+80.09	LOG STEP	771.03	0.40
23+18.07	LOG STEP	770.44	0.40
23+71.74	LOG STEP	769.79	0.40
24+15.02	LOG STEP	769.18	0.40
24+58.69	LOG STEP	768.57	0.40

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REVISIONS

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CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
DESIGN TABLES

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: D.A.B.

SHEET NO.
2.5

RADIUS TABLE - REACH 3

REACH 3						
PC	PT	PC BKF ELEV	PT BKF ELEV	RADIUS	CL RADIUS	POOL
-	0+00.00	-	825.10	-	-	-
0+14.33	0+35.64	824.92	824.92	R1	25.0	RIGHT
0+53.47	0+70.29	824.70	824.70	R2	25.0	LEFT
0+84.84	1+02.52	824.52	824.52	R3	25.0	RIGHT
1+19.64	1+36.08	824.30	823.70	R4	25.0	LEFT
1+52.37	1+71.27	823.50	822.90	R5	25.0	RIGHT
1+91.05	2+05.71	822.11	821.31	R6	25.0	LEFT
2+27.00	2+50.82	820.25	819.45	R7	25.0	RIGHT
2+61.07	2+73.22	818.43	817.63	R8	25.0	LEFT
2+93.72	3+03.92	816.85	816.05	R9	25.0	LEFT
3+24.35	3+44.03	814.74	813.94	R10	25.0	RIGHT
3+68.25	3+86.81	812.54	811.74	R11	25.0	LEFT
3+99.83	4+20.19	810.96	810.36	R12	25.0	RIGHT
4+33.59	4+53.64	809.69	809.29	R13	25.0	LEFT
4+63.25	4+74.22	809.22	808.82	R14	25.0	RIGHT
5+06.53	5+16.97	808.58	808.18	R15	25.0	RIGHT
5+33.36	5+52.47	807.36	806.96	R16	25.0	LEFT
5+74.92	5+85.95	805.83	805.23	R17	25.0	RIGHT
6+09.04	6+24.06	804.31	803.71	R18	25.0	RIGHT
6+41.17	6+53.44	803.20	803.00	R19	25.0	LEFT
6+74.04	-	802.40	-		-	-

STRUCTURE TABLE - REACH 3

STRUCTURE TABLE REACH 3			
STATION	STRUCTURE	INVERT	DROP
0+14.33	LOG STEP	824.22	0.0
0+53.47	LOG STEP	824.00	0.0
0+84.84	LOG STEP	823.82	0.0
1+19.64	LOG STEP	823.60	0.6
1+52.37	LOG STEP	822.80	0.6
1+71.27	BOULDER CONSTRUCTED RIFFLE	822.20	N/A
1+91.05	LOG STEP	821.41	0.8
2+05.71	BOULDER CONSTRUCTED RIFFLE	820.61	N/A
2+27.00	LOG STEP	819.55	0.8
2+50.82	BOULDER CONSTRUCTED RIFFLE	818.75	N/A
2+61.07	LOG STEP	817.73	0.8
2+73.22	BOULDER CONSTRUCTED RIFFLE	816.93	N/A
2+93.72	LOG STEP	816.15	0.8
3+03.92	BOULDER CONSTRUCTED RIFFLE	815.35	N/A
3+24.35	LOG STEP	814.04	0.8
3+44.03	BOULDER CONSTRUCTED RIFFLE	813.24	N/A
3+68.25	LOG STEP	811.84	0.8
3+86.81	BOULDER CONSTRUCTED RIFFLE	811.04	N/A
3+99.83	LOG STEP	810.26	0.6
4+20.19	BOULDER CONSTRUCTED RIFFLE	809.66	N/A
4+33.59	LOG STEP	808.99	0.4
4+63.25	LOG STEP	808.52	0.4
5+06.53	LOG STEP	807.88	0.4
5+16.97	BOULDER CONSTRUCTED RIFFLE	807.48	N/A
5+33.36	LOG STEP	806.66	0.4
5+52.47	BOULDER CONSTRUCTED RIFFLE	806.26	N/A
5+74.92	LOG STEP	805.13	0.6
5+85.95	BOULDER CONSTRUCTED RIFFLE	804.53	N/A
6+09.04	LOG STEP	803.61	0.6
6+24.06	BOULDER CONSTRUCTED RIFFLE	803.01	N/A
6+41.17	ROCK AND LOG STEP	802.50	0.2
6+53.44	BOULDER CONSTRUCTED RIFFLE	802.30	N/A

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801 Jones Franklin Rd., Suite 300
Raleigh NC U.S.A.
27606
Tel. 919.851.6866
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REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
DESIGN TABLES

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
2.6

RADIUS TABLE - REACH 4

REACH 4						
PC	PT	PC BKF ELEV	PT BKF ELEV	RADIUS	CL RADIUS	POOL
-	0+00.00	-	786.50	-	-	-
0+08.70	0+53.89	786.35	786.15	R1	36.0	LEFT
0+88.69	1+23.53	785.55	785.55	R2	200.0	RIGHT
1+55.81	1+88.08	785.00	785.00	R3	54.0	LEFT
2+44.91	3+02.25	784.03	784.03	R4	40.0	RIGHT
3+42.15	3+89.80	783.43	783.43	R5	46.0	LEFT
4+32.67	4+93.56	782.87	782.87	R6	42.0	RIGHT
5+37.17	5+93.00	782.39	782.39	R7	45.0	LEFT
6+50.27	7+05.42	781.82	781.82	R8	45.0	RIGHT
7+50.88	7+99.91	781.36	781.36	R9	45.0	LEFT
8+45.99	9+02.31	780.86	780.86	R10	45.0	RIGHT
9+60.65	10+04.73	780.16	779.96	R11	51.0	LEFT
10+55.44	11+13.81	779.40	779.20	R12	48.0	RIGHT
11+74.90	12+18.13	778.41	778.41	R13	52.0	LEFT
12+57.10	12+93.25	777.82	777.82	R14	250.0	LEFT
13+27.62	13+69.25	777.24	777.24	R15	48.0	LEFT
14+16.85	14+73.22	776.33	776.33	R16	45.0	RIGHT
15+14.02	15+66.01	775.56	775.36	R17	45.0	LEFT
16+03.92	16+63.67	774.64	774.54	R18	45.0	RIGHT
17+08.70	17+61.44	773.68	773.68	R19	40.0	LEFT
18+28.61	18+78.40	772.27	772.27	R20	44.0	RIGHT
19+15.45	19+55.50	771.64	771.44	R21	52.0	LEFT
19+93.76	20+27.45	770.79	770.59	R22	54.0	LEFT
21+07.02	-	768.52	-			-

STRUCTURE TABLE - REACH 4

STRUCTURE TABLE REACH 4			
STATION	STRUCTURE	INVERT	DROP
0+08.70	J-HOOK	784.25	0.2
0+53.89	BOULDER CONSTRUCTED RIFFLE	784.05	N/A
1+55.81	J-HOOK	782.90	0.0
1+88.08	BOULDER CONSTRUCTED RIFFLE	782.90	N/A
9+60.65	J-HOOK	778.06	0.2
10+55.44	J-HOOK	777.30	0.2
11+13.81	BOULDER CONSTRUCTED RIFFLE	777.10	N/A
11+74.90	J-HOOK	776.31	0.0
12+18.13	BOULDER CONSTRUCTED RIFFLE	776.31	N/A
12+93.25	BOULDER CONSTRUCTED RIFFLE	775.72	N/A
14+16.85	J-HOOK	774.23	0.0
15+14.02	J-HOOK	773.46	0.2
16+03.92	J-HOOK	772.54	0.1
17+61.44	BOULDER CONSTRUCTED RIFFLE	771.58	N/A
19+15.45	J-HOOK	769.54	0.2
19+93.76	J-HOOK	768.69	0.2
20+45.00	J-HOOK	768.69	0.2
20+45.00	DOUBLE STEP ROCK CROSS VANE	768.69	0.2

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Raleigh NC U.S.A.
27606
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REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
DESIGN TABLES

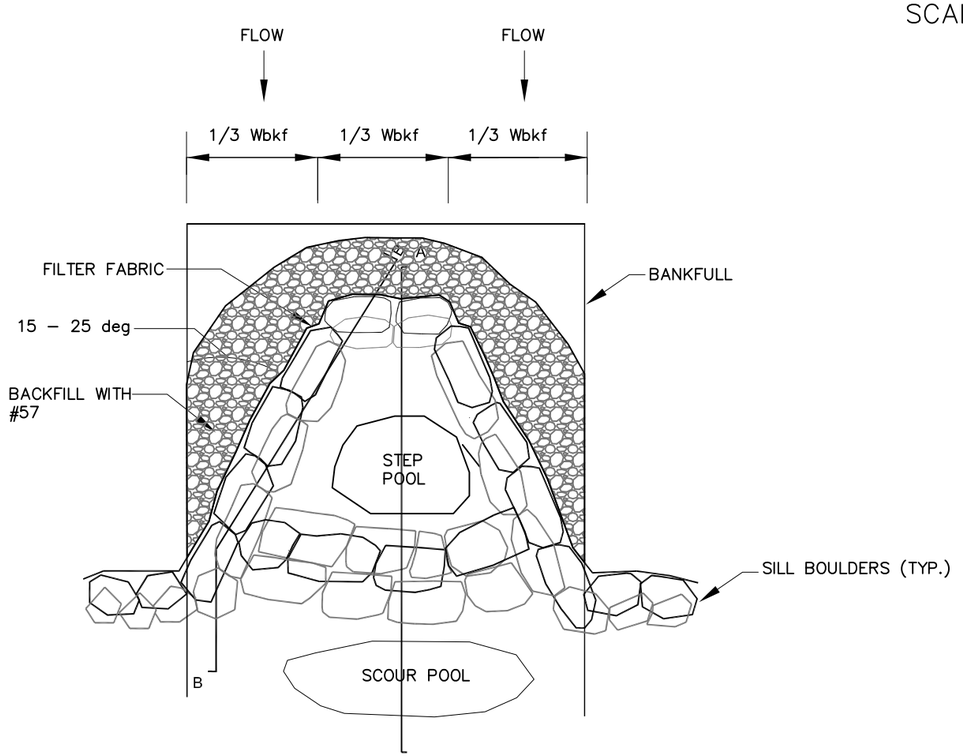
CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

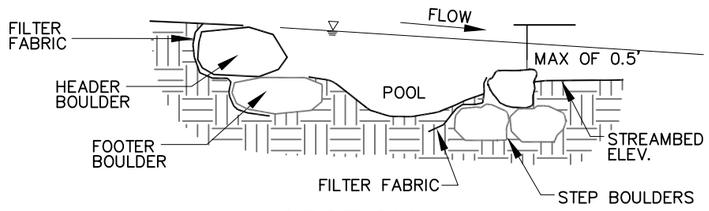
SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
2.7

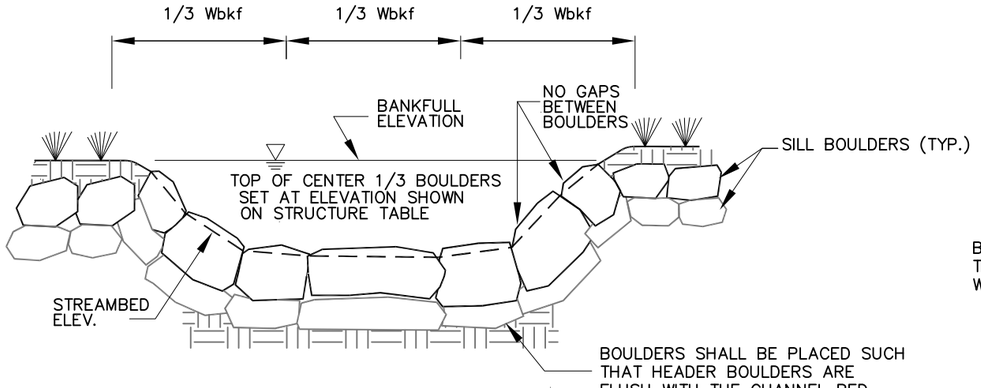
DOUBLE STEP ROCK CROSS VANE

SCALE: NTS

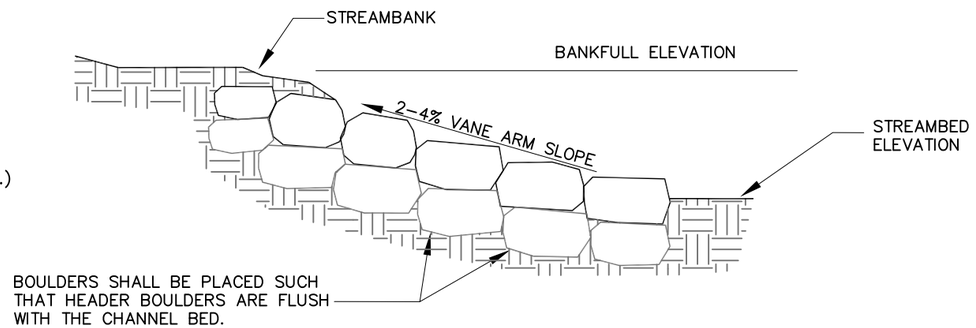




SECTION A–A



CROSS–SECTION



SECTION B–B

NOTES:

1. ALL STONE IS TO BE STRUCTURE STONE.
2. FOOTER BOULDERS AND VANE BOULDERS SHALL BE NATIVE STONE OR SHOT ROCK, CUBICAL OR RECTANGULAR IN NATURE.
3. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE STRUCTURE TO PREVENT WASHOUT OF SEDIMENT THROUGH BOULDER GAPS. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER BOULDER TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.
4. SLOPE OF VANE ARM SHALL BE 2–4%.
5. DIMENSIONS AND SLOPES MAY BE ADJUSTED TO FIT BY THE DESIGN ENGINEER.
6. GAPS BETWEEN BOULDERS SHALL BE MINIMIZED BY FITTING BOULDERS TIGHTLY TOGETHER AND PLUGGING WITH STRUCTURE STONE, CLASS "A" RIP RAP OR CHINKING STONE APPROVED BY DESIGN ENGINEER, AND LINING WITH FILTER FABRIC.
7. THERE SHALL BE NO DROP GREATER THAN 6 INCHES OVER EACH STEP, UNLESS DIRECTED BY DESIGNER.

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CERTIFICATION AND SEAL

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NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

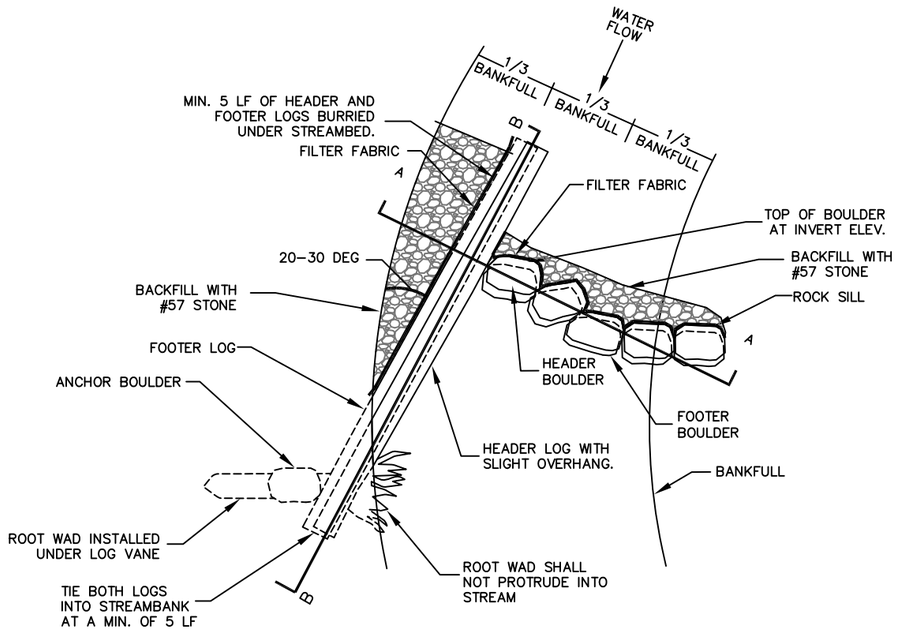
PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
DOUBLE STEP ROCK CROSS VANE

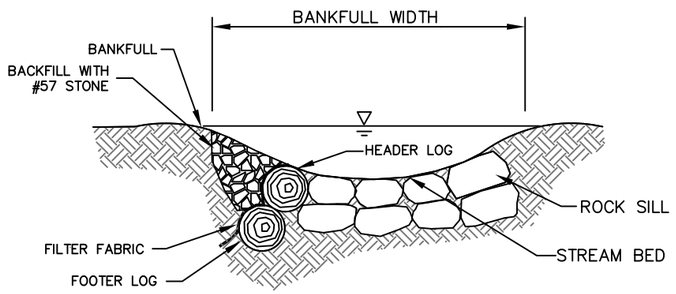
CADD PLOT: C.T.M.	SCALE: N/A	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	3.1
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

LOG VANE WITH ROCK J–HOOK

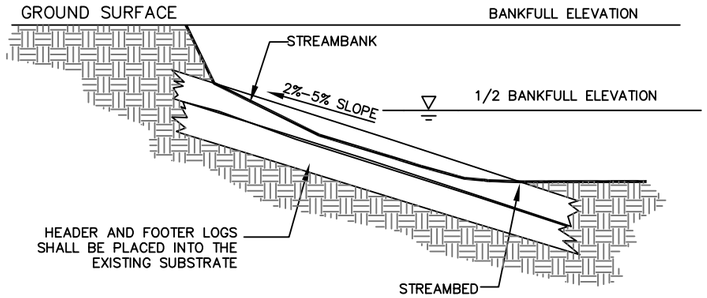
SCALE: NTS



PLAN VIEW



SECTION A–A



SECTION B–B

NOTES FOR LOG VANE WITH ROCK J–HOOK

1. FILTER FABRIC SHALL BE INSTALLED ON THE UPSTREAM SIDE OF THE STRUCTURE 1/4 DIAMETER LENGTH FROM THE TOP OF THE LOG. THE NAILS SHALL BE NO GREATER THAN 12 INCHES ON CENTER. FILTER FABRIC SHALL BE BURIED IN THE BOTTOM OF THE CHANNEL AND SHALL BE PLACED THE ENTIRE LENGTH OF STRUCTURE.
2. A HYDRAULIC EXCAVATOR, WITH A HYDRAULIC THUMB, SHALL BE USED TO PLACE BOULDERS AND LOGS WITH THE SUPERVISION OF THE ENGINEER.
3. SEE SPECIAL PROVISIONS FOR HEADER AND FOOTER DIMENSIONS.
4. HEADER AND FOOTER LOGS SHALL BE PLACED IN A PRE–EXCAVATED TRENCH. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE VANE STRUCTURE PRIOR TO BACKFILLING THE TRENCH WITH ABC STONE. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER LOG TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF STRUCTURE. LOGS SHALL HAVE A MINIMUM TRUNK DIAMETER OF 12".
5. 1/3 OF THE WAY ACROSS THE CHANNEL FROM THE OUTSIDE BANK THE HEADER ROCK SHALL BE PLACED AT 0.2 FT ABOVE THE CHANNEL INVERT ELEVATION.
6. THERE SHALL BE NO GAPS BETWEEN THE HEADER ROCKS.
7. LOG VANE SHALL EXTEND FROM THE BOTTOM OF THE BED ELEVATION TO THE HEAD OF THE VANE AT A MIN. DEPTH OF ½ BANKFULL ELEVATION. THE LOG VANE ARM SHALL HAVE A SLOPE OF 2%–5%. HEADER AND FOOTER LOGS SHALL BE TIED SECURELY INTO THE BANK IN SUCH A WAY THAT ELIMINATES THE POSSIBILITY OF STREAMFLOW DIVERTING AROUND THEM.
8. ANY SOIL DISTURBED DURING THE PLACEMENT OF J–HOOK LOG VANES, SHALL BE SEEDED USING TEMPORARY AND PERMANENT SEEDING METHODS.

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801 Jones Franklin Rd., Suite 300
Raleigh NC U.S.A.
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Fax. 919.851.7024
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REVISIONS

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CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

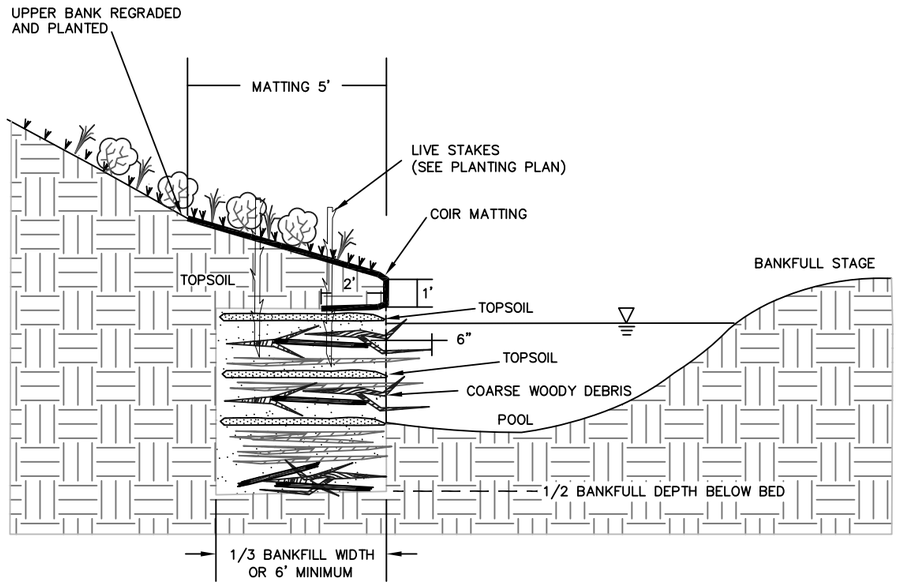
PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
LOG VANE WITH ROCK J-HOOK

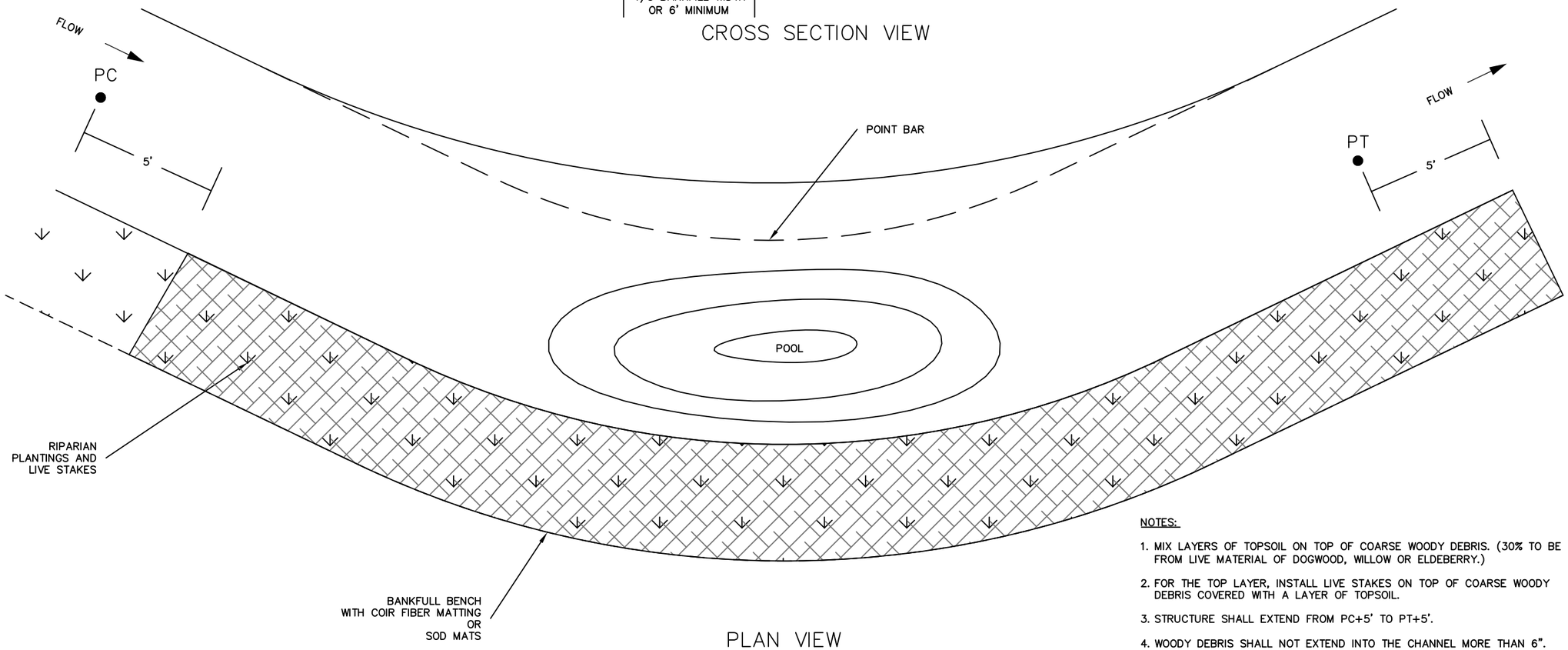
CADD PLOT: C.T.M.	SCALE: N/A	SHEET NO. 3.2
VOID PLOT:	DRAWN BY: C.T.M.	
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

WOODY DEBRIS TOE PROTECTION

SCALE: NTS



CROSS SECTION VIEW



PLAN VIEW

NOTES:

1. MIX LAYERS OF TOPSOIL ON TOP OF COARSE WOODY DEBRIS. (30% TO BE FROM LIVE MATERIAL OF DOGWOOD, WILLOW OR ELDEBERRY.)
2. FOR THE TOP LAYER, INSTALL LIVE STAKES ON TOP OF COARSE WOODY DEBRIS COVERED WITH A LAYER OF TOPSOIL.
3. STRUCTURE SHALL EXTEND FROM PC+5' TO PT+5'.
4. WOODY DEBRIS SHALL NOT EXTEND INTO THE CHANNEL MORE THAN 6".

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REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

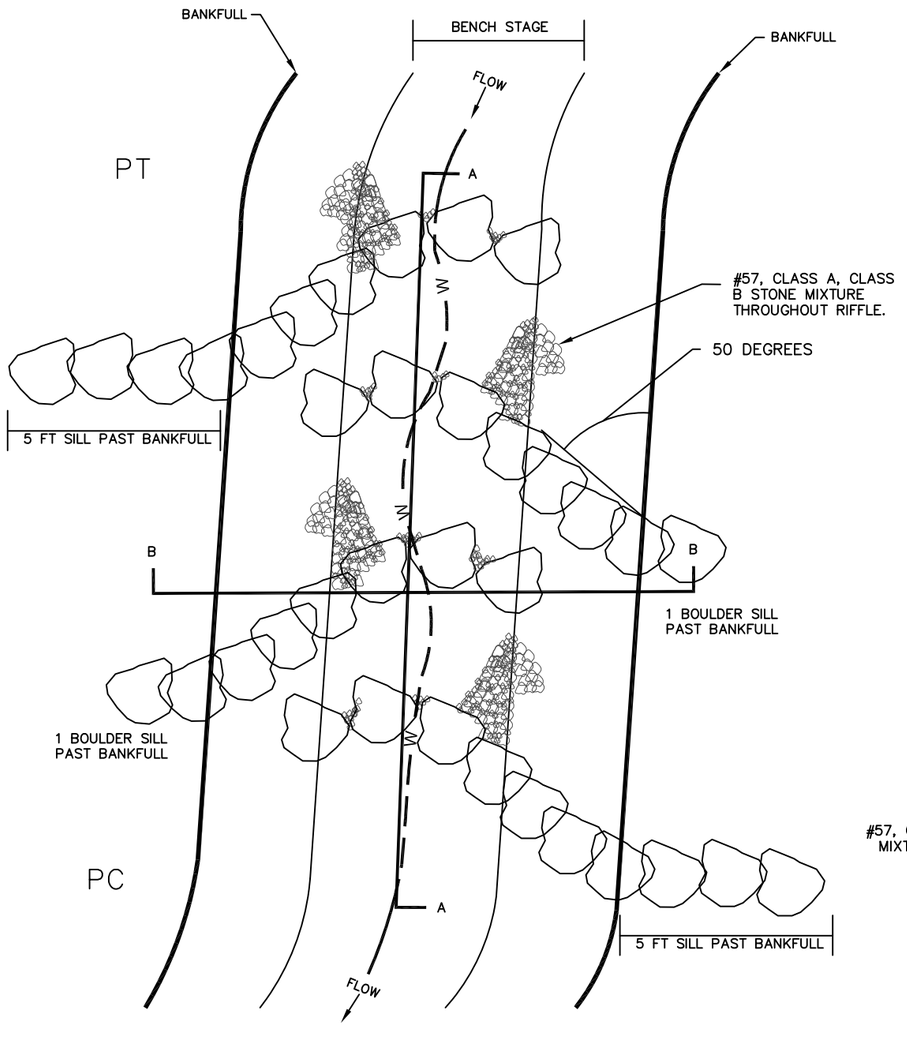
NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIAN A. MAZZOCHI

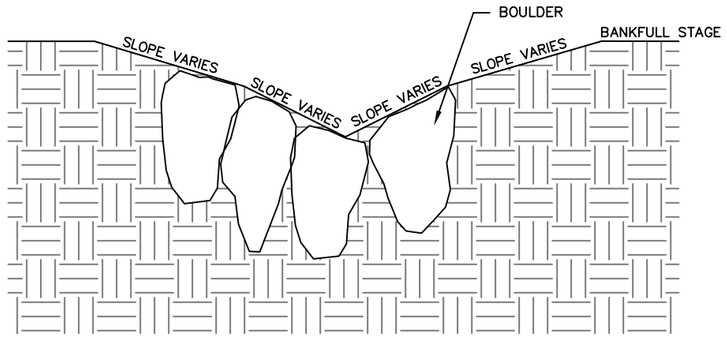
PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
WOODY DEBRIS TOE PROTECTION

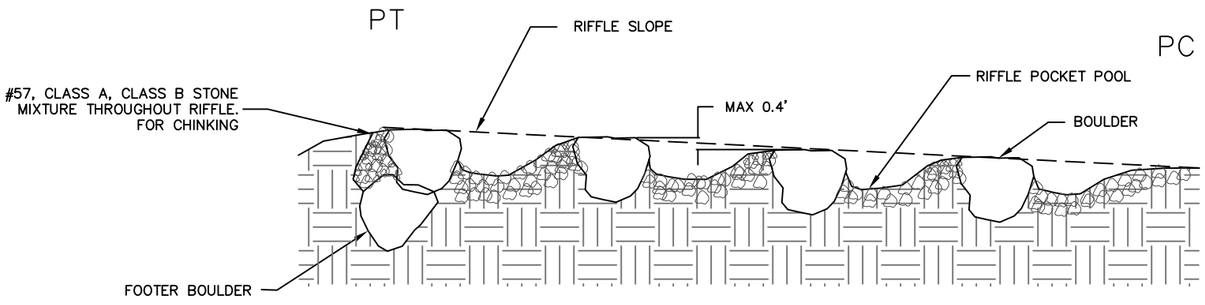
CADD PLOT:	SCALE: N/A	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	3.3
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	



PLAN VIEW



SECTION B–B



SECTION A–A

NOTES FOR BOULDER CONSTRUCTED RIFFLE

1. A MIXURE OF #57 STONE, CLASS A AND CLASS B STONE WILL BE USED IN THE RIFFLES TO CHINK GAPS IN THE ANCHOR BOULDERS.
2. NO COIR MATTING SHALL BE INSTALLED IN THE LOW–FLOW CHANNEL. COIR MATTING SHALL BE INSTALLED ABOVE THE INNER–BERM STAGE. SEE TYPICAL CROSS–SECTION DATA FOR INNER BERM INFORMATION.
3. THE MAXIMUM AMOUNT OF DROP FROM ONE MINI–VANE TO THE NEXT SHALL BE NO GREATER THAN 0.4 FT. THE COMBINED AMOUNT OF DROP OVER ALL THE MINI–VANES SHALL NOT EXCEED THE TOTAL AMOUNT OF FALL IN THE RIFFLE SLOPE.
4. ALL STONES ARE TO BE STRUCTURE STONE AS DETAILS IN THE PROJECT MANUAL.
5. LOW POINT SHALL ALTERNATE LEFT AND RIGHT OF C/L BY 6".
6. MINIVANES SHALL BE EQUALLY SPACED.

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Raleigh NC U.S.A.
27606
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REVISIONS

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CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
BOULDER CONSTRUCTED RIFFLE

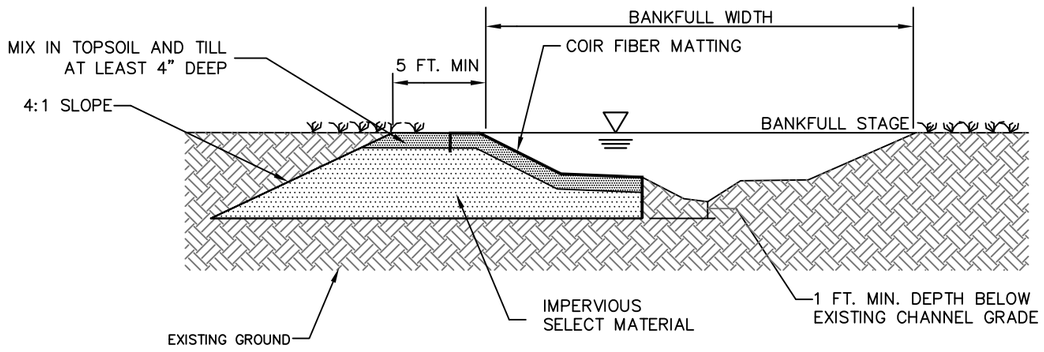
CADD PLOT: C.T.M.
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
3.4

IMPERVIOUS STREAM CHANNEL PLUG

SCALE: NTS

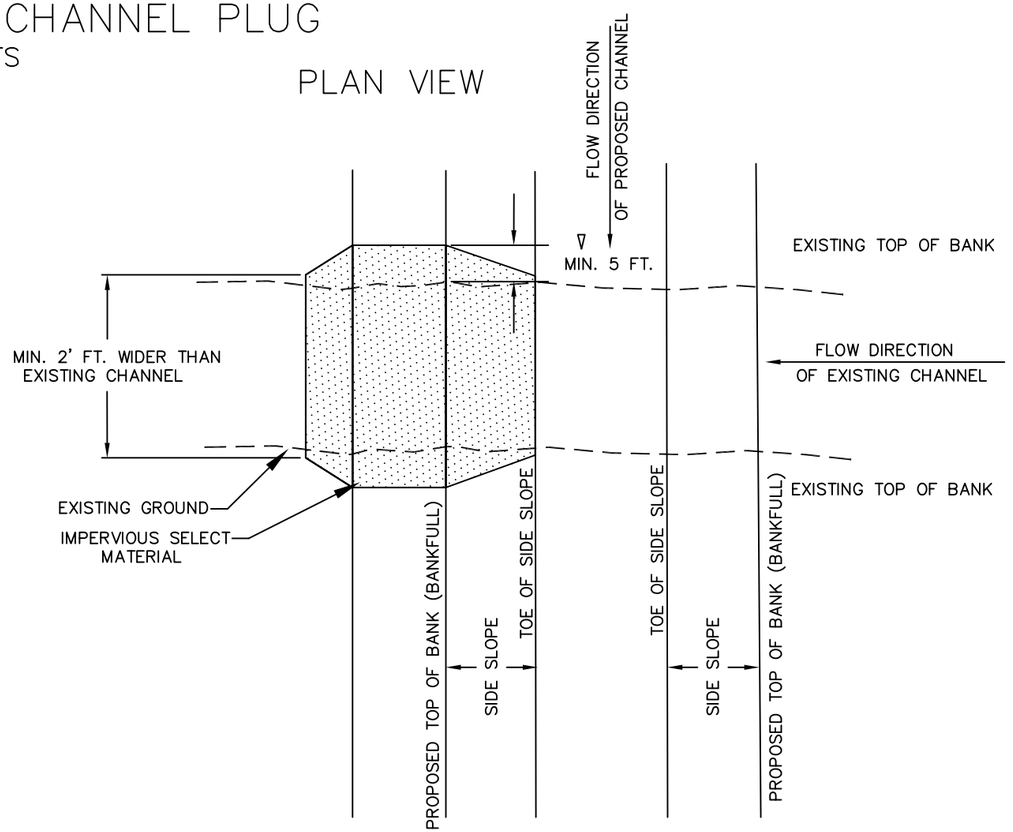


CROSS-SECTION

NOTES

1. BEFORE WRAPPING PLUG WITH COIR FIBER MATTING, MIX IN TOPSOIL AND TILL AT LEAST THE UPPER 4" TO HELP VEGETATION TO ESTABLISH.
2. RAKE SOIL LEVEL AND ADD SEED AND MULCH BEFORE INSTALLING COIR FIBER MATTING.

PLAN VIEW



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CERTIFICATION AND SEAL

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NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIAN A. MAZZOCHI

PROJECT NAME

NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE

IMPERVIOUS STREAM CHANNEL PLUG

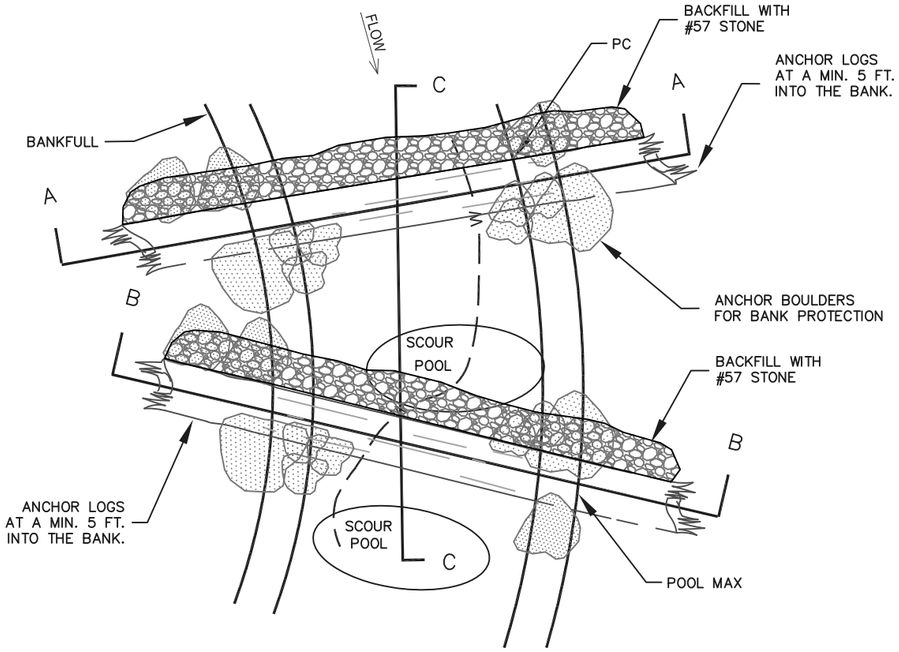
CADD PLOT: C.T.M.
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

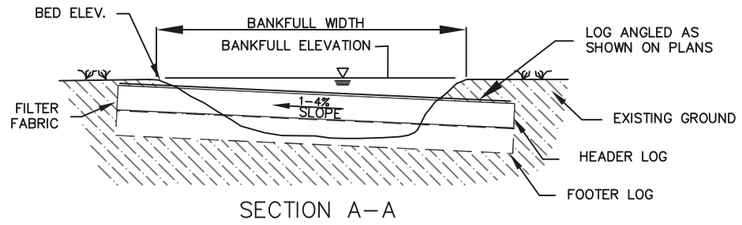
SHEET NO. 3.5

LOG STEP POOL

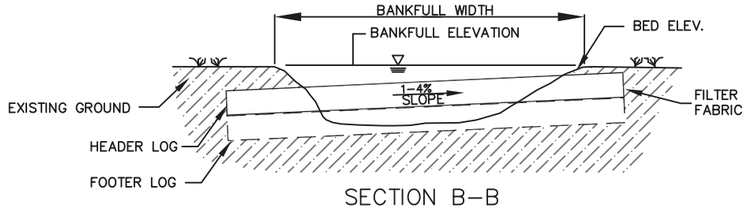
SCALE: NTS



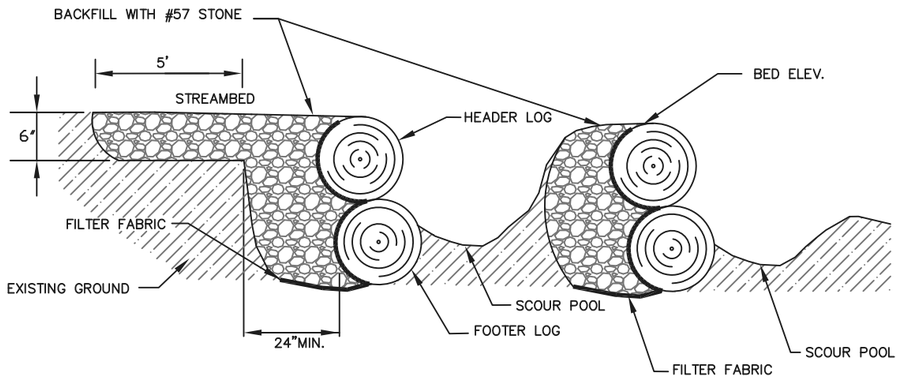
PLAN VIEW



SECTION A–A



SECTION B–B



SECTION C–C

NOTES

LOGS SHALL BE HAVE A MINIMUM TRUNK DIAMETER OF 12"

LOG STEPS SHALL BE CONSTRUCTED WITH 1 FOOTER LOG AND 1 HEADER LOG.

NAIL FILTER FABRIC ON TOP OF FOOTER LOG USING 3" 10D GALVANIZED COMMON NAIL ON 1' SPACING ALONG THE LOG.

PLACE HEADER LOG SLIGHTLY BACK ON TOP OF THE FOOTER LOG.

PLACE LOGS AND BACKFILL WITH #57 STONE.

FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER LOG TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.

LOGS SHALL POINT TOWARDS CENTER OF RADIUS.

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REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIAN A. MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

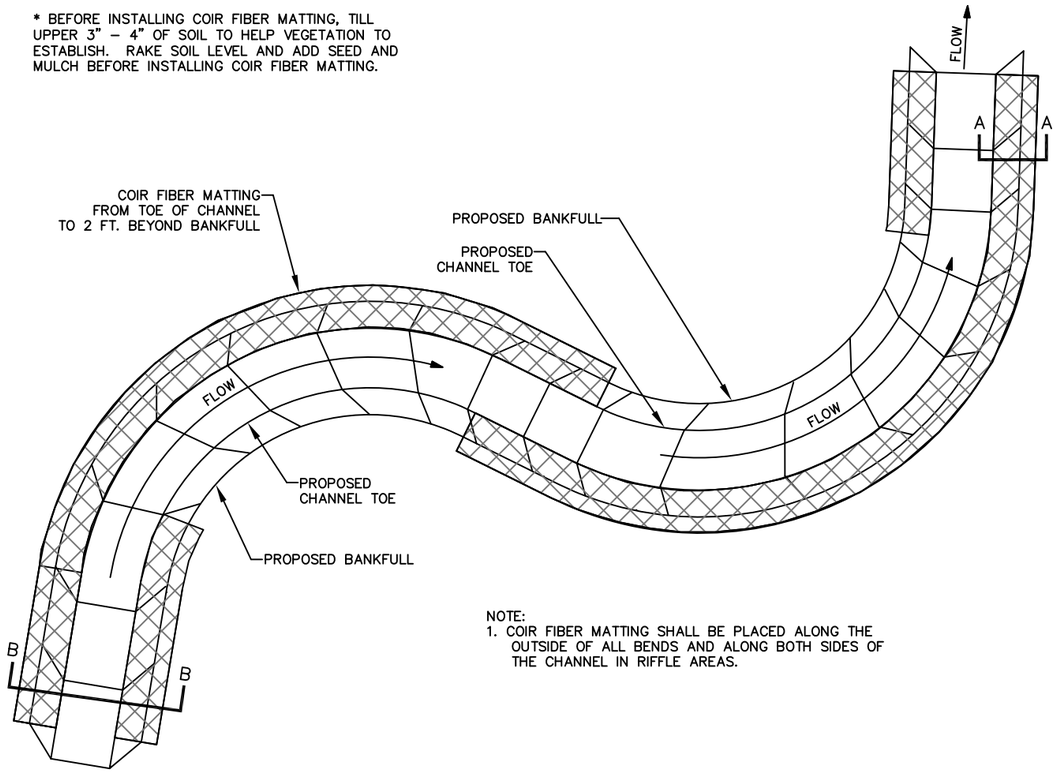
DRAWING TITLE
LOG STEP POOL

CADD PLOT: C.T.M.	SCALE: N/A	SHEET NO. 3.6
VOID PLOT:	DRAWN BY: C.T.M.	
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

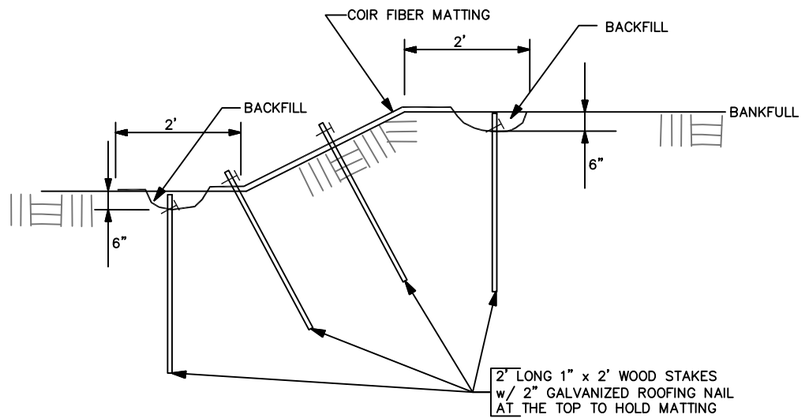
TYPICAL MATTING DETAIL

SCALE: NTS

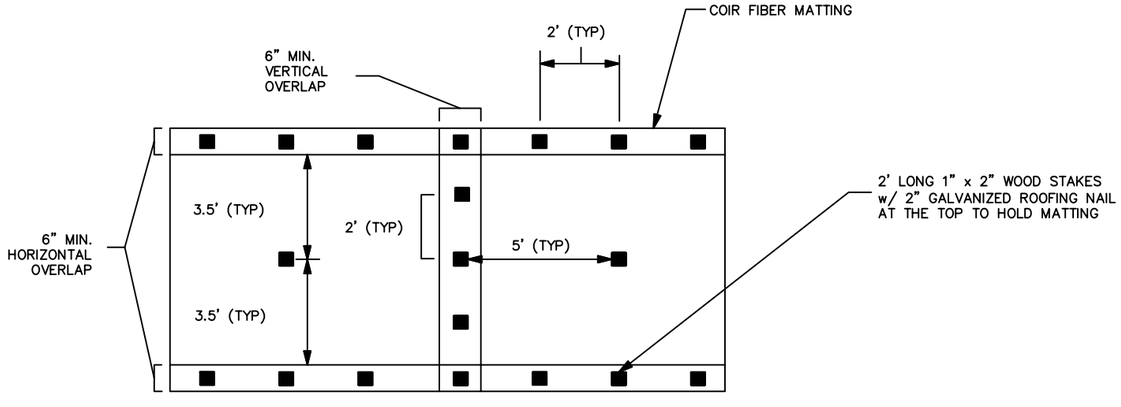
* BEFORE INSTALLING COIR FIBER MATTING, TILL UPPER 3" – 4" OF SOIL TO HELP VEGETATION TO ESTABLISH. RAKE SOIL LEVEL AND ADD SEED AND MULCH BEFORE INSTALLING COIR FIBER MATTING.



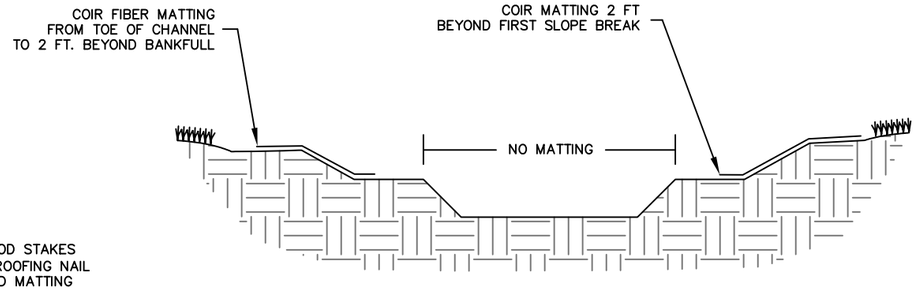
NOTE:
1. COIR FIBER MATTING SHALL BE PLACED ALONG THE OUTSIDE OF ALL BENDS AND ALONG BOTH SIDES OF THE CHANNEL IN RIFFLE AREAS.



SECTION A–A



MATTING STAKING VIEW



SECTION B–B

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REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

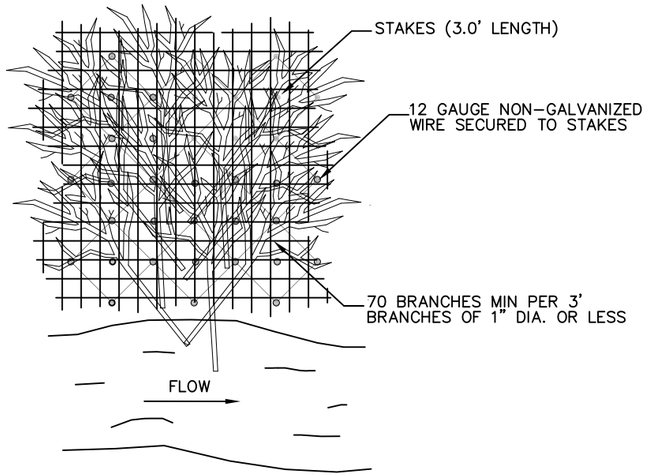
PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
TYPICAL MATTING

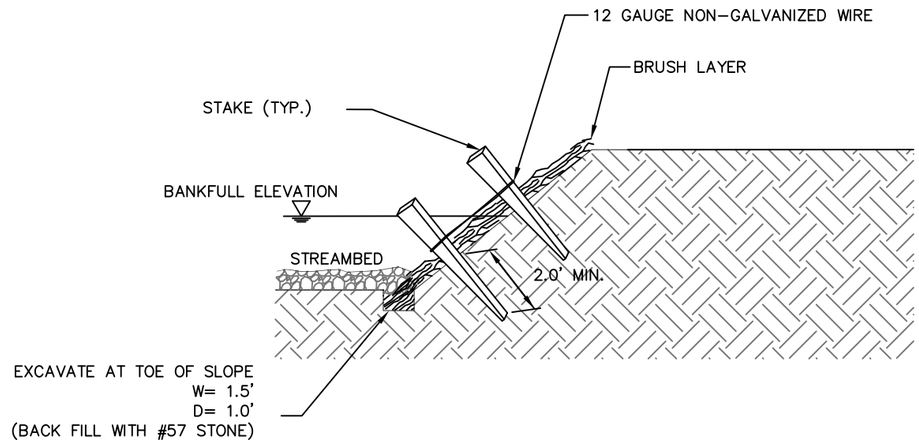
CADD PLOT: C.T.M.	SCALE: N/A	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	3.7
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

BRUSH MATTRESS

SCALE: NTS



PLAN VIEW



CROSS SECTION

NOTES:

BRUSH MATTRESS – THIS METHOD USES HARDWOOD BRUSH LAYERED ALONG A STREAMBANK AS A MATTRESS AND ANCHORED IN PLACE WITH GRID OF STAKES AND WIRE. THE TOE BELOW THE WATERLINE IS ANCHORED BY ROCK.

1. CUT BRANCHES OF SPECIFIED TYPE AT 45 DEGREE ANGLE LONG ENOUGH TO COVER BANKS PLUS 1' DEEP INTO TRENCH.
2. DIG 1' TRENCH AT BASE OF BANK, RESERVING SOIL FOR BACKFILL
3. LAY FIRST LAYER OF CUTTINGS PERPENDICULAR TO SLOPE, MAKING SURE TO PUSH CUT END INTO TRENCH
4. LAY SECOND LAYER AT 45 DEGREES (UPSTREAM)
5. LAY THIRD LAYER AT 45 DEGREE (DOWNSTREAM)
6. (OPTIONAL STEP IF NEEDED TO HOLD BRANCHES CLOSE TO GROUND SURFACE AT TOP OF STREAMBANK). ABOUT 1/2–2/3 OF THE WAY UP THE BANK, PLACE STAKES IN A ROW, SPACED 3' APART. HAMMER TO GET STARTED. WRAP WIRE AROUND 1ST STAKE; CONNECT TO 2ND STAKE AND WRAP; CONNECT TO 3RD STAKE AND WRAP, ETC.
7. USING SHOVELS AND BUCKETS OR TRACK HOE BUCKET, SPRINKLE SOIL THROUGH THE CUTTINGS
8. IF USING OPTIONAL STAKES, HAMMER INTO BANK
9. INSTALL COIR MATTING
10. WRAP WIRE NEAR TOP OF STAKES IN CRISSCROSS PATTERN.
11. FINISH BY HAMMERING REMAINING STAKES INTO BANK.

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CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

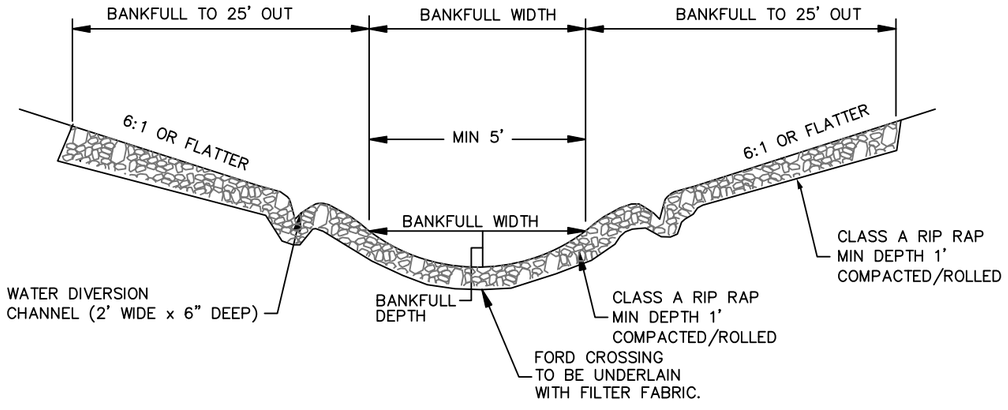
PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
BRUSH MATTRESS

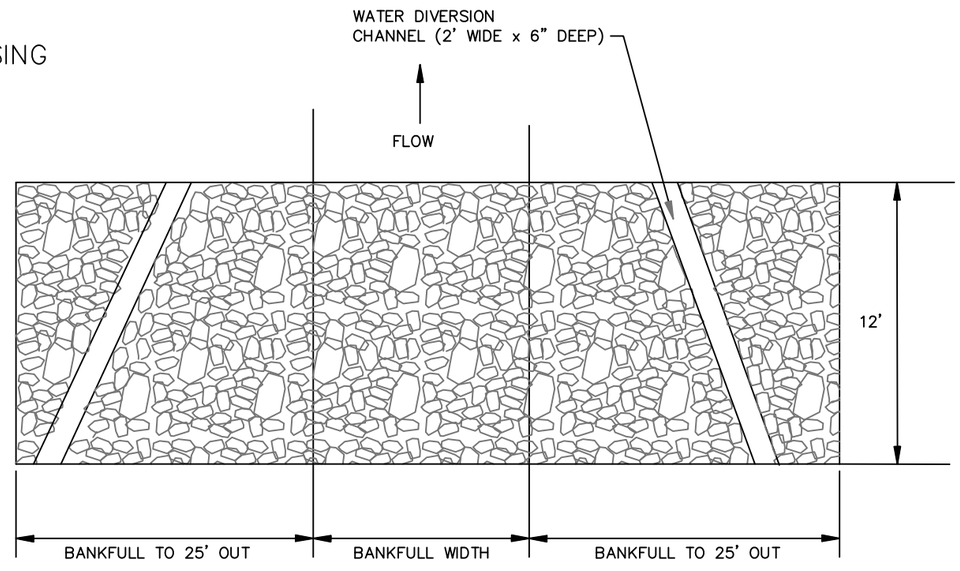
CADD PLOT: C.T.M.	SCALE: N/A	SHEET NO. 3.8
VOID PLOT:	DRAWN BY: C.T.M.	
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

PERMANENT FORD CROSSING

SCALE: N.T.S.



CROSS-SECTION



PLAN VIEW

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STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
PERMANENT FORD CROSSING

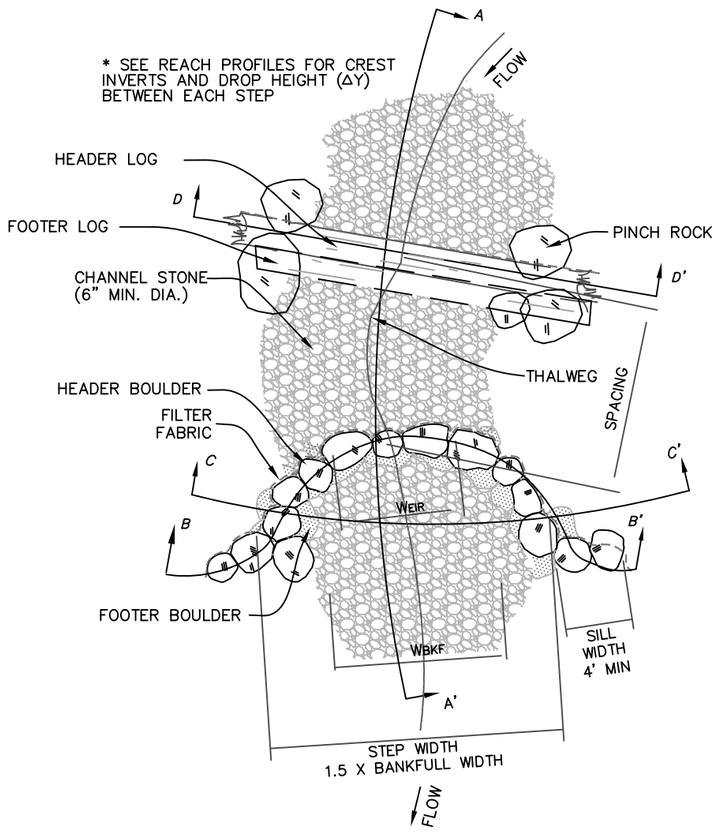
CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

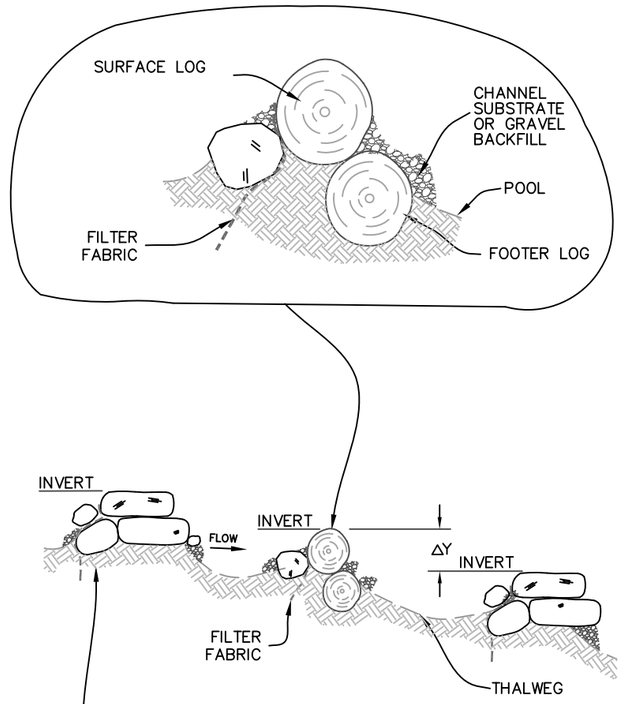
SHEET NO.
3.9

ROCK AND LOG STEPS

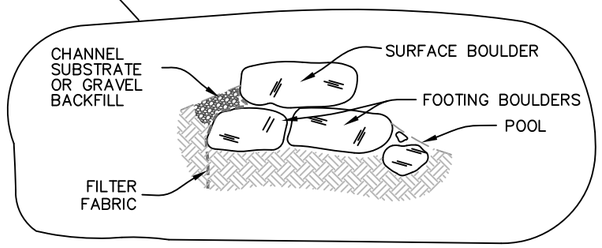
SCALE: NTS

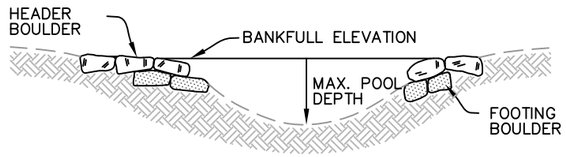


PLAN VIEW

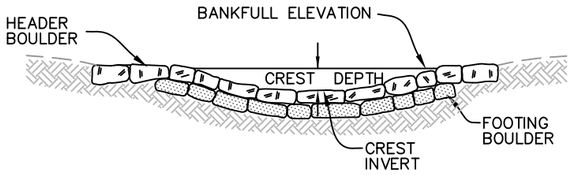


STEP/POOL PROFILE – A–A'

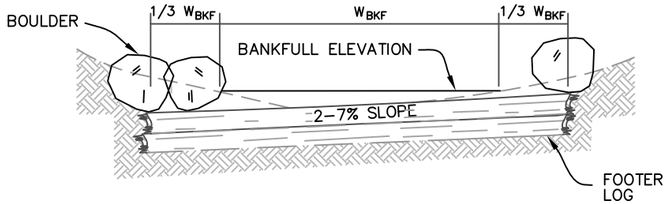




STEP/POOL SECTION C–C'



STEP WEIR – SECTION B–B'



STEP WEIR – SECTION D–D'

NOTES

1. NAIL FILTER FABRIC FROM THE BASE OF THE FOOTER LOG TO THE MIDDLE OF THE HEADER LOG USING 2" GALVANIZED ROOFING NAILS ON 1' SPACING ALONG THE ENTIRE LENGTH OF THE LOG.
2. SET INVERTS AT ELEVATIONS SHOWN IN REACH PROFILE
3. PINCH ROCKS AND LIVE CUTTINGS SHALL BE PLACED AT THE CHANNEL EDGE AROUND THE SILL ON BOTH THE LEFT AND RIGHT BANKS.
4. AN ALTERNATE GRADATION FOR CHANNEL STONE MAY BE USED IF APPROVED BY DESIGN ENGINEER BEFORE INSTALLATION.
5. LOGS SHALL BE EMBEDDED IN THE BANK BY AT LEAST 5' ON EACH END.

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CERTIFICATION AND SEAL

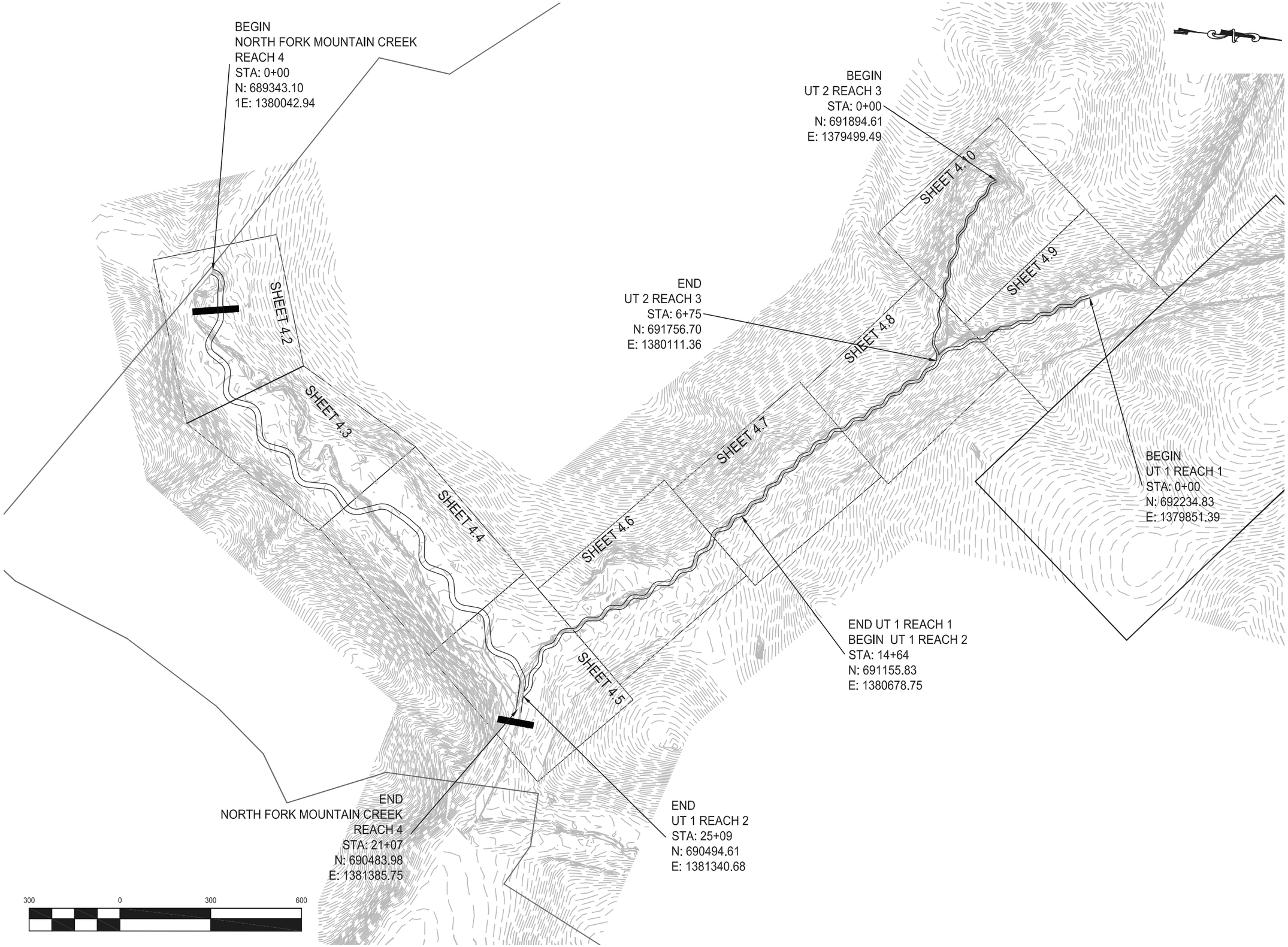
NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
ROCK AND LOG STEP

CADD PLOT:	SCALE: N/A	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	3.10
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	



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NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIAN A. MAZZOCHI

PROJECT NAME
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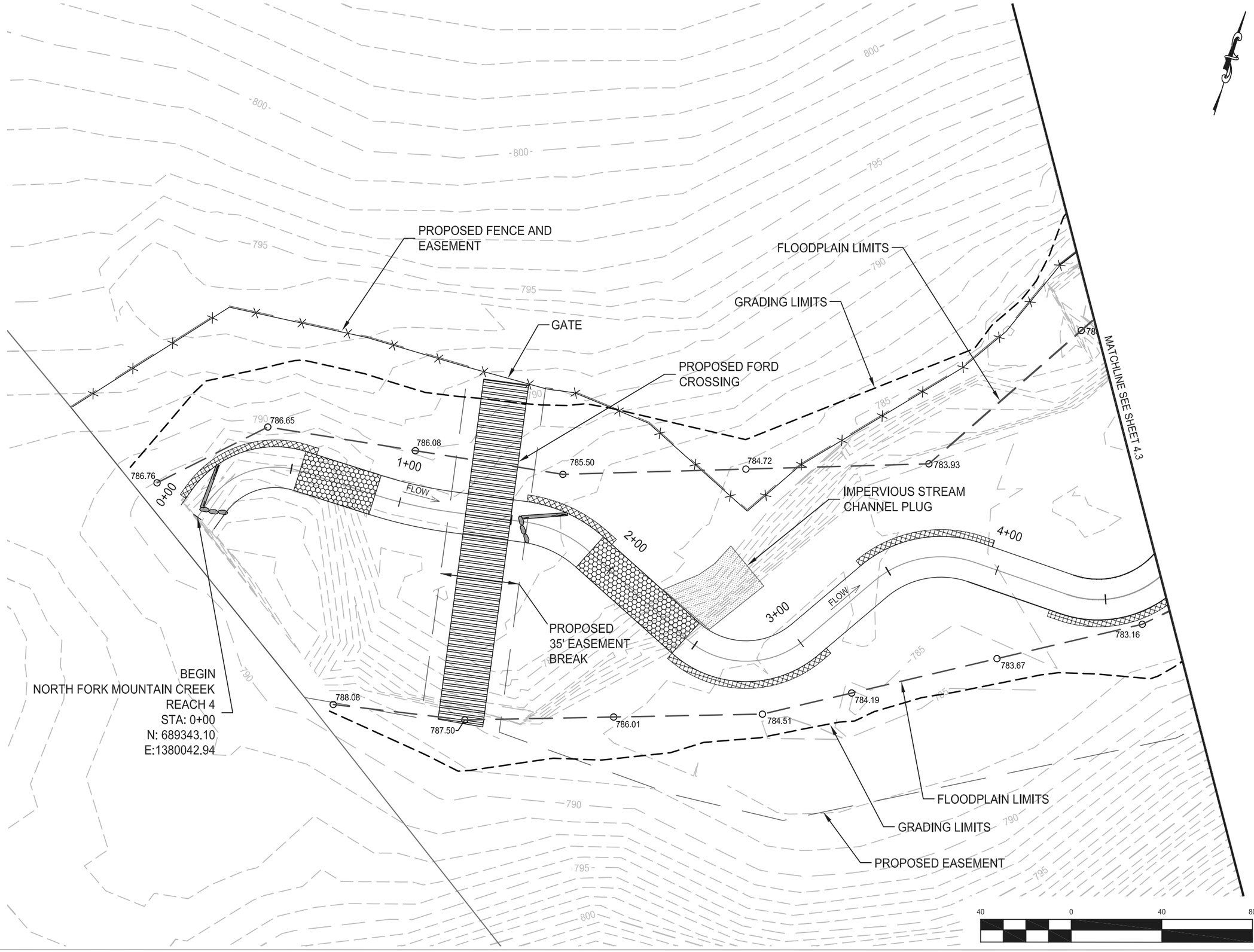
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
MASTER PLAN SHEET

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	4.1
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	



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CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	4.2
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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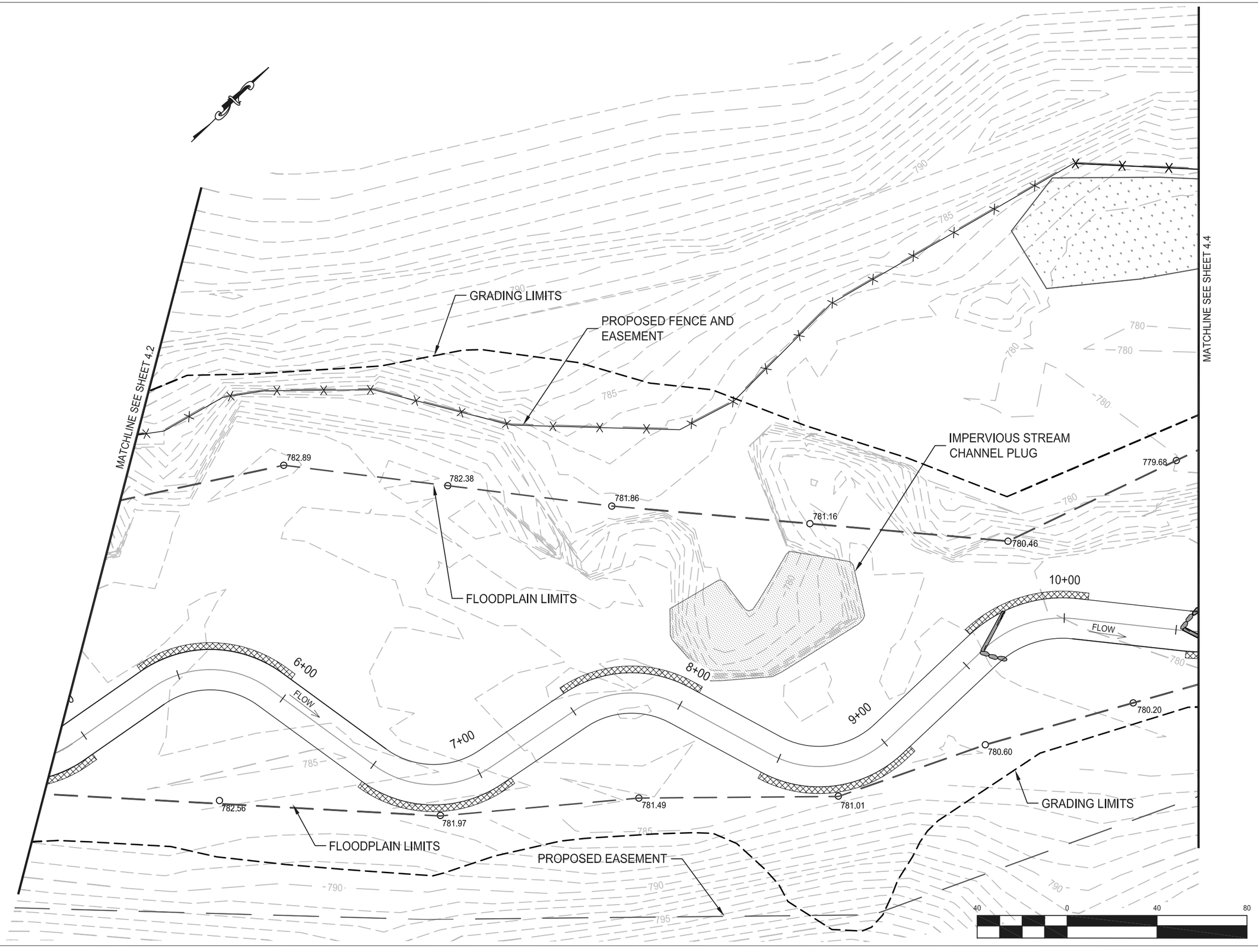

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VOID PLOT:
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SCALE:
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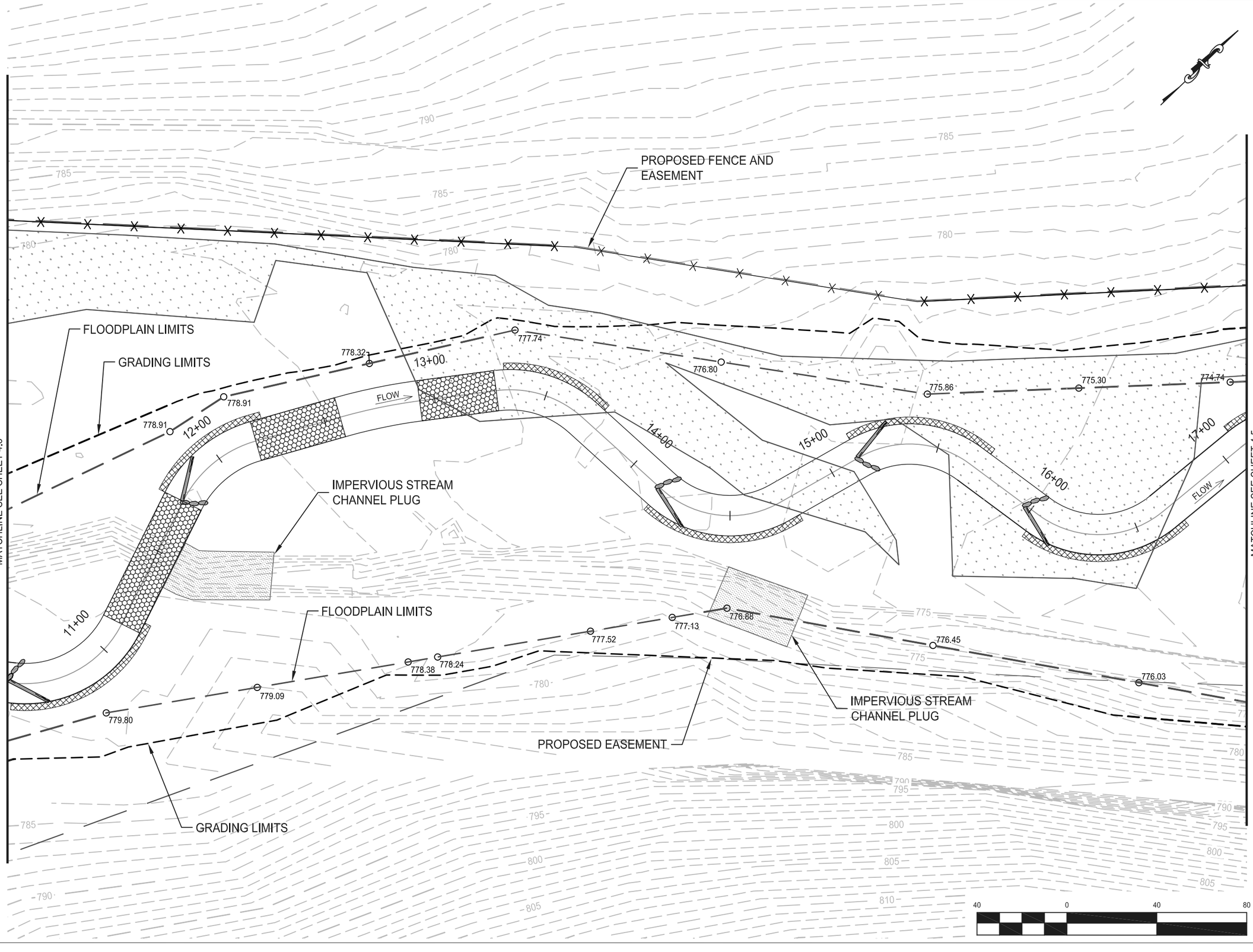
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
4.3



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NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
MASTER PLAN SHEET

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	4.4
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

MATCHLINE SEE SHEET 4.6

MATCHLINE SEE SHEET 4.4

PROPOSED
0.5' BERM WITH
3:1 SIDE SLOPES

IMPERVIOUS STREAM
CHANNEL PLUG

PROPOSED FENCE AND
EASEMENT

GRADING LIMITS

IMPERVIOUS STREAM
CHANNEL PLUG

FLOODPLAIN LIMITS

GRADING LIMITS

IMPERVIOUS STREAM
CHANNEL PLUG

FLOODPLAIN LIMITS

GRADING LIMITS

PROPOSED EASEMENT

END
NORTH FORK MOUNTAIN CREEK
REACH 4
STA: 21+07
N: 690483.98
E: 1381385.75

END
UT 1 REACH 2
STA: 25+09
N: 690494.61
E: 1381340.68

PROVIDE SMOOTH
TRANSITION TO
EXISTING CHANNEL

GATE

FENCE TO TIE INTO
EXISTING FENCE

PROPOSED FORD
CROSSING

FLOODPLAIN LIMITS

FLOW

774.12
773.95
773.45
772.86
772.21
774.90
774.18
773.32
772.45
771.60
770.99
770.81
769.01
775.60
773.40
771.21

18+00
19+00
20+00
21+00
22+00
23+00
24+00
25+00

40 0 40 80

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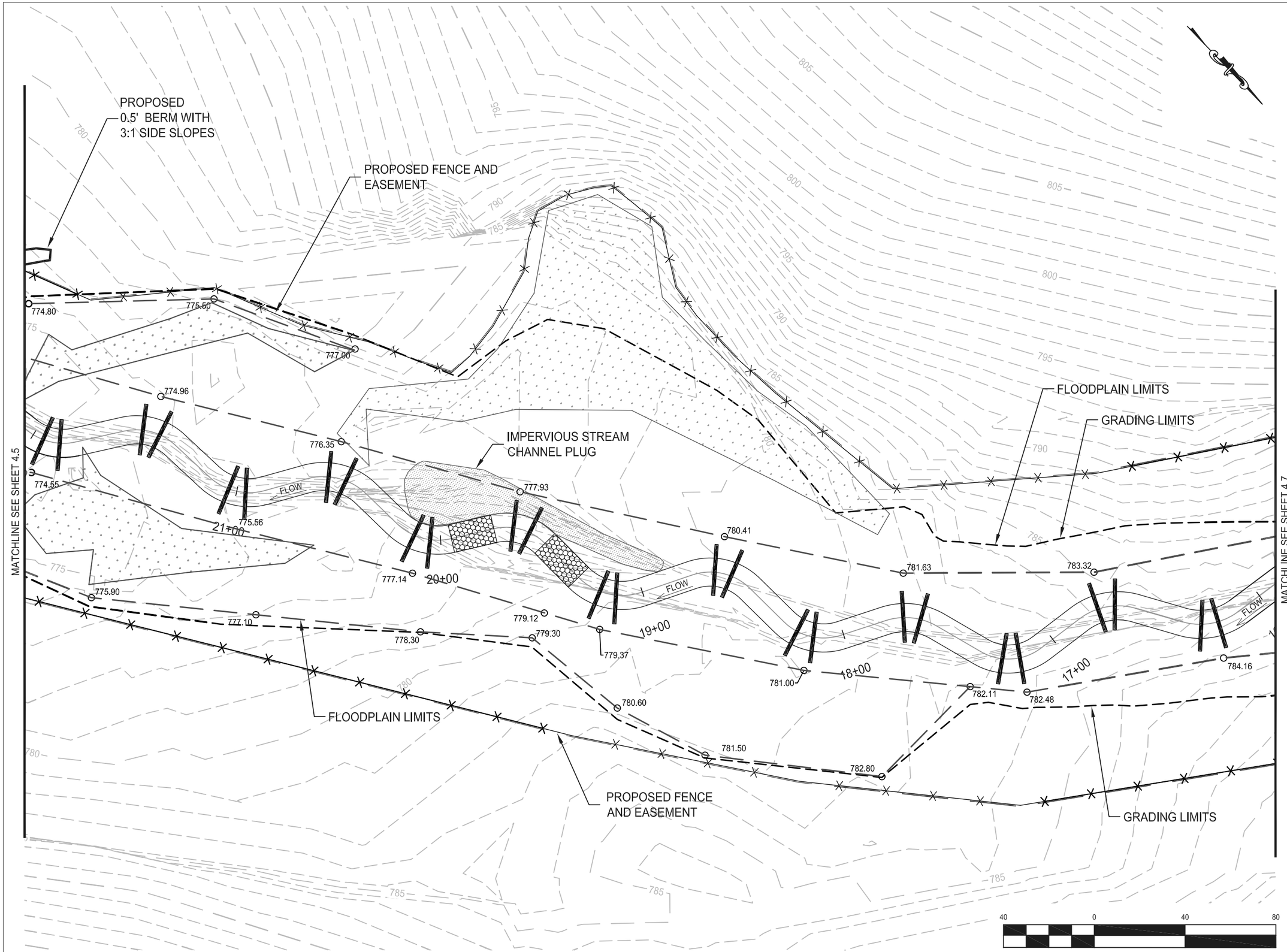
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
MASTER PLAN SHEET

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE:
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
4.5



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CATAWBA COUNTY, NORTH CAROLINA

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VOID PLOT:
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SCALE:
DRAWN BY: C.T.M.
DATE: 4-29-11
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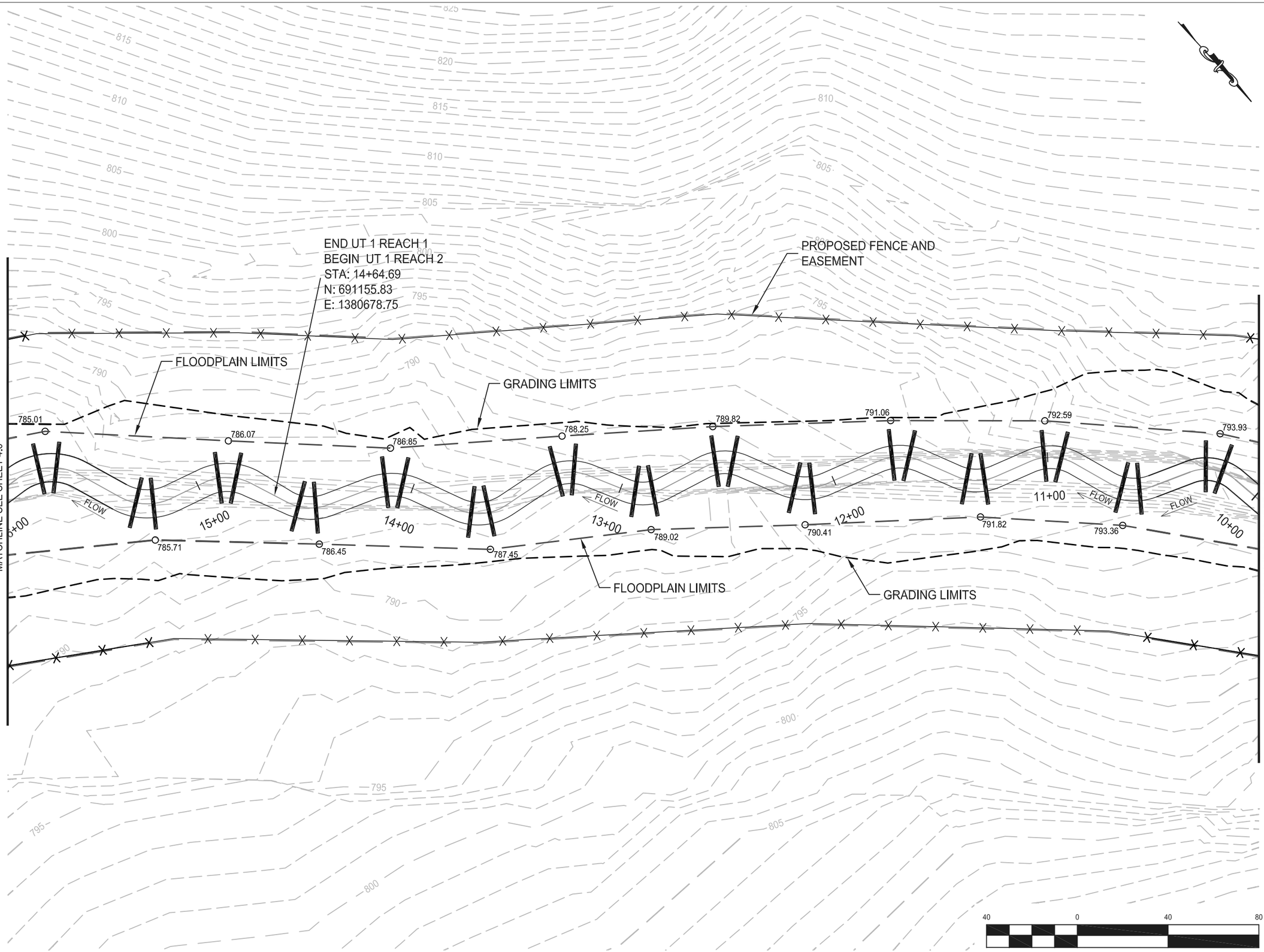
SHEET NO.
4.6



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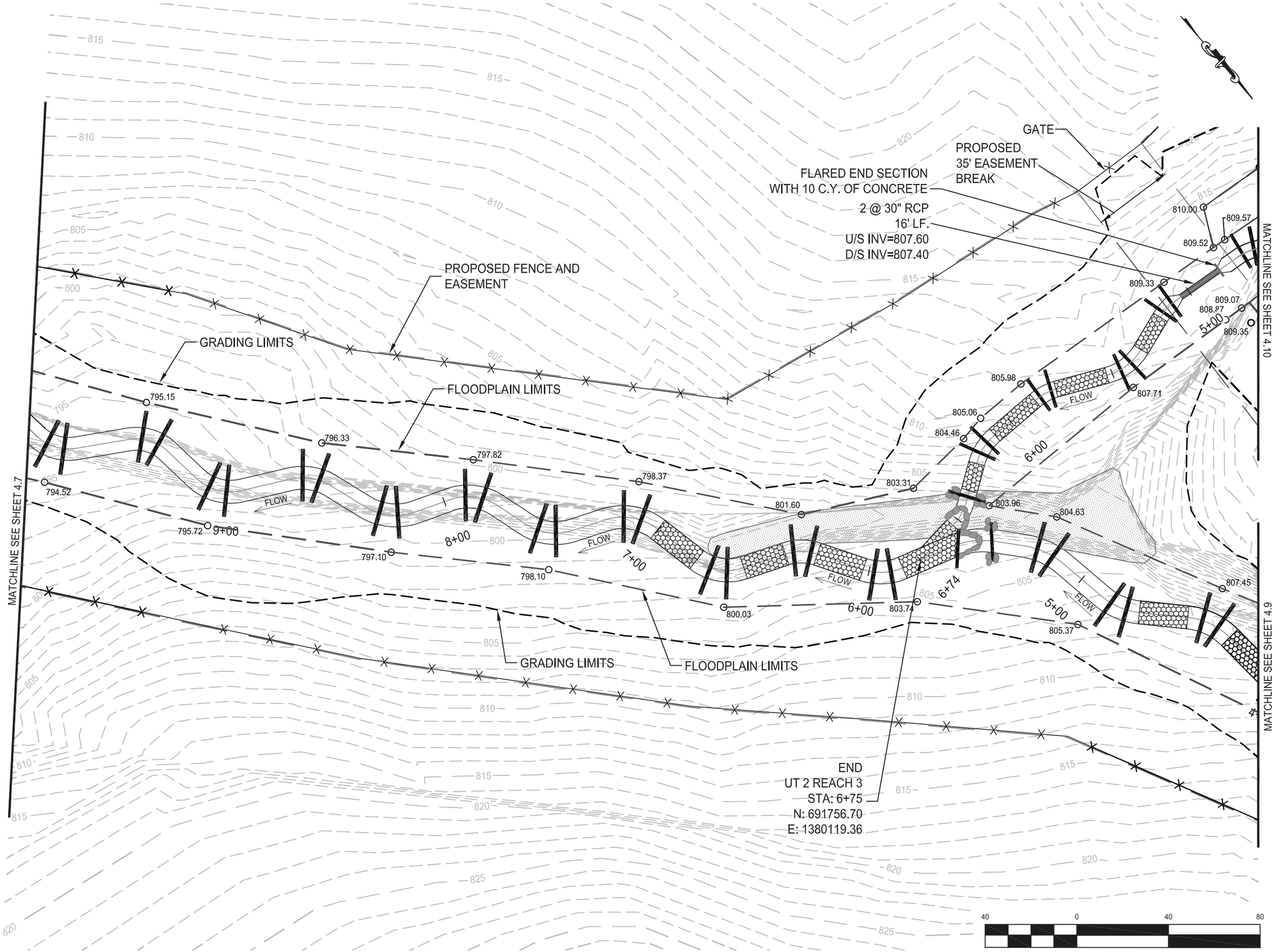
DRAWING TITLE
MASTER PLAN SHEET

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE:
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
4.7



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PROJECT NAME
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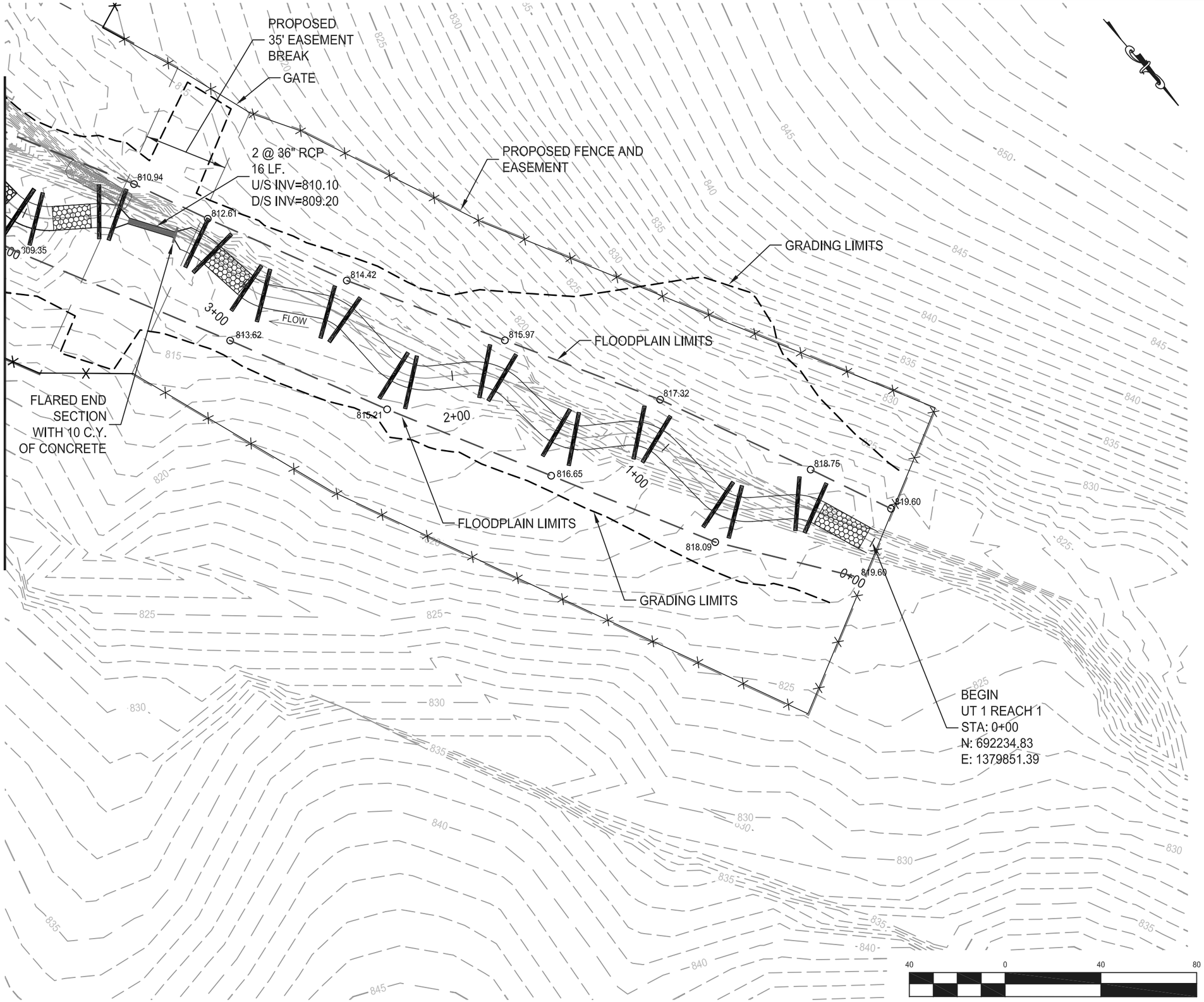
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
PLAN SHEET

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	4.8
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	



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RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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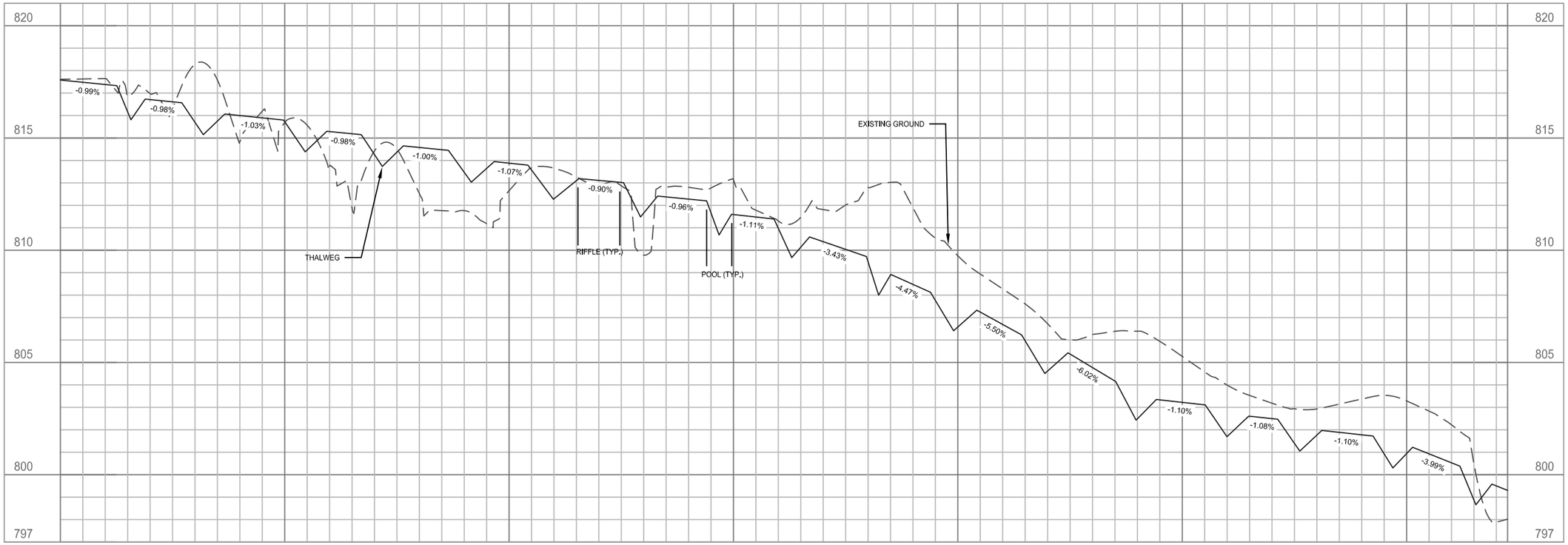
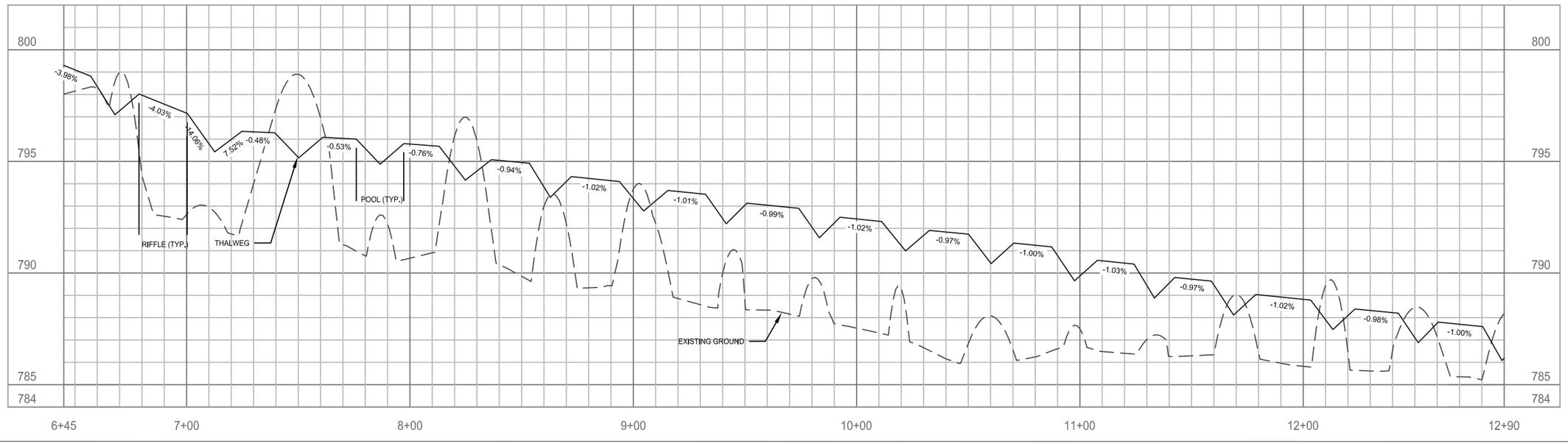
SCALE:
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
4.10

PROPOSED PROFILE - UT 1 REACH 1 & REACH 2



PROPOSED PROFILE - UT 1 REACH 1 & REACH 2



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NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

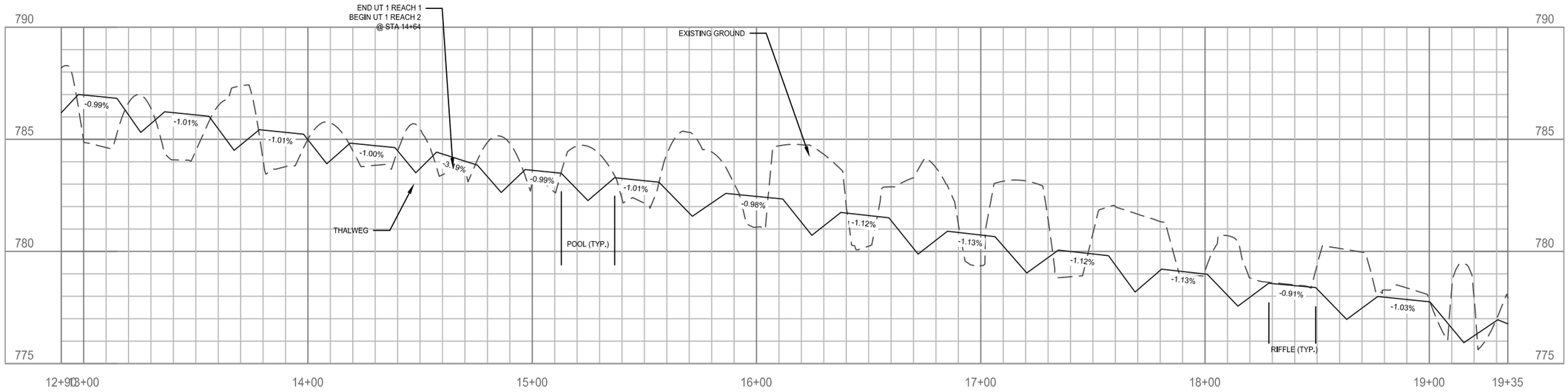
NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIAN A. MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
PROFILE SHEET

CADD PLOT:	SCALE: N/A	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	5.1
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

PROPOSED PROFILE - UT 1 REACH 1 & REACH 2



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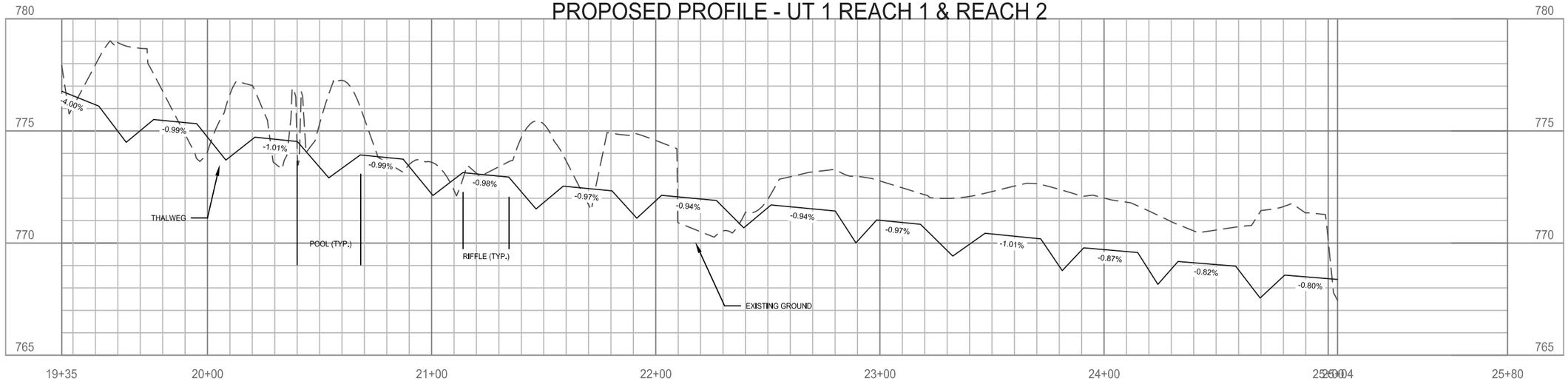

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801 Jones Franklin Rd., Suite 300
Raleigh NC U.S.A.
27606
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Fax. 919.851.7024
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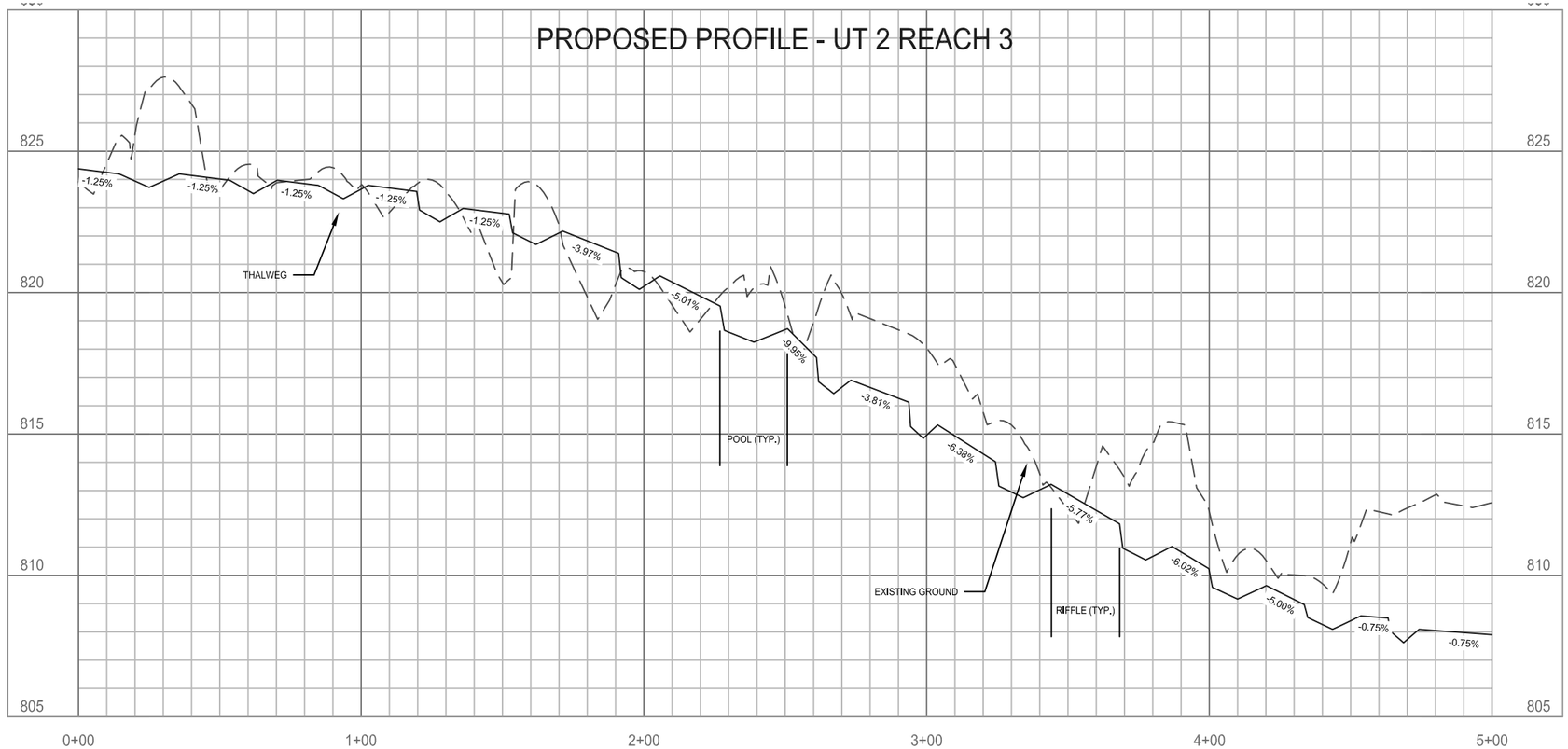

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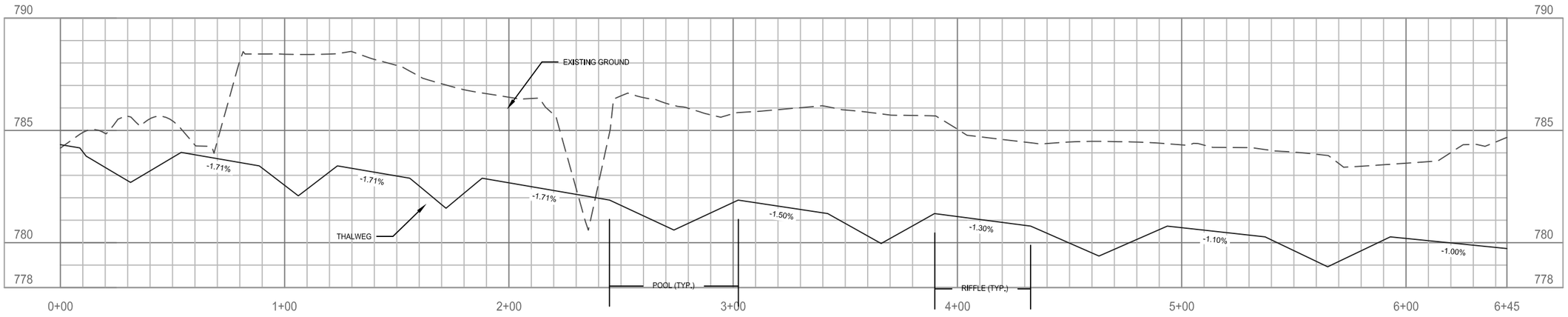
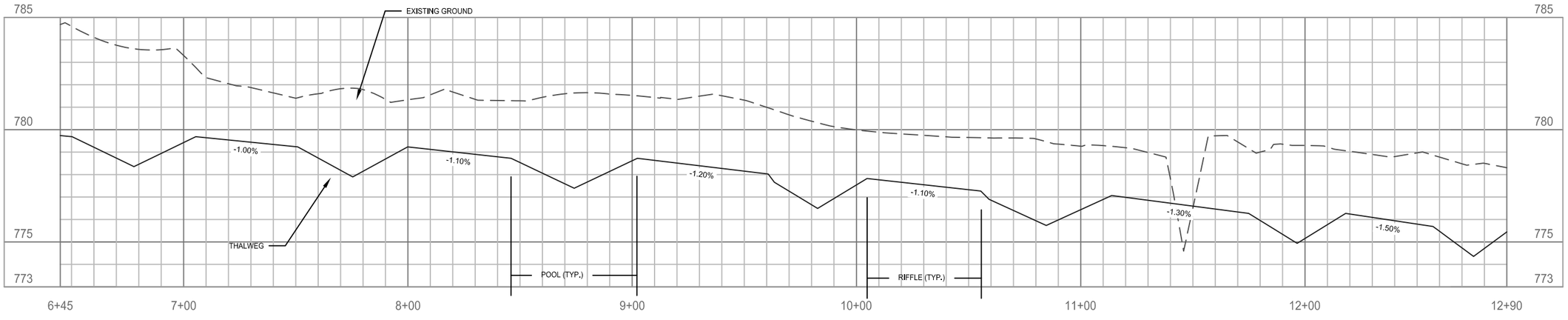
SHEET NO.
5.3

PROPOSED PROFILE - NORTH FORK MOUNTAIN CREEK REACH 4



PROPOSED PROFILE - NORTH FORK MOUNTAIN CREEK REACH 4



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CATAWBA COUNTY, NORTH CAROLINA

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PROFILE SHEET

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RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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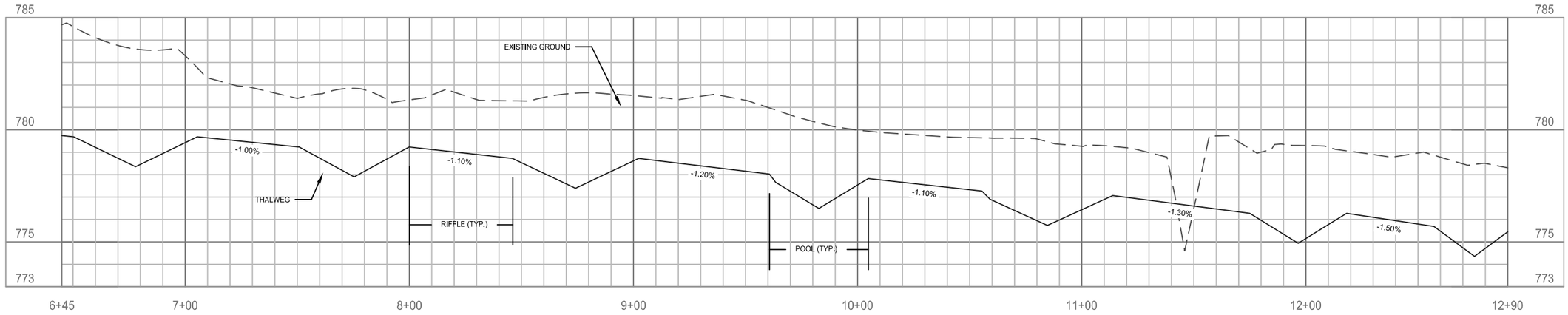
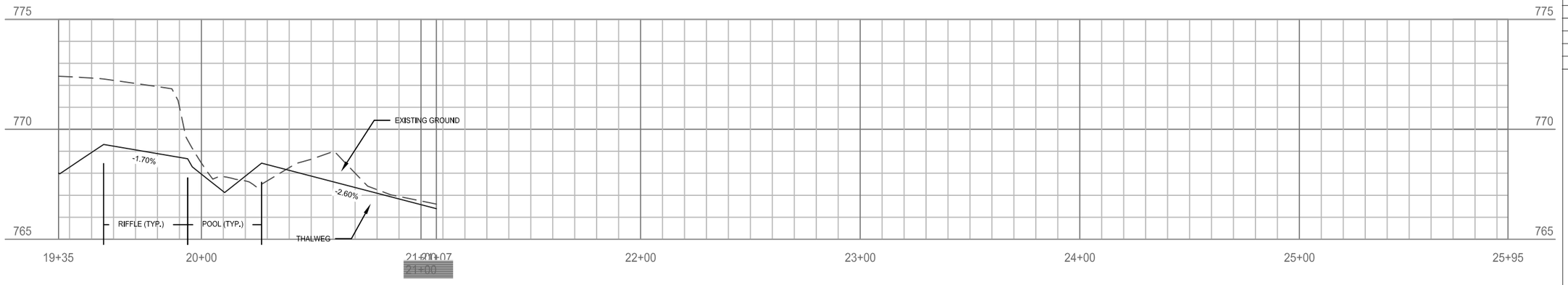
PROPOSED PROFILE - NORTH FORK MOUNTAIN CREEK REACH 4



PROPOSED PROFILE - NORTH FORK MOUNTAIN CREEK REACH 4



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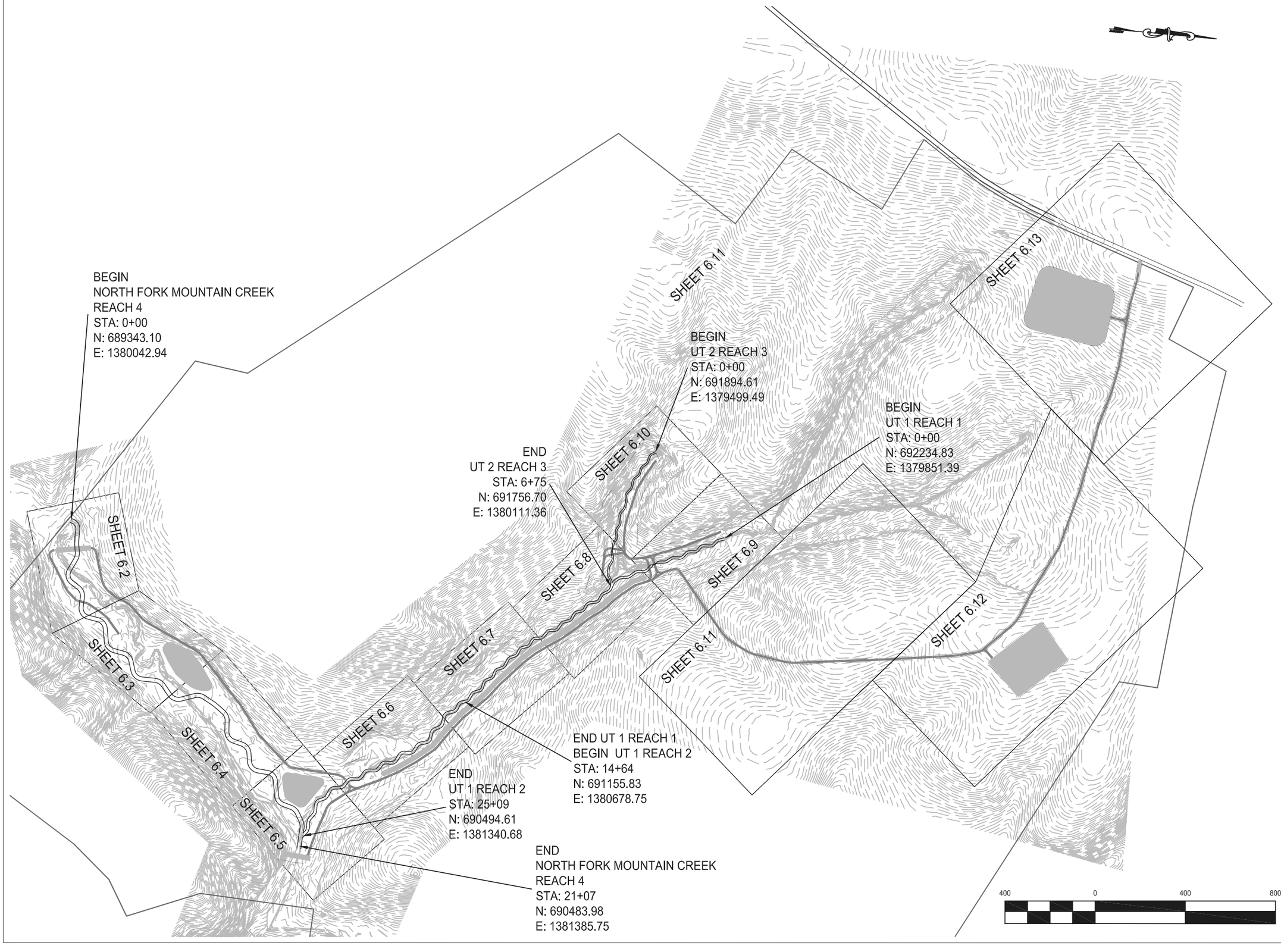

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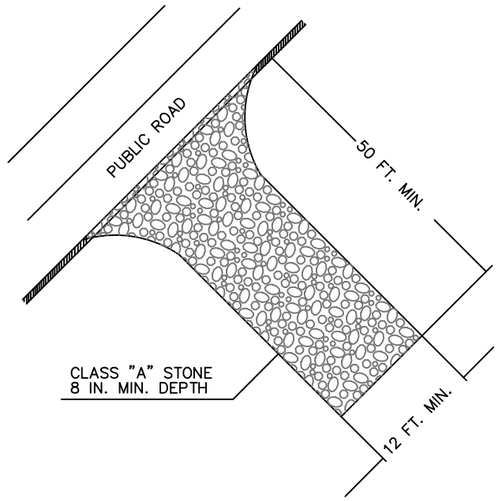
PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
EROSION & SEDIMENT CONTROL PLAN

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	6.1
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

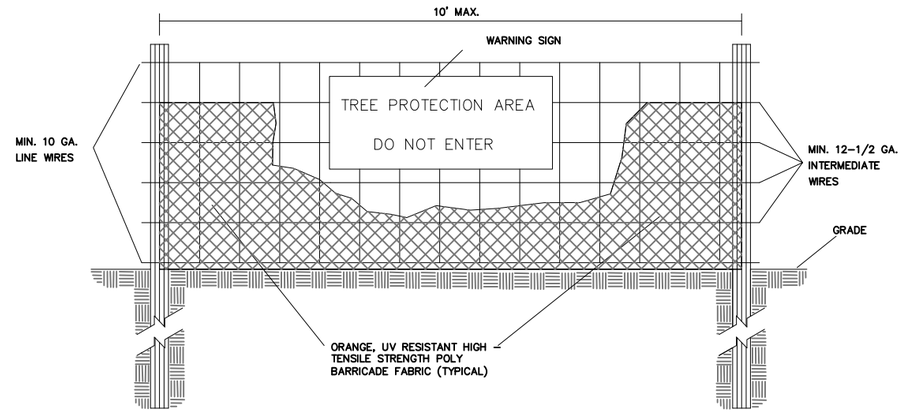
EROSION CONTROL DETAIL

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

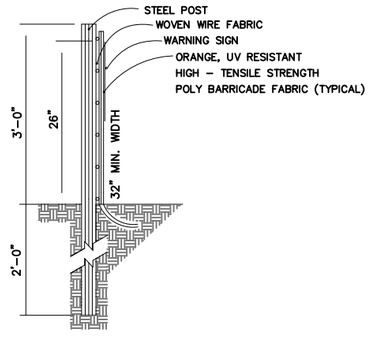


NOTES:
1. TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS SHALL BE PROVIDED.
2. ENTRANCE(S) SHOULD BE LOCATED TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOP DRESSING WITH STONE WILL BE NECESSARY.
4. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
5. GRAVEL CONSTRUCTION ENTRANCE SHALL BE LOCATED AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED.
FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE MUST BE PROVIDED.
6. FILTER FABRIC TO BE PLACED BENEATH STONE.

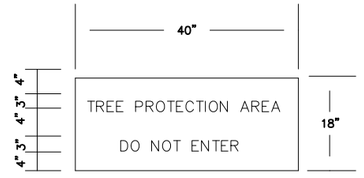
TREE PROTECTION FENCE



FRONT VIEW



SIDE VIEW



WARNING SIGN DETAIL

NOTES:
1. WARNING SIGNS TO BE MADE OF DURABLE, WEATHERPROOF MATERIAL. LETTERS TO BE 3" HIGH MINIMUM, CLEARLY LEGIBLE AND SPACED AS DETAILED.

2.SIGNS SHALL BE PLACED AT 200' MAXIMUM INTERVALS. PLACE A SIGN AT EACH END OF LINEAR TREE PROTECTION AND 200' ON CENTER THEREAFTER.

3. FOR TREE PROTECTION AREAS LESS THAN 200' IN PERIMETER, PROVIDE NO LESS THAN ONE SIGN PER PROTECTION AREA.

4. ATTACH SIGNS SECURELY TO FENCE POSTS AND FABRIC. MAINTAIN TREE PROTECTION FENCE THROUGHOUT DURATION OF PROJECT.

5. PLACE A SIGN AT EACH END OF LINEAR TREE PROTECTION AND 200' ON CENTER THEREAFTER.

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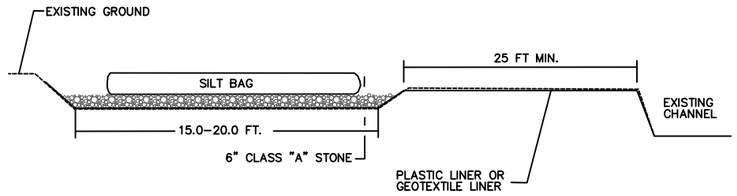
EROSION CONTROL DETAIL

PUMP-AROUND OPERATION

SCALE: NTS

SILT BAG WITH ROCK PAD



SCALE: NTS

NOTE: PROVIDE STABILIZED OUTLET

SEQUENCE OF CONSTRUCTION FOR TYPICAL WORK AREA

1. INSTALL SILT BAGS WITH ROCK PADS.
2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3. PLACE UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. PLACE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA. AREA TO BE DEWATERED SHALL BE EQUAL TO ONE DAY'S WORK.
5. PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLANS.
6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERVIOUS DIKES. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE. (DOWNSTREAM IMPERVIOUS DIKES FIRST).
7. ALL GRADING AND STABILIZATION MUST BE COMPLETED IN ONE DAY WITHIN THE PUMP AROUND AREAS BETWEEN THE IMPERVIOUS DIKES. THE IMPERVIOUS DIKE LOCATIONS AS SHOWN ON THIS SHEET ONLY SHOW THE UPPER AND LOWER EXTENT OF WORK FOR EACH STREAM SEGMENT. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF THE IMPERVIOUS DIKE(S) FOR EACH DAY'S WORK.
8. REMOVE SILT BAGS WITH ROCK PADS AND BACKFILL.
9. STABILIZE DISTURBED AREA WITH SEED AND MULCH.

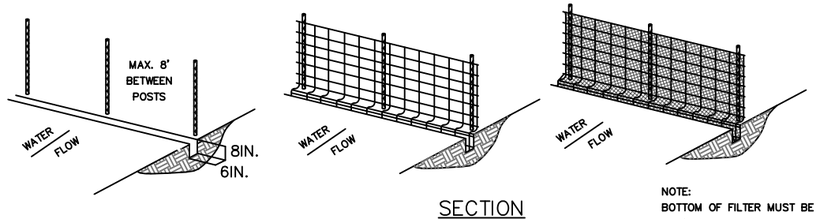
STANDARD TEMPORARY SILT FENCE

NOTE:
WIRE BACKING FOR SILT FENCE MAY BE OMITTED IF HIGH STRENGTH FILTER FABRIC IS USED AND POST SPACING IS REDUCED TO 6' ON CENTER.

STEP 1:
DRIVE STEEL POSTS 24IN. INTO GROUND AND EXCAVATE A 6IN.x 8IN. TRENCH UPHILL ALONG THE LINE OF POSTS.

STEP 2:
ATTACH WIRE FENCE TO POSTS AND EXTEND THE BOTTOM OF THE FENCE 8IN. INTO THE EXCAVATED TRENCH.

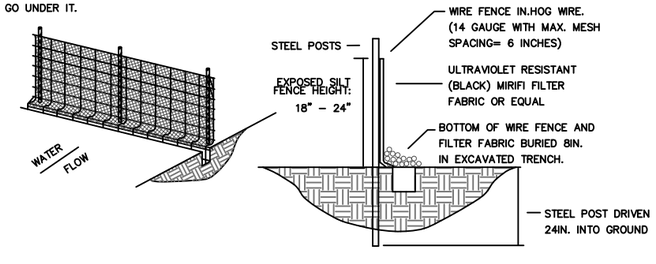
STEP 3:
ATTACH THE FILTER FABRIC TO POST WITH 3 TIES AND EXTEND THE BOTTOM OF THE FABRIC 8IN. INTO THE TRENCH.



SECTION

NOTE:
BOTTOM OF FILTER MUST BE PLACED IN TRENCH AND SECURED BY EITHER BACK-FILLING WITH SOIL MATERIAL AND TAMPING OR BY PLACING WASHED STONE TO A HEIGHT OF 6IN. ABOVE GROUND LEVEL.

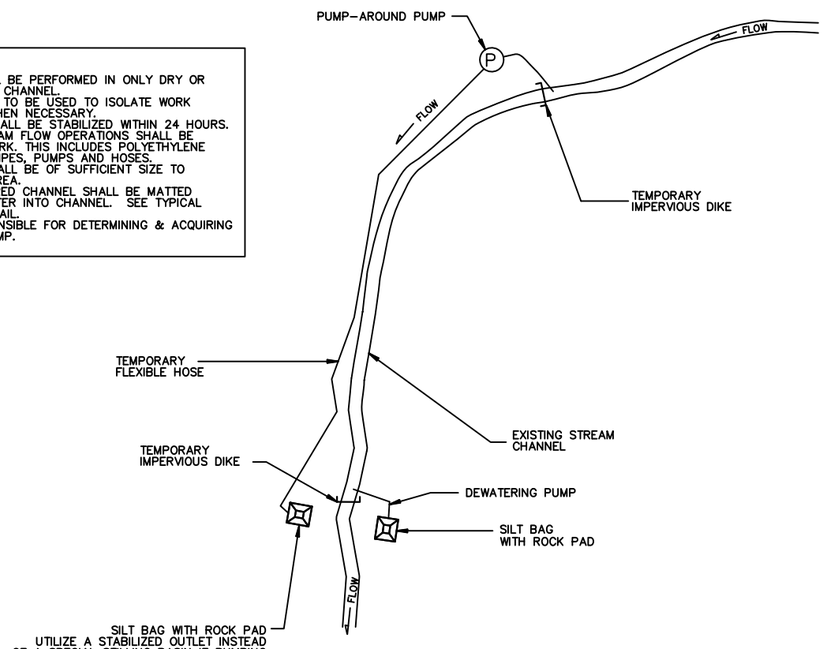
STEP 4:
BACKFILL THE TRENCH AND COMPACT THE SOIL FIRMLY TO ANCHOR THE BOTTOM OF THE SILT FENCE SO THAT RUNOFF IS FORCED TO GO THROUGH THE FENCE AND CANNOT GO UNDER IT.



CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT SEDIMENT FENCE ON LOW SIDE OF TOPSOIL STOCKPILE TO PREVENT SEDIMENT FROM BEING WASHED INTO THE DRAINAGE SYSTEM. FENCE TO EXTEND AROUND APPROXIMATELY 70% OF THE PERIMETER OF THE STOCKPILE.
2. LOCATE POSTS DOWNSLOPE OF FABRIC TO HELP SUPPORT FENCING.
3. BURY TOE OF FENCE APPROXIMATELY 8" DEEP TO PREVENT UNDERCUTTING.
4. WHEN JOINTS ARE NECESSARY, SECURELY FASTEN THE FABRIC AT A SUPPORT POST WITH OVERLAP TO THE NEXT POST.
5. FILTER FABRIC TO BE ON NYLON, POLYESTER, PROPYLENE OR ETHYLENE YARN WITH EXTRA STRENGTH-50LB/ LIN. IN. (MINIMUM) AND WITH A FLOW RATE OF AT LEAST 0.3 GAL./FT/MINUTE. FABRIC SHOULD CONTAIN ULTRAVIOLET RAY INHIBITORS AND STABILIZERS.

NOTES:
1. ALL EXCAVATION SHALL BE PERFORMED IN ONLY DRY OR ISOLATED SECTIONS OF CHANNEL.
2. IMPERVIOUS DIKES ARE TO BE USED TO ISOLATE WORK FROM STREAM FLOW WHEN NECESSARY.
3. ALL GRADED AREAS SHALL BE STABILIZED WITHIN 24 HOURS.
4. MAINTENANCE OF STREAM FLOW OPERATIONS SHALL BE INCIDENTAL TO THE WORK. THIS INCLUDES POLYETHYLENE SHEETING, DIVERSION PIPES, PUMPS AND HOSES.
5. PUMPS AND HOSES SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA.
6. SIDESLOPES OF RESTORED CHANNEL SHALL BE MATTED PRIOR TO TURNING WATER INTO CHANNEL. SEE TYPICAL MATTING LOCATION DETAIL.
7. CONTRACTOR IS RESPONSIBLE FOR DETERMINING & ACQUIRING THE PROPER SIZED PUMP.



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PROJECT NAME
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STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
EROSION CONTROL DETAILS

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VOID PLOT:	DRAWN BY: C.T.M.	6.1B
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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GENERAL NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH ALL STATE AND LOCAL CODES IN OBSERVING EROSION CONTROL MEASURES BOTH ON AND OFF SITE.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL EROSION CONTROL MEASURES:
   a. INSPECT ALL EROSION CONTROL MEASURES FOR STABILITY AND OPERATION WEEKLY OR WITHIN 24 HOURS AFTER ANY SIGNIFICANT STORM EVENT.
   b. REMOVE SEDIMENT FROM BEHIND SILT FENCE WHEN IT'S DEPTH REACHES 0.5 FEET. SEDIMENT SHALL BE DISPOSED OF ON THE PROJECT ONLY IN PROTECTION AREAS OR HAULED AWAY IF NOT SUITABLE FOR FILL MATERIAL.
   c. IF ANY EROSION CONTROL MEASURE IS FOUND TO BE UNSTABLE OR NOT FUNCTIONING PROPERLY, REPAIRS SHOULD BE DONE IMMEDIATELY TO MAINTAIN MEASURES AS DESIGNED OR AS DIRECTED BY THE ENGINEER.
3. TEMPORARY AND PERMANENT SEEDING OF DENUDED AREAS WILL BE DONE ACCORDING TO THE SEEDING SCHEDULE. AREAS WILL BE RESEEDED AS NECESSARY TO MAINTAIN GOOD VEGETATIVE COVER.

CONSTRUCTION SEQUENCE

THE CONTRACTOR IS RESPONSIBLE FOR THE FOLLOWING SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE CONSTRUCTION PLANS. ANY CHANGES OR IMPROVEMENTS TO THE SEQUENCE OF CONSTRUCTION MUST BE APPROVED BY THE DESIGN ENGINEER OR BY AN ON-SITE DESIGNER'S CONSTRUCTION MANAGER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT AN APPROVED FIELD CHANGE IS ISSUED PRIOR TO CONDUCTING RELATED WORK.

GENERAL NOTES:

1. STOCKPILE AND SEPARATE ALL SOIL SUITABLE FOR FILL OR TOPSOIL IN THE AREA INDICATED ON THE CONSTRUCTION PLANS.

2. ANY SOIL UNSUITABLE FOR FILL SHALL BE DISPOSED OF AS DIRECTED.

3. ANY SUITABLE JUNCAS MATTING SHALL BE SAVED AND STOCKPILED FOR TRANSPLANT.

4. MAINTENANCE OF STREAM FLOW OPERATIONS SHALL BE INCIDENTAL TO THE WORK. THIS INCLUDES POLYETHYLENE SHEETING, DIVERSION PIPES, PUMPS AND HOSES. PUMPS AND HOSES SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA

5. PROVIDE PERMANENT GROUND COVER ON ALL DISTURBED AREAS WITHIN 21 CALENDAR DAYS FOLLOWING COMPLETION OF CONSTRUCTION.

I. INITIAL SITE PREPARATION

1. OBTAIN ALL APPLICABLE PERMITS, SEND PROPER NOTIFICATIONS, SCHEDULE A PRECONSTRUCTION MEETING, AND OBTAIN NOTICE TO PROCEED FROM E&SC INSPECTOR.

2. INSTALL CONSTRUCTION ENTRANCE.

3. CONSTRUCT ACCESS ROAD AND TEMPORARY CROSSINGS AND PIPES AT STATIONS 3+50 REACH 1 AND 5+00 REACH 3 AS SHOWN ON PLANS. IT IS THE CONTRACTORS RESPONSIBILITY TO MAINTAIN THE ACCESS ROAD THROUGHOUT CONSTRUCTION

4. INSTALL ALL PERIMETER EROSION CONTROL MEASURES SUCH AS TEMPORARY SILT FENCE AND CONSTRUCTION ENTRANCES. SCHEDULE ON-SITE INSPECTION OF MEASURES BEFORE ROUGH GRADING BEGINS.

5. PREPARE STAGING AND STOCKPILING AREAS IN LOCATIONS AS SHOWN ON THE CONSTRUCTION PLANS OR AS APPROVED BY THE OWNER OR OWNERS REPRESENTATIVE.

II. REACH 4 INITIAL CONSTRUCTION

1. CONSTRUCT REACH 4 FROM STATION 3+00 TO STATION 11+20.
2. CONSTRUCT REACH 4 FROM STATION 1+00 TO STATION 2+00.
3. CONSTRUCT REACH 4 FROM STATION 11+70 TO STATION 19+60.
4. MATERIAL EXCAVATED FROM THE REACH 4 AREA IN EXCESS OF THAT REQUIRED TO FILL THE EXISTING CHANNEL SHALL BE STOCKPILED ALONG REACHES 1 AND

III. CONSTRUCTION OF REACHES 1,2 AND 3.

1. CONSTRUCTED STREAM MUST BE STABILIZED BEFORE RECEIVING FLOW.
2. INSTALL PUMP AROUND UPSTREAM OF REACH 1 STATION 0+00.
3. CONSTRUCT REACH 1 FROM STATION 0+00 TO STATION 5+00.
4. INSTALL PUMP AROUND AT REACH 3 STATION 0+00.
5. CONSTRUCT REACH 1 FROM STATION 5+00 TO STATION 6+20. AND REACH 3 FROM STATION 0+00 TO STATION 6+75
6. CONSTRUCT REACH 1 FROM STATION 6+20 TO STATION 14+64.69 AND REACH 2 FROM STATION 14+64.69 TO STATION 23+00.

IV. REACH 2 AND REACH 4 COMPLETION

1. INSTALL PUMP AROUND AT REACH 4 STATION 0+00.
2. CONSTRUCT REACH 4 FROM STATION 0+00 TO STATION 1+00
3. CONSTRUCT REACH 4 FROM STATION 2+00 TO STATION 3+00
4. INSTALL PUMP AROUND AT REACH 4 STATION 11+00.
5. CONSTRUCT REACH 4 FROM STATION 11+20 TO STATION 11+70.
6. INSTALL PUMP AROUND AT REACH 4 STATION 19+50.
7. CONSTRUCT REACH 4 FROM STATION 19+60 TO STATION 21+07.
8. INSTALL PUMP AROUND AT REACH 2 STATION 22+90.
9. CONSTRUCT REACH 2 FROM STATION 23+00 TO STATION 25+09.

V. CONSTRUCTION COMPLETION AND CLEAN UP

1. FINISH FLOODPLAIN GRADING.
2. REMOVE AND RIP ACCESS ROADS INSIDE CONSERVATION EASEMENT
3. PREP SOIL FOR PLANTING.
4. REMOVE SILT ENCE AFTER SITE IS STABLE AND APPROVED BY THE DESIGNER.

VI. PLANTING

1. FOLLOW PLANTING PLAN AS DESCRIBED IN PLANS AND PROJECT MANUAL.

SEEDING PLAN

TEMPORARY SEEDING

TEMPORARY SEEDING SHALL BE AT THE RATE OF 50 POUNDS PER ACRE. THE CONTRACTOR MAY CHOOSE BETWEEN USING GERMAN MILLET OR BROWNTOP MILLET IN SUMMER MONTHS. RYE GRAIN AND WHEAT SHALL BE USED DURING THE REMAINDER OF THE YEAR. THE DATES FOR SEEDING DURING SUMMER MONTHS ARE MAY 15 THROUGH AUGUST 15 AND DATES FOR SEEDING DURING THE WINTER MONTHS ARE SEPTEMBER 15 THROUGH MAY 15. TEMPORARY SEEDING SHALL OCCUR IN ALL DISTURBED AREAS WITHIN THE LIMITS OF DISTURBANCE. IF THE DISTURBED AREA IS AT FINAL GRADE AND READY FOR THE FINAL SEEDING, TEMPORARY SEEDING AND PERMANENT SEEDING WILL OCCUR AT THE SAME TIME.

TEMPORARY SEEDING IS TO PROVIDE TEMPORARY COVER ON DISTURBED AREAS FOR LESS THAN 12 MONTHS. SEED SHALL HAVE A MINIMUM GERMINATION RATE OF 90%. CONTRACTOR SHALL USE CERTIFIED SEED THAT BEARS A LABEL STATING THE SEED HAS BEEN CERTIFIED BY THE NORTH CAROLINA CROP IMPROVEMENT ASSOCIATION. LABEL SHALL CONTAIN INFORMATION SUCH AS SEED PURITY, GERMINATION AND PRESENCE OF WEED SEEDS. SEED BED PREPARATIONS AND SOIL AMENDMENTS SHALL BE IN ACCORDANCE WITH THE METHOD DESCRIBED UNDER "SEEDING AND MULCHING".

SEEDING AND MULCHING

SEEDING AND MULCHING SHALL BE DONE AT THE END OF THE DAY FOLLOWING CONSTRUCTION OF A CHANNEL SECTION. ALL DISTURBED AREAS SHALL BE DRESSED TO A DEPTH OF 8 INCHES. THE TOP 3 INCHES SHALL BE PULVERIZED TO PROVIDE A UNIFORM SEEDBED. AGRICULTURAL LIME SHALL BE INCORPORATED INTO THE SOIL AT A RATE OF 4000 LB/AC.

5-10-10 FERTILIZER SHALL BE APPLIED TO ALL DISTURBED AREAS AT A RATE OF 1,750 LB/AC, OR 10-20-20 FERTILIZER AT A RATE OF 875 LB/AC. MULCHING SHALL CONSIST OF SMALL GRAIN STRAW APPLIED AT A RATE OF 4000 LB/AC. CONTRACTOR SHALL USE APPROVED METHODS SUFFICIENT TO HOLD THE STRAW IN PLACE IN ALL MULCHED AREAS. IF ACTIVE CONSTRUCTION CEASES, MEANING NO SUBSTANTIAL OR SIGNIFICANT PROGRESS IS MADE IN ANY AREA FOR MORE THAN 30 DAYS, ALL DISTURBED AREAS MUST BE SEEDED, MULCHED, AND TACKED UNLESS WRITTEN APPROVAL IS GRANTED BY THE EROSION CONTROL OFFICER. INCIDENTAL GRADING SHALL NOT CONSTITUTE SUBSTANTIAL OR SIGNIFICANT PROGRESS IN CONSTRUCTION ACTIVITY.

PERMANENT SEEDING

PERMANENT SEEDING IS THE ESTABLISHMENT OF PERENNIAL VEGETATION COVER FOR PERIODS LONGER THAN 12 MONTHS. SEED SHALL HAVE A MINIMUM GERMINATION RATE OF 90%. CONTRACTOR SHALL USE CERTIFIED SEED THAT BEARS A LABEL STATING THE SEED HAS BEEN CERTIFIED BY THE NORTH CAROLINA CROP IMPROVEMENT ASSOCIATION. LABEL SHALL CONTAIN INFORMATION SUCH AS SEED PURITY, GERMINATION AND PRESENCE OF WEED SEEDS.

ALL DISTURBED AREAS SHALL RECEIVE PERMANENT SEEDING AT THE GIVEN RATES IN THE PERMANENT SEEDING TABLE FROM DEC. 1 THROUGH APRIL 1. SEED BED PREPARATIONS AND SOIL AMENDMENTS SHALL BE IN ACCORDANCE WITH SECTION SEEDING AND MULCHING LISTED ABOVE. AS A PART OF PERMANENT SEEDING, MAINTENANCE MAY BE REQUIRED TO MAINTAIN VEGETATION FOR 12 MONTHS. THIS MAINTENANCE SHALL BE CONSIDERED A PART OF ESTABLISHING PERMANENT GROUND COVER.

SEEDBED PREPARATION

1. CHISEL COMPACTED AREAS AND SPREAD TOPSOIL 3 INCHES DEEP OVER ADVERSE SOIL CONDITIONS, IF APPLICABLE.
2. RIP THE ENTIRE AREA TO 8 INCHES DEPTH.
3. REMOVE ALL LOOSE ROCK, ROOTS, AND OTHER OBSTRUCTIONS LEAVING SURFACE REASONABLY SMOOTH AND UNIFORM.
4. APPLY AGRICULTURAL LIME AT A RATE OF 4000 LB/AC; APPLY 5-10-10 FERTILIZER AT A RATE OF 1,750 LB/AC. OR APPLY 10-20-20 FERTILIZER AT A RATE OF 875 LB/AC AND UNIFORMLY MIX WITH SOIL.
5. CONTINUE TILLAGE UNTIL A WELL-PULVERIZED, FIRM, REASONABLY UNIFORM SEEDBED IS PREPARED 4 TO 6 INCHES DEEP.
6. SEED ON A FRESHLY PREPARED SEEDBED AND COVER SEED LIGHTLY WITH SEEDING EQUIPMENT OR CULTIPACK AFTER SEEDING.
7. MULCH AT A RATE OF 4000 LB/AC WITH APPROVED METHODS SUFFICIENT ENOUGH TO HOLD THE STRAW IN PLACE IMMEDIATELY AFTER SEEDING.
8. INSPECT ALL SEEDED AREAS AND MAKE NECESSARY REPAIRS OR RE-SEEDINGS WITHIN THE PLANTING SEASON, IF POSSIBLE. IF STAND BECOMES OVER 60% DAMAGED, RE-ESTABLISH FOLLOWING ORIGINAL LIME, FERTILIZER AND SEEDING RATES.
9. CONSULT CONSERVATION INSPECTOR ON MAINTENANCE TREATMENT AND FERTILIZATION AFTER PERMANENT COVER IS ESTABLISHED.

Temporary Seeding				
All Planting Zones ,				Acres
Approved Date	**Species Name**	**Stratum**	**Common Name**	**Lbs/ac**
8/15 - 4/15	*Secale cereale*	herb	Rye grain	
8/15 - 5/15	*Triticum aestivum*	herb	Wheat	
5/15 - 8/15	*Setaria italica*	herb	German Millet	
5/15 - 8/16	*Urochloa ramosa*	herb	Browntop Millet	
			Total	**50**
One of the species, depending on the season, may be chosen and planted at 50 lbs/ac.				

Permanent Seeding				
Riparian Buffer				Acres
Approved Date	**Species Name**	**Stratum**	**Common Name**	**Lbs/ac**
12/1 - 4/1	*Panicum virgatum*	herb	Switchgrass	3
5/1 - 4/1	*Dichanthelium clandestinum*	herb	Deertongue	5
12/1 - 4/1	*Andropogon gerardii*	herb	Big Bluestem	6
12/1 - 4/1	*Schizachyrium scoparium*	herb	Little Bluestem	6
12/1 - 4/1	*Sorghastrum nutans*	herb	Indian Grass	6
			Total	26

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Raleigh NC U.S.A.
27606
Tel. 919.851.6866
Fax. 919.851.7024
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REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

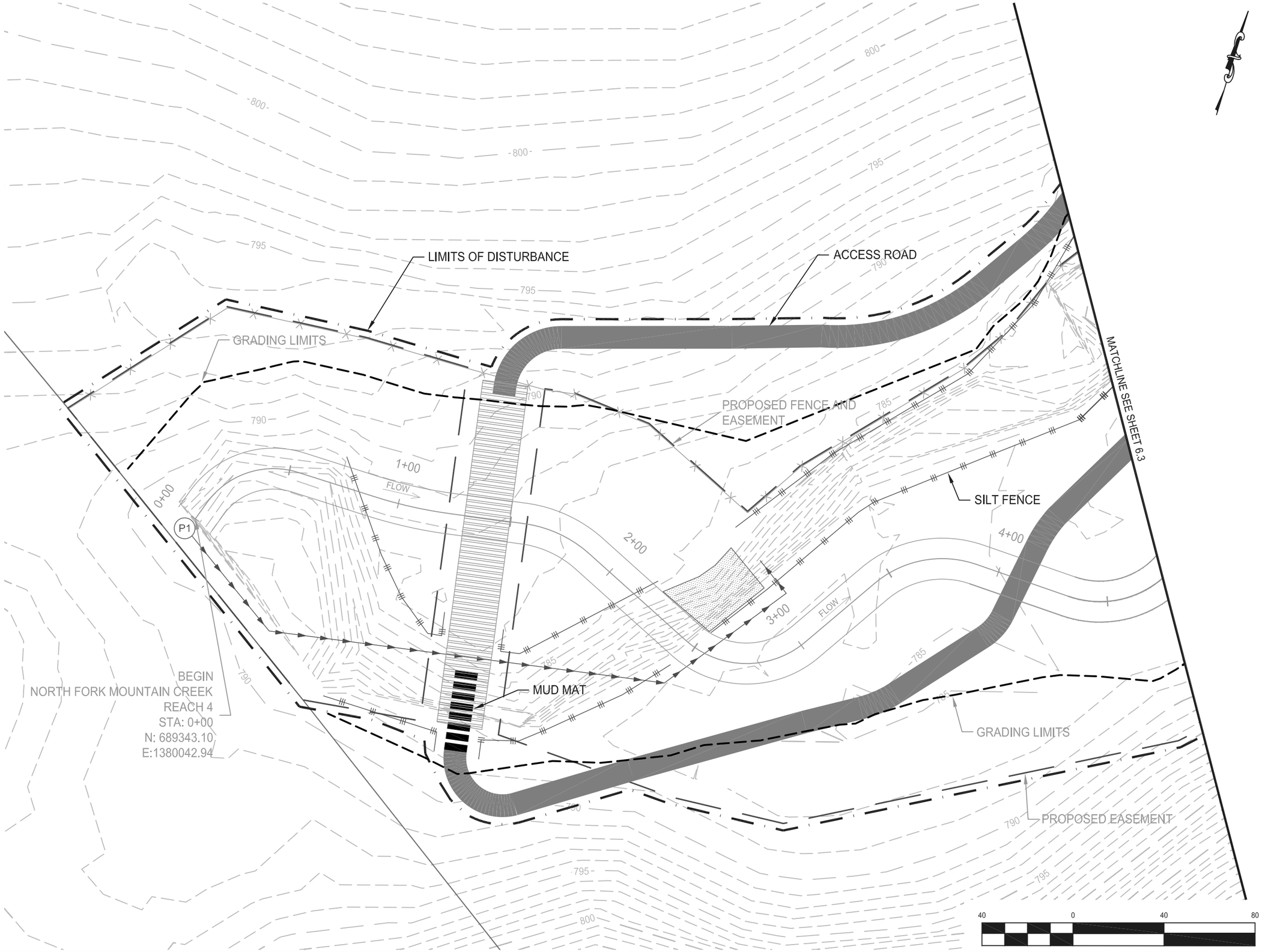
PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
EROSION CONTROL DETIALS

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE: N/A
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
6.1C



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PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
EROSION & SEDIMENT CONTROL PLAN

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	6.2
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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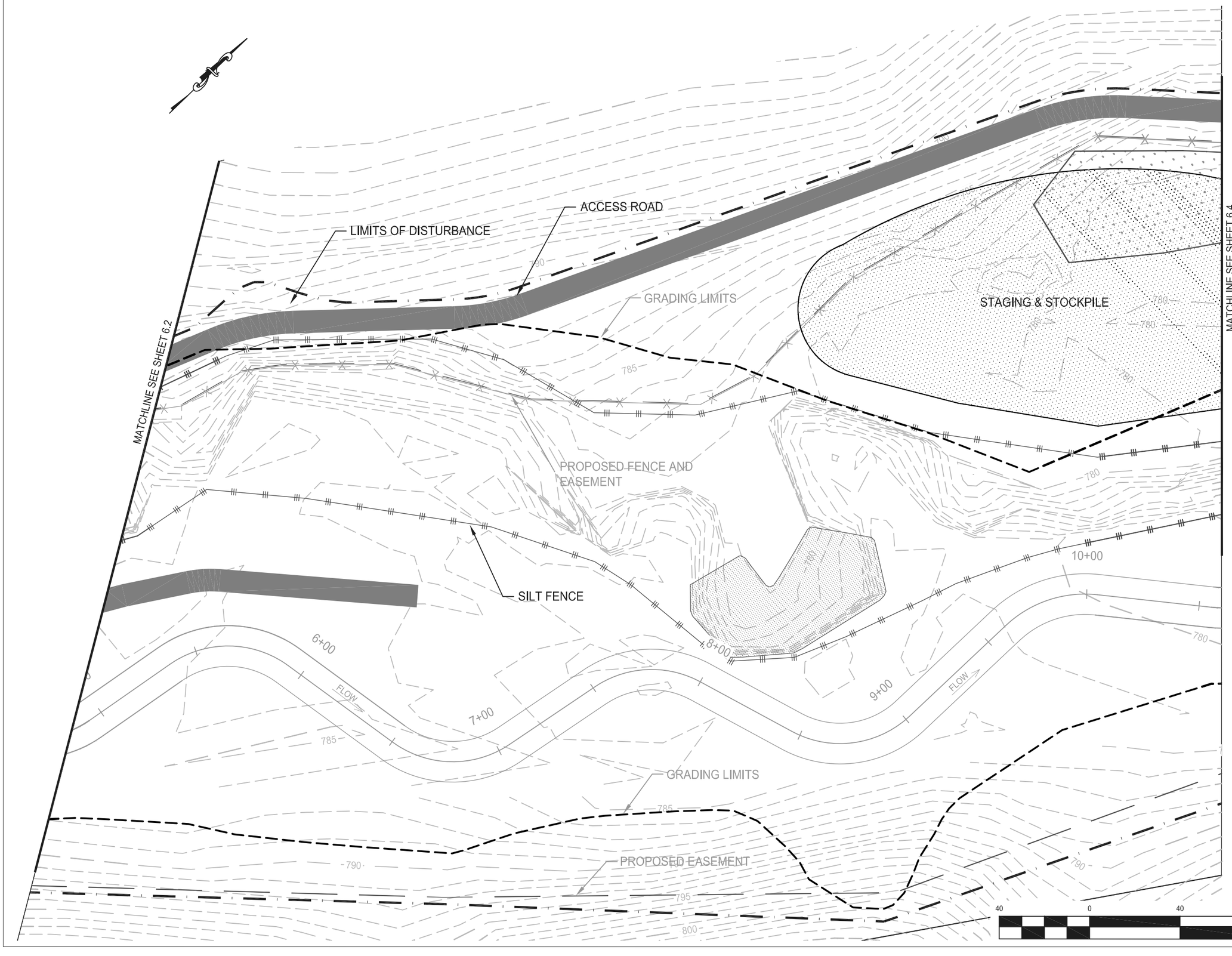

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CADD PLOT:	SCALE:	SHEET NO.
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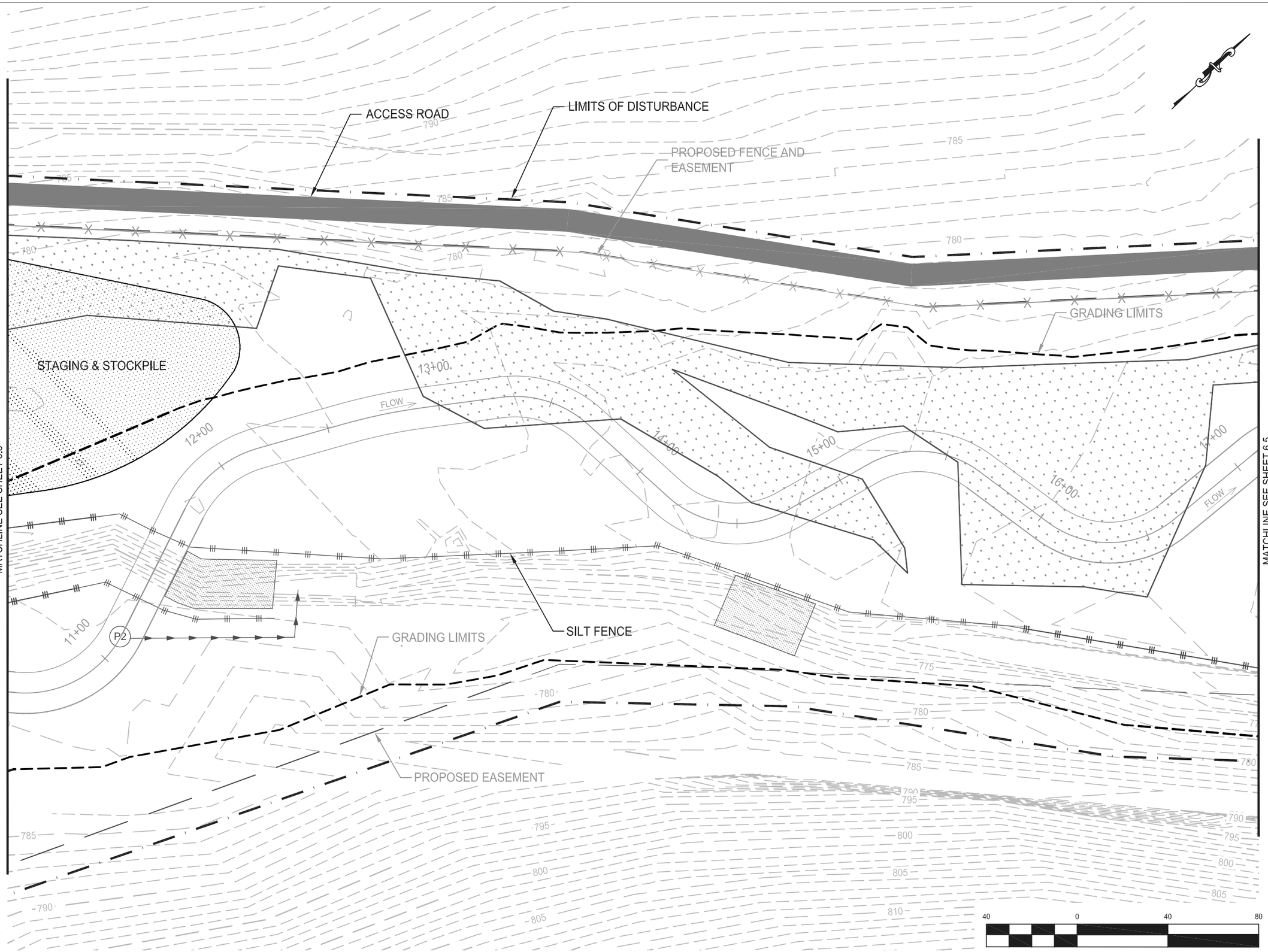

MATCHLINE SEE SHEET 6.3

MATCHLINE SEE SHEET 6.5

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CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	6.4
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

MATCHLINE SEE SHEET 6.6

MATCHLINE SEE SHEET 6.4

PROPOSED FENCE AND EASEMENT

STAGING & STOCKPILE

GRADING LIMITS

ACCESS ROAD

LIMITS OF DISTURBANCE

PROPOSED FENCE AND EASEMENT

FENCE TO TIE INTO EXISTING FENCE

SILT FENCE

GRADING LIMITS

PROPOSED EASEMENT

P3

P4

FLOW

18+00

19+00

20+00

21+00

22+00

23+00

24+00

25+00

END
UT 1 REACH 2
STA: 25+09
N: 690494.61
E: 1381340.68

END
NORTH FORK MOUNTAIN CREEK
REACH 4
STA: 21+07
N: 690483.98
E: 1381385.75

40 0 40 80

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RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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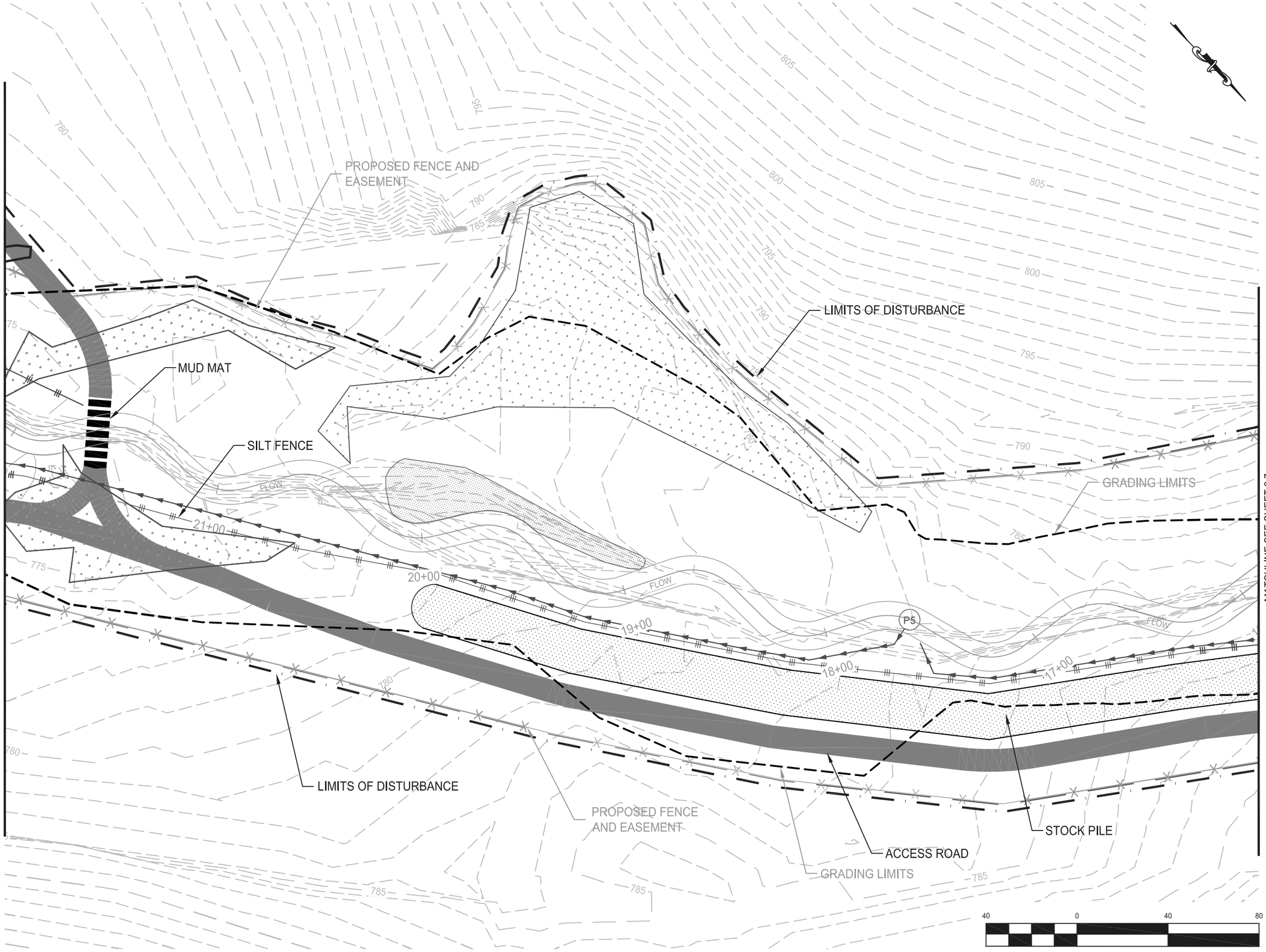

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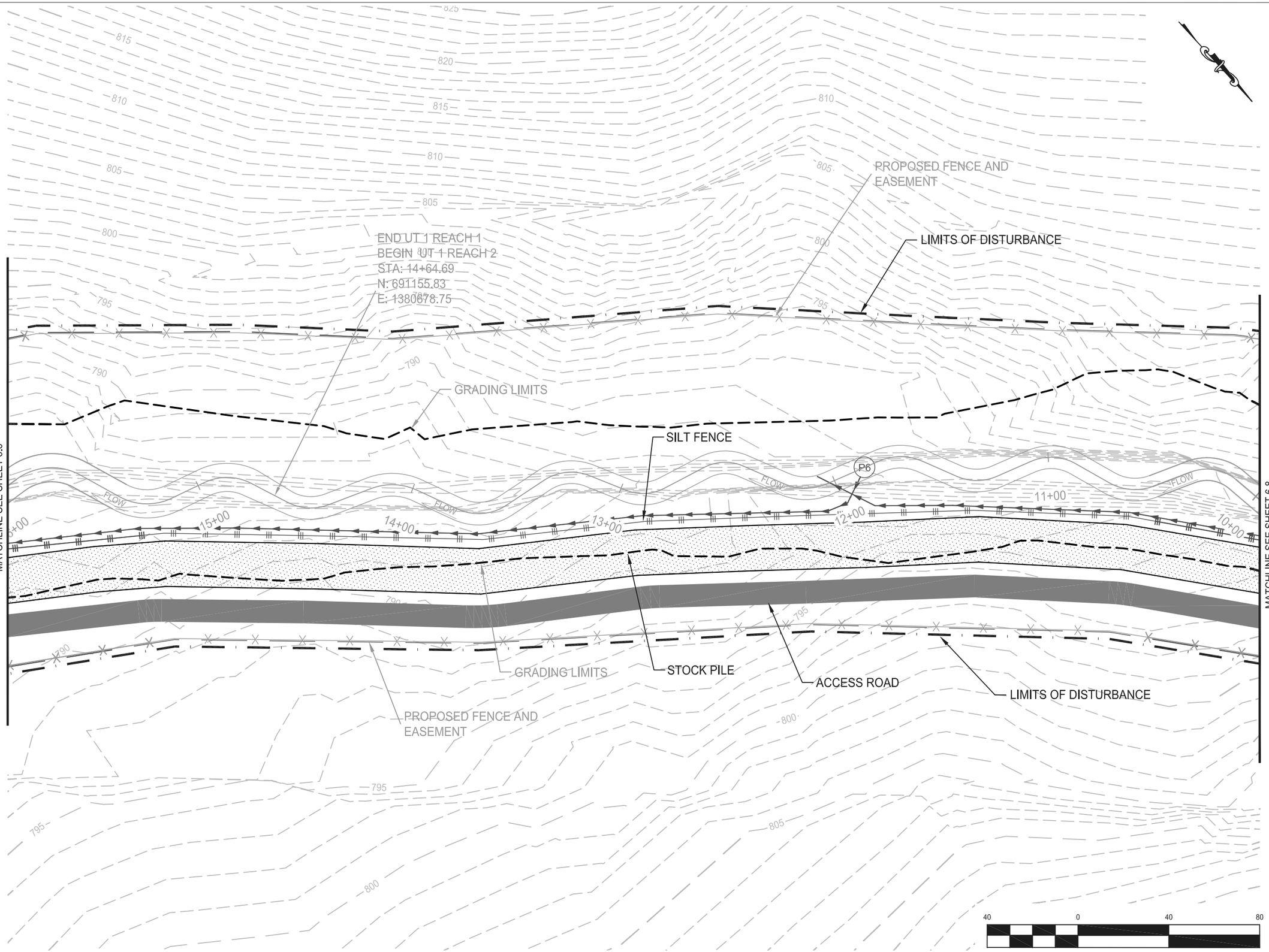

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CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	6.7
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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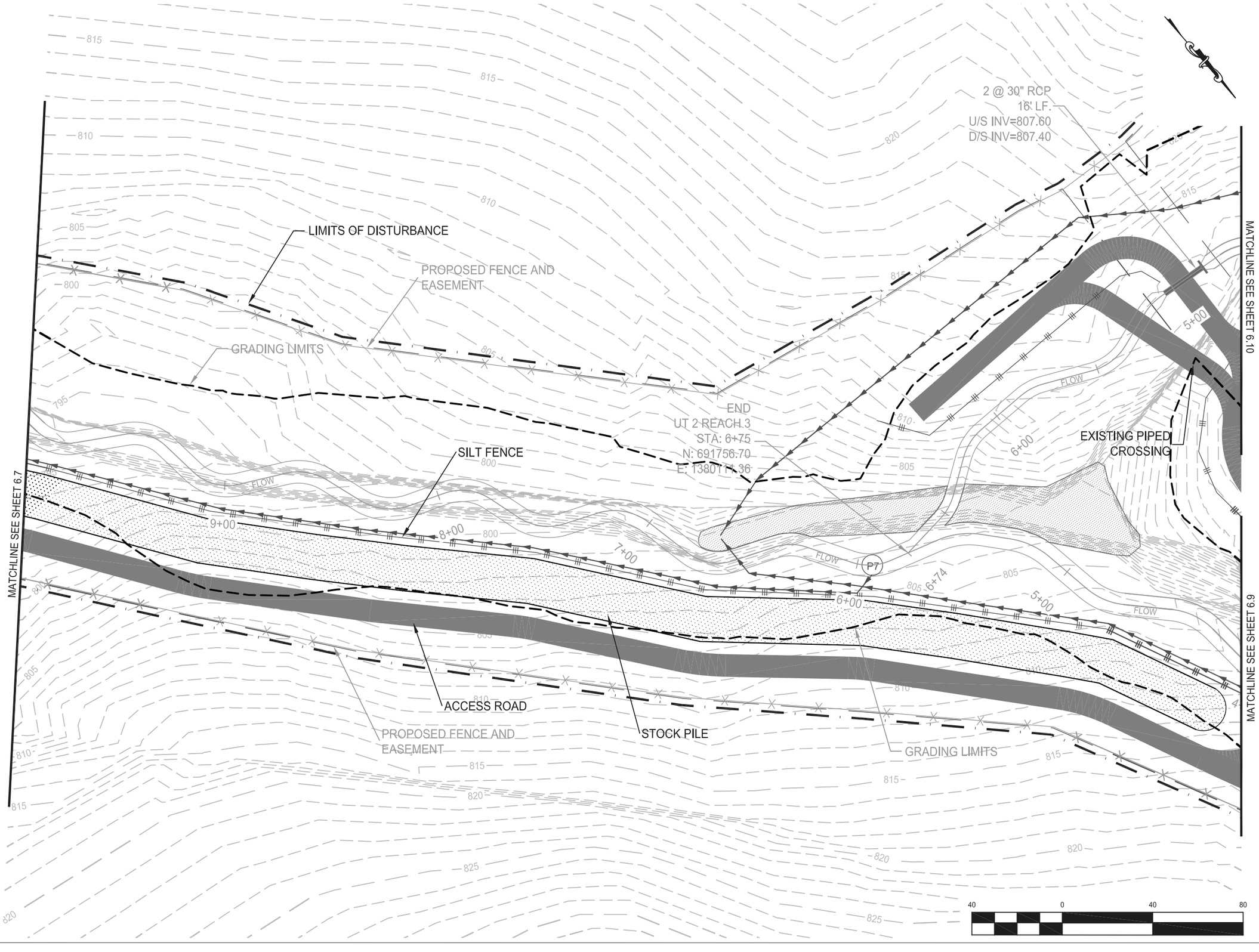

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RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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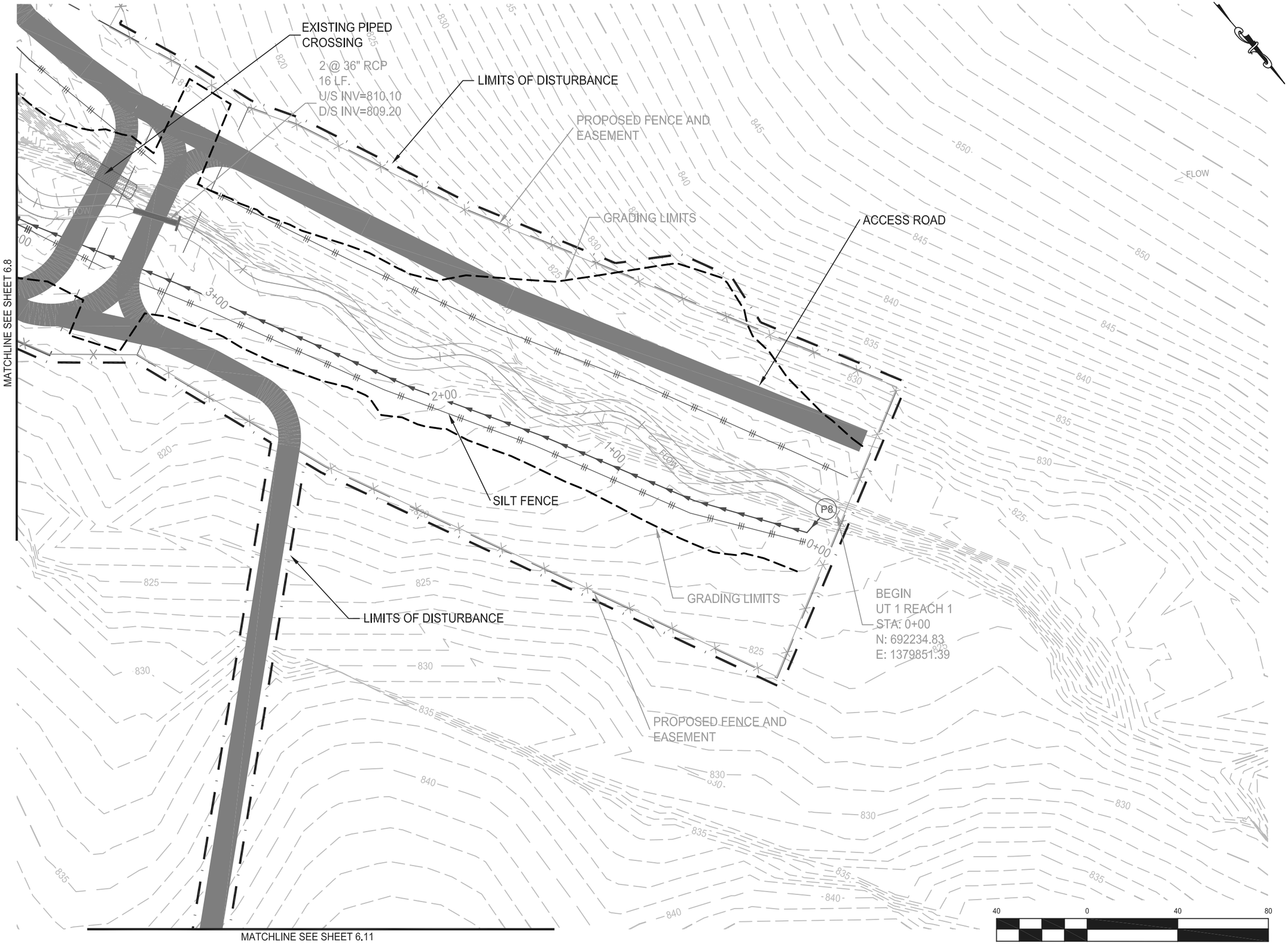

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SCALE:
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DATE: 4-29-11
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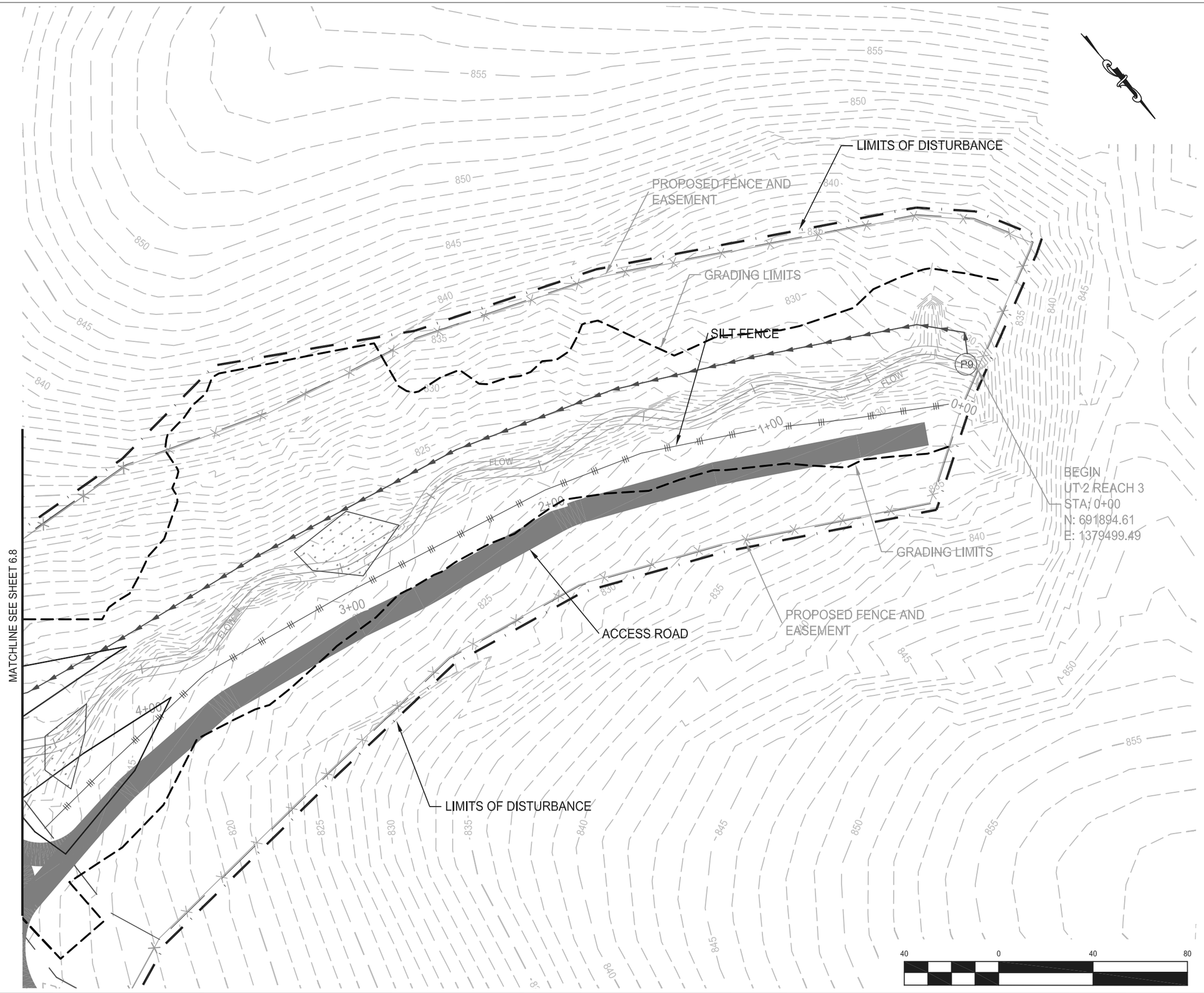
SHEET NO.
6.9



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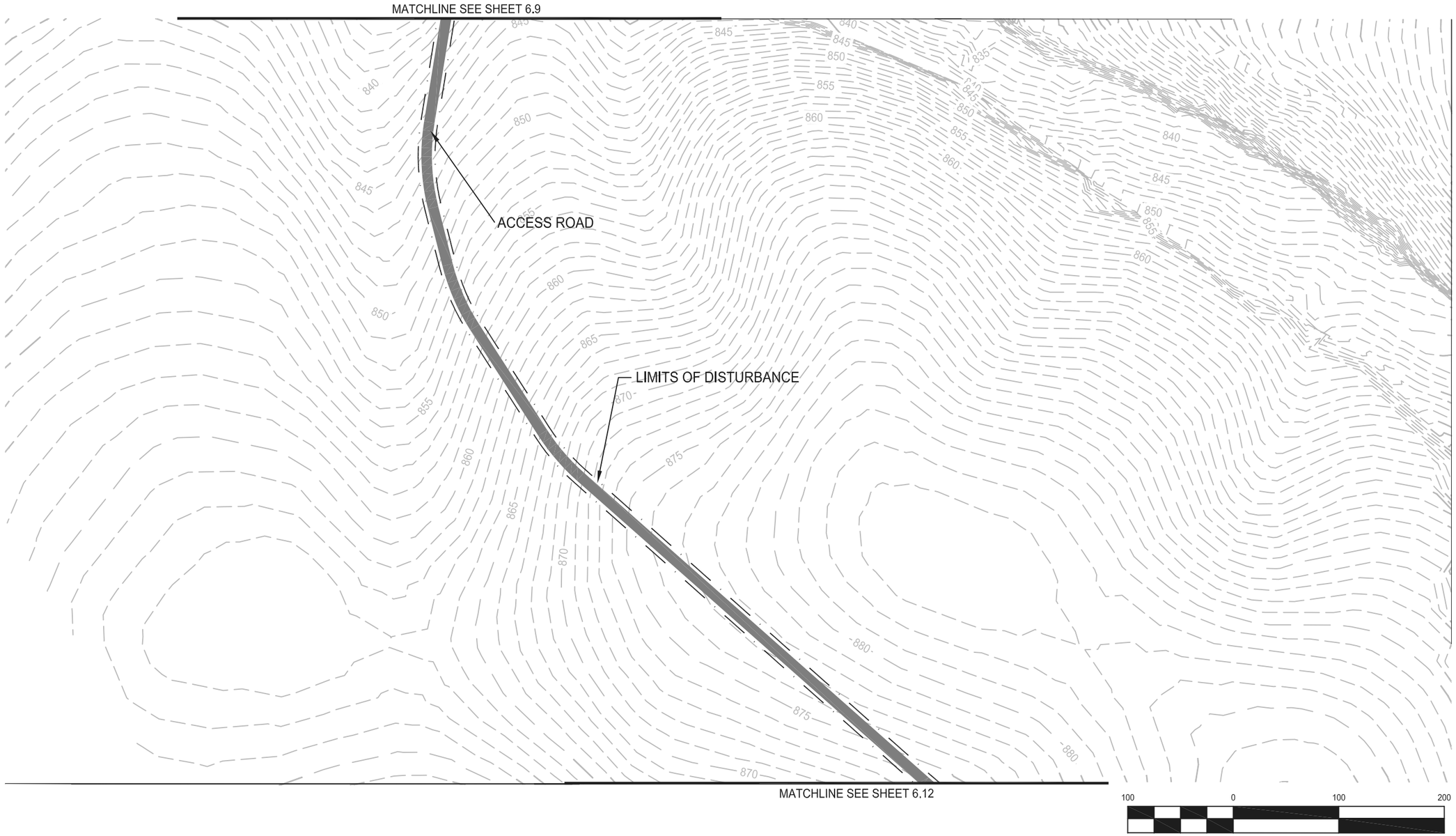

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VOID PLOT:	DRAWN BY: C.T.M.	6.11
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

MATCHLINE SEE SHEET 6.11

MATCHLINE SEE SHEET 6.13

LIMITS OF DISTURBANCE

ACCESS ROAD

WASTE MATERIALS AREA

SILT FENCE

100 0 100 200

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VOID PLOT:
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SCALE:
DRAWN BY: C.T.M.
DATE: 4-29-11
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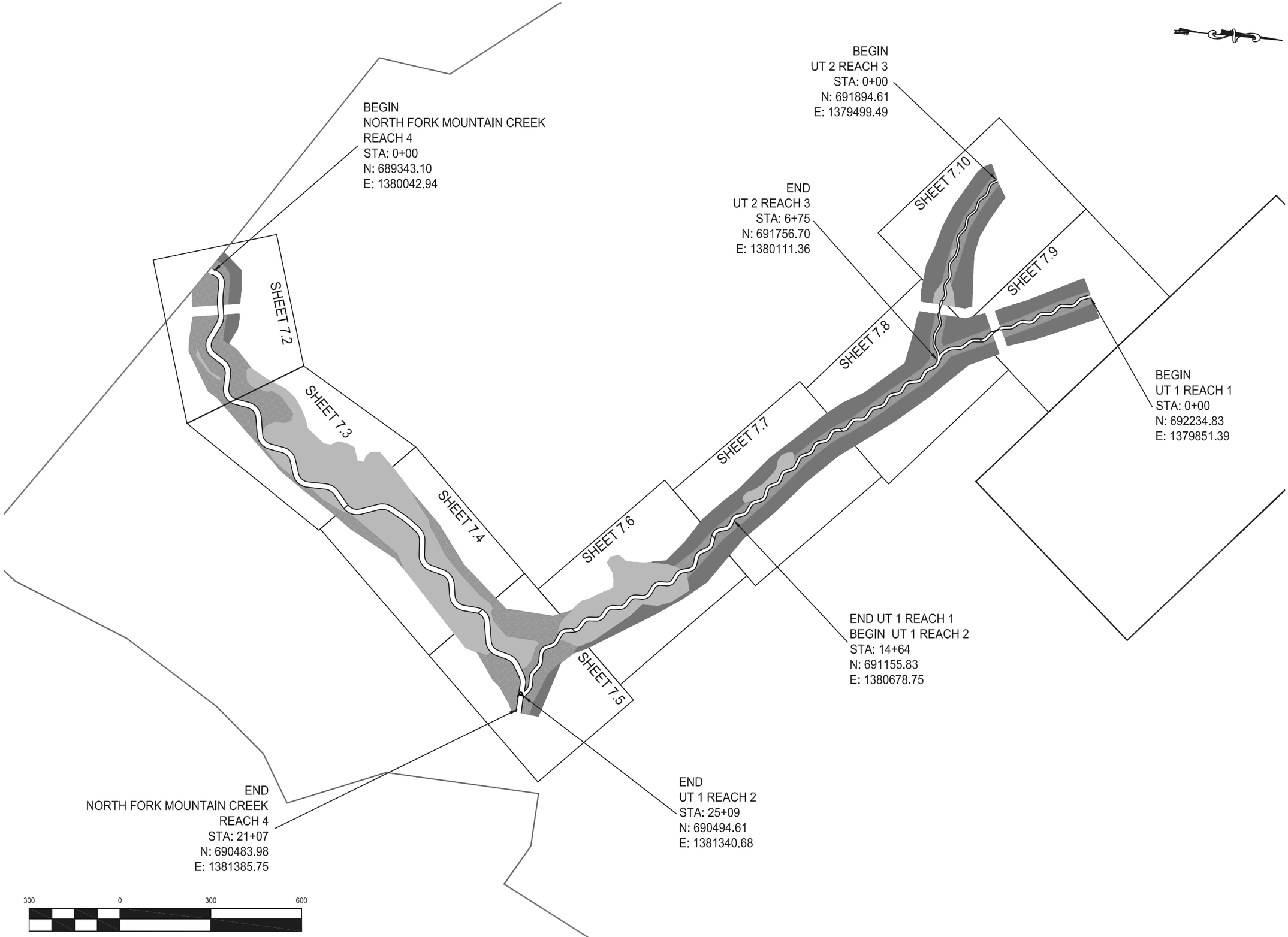
SHEET NO.
6.13



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PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
MASTER PLANTING SHEET

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	7.1
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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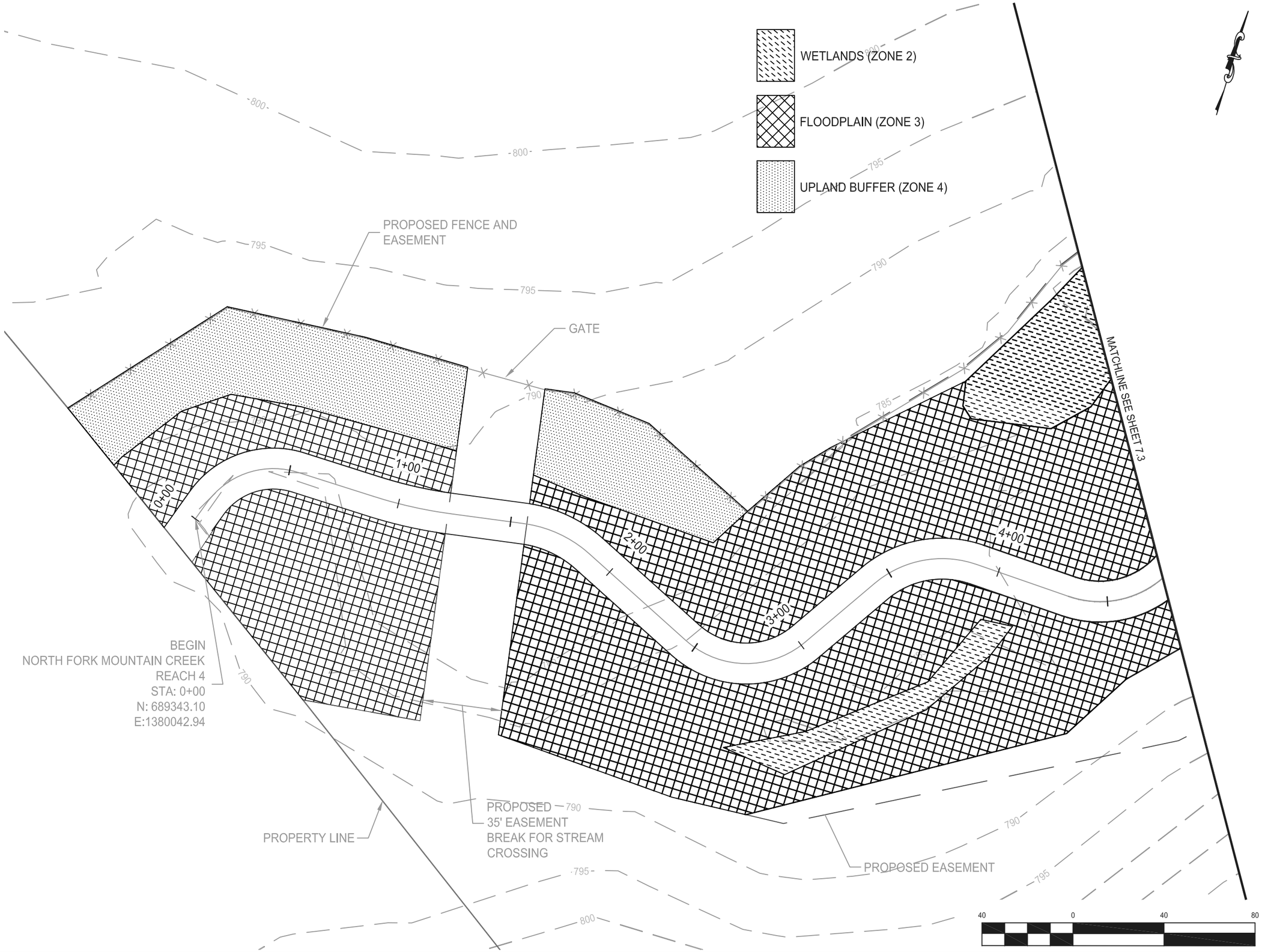

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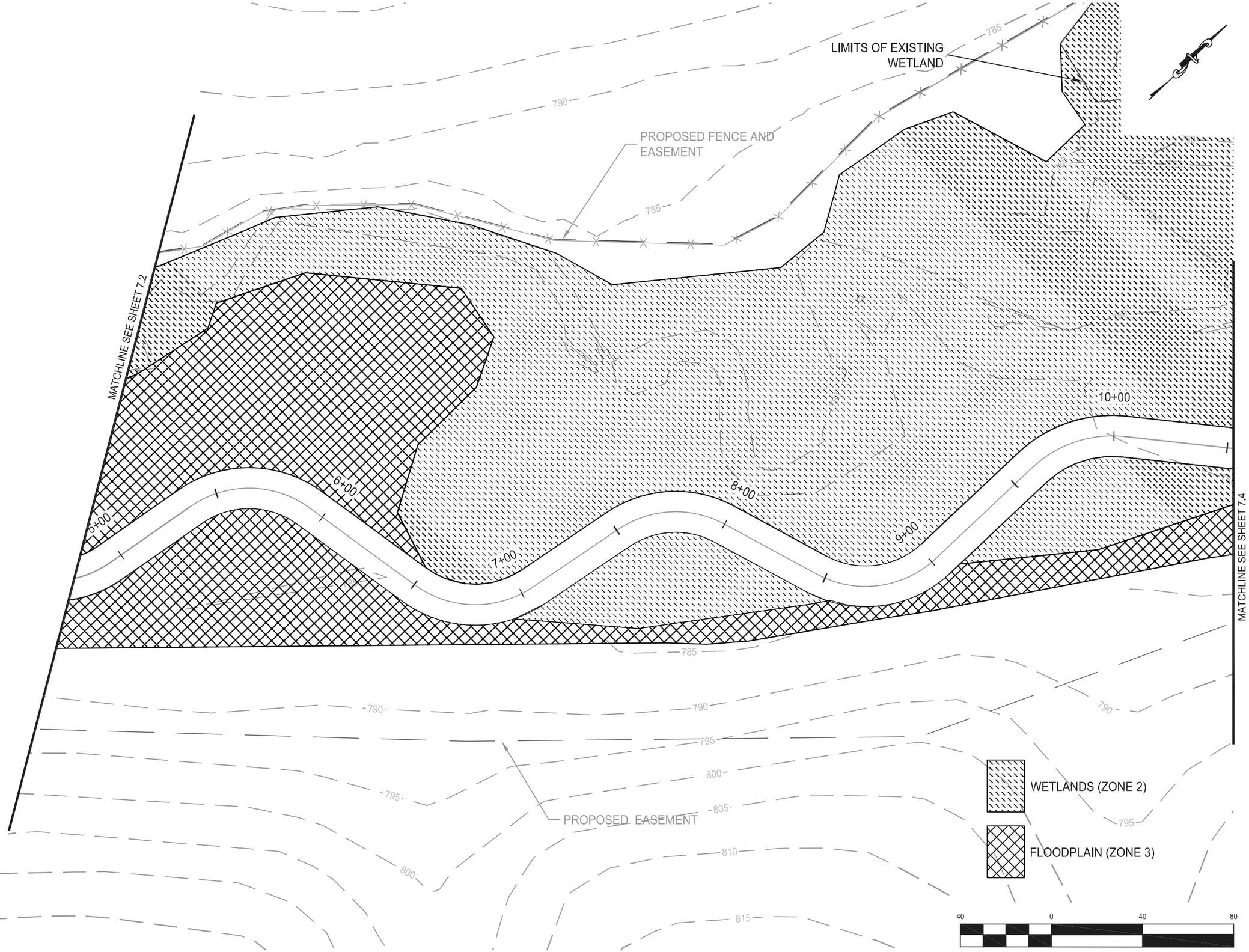
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
PLANTING SHEET

CADD PLOT:
VOID PLOT:
RELEASED TO CONSTRUCTION

SCALE:
DRAWN BY: C.T.M.
DATE: 4-29-11
REVIEWED BY: B.A.M.

SHEET NO.
7.2



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DRAWING TITLE
PLANTING SHEET

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SCALE:
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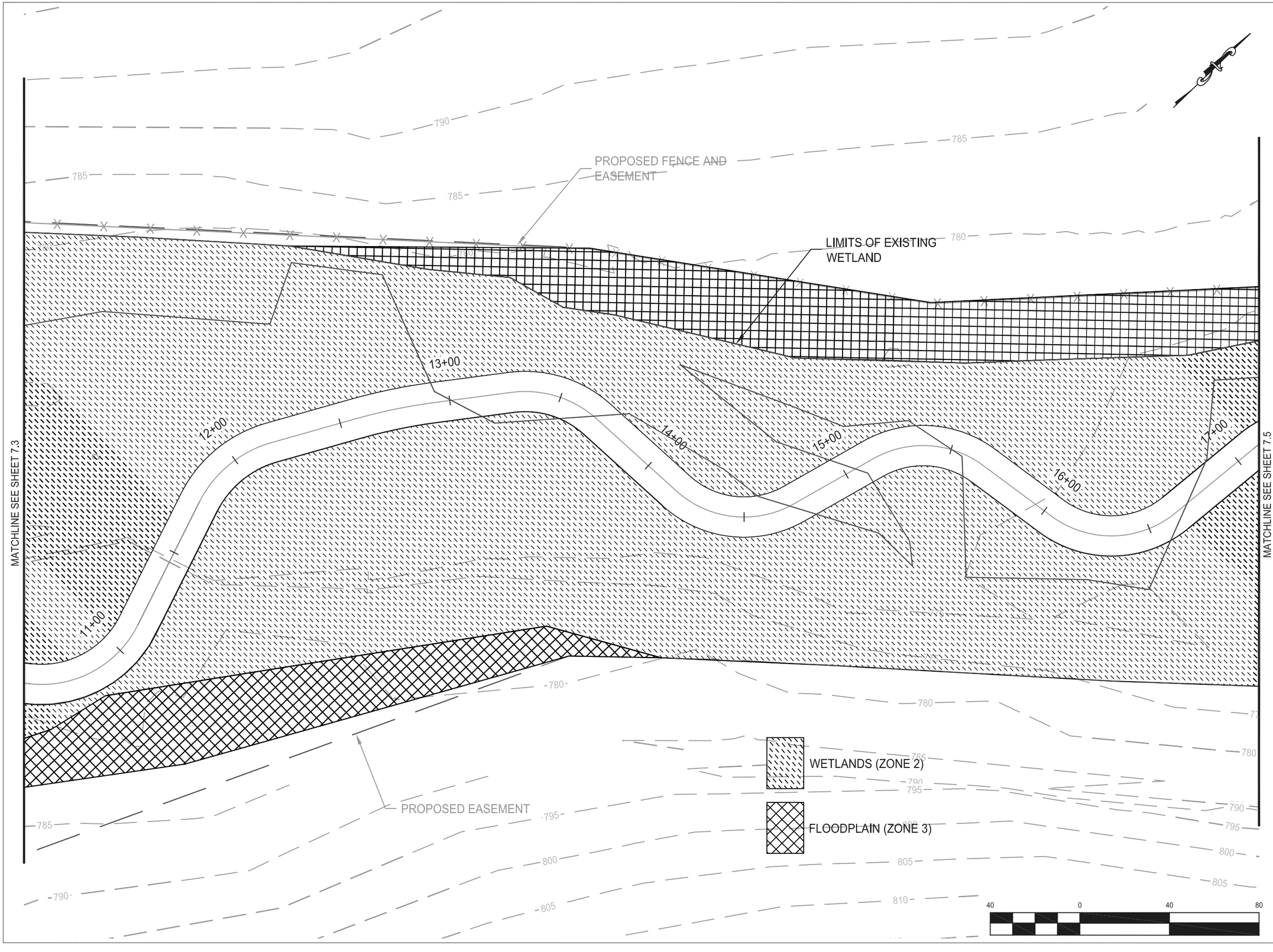
SHEET NO.
7.3



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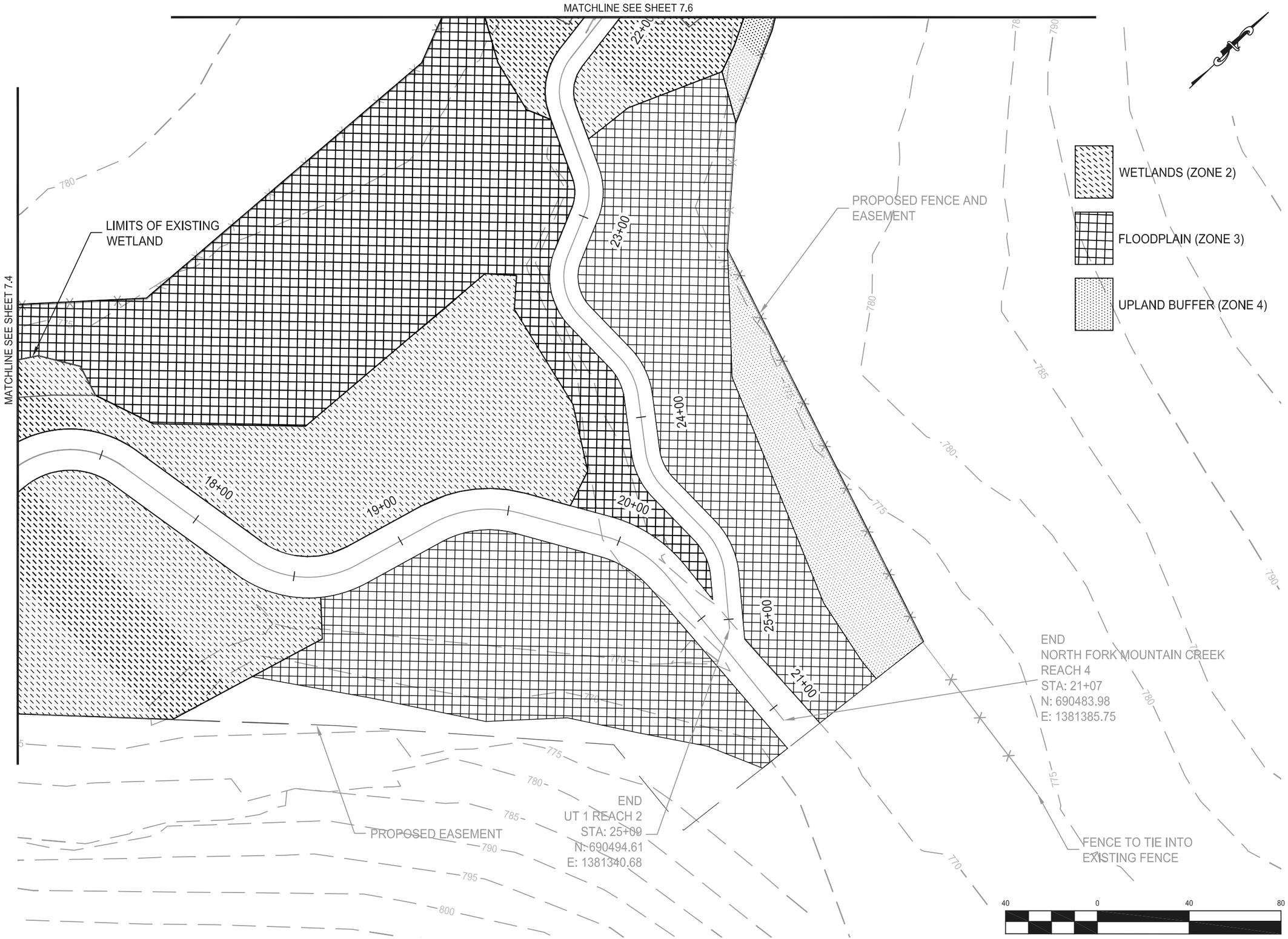

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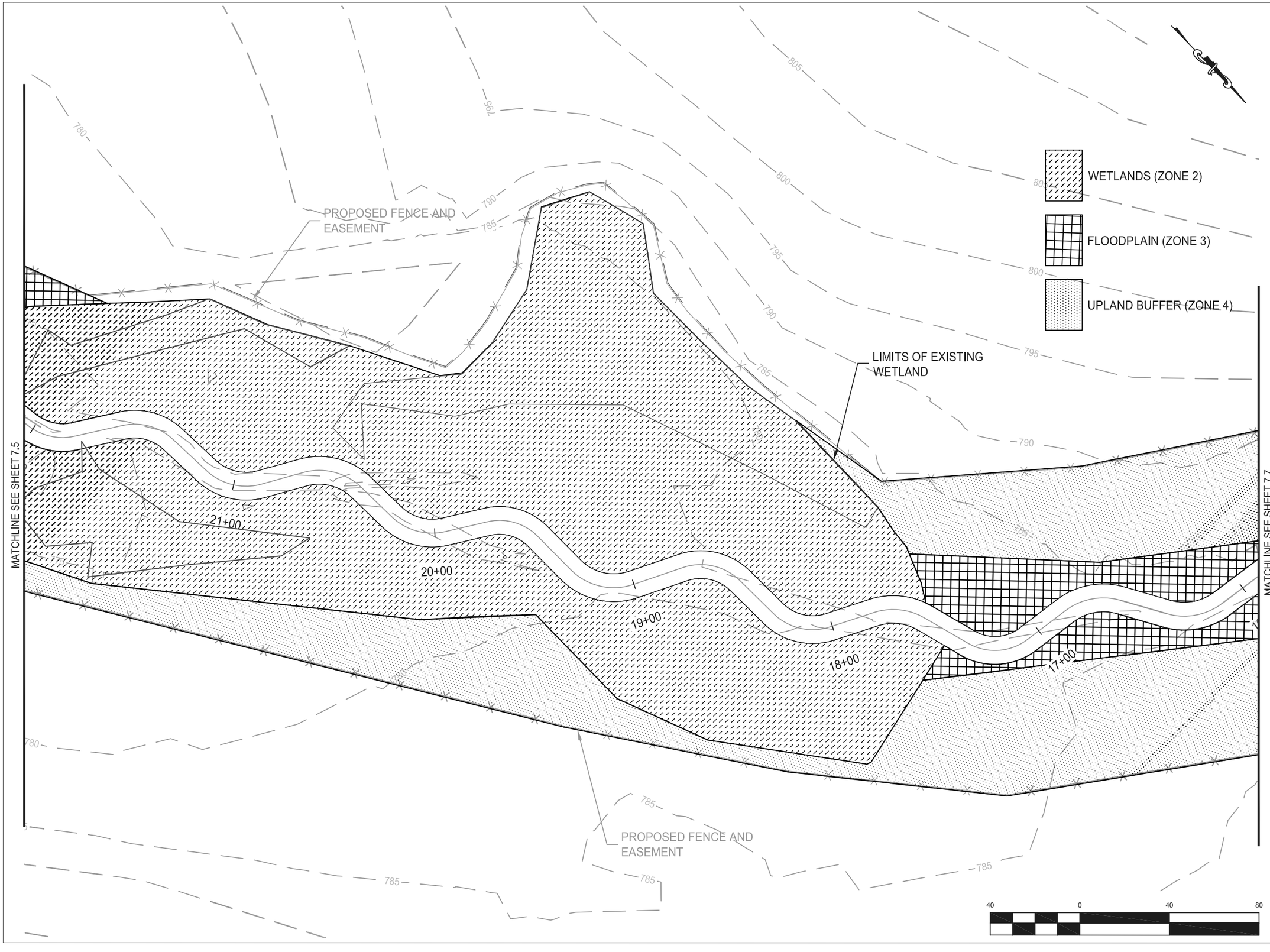
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
PLANTING SHEET

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	7.5
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	



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801 Jones Franklin Rd., Suite 300
Raleigh NC U.S.A.
27606
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Fax. 919.851.7024
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License No. F-0672

REVISIONS

NO.	DATE	BY	DESCRIPTION

CERTIFICATION AND SEAL

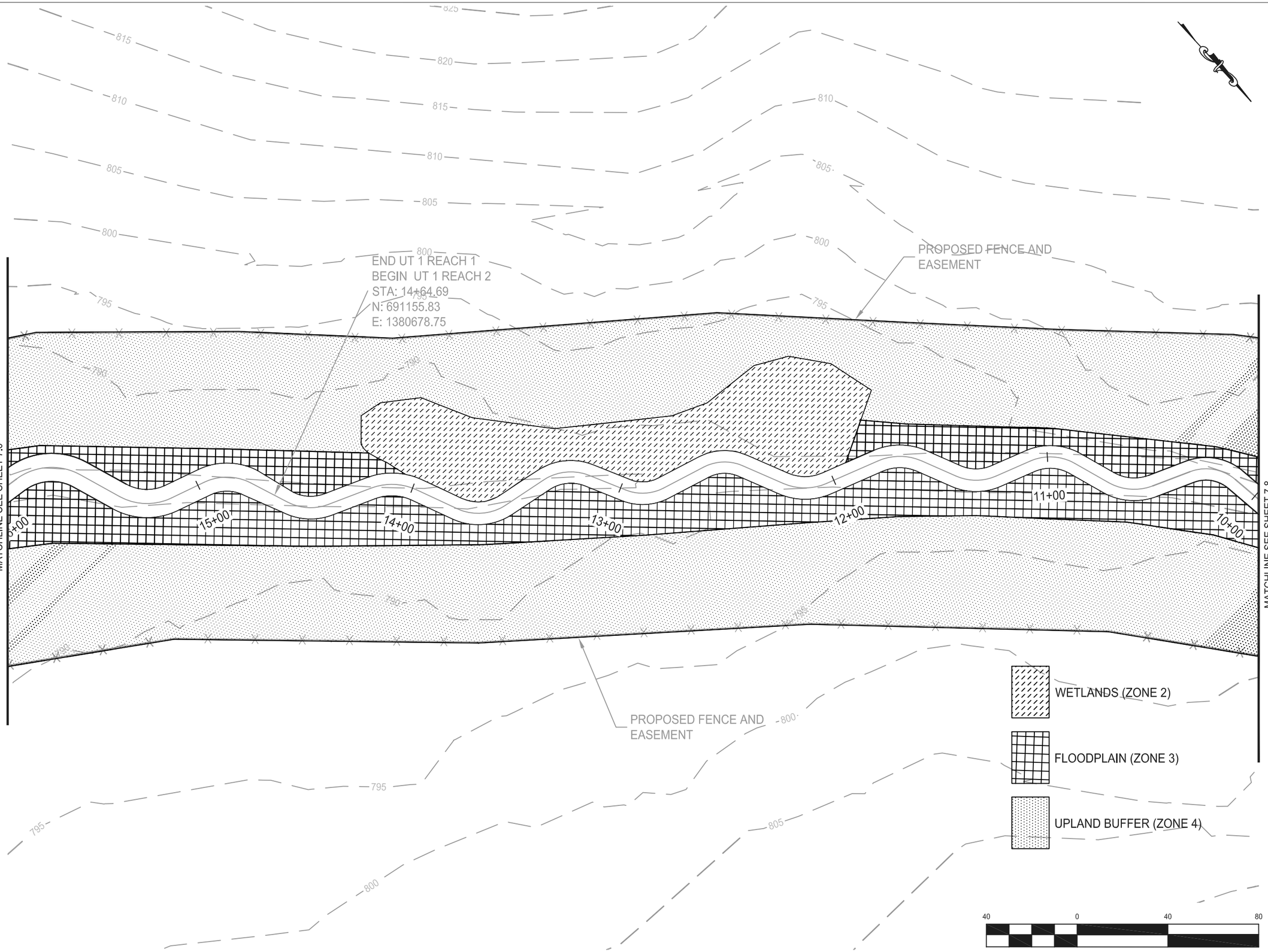
NOT FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
PLANTING SHEET

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	7.6
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	



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CATAWBA COUNTY, NORTH CAROLINA

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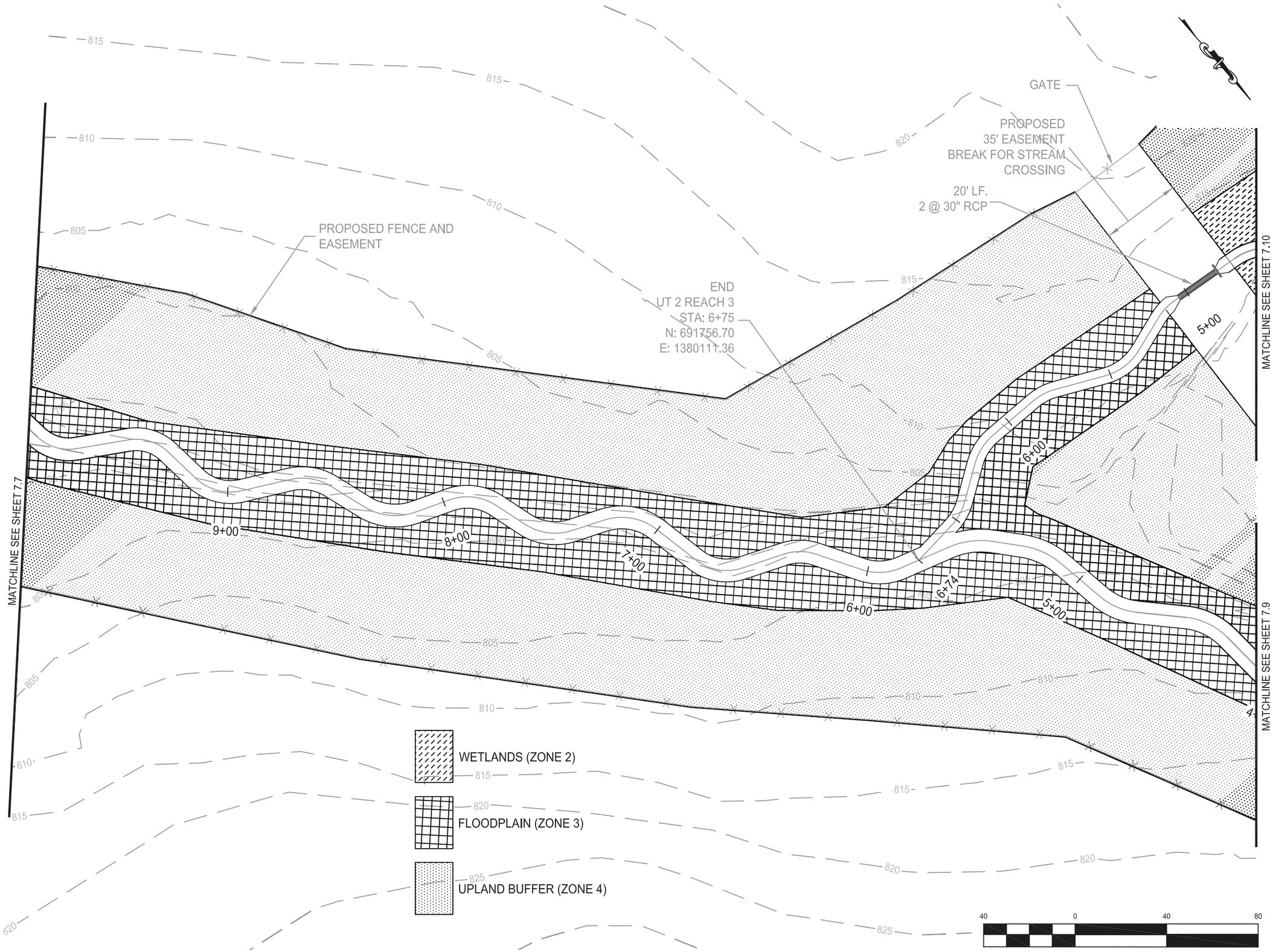
CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	7.7
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	



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STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
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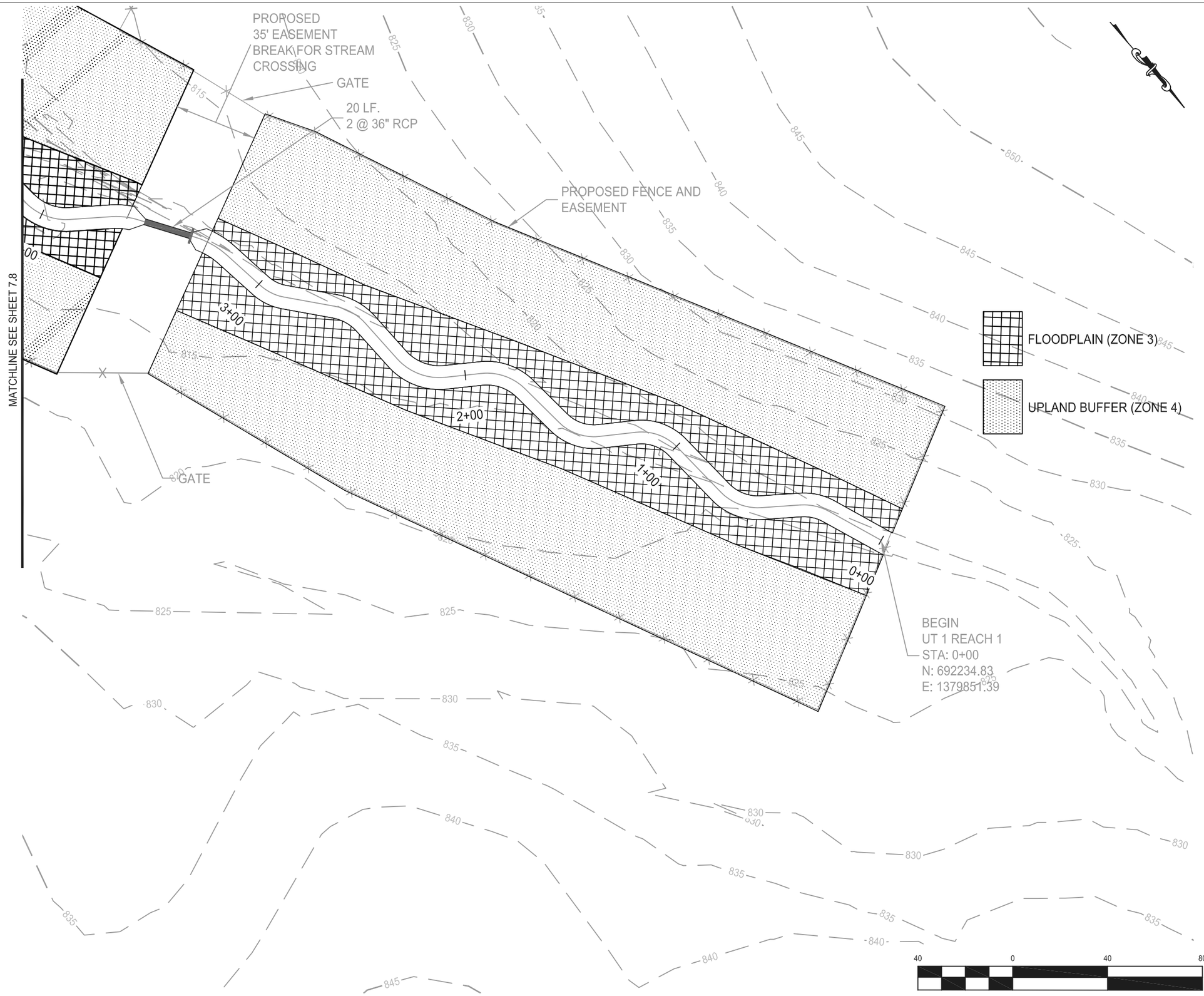
CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	7.8
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	



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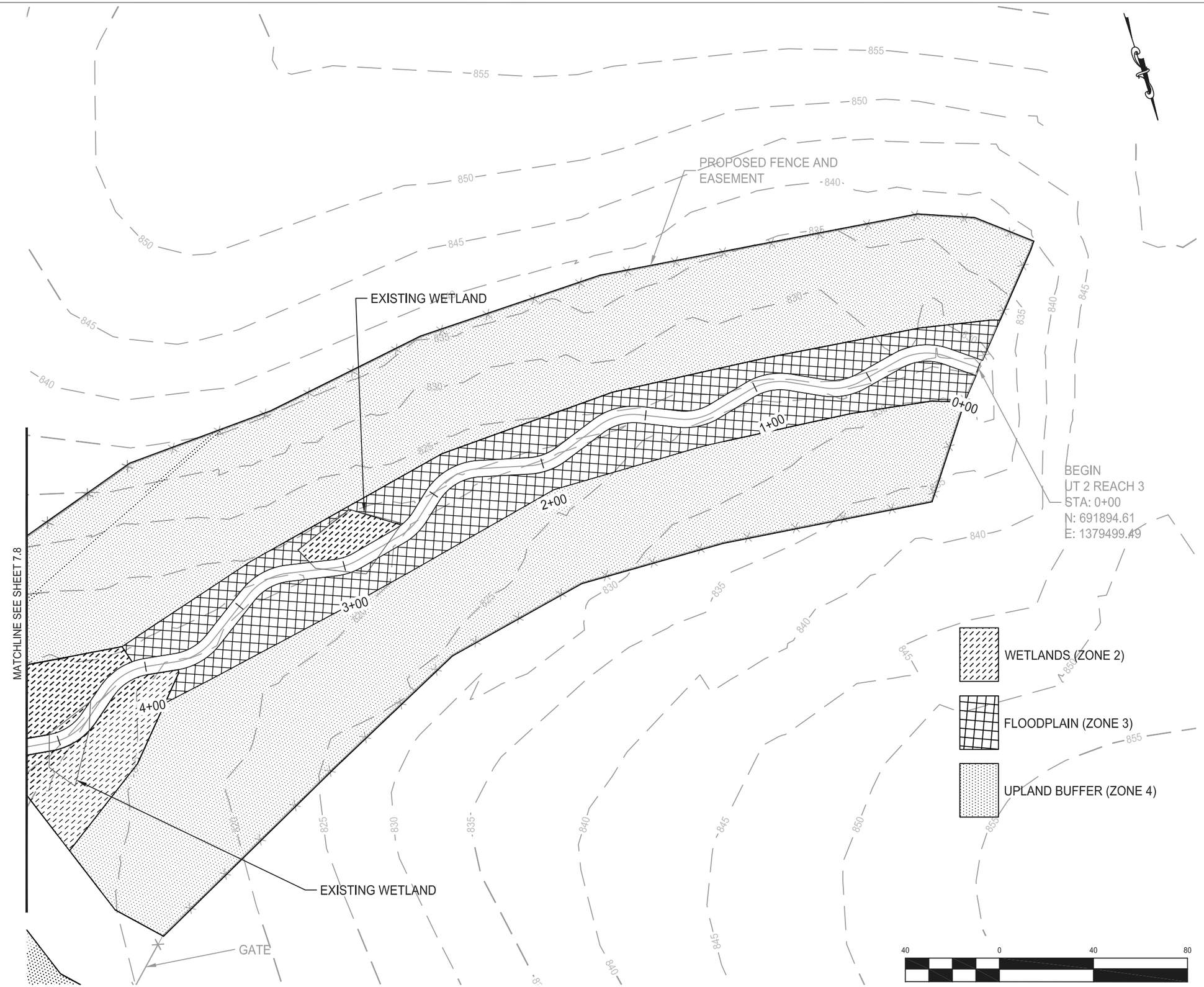
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
PLANTING SHEET

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	7.9
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	



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PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

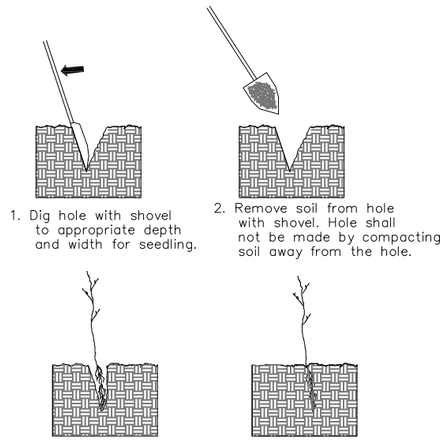
DRAWING TITLE
PLANTING SHEET

CADD PLOT:	SCALE:	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	7.10
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
	REVIEWED BY: B.A.M.	

PLANTING DETAILS

SEEDLING / LINER BAREROOT / PLUG PLANTING

PLANTING METHOD WITH A SHOVEL



1. Dig hole with shovel to appropriate depth and width for seedling.
2. Remove soil from hole with shovel. Hole shall not be made by compacting soil away from the hole.
3. Remove shovel and place seedling at correct depth.
4. Fill hole with soil. Tamp soil to remove air pockets. Water Thoroughly.

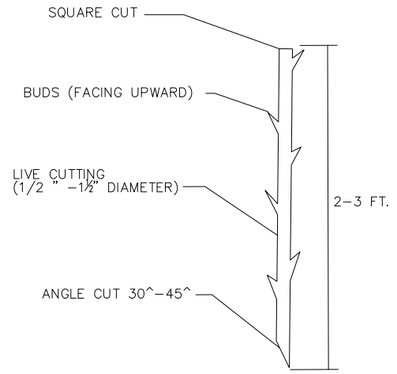
PLANTING NOTES:

PLANTING BAG
During planting, seedlings shall be kept in a moist canvas bag or similar container to prevent the root systems from drying.

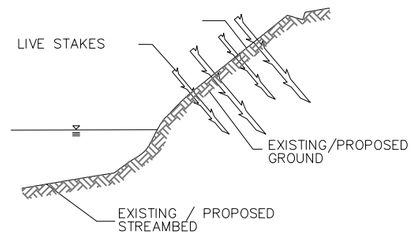
ROOT PRUNING
All seedlings shall be root pruned, if necessary, so that no roots extend more than 24inches (24IN.) below the root collar.

LIVE STAKE DETAIL

LIVE STAKE



BANK STABILIZATION WITH LIVE STAKES



NOTE: STAKING MAY BE REQUIRED THROUGH MATTING, ROCK OR COMPACTED SOILS. A STARTER HOLE MAY BE REQUIRED.

NOTE:

1. LIVE STAKES SHALL BE EVENLY SPACED 3 FT. APART.
2. LIVE STAKES SHALL BE DRIVEN UNTIL APPROXIMATELY 3/4 OF LIVE STAKE IS WITHIN GROUND.
3. IF STARTER HOLE IS NEEDED, MINIMIZE AIR POCKET.
4. UTILIZE ALL ON SITE TRANSPLANT MATERIALS MADE AVAILABLE BY THE OWNER. ONCE SOURCE OF TRANSPLANT MATERIAL HAS BEEN HARVESTED, THEN UTILIZE LIVE STAKING.

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NORTH CAROLINA PROFESSIONAL SEAL 033719 ENGINEER BRIANA MAZZOCHI

PROJECT NAME
NORTH FORK MOUNTAIN CREEK
STREAM RESTORATION
CATAWBA COUNTY, NORTH CAROLINA

DRAWING TITLE
PLANTING DETAILS

CADD PLOT:	SCALE: N/A	SHEET NO.
VOID PLOT:	DRAWN BY: C.T.M.	7.11
RELEASED TO CONSTRUCTION	DATE: 4-29-11	
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14.0 Appendices

Appendix 14.1. Project Site Photographs

Appendix 14.2. Project Site USACE Jurisdictional Wetland Determination and Data Forms

Appendix 14.3. Project Site NCDWQ Stream Classification Forms

Appendix 14.4. Reference Site Photographs

Appendix 14.5. Reference Site USACE Routine Wetland Delineation Forms

Appendix 14.6. Reference Site NCDWQ Stream Classification Forms

Appendix 14.7. Project Site Hydrologic Gauge Data Summary

Appendix 14.8. Reference Site Hydrologic Gauge Data Summary

Appendix 14.9. HEC–RAS Analysis Summary Tables

Appendix 14.10. EEP Floodplain Requirements Checklist

Appendix 14.11. Categorical Exclusion Approval Form

Appendix 14.12 Soil Profile Descriptions

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Appendix 14.1. Project Site Photos

Photo 1 – Panoramic overview of property

Photo 2 – Reach 4 entering southwest end of easement, looking downstream

Photo 3 –Reach 2

Photo 4 – Bank incision on Reach 4

Photo 5 - General area where *Hexastylis sp*. was observed (right bank Reach 4)

Photo 6 – *Hexastylis sp.*

Photo 7 – Reach 2

Photo 8 – Hoof shear on Reach 2

Photo 9 – Bank erosion on Reach 1

Photo 10 – Confluence of Reach 1 and Reach 3

Photo 11 – Pond outfall to Reach 3

Photo 12 – Headcut on Reach 3

Appendix 14.2. Project Site USACE Jurisdictional Wetland Determination and Data Forms

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DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: EBX North Fork Mtn Creek Applicant/Owner: EBX Investigator: TB	Date: 9/6/10 County: Catawba State: NC
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: _____ Transect ID: _____ Plot ID: DF-4

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Eulalia viridacea	herb	FAC+	9. Solanum carolinense	herb	FACU
2. Polygonum pensylvanicum	herb	FACW	10. Eupatorium perfoliatum	herb	FACW+
3. Alnus serrulata	shrub	FACW+	11. Diospyrus virginiana	tree	FAC
4. Eupatorium capillifolium	herb	FACU	12.		
5. Ligaid ambar styraciflua	tree	FAC+	13.		
6. Verbesina occidentalis	herb	FACU	14.		
7. Acer rubrum	tree	FAC	15.		
8. Lonicera japonica	vine	FAC-	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). _____

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water:	_____ (in.)
Depth to Free Water in Pit:	720 (in.)
Depth to Saturated Soil:	720 (in.)

Wetland Hydrology Indicators:
Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Data from near-by well demonstates lack of wetland hydrology in similar area/ position

SOILS

DA4

Map Unit Name
(Series and Phase): _____

Taxonomy (Subgroup): _____

Drainage Class: _____
Field Observations
Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-2	A	7.5 YR 3/4			si cl loam
2-8	B+1	7.5 YR 4/2	7.5 YR 4/4	M / F	cl loam
[redacted]			5 YR 4/6	F / D	
8-16	B+2	5 YR 4/6	7.5 YR 4/2	M / F	si clay
16-20+		7.5 YR 6/1	7.5 YR 5/6	M / D	si loam, stong pore linings

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content in Surface Layer in Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes No (Circle)	(Circle)
Wetland Hydrology Present?	Yes (No)	
Hydric Soils Present?	Yes No	Is this Sampling Point Within a Wetland? Yes (No)

Remarks:

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: EBX North Fork Mtn. Creek Applicant/Owner: EBX Investigator: TB	Date: 8-23-10 County: Catawba State: NC
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: _____ Transect ID: _____ Plot ID: DF-1 (1000, 1100)

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Polygonum pensylvanica	herb	FACW
2. Juncus spp.	herb	FACW
3. Carex spp.	herb	FACW
4. Vernonia noveboracensis	herb	FAC+
5. Ludwigia sp.	herb	OBL
6. Murdannia keisak	herb	OBL
7. Polygonum sagittatum	herb	OBL
8. Pilea pumila	herb	FACW
9. Woodwardia areolata	herb	OBL
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: 2 (in.)

Depth to Saturated Soil: 1 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

SOILS

DF-1

Map Unit Name
(Series and Phase): _____

Taxonomy (Subgroup): _____

Drainage Class: _____
Field Observations
Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-12+		10 YR 6/1			Sandy loam

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content in Surface Layer in Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks: Soils consist of eroded banks, adjacent to channels, subject to cattle crossing

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

Abutting wetlands to tributary (perennial)

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: EBX North Fork Mtn. Crk Applicant/Owner: EBX Investigator: Tamp Bandy	Date: 8-23-10 County: Catawba State: NC
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: _____ Transect ID: _____ Plot ID: DF-2 (1200)

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Impatiens capensis	herb	FACW
2. Alnus serulata	sap	FACW+
3. Sagittaria latifolia	herb	OBL
4. Eupatoriadelphus fist.	herb	FAC+
5. Juncus spp.	herb	FACW
6. Eulalia viminea	herb	FACW
7. Acer rubrum	tree	FAC
8. Carex sp.	herb	FACW

Dominant Plant Species	Stratum	Indicator
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks):
___ Stream, Lake, or Tide Gauge
___ Aerial Photographs
___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____(in.)
Depth to Free Water in Pit: 11 (in.)
Depth to Saturated Soil: 11 (in.)

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated
✓ Saturated in Upper 12 Inches
___ Water Marks
___ Drift Lines
___ Sediment Deposits
___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
✓ Oxidized Root Channels in Upper 12 Inches
✓ Water-Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks:

SOILS

DF-2

Map Unit Name
(Series and Phase): _____

Taxonomy (Subgroup): _____

Drainage Class: _____
Field Observations
Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
A	0-4	7.5 YR 4/3			si cl loam
Bwg	4-16	7.5 YR 6/1	2.5 YR 4/8		cl loam
Bg2	16+	N 4/0	10 YR 6/8		s cl loam

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content in Surface Layer in Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? ~~Yes~~ No (Circle)
Wetland Hydrology Present? ~~Yes~~ No
Hydric Soils Present? ~~Yes~~ No

(Circle)
Is this Sampling Point Within a Wetland? ~~Yes~~ No

Remarks:

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: EBX North Fork Mtn Creek Applicant/Owner: EBX Investigator: Tanp Bandy	Date: 9/2/10 County: Catawba State: NC
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: _____ Transect ID: _____ Plot ID: DF 3

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Polygonum pensylvan.	herb	FACW	9. Fraxinus pennsylvanica	sap	FACW
2. Vernonia noveboracensis	herb	FAC+	10. Rosa palustris	shrub	OBL
3. Impatiens capensis	herb	FACW	11. Acer rubrum	tree	FAC
4. Alnus serrulata	shrub	FACW+	12. Murdannia keisak	herb	OBL
5. Pilea pumila	herb	FACW	13. Eupatorium perfoliatum	herb	FACW+
6. Eupatoriadelphus fistulosum	herb	FAC+	14.		
7. Lobelia cardinalis	herb	FACW+	15.		
8. [redacted] Sagittaria latifolia	herb	OBL	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100 %

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: 7 18 (in.)

Depth to Saturated Soil: 7 18 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- X Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

SOILS

DF-3

Map Unit Name
(Series and Phase): _____

Taxonomy (Subgroup): _____

Drainage Class: _____
Field Observations
Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-2	A	7.5 YR 4/2	5 YR 4/6	M / D	si cl loam
2-12	B+	7.5 YR 4/2	5 YR 5/6	F / D	"
12-18+	B+2	10 YR 4/2	10 YR 5/6	F / F	"

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content in Surface Layer in Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: EBX North Fork Mtn. Cole Applicant/Owner: EBX Investigator: TB	Date: 8-23-10 County: Catawba State: NC
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: _____ Transect ID: _____ Plot ID: up

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Boehmeria cylindrica	herb	FACW+	9.		
2. Eupatorium perfoliatum	herb	FACW+	10.		
3. Eupatoriadelphus fist.	herb	FAC+	11.		
4. Festuca arundinacea	herb	FAC-	12.		
5. Eupatorium capillifolium	herb	FACU	13.		
6. Digitaria ischaemum	herb	UPL	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 50

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: 7 20 (in.)

Depth to Saturated Soil: 7 20 (in.)

Wetland Hydrology Indicators:
Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

SOILS

4P

Map Unit Name
(Series and Phase): _____

Drainage Class: _____

Taxonomy (Subgroup): _____

Field Observations
Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-8	A	7.5 4R 5/2	10 4R 5/1	C / F	cl loam
			7.5 4R 5/4	F / D	
8-16	Bw	7.5 4R 4/6	7.5 4R 5/4	F / F	cl loam

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content in Surface Layer in Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No) (Circle)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? Yes (No)

Remarks:

Approved by HQUSACE 3/92

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **2010-01537** County: **Catawba** U.S.G.S. Quad: **NC-Catawba**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner/Agent: **Hunsucker Farms, LLC**
Address: **3223 John Daniel Drive**
Conover, NC 28613
Telephone No.:

Property description:
Size (acres) **~4,300 LF of stream, and 3.14 acres of wetland** Nearest Town **Conover**
Nearest Waterway **North Fork Mountain Creek** River Basin **Upper Catawba**
USGS HUC **03050102** Coordinates **35.62724 N, -81.08449 W**

Location description **The site is located off of Buffalo Shoals Road (SR 1003), east of Feed Lot Road, near Conover, Catawba County, NC. North Fork Mountain Creek and an UT to North Fork Moutain Creek exist on the site. Coordinates in DD are: 35.62724 N, -81.08449 W.**

Indicate Which of the Following Apply:

A. Preliminary Determination

- Based on preliminary information, there may be waters on the above described property. We strongly suggest you have this property inspected to determine the extent of Department of the Army (DA) jurisdiction. To be considered final, a jurisdictional determination must be verified by the Corps. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331).

B. Approved Determination

- There are Navigable Waters of the United States within the above described property 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.

- There are waters on the above described property 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.

_ We strongly suggest you have the waters on your property delineated. Due to the size of your property and/or our present workload, the Corps may not be able to accomplish this wetland delineation in a timely manner. For a more timely delineation, you may wish to obtain a consultant. To be considered final, any delineation must be verified by the Corps.

X The waters on your property have been delineated and the delineation has been verified by the Corps. We strongly suggest you have this delineation surveyed. Upon completion, this survey should be reviewed and verified by the Corps. Once verified, this survey will provide an accurate depiction of all areas subject to CWA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

_ The waters have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on ___. 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.

- There are no waters of the U.S., to include wetlands, present on the above described property which are subject to the permit requirements of Section 404 of the Clean Water Act (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.

Action Id. 2010-1537

Placement of dredged or fill material within waters of the US and/or wetlands without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **Tyler Crumbley** at **828-271-7980**.

C. Basis For Determination

The site contains wetlands as determined by the USACE 1987 Wetland Delineation Manual and is adjacent to stream channels located on the property that exhibit indicators of ordinary high water marks. The stream channel on the property is an unnamed tributary to North Fork Mountain Creek which flows into the Upper Catawba River and ultimately flows to the Atlantic Ocean.

D. Remarks

E. Appeals Information (This information applies only to approved jurisdictional determinations as indicated in B. above)

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 Program
Attn: Tyler Crumbley, Project Manager
151 Patton Avenue, Room 208
Asheville, North Carolina 28801

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 Division 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 by 14 November, 2010.

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

Corps Regulatory Official: Tyler Crumbley Tyler A. Crumbley

Issue Date: **Catawba** Expiration Date: **16 September, 2015**

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

Wetland and Natural Resource Consultants, Inc. Attn: Tamp Bandy

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL		
Applicant: Hunsucker Farms, LLC	File Number: 2010-1537	Date: 16 September, 2010
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: Tyler Crumbley, Project Manager USACE, Asheville Regulatory Field Office 151 Patton Ave RM 208 Asheville, NC 28806 828-271-7980	If you only have questions regarding the appeal process you may also contact: Mr. Michael F. Bell, Administrative Appeal Review Officer CESAD-ET-CO-R U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 9M15 Atlanta, Georgia 30303-8801

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.

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

For appeals on Initial Proffered Permits and approved Jurisdictional Determinations send this form to:

District Engineer, Wilmington Regulatory Division, Attn: Tyler Crumbley, Project Manager, Asheville Regulatory Field Office, 151 Patton Avenue, Room 208, Asheville, NC 28801.

Appendix 14.3. Project Site NCDWQ Stream Classification Forms

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North Carolina Division of Water Quality – Stream Identification Form; Version 3.1

Date: August 14, 2008	**Project:** North Fork Mountain Creek Restoration	**Latitude:**
Evaluator: T Bandy	**Site:** Reach 3	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 35.25	**County:** Catawba	**Other** e.g. Quad Name:

A. Geomorphology (Subtotal = 19)	Absent	Weak	Moderate	Strong
1[a]. Continuous bed and bank	0	1	2	3
2. Sinuosity	0	1	2	3
3. In-channel structure: riffle-pool sequence	0	1	2	3
4. Soil texture or stream substrate sorting	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	1	2	3
9[a]. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. Second or greater order channel on existing USGS or NRCS map or other documented evidence.	No = 0		Yes = 3	

[a] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)				
14. Groundwater flow/discharge	0	1	2	3
15. Water in channel and > 48 hrs since rain, **or** Water in channel – dry or growing season	0	1	2	3
16. Leaflitter	1.5	1	0.5	0
17. Sediment on plants or debris	0	0.5	1	1.5
18. Organic debris lines or piles (Wrack lines)	0	0.5	1	1.5
19. Hydric soils (redoximorphic features) present?	No = 0		Yes = 1.5	

C. Biology (Subtotal = 7.25)				
20[b]. Fibrous roots in channel	3	2	1	0
21[b]. Rooted plants in channel	3	2	1	0
22. Crayfish	0	0.5	1	1.5
23. Bivalves	0	1	2	3
24. Fish	0	0.5	1	1.5
25. Amphibians	0	0.5	1	1.5
26. Macrobenthos (note diversity and abundance)	0	0.5	1	1.5
27. Filamentous algae; periphyton	0	1	2	3
28. Iron oxidizing bacteria bacteria/fungus	0	0.5	1	1.5
29[b]. Wetland plants in streambed	FAC = 0.5; FACW = 0.75; OBL = 1.5; SAV = 2.0; Other = 0			

[b] Items 20 and 21 focus on the presence of upland plants, Item 29 focuses on the presence of aquatic or wetland plants.

Notes: (use back side of this form for additional notes.)

Sketch:

North Carolina Division of Water Quality – Stream Identification Form; Version 3.1

Date: July 25, 2008	**Project:** North Fork Mountain Creek Restoration	**Latitude:**
Evaluator: M Ruiz, B Fairley	**Site:** N Fork Mountain Creek (Reach 4)	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 39.25	**County:** Catawba	**Other** e.g. Quad Name:

A. Geomorphology (Subtotal = 20)	Absent	Weak	Moderate	Strong
1[a]. Continuous bed and bank	0	1	2	3
2. Sinuosity	0	1	2	3
3. In-channel structure: riffle-pool sequence	0	1	2	3
4. Soil texture or stream substrate sorting	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	1	2	3
9[a]. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. Second or greater order channel on existing USGS or NRCS map or other documented evidence.	No = 0		Yes = 3	

[a] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10.5)				
14. Groundwater flow/discharge	0	1	2	3
15. Water in channel and > 48 hrs since rain, **or** Water in channel – dry or growing season	0	1	2	3
16. Leaflitter	1.5	1	0.5	0
17. Sediment on plants or debris	0	0.5	1	1.5
18. Organic debris lines or piles (Wrack lines)	0	0.5	1	1.5
19. Hydric soils (redoximorphic features) present?	No = 0		Yes = 1.5	

C. Biology (Subtotal = 8.75)				
20[b]. Fibrous roots in channel	3	2	1	0
21[b]. Rooted plants in channel	3	2	1	0
22. Crayfish	0	0.5	1	1.5
23. Bivalves	0	1	2	3
24. Fish	0	0.5	1	1.5
25. Amphibians	0	0.5	1	1.5
26. Macrobenthos (note diversity and abundance)	0	0.5	1	1.5
27. Filamentous algae; periphyton	0	1	2	3
28. Iron oxidizing bacteria bacteria/fungus	0	0.5	1	1.5
29[b]. Wetland plants in streambed	FAC = 0.5; FACW = 0.75; OBL = 1.5; SAV = 2.0; Other = 0			

[b] Items 20 and 21 focus on the presence of upland plants, Item 29 focuses on the presence of aquatic or wetland plants.

Notes: (use back side of this form for additional notes.)

Sketch:

North Carolina Division of Water Quality – Stream Identification Form; Version 3.1

Date: July 25, 2008	**Project:** North Fork Mountain Creek Restoration	**Latitude:**
Evaluator: M Ruiz, B Fairley	**Site:** Reach 1	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 31	**County:** Catawba	**Other** e.g. Quad Name:

A. Geomorphology (Subtotal = 19)	Absent	Weak	Moderate	Strong
1[a]. Continuous bed and bank	0	1	2	3
2. Sinuosity	0	1	2	3
3. In-channel structure: riffle-pool sequence	0	1	2	3
4. Soil texture or stream substrate sorting	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	1	2	3
9[a]. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. Second or greater order channel on existing USGS or NRCS map or other documented evidence.	No = 0		Yes = 3	

[a] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8.5)				
14. Groundwater flow/discharge	0	1	2	3
15. Water in channel and > 48 hrs since rain, **or** Water in channel – dry or growing season	0	1	2	3
16. Leaflitter	1.5	1	0.5	0
17. Sediment on plants or debris	0	0.5	1	1.5
18. Organic debris lines or piles (Wrack lines)	0	0.5	1	1.5
19. Hydric soils (redoximorphic features) present?	No = 0		Yes = 1.5	

C. Biology (Subtotal = 3.5)				
20[b]. Fibrous roots in channel	3	2	1	0
21[b]. Rooted plants in channel	3	2	1	0
22. Crayfish	0	0.5	1	1.5
23. Bivalves	0	1	2	3
24. Fish	0	0.5	1	1.5
25. Amphibians	0	0.5	1	1.5
26. Macrobenthos (note diversity and abundance)	0	0.5	1	1.5
27. Filamentous algae; periphyton	0	1	2	3
28. Iron oxidizing bacteria bacteria/fungus	0	0.5	1	1.5
29[b]. Wetland plants in streambed	FAC = 0.5; FACW = 0.75; OBL = 1.5; SAV = 2.0; Other = 0			

[b] Items 20 and 21 focus on the presence of upland plants, Item 29 focuses on the presence of aquatic or wetland plants.

Notes: (use back side of this form for additional notes.)

5 ft TOB

2-4 Bottom width

3-10 TOB width

Sketch:

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Appendix 14.4. Reference Site Photographs

Photo R1 - Morgan Creek in Orange County, NC

Photo R2 - Morgan Creek in Orange County, NC

Photo R3 - Thickety Creek Montgomery County, NC

Photo R4 - UT to Thickety Creek Montgomery County, NC

Photo R5 – South Fork reference wetland

Photo R6 – South Fork reference wetland

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Appendix 14.5. Reference Site USACE Routine Wetland Determination Forms

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DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork North
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 2-13-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical situation)? Yes ____ No X
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W13
Transect ID: ____
Plot ID: DP#1 Wetland

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Betula nigra	1	FACW
2. Acer rubrum	1	FAC
3. Ligustrum sinense	2	FAC
4. Alnus rugosa	2	FACW
5. Arundinaria gigantea	3	FACW
6.		
7.		
8.		

Dominant Plant Species	Stratum	Indicator
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: _____ **(in.)**

Depth to Free Water in Pit: Surface **(in.)**

Depth to Saturated Soil: Surface **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- ___ **Inundated**
- X **Saturated in Upper 12"**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- X **Drainage Patterns in Wetlands**

Secondary Indicators:
- ___ **Oxidized Roots Channels in Upper 12"**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- ___ **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

Hydrology from hillside seepage and groundwater.

SOILS

Map Unit Name
(Series and Phase): Wehadkee **Drainage Class:** Poorly Drained

Taxonomy (Subgroup): Fluvaquentic Endoaquepts
Confirm Mapped Type? Yes ___ **No** X .

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-15	A1	10YR 3/2			fsl, 1fgr

Hydric Soil Indicators:

___ Histosol	___ Concretions
___ Histic Epipedon	___ High Organic Content in Surface Layer in Sandy Soils
X Sulfidic Odor	___ Organic Streaking in Sandy Soils
___ Aquic Moisture Regime	X Listed On Local Hydric Soils List
___ Reducing Conditions	X Listed on National Hydric Soils List
X Gleyed or Low-Chroma Colors	___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ___
Wetland Hydrology Present? Yes X No ___
Hydric Soils Present? Yes X No ___

Is the Sampling Point Within a Wetland? Yes X No ___

Remarks:

M:/2007/12071067_2007 EEP OPEN END\12071067D_South Fork\WETLANDS\Data Forms\ Wetlands.W13 unit.DP#1_ Wetland

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork North
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 2-13-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes X No ____
Is the site significantly disturbed (Atypical situation)? Yes ____ No X
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W13
Transect ID: ____
Plot ID: DP#2 NW

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Festuca arundinacea	3	FAC-
2. Liriodendron tulipifera	1	FAC
3. Platanus occidentalis	1	FACW-
4. Fraxinus pennsylvanica	2	FACW
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:
This is a planted riparian buffer previously in pasture.

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: _____ **(in.)**

Depth to Free Water in Pit: >15 **(in.)**

Depth to Saturated Soil: _____ **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- ___ **Inundated**
- ___ **Saturated in Upper 12”**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- X **Drainage Patterns in Wetlands**

Secondary Indicators:
- ___ **Oxidized Roots Channels in Upper 12”**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- ___ **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Chewacla **Drainage Class:** Somewhat Poorly

Taxonomy (Subgroup): Fluvaquentic Dystrudepts **Confirm Mapped Type? Yes** ___ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	Ap	5YR 4/4			fsl, 1fgr
3-15	Bw1	5YR 4/6			scl, 1fsbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed On Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes ___ No X
Wetland Hydrology Present? Yes ___ No X
Hydric Soils Present? Yes ___ No X

Is the Sampling Point Within a Wetland? Yes ___ No X

Remarks:

M:/2007/12071067_2007 EEP OPEN END\12071067D_South Fork\WETLANDS\Data Forms\ Wetlands.W13 unit.DP#2_ NonWetland

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork South
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 2-16-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical situation)? Yes X No ____
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W18
Transect ID: ____
Plot ID: DP#4 Wetland

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Salix nigra	1	OBL
2. Salix nigra	1	OBL
3. Plantanas occidentalis	1	FACW-
4. Juncus effusus	3	FACW+
5. Ludwigia alternifolia	3	OBL
6. Typha latifolia	3	OBL
7. Polygonum sagittatum	3	OBL
8.		

Dominant Plant Species	Stratum	Indicator
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:
This is a planted riparian buffer.

HYDROLOGY

____ **Recorded Data (Describe In Remarks):**
- ____ **Stream, Lake, or Tide Gauge**
- ____ **Aerial Photographs**
- ____ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: 1-6 **(in.)**

Depth to Free Water in Pit: _____ **(in.)**

Depth to Saturated Soil: _____ **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- X **Inundated**
- X **Saturated in Upper 12"**
- ____ **Water Marks**
- ____ **Drift Lines**
- ____ **Sediment Deposits**
- X **Drainage Patterns in Wetlands**

Secondary Indicators:
- ____ **Oxidized Roots Channels in Upper 12"**
- X **Water-Stained Leaves**
- ____ **Local Soil Survey Data**
- X **FAC-Neutral Test**
- ____ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Chewacla Variant **Drainage Class:** Somewhat Poorly

Taxonomy (Subgroup): Fluvaquentic Dystrudepts **Confirm Mapped Type? Yes** ___ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	Ap	10YR 3/2			sl, 1fgr
2-6	Bw1	5YR 4/3	5YR 4/4 c2d		sl-scl, 1fsbk
6-10	Bw2	5YR 3/3			scl. massive
10-12	Bw3	10YR 3/3	10YR2/1		scl, mass, charcoal bits
12-18	Cg	10YR 2/1	10YR 2/2 c2d		ls, single grain

Hydric Soil Indicators:

___ **Histosol**	___ **Concretions**
___ **Histic Epipedon**	___ **High Organic Content in Surface Layer in Sandy Soils**
___ **Sulfidic Odor**	___ **Organic Streaking in Sandy Soils**
___ **Aquic Moisture Regime**	___ **Listed On Local Hydric Soils List**
X **Reducing Conditions**	___ **Listed on National Hydric Soils List**
___ **Gleyed or Low-Chroma Colors**	___ **Other (Explain in Remarks)**

Remarks:
Soil tests positive for alpha, alpha Dipyridyl. Soil is saturated for long or very long duration during the growing season.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	**Yes** X	**No** ___	**Is the Sampling Point**	
Wetland Hydrology Present?	**Yes** X	**No** ___	**Within a Wetland?**	**Yes** X **No** ___
Hydric Soils Present?	**Yes** X	**No** ___		

Remarks:

Area disturbed by grading for stream restoration. The stream bed elevation was raised for priority level 1 stream restoration which also raised the groundwater elevation.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork South **Applicant / Owner:** NCEEP **Investigator:** Steven F. Stokes, LSS	**Date:** 2-16-09 **County:** Catawba **State:** NC
Do normal circumstances exist on the site? Yes ____ No X **Is the site significantly disturbed (Atypical situation)?** Yes ____ No X **Is the area a potential problem area?** Yes ____ No X **(explain on reverse if needed)**	**Community ID:** W18 **Transect ID:** ____ **Plot ID:** DP#5 NW

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Fraxinus pennsylvanica	1	FACW	9.		
2. Acer negundo	2	FACW	10.		
3. Platanus occidentalis	2	FACW-	11.		
4. Salix nigra	2	OBL	12.		
5. Cornus amomon	2	FACW+	13.		
6. Juncus effusus	3	FACW+	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:
The trees were planted as a part of the stream restoration project.

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: _____ **(in.)**

Depth to Free Water in Pit: >17 **(in.)**

Depth to Saturated Soil: _____ **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- ___ **Inundated**
- ___ **Saturated in Upper 12"**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- ___ **Drainage Patterns in Wetlands**

Secondary Indicators:
- ___ **Oxidized Roots Channels in Upper 12"**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- ___ **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Chewacla Variant **Drainage Class:** Somewhat Poorly

Taxonomy (Subgroup): Fluvaquentic Dystrudepts **Confirm Mapped Type? Yes** ___ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	Ap	10YR 3/3			l, 1fgr
3-8	Bw1	5YR 4/3			scl, 1msbk
8-17	Bw2	5YR 3/3			scl, 1msbk
17-18	Cg	10YR 2/1			ls, single grain

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed On Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ___
Wetland Hydrology Present? Yes ___ No X
Hydric Soils Present? Yes ___ No X

Is the Sampling Point Within a Wetland? Yes ___ No X

Remarks:

M:/2007/12071067_2007 EEP OPEN END\12071067D_South Fork\WETLANDS\Data Forms\ Wetlands.W18 unit.DP#5_ NonWetland

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork South
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 2-17-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical situation)? Yes X No ____
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W24
Transect ID: ____
Plot ID: DP#6 Wetland

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Salix nigra	2	OBL
2. Acer rubrum	1	FAC
3. Rosa multiflora	2	UPL
4. Juncus effusus	3	FACW+
5. Typha latifolia	3	OBL
6.		
7.		
8.		

Dominant Plant Species	Stratum	Indicator
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 80%

Remarks:
Hydrology from hillside seepage and groundwater. The stream bed elevation was raised for priority level 1 stream restoration which also raised the groundwater elevation.

HYDROLOGY

____ **Recorded Data (Describe In Remarks):**
- ____ **Stream, Lake, or Tide Gauge**
- ____ **Aerial Photographs**
- ____ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: _____ **(in.)**

Depth to Free Water in Pit: Surface **(in.)**

Depth to Saturated Soil: Surface **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- X **Inundated**
- X **Saturated in Upper 12"**
- ____ **Water Marks**
- ____ **Drift Lines**
- ____ **Sediment Deposits**
- X **Drainage Patterns in Wetlands**

Secondary Indicators:
- ____ **Oxidized Roots Channels in Upper 12"**
- X **Water-Stained Leaves**
- ____ **Local Soil Survey Data**
- X **FAC-Neutral Test**
- ____ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Wehadkee **Drainage Class:** Poorly Drained

Taxonomy (Subgroup): Fluvaquentic Endoaquepts **Confirm**
Mapped Type? Yes _____ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	A	10YR 3/1			ls, 1fgr
4-18	Bw1	10YR 3/1			sl, single grain

Hydric Soil Indicators:

____ Histosol	____ Concretions
____ Histic Epipedon	____ High Organic Content in Surface Layer in Sandy Soils
_X_ Sulfidic Odor	____ Organic Streaking in Sandy Soils
____ Aquic Moisture Regime	_X_ Listed On Local Hydric Soils List
____ Reducing Conditions	_X_ Listed on National Hydric Soils List
_X_ Gleyed or Low-Chroma Colors	____ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes _X_ No ____
Wetland Hydrology Present? Yes _X_ No ____
Hydric Soils Present? Yes _X_ No ____

Is the Sampling Point Within a Wetland? Yes _X_ No ____

Remarks:

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DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork South
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 2-17-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes X No ____
Is the site significantly disturbed (Atypical situation)? Yes ____ No X
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W24
Transect ID: ____
Plot ID: DP#7 NW

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Andropogon virginicus	3	FAC-
2. Eupatorium leptophyllum	3	FAC+
3. Conyza canadensis	3	FACU
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 33%

Remarks:
Overgrown pasture

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: _____ **(in.)**

Depth to Free Water in Pit: >17 **(in.)**

Depth to Saturated Soil: _____ **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- ___ **Inundated**
- ___ **Saturated in Upper 12"**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- ___ **Drainage Patterns in Wetlands**

Secondary Indicators:
- ___ **Oxidized Roots Channels in Upper 12"**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- ___ **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Chewacla **Drainage Class:** Well Drained

Taxonomy (Subgroup): Fluvaquentic Dystrudepts **Confirm Mapped Type? Yes** ___ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-8	A	10YR 3/2			sl, 1fgr
8-17	Bw	10YR 4/3			scl, 1fsbk, charcoal bits
17-18	Cg	10YR 3/1			ls, massive

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed On Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes ___ No X
Wetland Hydrology Present? Yes ___ No X
Hydric Soils Present? Yes ___ No X

Is the Sampling Point Within a Wetland? Yes ___ No X

Remarks:

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DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork North
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 2-17-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical situation)? Yes X No ____
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W1
Transect ID: ____
Plot ID: DP#8 Wetland

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Scirpus cyperinus	3	OBL
2. Hibiscus moscheutos	3	OBL
3. Polygonum sagittatum	3	OBL
4. Unknown Sedge	3	
5.		
6.		
7.		
8.		

Dominant Plant Species	Stratum	Indicator
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: 6 **(in.)**

Depth to Free Water in Pit: ____ **(in.)**

Depth to Saturated Soil: ____ **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- X **Inundated**
- X **Saturated in Upper 12"**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- ___ **Drainage Patterns in Wetlands**

Secondary Indicators:
- X **Oxidized Roots Channels in Upper 12"**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- X **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Wehadkee **Drainage Class:** Poorly Drained

Taxonomy (Subgroup): Fluvaquentic Endoaquepts **Confirm**
Mapped Type? Yes **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	Ap	10YR 4/2	10YR 4/1 c2f		l, 1mgr
8-18	Bg1	10YR 4/2	10YR 4/1 m2d		scl, massive

Hydric Soil Indicators:

____ Histosol	____ Concretions
____ Histic Epipedon	____ High Organic Content in Surface Layer in Sandy Soils
____ Sulfidic Odor	____ Organic Streaking in Sandy Soils
____ Aquic Moisture Regime	X Listed On Local Hydric Soils List
X Reducing Conditions	X Listed on National Hydric Soils List
X Gleyed or Low-Chroma Colors	____ Other (Explain in Remarks)

Remarks:
Soil tests positive for alpha, alpha Dipyridyl. Soil is saturated for long or very long duration during the growing season.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____
Hydric Soils Present? Yes X No ____

Is the Sampling Point Within a Wetland? Yes X No ____

Remarks:
The stream elevation was raised through priority level 1 restoration which increases the hydrology in wetlands through inundation at low flows.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork North
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 2-17-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical situation)? Yes X No ____
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W3
Transect ID: ____
Plot ID: DP#9 Wetland

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Ludwigia alternifolia	3	OBL
2. Hibiscus moscheutos	3	OBL
3. Betula nigra	2	FACW
4. Platanus occidentalis	2	FACW-
5. Cephalanthus occidentalis	2	OBL
6. Unknown Sedge		
7.		
8.		

Dominant Plant Species	Stratum	Indicator
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:
The trees were planted.

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: 1-6 **(in.)**

Depth to Free Water in Pit: ____ **(in.)**

Depth to Saturated Soil: ____ **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- X **Inundated**
- X **Saturated in Upper 12"**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- X **Drainage Patterns in Wetlands**

Secondary Indicators:
- X **Oxidized Roots Channels in Upper 12"**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- X **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Chewacla Variant **Drainage Class:** Somewhat Poorly

Taxonomy (Subgroup): Fluvaquentic Dystrudepts **Confirm Mapped Type? Yes** ___ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	Ap	7.5YR 3/2			l, 1mgr, oxidized roots
2-4	BA	7.5YR 4/3	5YR 4/6 f1d		l, 1msbk
4-10	Bw1	5YR 4/6	7.5YR 4/4 c2f		cl, 2msbk, clay skins
10-15	Bw2	5YR 4/6	7.5YR 4/4 c2f		cl, 1fsbk

Hydric Soil Indicators:

___ Histosol	___ Concretions
___ Histic Epipedon	___ High Organic Content in Surface Layer in Sandy Soils
___ Sulfidic Odor	___ Organic Streaking in Sandy Soils
___ Aquic Moisture Regime	___ Listed On Local Hydric Soils List
X Reducing Conditions	___ Listed on National Hydric Soils List
X Gleyed or Low-Chroma Colors	___ Other (Explain in Remarks)

Remarks:
Tests positive for alpha, alpha Dipyridyl. Soil is saturated for long or very long duration during the growing season.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	**Yes** X	**No** ___	**Is the Sampling Point**	
Wetland Hydrology Present?	**Yes** X	**No** ___	**Within a Wetland?**	**Yes** X **No** ___
Hydric Soils Present?	**Yes** X	**No** ___		

Remarks:
The stream elevation was raised through priority level 1 restoration which increases the hydrology of wetlands through inundation at low flows.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork North
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 2-17-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical situation)? Yes X No ____
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W3
Transect ID: ____
Plot ID: DP#10 NW

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Betula nigra	3	FACW
2. Fraxinus pennsylvanica	2	FACW
3. Juncus effusus	3	FACW+
4. Polygonum sagittatum	3	OBL
5. Acer negundo	2	FACW
6. Scirpus cyperinus	3	OBL
7. Unknown Sedge		
8.		

Dominant Plant Species	Stratum	Indicator
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:
The trees were planted as a part of the stream restoration project.

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: _____ **(in.)**

Depth to Free Water in Pit: 12 **(in.)**

Depth to Saturated Soil: 6 **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- ___ **Inundated**
- X **Saturated in Upper 12"**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- ___ **Drainage Patterns in Wetlands**

Secondary Indicators:
- ___ **Oxidized Roots Channels in Upper 12"**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- X **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Chewacla **Drainage Class:** Somewhat Poorly

Taxonomy (Subgroup): Fluvaquentic Dystrudepts **Confirm Mapped Type? Yes** ___ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	Ap	7.5YR 4/4			l, 1fgr
5-18	Bw1	5YR 4/6			sicl, 1fsbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed On Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ___
Wetland Hydrology Present? Yes X No ___
Hydric Soils Present? Yes ___ No X

Is the Sampling Point Within a Wetland? Yes ___ No X

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork North
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 3-10-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical situation)? Yes X No ____
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W7
Transect ID: ____
Plot ID: DP#16Wetland

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Platanus occidentalis	3	FACW-
2. Cornus amomun	2	FACW+
3. Acer negundo	3	FACW
4. Panicum virgatum	3	FAC+
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:
The trees were planted during the stream restoration project.

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: 1-3 **(in.)**

Depth to Free Water in Pit: ____ **(in.)**

Depth to Saturated Soil: ____ **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- X **Inundated**
- X **Saturated in Upper 12"**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- ___ **Drainage Patterns in Wetlands**

Secondary Indicators:
- ___ **Oxidized Roots Channels in Upper 12"**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- ___ **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Chewacla Variant **Drainage Class:** Somewhat Poorly

Taxonomy (Subgroup): Fluvaquentic Dystrudepts **Confirm Mapped Type? Yes** ___ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	Ap	7.5YR 4/3			l, 1fgr
3-5	Bw1	7.5YR 4/4	5YR 4/6 f1d		c, mass breaking to 1msbk
5-12	Bw2	7.5YR 4/4	5YR 4/6 c2d		
12-15	Bw3	7.5YR 2/1	5YR 4/6 c2d		c, massive, charcoal bits
			7.5YR 4/2 f1f		

Hydric Soil Indicators:

___ Histosol	___ Concretions
___ Histic Epipedon	___ High Organic Content in Surface Layer in Sandy Soils
___ Sulfidic Odor	___ Organic Streaking in Sandy Soils
___ Aquic Moisture Regime	___ Listed On Local Hydric Soils List
X Reducing Conditions	___ Listed on National Hydric Soils List
___ Gleyed or Low-Chroma Colors	___ Other (Explain in Remarks)

Remarks:
Soil tests positive for alpha, alpha Dipyridyl. Soil is ponded for long to very long duration during the growing season.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ___
Wetland Hydrology Present? Yes X No ___
Hydric Soils Present? Yes X No ___

Is the Sampling Point Within a Wetland? Yes X No ___

Remarks:
Unit disturbed by grading for stream restoration. Stream elevation raised for priority level 1 restoration which causes overbank flow during high flows into depressional wetland unit.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork North **Applicant / Owner:** NCEEP **Investigator:** Steven F. Stokes, LSS	**Date:** 3-10-09 **County:** Catawba **State:** NC
Do normal circumstances exist on the site? Yes X No ____ **Is the site significantly disturbed (Atypical situation)?** Yes ____ No X **Is the area a potential problem area?** Yes ____ No X **(explain on reverse if needed)**	**Community ID:** W7 **Transect ID:** ____ **Plot ID:** DP#17Wetland

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Panicum virgatum	3	FAC+	9.		
2. Eupatorium leptophyllum	3	FAC+	10.		
3. Acer negundo	2	FACW	11.		
4. Hamamelis virginiana	2	FACU	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 75%

Remarks:
The trees were planted.

HYDROLOGY

___ Recorded Data (Describe In Remarks):
- **___ Stream, Lake, or Tide Gauge**
- **___ Aerial Photographs**
- **___ Other**

X No Recorded Data Available

Field Observations:

Depth of Surface Water: _____(in.)

Depth to Free Water in Pit: >18 (in.)

Depth to Saturated Soil: _____(in.)

Wetland Hydrology Indicators

Primary Indicators:
- **___ Inundated**
- **___ Saturated in Upper 12"**
- **___ Water Marks**
- **___ Drift Lines**
- **___ Sediment Deposits**
- **___ Drainage Patterns in Wetlands**

Secondary Indicators:
- **___ Oxidized Roots Channels in Upper 12"**
- **___ Water-Stained Leaves**
- **___ Local Soil Survey Data**
- **___ FAC-Neutral Test**
- **___ Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Chewacla **Drainage Class:** Somewhat Poorly

Taxonomy (Subgroup): Fluvaquentic Dystrudepts **Confirm Mapped Type? Yes** ___ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	Ap	7.5YR 4/4			l, 1fgr
7-15	Bw1	5YR 4/4			sl, 1fsbk
15-18	Bw2	5YR 4/4	2.5YR 3/4 c2d		scl, 1msbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed On Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ___
Wetland Hydrology Present? Yes ___ No X
Hydric Soils Present? Yes ___ No X

Is the Sampling Point Within a Wetland? Yes ___ No X

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork South
Applicant / Owner: NCEEP
Investigator: Steven F. Stokes, LSS

Date: 3-10-09
County: Catawba
State: NC

Do normal circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical situation)? Yes X No ____
Is the area a potential problem area? Yes ____ No X
(explain on reverse if needed)

Community ID: W33
Transect ID: ____
Plot ID: DP#18Wetland

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Juncus effusus	3	FACW+
2. Typha latifolia	3	OBL
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:
The trees were planted.

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: 6-7 **(in.)**

Depth to Free Water in Pit: ____ **(in.)**

Depth to Saturated Soil: ____ **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- X **Inundated**
- X **Saturated in Upper 12"**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- ___ **Drainage Patterns in Wetlands**

Secondary Indicators:
- ___ **Oxidized Roots Channels in Upper 12"**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- ___ **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Hiwassee Variant **Drainage Class:** Poorly Drained

Taxonomy (Subgroup): Rhodic Kanhapludults **Confirm Mapped Type? Yes** **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	Ap	7.5YR 4/4	6/10GY c1p		sl, 1fgr
5-10	Cg1	7.5YR 3/2			s, single grain
10-18	Cg2	7.5YR 2.5/1			ls, single grain

Hydric Soil Indicators:

- ____ **Histosol**
- ____ **Histic Epipedon**
- ____ **Sulfidic Odor**
- ____ **Aquic Moisture Regime**
- ____ **Reducing Conditions**
- ____ **Gleyed or Low-Chroma Colors**
- ____ **Concretions**
- ____ **High Organic Content in Surface Layer in Sandy Soils**
- ____ **Organic Streaking in Sandy Soils**
- ____ **Listed On Local Hydric Soils List**
- ____ **Listed on National Hydric Soils List**
- ____ **Other (Explain in Remarks)**

Remarks:
Soil tests positive for alpha, alpha Dipyridyl. Solum has been removed by excavation. Auger refusal is at 10 inches. Soil is ponded for long or very long duration during the growing season.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? **Yes** X **No** ____
Wetland Hydrology Present? **Yes** X **No** ____
Hydric Soils Present? **Yes** X **No** ____

Is the Sampling Point Within a Wetland? **Yes** X **No** ____

Remarks:

Wetland appears to have been excavated from high ground.

M:/2007/12071067_2007 EEP OPEN END\12071067D_South Fork\WETLANDS\Data Forms\ Wetlands.W33 unit.DP#18_Wetland

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: South Fork South **Applicant / Owner:** NCEEP **Investigator:** Steven F. Stokes, LSS	**Date:** 3-10-09 **County:** Catawba **State:** NC
Do normal circumstances exist on the site? Yes ____ No X **Is the site significantly disturbed (Atypical situation)?** Yes X No ____ **Is the area a potential problem area?** Yes ____ No X **(explain on reverse if needed)**	**Community ID:** W33 **Transect ID:** ____ **Plot ID:** DP#19Wetland

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Andropogon virginicus	3	FAC-	9.		
2. Panicum virgatum	3	FAC+	10.		
3. Platanus occidentalis	2	FAC	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 66%

Remarks:
The trees were planted as part of the stream restoration project.

HYDROLOGY

___ **Recorded Data (Describe In Remarks):**
- ___ **Stream, Lake, or Tide Gauge**
- ___ **Aerial Photographs**
- ___ **Other**

X **No Recorded Data Available**

Field Observations:

Depth of Surface Water: _____ **(in.)**

Depth to Free Water in Pit: >12 **(in.)**

Depth to Saturated Soil: _____ **(in.)**

Wetland Hydrology Indicators

Primary Indicators:
- ___ **Inundated**
- ___ **Saturated in Upper 12"**
- ___ **Water Marks**
- ___ **Drift Lines**
- ___ **Sediment Deposits**
- ___ **Drainage Patterns in Wetlands**

Secondary Indicators:
- ___ **Oxidized Roots Channels in Upper 12"**
- ___ **Water-Stained Leaves**
- ___ **Local Soil Survey Data**
- ___ **FAC-Neutral Test**
- ___ **Other (Explain in Remarks)**

Remarks:

SOILS

Map Unit Name
(Series and Phase): Hiwassee **Drainage Class:** Well Drained

Taxonomy (Subgroup): Rhodic Kanhapludults **Confirm Mapped Type? Yes** _____ **No** X

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12	Ap	5YR 5/6	10YR 7/3		scl, 1fsbk

Hydric Soil Indicators:

- ____ Histosol
- ____ Histic Epipedon
- ____ Sulfidic Odor
- ____ Aquic Moisture Regime
- ____ Reducing Conditions
- ____ Gleyed or Low-Chroma Colors
- ____ Concretions
- ____ High Organic Content in Surface Layer in Sandy Soils
- ____ Organic Streaking in Sandy Soils
- ____ Listed On Local Hydric Soils List
- ____ Listed on National Hydric Soils List
- ____ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ____
Wetland Hydrology Present? Yes ____ No X
Hydric Soils Present? Yes ____ No X

Is the Sampling Point Within a Wetland? Yes ____ No X

Remarks:

Appendix 14.6. Reference Site NCDWQ Stream Classification Forms

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North Carolina Division of Water Quality – Stream Identification Form; Version 3.1

Date: Dec. 16th/2008	**Project:** Big Harris		**Latitude:**
Evaluator: N. Jean	**Site:** Ref. 2		**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 42.75	**County:** Montgomery		**Other** *e.g. Quad Name:* Biscoe

A. Geomorphology (Subtotal = 23)

	Absent	Weak	Moderate	Strong
1[a]. Continuous bed and bank	0	1	2	(3)
2. Sinuosity	0	1	(2)	3
3. In-channel structure: riffle-pool sequence	0	1	2	(3)
4. Soil texture or stream substrate sorting	0	1	(2)	3
5. Active/relic floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	0	1	(2)	3
9[a] Natural levees	(0)	1	2	3
10. Headcuts	(0)	1	2	3
11. Grade controls	0	0.5	1	(1.5)
12. Natural valley or drainageway	0	0.5	1	(1.5)
13. Second or greater order channel on existing USGS or NRCS map or other documented evidence.	No = 0		(Yes = 3)	

[a] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)

14. Groundwater flow/discharge	0	1	(2)	3
15. Water in channel and > 48 hrs since rain, or Water in channel -- dry or growing season	0	1	2	(3)
16. Leaflitter	1.5	1	(0.5)	0
17. Sediment on plants or debris	0	(0.5)	1	1.5
18. Organic debris lines or piles (Wrack lines)	0	0.5	1	(1.5)
19. Hydric soils (redoximorphic features) present?	No = 0		(Yes = 1.5)	

C. Biology (Subtotal = 10.75)

20[b]. Fibrous roots in channel	3	2	(1)	0
21[b]. Rooted plants in channel	(3)	2	1	0
22. Crayfish	0	(0.5)	1	1.5
23. Bivalves	0	(1)	2	3
24. Fish	0	(0.5)	1	1.5
25. Amphibians	0	0.5	(1)	1.5
26. Macrobenthos (note diversity and abundance)	0	0.5	(1)	1.5
27. Filamentous algae; periphyton	0	(1)	2	3
28. Iron oxidizing bacteria/fungus.	0	0.5	(1)	1.5
29[b]. Wetland plants in streambed	FAC = 0.5; (FACW = 0.75;) OBL = 1.5 SAV = 2.0; Other = 0			

[b] Items 20 and 21 focus on the presence of upland plants, Item 29 focuses on the presence of aquatic or wetland plants.

Notes: (use back side of this form for additional notes.)

Sketch:

North Carolina Division of Water Quality – Stream Identification Form; Version 3.1

Date: Dec. 15th, 2008	**Project:** Big Harris	**Latitude:**	
Evaluator: N. Jean	**Site:** Ref. 3	**Longitude:**	
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 42.75	**County:** Montgomery	**Other** *e.g. Quad Name:* Biscoe	

A. Geomorphology (Subtotal = 23)

	Absent	Weak	Moderate	Strong
1[a]. Continuous bed and bank	0	1	2	(3)
2. Sinuosity	0	1	(2)	3
3. In-channel structure: riffle-pool sequence	0	1	2	(3)
4. Soil texture or stream substrate sorting	0	1	(2)	3
5. Active/relic floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	0	1	(2)	3
9[a] Natural levees	(0)	1	2	3
10. Headcuts	(0)	1	2	3
11. Grade controls	0	0.5	1	(1.5)
12. Natural valley or drainageway	0	0.5	1	(1.5)
13. Second or greater order channel on existing USGS or NRCS map or other documented evidence.	No = 0		(Yes = 3)	

[a] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)

14. Groundwater flow/discharge	0	1	(2)	3
15. Water in channel and > 48 hrs since rain, or Water in channel -- dry or growing season	0	1	2	(3)
16. Leaflitter	1.5	1	(0.5)	0
17. Sediment on plants or debris	0	(0.5)	1	1.5
18. Organic debris lines or piles (Wrack lines)	0	0.5	1	(1.5)
19. Hydric soils (redoximorphic features) present?	No = 0		(Yes = 1.5)	

C. Biology (Subtotal = 10.75)

20[b]. Fibrous roots in channel	3	2	(1)	0
21[b]. Rooted plants in channel	(3)	2	1	0
22. Crayfish	0	(0.5)	1	1.5
23. Bivalves	0	(1)	2	3
24. Fish	0	(0.5)	1	1.5
25. Amphibians	0	0.5	(1)	1.5
26. Macrobenthos (note diversity and abundance)	0	0.5	(1)	1.5
27. Filamentous algae; periphyton	0	(1)	2	3
28. Iron oxidizing bacteria/fungus.	0	0.5	(1)	1.5
29[b]. Wetland plants in streambed	FAC = 0.5; (FACW = 0.75;) OBL = 1.5 SAV = 2.0; Other = 0			

[b] Items 20 and 21 focus on the presence of upland plants, Item 29 focuses on the presence of aquatic or wetland plants.

Notes: (use back side of this form for additional notes.)

Sketch:

North Carolina Division of Water Quality – Stream Identification Form; Version 3.1

Date: Jan. 9th 09	**Project:** Big Harris	**Latitude:**	
Evaluator: C.W. Gaskill	**Site:** Ref. 4 (Morgan Creek)	**Longitude:**	
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 46	**County:** Orange	**Other** *e.g. Quad Name:*	Chapel Hill

A. Geomorphology (Subtotal = 24)

	Absent	Weak	Moderate	Strong
1[a]. Continuous bed and bank	0	1	2	(3)
2. Sinuosity	0	1	(2)	3
3. In-channel structure: riffle-pool sequence	0	1	2	(3)
4. Soil texture or stream substrate sorting	0	1	(2)	3
5. Active/relic floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	2	(3)
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	0	1	(2)	3
9[a] Natural levees	(0)	1	2	3
10. Headcuts	(0)	1	2	3
11. Grade controls	0	0.5	1	(1.5)
12. Natural valley or drainageway	0	0.5	1	(1.5)
13. Second or greater order channel on existing USGS or NRCS map or other documented evidence.	No = 0		(Yes = 3)	

[a] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)

14. Groundwater flow/discharge	0	1	(2)	3
15. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	1	2	(3)
16. Leaflitter	1.5	1	(0.5)	0
17. Sediment on plants or debris	0	(0.5)	1	1.5
18. Organic debris lines or piles (Wrack lines)	0	0.5	1	(1.5)
19. Hydric soils (redoximorphic features) present?	No = 0		(Yes = 1.5)	

C. Biology (Subtotal = 13)

20[b]. Fibrous roots in channel	3	(2)	1	0
21[b]. Rooted plants in channel	(3)	2	1	0
22. Crayfish	0	(0.5)	1	1.5
23. Bivalves	0	1	(2)	3
24. Fish	0	(0.5)	1	1.5
25. Amphibians	0	0.5	(1)	1.5
26. Macrobenthos (note diversity and abundance)	0	0.5	(1)	1.5
27. Filamentous algae; periphyton	0	1	(2)	3
28. Iron oxidizing bacteria/fungus.	0	0.5	(1)	1.5
29[b]. Wetland plants in streambed	FAC = 0.5; (FACW = 0.75;) OBL = 1.5 SAV = 2.0; Other = 0			

[b] Items 20 and 21 focus on the presence of upland plants, Item 29 focuses on the presence of aquatic or wetland plants.

Notes: (use back side of this form for additional notes.)

Sketch:

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Appendix 14.7. Project Site Hydrologic Gauge Data Summary

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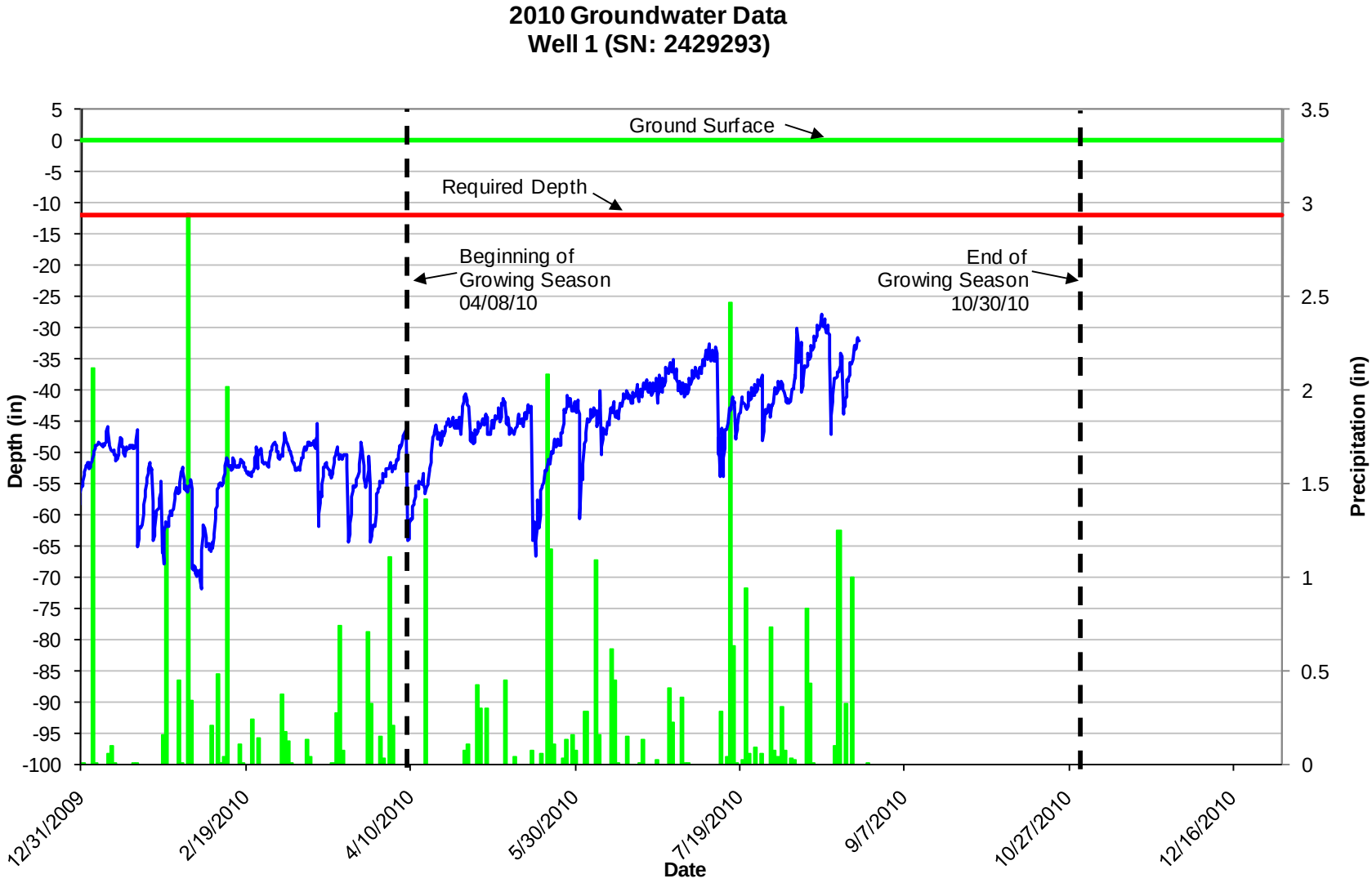
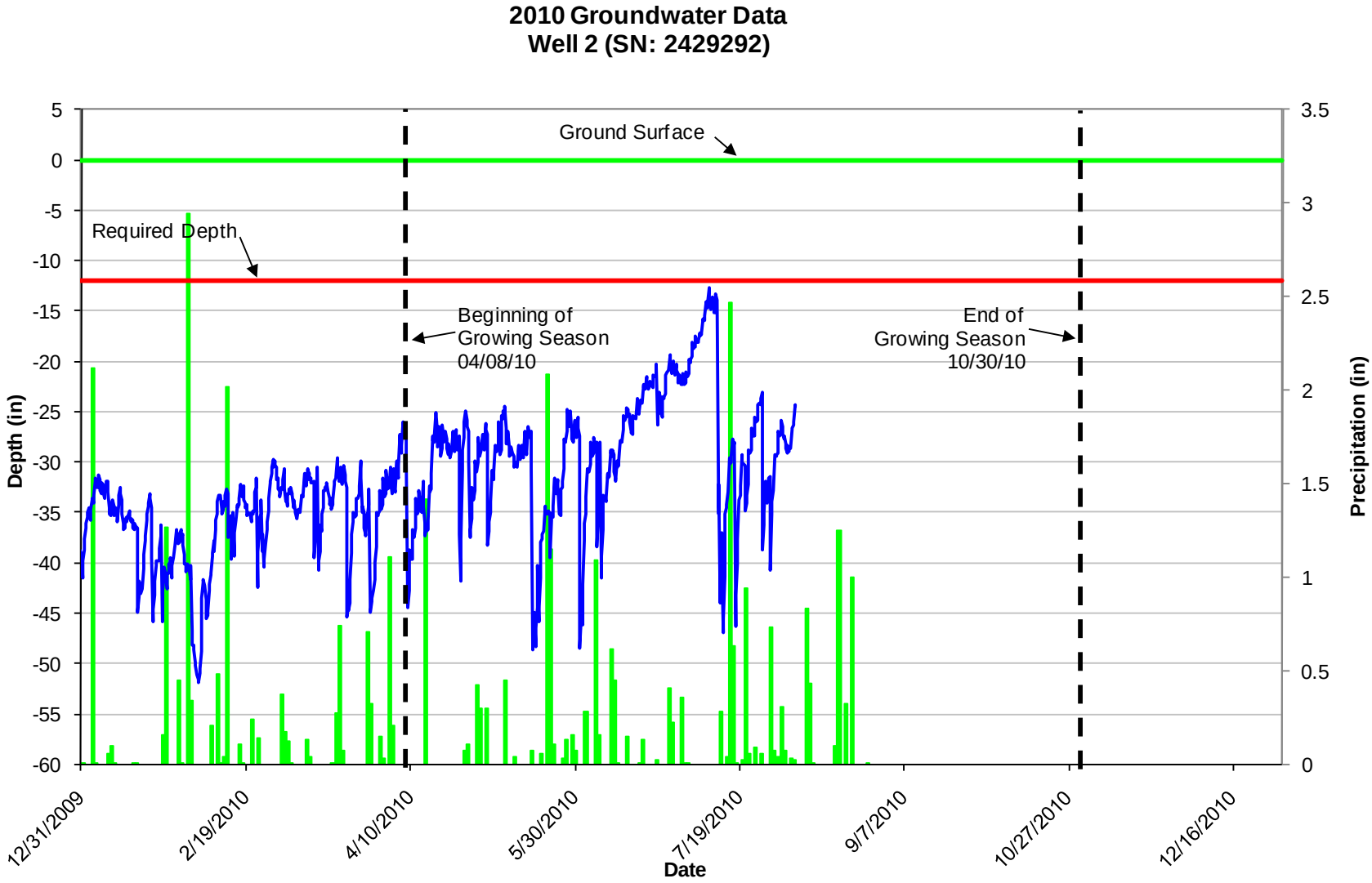
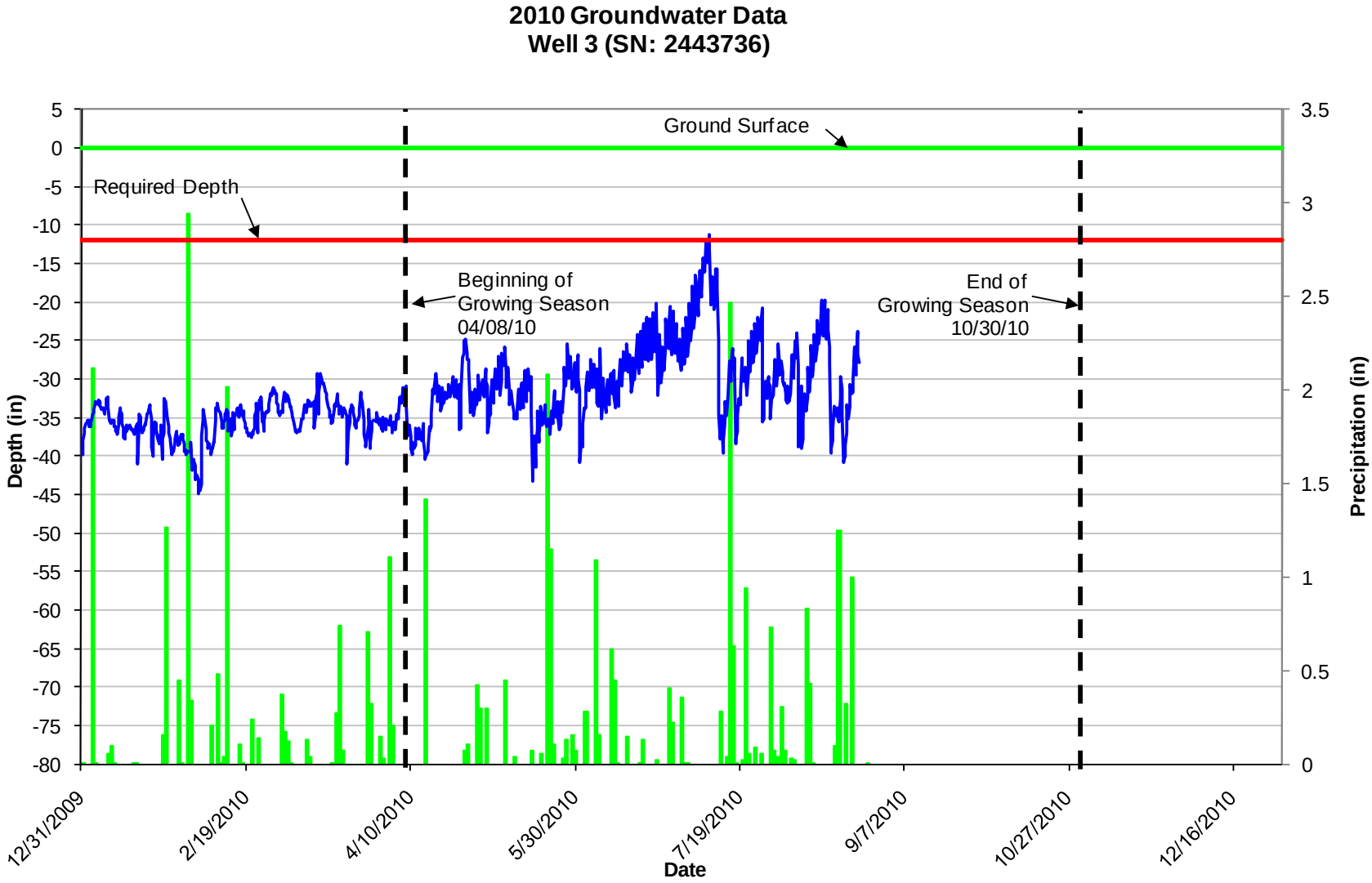
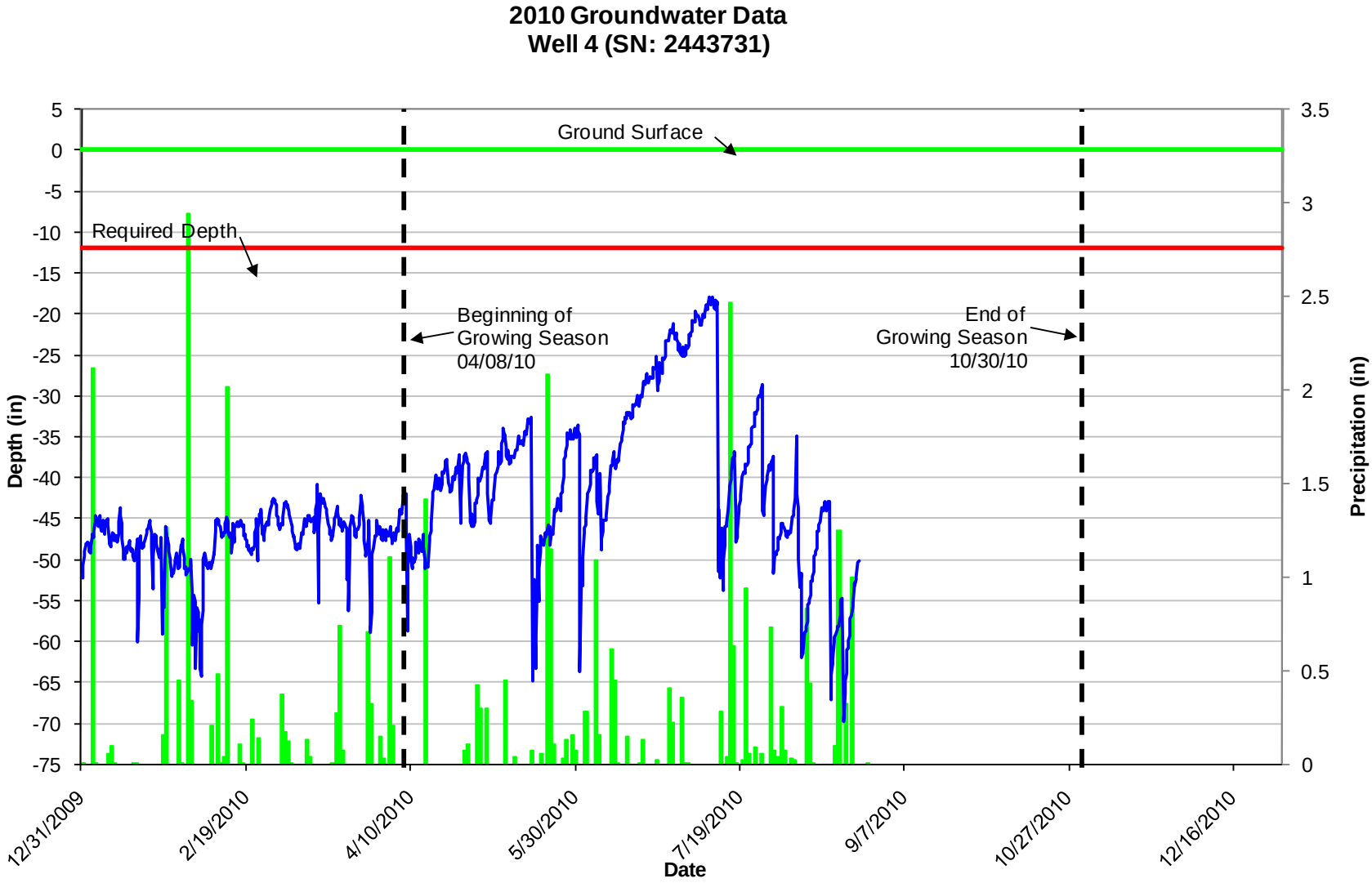
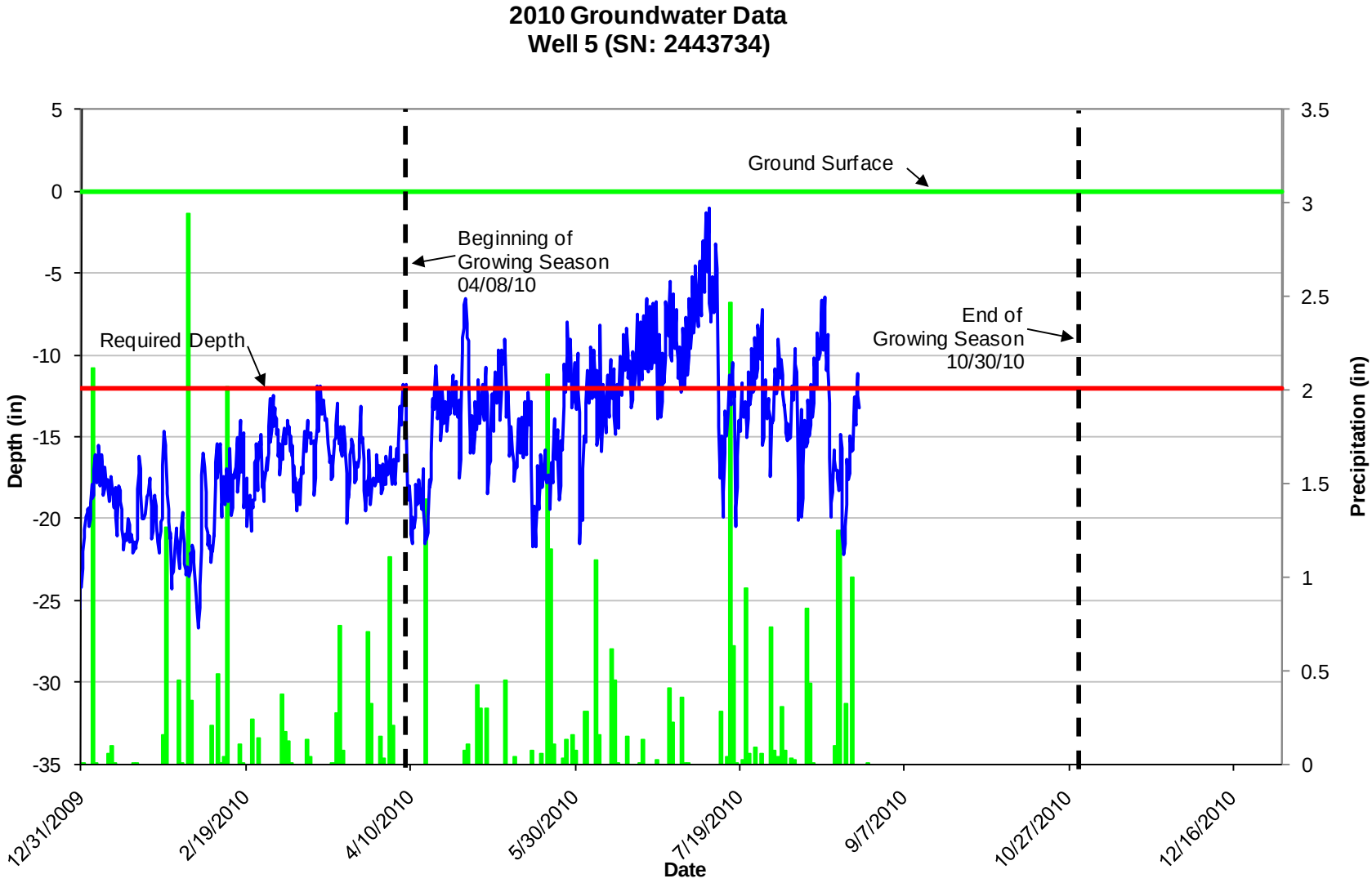
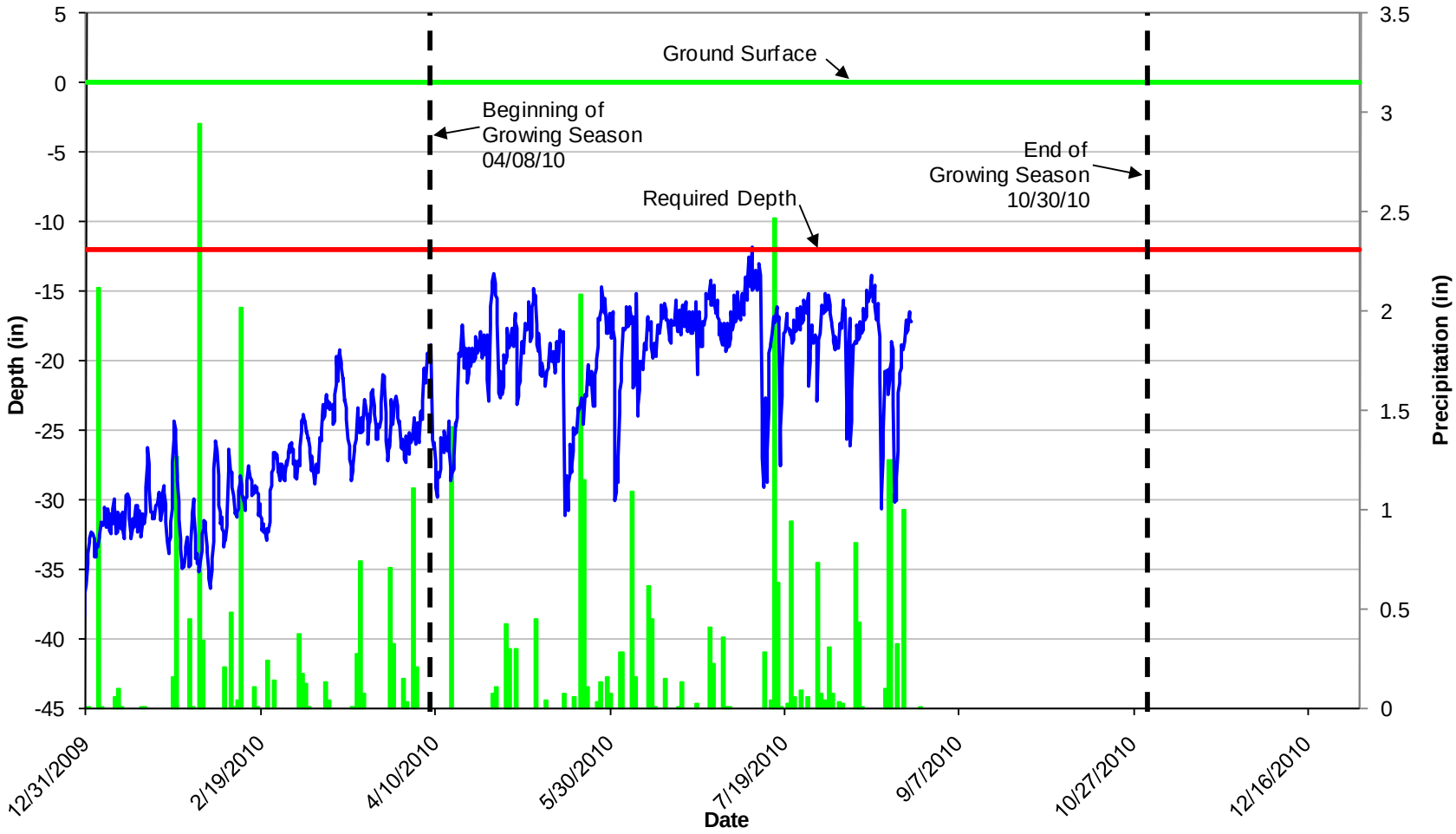

2010 Groundwater Data
Well 1 (SN: 2429293)
Ground Surface
Required Depth
Beginning of
Growing Season
04/08/10
End of
Growing Season
10/30/10
Depth (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100
3.5
3
2.5
2
1.5
1
0.5
0
12/31/2009
2/19/2010
4/10/2010
5/30/2010
7/19/2010
9/7/2010
10/27/2010
12/16/2010


2010 Groundwater Data
Well 2 (SN: 2429292)
Ground Surface
Required Depth
Beginning of
Growing Season
04/08/10
End of
Growing Season
10/30/10
Depth (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
3.5
3
2.5
2
1.5
1
0.5
0
12/31/2009
2/19/2010
4/10/2010
5/30/2010
7/19/2010
9/7/2010
10/27/2010
12/16/2010


2010 Groundwater Data
Well 3 (SN: 2443736)
Ground Surface
Required Depth
Beginning of
Growing Season
04/08/10
End of
Growing Season
10/30/10
Depth (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
3.5
3
2.5
2
1.5
1
0.5
0
12/31/2009
2/19/2010
4/10/2010
5/30/2010
7/19/2010
9/7/2010
10/27/2010
12/16/2010


2010 Groundwater Data
Well 4 (SN: 2443731)
Ground Surface
Required Depth
Beginning of
Growing Season
04/08/10
End of
Growing Season
10/30/10
Depth (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
3.5
3
2.5
2
1.5
1
0.5
0
12/31/2009
2/19/2010
4/10/2010
5/30/2010
7/19/2010
9/7/2010
10/27/2010
12/16/2010


2010 Groundwater Data
Well 5 (SN: 2443734)
Ground Surface
Beginning of
Growing Season
04/08/10
Required Depth
End of
Growing Season
10/30/10
Depth (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
3.5
3
2.5
2
1.5
1
0.5
0
12/31/2009
2/19/2010
4/10/2010
5/30/2010
7/19/2010
9/7/2010
10/27/2010
12/16/2010


2010 Groundwater Data
Well 6 (SN: 2443732)
Ground Surface
Beginning of
Growing Season
04/08/10
End of
Growing Season
10/30/10
Required Depth
Depth (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3.5
3
2.5
2
1.5
1
0.5
0
12/31/2009
2/19/2010
4/10/2010
5/30/2010
7/19/2010
9/7/2010
10/27/2010
12/16/2010

Appendix 14.8. Reference Site Hydrologic Gauge Data Summary

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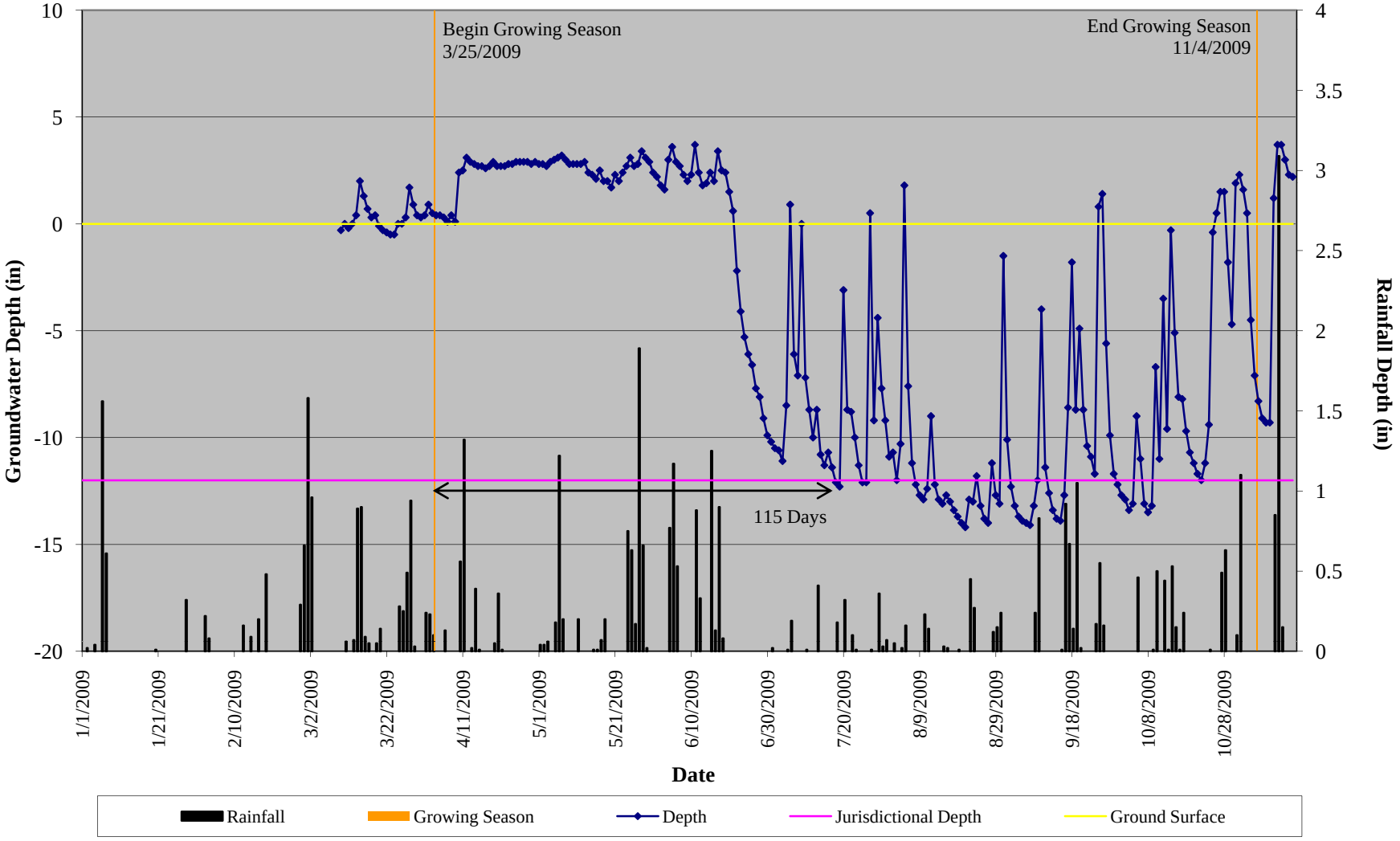
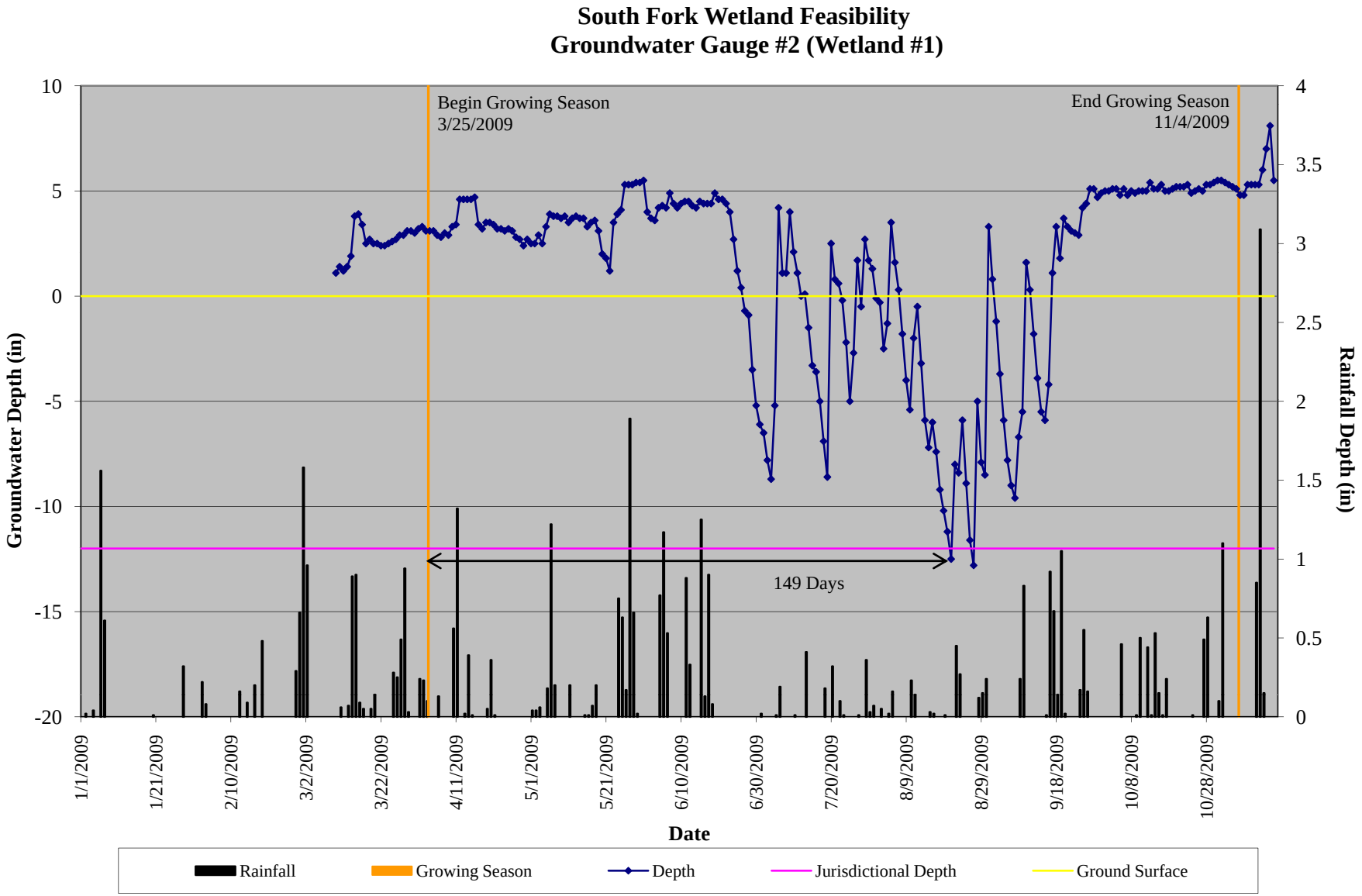
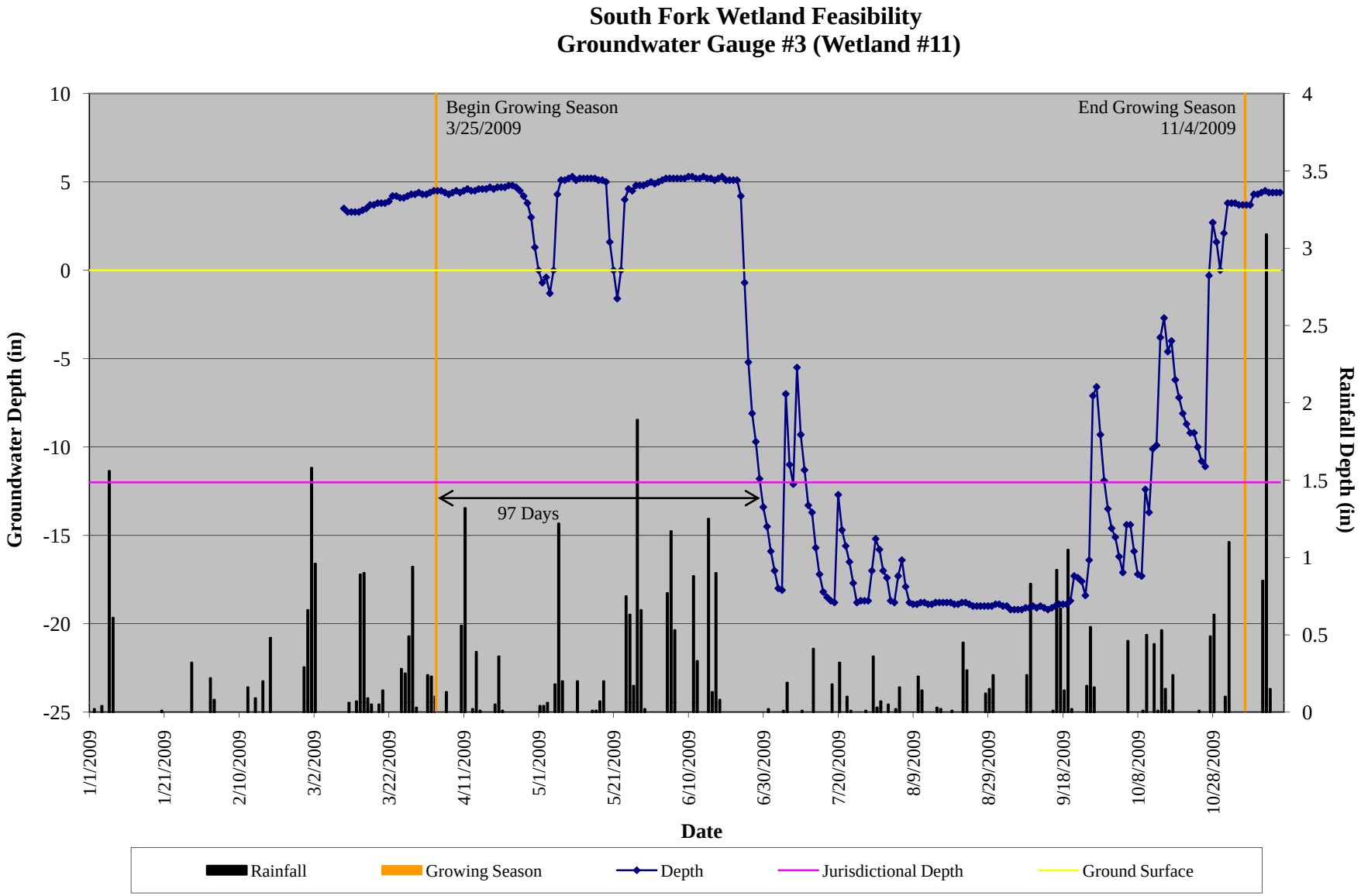
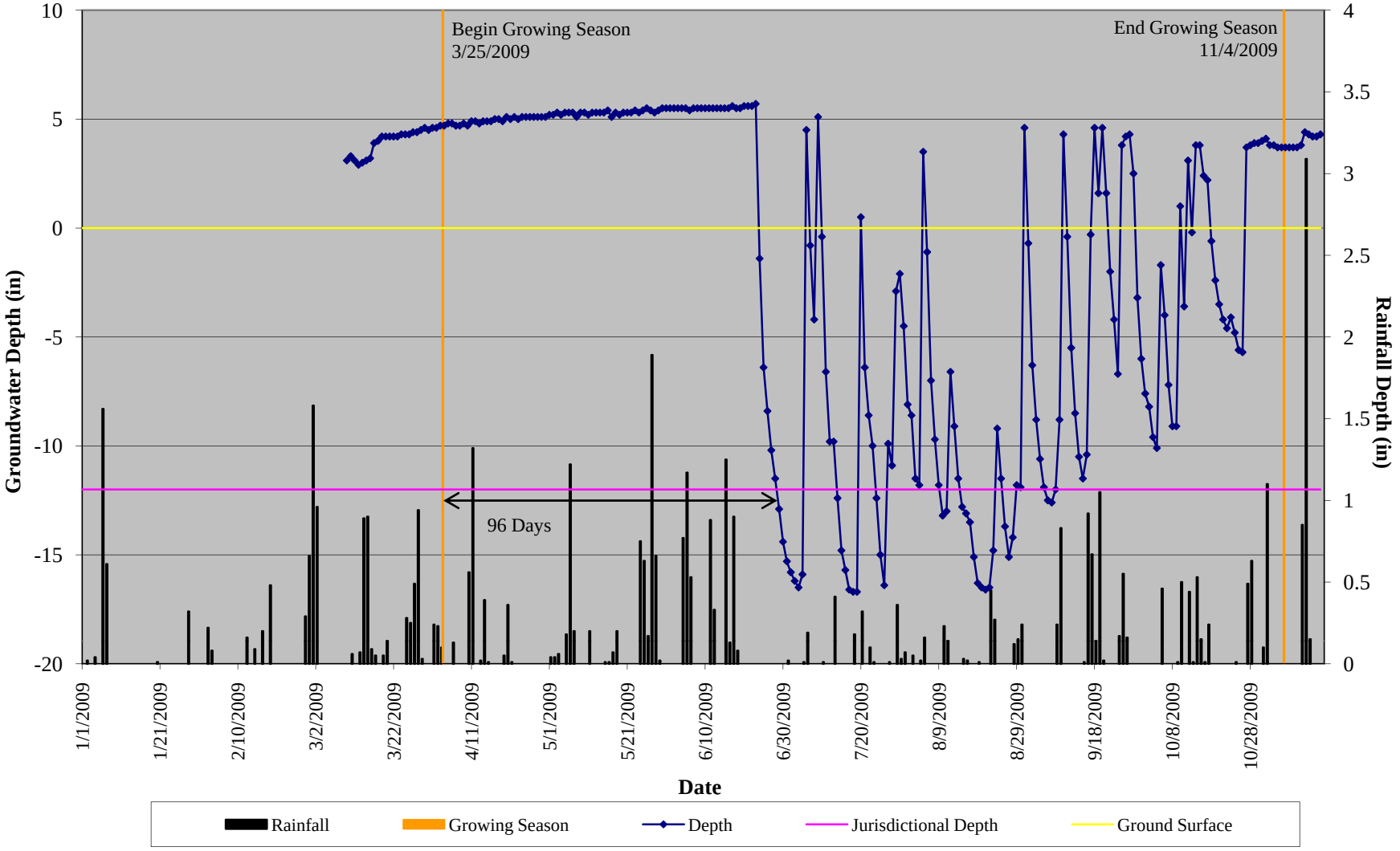
South Fork Wetland Feasibility
Groundwater Gauge #1 (Wetland #14)



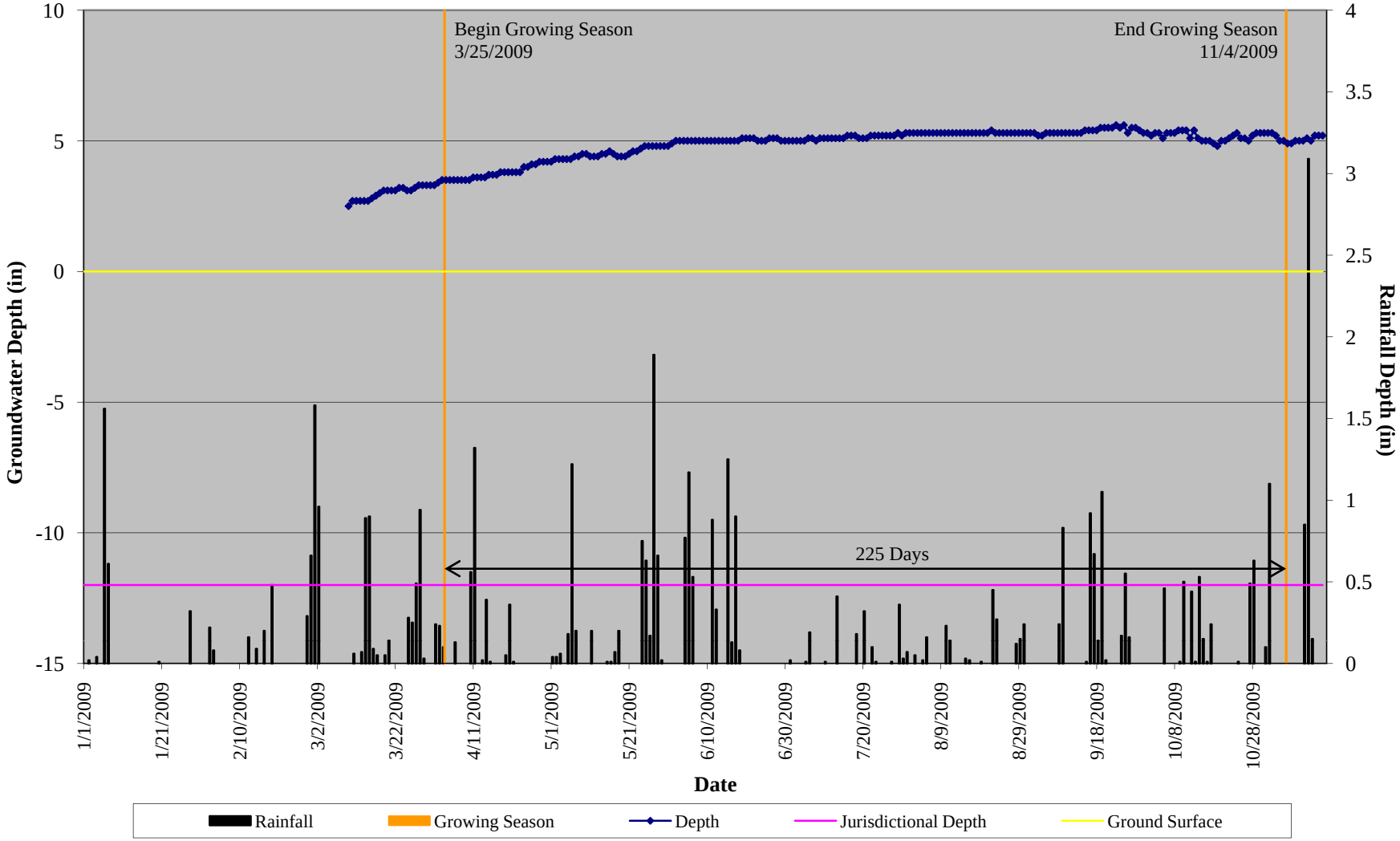

South Fork Wetland Feasibility
Groundwater Gauge #2 (Wetland #1)
Begin Growing Season
3/25/2009
End Growing Season
11/4/2009
149 Days
Groundwater Depth (in)
Rainfall Depth (in)
Date
10
5
0
-5
-10
-15
-20
4
3.5
3
2.5
2
1.5
1
0.5
0
1/1/2009
1/21/2009
2/10/2009
3/2/2009
3/22/2009
4/11/2009
5/1/2009
5/21/2009
6/10/2009
6/30/2009
7/20/2009
8/9/2009
8/29/2009
9/18/2009
10/8/2009
10/28/2009
Rainfall
Growing Season
Depth
Jurisdictional Depth
Ground Surface


South Fork Wetland Feasibility
Groundwater Gauge #3 (Wetland #11)
Begin Growing Season
3/25/2009
End Growing Season
11/4/2009
97 Days
Groundwater Depth (in)
Rainfall Depth (in)
Date
10
5
0
-5
-10
-15
-20
-25
4
3.5
3
2.5
2
1.5
1
0.5
0
1/1/2009
1/21/2009
2/10/2009
3/2/2009
3/22/2009
4/11/2009
5/1/2009
5/21/2009
6/10/2009
6/30/2009
7/20/2009
8/9/2009
8/29/2009
9/18/2009
10/8/2009
10/28/2009
Rainfall
Growing Season
Depth
Jurisdictional Depth
Ground Surface

South Fork Wetland Feasibility
Groundwater Gauge #4 (Wetland #7)



South Fork Wetland Feasibility
Groundwater Gauge #5 (Wetland #33)



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Appendix 14.9. HEC-RAS Analysis

Reach 4 HEC-RAS Analysis Summary Table			Existing		Design	
River XSC	Profile	Total Discharge (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)
1	2-YR	178	784.88	787.25	783.03	786.32
1	5-YR	332	784.88	788.16	783.03	787.16
1	10-YR	448	784.88	788.55	783.03	787.57
1	25-YR	603	784.88	788.96	783.03	787.88
1	50-YR	741	784.88	789.27	783.03	788.16
1	100-YR	869	784.88	789.52	783.03	788.39
2	2-YR	178	780.53	785.6	782.02	784.9
2	5-YR	332	780.53	786.45	782.02	785.56
2	10-YR	448	780.53	786.77	782.02	785.94
2	25-YR	603	780.53	787.1	782.02	786.42
2	50-YR	741	780.53	787.35	782.02	786.69
2	100-YR	869	780.53	787.56	782.02	786.91
3	2-YR	178	780.7	784	779.85	783.37
3	5-YR	332	780.7	784.57	779.85	783.93
3	10-YR	448	780.7	784.85	779.85	784.25
3	25-YR	603	780.7	785.14	779.85	784.63
3	50-YR	741	780.7	785.37	779.85	784.9
3	100-YR	869	780.7	785.57	779.85	785.12
4	2-YR	178	777.85	782.65	779.35	782.36
4	5-YR	332	777.85	783.02	779.35	782.85
4	10-YR	448	777.85	783.27	779.35	783.12
4	25-YR	603	777.85	783.57	779.35	783.42
4	50-YR	741	777.85	783.82	779.35	783.66
4	100-YR	869	777.85	784.03	779.35	783.86

Reach 4 HEC-RAS Analysis Summary Table			Existing		Design	
5	2-YR	178	775.9	779.95	776.85	780.35
5	5-YR	332	775.9	780.82	776.85	780.71
5	10-YR	448	775.9	781.13	776.85	780.91
5	25-YR	603	775.9	781.46	776.85	781.14
5	50-YR	741	775.9	781.67	776.85	781.32
5	100-YR	869	775.9	781.86	776.85	781.48
6	2-YR	178	774.37	777.89	775.91	778.66
6	5-YR	332	774.37	778.66	775.91	779.08
6	10-YR	448	774.37	779.18	775.91	779.3
6	25-YR	603	774.37	779.48	775.91	779.57
6	50-YR	741	774.37	779.75	775.91	779.8
6	100-YR	869	774.37	779.95	775.91	779.99
7	2-YR	178	772.66	776.19	773.41	776.52
7	5-YR	332	772.66	777.03	773.41	777.07
7	10-YR	448	772.66	777.17	773.41	777.36
7	25-YR	603	772.66	777.5	773.41	777.68
7	50-YR	741	772.66	777.75	773.41	777.93
7	100-YR	869	772.66	777.98	773.41	778.13
8	2-YR	178	770.99	773.23	771.87	774.32
8	5-YR	332	770.99	774	771.87	774.73
8	10-YR	448	770.99	774.82	771.87	774.95
8	25-YR	603	770.99	775.12	771.87	775.17
8	50-YR	741	770.99	775.31	771.87	775.35
8	100-YR	869	770.99	775.45	771.87	775.51
9	2-YR	178	768.00	770.77	769.00	771.79
9	5-YR	332	768.00	771.84	769.00	772.49
9	10-YR	448	768.00	772.42	769.00	772.91
9	25-YR	603	768.00	773.02	769.00	773.38
9	50-YR	741	768.00	773.44	769.00	773.72
9	100-YR	869	768.00	773.77	769.00	774.01

Reach 4 HEC-RAS Analysis Summary Table			Existing		Design	
10	2-YR	205	766.51	769.03	766.51	769.53
10	5-YR	379	766.51	770.02	766.51	770.27
10	10-YR	509	766.51	770.52	766.51	770.69
10	25-YR	684	766.51	771.03	766.51	771.16
10	50-YR	840	766.51	771.4	766.51	771.51
10	100-YR	983	766.51	771.69	766.51	771.79
11	2-YR	236	760.26	762.72	760.26	762.72
11	5-YR	435	760.26	763.44	760.26	763.44
11	10-YR	584	760.26	763.85	760.26	763.85
11	25-YR	782	760.26	764.29	760.26	764.29
11	50-YR	959	760.26	764.63	760.26	764.63
11	100-YR	1122	760.26	764.9	760.26	764.9

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Appendix 14.10. EEP Floodplain Requirements Checklist

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EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. Edward Curtis), NC Floodplain Mapping Unit (attn. John Gerber) and NC Ecosystem Enhancement Program.

Project Location

Name of project:	North Fork Mountain Creek Restoration
Name if stream or feature:	North Fork Mountain Creek and two unnamed tributaries
County:	Catawba
Name of river basin:	Catawba
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Catawba County
DFIRM panel number for entire site:	3710368800J
Consultant name:	Stantec
Phone number:	919-851-6866
Address:	801 Jones Franklin Rd Suite 300 Raleigh, NC 27606

Design Information

Currently, reaches along North Fork Mountain Creek and its tributaries exhibit slight to severe degradation of ecological function and structural stability. This project involves the restoration of over 5000 linear feet of stream to restore channel dimension, pattern and profile, and reconnect the streams with their floodplain. Native riparian vegetation will also be planted in order to stabilize banks.

Reach	Length	Priority
Reach 1	1000	P1
	238	P2
Reach 2	955	P1
	90	P2
Reach 3	726	P2
Reach 4	1367	P1
	740	P2

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

☐ Yes ☉ No

If project is located in a SFHA, check how it was determined:

☐ Redelineation

☐ Detailed Study

☐ Limited Detail Study

☐ Approximate Study

☐ Don't know

List flood zone designation:

Check if applies:

☐ AE Zone

- ☐ Floodway
- ☐ Non-Encroachment
- ☉ None

☐ A Zone

- ☐ Local Setbacks Required
- ☐ No Local Setbacks Required

If local setbacks are required, list how many feet: n/a

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

☐ Yes ☉ No

Land Acquisition (Check)

☐ State owned (fee simple)

☐ Conservation easment (Design Bid Build)

☑ Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)

Is community/county participating in the NFIP program?

Is community/county participating in the NFIP program?

(•) Yes ( ) No

Note: if community is not participating, then all requirements should be addressed to NFIP (attn: Edward Curtis, (919) 715-8000 x369)

Name of Local Floodplain Administrator: Chris Timberlake
Phone Number: 828-465-8382

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☑ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision

☐ Other Requirements

List other requirements:

Comments:
The restoration site is in an unstudied zone. HEC-RAS modeling demonstrated that the project will not raise flood elevations upstream of the project site.

Name: Brian A. Mazzochi, PE, CFM Signature: Brian A. Mazzochi

Title: Water Resources Engineer Date: 10/12/2010

Appendix 14.11. Categorical Exclusion Form

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Appendix A

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	North Fork Mountain Creek
County Name:	Catawba
EEP Number:	
Project Sponsor:	Environmental Banc and Exchange
Project Contact Name:	Norton Webster
Project Contact Address:	909 Capability Drive, Suite 3100, Raleigh, North Carolina 27606
Project Contact E-mail:	norton@ebxusa.com
EEP Project Manager:	

Project Description

The North Fork Mountain Creek Stream and Wetland Restoration Project has been initiated by EBX to restore ecological function to an impaired section of North Fork Mountain Creek in Catawba County, NC. The project will provide in-kind mitigation and generate stream and wetland mitigation credit in the Catawba River Basin. Restoration will encompass approximately 2 miles of stream restoration, 4.5 acres of riparian wetland restoration, and 0.5 acres of riparian wetland enhancement. Other project components include 6 stream crossings, 8 water tanks for livestock watering, and fencing along the entire length of the project.

For Official Use Only

Reviewed By:

Date | **EEP Project Manager**

Conditional Approved By:

Date | **For Division Administrator FHWA**

☐ **Check this box if there are outstanding issues**

Final Approval By:

Date | **For Division Administrator FHWA**

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☑ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☑ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☑ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☑ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☑ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☐ No ☑ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☑ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☑ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☑ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☑ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☑ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Does the project require the acquisition of real estate?	☑ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☑ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☑ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☑ Yes ☐ No
2. Is the site of religious importance to American Indians? A response has not yet been received from the EBCI.	☐ Yes ☑ No ☐ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☑ No ☐ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☑ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☑ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☑ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☑ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☐ Yes ☑ No ☐ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☑ No ☐ N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☑ No ☐ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☑ Yes ☐ No ☐ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☑ No ☐ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☑ Yes ☐ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project? A response has not yet been received from the EBCI.	☐ Yes ☑ No ☐ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☑ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☑ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☑ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☑ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☑ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☑ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☑ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☑ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☑ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☑ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☑ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☑ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☑ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☑ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☑ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☑ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☑ N/A

Appendix 14.12. Soil Profile Descriptions

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Soil Profile Descriptions

9/1/2010

ID	Depth (in.)	Horizon	Matrix Color	Texture	Mottle Color Conc.	Mottle Color Depl.	Structure	Roots	Boundary	Notes
B-1										
	10	Ap	7.5YR 4/6	L			Gr	Few	A	
	21	Bw1	5YR 4/6	SCL			SBK	none	G	
	28	Bw2	5YR 4/6	SCL			SBK	none	A	
	28+	BC	7.5YR 4/4	SL			Gr	none	n/a	Very Gravelly
B-6										
	5	A	10YR 3/3	L	5YR 4/6 (2% PL)		Gr	Many	C	
	18	Bt1	7.5YR 4/6	C			SBK	none	C	
	32	Bt2	7.5YR 4/6	C		10YR 5/3 (40% M)	SBK	none	C	
	42+	Bt3	10YR 3/1	C			SBK	none	C	Very Gravelly bottom 2"
B-9										
	10	Ap	7.5YR 4/6	L			Gr	Few	C	
	36	Bt1	5YR 4/4	C			SBK	none	A	
	42+	Bt2	5YR 3/1	C	7.5YR 4/6 (25% M)		SBK	none	n/a	No gravel layer found in the profile
B-12										
	6	Bt1	5YR 4/6	L			Gr	Few	A	Surface horizon has eroded off, no A horizon present
	18	Bw1	10YR 3/2	SiCL			SBK	none	G	Gravelly
	36+	Bw2	10YR 4/2	SiCL			SBK	none	A	Very Gravelly
B-13										
	10	Ap	10YR 3/4	L			Gr	Few	A	
	32	Bt1	2.5Y 5/4	CL			SBK	none	A	
	43+	Bt2	2.5Y 3/1	CL			SBK	none	A	Soil profile lacked red clay common to the rest of the site

ID	Depth (in.)	Horizon	Matrix Color	Texture	Mottle Color Conc.	Mottle Color Depl.	Structure	Roots	Boundary	Notes
B-14										
	10	Ap	10YR 3/3	L			Gr	Few	G	
	20	Bw	10YR 3/4	L			SBK	none	A	
										Shallow soil underlain by friable weathered rock, possibly shale

Soil Profile Descriptions

2/16/2011

ID	Depth (in.)	Horizon	Matrix Color	Texture	Mottle Color Conc.	Mottle Color Depl.	Structure	Roots	Boundary	Notes
A										
	2	A	10YR 4/4	L			Gr	Many		Mica
	15	Bt1	7.5YR 4/4	SL			SBK		Diffuse	Mica flakes
	18	Bt2	5YR 4/4	SCL			SBK			Mica
	20	Bt3	5YR 4/4	SCL		7.5YR 4/2 (50%)	SBK			Mica
	24	Btg	10YR 4/2	SCL/CL	5YR 4/4 (>20%)					There were also pieces of Organic Matter in the horizon with a color of 5YR 4/6
	24+	Water was coming into the hole, and soil would not stay in auger								
	Depth to Water	Sat. @ 20"								
	Depth to Ch ≤ 2 mottles	18"								
	Additional Notes	Wetland creation based on USACE (Todd Tugwell's) criteria								

ID	Depth (in.)	Horizon	Matrix Color	Texture	Mottle Color Conc.	Mottle Color Depl.	Structure	Roots	Boundary	Notes
B										
	3	A	7.5YR 4/4	SL			Gr	Many		Sand particles and mica visible in surface
	16	Bt1	7.5YR 3/4	SL			SBK	Common fine		Sand/gravel particles and mica visible in surface
	24	Bt2	5YR 4/4	CL			SBK			
	30	Btg1	10YR 4/2	SCL		7.5YR 3/1	SBK		Abrupt	
	36+	Bg	10YR 3/1	LS			Gr			
	Depth to Water	Sat. @ 24"								
	Depth to Ch ≤ 2 mottles									
	Additional Notes	Wetland creation (USACE criteria) - Edge of restoration definite microtopography boundary northward.								
C										
	4	A	10YR 3/3	SL	7.5YR 3/4 (>20%)	10YR 5/3 (>20%)	Gr	Many		Oxidzed root channels. Mica present.
	14	Bt1	7.5YR 4/3	SL	2.5YR 3/6 (<2%)		Gr			Sand/gravel particles and mica visible in surface
	20	Bt2	5YR 4/4	CL	10YR 4/3 (<2%)	10YR 2/1 (>20%)	SBK			Few clay films and some gravel
	24+	Bg	10YR 4/1	SL	10yr 3/6 (2-20%)		SBK	Common fine		Very sandy. Oxidized root channels present
	Depth to Water	18"								
	Depth to Ch ≤ 2 mottles	14"								
	Depth to Ch ≤ 2 matrix	20"								
	Additional Notes	This boring was adjacent to the boring that USACE (Todd Tugwell) liked and indicated would be suitable for restoration.								

ID	Depth (in.)	Horizon	Matrix Color	Texture	Mottle Color Conc.	Mottle Color Depl.	Structure	Roots	Boundary	Notes
D										
	2	A	10YR 4/4	L	7.5YR 4/4 (<2%)	10YR 5/3 (>20%)	Gr	Many		
	12	Bt1	10YR 4/3	SCL	7.5YR 4/4 (2-20%)	10YR 2/1 (<2%)	SBK	Many		Mica present
	24	Bt2	7.5YR 3/3	SCL	5YR 3/4 (2-20%) 7.5YR 4/3 (>20%)	10YR 2/1 (<2%)	SBK	Few		Mica present
	48+	Btg	10YR 4/2	CL	10yr 3/6 (2-20%)		SBK	Few	A	
	Depth to Water	17"								
	Depth to Ch ≤ 2 mottles	2"								
	Depth to Ch ≤ 2 matrix	24"								
	Additional Notes	This area is being classified as restoration, the boring and area meets the criteria indicated by USACE (Todd Tugwell).								
E										
	4	A	10YR 4/3	L	7.5YR 3/4 (>20%)		Gr	Many		
	10	Bt1	10YR 4/3	SCL	7.5YR 3/4 (>20%)	10YR 2/1 (<2%)	SBK			
	16	Bt2	7.5YR 3/4	SCL	5YR 3/4 (2-20%)	10YR 4/2 (2-20%)	SBK			
	18+	Bt3	7.5YR 3/5	CL		10yr 3/3 (>20%)	SBK			
	Depth to Water	15"								
	Depth to Ch ≤ 2 mottles	5"								
	Depth to Ch ≤ 2 matrix									
	Additional Notes									

ID	Depth (in.)	Horizon	Matrix Color	Texture	Mottle Color Conc.	Mottle Color Depl.	Structure	Roots	Boundary	Notes
F										
	6	A	10YR 4/2	L	7.5YR 5/8 (>20%)	7.5YR 4/2 (>20%)	weak SBK	Many		
	15	Bt1	7.5YR 4/6	SCL	7.5YR 5/8 (15%)	7.5YR 3/1 (5%)	SBK			
	28+	Bt2	7.5YR 4/7	SCL	7.5YR 5/8 (15%)	7.5YR 3/1 (15%)	SBK			
	Depth to Water	14"								
	Depth to Ch ≤ 2 mottles	2"								
	Depth to Ch ≤ 2 matrix									
	Additional Notes									
G										
	4	A	10YR 3/3	L	7.5YR 4/4 (25%)	7.5YR 4/2 (>25%)	weak SBK	Many		
	12+	Bt	7.5YR 4/6	SCL	7.5YR 4/4 (15%)	7.5YR 4/2 (15%)	SBK			
	Depth to Water	14"								
	Depth to Ch ≤ 2 mottles	2"								
	Depth to Ch ≤ 2 matrix									
	Additional Notes									

ID	Depth (in.)	Horizon	Matrix Color	Texture	Mottle Color Conc.	Mottle Color Depl.	Structure	Roots	Boundary	Notes
H										
	4	A	7.5YR 3/3	L	7.5YR 4/6 (30%)	7.5YR 3/1 (30%)	weak SBK	Many		
	14	Bt1	7.5YR 4/6	SCL	7.5YR 4/6 (60%)	2.5Y 3/2 (40%)	SBK			
	19+	Bt2	2.5Y 3/2	SCL	7.5YR 4/6 (40%)	2.5Y 3/2 (60%)	SBK			
	Depth to Water	12"								
	Depth to Ch ≤ 2 mottles	1"								
	Depth to Ch ≤ 2 matrix	14"								
	Additional Notes									

I										
	2	A	7.5YR 3/3	L			weak SBK			
	6	Bt1	7.5YR 4/3	SCL			weak SBK			30% Mica and coarse rock fragments.
	12	Bt2	7.5YR 4/3	SCL	7.5YR 5/8 (20%)	7.5YR 3/1 (20%)	weak SBK			50% Mica and coarse rock fragments.
	12+	BC	7.5YR 2.5/1	SL			GR			
	Location:	In wetland								
	Landscape:	Toe slope								
	Veg/Crop:	Grass, juncus, ironweed								
	Depth to Water									
	Depth to Ch ≤ 2 mottles	6"								
	Depth to Ch ≤ 2 matrix	12"								
	Additional Notes	Small wetland restoration area adjacent to tributary. Rock appears to be restricting water and allowing hydric soil features to form.								