Martin's Creek II Mitigation Plan
Cherokee County, North Carolina

Prepared For

NCDENR-EEP
1652 Mail Service Center
Raleigh, North Carolina 27699-1652
Phone: 919-715-0476
Fax: 919-715-2219

EEP Project #: 92633 SCO #: 08-07251-01

Michael Baker Engineering, Inc., NC Professional Engineering License # F-1084
9/22/10

♻ *This document was printed using 100% recycled paper.*

Martin's Creek II Mitigation Plan

Cherokee County, North Carolina

Report Prepared and Submitted by Michael Baker Engineering, Inc.

Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Micky Clemmons
Office Principal & Project Manager

Jake McLean, PE
Project Engineer

EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) proposes the restoration of 3,505 lf of stream, enhancement of 2,764 lf of channel and preservation 21,530 lf of headwater tributaries to Martin's Creek in Cherokee County, NC (ES Figure 1.0). All restoration and enhancement reaches have been identified as jurisdictional waters. Jurisdictional wetlands on-site totaled 1.61 acres; these will be enhanced during this project. Based on the identification of relic wetland soils Baker proposes to restore 5.2 acres of wetlands resulting in approximately 6.81 acres of restored and enhanced wetlands under this project. The nearest town, Murphy, is approximately two and a half miles north of the Martin's Creek II mitigation project site. The site lies in the Hiwassee River Basin within North Carolina Division of Water Quality (NCDWQ) sub-basin 04-05-02 and local watershed unit 06020002170010.

The Martin's Creek II mitigation project area lies within the focus area of the Peachtree-Martins Creek Local Watershed Plan (LWP) (http://www.nceep.net/services/lwps/pull_down/by_basin/Hiwassee_RB.html) and roughly corresponds to Restoration site # 1 & Preservation site # 1 of the LWP project atlas. Additionally, the mitigation project site watershed is identified as Hydrologic Unit Code (HUC) 06020002170010 which was identified as a Targeted Local Watershed (TLW) in EEP's 2001 and 2008 Hiwassee River Basin Restoration Priority (RBRP) Plans (http://www.nceep.net/services/lwps/pull_down/by_basin/Hiwassee_RB.html).

The Peachtree-Martins Creek LWP identified numerous point and nonpoint source pollutants present in the Peachtree-Martins Creek watershed. Water quality stressors that were located in the project watershed and the project site itself include inadequate riparian buffer cover, channel modification, excess nutrient and sediment loading, and fecal bacteria contamination. Other water quality issues in the project LWP area include increased flow velocities associated with stormwater runoff, groundwater contamination, and sediment inputs from a local quarry (only point source identified).

The goals for the stream restoration project are as follows:

- Create geomorphically stable stream channels within the Martin's Creek II mitigation project area,
- Restoration or enhancement of wetlands on- site,
- Exclude livestock from accessing the project streams, wetlands, and riparian zones,
- Improve and restore hydrologic connections and overall ecosystem functionality,
- Improve water quality within the Martin's Creek II project area through reduction of bank erosion, improved nutrient and sediment removal, and stabilization of streambanks,
- The restoration and preservation of headwater tributaries to the Peachtree-Martins Creek Watershed and the Hiwassee River, and
- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, reduction of water temperature, and restoration of terrestrial habitat.

To accomplish these goals, we recommend the following actions:

- Make important design decisions based on geomorphic analyses of the site, from reference conditions, supporting information from hydraulic modeling and dimensionless ratios that Baker has consistently found to produce stabile conditions in order to incorporate important elements of all,
- Use constructability as a guiding consideration in order to produce a realistic design that is possible to build given field constraints and construction tolerances,
- Minimize disturbance to ecologically functional and physically stable areas; mimic the character of these areas and borrow materials from them where appropriate to create a more natural design, and
- Structures and overall design will attempt to use native materials and minimize materials brought onsite in order to produce habitat favoring native flora and fauna, reduce compaction and site disturbance from material transport, and produce an aesthetically pleasing result.

The project goals will directly address stressors identified in the Peachtree-Martins Creek LWP, namely lack of riparian vegetation, channel modification, excess sediment inputs, excess nutrient inputs, and bacterial contamination. Baker's natural stream channel design approach will result in a stable riparian system that will reduce sediment and nutrient loading to Martin Creek while contributing to water quality conditions that support terrestrial and aquatic species including priority species identified in the basin.

Table ES.1 Martin's Creek II Mitigation Project Overview
Martin's Creek II Mitigation Project--NCEEP Project #92633

Reach	Design Approach	Existing Reach (LF)	Design Reach (LF)	Potential SMUs/ WMUs	SMU/WMU Credit Ratio	Watershed Drainage Area (square miles)
Right Prong Martin's Creek (RP) Unnamed Tributaries						
RP-UT1	Preservation	541	541	108	5:1	0.162
RP-UT1	Enhancement II	399	399	159	2.5:1	.169
RP-UT2	Preservation	2,472	2,472	494	5:1	0.076
RP-UT2-1	Preservation	1,366	1,366	273	5:1	0.037
RP-UT3	Preservation	1,379	1,379	276	5:1	0.097
RP-UT3-1	Preservation	1,060	1,060	212	5:1	0.027
RP-UT4	Preservation	1,832	1,832	366	5:1	0.073
RP-UT4-1	Preservation	698	698	140	5:1	0.019
RP-UT5	Preservation	818	818	164	5:1	0.016
RP-UT6	Preservation	1,069	1,069	214	5:1	0.036
RP-UT7	Preservation	791	791	158	5:1	0.013
Right Prong Martin's Creek (Reach 1)	Preservation	5,208	5,208	1,042	5:1	0.413
Right Prong Martin's Creek (Reach 2)	Enhancement II	572	572	229	2.5:1	0.603
Martin's Creek (MC) Unnamed Tributaries						
MC-UT1 (Reach 1)	Preservation	2,482	2,482	496	5:1	0.065
MC-UT1 (Reach 2)	Restoration	1,070	1,070	1,070	1:1	0.092
MC-UT1 (Reach 3)	Enhancement I	345	345	230	1.5:1	0.161
MC-UT1 (Reach 4)	Restoration	332	1,149	1,149	1:1	0.176
MC-UT1-1	Preservation	689	689	138	5:1	0.018
MC-UT1-2	Preservation	923	923	185	5:1	0.019
MC-UT1-2-1	Preservation	202	202	40	5:1	0.005
MC-UT1-3 (Reach 1)	Enhancement I	516	516	344	1.5:1	0.07
MC-UT1-3 (Reach 2)	Restoration	1,068	1,286	1,286	1:1	0.08
MC-UT2	Enhancement II	75	75	30	2.5:1	0.385
Martin's Creek	Enhancement II	857	857	343	2.5:1	6.81
TOTAL STREAM FOOTAGE BY TYPE		26,764	27,799	9,146		
Stream Design Approach						
Stream Length/SMUs	Restoration	2,470	3,505	3,505	1:1	
	Enhancement I	861	861	574	1.5:1	
	Enhancement II	1,903	1,903	761	2.5:1	
	Preservation	21,530	21,530	4,306	5:1	
		26,764	27,799	9,146		

Table ES.1 Mitigation Plan Overview

Martin's Creek II Mitigation Project--NCEEP Project #92633

TOTAL WETLAND ACREAGE						
Wetland Design Approach (Acres)						
Total Wetland Acreage	Restoration	-	5.2	5.2	1:1	
	Enhancement	1.61	1.61	.80	2:1	
			6.81	6.0		
Watershed Size at Downstream End of Reach			6.81 Square Miles			

This document is consistent with the requirements of the federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14). Specifically the document addresses the following requirements of the federal rule:

(2) *Objectives.* A description of the resource type(s) and amount(s) that will be provided, the method of compensation (i.e., restoration, establishment, enhancement, and/or preservation), and the manner in which the resource functions of the compensatory mitigation project will address the needs of the watershed, ecoregion, physiographic province, or other geographic area of interest.

(3) *Site selection.* A description of the factors considered during the site selection process. This should include consideration of watershed needs, onsite alternatives where applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the compensatory mitigation project site. (See § 332.3(d).)

(4) *Site protection instrument.* A description of the legal arrangements and instrument, including site ownership, that will be used to ensure the long-term protection of the compensatory mitigation project site (see § 332.7(a)).

(5) *Baseline information.* A description of the ecological characteristics of the proposed compensatory mitigation project site and, in the case of an application for a DA permit, the impact site. This may include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, a map showing the locations of the impact and mitigation site(s) or the geographic coordinates for those site(s), and other site characteristics appropriate to the type of resource proposed as compensation. The baseline information should also include a delineation of waters of the United States on the proposed compensatory mitigation project site. A prospective permittee planning to secure credits from an approved mitigation bank or in-lieu fee program only needs to provide baseline information about the impact site, not the mitigation bank or in-lieu fee project site.

(6) *Determination of credits.* A description of the number of credits to be provided, including a brief explanation of the rationale for this determination. (See § 332.3(f).)

(7) *Mitigation work plan.* Detailed written specifications and work descriptions for the compensatory mitigation project, including, but not limited to, the geographic boundaries of the project; construction methods, timing, and sequence; source(s) of water, including connections to existing waters and uplands; methods for establishing the desired plant community; plans to control invasive plant species; the proposed grading plan, including elevations and slopes of the substrate; soil management; and erosion control measures. For stream compensatory mitigation projects, the mitigation work plan may also include other relevant information, such as plan form geometry, channel form (e.g. typical channel cross sections), watershed size, design discharge, and riparian area plantings.

(8) *Maintenance plan.* A description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed.

(9) *Performance standards.* Ecologically-based standards that will be used to determine whether the compensatory mitigation project is achieving its objectives. (See § 332.5.)

(10) *Monitoring requirements.* A description of parameters to be monitored in order to determine if the compensatory mitigation project is on track to meet performance standards and if adaptive management is needed. A schedule for monitoring and reporting on monitoring results to the district engineer must be included. (See § 332.6.)

(11) *Long-term management plan.* A description of how the compensatory mitigation project will be managed after performance standards have been achieved to ensure the long-term sustainability of the resource, including long-term financing mechanisms and the party responsible for long-term management. (See § 332.7(d).)

(12) *Adaptive management plan.* A management strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project, including the party or parties responsible for implementing adaptive management measures. The adaptive management plan will guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success. (See § 332.7(c).)

(13) *Financial assurances.* A description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with its performance standards (see § 332.3(n)).

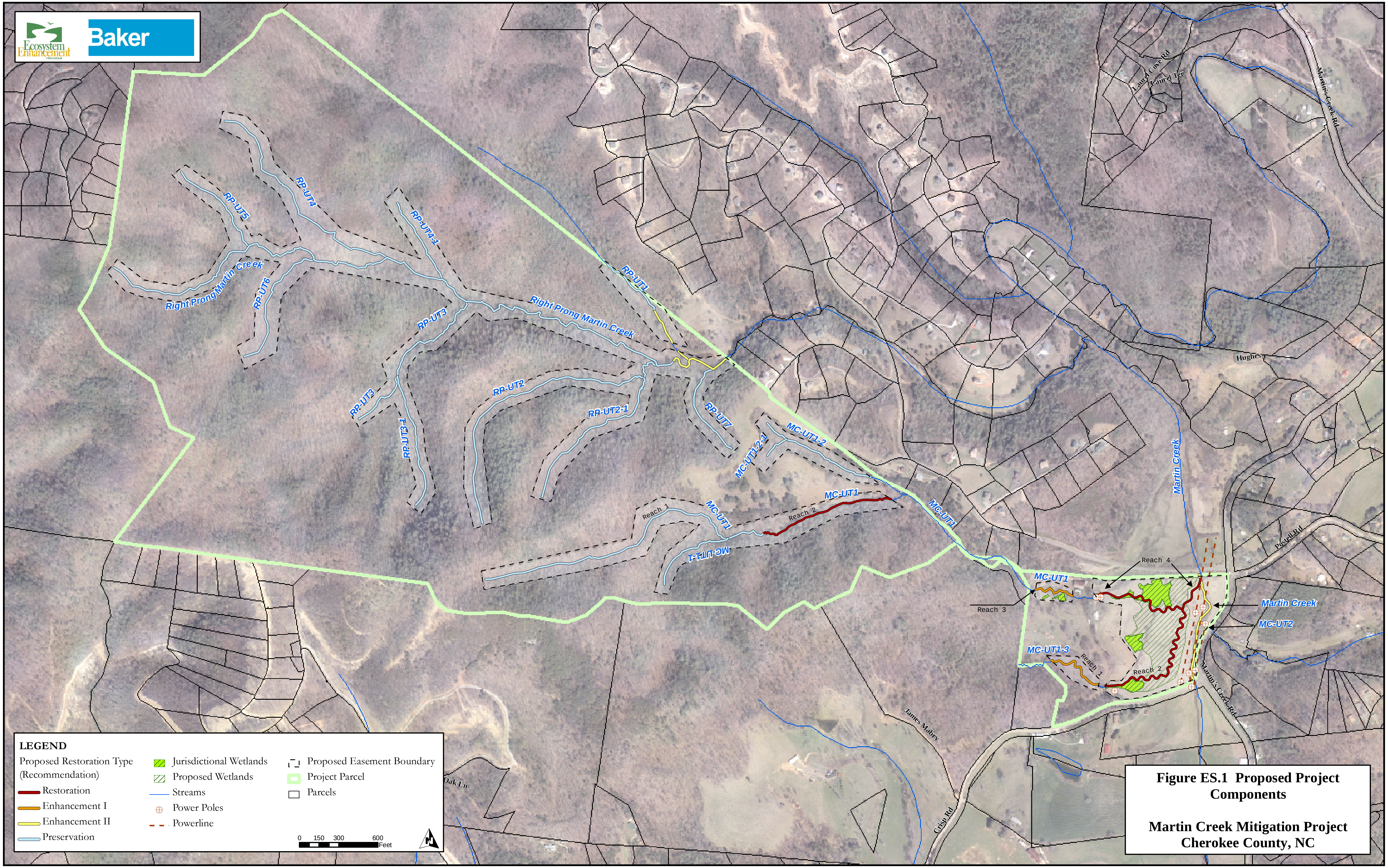


Figure ES.1 Proposed Project Components

Martin Creek Mitigation Project
Cherokee County, NC

TABLE OF CONTENTS

LIST OF TABLES

List of Figures

List of Appendices

1.0 PROJECT SITE IDENTIFICATION AND LOCATION

1.1 Project Description and Directions to Project Site

Baker proposes the restoration of 3,505 lf of stream, enhancement of 2,764 lf of channel and preservation 21,530 lf of headwater tributaries to the Martin's Creek drainage in Cherokee County, NC (ES Figure 1). Delineated wetlands identified totaled 1.61 acres that will be enhanced. Based on the identification of relic wetland soils Baker proposes to restore 5.2 acres of wetlands resulting in approximately 6.81 acres of restored and enhanced wetlands under this project.

The Martin's Creek II project site is located in Cherokee County in western North Carolina, just south of the town of Murphy. From Murphy, continue along U.S. Highway 64/74 across the Hiwassee River. Turn left onto Hiwassee Street at the first traffic light after crossing the river. Continue for approximately .6 miles and turn right onto Martin's Creek Road. After turning onto Martin's Creek Road, travel approximately 2.2 miles and turn right onto Crisp Road. The lower reaches of the project site are accessible by entering the field north of Crisp Road at this intersection. There is no road access to the higher elevation streams on this project site. Access can be gained from the Wildcat subdivision if permission is obtained from the developer. To reach the upper extent of the project area and the Right Prong of Martin's Creek, turn off Martin's Creek Road onto Wildcat Road. Wildcat Road is located just before Crisp Road and borders the northern boundary of the project area. Follow Wildcat Road through the subdivision and turn left onto Alto Vista Road. Once on Alto Vista Road, turn left and continue until you reach a vacant lot where the road ends. From this dead-end the property can be accessed by walking southeast, down the slope to the property at the bottom of the hill.

1.2 USGS Hydrologic Unit Code and NCDWQ River Basin Designations

The Martin's Creek II project site lies in the Hiwassee River Basin, within North Carolina Division of Water Quality (NCDWQ) sub-basin 04-05-02 and United States Geologic Survey (USGS) local watershed unit 06020002170010 (Figure 1). The project will involve the Right Prong of Martin's Creek (RP) and eight unnamed tributaries (UT), five unnamed tributaries to Martin's Creek (MC) and Martin's Creek itself, which flows into the Hiwassee River. Tributaries that flow into Right Prong Martin's Creek within the project area have been identified as RP-UT1, RP-UT2, RP-UT2-1, RP-UT3, RP-UT3-1, RP-UT4, RP-UT4-1 and RP-UT5. Other tributaries upstream of the Right Prong confluence which flow into Martin's Creek are labeled as: MC-UT1, MC-UT1-1, MC-UT1-2, MC-UT1-3 and MC-UT2.

Right Prong Martin's Creek, RP-UT1, RP-UT3, MC-UT1, MC-UT1-3, MC-UT2 and the mainstem of Martin's Creek are shown as solid blue-line streams throughout the site on the USGS topographic quadrangle map. The remaining tributaries do not appear on the USGS quadrangle map for this site. Martin's Creek enters and exits the project area via culverts that run under Crisp Road and Wildcat Road, respectively. Land use upstream and downstream of the project area consists of grassed lands that have been used to pasture horses and cattle. The Right Prong Martin's Creek drainage, UT1 to Martin's Creek and UT1-3 to Martin's Creek enter the project area through upland forests on-site. Unnamed Tributary 2 to Martin's Creek enters the project area through a culvert under Martin's Creek Road after meandering through a residential area.

After referencing USGS topographic quadrangle maps to determine stream order, a field evaluation using the North Carolina Division of Water Quality (NCDWQ) stream assessment protocol was conducted. Based on field data, RP-UT4-1, RP-UT5, MC-UT1-3, MC-UT2 and Martin's Creek are the only streams that are perennial throughout the project site. Right Prong Martin's Creek tributary UT2-1 and UT3-1 are the only streams in the project area that are intermittent. All remaining streams within the project area exhibited some combination of ephemeral, intermittent and perennial reaches. NCDWQ Stream Identification Forms completed for the project reaches are included in Appendix A. A figure denoting intermittent and perennial breaks on project streams is provided in Section 3 of this plan. The total current length of stream within the project is 26,816 LF.

1.3 Project Components and Structure

Distinct project reaches are summarized in Table 1 below and are depicted in the Project Components figure in the Executive Summary (ES.1). A table (1.1) summarizing project component attributes is also provided.

Table 1.0 Project Restoration Components
Martin's Creek II Mitigation Project-NCEEP Project #92633

Project Segment or Reach ID	Existing Feet/Acres	Type	Approach	Footage or Acreage	Mitigation Ratio	Mitigation Units	Stationing	Comment
Right Prong Martin's Creek (RP) Unnamed Tributaries								
RP-UT1	541	-	P	541	5:1	108	-	No channel alteration
RP-UT1	399	LII	E	399	2.5:1	159	Refer to Plan Sheet Pg. 16	Improve riparian buffer by removing invasive/exotic vegetation; replanting with native vegetation.
RP-UT2	2,472	-	P	2,472	5:1	494	-	No channel alteration
RP-UT2-1	1,366	-	P	1,366	5:1	273	-	No channel alteration
RP-UT3	1,379	-	P	1,379	5:1	276	-	No channel alteration
RP-UT3-1	1,060	-	P	1,060	5:1	212	-	No channel alteration
RP-UT4	1,832	-	P	1,832	5:1	366	-	No channel alteration
RP-UT4-1	698	-	P	698	5:1	140	-	No channel alteration
RP-UT5	818	-	P	818	5:1	164	-	No channel alteration
RP-UT6	1,069	-	P	1,069	5:1	214	-	No channel alteration
RP-UT7	791	-	P	791	5:1	158	-	No channel alteration
Right Prong Martin's Creek (Reach 1)	5,208	-	P	5,208	5:1	1,042	-	No channel alteration
Right Prong Martin's Creek (Reach 2)	572	LII	E	572	2.5:1	229	Refer to Plan Sheet Pg. 16	Improve riparian buffer by removing invasive/exotic vegetation; replanting with native vegetation.
Martin's Creek (MC) Unnamed Tributaries								
MC-UT1 (Reach 1)	2,482	-	P	2,482	5:1	496	-	No channel alteration
MC-UT1 (Reach 2)	1,070	PI	R	1,070	1:1	1,070	0+00-10+70	Restore natural hydrology and geomorphic form by relocating portion of channel to the low point of the valley
MC-UT1 (Reach 3)	345	LI	E	345	1.5:1	230	0+00-3+45	Improve grade control and bank stability where needed and adjust channel dimension
MC-UT1 (Reach 4)	332	PI	R	1,149	1:1	1,149	5+48-16+97	Restore wetland hydrology and restore geomorphic form to

								channel by relocating channel within greater wetland complex and adjusting confluence of UT1 and UT1-3
MC-UT1-1	689	-	P	689	5:1	138	-	No channel alteration
MC-UT1-2	923	-	P	923	5:1	185	-	No channel alteration
MC-UT1-2-1	202	-	P	202	2.5:1	40	-	No channel alteration
MC-UT1-3 (Reach 1)	516	LI	E	516	1.5:1	344	0+00-5+16	Improve channel profile, sediment transport function and bank stability where needed and adjust channel dimension
MC-UT1-3 (Reach 2)	1,068	PI	R	1,286	1:1	1,286	5+78-18+64	Restore wetland hydrology and restore geomorphic form to channel by relocating channel within greater wetland complex and adjusting confluence of tributary with UT1
MC-UT2	75	LII	E	75	2.5:1	30	Refer to Plan Sheet Pg. 16	Improve riparian buffer by removing invasive/exotic vegetation; replanting with native vegetation.
Martin’s Creek	857	LII	E	857	2.5:1	343	Refer to Plan Sheet Pg. 16	Improve riparian buffer by removing invasive/exotic vegetation; replanting with native vegetation.
Wetland pockets upstream of barn	.08		E	.08	2:1	.04	Refer to Plan Sheet Pg. 17	Protection of wetland pockets within easement; minor removal of invasive vegetation
Wetland pockets in field adjacent to MC UT1-3	1.53		E	1.53	2:1	.765	Refer to Plan Sheet Pg. 17	Improve hydrology by removal of subsurface drains, surface roughening and restoration of confluence between MC UT1 and MC UT1-3; removal of invasive plants and replant with native vegetation
Area of Buried Hydric Soil	5.2		R	5.2	1:1	5.2	Refer to Plan Sheet Pg. 17	Expose buried hydric soil layer; restore hydrology through removal of subsurface drains installed; roughen surface; replant with native vegetation

Mitigation Unit Summations

Stream (LF)	Riparian Wetland (Ac)	Nonriparian Wetland (Ac)	Total Wetland (Ac)	Buffer (Ac)	Comment
9,146	6.81	NA	6.81	93.87	

Table 1.1 Project Attributes Table

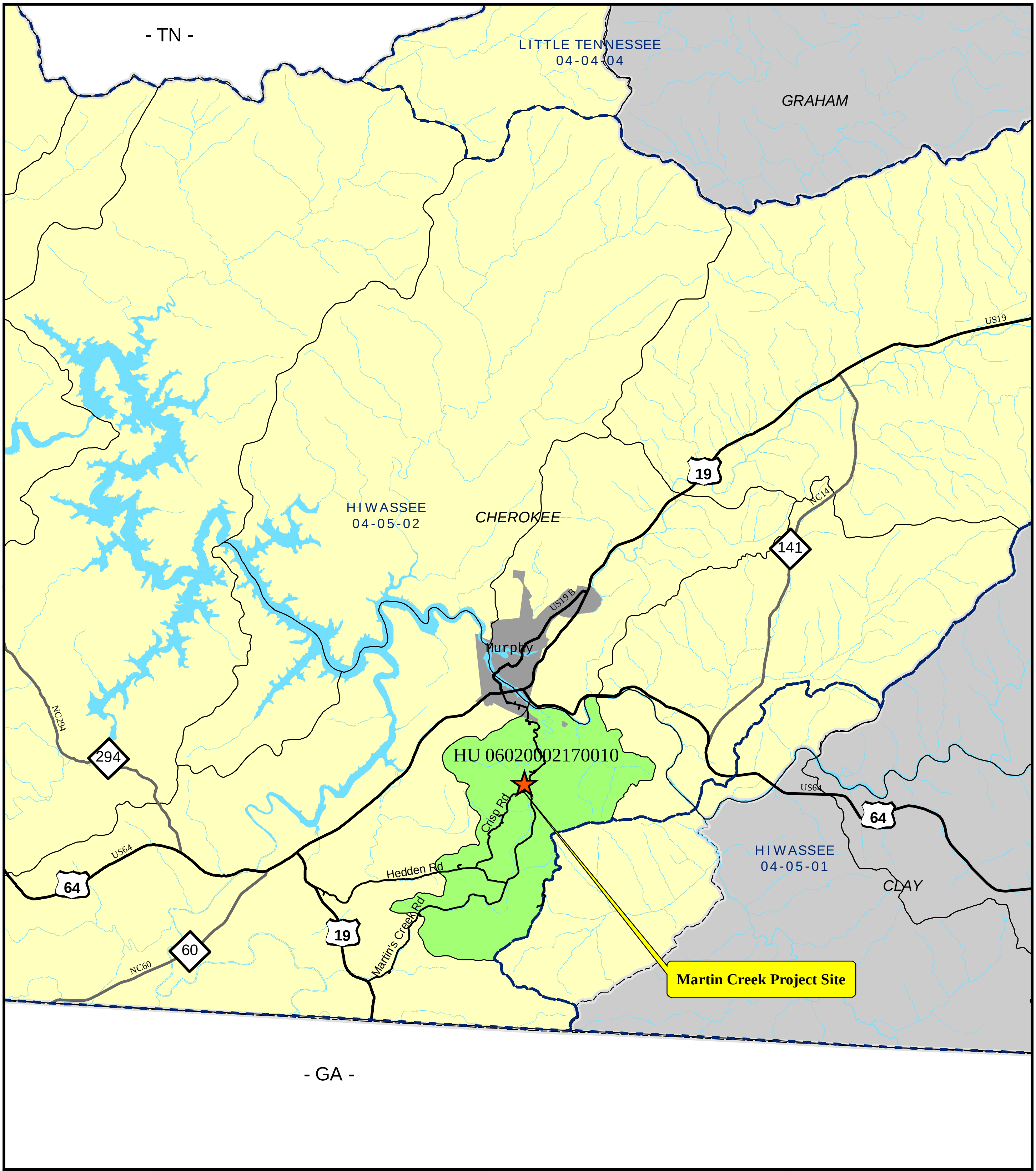
Martin’s Creek II Mitigation Project-NCEEP Project #92633

Project County	Cherokee
Physiographic Region	Blue Ridge
Ecoregion	Broad Basins
Project River Basin	Hiwassee
USGS HUC for Project	06020002170010
NCDWQ Sub-basin for Project	04-05-02
Planning Area	Peachtree-Martins Creek LWP
WRC Class	Cold
% of Project Easement Fenced or Demarcated	100% of easement demarcated with NCEEP signs and yellow blazing in trees
Beaver Activity Observed During Design Phase	No

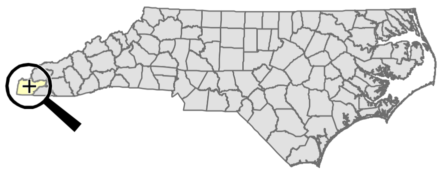
Restoration Component Attribute Table

	Right Prong Martin’s Cr.		Martin’s Creek					
	RP UT1	RP Mainstem	MC UT1[1]		MC UT1-3		MC UT2	MC Mainstem
			(LII Enh)	PI Rest	(LI Enh)	PI Rest		
Drainage Area (square miles)	.17	.60	.02-.18		.07- .08		.39	6.81
Stream Order	1st	3rd	2nd		1st		1st	3rd
Restored Length (feet)	399	572	345	1,070/ 1,149	516	1,286	75	857
Perennial or Intermittent	I/P	I/P	P	P	P	P	P	P
Watershed Type	Rural							
Watershed LULC Distribution* (Cumulative acreage)								
Developed Open Space	3.8							
Deciduous Forest	453.6							
Evergreen Forest	29.4							
Mixed Forest	46.1							
Shrub/Scrub	4.0							
Grassland/Herbaceous	4.5							
Pasture/Hay	24.0							
Land Use Note: Cumulative acreage limited to project subwatershed, not entire 11.6 sq.mi. drainage, which is rural and similar in nature to project area.								
Watershed Impervious Cover (%)	<10%							
NCDWQ AU/Index Number	1-49 (Martin’s Creek), 1-49-3 (Right Prong Martin’s Creek)							
NCDWQ Classification	C		C		C		C	C
303d Listed	No		No		No		No	No
Upstream of 303d Listed Segment	No		No		No		No	No
Reasons for 303d Listing/Stressor	N/A		N/A		N/A		N/A	N/A
Easement Acreage (Cumulative)	93.87							
Vegetated Acreage in Easement	-		-		-		-	-

Planted Acreage As Part of the Restoration	17 Acres							
Rosgen Classification (Pre-existing)	B	B	Eb/Fb/B/G	Cb/G	Eb/B	C/F	B	C
Rosgen Classification of As-built (Design)	B	B	B/C	B/C	B	C	B	C
Valley Type	II		II		VIII		VIII	VIII
Valley Slope	N/A		.015-.05		.007-.04		N/A	N/A
Valley Side Slope Range	U		U		U		U	U
Valley Toe Slope Range	U		U		U		U	U
Cowardin Classification	N/A		N/A		N/A		N/A	N/A
Trout Waters Designation	No		-		-		-	-
Species of Concern, Endangered, etc.	No		No		No		No	No
Dominant Soil Series and Characteristics								
Series	Cullowhee fine sandy loam		Thurmont-Dillard Complex/ Arkaqua loam		Dillard loam /Arkqua loam		Arkaqua loam	Arkaqua loam
Depth	20-40		>80/44-72		>80/44-72		44-72	44-72
Clay %	5-18		3-35/10-34		18-35/10-34		10-34	10-34
K	.10-.15		.20-.32/.24-.32		.15-.28/.24-.32		.24-.32	.24-.32
T	2		5/4		5/4		4	4
Notes:[1] Activities on MC-UT1 are subdivided into one Level II Enhancement Reach and two Priority I Restoration Reaches. Data per reach is denoted by the "/" symbol.								



Map Inset



Cherokee County, NC

LEGEND

- ⬚ NCDWQ Sub-basin
- ⬚ Counties
- ☐ USGS Hydrologic Unit
- 🟩 Project Hydrologic Unit
- 🟨 Cherokee County

0 1 2 4 Miles

Figure 1. Project Location Map

Martin Creek Mitigation Project
Cherokee County, NC

2.0 WATERSHED CHARACTERIZATION

2.1 Watershed Delineation

The Martin's Creek II mitigation project is located in Cherokee County in the Hiwassee River Watershed. The total drainage area at the downstream end of the project area is approximately 6.8 square miles. Figure 2. provides a topographic view of the watershed drainage area for Martin's Creek by project reach. A total of 93.87 acres will be protected with a conservation easement through this project.

Table 2.0 Drainage Areas By Reach
Martin's Creek II Mitigation Project-NCEEP Project #92633

Reach	Existing Reach Length (LF)	Watershed Size at Downstream End of Reach (sq mi.)
Right Prong Martin's Creek (RP) Unnamed Tributaries		
RP-UT1 (Reach 1)	541	0.162
RP-UT1 (Reach 2)	399	.169
RP-UT2	2,472	0.076
RP-UT2-1	1,366	0.037
RP-UT3	1,379	0.097
RP-UT3-1	1,060	0.027
RP-UT4	1,832	0.073
RP-UT4-1	698	0.019
RP-UT5	818	0.016
RP-UT6	1,069	0.036
RP-UT7	791	0.013
Right Prong Martin's Creek (Reach 1)	5,208	0.413
Right Prong Martin's Creek (Reach 2)	572	0.603
Martin's Creek (MC) Unnamed Tributaries		
MC-UT1 (Reach 1)	2,482	0.065
MC-UT1 (Reach 2)	1,070	0.077
MC-UT1 (Reach 3)	345	0.092
MC-UT1 (Reach 4)	332	0.161
MC-UT1-1	689	0.018
MC-UT1-2	923	0.019
MC-UT1-2-1	202	0.005
MC-UT1-3 (Reach 1)	516	0.07
MC-UT1-3 (Reach 2)	1,068	0.08
MC-UT2	75	0.385
Martin's Creek	857	6.81
Total Existing Stream Length	26,764	6.81/.60

2.2 Surface Water Classification/ Water Quality

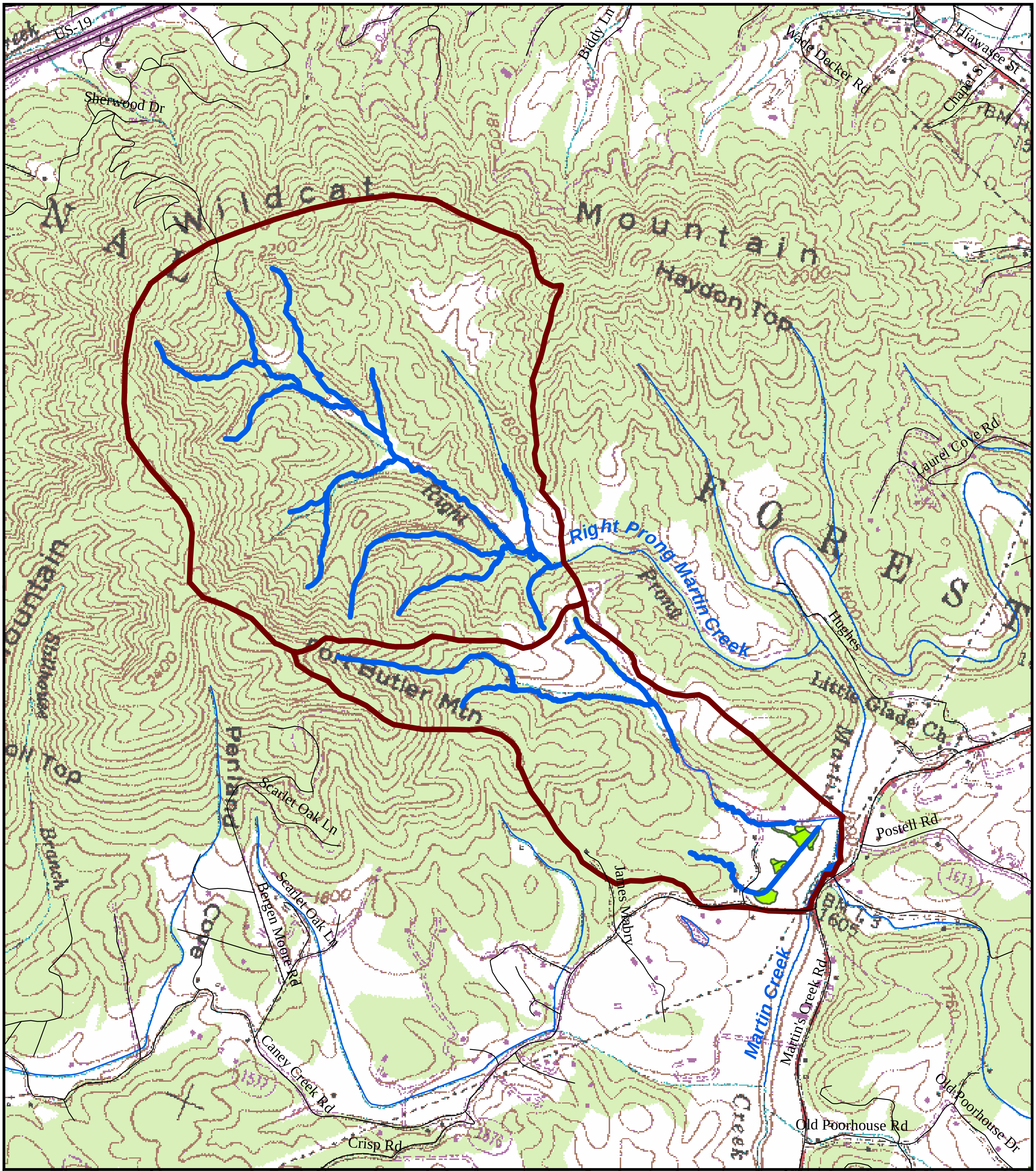
The NCDWQ designates surface water classifications for water bodies such as streams, rivers, and lakes, which define the best uses to be protected for these waters (e.g., swimming, fishing, and drinking water supply). These classifications are associated with water quality standards designed to protect these uses. All surface waters in North Carolina must, at minimum, meet the standards for Class C (fishable/swimmable) waters. Other primary classifications provide additional levels of protection for primary water contact recreation (Class B) and drinking water supplies (WS). In addition to these primary classifications, supplemental classifications are sometimes assigned to water bodies to protect special uses or values.

The NCDWQ has classified Martin's Creek as a Class C waterbody (DWQ Index No. 04-05-02) indicating that the system is considered to support aquatic life and secondary recreational uses. Restoration of the streams at the Martin's Creek II project site will reduce the amount of sediment, nutrients and bacteria being discharged from the project area, improving the water quality in the Hiwassee River Basin.

2.3 Physiography, Geology and Soils

The Martin's Creek II project site is geographically located in the Broad Basins Ecoregion Level IV Boundary. The underlying geology of the project site predominantly consists of the Mineral Bluff Formation although the Murphy Marble, Andrews and Brasstown Formations are also present to a lesser extent. According to the NC Geological Survey Map for the state, the Mineral Bluff Formation is made up of dark slate, phyllite interlayered with quartzite and multiple schists including "Quartz-chlorite-sericite schist, interbedded graphitic schist, garnet-mica schist, staurolite schist, and cross-biotite schist," (Geologic Survey of North Carolina, NC Geological Survey, 1985 and 1998). The Murphy Marble and Andrews Formations within the vicinity of the project area are calcareous and dolomitic. The Brasstown Formation is made up of cross-biotite schist and includes micaeous quartzite.

The US Department of Agriculture, Natural Resource Conservation Service (NRCS) Soil Data Mart website (http://soildatamart.nrcs.usda.gov/Default.aspx), was referenced in conjunction with "pdf" formatted soils maps provided by Cherokee County NRCS staff to determine soil types for the project area. Soils found within the project area are primarily loamy soils and include the Cullowhee fine sandy loam, Thurmont-Dillard and Sylco-Cataska complexes, as well as the Dillard loam and Ark aqua loam soil series (NRCS, 2008). Soils of the Thurmont-Dillard and Sylco-Cataska complexes are dominant in areas adjacent to the streams in the forested area of the project. These soils are located on moderate slopes in the valley of the project, are well drained and lie above the seasonal high water table. In the lower section of the valley, project streams course through both Dillard loams, Cullowhee sandy loams and Arkaqua loams. Dillard loams are located in the project area in the transitional zone between the upland forested areas and the floodplain. This soil series is defined as being moderately well drained, rarely flooded and typically 24 to 36 inches above the water table. The Arkaqua and Cullowhee loam soils are located in the lower valley of the Martin's Creek watershed and are primarily within the floodplain for Right Prong Martin's Creek and Martin's Creek. As evidenced by the presence and location of wetlands on-site, the Arkaqua loams within the project area as well as the Cullowhee loams are somewhat poorly drained and are occasionally flooded. Whereas the depth to the water table in the upper extent of the project area ranges from 36 to 72 inches, the depth to the water table where Arkaqua and Cullowhee loams are present is approximately 18 to 24 inches; however, water is at the ground surface in some wetland areas. A summary of information on each soil type is presented in Tables 2.1 and 2.2.



LEGEND:

▬ Project Reach — Streams ▭ Watershed Boundary

▨ Project Wetlands

Figure 2. Project Watershed Map (Murphy Quad)

Martin Creek Mitigation Project
Cherokee County, NC

Ecosystem Enhancement PROGRAM

Baker

Table 2.1 Project Soil Types and Descriptions Martin's Creek II Mitigation Project-NCEEP Project #92633			
Soil Name	Taxonomic Class	Location	Description
Thurmont - Dillard complex (2-8% and 8-15% slopes)	Fine-loamy, Active, Mesic Oxyaquic Hapludults/ Fine-loamy, mixed, semiactive, mesic Aquic Hapludults	Footslopes, colluvial fans, benches, stream terraces	Moderately permeable, deep, well drained soils; developed in colluvium and alluvium from a mixture of metamorphic rocks. Dillard soils are formed from Holocene-aged loamy alluvium.
Sylco-Cataska complex (50-95% slopes)	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts/ Loamy-skeletal, mixed, semiactive, mesic, shallow Typic Dystrudepts	Mountain summits, side slopes of Southern Appalachians	Moderately rapid permeability, deep, very well drained soils; weathered, low-grade metasedimentary residuum/ Shallow, moderately rapid permeability, very well drained soils; weathered from low-grade metasedimentary residuum.
Cullowhee fine sandy loam (0-3% slopes)	Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Fluvaquentic Dystrudepts	Floodplains in upper reaches of watersheds in Southern Appalachians	Rapidly permeable, somewhat poorly drained soils; developed from loamy alluvium over sandy and gravel alluvium.
Dillard loam (1-5% slopes)	Fine-loamy, mixed, semiactive, mesic Aquic Hapludults	Footslopes, colluvial fans, benches, stream terraces	Moderately permeable, deep, well drained soils; formed from Holocene-aged loamy alluvium.
Arkaqua loam (0-2% slopes)	Fine-loamy, mixed, active, mesic Fluvaquentic Dystrudepts	Floodplains	Moderately permeable, somewhat poorly drained soils; developed from loamy alluvial sediments washed largely from metamorphic rock residuum.
Note: NRCS, USDA. Official Soil Series Descriptions http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi http://soildatamart.nrcs.usda.gov/Default.aspx			

Table 2.2 Project Soil Type Characteristics Martin's Creek II Mitigation Project-NCEEP Project #92633							
Series	Hydric Rating/Criteria	Max Depth (in)	% Clay on Surface	Erosion Factor K	Erosion Factor T	Drainage Class	OM%
Thurmont -Dillard complex (8-15% slopes)	2**B**3 (Poor drainage and a water table at a depth of 1-foot or less during growing season if permeability is less than 6"/hr in any layer within a depth of 20"	30-80/ 30-60	3-27/ 10-35	.24/.32	5	Well drained	0.0-8.0/.05-5.0
Sylco-Cataska complex (50-95% slopes)	No	~33/ 10-20	15-35/ 12-22	.10-.15	2	Very well drained	0.5-6.0
Cullowhee fine sandy loam (0-3% slopes)	2**B**3 (Poor drainage and a water table at a depth of 1-foot or less during growing season if permeability is less than 6"/hr in any layer within a depth of 20"	20-40	5-18	.10-.15	2	Somewhat poorly drained	0.5-12

Dillard loam (1-5% slopes)	2**B**3 (Poor drainage and a water table at a depth of 1-foot or less during growing season if permeability is less than 6"/hr in any layer within a depth of 20"	30-60	5-35	.15-.28	5	Moderately well drained	0.0-8.0
Arkaqua loam (0-2% slopes)	2**B**3 (Poor drainage and a water table at a depth of 1-foot or less during growing season if permeability is less than 6"/hr in any layer within a depth of 20"	44-72	10-34	.24-.32	4	Somewhat poorly drained	1.0-5.0
Notes: 1. % Clay figured up to depth of ~ 50". Source: NRCS Soil Data Mart; URL: http://soildatamart.nrcs.usda.gov/ReportViewer.aspx?File=D:\Domains\SoilDataMart\temp\daa4f32f-e76c-4167-8743-1f4217c338a6.PDF&Name=Hydric_Soils&Wait=1							

2.4 Historical Land Use and Development Trends

The most recent land use within the project area consists of historic livestock pastures, open land, a residence and forested areas. However, the Martin's Creek watershed remains largely forested, with pastureland and hay production occurring in the floodplain of the Martin's Creek valley (Table 2.3). There are a few scattered residences west of the Martin's Creek II project site and a medium density residential development borders part of the northern boundary of the Right Prong Martin's Creek drainage area. Crisp Road and Wildcat Road parallel the southern and northern property boundaries respectively; this has resulted in two culverted crossings of Martin's Creek just outside the project area.

The Hiwassee River Watershed in North Carolina does not have any major population centers (less than 37,000 in Cherokee and Clay Counties in 2008). Land use within the watershed is rural in character and is unlikely to change significantly in the near future. Single-family homes are found at a medium-density and growth is expected to continue near the vicinity of the project; however, it will most likely maintain its rural nature. Potential for land use change in the area adjacent to the conservation easement is low.

Martin's Creek and its tributaries have been impaired by historical and current land management practices, which include timber harvesting, pasture conversion, channelization, and livestock grazing. Stream channelization and channel dredging are evident through much of the lower project site. Over time, these practices have contributed excessive sediment and nutrient loading to Martin's Creek and ultimately to the Hiwassee River.

During development of the land for agricultural use, a significant portion of stream bank vegetation was removed. Until 2009 and implementation of planning for this project, livestock had open access to portions of the Martin's Creek drainage on this property. Past dredging activities and down-cutting have disconnected Martin's Creek from its floodplain resulting in an incised channel; while in other sections of the project area, stream banks have been trampled down, creating over widened channel conditions that contribute to additional sediment and nutrient loading. The extent of incision at the project site has been largely minimized by bedrock.

Management of land in the project area for agricultural purposes has induced changes to Martin's Creek and its tributaries primarily through alteration of drainage patterns, removal of vegetation in the riparian zone, and open access of cattle to the branches. Restoration of the site and removal of livestock from the stream corridors will reduce the sediment and nutrient loading to Martin's Creek and in turn improve water quality in the Hiwassee River.

Table 2.3 Martin's Creek Watershed Land Use/Land Cover
Martin's Creek II Mitigation Project-NCEEP Project #92633

Land Use Category[1]	Area (acres)	Percent Area
Developed Open Space	4	1
Deciduous Forest	454	80
Evergreen Forest	29	5
Mixed Forest	46	8
Shrub/Scrub	4	1
Grassland/Herbaceous	4	1
Pasture/Hay	24	4

Note: 1. Values calculated using USGS land use data from 2001.

2.5 Watershed Planning

The Martins Creek mitigation project (Site) area lies within the focus area of the Peachtree-Martins Creek Local Watershed Plan (LWP) (http://www.nceep.net/services/lwps/pull_down/by_basin/Hiwassee_RB.html) and roughly corresponds to Restoration site # 1 & Preservation site # 1 of the LWP project atlas. This Site is also located in a Targeted Local Watershed (TLW) as identified in the 2008 Hiwassee River Basin Restoration Priorities Plan (http://www.nceep.net/services/lwps/pull_down/by_basin/Hiwassee_RB.html).

Through the completion of the LWP in 2007, the Peachtree-Martins Creek Watershed was identified by the state as a watershed in the Hiwassee River Basin that presented great opportunity for stream and wetland restoration activities. The Peachtree-Martins Creek LWP included land use analysis, water quality monitoring and stakeholder input to identify problems with water quality, habitat and hydrology.

Landcover in the project consists of low to medium-density residential development, forested cover and agricultural fields that are primarily located in the valleys along Martin Creek and its tributaries. The Peachtree-Martins Creek LWP identified numerous point and nonpoint source pollutants present in the Peachtree-Martins Creek watershed. Fields managed for livestock in this watershed often include open access to streams, which has led to such problems as degraded riparian buffers or a general lack of riparian buffer, stream channel and bank instability, increased sediment and nutrient loading to streams and degraded habitat conditions. In fact, a lack of riparian vegetation, channel modification, excess nutrients and sediments, and fecal bacterial contamination were listed as stressors affecting streams in the LWP for the Peachtree-Martins Creek Watershed (NCEEP, Equinox 2007). Other stressors in the project LWP area include pollutants and increased flow velocities associated with stormwater runoff, groundwater contamination, and sediment inputs from a local quarry.

According to the 2007 Basinwide Management Report, the Martin Creek watershed is the most developed of those sampled by the NCDWQ in the greater Hiwassee basin (NCDWQ 2007). Single-family residential development along Right Prong Martin Creek was noted in the report and serves as an example of higher density housing development that is occurring in parts of the basin. Other land use impacts consist of agricultural operations, lower density residential development and commercial growth associated with municipalities such as the town of Murphy. Water quality and ecological monitoring performed by the NCDWQ on Martin Creek and its unnamed tributaries have shown that biological communities are in neither an excellent or poor condition, but somewhere in between (NCDWQ 2007). Aquatic organisms and water quality have been impacted by habitat degradation and elevated nutrient levels.

Habitat degradation and elevated nutrient levels are evident at the project site, particularly in the lower half of the project area where past agricultural practices have included channel manipulation, draining of wetlands, clearing of riparian buffers and open access to streams by livestock. The NCEEP's local watershed plan for the Peachtree-Martins Creek watershed has identified a number of strategies that could be used to mitigate existing degradation. The restoration strategy proposed in this mitigation plan will implement many of the strategies recommended, including: revegetation of riparian areas, stream channel restoration, livestock exclusion, and stabilization of eroding stream banks. This site was highly rated within the LWP as an ideal NCEEP project site because of the potential to implement most of the recommended strategies within a subwatershed with high needs. As proposed, the recommendations incorporated in this mitigation plan should enable Baker and the NCEEP to meet the goals of the plan for this site while also contributing to meeting the TLW goals identified in the 2008 Hiwassee River Basin Restoration Priorities Plan.

Restoration and enhancement goals addressed through the design approaches proposed are consistent with the NCEEP's planning efforts to improve water quality not only in the Martin Creek drainage, but also in the Hiwassee River into which Martin Creek flows. Using natural channel design principles and experience gleaned from multiple stream and wetland restoration projects, Baker is developing a stream and wetland restoration approach that will enable the NCEEP to re-establish stable riparian zones and channel morphology for streams targeted by this effort. Wetland restoration will be achieved by returning site hydrology, vegetation and noncompacted surface features to what was once a larger wetland complex. Other wetlands present will be enhanced by improving the vegetative community.

Practices implemented during this project will support the State's efforts to improve habitat quality and diversity, and should result in a reduction in siltation and nutrient levels contributed to Martin Creek. The project goals for this restoration project will be accomplished by increasing bank and streambed stability as well as increasing the buffering and filtering capacity created from restored riparian zones and wetlands. Although aggradation is present, overall stream conditions present on-site reflect varying degrees of incision and continued degradation that has been mitigated by the presence of exposed bedrock. If left unchecked, bank erosion will continue contributing sediment to areas downstream of the project site. Restoration and enhancement measures will help to stabilize the channel, halt incision and significantly diminish bank erosion. Establishment of a conservation easement around the project streams and preservation of more stable segments of tributaries in the lower Martin Creek drainage will further promote improvements in terrestrial and aquatic habitat quality and water quality by ensuring development and other land disturbing activities maintain a setback away from streams and wetlands.

2.6 Endangered/Threatened Species

Some populations of plants and animals are declining as a result of various natural forces including loss of habitat and competition with humans for resources. The North Carolina Natural Heritage Program (NHP) and United States Fish and Wildlife Service (USFWS) compiled a list of rare and protected animal and plant species that includes seven federally listed species known to exist in Cherokee County (USFWS, 2008 and NHP, 2009).

The cornerstone of legal protection for federally listed species (Threatened (T) or Endangered (E) status), is conferred by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1534). This act makes illegal the killing, harming, harassing, or removing of any federally listed animal species from the wild; plants are similarly protected but only on federal lands. Section 7 of this act requires federal agencies to ensure that actions they fund or authorize do not jeopardize any federally listed species.

Organisms that are listed as Endangered (E), Threatened (T), or Special Concern (SC) on the NHP list of Rare Plant and Animal Species are afforded state protection under the State Endangered Species Act and the North Carolina Plant Protection and Conservation Act of 1979.

Species that the NHP lists under federal protection in Cherokee County as of November 16, 2009 are shown in Table 2.4. Pedestrian surveys of the project area and adjacent lands did not result in the observation of any federally protected species listed. An October 31, 2008 search of the NCNHP database revealed several element occurrences within 2 miles of the project area. Species for which observations have been recorded with the NCNHP since 1991 include the Southern blotched chub (*Erimystax insignis eristigma*), sicklefin redhorse (*Moxostoma sp.2*), Tennessee clubshell (*Pleurobema oviforme*), and the Eastern small-footed myotis (*Myotis leibii*). An observation of the seepage salamander (*Desmognathus aeneus*), a species of federal concern, was last observed near the project area prior to 1967.

According to information provided in the database, there are no recorded observations of federally listed species within two miles of the project area. State listed species observed within two miles of the project area include the sicklefin redhorse, Tennessee clubshell, and the mountain creekshell (*Villosa vanuxensis*). A brief description of the characteristics and habitat requirements of the federally protected species is included in the following section, along with a conclusion regarding potential project impacts. Cherokee County does not contain any federally designated critical habitat.

Table 2.4 Species of Federal and State Status in Cherokee County
Martin's Creek II Mitigation Project-NCEEP Project #92633

Family	Scientific Name	Common Name	Federal Status	State Status	Habitat Present / Biological Conclusion
Vertebrate					
Accipitridae	*Haliaeetus leucocephalus*	Bald Eagle	BGPA	T	No/No effect
Vespertilionidae	*Myotis sodalist*	Indiana Bat	E	E	No/No effect
Emydidae	*Glyptemys muhlenbergii*	Bog Turtle	T (S/A)	T	No/No Effect
Invertebrate					
Unionidae	*Villosa trabalis*	Cumberland Bean (pearlymussel)	E	SR	No/No Effect
Unionidae	*Pegias fibula*	Little-Wing Pearlymussel	E	E	No/No Effect
Unionidae	*Epioblasma florentina walkeri* (=E. *walkeri)*	Tan Riffleshell	E	EX	No/No Effect
Vascular Plant					
Orchidaceae	*Isotria medeoloides*	Small Whorled Pogonia	T	E	No/No Effect

Notes:

BGPA: Bald and Golden Eagle Protection Act. As of August 8, 2007, the Bald and Golden Eagle Protection Act (Eagle Act) (16 U.S.C. 668 d) is the primary law protecting bald and golden eagles. The Eagle Act prohibits take of bald and golden eagles and provides a statutory definition of "take" that includes "disturb".

E: An endangered species is one whose continued existence as a viable component of the state's flora or fauna is determined to be in jeopardy.

EX: Extirpated – a species that is no longer believed to exist in the county.

T: Threatened

S/A: The Endangered Species Act authorizes the treatment of a species (subspecies or population segment) as threatened even though it is not otherwise listed as threatened if: (a) The species so closely resembles in appearance a threatened species that enforcement personnel would have substantial difficulty in differentiating between the listed and unlisted species; (b) the effect of this substantial difficulty is an additional threat to a threatened species; and (c) such treatment of an unlisted species will substantially facilitate the enforcement and further the policy of the Act. The bog turtle (southern population) has this designation due to similarity of appearance to bog turtles in the threatened northern population.

SR: Reported from North Carolina, but without persuasive documentation for either accepting or rejecting the report.

The NCWRC was notified of the project via letter on November 24, 2008. A letter was submitted to the USFWS December 3, 2008. Baker received comments from NCWRC on December 9, 2008, which indicated that Martin's Creek supports sensitive aquatic life like the sicklefin redhorse, mountain creekshell, and hiwassee crayfish. According to the NCWRC, these and several other sensitive species are found in the Hiwassee River further downstream. In addition to recommending minimization of site disturbance and implementation of effective erosion control measures, the NCWRC also anticipates requesting that stream construction be avoided from April 1st to June 15th during the spawning season for any sicklefin redhorse populations that may exist in Martin's Creek.

After discussions were held regarding impact avoidance measures to protect any Indiana bat colonies present on or near the project site, the USFWS submitted their concurrence for this project June 23, 2009. Among the avoidance measures agreed upon was the identification and avoidance of habitat favored by the Indiana bat to the extent possible, the timeframe in which vegetation removal would occur (between October 15 and April 15) , and incorporation of trees favored by the Indiana bat into the planting plan for this site. Correspondence between Baker and the NCWRC and USFWS is included in Appendix B.

2.6.1 Federally Listed Endangered Species

2.6.1.1 Vertebrates

***Haliaeetus leucocephalus* (Bald Eagle)**

Bald eagles are large raptors, 32 to 43 inches long, with a white head, white tail, yellow bill, yellow eyes, and yellow feet. The lower section of the leg has no feathers. Wingspread is about seven feet. The characteristic plumage of adults is dark brown to black with young birds completely dark brown. Juveniles have a dark bill, pale markings on the belly, tail, and under the wings and do not develop the white head and tail until five to six years old.

According to the NHP species account, bald eagles in the Southeast frequently build their nests in the transition zone between forest and marsh or open water. Nests are cone-shaped, six to eight feet from top to bottom, and six feet or more in diameter. They are typically constructed of sticks lined with a combination of leaves, grasses, and Spanish moss. Nests are built in dominant live pines or cypress trees that provide a good view and clear flight path, usually less than 0.5 miles from open water. Winter roosts are usually in dominant trees, similar to nesting trees, but may be somewhat farther from water. In North Carolina, nest building takes place in December and January, with egg laying (clutch of one to three eggs) in February and hatching in March. Bald eagles are opportunistic feeders consuming a variety of living prey and carrion. Up to 80 percent of their diet is fish, which is self caught, scavenged, or robbed from ospreys. They may also take various small mammals and birds, especially those weakened by injury or disease.

(Henson 1990, Potter et al. 1980, USFWS 1992a)

Biological Conclusion: No Effect

According to the NCNHP virtual workroom website, the project site is over two miles from a recorded occurrence of bald eagle habitat. With the exception of Martin’s Creek, the project area consists of headwater streams with very small drainage areas. Furthermore, the Martin’s Creek II project site primarily consists of pasture land. Forested sections of the project area have been impacted by livestock operations and some timber harvesting activities. Although this project site is located within the vicinity of the Hiwassee River, which supports the bald eagle, other habitat features favored by the bald eagle are not currently present at the Martin’s Creek II mitigation site nor are any waters within the project area listed as trout supporting streams.

Improvements made through this project will not adversely impact any bald eagle populations or habitat. Canopy improvements made to the riparian zone within the restoration and enhancement reaches of the project area could actually support bald eagles in the long term should any of the planted trees become dominant canopy trees. Stream preservation, restoration and enhancement activities will ultimately result in improved channel stability and water quality downstream through a reduction in sediment loading. Therefore, a determination was made that the proposed project will have no effect on this species.

***Myotis sodalis* (Indiana Myotis)**

The Indiana bat is 3.5 inches long, with mouse-like ears, plain nose, dull, grayish fur on the back, and lighter, cinnamon-brown fur on the belly. Its “wingspread” ranges from 9.5 to 10.5 inches. From early October until late March and April, Indiana bats hibernate in large clusters of hundreds or even thousands in limestone caves and abandoned mines, usually near water. During summer, females establish maternity colonies of two dozen to several hundred under the loose bark of dead and dying trees or shaggy-barked live trees, such as the shagbark hickory. Hollows in live or dead trees are also used. Most roost trees are usually exposed to the sun and are near water. Males and non-reproductive females typically roost singly or in small groups. Roost trees can be found within riparian areas, bottomland hardwoods, and upland hardwoods (Adams 1987, USFWS 1992a).

Biological Conclusion: No Effect

Riparian corridors within the Martin's Creek II project area may provide suitable summer foraging habitat
for the Indiana bat; however there are no loose-barked trees within the project area or other habitat suitable for maternity colonies of the bat. There are also no mines or caves within the project area for winter hibernation.

Baker received correspondence from the USFWS on January 26, 2009 indicating their concern that habitat may exist within the project area. The USFWS requested that site clearing activities be conducted during mid-October to mid-April and other measures be taken to avoid adverse impacts to potential bat populations or habitat on-site.

After additional site visits and a review of the project construction schedule, it was determined that this project would have no affect on the Indiana bat or its habitat. In response to the USFWS concerns, Baker submitted a letter to the USFWS outlining measures designed to minimize and avoid project impacts on the Indiana bat. These measures include performing tree and vegetation removal outside of the Indiana bat's maternity/roosting period, walking the site with the construction manager and marking any trees within the project area that may be favored by the bat. Trees that may be favored by the bat will be avoided to the extent possible. Baker has also proposed to incorporate trees favored by the Indiana bat into a planting plan for the site. Based on measures proposed, the USFWS submitted their concurrence for the project June 23, 2009. Therefore a "no effect" determination was made.

***Clemmys muhlenbergii* (Bog Turtle)**

The Bog Turtle is among the smallest turtles of North America at only 3-4.5 inches in length with an average weight of 4 ounces. Its shell is light brown to ebony in color and it has a notable bright orange, yellow or red blotch on each side of its head. The bog turtle's preferred habitat in the southern Appalachians includes sphagnum bogs, slowly drained swamps, and mucky, slow moving spring-fed streams in meadows and pastures that are typically less than 4 acres in size (USFWS 1997a).

Biological Conclusion: No Effect

The Martin's Creek II project site does possess some potential habitat for the bog turtle in the floodplain for Martin's Creek. Although no bogs were present on-site or near the vicinity of the project area, the pasture that makes up a portion of the lower project area does contain wetlands with very shallow standing water. These pocket wetlands contain both exotic, invasive plant vegetation, as well as hydrophytic vegetation such as sedges and juncus. Cattle had open access to these wetlands until the winder of 2009. No evidence of bog turtle habitation or observations of bog turtles were made during site visits in the spring and fall of 2008. A search of the NCNHP database did not reveal any recorded observations of the bog turtle within two miles of the project area. Correspondence was submitted to the USFWS December 2, 2008 that indicated the potential habitat present within the project area. Correspondence received from the USFWS March

10, 2009 and June 23, 2009 did not indicate concern over impacts the project might have on the bog turtle.

Based on the lack of bog turtle observations made during on-site visits as well as a lack of recorded species observation in the NCNHP database, it was determined that this project will not impact the bog turtle or any known populations that may occur within Cherokee County. Furthermore, nearly seven acres of wetlands will be restored or enhanced through this project. While Restoration and enhancement activities will not result in the current wetland being converted to a bog, wetland functions will be restored to the site, which may enhance some habitat conditions favored by the bog turtle as well as other wildlife and plant communities.

2.6.1.2 Invertebrates

***Villosa trabalis* (Cumberland Bean)**

The Cumberland bean is a medium-sized freshwater mussel or bivalve mollusk with an olive colored shell displaying faint wavy green lines. This mussel can be found in sand, gravel, and cobble substrates in moderate to fast-moving waters at depths less than a meter (Gordon and Layzer, 1989). As is typical with many mussels, the Cumberland bean favors clean shoal areas and silt-free riffles consisting of relatively firm rubble, gravel, and sand (USFWS, 1984). Its current range includes the Hiwasee River, Polk County, Tennessee and North Carolina (Bogan and Parmalee, 1983).

Many intermittent and perennial streams within the project area that were found to contain water during field surveys also contained moderate amounts of silt and had slow to moderate currents. Some of these tributaries were also found to go subsurface for short distances as well. Historical agricultural land use practices of the project area and passage to perennial unnamed tributaries that have been affected by culvert installation and headcutting make it unlikely that any populations which may have existed prior to the conversion of the surrounding landscape would have survived.

Biological Conclusion: No Effect

Martin’s Creek is a targeted local watershed within the Hiwassee River Basin and is known for its excessive sediment and nutrient loading problems, making it unlikely that the Cumberland bean is located on Martin’s Creek which is the largest waterbody within the project site. There are no recorded observations of the Cumberland bean within two miles of the project site and none were observed during site surveys.

Stormwater and erosion control best management practices will be applied during construction activities associated with stream and wetland restoration and enhancement, minimizing impacts to any potential habitat or populations of the Cumberland bean on Martin’s Creek downstream of the project area. Furthermore, the project will not affect the ability of the mussel to migrate upstream or downstream of the project area on Martin’s Creek. Due to a lack of suitable mussel habitat, and the application of adequate erosion control measures during project construction, this project will not impact habitat for the Cumberland bean.

***Pegias fibula* (Little-Wing Pearlymussel)**

The little-wing pearlymussel is a freshwater bivalve mollusk that reaches an average length of 24-millimeters at maturity. Immature little-wing pearlymussels possess dark rays at the base of their shell. By the time the mussel reaches adulthood, its outer shell is usually eroded away. This species is found in small, cool streams at the head of riffles, although it can inhabit other areas in and below riffles in substrate consisting of sand or gravel and scattered cobbles. It has also been observed in silt-free environments underneath large rocks and is known to occupy sand pockets between rocks, cobbles and boulders (Gordon and Layzer, 1989). This mussel is most often found submerged on top or partially buried within substrate as previously described in approximately 6 to 10 inches of water (Bogan and Parmalee, 1983; Stansbery, 1976).

Bogan (2002) cites the mussel as occurring in the Hiwassee and Little Tennessee River basins in North Carolina. It was formerly observed in the Valley River in Cherokee County and, in addition to Bogan, was cited by LeGrand et al. (2006) as being present in the Little Tennessee River in North Carolina. Based on state species account information provided by the NCNHP and the NC Wildlife Resource Commission's (NCWRC), state atlas of freshwater mussels, it appears this species now only inhabits a section of the Little Tennessee River basin between Swain and Macon counties.

Biological Conclusion: No Effect

Based on the lack of observations made during on-site visits and information provided by the NCNHP and NCWRC, the little-wing pearlymussel does not inhabit the project site or waters within at least two miles of the project. Therefore, this project will not impact habitat or known populations of the little-wing pearlymussel in western North Carolina.

***Epioblasma florentina walkeri* (E. *walkeri)* (Tan Riffleshell)**

Like the Cumberland bean, the tan riffleshell is a medium-sized freshwater mussel that has multiple green rays and a brown to yellow colored shell. Its habitat requirement are also similar to the Cumberland bean as it is found in headwaters, riffles, and shoals made up of sand and gravel substrates (Bogan & Parmalee, 1983). While it is possible that populations of this mussel may still exist in the Hiwassee River, recorded populations of this species are located outside of the state, primarily within the Clinch River drainage in Tennessee (Jones, 2004). Based on population declines, it appears this mussel is particularly sensitive to poor water quality and habitat disturbance including the loss of glochidial hosts.

Biological Conclusion: No Effect

The Martin's Creek II project will not affect any tan riffleshell populations which may exist in the Hiwassee for the same factors listed in the biological conclusion for the Cumberland bean. According to the NCNHP database, there have been no recorded observations of the tan riffleshell within two miles of the project area which covers a segment of the Hiwassee River in the vicinity of the site. A review of the US Fish and Wildlife Service, Asheville Ecological Field Office website (last updated May 15, 2008) on threatened and endangered species associated with the North Carolina lists the tan riffleshell as being extirpated.

2.6.1.3 Vascular Plants

***Isotria medeoloides* (Small-Whorled Pogonia)**

The small-whorled pogonia is a small, perennial member of the Orchidaceae. These plants arise from long slender roots, with hollow stems terminating in a whorl of five or six light green leaves. The single flower is approximately one inch long, with yellowish-green to white petals and three longer green sepals. This orchid blooms in late spring, from mid-May to mid-June. Populations of this plant are reported to have extended periods of dormancy and to bloom sporadically. This small spring ephemeral orchid is not observable outside of the spring growing season. When not in flower, young plants of Indian cucumber-root (*Medeola virginiana*) also resemble small-whorled pogonia; however, the hollow stout stem of *Isotria* separates it from the genus *Medeola*, which has a solid, more slender stem (U.S. Fish and Wildlife Service County Listing, 2008).

Small-whorled pogonias may occur in young as well as maturing forests, but typically grows in open, dry, deciduous woods and areas along streams with acidic soil. It also grows in rich, mesic woods in association with white pine and rhododendron.

Biological Conclusion: No Effect

Suitable habitat for the small-whorled pogonia as described above does not exist in the restoration and enhancement reaches of the Martin's Creek II project area. No plants were located during field assessments performed; a review of the NCNHP database did not reveal any recorded observations within two miles of the project limits. Therefore, this project will not have an impact on any small-whorled pogonia populations occurring in Cherokee County.

2.7 Cultural Resources

A letter was sent to the North Carolina State Historic Preservation Office (SHPO) and Eastern Band of Cherokee Indians Tribal Historic Preservation Office (THPO) on November 21, 2008, requesting a review and comment for the potential of cultural resources in the vicinity of the Martin's Creek II project. The SHPO responded on January 8, 2009, and requested that a Phase I Archaeological Survey be completed based on the high probability that prehistoric or historic archaeological sites may be present due to the topography and hydrological features of the area. The NCEEP contracted with Robert J. Goldstein & Associates, Inc. to perform a Phase I archaeological survey which was completed in May, 2009. The archaeological consulting group did locate one site within the project area; however it was determined that the site is not eligible for listing in the National Register of Historic Places. Other findings in the archaeological report included a recommendation that no further archaeological investigations be conducted for the purposes of this project. On June 10, 2009, the SHPO submitted correspondence to Baker agreeing with the findings. As of June 30, 2009, the Tribal Historic Preservation Office has not commented with concerns. A copy of the SHPO and THPO correspondence is included in Appendix B.

2.8 Potential Constraints

Baker Engineering assessed the Martin's Creek II project site with regard to potential fatal flaws and site constraints. No fatal flaws have been identified at this stage of the project. There are constraints to our restoration approach on Martin's Creek and at specific locations on some of the tributaries. Martin's Creek has been moved in the past to increase the pasture area. It now flows in a relatively straight path between Crisp Road and Wildcat Road. Martin's Creek Road parallels the creek on the east side and comes within 15 to 20 feet of the right bank at the upstream end of the project site. High-tension power lines run overhead for the length of Martin's Creek on the project property. These constraints limit the practical approach along Martin's Creek proper. While more extensive restoration could be proposed, and would be beneficial on this reach, it is likely that maintenance along the power line right-of-way would limit tree growth and thus the ability to develop a mature, forested riparian zone. There are also farm road crossings of two channels; these crossings will be removed from the easement because restoration activities would not be consistent with the crossings. Above one of these crossings, on the left bank is a barn and on the right bank is an area where household garbage appears to have been dumped in the past. These constraints will limit the ability to get a 30-foot easement and to make any adjustments to the stream. This short reach of the stream may also need to be excluded to avoid issues that these constraints create. Six other easement breaks were identified based on the existing road network in the vicinity of the project and the landowners' future plans for the property. These are the only project constraints or potential constraints observed to date.

2.8.1 Property Ownership, Boundary and Site Access

Currently, the Martin's Creek II project site is owned by the trustees of George Cohen. The NCEEP has obtained a conservation easement from the current landowners for the Martin's Creek II project area. The easement is held by the State of North Carolina and has been recorded at the Cherokee County Courthouse. The easement allows Baker to proceed with the mitigation project and restricts the land use in perpetuity.

The site is connected to NCDOT right of way as well as to unpaved roads that can be accessed for construction and post-restoration monitoring.

2.8.2 Utilities

The Martin's Creek II project site is crossed by a 40-foot wide power line easement. In addition, several phone lines run adjacent to the project area next to Martin's Creek Road, Crisp Road and Wildcat Road. Baker contacted NC One Call to locate any underground utilities at the project site. The site was inspected by Mr. Mark Davidson of Blue Ridge EMC and his conclusion was that no underground utilities exist within the project area. The proposed restoration activities will be designed to try to avoid any permanent impacts to the power line easement area. The proposed restoration activities will be designed to try to avoid any permanent impacts to the power line easement area.

2.8.3 Hydrologic Trespass and Floodplain Characterization

The Martin's Creek II mitigation project is located in both regulated and non-regulated floodplains. The upper reaches of the unnamed tributaries are not regulated and do not pose a flooding threat to any structures or other infrastructure. The lower portion of the Martin's Creek II project site, which consists of several tributaries to Martin's Creek and the mainstem of Martin's Creek and its valley, has been mapped within a Federal Emergency Management Agency (FEMA)-identified flood zone (Zone AE). This is a special flood hazard area with a designated 100-Year Base Flood Elevation (BFE) and non-encroachment areas. Modifications within the non-encroachment areas require a flood study to determine whether the proposed modifications will impact the established BFEs or non-encroachment widths. If the difference in the BFE is between 0 and -0.10' (decrease of 1/10th of a foot or less), this is considered "no impact". If a rise is indicated by the proposed changes, this would necessitate a Conditional Letter of Map Revision (CLOMR) and post-project Letter of Map Revision (LOMR). If a decrease of greater than 0.10' is indicated (not a valid "no impact", but a valid "no rise"), this would require a post-project LOMR as well; typically, in such a case, the flood study demonstrating no rise in the BFEs would be accepted in lieu of a CLOMR and the project could proceed upon local or state review of the study.

Baker has confirmed the map designations with the NC floodplain mapping information system on-line (http://floodmaps.nc.gov/). Based on the current plans, Baker has conducted preliminary modeling and believes that the project can be permitted with a no-impact certification (i.e. there are no rises, and all decreases are less than 0.10'). Upon acceptance of the restoration plan and drawings, Baker will finalize modeling and submit a report summarizing the project and modeling results to the designated floodplain administrator for Cherokee County. Baker has discussed this project with the county and does not anticipate any other requirements that will affect the project.

2.9 Potentially Hazardous Environmental Sites

An Environmental Data Resources, Inc. report that identifies and maps both previously documented or potentially hazardous environmental sites within two miles of the project area was prepared for the site on October 17, 2008. A copy of the report with an overview map is included in Appendix C. Site searches conducted under the report included but were not limited to the following queries: Superfund Database (National Priorities List, NPL) (for hazardous waste treatment, storage, or disposal facilities); the Comprehensive Environmental Response, Compensation, and Liability Act Information System (CERCLIS) Database (for suspect state hazardous waste, solid waste or landfill facilities). A search regarding prior incidents of leaking underground storage tanks in the proposed project area also yielded no results. Based on the EDR report, there are no known or potentially hazardous waste sites within or adjacent to the project area. During field data collection, there was no evidence of these sites in the proposed project vicinity, and conversations with landowners did not reveal any further knowledge of hazardous environmental sites in the area. Therefore, the overall environmental risk for this site was determined to be low.

3.0 PROJECT SITE STREAMS

3.1 Existing Conditions Survey

Baker conducted a detailed channel morphological survey on all of the restoration and enhancement reaches with a total station. Along with providing detailed topography, this survey included two cross sections on Martin's Creek, two or more cross sections on each unnamed tributary, and a longitudinal profile for all reaches. Baker also collected multiple substrate samples to characterize stream sediments. Figure 3.0 illustrates the locations of cross section surveys and each project reach. Surveyed cross sections and profiles are included in Appendix D. A photo log that depicts the existing conditions at the Martin's Creek II project site is provided in Appendix E.

The existing conditions of designated project reaches are described below with Table 3.0 summarizing the representative geomorphic conditions currently present at the Martin's Creek mitigation site. The table also provides regional curve data for comparison based on the drainage area of each reach (Harman, 2000). The applicability of the regional curve data has been tempered against the small drainage areas and steep slopes present within restoration and enhancement areas; these extremes are not well represented in the original regional empirical data sets. As part of the interpretation of the regional curve data, Baker considered other empirical data collected in-house, and by the NRCS, as supplemental. A more detailed discussion of the analysis conducted to assess channel stability and estimate channel forming discharge for project streams is included in Sections 3.5 through 3.7.

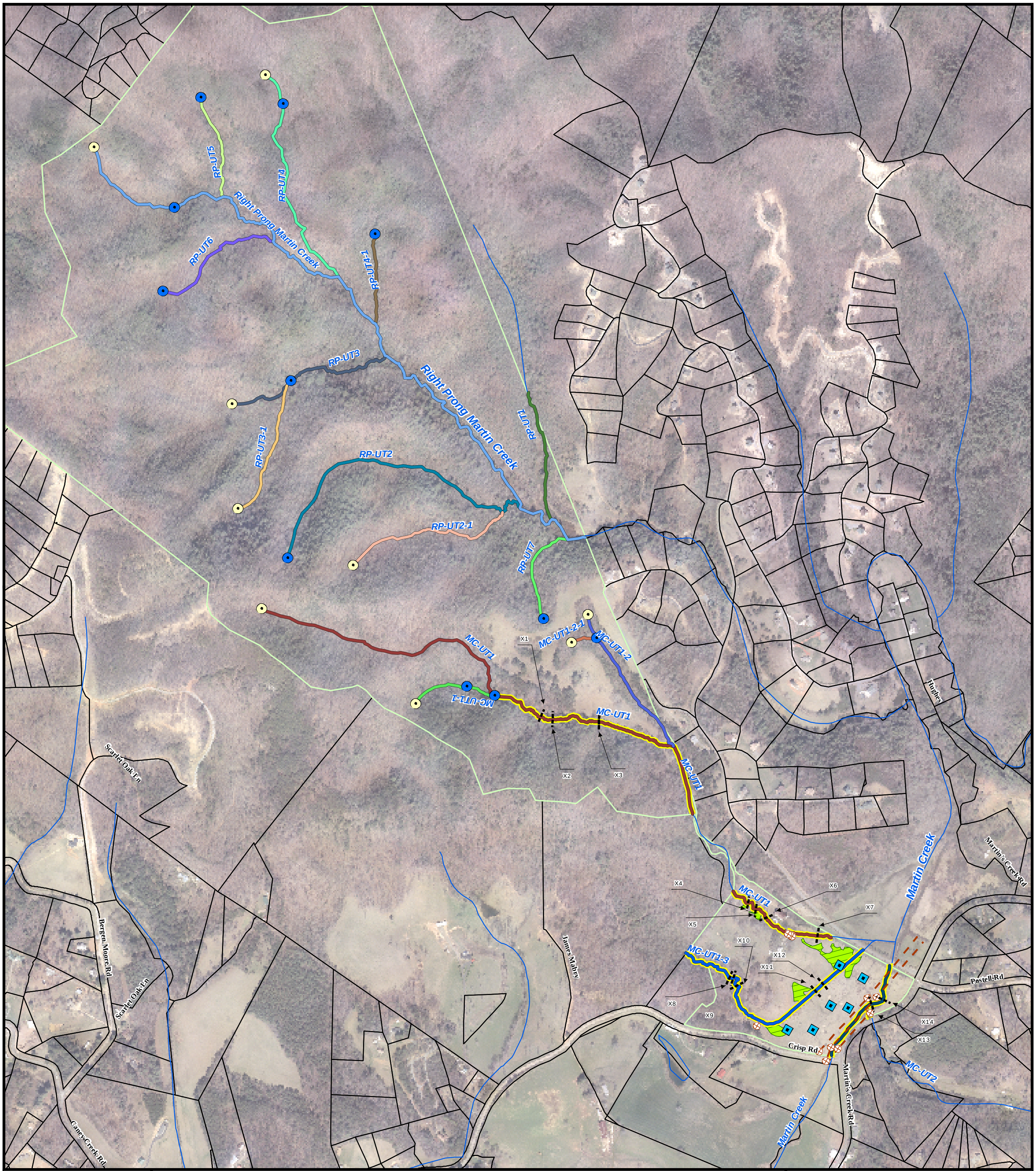
Baker assessed the stream and valley types present and considered their evolutionary stage and likely endpoint in order to develop a basis for the proposed restoration efforts. The project contains both colluvial and alluvial valleys with a wide range of slopes present. There are B, E, C, G and F-type streams found within the project reaches as a steeper valley type is present in the upper reaches, and a broad low-slope valley is present in the main valley of Martin's Creek. All streams have been altered by straightening, relocation to enlarge pastures, and livestock impacts.

3.2 Channel Classification

There are multiple Preservation reaches within the project area. Most of the tributaries to the Right Prong of Martin's Creek and Martin's Creek UT1 Reach 1, Martin's Creek UT1-1, and 1-2 are all Preservation reaches. These reaches are steeper headwater streams that are entrenched with lower sinuosity's and width/depth ratios, and moderate to steep gradients. These features classify them as A, B and G-type streams. The only streams in the Right Prong to Martin's Creek watershed that are not preservation are the downstream most reach of Right Prong to Martin's Creek and the downstream most reach of one tributary (RP-UT1) that are proposed to be treated as Enhancement II reaches. These reaches have a lower gradient, moderate sinuosity and width/depth rations and have a low bank height ratio. These reaches are E or C type channels and are being impacted by extensive stands of invasive species. The mainstem of Martin's Creek and UT2 are also proposed to be restored at the Enhancement II level. These channels are C, and G -type channels respectively. These two channels could have a greater level of work done than what is proposed but because of their proximity to an existing power-line it is felt that there are notable limitations to the extent of riparian restoration that can occur given the periodic maintenance required for the utility corridor. All of the remaining Enhancement II and Preservation reaches exhibit a moderate to high level of stability, which is justification for the recommended mitigation approach.

The following is a discussion of the channel classification for those reaches with higher levels of intervention (Enhancement I and Restoration). These reaches are:

- Martin's Creek (MC)-UT1, Reach 2 - Restoration;
- MC-UT1, Reach 3 - Enhancement I



LEGEND

▨ Jurisdictional Wetlands

— Geomorphic Survey

NCDWQ Stream Classification Break

● Perennial/Intermittent

○ Intermittent/Ephemeral

▪ Monitoring Wells

- - Powerline

⊕ Power Pole

☐ Project Parcel

☐ Parcels

------ Cross Sections

Figure 3. Project Reaches & Survey Cross Section Locations

Martin Creek Mitigation Project
Cherokee County, NC

Ecosystem Enhancement PROGRAM

Baker

- MC-UT1, Reach 4 - Restoration;
- MC-UT1-3, Reach 1 - Enhancement I;
- MC-UT1-3, Reach 2 - Restoration.

MC-UT1 Reach 1 begins in a forested upland section of the project area at the confluence of two smaller tributaries high in the watershed and continues downstream to the edge of a hayfield. Reach 2, MC-UT1 begins at the point where the stream enters a hayfield. Through this reach the stream is impacted by buffer removal on the left bank, channel realignment to the bottom of the right valley wall, a series of headcuts and moderate to severe incision. This reach is proposed for Restoration. Based respectively on cross sections X1 and X2, Reach 2 was classified as an Eb and Fb stream type. In the case of X1, while the channel classifies as an Eb, it is functioning as a G as demonstrated by the high bank height ratio of 1.8. The channel is incised and it can be assumed that the channel will continue to incise and eventually classify as a G. Based on the classification, X2 is also very incised, but has started to widen towards an F-type channel. However, this reflects some deposition at this cross section due to right bank sediment falling into the channel and a channel blockage just downstream of this section. Differences in local conditions may commonly result in a different stage of channel evolution. In both cases, the classification indicates that restoration is warranted. Cross section X3 is further downstream in the same reach and classifies as a B channel. However, it is obvious in X3 that the right bank is up against the valley wall. This is the case for much of the reach length. A comparison of contours for those existing segments up against the valley wall, versus the one substantial existing segment (proposed station 3+50 to 4+00) that has migrated away from the toe of the valley wall, shows that this right bank is extremely steep and that loosened soil (through stormwater flow or freeze and thaw) that makes up this slope, will cascade into the channel. At these steep locations, the valley wall starts at an abrupt slope steeper than 1:1 from the toe of the channel (some of the slopes are as steep as 0.5:1). In non-eroding areas, the valley wall slope is 1.5:1 or greater. In multiple locations, there is evidence that the stream has eroded, or is presently eroding, the toe of the slope, resulting in collapse and over steepening of the bank. The segment from 3+50 to 4+00, that was previously mentioned, may have moved away from the toe of the valley wall as a result of such a failure. This colluvial input would have forced the channel to move to the left. This, and other similar evidence of such morphologic change (such as at proposed station 5+00), is an unnatural response of the stream to channelization. The combination of incision, channel widening, and bank and slope erosion dictates that the channel be restored by moving away from the toe of slope and more to the center of the narrow valley.

Below Reach 2, the stream continues through another wooded area where it leaves the project property. It comes back onto the property, as the lower segment of MC-UT1 (Reaches 3 and 4). On the plans Reach 3 starts at station 0+00 and continues to station 3+46. Reach 3 begins just below a stream crossing that is located where the stream emerges from the upstream forested section. This reach has an extensive coverage by multiflora rose that has limited the growth of other vegetation along the channel. Until recently, cattle have also used this reach for resting in hot weather and as a source of water. This has resulted in some areas of stream bank instability and erosion. This reach is represented by Cross Sections X4 and X5. The stream classified as a G-type channel at X4, and an E at X5. This represents the difference in stream quality between an area where invasive vegetation is extensive (X4) and an area where it has been eliminated and there are few cattle impacts (X5). Downcutting, local bank erosion and invasive removal are to be addressed with Enhancement I activities in this reach. The reach ends just upstream of the barn and outbuilding on the left side of the stream. Due to the close proximity of this barn to the creek and an existing culverted stream crossing, a short area of channel (station 3+46 to 5+50) was excluded from the project.

Reach 4 starts below the culverted stream crossing that goes to the barn area and is the point on the stream where it transitions from the steeper channel to a flatter main valley. The valley slope broadens and MC-UT1 exhibits characteristics of a G-type stream; this is seen in X7, located in a perched and channelized portion of the reach. Based on observations in the adjoining field the existing channel was created by channelization below the culvert sometime in the past to increase the pasture area and move the channel to the property line. Levy installation and downcutting resulting from channelization have resulted in an incised channel with poor floodplain connectivity. Currently MC-UT1 crosses under Wildcat Branch Road before entering Martin's Creek. Adjacent depressional wetlands along the old channel alignment have been impacted by this channel being moved and the hydrology being redirected away from the field and wetland areas, as well as from livestock and exotic invasive vegetation. However, we propose to route the stream back into the relic channel so that it continues on to the mainstem of Martin's Creek on the project property.

UT 1-3 to Martin's Creek (MC-UT1-3) enters the project area in the southwest quadrant of the lower property parcel. This channel appears to begin within a hundred feet of where it crosses onto the project property. After crossing a property line fence it appears to straddle adjacent properties as it flow near the bottom of a forested hillslope on the right bank and along the fringe of a pasture on the left.   Upon entering the project area at station 0+00, Reach 1 begins where the stream enters a forested area. Livestock have used this forested area for shade during the summer months. Cattle access has caused downcutting in some sections and aggradation in other areas. This reach also has one large headcut that has moved through much of the reach and is continuing to work upstream at the upper end of the reach.   The channel classifies as an Eb and B-type stream from cross sections X8, X9 and X10. There are a number of meanders within the reach that appear to have become established before he young forest developed. Some of these meanders are cutting into steep, red clay hill slopes and these meanders will be modified so that they no longer extend as far as the slopes allowing for the development of a narrow floodplain along the outside of the meander.

MC-UT1-3 Reach 2 begins where the tributary flows through a crossing in the driveway and enters into the broader valley shared with the mainstem of Martin's Creek. This reach from the driveway crossing to where it leaves the property line at the downstream end of the reach, has been channelized into a perched channel. The channel runs down slope along one side of a wetland area, then the alignment turns sharply in a northeasterly direction and runs down the field, parallel to the mainstem along the foot of a slope. It eventually crosses the property line and under Wildcat Branch Road through its own culvert, and converges with MC-UT1 just north of the road.   The channelized reach has a levy on the right bank which keeps water from flowing to the low point in the valley. Unnamed Tributary 1-3 to Martin's Creek is classified as a C-type channel based on cross sections X11 and an F-type based on X12. The high width/depth ratio of both cross sections indicate the oversized channel that was dredged and the lack of stream habitat. In fact, flow through this channel is very slow and is not likely to support biological communities expected for flowing, cool or cold water streams. The channel has extensive stands of multiflora rose along both banks but few trees.

3.3 Valley Classification

In addition to determining stream types present at the Martin's Creek Site, valley types were also considered. All of the upper reaches, draining the slopes in the Martin's Creek mitigation project, are located in Type II valley settings. Type II valleys typically drain moderately steep colluvial streams and have floor slopes less than 4% (Rosgen 1996). The B, G, and Fb channel types present in the upper project reaches are commonly seen in Valley Type II drainages throughout the Blue Ridge Province where channelization, dredging and other practices associated with agricultural land use activities have directly affected the channel and riparian zone, resulting in an unstable system. In the lower valley that Martin's Creek passes through, the valley type is most consistent with a Type VIII, having wide, gentle valley slopes with a well developed floodplain. Stream types commonly found in stable Type VIII valleys are E, C, and occasionally D, F or G. G-type streams are also present in the project area, owing to prior anthropogenic impacts to stream stability.

Table 3.0 Representative Geomorphic Data for Martin's Creek and Unnamed Tributaries
Stream Channel Classification Level II
Martin's Creek II Mitigation Project-NCEEP Project #92633

Parameter	Value						Units
	Unnamed Tributary 1 to Martin's Creek (MC-UT1)						
	MC-UT1 Reach 2			MC-UT1 Reach 3		MC-UT1 Reach 4	
	X1	X2	X3	X4	X6	X7	
Reach Length	1,070			345		332	Linear Feet
Feature Type	Riffle	Riffle	Riffle	Riffle	Riffle	Riffle	
Drainage Area	0.09			0.17		0.17	Square Miles
NC Mountain Regional Curve (W_{bkf})	7.8			9.9		9.9	Feet
NC Mountain Regional Curve (D_{bkf})	0.5			0.6		0.6	Feet
NC Mountain Regional Curve (A_{bkf})	4.2			6.5		6.5	Feet
Bankfull Width (W_{bkf})	6.4	7.5	14.0	5.9	9.8	7.6	Feet
Bankfull Mean Depth (d_{bkf})	0.60	0.52	0.25	0.78	0.63	0.81	Feet
Cross-Sectional Area (A_{bkf})	3.8	3.9	3.6	4.6	6.2	6.1	Square Feet
Width/Depth Ratio (W/D ratio)	10.7	14.5	55.0	7.6	15.4	9.4	
Bankfull Max Depth (d_{mbkf})	0.97	0.62	0.65	1.09	1.06	1.11	Feet
Floodprone Area Width (W_{fpa})	18.6	9	>30.8	9.4	>20.6	13.7	Feet
Entrenchment Ratio (ER)	2.9	1.2	>2.2	1.6	>2.1	1.8	
Bank Height Ratio (BHR)**	1.8	2.2	1.3	1.8	1.0	4.1	
Channel Materials (Particle Size Index – d_{50})							
d_{16}	0.8		0.8	0.3		0.3	mm
d_{35}	4.4		4.4	1.1		1.1	mm
d_{50}	8.7		8.7	3.5		3.5	mm
d_{84}	28.0		28.0	12.1		12.1	mm
d_{95}	66.8		66.8	15.7		15.7	mm

Water Surface Slope (S)	0.04-0.05		0.04-0.05	0.03-0.04		0.015	Ft/Ft
Channel Sinuosity (K)*	1.06-1.18			~1-1.26		<1.2	
Rosgen Stream Type	Eb	Fb	B	G	Cb	G	

* Low sinuosity channels present due to prior channelization.

** High bank height ratios should be noted, values in excess of 1.5 have little or no chance for self-recovery (Rosgen, D. L., 2001a). Also refer to Table 3.2.

1. Due to aggraded channel conditions, abundance of silt present and channel flow characteristics at the time of assessment, substrate sample not collected in this reach of MC-UT1-3.

Table 3.0 Representative Geomorphic Data for Martin's Creek and Unnamed Tributaries Stream Channel Classification Level II (cont.)

Martin's Creek II Mitigation Project-NCEEP Project #92633

Parameter	Value				Units
	Unnamed Tributary 1-3 to Martin's Creek (MC-UT1-3)				
	MC-UT1-3 Reach 1		MC-UT1-3 Reach 2		
	X8	X9	X11	X12	
Reach Length	516		1,068		Linear Feet
Feature Type	Riffle	Riffle	Riffle	Riffle	
Drainage Area	0.07		0.08		Square Miles
NC Mountain Regional Curve (W_{bkf})	7.1		7.5		Feet
NC Mountain Regional Curve (D_{bkf})	0.5		0.5		Feet
NC Mountain Regional Curve (A_{bkf})	3.5		3.9		Feet
Bankfull Width (W_{bkf})	5.0	6.8	11.4	6.9	Feet
Bankfull Mean Depth (d_{bkf})	0.58	0.45	0.29	0.43	Feet
Cross-Sectional Area (A_{bkf})	2.9	3.0	3.3	2.9	Square Feet
Width/Depth Ratio (W/D ratio)	8.6	15.2	39.7	16.0	
Bankfull Max Depth (d_{mbkf})	1.0	0.87	0.88	0.90	Feet
Floodprone Area Width (W_{fpa})	13.5	11.6	26.2	10.3	Feet
Entrenchment Ratio (ER)	2.7	1.7	2.3	1.5	
Bank Height	1.0	1.8	1.0	3.0	

Ratio (BHR)					
Channel Materials (Particle Size Index – d_{50})					
d_{16}	0.26		Silt[1]		mm
d_{35}	1.08		Silt[1]		mm
d_{50}	3.49		Silt[1]		mm
d_{84}	12.07		Silt[1]		mm
d_{95}	15.74		Silt[1]		mm
Water Surface Slope (S)	0.03-0.04		0.007		Ft/Ft
Channel Sinuosity (K)	<1.2		<1.2		
Rosgen Stream Type	Eb	B	C	F	

* Low sinuosity channels present due to prior channelization.

** High bank height ratios should be noted, values in excess of 1.5 have little or no chance for self-recovery (Rosgen, D. L., 2001a). Also refer to Table 3.2.

1. Due to aggraded channel conditions, abundance of silt present and channel flow characteristics at the time of assessment, substrate sample not collected in this reach of MC-UT1-3.

3.4 Project Reach Characterization

Martin’s Creek and tributaries within the project area have been impaired by historical and current land management practices, which include pasture conversion, channelization, and livestock grazing. Riparian disturbance, livestock access to streams and channel manipulation are evident throughout much of the project site. Over time, these practices have contributed excessive siltation and nutrients to Martin’s Creek and ultimately to the Hiwassee River impacting the habitat of sensitive aquatic taxa.

During development of the land for livestock grazing, most of the woody stream bank vegetation was removed on at least one bank of MC-UT1 and MC-UT1-3. Stream channels were relocated and straightened to maximize the pasture available for grazing. The removal of woody vegetation along Martin’s Creek is also related to the power lines that run overhead, thus limiting the degree to which riparian restoration can be accomplished along the mainstem. The most common problems present along the tributaries where enhancement and restoration work is proposed include poor riparian conditions due to invasive vegetation, lack of woody vegetation, loss of connectivity to the floodplain, poor geomorphic heterogeneity and stream banks that have been trampled, forming ruts and gullies along the banks.

3.4.1 Martin’s Creek (Mainstem)

Martin’s Creek appears to have been channelized in the past to maximize available pasture land. In general, the pattern and bedform diversity of Martin’s Creek is lacking and the degree of floodplain connectivity is impaired by the presence of a manmade levy on the left bank. Due to the location of the power lines overhead and the corresponding utility corridor easement, our design approach on the mainstem is limited and will consist of partial levy removal, invasive plant species removal and replanting of the riparian zone to the extent possible.

Activities are intended, among other things, to reduce sediment erosion from bank instability and to filter surface runoff draining directly into Martin's Creek from adjacent pastureland. Land cover adjacent to the channel consists of pasture land and the adjacent Martin's Creek Road corridor. The overall valley slope is 0.004 ft/ft.

3.4.2 Martin's Creek UT1-1 and UT1-2 (MC-UT1-1 and MC-UT1-2)

Martin's Creek (MC) UT1-1 and UT1-2 are first or second order tributaries located in the next field up the access road above the barn and on the west side of Wildcat Drive as you travel northwest from the Wildcat Drive Bridge over the mainstem of Martin's Creek.

Just beyond the western edge of the field, at 689 LF in length, MC-UT1-1 is a short tributary that contributes to MC-UT1. Due to the forested riparian conditions and geomorphic features present, MC-UT1-1 is a proposed preservation reach.

Confluencing with MC-UT1 at a point where the access road enters the upper field, MC-UT1-2 is another small, drainage and is likewise slated for preservation. This 923-foot-long tributary is primarily an intermittent channel in the project area. The channel parallels the property line on the north side of the field. While surrounded by grassed areas of the field, the channel does have a riparian buffer that is forested. This buffer is variable in width, and is more narrow near the confluence of UT1-2 and MC-UT1 near the lower end of the field.

3.4.3 Martin's Creek UT1 (MC-UT1)

MC-UT1 originates on the high elevation slopes above the upper field. Upstream of this cleared upper field MC-UT1 is a first order stream and is referred to as Reach 1. At the point where the valley broadens slightly and enters the area that has been converted to pasture, it is referred to as Reach 2. Reach 1 of UT1 is a completely forested headwater tributary that is proposed to be managed as a preservation reach. The reach break has been designated at the interface of the forested stream and the reach of stream in the upper field. MC-UT1 Reach 2 has been moved against the right valley wall and flows along the edge of the pasture at the foot of the right slope. Below Reach 2, MC-UT1 continues through a wooded area as it parallels the Wildcat Acres property line and an established right-of-way-access road. Over this segment, it straddles the property boundaries and is close to the road, and therefore has not been included in the project until it enters the lower property within a livestock paddock that is attached to the barn. At the point where it flows back on the project property it first flows through a ford crossing and then enters Reach 3. This reach includes a relatively short stream segment that has been impacted by invasive multiflora rose and privet, cattle grazing and past alignment manipulation. This reach ends at a point where the barn is too close to the stream to allow for an easement or stream work. Reach 4 begins below a culvert that leads to the barn. The existing channel for this reach was channelized along the property line and then onto the adjoining Wildcat Acres where it crosses the developments access road and then connects to Martin's Creek.

The first restoration reach (Reach 2) on MC-UT1 begins at a point where the stream enters the upper field and where the channel was relocated at some point in the past to the toe of the right hill slope. In multiple locations, this has resulted in past and ongoing undercutting of the toe of the valley wall, over-steepening of the lower hillside to slopes steeper than 1:1, and subsequent erosion and sedimentation into the stream by soil and colluvium from the valley wall. The cross sections surveyed depict a stream with a high bank height ratio and are trending towards continued entrenchment and then widening to an F-type channel. Through this reach the channel has developed a series of headcuts that are destabilizing the channel. This means that the reach is still in the worsening stages of channel evolution and that it can benefit considerably from restoration activities. The design approach calls for dimension, pattern and profile adjustments. Grade control has been designed to create a series of steps and pools that stabilize the existing unstable profile. This will result in a geomorphology that is typical to the setting of this moderately steep second order stream. The reach has also been moved away from the valley wall to eliminate erosion of the soil and colluviums from undercutting of the toe of the valley wall, and mass wasting from the high slope into the stream. Restoration of the channel to its natural location in the valley will coincide with the other necessary dimension and grade control improvements; the result will provide improved floodplain connectivity and conveyance. The existing banks are primarily vegetated with exotic invasive vegetation including multiflora rose and privet. This vegetation will be removed and the banks planted with native riparian woody and herbaceous species.

Reach 3, of MC-UT1 is the only reach on MC-UT1 that is being restored using an Enhancement I approach. This reach has an extensive, continuous stand of multiflora rose and privet on the left bank with scattered stands on the right bank. This has prevented deeply rooted vegetation from growing along this channel resulting in several areas of bank instability. This reach has also been impacted by cattle access in the past and sediment deposition from cattle degradation to the adjoining paddock. In some areas the channel is in good shape due to low bank heights and this allowed a quick recovery after livestock were recently removed. This reach will be restored by removing the invasive species, sloping and stabilizing eroding stream banks, adding grade control structures at key locations and replanting the reach with native plant species.

A second restoration reach (Reach 4) will tie MC-UT1 into another tributary (UT1-3, Reach 2) running down the main valley of Martin's Creek and then these will enter Martin's Creek within the project area. The existing channel of MC-UT1 has been channelized from the existing culverted stream crossing straight to the property line and then onto the Wildcat Acres property. It presently functions as a ditch that was dug to redirect the stream off the property as directly as possible and under Wildcat Road. The channel survey showed that the existing G-type channel is very entrenched and has a bank height ratio of 4.1, reflecting the prior anthropogenic impacts. The relict channel is still discernable in the adjoining pasture. A new stable E-type channel will be constructed with an alignment that utilizes the relict channel and brings the tributary down into the low part of the main valley, contributes additional hydrology to the wetlands located in the low part of the valley, and ties it into the other restored tributary and the mainstem..

3.4.4 Martin's Creek UT1-3 (MC-UT1-3)

Martin's Creek UT1-3 is located near Crisp Road and is the southernmost tributary on the project site flowing down the south side of a ridge that divides the lower parcel and then flows into the valley in which the mainstem Martin's Creek flows. It is crossed by a gravel driveway that extends to a residence located within this lower parcel. MC-UT1-3 is divided into two reaches. Reach 1 will have an Enhancement Level I approach applied from the property line where the stream enters the property downstream to the driveway. Reach 2 will be restored with a Priority 1 Restoration approach starting at the driveway and extending to a confluence with MC-UT-1.

Land cover in the enhancement reach consists of forested cover on the right bank and pasture or semi-forested cover along the left bank. The channel dimension near the beginning of the enhancement reach reflects aggradation brought about by bank instability from livestock-trampled banks. Further downstream, the channel becomes incised, with bank height ratios of 1.5-1.8 reflecting the unstable nature of the channel in the past before the forest canopy developed. The incised condition continues to create unstable channel conditions such as bank erosion and headcutting. Bedform diversity is somewhat poor and consists of long riffles and irregularly spaced, shallow pools. Exotic invasive vegetation is present in extensive stands on the left bank were forest cover is minimal and in isolated areas on the right bank along the stream corridor.

Downstream of the gravel drive, MC-UT1-3 flows across a pasture that was in use until the winter of 2009. Exotic invasive vegetation has developed thick stands along both banks throughout this entire reach. The existing channel was created by channelization resulting in a perched channel that is higher than the low point in the valley. The channel is over wide, has a manmade levy on the right bank from the side casting of dredged material and does not appear to be adequately transporting sediment through the stream system as evidenced by the accumulated silt. The channel has also been significantly impacted by the trampling of the streambanks and channel by livestock. The channel typically exhibits an incised condition, except for areas where bank degradation and sediment deposition has resulted from livestock access. Full restoration involving the restoration of pattern, dimension and profile are being proposed due to the severity of impacts to this tributary and in order to move the channel to the low point of the valley.

In addition to channel morphology and ecological considerations, the design approach for MC-UT1-3 also takes into consideration the restoration processes needed to restore the connectivity of MC-UT1-3 to the existing wetlands and more extensive wetlands that will be restored in this lower field. Further discussion of the approaches for restoring ecological and hydrologic functions to streams and wetlands is provided in Sections 5 and 7 of this plan.

3.4.5 Martin’s Creek UT2 (MC-UT2)

MC-UT2 is a tributary feeding directly into the mainstem of Martin’s Creek. It is a very short reach, and due to the extent of exposed bedrock present and other site constraints such as a N.C. Department of Transportation (NCDOT) secondary road and overhead power-lines, an Enhancement II approach is being proposed. Activities will include improvements to channel dimension through bank sloping and riparian enhancement through the removal of invasive vegetation and re-establishment of a buffer consisting of woody and herbaceous vegetation native to the project area.

3.4.6 Right Prong Martin’s Creek (Mainstem)

The Right Prong Martin’s Creek drainage can be accessed by turning off Martin’s Creek Road into a small gated community on Wildcat Road. Right Prong Martin’s Creek and its many tributaries are located in the forested, upland portion of the project area (large western most parcel) that has a drainage area of approximately 0.6 square miles. Right Prong Creek undergoes several changes in slope from source to valley. However, adequate grade control and pool spacing over most of the 5,208 LF of Reach 1, in addition to an well established forest canopy, have resulted in a natural channel system that will be preserved as part of this Martin’s Creek II mitigation project.

Reach 2 of RP-UT1 is a 572 LF reach that starts just upstream of the confluence with RP-UT1 and ends at the property boundary. This reach flows alongside an area that has been cleared for a field in the recent past. This field has been abandoned and is now in the early stages of succession, returning to a forested condition. However, nonnative, invasive plant species have taken over the area and now have a thick stand across the entire area that was cleared. The channel in this area is in good condition with only minor instability in areas where woody vegetation is minimal. Enhancement of this reach will consist of removing invasive vegetation and replanting the area with native woody and herbaceous vegetation.

3.4.7 Right Prong Martin’s Creek UT1 (RP-UT1)

Right Prong Martin’s Creek UT1 is located near the property boundary that abuts the gated development north of the project site. Like Right Prong Martin’s Creek, the upper 541 LF of RP-

UT1will be preserved while the remaining 399 LF of tributary within the project limits will be addressed with an Enhancement II approach.

Channel conditions in the enhancement reach are generally good. Like RP-UT1 this reach is located in the “old field” area and has extensive stands of invasive species. Where these stands have limited the growth of native species some bank instability has occurred; however, most of the channel has a narrow strip of native vegetation in the riparian zone and then beyond this narrow buffer zone there are thick stands of invasive species. There is one meander bend that is unstable due to the absence of woody vegetation. Exotic invasive species treatment is also prescribed for the 399 LF of this enhancement reach.

3.4.8 Other Preservation Reaches in the Right Prong Martin’s Creek Drainage: RP-UT2, RP-UT2-1, RP-UT3, RP-UT3-1, RP-UT4, RP-UT4-1, and RP-UT5

These tributaries are located on moderate to very steep slopes and are intermittent or perennial. All evidence suggests that these tributaries to Right Prong Martin’s Creek have been left relatively undisturbed for several decades or longer. There is evidence of some old roads within this forested area and some timber harvest may have occurred, but if this was done it appears to have been limited. The forest canopy is dominated by Oaks and Hickory species and the streams have either cascading or step-pool geomorphology with adequate grade control consisting of bedrock, boulder and log or root nickpoints. Preservation is proposed for these streams because they are in a natural state and invasives are minimal in this portion of the watershed.

3.5 Channel Morphology, Evolution and Stability Assessment

Channel stability is defined here as the stream’s ability to transport incoming flows and sediment loads supplied by the watershed without undergoing significant changes over a geologically short time-scale. A generalized relationship of stream stability was proposed by Lane (1955); it states that the product of sediment load and sediment size is in balance with the product of stream slope and discharge, or stream power. A change in any one of these variables induces physical adjustment of one or more of the other variables to compensate and maintain the proportionality.

Longitudinally, the water and sediment flows delivered to each subsequent section are the result of the watershed and upstream or backwater (downstream) conditions. Water and sediment pass through the channel, which is defined by its shape, material, and vegetative condition. Flow and sediment are either stored or passed through at each section along the reach. The resulting physical changes are a balancing act between gravity, friction, and the sediment and water being delivered into the system (Leopold et al., 1964).

Observed stream response to induced instability, as described by Simon’s (1989) Channel Evolution Model, involve extensive modifications to channel form resulting in profile, cross-sectional, and plan form changes which often take decades or longer to achieve resolution. The Simon (1989) Channel Evolution Model characterizes typical evolution in six steps:

1. Pre-modified
2. Channelized
3. Degradation
4. Degradation and widening
5. Aggradation and widening
6. Quasi-equilibrium.

The channel evolution process is initiated once a stable, well-vegetated stream that interacts frequently with its floodplain is disturbed. Channelization, dredging, changing land use, removal of streamside vegetation, upstream or downstream channel modifications, and/or change in other hydrologic variables result in adjustments in channel morphology to compensate for the new condition(s). Disturbance commonly results in an increase in stream power that can cause degradation, often referred to as channel incision (Lane, 1955). Incision eventually leads to over-steepening of the banks and, when critical bank heights are exceeded, the banks begin to fail and mass wasting of soil and rock leads to channel widening. Incision and widening continue moving upstream in the form of a head-cut. Eventually the mass wasting slows, and the stream begins to aggrade. A new, low-flow channel begins to form in the sediment deposits. By the end of the evolutionary process, a stable stream with dimension, pattern, and profile similar to those of undisturbed channels forms in the deposited alluvium. The new channel is at a lower elevation than its original form, with a new floodplain constructed of alluvial material (FISRWG, 1998).

Channels within the project area are mostly perennial, have experienced prior channelization or other kinds of watershed disturbance, and are currently impacted by grazing. Channel stability was assessed with one or more of the following methods: qualitative and quantitative site observations, site-specific hydraulic modeling using detailed topographic data collected for the project, and sediment transport modeling. Conclusions reached from these methods were used to define site stability and determine appropriate restoration approaches for each sub-reach.

The project area consists of channels that are primarily in a degradational phase of the channel evolutionary sequence, with some of the reaches experiencing widening or aggradation (typically aggradation is a result of local widening due to livestock impacts or channelization). As a result, these streams are prime candidates for restoration and enhancement. Enhancement I and Restoration reaches are discussed, related to the Simon Channel Evolution Model, below. Stream restoration techniques act to minimize the erosion and geomorphic disturbance required to achieve a new stable state naturally. Restoration activities proposed at the Martin’s Creek Site will recreate channel types that are appropriate to the valley types and slopes present. In addition to the installation of grade control structures, restoration efforts will involve the alteration of channel dimension, pattern and profile. This resets the evolutionary cycle; the structures and measures installed, in conjunction with the protective buffer, should ensure the continued stability of the streams within the project area, barring major disturbance in the unprotected areas of the greater watershed.

Martin’s Creek has been channelized in the past and its riparian buffer undergoes periodic manipulation as overhead powerlines run nearly parallel with the stream. This channel is at Step 5 (aggradation and widening of the Simon Channel Evolution Model. The width needed was most likely achieved through degradational processes as bedrock makes up a considerable portion of channel substrate in the project reach. Evidence of inner berms was sporadically located along the right bank of Martin’s Creek. Due to constraints posed by the overhead utilities and the proximity of Martin’s Creek Road, no pattern adjustments are proposed.

Reach 2 of MC-UT1 is proposed for Restoration. This reach exhibits characteristics of a stream at steps 3 and 4, with downcutting and widening as the two active evolutionary drivers in the present channel. These are the likely result of prior channelization, during which the channel was moved against the valley wall and straightened to maximize pasture land.

Reach 3 of MC-UT1 is proposed for Enhancement I. This reach intermittently exhibits characteristics of a stream at step 3. It has been impacted from land use and land cover impacts. As a result, some of the cross sections exhibit high bank height ratios, which indicate a downcutting trend. Lateral stabilization and dimension adjustments are necessary to create permanent stability that will be supported by the reforestation of the riparian buffer. In the absence of this treatment, it is at a high risk for continued lateral erosion and the propagation of head cutting. In addition, invasive plant species will continue to inhibit the establishment of native species which can better stabilize the stream banks.

Reach 4 of MC-UT1 is proposed for Restoration. This reach exhibits characteristics of a stream at step 3. It was channelized and levied and is experiencing downcutting. The levying of the stream is particularly detrimental and will serve to accelerate the downcutting process; the bank height ratio is 4.1 so floodplain connectivity is non-existent. This proposal will reestablish this channel in its original alignment.

MC-UT1-3 Reach 1 is proposed for Enhancement I. This reach has been impacted by livestock access and past land use when the property was cleared. During this time the channel downcut and meandered. As woody vegetation matured this channel form became more stable. However, the incised condition continues to cause channel instability. Some of the reach is experiencing downcutting (headcuts) and there are areas where the bank height ratio exceeds 1.5. Now parts of the channel exhibit characteristics of a stabile B channel at Simon's Stage 6, but other areas are at Stage 4 with degradation and widening. This is particularly problematic at the back of meander bends where erosion is occurring into steep clay banks.

MC-UT1-3 Reach 2 is proposed for Restoration. This reach exhibits characteristics of a stream at step 4 to 5. It was previously channelized and dredged material was cast on the right bank, creating a significant levy. Much of this channel is aggrading due to the channel being made over wide when it was dredged. The channel is perched on the hillside and does not have a normal hydrology or the floodplain access that it should. The entrenchment ratio for this stream should be much higher, but the levy on the right bank and the hill slope on the left confine the channel. These factors will not allow the stream to be fully functional, and furthermore impact the hydrology of wetlands in the lowest part of the valley. Restoration will put this channel in the low part of the valley, which will restore hydrology to adjacent riparian wetlands, and create a channel that is connected to its floodplain with all the benefits that this provides.

Tables 3.1and 3.2 summarize existing channel morphology in the project area for the Enhancement I and Restoration reaches on tributaries UT1 and UT1-3 to Martin's Creek. Data was taken from surveyed cross sections distributed across the project area. Table 3.3 summarizes research findings by Rosgen (2001) concerning bank height ratios as an indicator of channel stability.

Table 3.1 Channel Morphology Features and Stability Indicators for Martin's Creek and Unnamed Tributaries to Martin's Creek
Martin's Creek II Mitigation Project-NCEEP Project #92633

Parameter	Martin's Creek Tributaries			
	UT1 Reach 2 (X1-X3)	UT1 Reaches 3-4 (X4-X7)	UT1-3 Reach 1 (X8-X9)	UT1-3 Reach 2 (X11-X12)
Stream Type	Eb*/Fb/B *functioning like G	G/Cb/G	Eb/B	C/F
Riparian Vegetation	Pasture on LB and forested, steep slope on RB of stream. Vegetation on both banks within 25 feet of channel is primarily invasive, nonnative.	Grazed pasture on both sides of stream. Vegetation on both banks within 25 feet of channel is primarily invasive, nonnative.	Pasture on LB and forested area on RB of stream. Vegetation on RB within 25 feet of channel is primarily invasive, nonnative, LB is young hardwoods.	Grazed pasture on both sides of stream. Vegetation on both banks within 25 feet of channel is primarily invasive, nonnative or grasses.
Channel Dimension				
Bankfull Area (SF)	3.8, 3.9, 3.6	4.6, 6.2, 6.1	2.9, 3.0	3.3, 2.9
Width/Depth Ratio	10.7, 14.4, 55.0	7.6, 15.4, 9.4	8.6, 15.2	39.7, 16.0
Channel Pattern				
Meander Width Ratio	N/A	4.7, N/A (Reach 4)	4.3	N/A

Sinuosity	1.1	1.2, N/A (Reach 4)	1.3	~1.0
Vertical Stability				
Bank Height Ratio (BHR)	1.8, 2.2, 1.3	1.8, 1.0, 4.1	1.0, 1.0	1.0, 3.0
Entrenchment Ratio (ER)	2.9, 1.2, >2.2	1.6, >2.1, 1.8	2.7, 1.7	2.3, 1.5
Evolution Scenario (I-II-III…)	Eb-**G**-**Fb**-B, B-**G**-**Fb**-B	Cb-**G**-F-C	**Eb**-G-Fb-B, B-G-**Fb**-B	C-G-**F**-C
Existing Evolution Stage^2	Degradation, Widening	Degradation	Aggradation and Widening	Degradation/ Aggradation and Widening
Notes: 1. N/A: Meander Width Ratio not measured because channel has been straightened. 2. Simon Channel Evolution Model.				

Table 3.2 Rosgen Channel Stability Assessment
Martin's Creek II Mitigation Project-NCEEP Project #92633

Stability Rating	Bank Height Ratio (BHR)
Stable (low risk of degradation)	1.0-1.1
Moderately unstable	1.1-1.3
Unstable (high risk of degradation)	1.3-1.5
Highly unstable	>1.5

Notes: Rosgen, D. L. (2001) A stream channel stability assessment methodology. Proceedings of the Federal Interagency Sediment Conference. Reno, NV. March, 2001.

3.6 Bankfull Verification

Baker engaged physical, analytical, and empirical methods to verify the bankfull stage and discharge of the project reaches of Martin's Creek and its tributaries. These methods were each given weight, with physical field measurements and analytical data having a slightly higher weight due to their site-specific nature. Subsequent methods were used to interpret and sometimes adjust field observations.

In summary, the following steps were taken:

1. Identified and surveyed representative cross sections with physical bankfull indicators.
2. Compared surveyed cross sections with each other to ensure consistency.
3. Compared values to regional empirical data (regional curves).
4. Used Manning's equation to estimate design discharge through cross sections.
5. Built and ran a HEC-RAS existing conditions model with estimated flows.
6. Finally, considered all results and determined dimensions and flows that correspond to bankfull.

3.6.1 Physical Field Measurement

Physical bankfull indicators surveyed during the existing conditions analysis were typically depositional bars, defined breaks in slope at a consistent elevation relative to the water surface or transitions in bank vegetation.

Upon completion of the field survey, data was plotted to check for consistency and correlation with region-specific empirical equations and regional reference data. This data was analyzed to determine the most likely bankfull stages on all project reaches. Once bankfull stage was determined using these methods, a secondary check was performed using HEC-RAS hydraulic models to assess whether a particular flow rate (regional curve flow was used as a first estimate) would produce the bankfull stage at successive cross sections. These verification methods are described below.

3.6.2 Regional Curve Equations

Publicly available and in-house bankfull regional curves are available for a range of stream types and physiographic provinces. The North Carolina Mountain Regional Curve (Harman et al., 2000) was used for comparison to other more site-specific means of estimating bankfull discharge. The tributaries on the site are small headwater streams; streams of this size are poorly represented on the regional curve. It has been found that the Mountain Regional Curve Equations typically returns high values in terms of discharge and channel dimension for smaller streams, such as those present at this site. Baker has conducted numerous projects in small drainages in WNC, and has produced mini-curves specific to these projects. The growing number of data points on our small streams curve provides supporting evidence for the selection of bankfull indicators that produce smaller dimensions and flow rates than the published regional data. Additionally, values considered for design were also compared to unpublished Mountain Regional Curve data being developed by the Natural Resources Conservation Service (A. Walker private communication).

3.6.3 Role of Hydraulic Modeling Using HEC-RAS 4.0 in Design Discharge Selection

On each tributary and the mainstem, a number of existing conditions cross sections were surveyed. These cross sections were input into simple HEC-RAS models to assess the channel filling discharge.

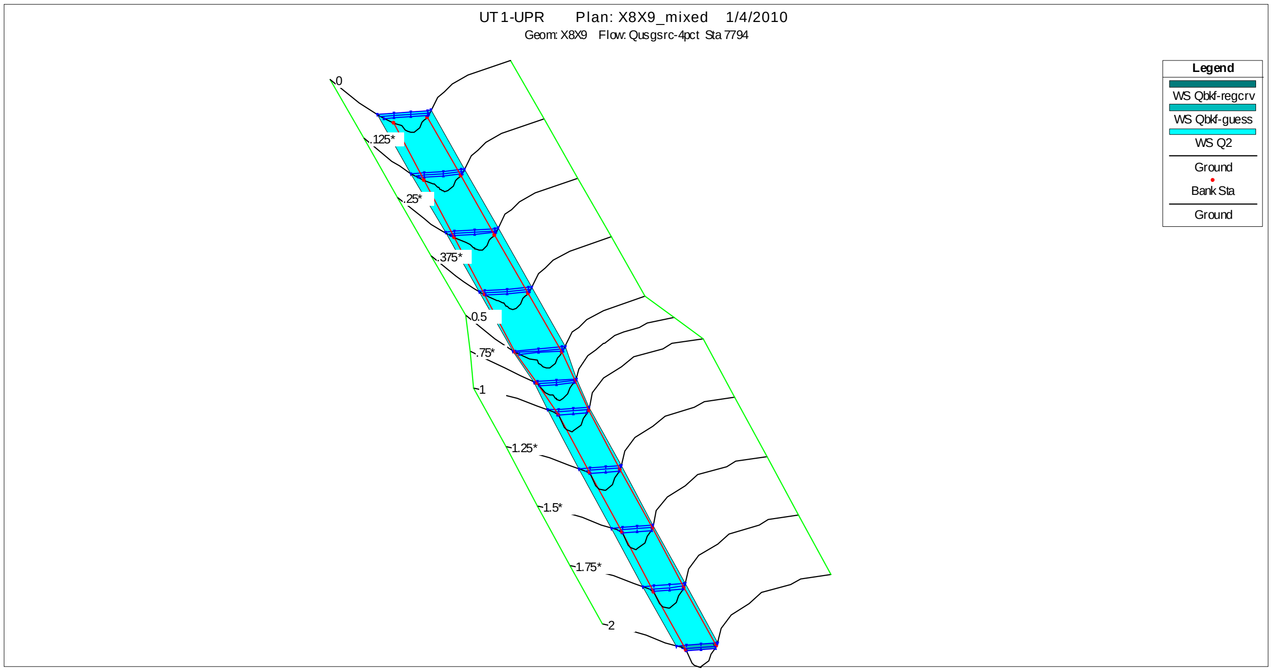
Each stream was analyzed individually using a range of flows determined from USGS data and from the NC Mountain Regional Curve for discharge. The USGS Region of Influence (ROI) method and USGS Regional Regression Equations (RRE) were considered. The ROI results are based on a subset of gages in adjacent watersheds, rather than depicting results based on data for the whole Blue Ridge region as the RRE method does. The ROI method suggested that the Site has lower flows than the region does on the whole. This would typically indicate the presence of some difference in rainfall, soil type, slope or other hydrologic influence that would result in lower flows. The phenomenon is fairly typical for the Blue Ridge which has widely varying hydrologic characteristics.

USGS ROI and NC Mountain Regional Curve flows were input into the model to assess the resulting hydraulics for the Bankfull Flow (Qbkf), 2-Year Flow (Q2), Q5, Q10, etc. Since the HEC-RAS models did not include more than two distinct cross sections, primarily cross sectional channel data (Figure 3.2) was scrutinized against water surface profiles to assess consistence of the top of bank, benches, slope breaks, and other depositional features throughout reaches of constant drainage area. Bankfull indicators were selected based on significant benches, breaks in slope, back of bench in pool sections, and other recognized physical features.

For these sites, the regional curve flows (Qbkf) produced stages that were generally consistent with physical indicators of bankfull. The HEC-RAS model, therefore, supports the bankfull features identified in the field indicating that the design flow should be fairly comparable to the regional curve flow. This is contrary to the USGS ROI data and also previous data collected on small streams in the region. Field data is given more weight than empirical data when choosing design ratios and dimensions, however, empirical data was considered in decision making. A high width to depth ratio has been chosen in most cases so that the channel may easily narrow based on typical evolution of newly built restoration channels and the likelihood that dense wetland vegetation is likely to become well established in most of these channels.

The design cross section was checked to ensure that a desirable stage-discharge relationship was achieved, but the first cut at producing the design cross section was based on existing conditions data and reference geomorphic ratios that have produced successful (stable) channels in past projects. To close the loop, the design cross section was input into HEC-RAS and assessed to see whether the flow that filled the design channel was comparable to the design flow selected during the hydraulic analysis. In most cases, the exercise confirmed that a flow close to or equal to the design flow would fill the channel, or that it would take a slightly higher flow at first (upon completion of construction), but that with one or two growing seasons, the channel would vegetate and narrow slightly to a point where it would overtop at a lower flow (see a visualization of this in Figure 3.3).

Figures 3.1 and 3.2 HEC-RAS Model Views for UT1-3 Upper, Water Surface Elevations for Design Flow (10 cfs) and the Mountain Regional Curve Flow (Q=14 cfs) (LOB=Left Top of Bank, ROB=Right Top of Bank)



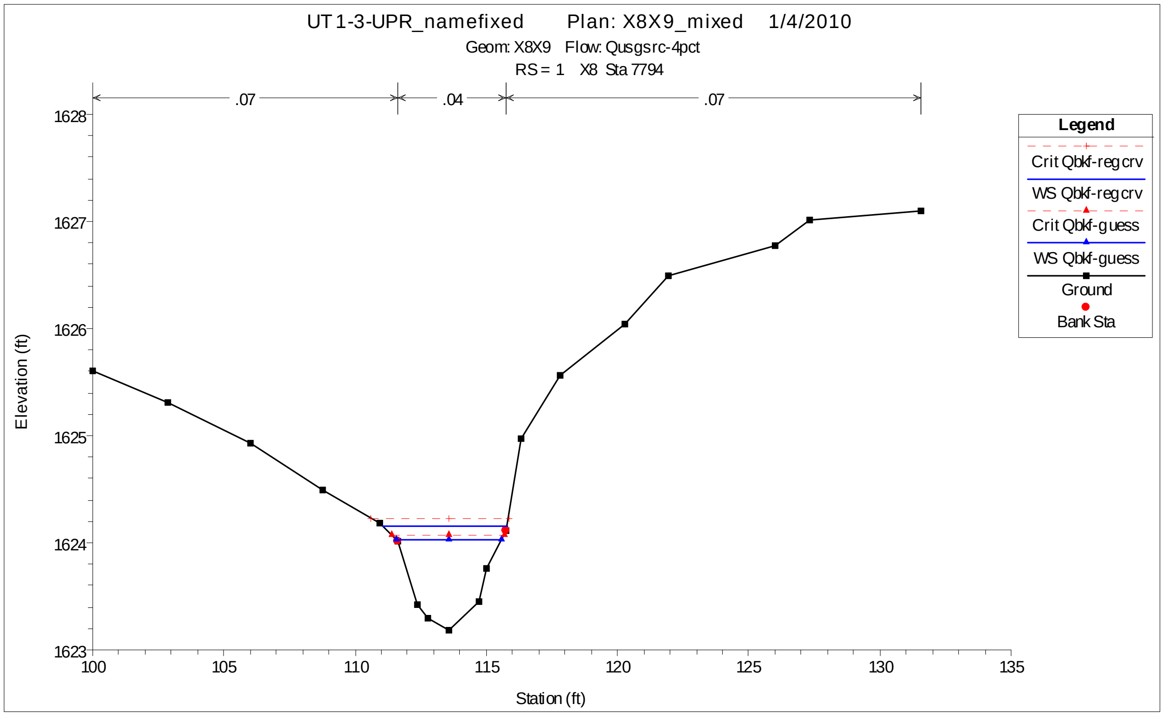
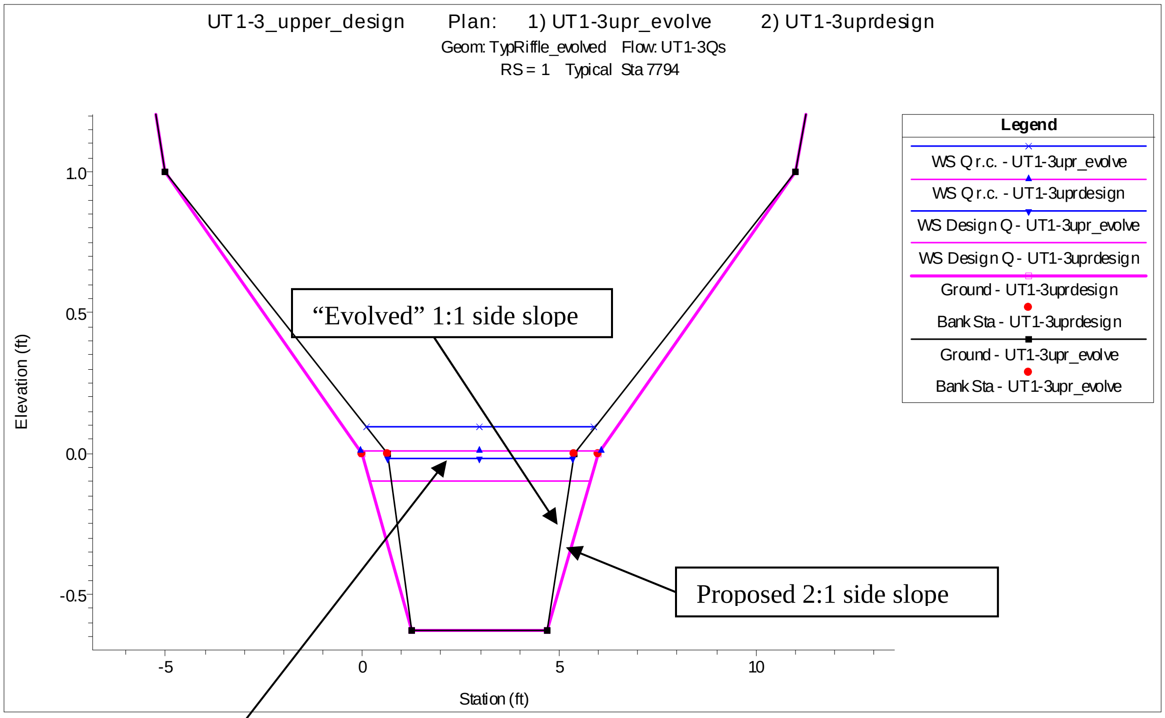


Figure 3.3 Sample Analysis of UT1-3 Upper Design Cross section for As-built Condition (2:1 side slope) Versus "Evolved" Condition (Where is has Narrowed to a 1:1 Side Slope) at Design Flow (10 cfs)



"Evolved" 1:1 side slope

Proposed 2:1 side slope

Horizontal pink line (water surface for design flow with channel built as proposed) evolves to the lower horizontal blue line (water surface for design flow based on the narrowing of the channel banks and increased roughness resulting from vegetation growth).

3.7 Conclusions for Channel Forming Discharge

Using multiple sources of data increased our confidence in our ultimate conclusion. Baker used detailed cross sections with field-identified bankfull indicators, validation and interpretation of data with hydraulic modeling, research of empirical (USGS and Regional Curve) hydrologic and hydraulic data, and prior project information (i.e. mini-project curves) for small WNC Mountain drainages to conduct the analysis. All sources of data suggest that the bankfull discharge for the project tributaries should be lower than the published NC Mountain Regional Curve values.

Soils in this watershed are predominantly deep and well-drained. This is physical hydrologic evidence that supports a high degree of infiltration, and hence a lower direct runoff to drainage features. Furthermore, the average annual rainfall in this location is 55-60 inches/year. The region on the whole has a highly variable average annual rainfall varying from 40 to 80+ inches/yr, so the site is in the middle of the range. The specific ecoregion is known as the "Broad Basins"; as the name implies, its drainages and watersheds have less slope and wider valleys than many of the steeper drainages on the Blue Ridge – another contributing factor to smaller discharges.

Table 3.3 provides a discharge analyses based on the regional curve flows for the drainage area being considered and the design discharge calculated based on the proposed design cross sections for each reach of the Martin's Creek mitigation project site.

Table 3.3 Design Discharge Summary for Martin's Creek and Tributaries by Reach

Martin's Creek II Mitigation Project-NCEEP Project #92633

Stream	Reach	Downstream Drainage Area (mi^2)	Q, Mountain Regional Curve (cfs)	Design Q [1] (cfs)
UT1	Upper	0.09	16	16
	Lower	0.17	26	25
UT1-3	Upper	0.07	13	14
	Lower	0.08	15	12 [3]
Mainstem	-	6.81	649 [2]	Not Applicable (Enhancement II)

* Estimate of design Q is based on HEC-RAS flow that fills the channel that develops over time (side slopes narrow and Manning's "n" roughness increases to 0.045 for main channel)

[2] The USGS extrapolated 1.5-Year flow is 495 cfs (Weaver et al., 2006)

[3] Bankfull Q is lower in this reach than in the upstream reach because of the affect of slope in computing Q using Manning's equation. The slope in UT1-3 upper is ~0.04, in the lower reach, it is 0.008

3.8 Vegetation Community and Disturbance History

Habitat within and adjacent to the proposed project area consists of pasture, fallow agricultural fields, pocket wetlands and oak dominated forests as described by Schafale and Weakley (1990). Compared to more mountainous ecoregions within the Blue Ridge Belt, the Broad Basins ecoregion has a composite of oaks and pine dominated forests more similar to the Piedmont region of the state. Oaks and pines common to this ecoregion include white oak (*Quercus alba*), southern red oak (*Q. falcata*), black oak (*Q. velutina*), scarlet oak (*Q. coccinea*), shortleaf pine (*Pinus echinata*) and Virginia pine (*P. virginiana*). This ecoregion also contains a higher percentage of agricultural land and development than other regions within Blue Ridge mountain region. Habitat within and adjacent to the proposed project area consists of pasture, fallow agricultural fields, pocket wetlands and oak dominated forests as described by Schafale and Weakley (1990) below. Riparian areas ranged from relatively undisturbed to very disturbed. A general description of each community follows.

3.8.1 Dry-Mesic Oak-Hickory Forest

This ecological community is located on the upland fringes of the grazing areas and low ridges near the project area. The dominant canopy species of the dry mesic oak forest area includes white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), mockernut hickory (*Carya alba* (*tomentosa*)), red hickory (*Carya ovalis*), and pignut hickory (*Caryus glabra*). Yellow poplar (*Liriodendron tulipifera*) is also common. Understory species included red maple (*Acer rubrum*), flowering dogwood (*Cornus florida),* sourwood *(Oxydendrum arborem),* American holly *(Ilex opaca)*, black tupelo *(Nyssa sylvatica)* rhododendron (*Rhododendron* spp.), and mountain laurel (*Kalmia latifolia*). Shrubs include downy arrowwood (*Viburnum rafinesquianum),*deerberry *(Vaccinium stamineum),*Blue Ridge blueberry *(Vaccinium pallidum (vacillans)),* and strawberry bush *(Evonymus americana).* Muscadine grapevines *(Vitis rotundifolia)* and poison ivy *(Toxicodendron (Rhus) radicans)*often are present. Herbs are fairly sparse, with *Hexastylis spp.,* striped prince's pine *(Chimaphila maculata),* nakedflower ticktrefoil *(Desmodium nudiflorum)*, and rattlesnakeweed common.

3.8.2 Montane Oak-Hickory Forest

Montane Oak-Hickory Forest communities present within the project area are also located in the mid to upland forested slopes along coves and ridgelines. Similar to the dry mesic oak forests present, this forest type at the project site was dominated by white oak (*Quercus alba*), and northern red oak (*Q. rubra*) as well as chestnut oak (*Q. prinus*). Other trees that are commonly found in Montane-Oak-Hickory forests include the mockernut hickory (*Carya alba (tomentosa)*) and pignut hickory (*C. glabra*). Black oak (*Quercus velutina*), red maple (*Acer rubrum*), tulip poplar (*Liriodendron tulipifera*), and scarlet oak (*Q. coccinea*) are also common to this forest type and were observed in the project area. The eastern white pine (*Pinus strobes*) or other pines may also be present in this forest type which historically was dominated by the American chestnut (*Castanea dentate*).

Understory trees noted by Schafale and Weakley to occur in this forest type include sourwood (*Oxydendrum arboretum)*, flowering dogwood (*Cornus florida)*, blackgum (*Nyssa sylvatica)*, and serviceberry (*Amelanchier arborea)*. Shrub layers are usually made up of flame azalea (*Rhododendron calendulaceum)*, bear huckleberry (*Gaylussacia ursine)*, mapleleaf viburnum (*Viburnum acerifolium)*, and witchhazel (*Hamamelis virginiana)*. Rhododendron (*Rhododendron maximum*) and mountain laurel (*Kalmia latifolia)* can also be found. Due to the density of other cover, herbaceous cover tends to be sparse but diverse, with Indian cucumber (*Medeola virginica)*, false Solomon's seal (*Maianthemum (Smilacina) racemosum)*, Solomon's seal (*Polygonatum biflorum)*, mountain bellwort (*Uvularia puberula (pudica))*, wild yam (*Dioscorea villosa)*, and American cancer-root (*Conopholis Americana)* present. According to Schafale and Weakley's 1990 "Classification of the Natural Communities of North Carolina (Third Approximation)," Montane Oak-Hickory Forests differ from Dry Mesic Oak-Hickory Forests by the presence of species typical to the mountainous region of the state. These species include, but are not limited to the American chestnut (*Castanea dentate*), Flame azalea (*Rhododendron calendulaceum*), Yellow birch (*Betula alleghaniensis (lutea)*), and Buffalo nut (*Pyrularia pubera*).

3.8.3 Agricultural Area

This community is the most dominant and covers approximately 40 percent of the project area. Pasture land within and adjacent to the project area was most recently used for cattle and horse grazing and hay production. Vegetation within open fields and pasture areas is primarily comprised of fescues (*Festuca* spp.) and dog fennel (*Eupatorium capillifolium*). Woody shrub and vine species including multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense)*, maleberry (*Lyonia ligustrina*), tag alder (*Alnus serrulata*), greenbriar (*Smilax rotundifolia*), and muscadine (*Vitis rotundifolia*). Herbaceous species consist of dog fennel (*Eupatorium capillifolium*), soft rush (*Juncus effusus*), and various sedges (*Carex* spp.).

3.8.4 Invasive Species

The primary invasive species present on the project site is multiflora rose (*Rosa multiflora*), although Chinese privet (*Ligustrum sinense)* was also abundant in some areas.

4.0 REFERENCE INDICATORS

Design ratios for pattern and profile were based on evaluating dimensionless ratios from a reference reach site on a restoration project completed by Baker in Surry County and on-site data from stable sections of MC-UT1-3 and MC-UT1. Design ratios used by Baker that have been successful at many similar sites were also referenced (Table 4.0).

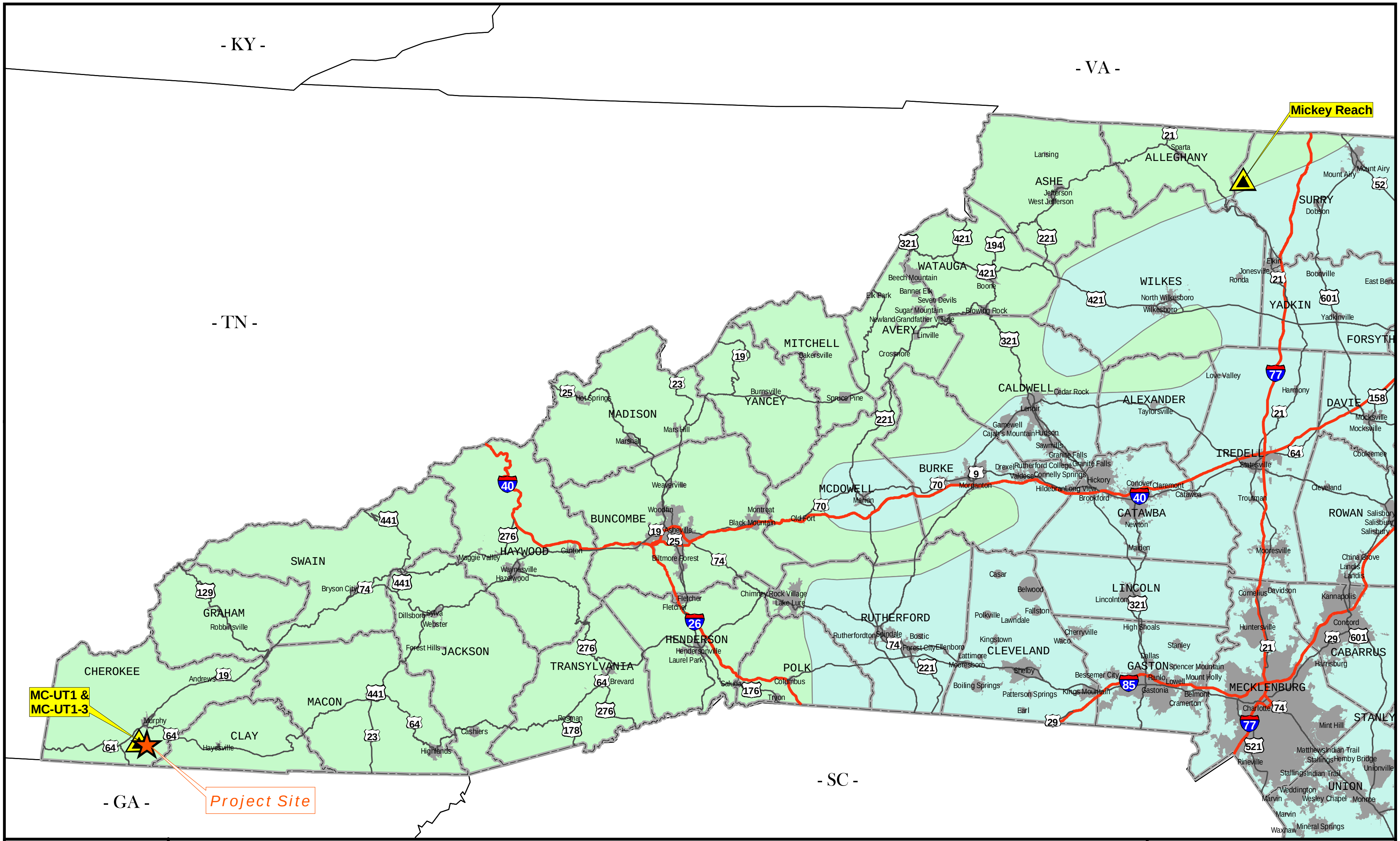
Upon review of the data, a number of reference sites (including several from the same physiographic region), were chosen to supplement the mountain regional curve data. This allowed us to review geomorphic data for a watershed comparable to the project drainage area. In the process of extending the curve beyond the range of the published data, slightly modified regional curve power functions were developed to account for the increased range in data. The regional curve results were used as part of the design decision making process. Values derived from these new power functions are summarized in Section 7 where design criteria are presented in numeric form.

MC-UT1-3 and part of MC-UT1 are being restored using a Priority 1, Restoration approach. This approach requires establishing a channel with correct dimension, pattern and profile that uses the existing valley floor as the bankfull elevation for the new channel. In order that we could evaluate the best meandering pattern for these new channels, we used the existing meandering pattern that is presently found in Reach 1 of UT1-3. While the number of meanders is limited, we felt that since this is the same stream, these meanders would provide the best information for dimensionless ratios that could guide the pattern design for the new Priority I channels. Reference reach information for pattern was collected from these meanders in Reach 1 and applied to the pattern design for streams in the lower field.

Mickey Reach, the aforementioned Baker stream restoration project in Surry County was used to compare to design data for the Martin’s Creek mitigation project due to its similar watershed size, substrate, sinuosity, and slope. Mickey Reach is located on an unnamed headwater tributary to the Mitchell River on the eastern escarpment of the Blue Ridge province and has a drainage area of approximately .45 square miles. While Mickey Reach is located on the eastern side of the Blue Ridge Mountains, both sites are located within the foothills region of the same physiographic area (Figure 4.1).

The UT on which Mickey Reach is located is a small B-type step-pool channel with an approximate channel slope of 3.3% (Harman, et al, 2004). Mickey Reach begins in an upland forested landscape that transitions into a valley occupied by an open field once used for agricultural purposes. Substrate present in the Mickey Reach primarily consists of gravels and cobbles; bedrock is also present and contributes grade control much the way it does at the Martin’s Creek Site. Reference reach data reviewed for the Martin’s Creek mitigation project from Mickey Reach consists of geomorphic data obtained from the original reference conditions-portion of Mickey Reach located in the upland forested as well as the now-stable portion of Mickey Reach that was restored approximately 8 years ago. The design stream type for Mickey Reach was a B4 channel with structures installed to restore a step-pool stream system with appropriate bedform diversity. Like the Martin’s Creek Site, the UT to the Mitchell River had become degraded due to impacts from historic timber harvesting and livestock access to the stream. The project was monitored for six years following construction and has remained stable, with diverse bedforms and excellent aquatic habitat.

Given the similarities in channel slope and other geomorphic features, and the longevity of site stability captured through post-construction monitoring, it was determined that the reference reach, design and monitoring information generated by work performed on Mickey Reach would provide valuable data to supplement on-site reference reach data collected. Although design data from this project was evaluated for application at the Martin’s Creek Site, B-type channels in the project area will not be completely regraded to form step-pool channels (a restoration approach).



LEGEND

Physiographic Province

🟩 Mountain

🟩 Piedmont

🟦 Coastal Plain

▲ Reference Reach Site

▭ Counties

10 5 0 10 Miles

Figure 4.1 Reference Reach Location

Martin Creek Mitigation Project
Cherokee County, NC

Ecosystem Enhancement PROGRAM

Baker

Instead an enhancement approach will be used; grade control structures will be utilized to prevent migration of headcutting while promoting a more diverse bedform and instream habitat and stable sections of the existing channel will not be disturbed or will have minimal disturbance to adjust dimension and profile.

The specific design parameters are described in detail in Section 7. On-site data, restoration project design data, and reference reach data were used in this design and these data are described below and summarized in Table 4.1. Surveyed cross sections from the Site are included in Appendix D. Surveyed profiles of project reaches are provided in the mitigation planset.

Table 4.0 Ratios from Reference Reaches used in the Design of Martin's Creek and its Tributaries
Martin's Creek II Mitigation Project-NCEEP Project #92633

Parameter	MIN	MAX	MIN	MAX
Stream Type (Rosgen)	B4		C4	
Bankfull Mean Velocity, Vbkf (ft/s)	4.0	6.0	3.5	5.0
Width to Depth Ratio, W/D (ft/ft)	12.0	18.0	10.0	14.0
Riffle Max Depth Ratio, Dmax/Dbkf	1.2	1.4	1.1	1.3
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.0	1.1	1.0	1.1
Meander Length Ratio, Lm/Wbkf	N/A	N/A	7.0	12.0
Rc Ratio, Rc/Wbkf	N/A	N/A	2.0	3.0
Meander Width Ratio, Wblt/Wbkf	N/A	N/A	3.5	8.0
Sinuosity, K	1.1	1.2	1.2	1.6
Riffle Slope Ratio, Srif/Schan	1.1	1.8	1.5	2.0
Pool Slope Ratio, Spool/Schan	0	.4	0	.2
Pool Max Depth Ratio, Dmaxpool/Dbkf	2.0	3.5	2.0	3.5
Pool Width Ratio, Wpool/Wbkf	1.1	1.5	1.3	1.7
Pool-Pool Spacing, Lps/Wbkf	1.5	5.0	4.0	7.0

Table 4.1 Reference Reach Geomorphic Parameters: Unnamed Tributary 1 to Martin's Creek (MC-UT1)
Martin's Creek II Mitigation Project-NCEEP Project #92633

	MC UT1 Existing Conditions[2]		MC UT1 Design		Mickey Reach Design	
	Min	Max	Min	Max	Min	Max
1. Stream Type	Eb/Fb/B/G/Cb		B/C		A6a+/B4c	
2. Drainage Area (square miles)	0.09	0.17	0.09	0.17	.45	.45
3. Bankfull Width (w_{bkf}) (ft)	7.8	9.9	7.7	8.5	11.7	21.7
4. Bankfull Mean Depth (d_{bkf}) (ft)	0.5	0.6	0.54	0.71	0.6	1
5. Width/Depth Ratio (W/D ratio)	10.7	55.0	12.0	14.3	10.7	17
6. Cross-sectional Area (A_{bkf}) (ft^2)[3]	3.6	6.2	4.1	6.0	13.1	10.2
7. Bankfull Mean Velocity (v_{bkf}) (ft/s)	4.2(min)	4.4(max)	3.9	4.3	---	---
8. Bankfull Discharge (Q_{bkf}) (ft^3/s) [1]	16	26	16	26	---	---
9. Bankfull Max Depth (d_{mbkf}) (ft)	0.62	1.11	0.7	0.9	.9	2.5
10. d_{mbkf} / d_{bkf} ratio	1.2	1.8	1.3	1.3	1.1	3.1
11. Low Bank Height to d_{mbkf} Ratio	1.0	4.1	1.0	1.0	1	1
12. Bank Height Ratio dlow/dmax	1.0	4.1	1.0	1.0	1	1
13. Floodprone Area Width (w_{fpa}) (ft)	9	>31	16	100	20	410
14. Entrenchment Ratio (ER)	1.2	2.9	2	11.8	1.7	32
15. Meander length (L_m) (ft)	0	0	15	30	70	260
16. Meander length to bankfull width (L_m/w_{bkf})	0	0	1.8	3.8	4.4	17.6
17. Radius of curvature (R_c) (ft)	0	0	30	40	28	47
18. Radius of curvature to bankfull width (R_c / w_{bkf})	0	0	3.8	4.7	2	3
19. Belt width (w_{blt}) (ft)	0	0	40	40	16	55
20. Meander Width Ratio (w_{blt}/W_{bkf})	0	0	4.7	4.7	1.1	4.1
21. Sinuosity (K) Stream Length/ Valley Distance	0	0	1.05	1.4	1.19	1.19
22. Valley Slope – feet per foot	0.015	0.05	0.016	0.06	.0398	.0396
23. Channel Slope ($s_{channel}$) – feet per foot	0.015	0.05	0.01	0.057	.0333	.0333
24. Pool Slope (s_{pool}) (feet per foot)	0	0	0	0	0	.005
25. Pool Slope to Average Slope (s_{pool} / $s_{channel}$)	---	---	0	0	0	.15
26. Maximum Pool Depth (d_{pool}) (ft)	---	---	1.6	2.0	2.2	2.5
27. Pool Depth to Average Bankfull Depth (d_{pool}/d_{bkf})	---	---	2.8	2.9	2	4
28. Pool Width (w_{pool}) (ft)	---	---	12	13	14.3	14.6
29. Pool Width to Bankfull Width (w_{pool} / w_{bkf})	---	---			.9	.9
30. Pool Area (A_{pool}) (ft^2)	---	---	11.5	14.3	14.8	15.9
31. Pool Area to Bankfull Area (A_{pool}/A_{bkf})	---	---	1.9	2.4	1.1	1.2
32. Pool-to-Pool Spacing (L_{ps}/W_{bkf})	30	85	12	45	48	231
33. Pool Spacing to Bankfull Width ($p\text{-}p/w_{bkf}$)	3.0	10.9	1.5	5.8	3	7
34. Riffle Slope (s_{riffle}) (feet per foot)	0.025	0.17	0.01	0.16	.2	1.9
35. Riffle Slope to Average Slope (s_{riffle}/ s_{bkf})	0.45	3.1	1.1	3.5	.2	1.9
36. Particle Size Distribution of Riffle Material - (applies to those riffles built with onsite material)	Fine to Medium Gravel		Fine to Medium Gravel			
d_{16} – mm	0.6	0.8	0.6	0.8		
d_{35} – mm	2.0	4.4	2.0	4.4		
d_{50} – mm	3.6	8.7	3.6	8.7		
d_{84} – mm	15.9	28.0	15.9	28.0		
d_{95} – mm	66.8	102.1	66.8	102.1		

Note:

[1] Existing Qbkf of 16cfs corresponds with the tributary with the smallest flow and drainage area of 0.09, Qbkf of 26 corresponds with the tributary with the largest flow and drainage area of 0.17 sq. mi.

[2] Existing conditions data reflects reference reach data evaluated on MC-UT1.

[3] Minimum values for flow and area (which correspond with the same cross-section) yield greater average velocity that maximum values for flow and area (i.e. $Q_{bkf,min}/A_{bkf,min}=v_{bkf},_{max}$ and vice-versa).

Table 4.2 Reference Reach Geomorphic Parameters: Unnamed Tributary 1-3 to Martin's Creek (MC-UT1-3)
Martin's Creek II Mitigation Project-NCEEP Project #92633

	MC UT1-3 Existing Conditions		MC UT1-3 Design		Mickey Reach Design	
	Min	Max	Min	Max	Min	Max
1. Stream Type	Eb/B/C/F		B/C		A6a+/B4c	
2. Drainage Area (square miles)	0.07	0.08	0.07	0.08	.45	.45
3. Bankfull Width (w_{bkf}) (ft)	5.0	11.4	6	6.5	11.7	21.7
4. Bankfull Mean Depth (d_{bkf}) (ft)	0.29	0.58	0.48	0.49	0.6	1
5. Width/Depth Ratio (W/D ratio)	8.6	39.7	12.5	12.5	10.7	17
6. Cross-sectional Area (A_{bkf}) (ft^2)	2.9	3.3	2.85	3.2	13.1	10.2
7. Bankfull Mean Velocity (v_{bkf}) (ft/s)	2	6	3.8	4.9	---	---
8. Bankfull Discharge (Q_{bkf}) (ft^3/s)	11	14	12	14	---	---
9. Bankfull Max Depth (d_{mbkf}) (ft)	0.87	1.0	0.6	0.6	.9	2.5
10. d_{mbkf} / d_{bkf} ratio	1.0	2.7	1.22	1.25	1.1	3.1
11. Low Bank Height to d_{mbkf} Ratio	1.0	2.7	1.0	1.0	1	1
12. Bank Height Ratio dlow/dmax	1.0	2.7	1.0	1.0	1	1
13. Floodprone Area Width (w_{fpa}) (ft)	10.3	26.2	11	100	20	410
14. Entrenchment Ratio (ER)	1.5	2.7	3.8	15.4	1.7	32
15. Meander length (L_m) (ft)	56	81	65	110	70	260
16. Meander length to bankfull width (L_m/w_{bkf})	4.9	16.2	10.8	16.9	4.4	17.6
17. Radius of curvature (R_c) (ft)	14	28	15	40	28	47
18. Radius of curvature to bankfull width (R_c / w_{bkf})	1.2	5.6	2.5	6.7	2	3
19. Belt width (w_{blt}) (ft)	22	46	26	50	16	55
20. Meander Width Ratio (w_{blt}/W_{bkf})	1.9	9.2	4.3	8.3	1.1	4.1
21. Sinuosity (K) Stream Length/ Valley Distance	1.0	1.4	1.26	1.42	1.19	1.19
22. Valley Slope – feet per foot	0.007	0.04	0.007	0.069	.0398	.0396
23. Channel Slope ($s_{channel}$) – feet per foot	0.007	0.04	0.005	0.054	.0333	.0333
24. Pool Slope (s_{pool}) (feet per foot)	N/A	N/A	0	0	0	0.005
25. Pool Slope to Average Slope (s_{pool} / $s_{channel}$)	N/A	N/A	0	0	0	0.15
26. Maximum Pool Depth (d_{pool}) (ft)	N/A	N/A	1.6	1.6	2.2	2.5
27. Pool Depth to Average Bankfull Depth (d_{pool}/d_{bkf})	N/A	N/A	2.7	2.7	2	4
28. Pool Width (w_{pool}) (ft)	N/A	N/A	9	11	14.3	14.6
29. Pool Width to Bankfull Width (w_{pool} / w_{bkf})	N/A	N/A	1.4	1.7	0.9	0.9
30. Pool Area (A_{pool}) (ft^2)	3.0	3.0	8	10.2	14.8	15.9
31. Pool Area to Bankfull Area (A_{pool}/A_{bkf})	0.9	1.0	2.5	3.2	1.1	1.2
32. Pool-to-Pool Spacing (L_{ps}/W_{bkf})	20	100	10	60	48	231
33. Pool Spacing to Bankfull Width (p-p/w_{bkf})	1.8	20	1.6	9.2	3	7
34. Riffle Slope (s_{riffle}) (feet per foot)	0.013	0.10	0.01	0.18	0.2	1.9
35. Riffle Slope to Average Slope (s_{riffle}/ s_{bkf})	0.5	3.6	0.7	1.6	0.2	1.9
36. Particle Size Distribution of Riffle Material - (applies to those riffles built with onsite material)	Fine Gravel		Fine Gravel			
d_{16} – mm	0.3		0.3			
d_{35} – mm	1.1		1.1			
d_{50} – mm	3.5		3.5			
d_{84} – mm	12.1		12.1			
d_{95} – mm	15.7		15.7			

Notes: Existing conditions data reflects reference reach data evaluated on MC-UT1-3. No sediment data was collected for the restoration reach of UT1-3 due to the extremely poor substrate currently present. The restoration reach will be designed to facilitate bedload transport based on particle sizes observed upstream in the enhancement reach of UT1-3. See Section 7.3.1 for a discussion on the selection of particle sizes used to supplement channel substrate and construct riffles.

5.0 PROJECT SITE WETLANDS (EXISTING CONDITIONS)

5.1 Jurisdictional Wetlands

The proposed project area was reviewed for the presence of wetlands and waters of the United States in accordance with the provisions on Executive Order 11990, the Clean Water Act, and subsequent federal regulations. Wetlands have been identified by the USACE as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(b) and 40 CFR 230.3 (t)). The areas in the project boundaries that displayed one or more wetland characteristics were reviewed to determine the presence of wetlands. The wetland characteristics included:

1. Prevalence of hydrophytic vegetation.
2. Permanent or periodic inundation or saturation.
3. Hydric soils.

On June 5, 2007, the USACE and US Environmental Protection Agency (USEPA) issued joint guidance for their field offices for Clean Water Act jurisdictional determinations in response to the Supreme Court's decision in the consolidated cases of Rapanos v. United States and Carabell v. United States (USEPA and USACE, 2007). Based on this guidance, the agencies will assert jurisdiction over the following waters:

- Traditional navigable waters (TNWs)
- Wetlands adjacent to TNWs
- Non-navigable tributaries of TNWs that are considered relatively permanent waters (RPWs). Such tributaries flow year-round or exhibit continuous flow for at least 3 months.
- Wetlands that directly abut RPWs.

The agencies will decide jurisdiction over the following waters based on a standardized analysis to determine whether they have a significant nexus with a traditional navigable water:

- Non-navigable tributaries that are not relatively permanent waters (non-RPWs)
- Wetlands adjacent to non-RPWs
- Wetlands that are adjacent to but do not directly abut an RPW.

The significant nexus analysis is fact-specific and assesses the flow characteristics of a tributary and the functions performed by all its adjacent wetlands to determine if they significantly affect the physical, chemical, and biological integrity of downstream TNWs. A significant nexus exists when a tributary, in combination with its adjacent wetlands, has more than a speculative or insubstantial effect on the physical, chemical, or biological integrity of a TNW.

The USACE and USEPA will apply the significant nexus standard within the limits of jurisdiction specified by the Supreme Court decision in the case of Solid Waste Agency of Northern Cook County (SWANCC) v. US Army Corps of Engineers. Under the SWANCC decision, the USACE and USEPA cannot regulate isolated wetlands and waters that lack links to interstate commerce sufficient to serve as a basis for jurisdiction under the Clean Water Act. Though isolated wetlands and waters are not regulated by the USACE, within the state of North Carolina isolated wetlands and waters are considered "waters of the state" and are regulated by the NCDWQ under the isolated wetlands rules (15A NCAC 2H .1300).

Following an in-office review of the National Wetland Inventory (NWI) map, NRCS soil survey, and USGS quadrangle map, a field survey of the project area was conducted May and June 2008, December 2008, and January 2009 to delineate wetlands and waters of the U. S. The project area was examined utilizing the jurisdictional definition detailed in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987). Supplementary information to further support wetland determinations was found in the *National List of Plant Species that Occur in Wetlands: Southeast (Region 2)* (Reed, 1988).

Based on the findings of the wetland delineation, three pockets of emergent wetlands (low mountain alluvial forest type) totaling 1.53 acres are present in the low elevation fields at the Martin's Creek project site (Appendix F). In addition, two small wetlands approximately .08 acres in size are present near MC-UT1 upstream of the barn and are supported by toe-slope drainage. Information on buried hydric soils located during wetland delineation surveys, ground water wells currently being monitored on-site, and topographic information have provided Baker with enough data to propose approximate boundaries for an additional total 5.2 acres of wetlands to be restored under this project.

The original plant community located in these wetlands was most likely typical of other forested wetlands in the region; however, past agricultural land use practices have altered the composition of the plant community currently present. At least three wetlands are supported by toe-slope seepage; the other two wetlands appear to be hydrologically linked to MC-UT1-3, which most likely followed a different pattern to Martin Creek in the past. It could be argued that the wetlands that are fed by toe-slope drainage or wetlands on-site that are hydrologically linked to a 1st order stream might once have been headwater forest wetlands given the forested conditions that were most likely present prior to the conversion of the project area for agricultural use. It is also entirely possible that the wetlands present might have historically been low mountain alluvial forested wetlands. This wetland type is also a reasonable approximation of the historic wetland type given the landscape positioning and proximity of the wetland complexes to nearby streams. Given the degree of disturbance to the vegetation community of the wetlands present, the extensive channel alteration that has occurred, and limited indicators present to identify the historic wetland type, the decision was made to restore the project wetlands as low mountain alluvial forest wetlands.

These wetlands have formed as a result of depressional topography, poor drainage, and groundwater discharge. These existing wetlands will be incorporated into the design as wetland enhancement areas. Through the proposed stream and wetland restoration practices, these areas will experience a more natural hydrology and flooding regime once the project is completed. In addition, the exclusion of livestock from the area will provide long-term protection. Since most of the existing wetlands are dominated by herbaceous wetland species, some of the area will also be planted with native woody vegetation that is tolerant of flooded conditions.

5.1.1 Wetland Impacts

All identified areas of existing wetlands and potential wetland restoration are located on the bottomland parcel (parcel that is located along Martin's Creek Road and Crisp Road). Under existing conditions, the bottomland parcel is partially drained by a ditch that runs southwest to northeast through the area, and intercepts flow coming into the site from a small stream in the southwestern corner of the parcel. It is likely that historically the small stream meandered through the bottomland areas of the site, providing much of the hydrology of the historic wetland system that has now been lost. There are now terra-cotta drainage tiles installed in the bottomland areas of the field that provide additional drainage. The eastern edge of the parcel is also drained by Martin's Creek, which is an incised stream system that exerts a drainage effect on the adjacent fields. The only existing wetlands on the parcel are toe-slope seepage wetlands that are located in isolated pockets along the western portion of the parcel and isolated wetland pockets adjacent to MC UT1-3, that total approximately 1.61 acres.

The majority of wetland areas once present in the center of the bottomland parcel were drained and filled in the past to promote agricultural land uses, and stream flows were diverted to a ditch along the toe of the upland slope. Soil investigations have shown that portions of the former wetland areas are overlain with 12 – 24 inches of upland soils. The goal of the mitigation plan for the parcel is to restore the historic stream and associated wetland system as closely as possible to predicted pre-disturbance conditions. Temporary wetland impacts associated with the restoration activities are considered minimal and required for overall restoration success. These temporary impacts, which total approximately .24 acres, will involve surface roughening, removal of exotic, invasive vegetation, re-establishment of wetland vegetation native to the region and minor adjustments to drainage patterns as necessary to restore channel pattern to MCUT1 and MCUT1-3 and to improve wetland hydrology. Stream and wetland restoration measures will not negatively impact the hydrology, vegetation and soils of the existing wetlands. It should be noted that efforts were taken during the design process to minimize impacts to existing jurisdictional wetlands. While restoring sinuosity to MCUT1 and MCUT1-3, pattern adjustments were made that resulted in the channels being located along the fringe of the existing wetlands. Pattern adjustments to MCUT1 will actually be making use of a relic channel utilized by this stream before it was relocated some time in the past.

5.1.2 Jurisdictional Wetland Findings

On-site surveys of the project areas were conducted in May and June 2008, December 2008, and January 2009 to identify potential U.S. Army Corps of Engineers (USACE) jurisdictional wetland locations and perennial and intermittent streams in the project area. Based on the findings of the wetland delineation, emergent wetlands (headwater forest type) are present in the bottomland parcel along Martin’s Creek Road (Appendix B). Information on buried hydric soils located during wetland delineation surveys, ground water wells currently being monitored on-site, and topographic information have provided Baker with enough data to propose approximate boundaries for wetland restoration, enhancement, and preservation activities.

Wetland locations were determined by evaluating existing soils, hydrology and hydrophytic vegetation within the project reaches. The original plant community located in these wetlands was most likely typical of other headwater forest wetlands in the region; however, past agricultural land use practices have altered the composition of the plant community currently present. Wetland boundaries were delineated and have been accepted by the USACE in a jurisdictional determination dated March 12, 2009. In total, there are 7.53 acres of existing wetlands on the project property (Figure 3), that will be restored or enhanced.

5.1.3 Palustrine Emergent Wetlands (Low Mountain Alluvial Forest)

This group encompasses forested, seasonally and semipermanently flooded bottomland sites of the Piedmont and valleys in the lower elevation Blue Ridge Province. The wetlands on the project site have been cleared in the past for agricultural purposes. Consequently, vegetation present consists of shrubs, rushes, grasses and herbaceous cover and differs somewhat from the typical plant composition present in this type of wetland. According to Schafale and Weakley, shrubs common to this wetland type include spicebush (*Lindera benzoin*), redtwig doghobble (*Leucothoe recurva*), beaked hazelnut (*Corylus cornuta*), and silky dogwood (*Cornus amomum*). Vines typically present include poison ivy (*Toxicodendron (Rhus) radicans*), Virginia creeper (*Parthenocissus quinquefolia*), crossvine (*Bignonia(Anisostichus) capreolata*), and wild grape (*Vitis spp*). Herbaceous cover usually consists of star chickweed (*Stellaria pubera*), blue-stemmed goldenrod (*Solidago caesia)*, Eastern star (*Aster divaricatus*), broad looseflower sedge (*Carex laxiflora*), Virginia wildrye (*Elymus virginicus*), rattlesnake fern (*Botrychium virginianum*), small spike false nettle (*Boehmeria cylindrical*), eastern bottlebrush grass (*Elymus hystrix (Hystrix patula)*), white avens (*Geum canadense*), wingstem (*Verbesina alternifolia*), and violet (*Viola spp*). Many places are heavily invaded by Japanese honeysuckle (*Lonicera japonica*) and Japanese stiltgrass (*Microstegium vimineum*) at the expense of native herbs.

5.2 Hydrological Characterization

5.2.1 Site Hydrology

Local drainage patterns of the bottomland parcel have been altered in the past to increase drainage and promote agricultural production. During conversion of the area to agriculture, flow from UT1-3 was diverted into a ditch that runs from the southwest corner of the parcel to its confluence with UT1 on the northern end of the parcel. Drainage tiles were installed in lowest portion of the field to provide further drainage, and upland fill material was placed over the low-lying areas to promote drier conditions for agriculture. Martin's Creek, which flows along the eastern edge of the parcel, was channelized and straightened, lowering the base flow elevation of the stream and providing additional drainage to the agricultural field areas. The existing hydrology of the site is controlled by the ditch, the channelized stream systems, and the drainage tiles that were placed through the center of the parcel. There are five existing wetland pockets, totaling 1.61 acres that are supported primarily by toe-slope seepage or hydrologic connectivity to MC UT1-3.

Six automated groundwater wells were installed in the project area to evaluate current hydrologic conditions on-site, as shown in Figure 3.0. These wells provide a basis for comparing pre- and post-restoration hydrology on the site. Water table data were collected from the wells from November 2008 through November 2009, as shown in Figure 5.0. The wells were installed in existing pasture and field areas targeted for wetland restoration and wetland enhancement. Wells were installed across a range of elevations and locations to evaluate the range of hydrologic conditions on-site. The wells were installed to a depth of approximately 41 inches below ground surface, and the automated loggers (RDS EcotoneTM WM units) were programmed to record water table levels every two hours.

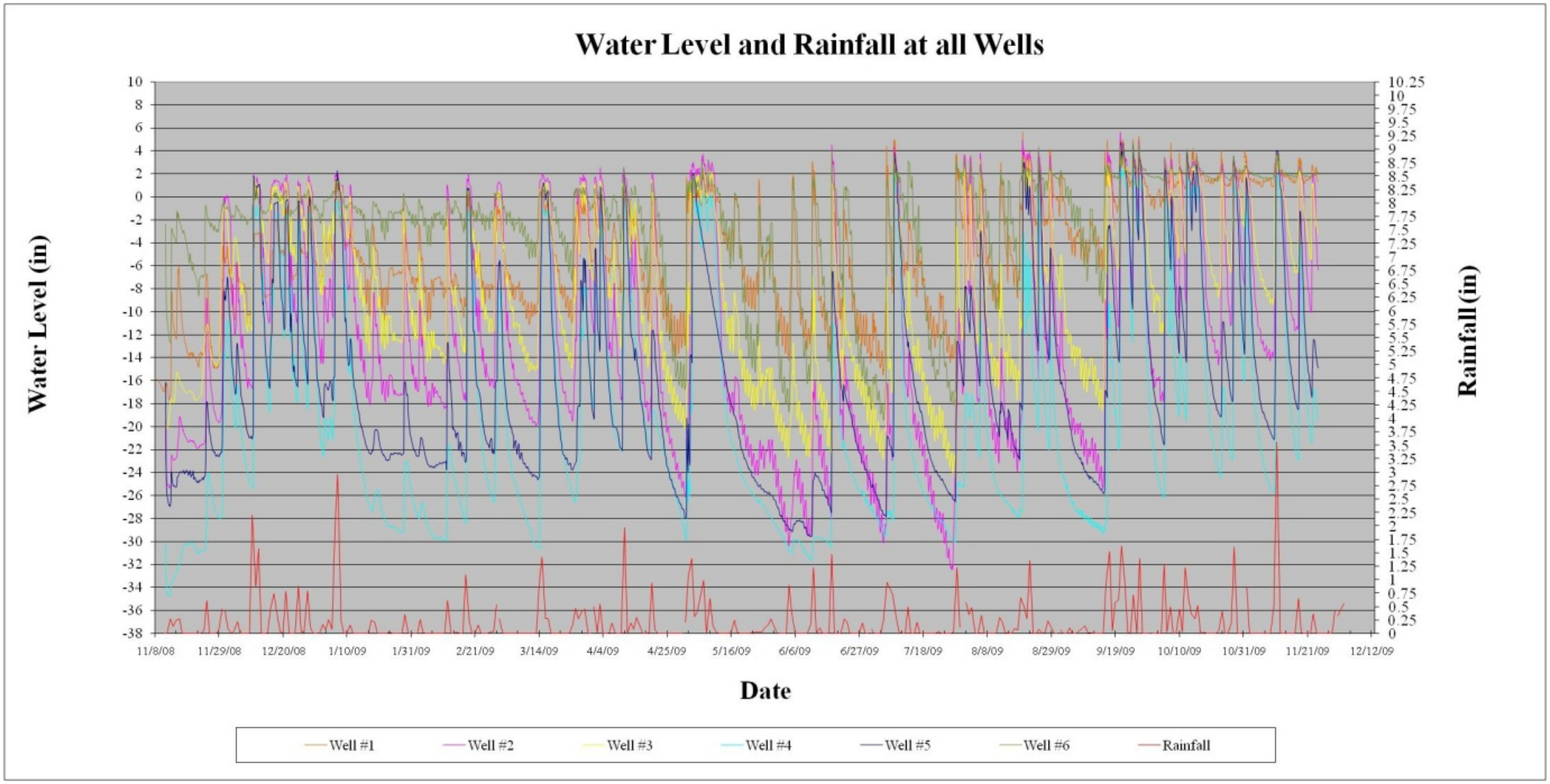
Well locations exhibited similar trends in water table depth throughout the monitoring period that in part reflect seasonal changes in rainfall and evapotranspiration. Due to wetter than average conditions during the monitoring period, water table levels were relatively high for most well locations during the monitoring period. Water table depths were highest during the fall and early winter of 2009, when rainfall during September, October, and November 2009 was considerably greater than the long-term average (Figure 5.1). Water table levels remained relatively high for all locations during this period, due to frequent heavy rainfall. Water table levels were at their deepest during June and July 2009, when rainfall was slightly below average and evapotranspiration losses were at their greatest.

Wells 1 and 6 experienced the highest water table levels during the monitoring period. Well 6 is located within one of the existing wetland areas on the site, and is supported by groundwater seepage during much of the year. As a result, water table levels during early and late 2009 were at or near the surface for Well 6. Well 1 is located just outside a jurisdictional wetland boundary, and therefore reflects the higher water table levels of the adjacent wetland. From early December 2008 through April 2009, water table depths at Well 1 were less than 12 inches below the ground surface, and generally deeper than water table levels at Well 6. During the summer months, the trend reversed with deeper water table levels at Well 6 as compared to Well 1. These data indicate that the groundwater and seepage discharge at the Well 1 location are stronger during the summer months than the Well 6 location.

Wells 3, 2, 5, and 4 exhibited progressively drier conditions, respectively, and document that the majority of the site does not currently support wetland hydrology in its drained condition. All wells are located in areas that were likely impacted by fill material that was placed over the field in the past. Of the four well locations, Well 3 is located a relatively low elevation near the middle of the field. Well 3 data show a rapid decrease in water table levels following rainfall events, attributed to the close proximity of the drain tiles that run through the center of the field. However, due to the relatively low topographic elevation, water table depths did not drop deeper than a depth of 24 inches during the monitoring period.

Wells 2, 4, and 5 exhibited very similar hydrologic responses throughout the monitoring period. Each shows a tendency for rapid drop in water table levels following rainfall events, due to onsite drainage. Well 2 is located close to the drainage tiles that run through the center of the field, and is at a higher elevation than Well 3. Well 4 is located the closest to Martin’s Creek and appears to exhibit some drainage effect from its proximity to the incised stream channel. Well 5 is located at a relatively high elevation between Martin’s Creek and the channelized UT1-3.

Figure 5.0 Hydrographs of the Groundwater Monitoring Wells Compared to Local Rainfall (November 2008 through November 2009).



5.2.2 Climatic Conditions

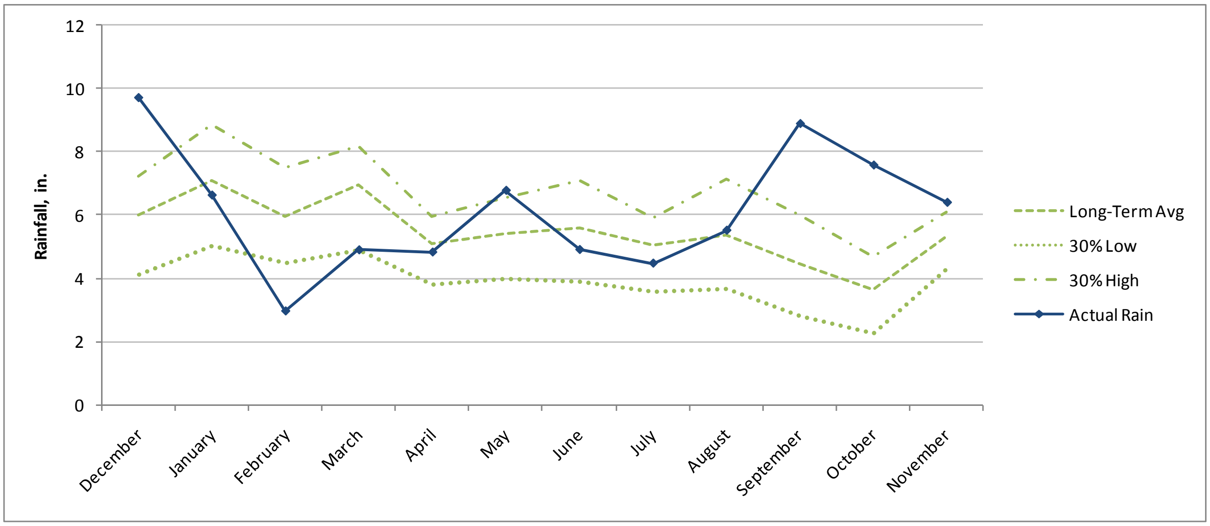
The average growing season (defined as the period in which air temperatures are maintained above 28 degrees Fahrenheit at a frequency of 5 years in 10) for the project locale is 190 days, beginning on April 14 and ending October 21 (Cherokee County WETS Table 37039, Andrews, NC: NC0184). The Town of Andrews, located approximately 15 miles northeast of the project site, experiences an average annual rainfall of 66 inches (Andrews, NC: NC0184). In much of the southeastern US, average rainfall exceeds average evapotranspiration losses and these areas experience a moisture excess during most years. Excess water leaves a site by groundwater flow, runoff, channelized surface flow, or deep seepage. Annual losses due to deep seepage, or percolation of water to confined aquifer systems, are usually small and are not considered a significant loss pathway for excess water. Although groundwater flow can be significant in some systems, most excess water is lost via surface and shallow subsurface flow.

Monthly precipitation amounts observed at a nearby weather station from December 2008 through November 2009 are compared with Cherokee County WETS table average monthly rainfall in Table 5.0 and Figure 5.1. Rainfall during the summer months of 2009 approximated normal rainfall conditions; however, rainfall amounts in the fall and early winter of 2009 greatly exceeded normal rainfall and promoted wet conditions across the site. Observed rainfall data were provided by the nearest automated weather station, located in the Town of Murphy (Station 316001).

Table 5.0 Comparison of Monthly Rainfall Amounts for Project Site and Long-term Averages
Martin's Creek II Mitigation Project-NCEEP Project #92633

Month-Year	Observed Monthly Precipitation (in)	WETS Table Average Monthly Precipitation (in)	Deviation of Observed from Average (in)
Dec-08	9.72	6.02	+3.7
Jan-09	6.64	7.1	-0.46
Feb-09	2.98	5.97	-2.99
Mar-09	4.91	6.97	-2.06
Apr-09	4.84	5.11	-0.27
May-09	6.79	5.43	+1.36
Jun-09	4.92	5.58	-0.66
Jul-09	4.49	5.05	-0.56
Aug-09	5.53	5.38	+0.15
Sep-09	8.9	4.44	+4.46
Oct-09	7.59	3.63	+3.96
Nov-09	6.41	5.33	+1.08
Sum	**73.72**	**66.01**	**+7.71**

Figure 5.1. Graphical Comparison of Observed Rainfall with Long-term Average Conditions.



5.3 Soil Characterization

While a recent Cherokee County Soil Survey is not available, older soil delineation maps on file with the NRCS indicate that the floodplain areas of the site are mapped primarily as Arkaqua loam, while the toe slopes are mapped primarily as Dillard loam. Arkaqua loam consists of somewhat poorly drained soils commonly found on nearly level flood plains along creeks and rivers in the Appalachian, Blue Ridge, and Great Smokey Mountains. The Arkaqua series is considered to be a Hydric "B"soil by the NRCS. Dillard loam consists of moderately well drained soils found on narrow, nearly level to sloping stream terraces and toe slopes. The Dillard series is not considered a hydric soil by the NRCS. The fact that there are existing jurisdictional wetlands that have been delineated within the mapped areas of Dillard soils indicates that the soil mapping in these areas is not accurate.

To further investigate the soil conditions present on the site, Baker contracted with ECS Carolinas LLP to conduct a detailed soils evaluation of the site. During December 2009, a licensed soil scientist from ECS evaluated the site to determine the depth of hydric soil conditions and the presence of buried hydric soil layers in the bottomland parcel. Assessments were carried out using hand-augers and backhoe pits every 50 feet along transects across the field areas. The assessment report developed by ECS is provided in Appendix F.

The results of the assessment indicate the presence of hydric indicators at depths typically ranging from 14 – 22 inches across much of the field areas (floodplain) adjacent to Martin's Creek. In several locations within the field, a "dark grayish loam A horizon" was discovered at a depth of approximately 14 – 22 inches. These results, along with observations of terra cotta drain tiles within the field, provide strong evidence that upland soils were placed over much of the field area in the past to promote better agricultural production from the field areas. It is possible that the upland soils placed on the field came from road construction nearby; thus, the field was likely used as a disposal area for excess spoil material. This practice was not uncommon prior to regulations protecting stream and wetlands, as it provided landowners and farmers with a way to convert wet fields into dry fields at little if any cost.

5.4 Plant Community Characterization

The proposed restoration area is comprised of pasture fields. Vegetation within these open pasture fields is primarily comprised of Fescues (*Festuca* spp.) and other common pasture grasses. Multiflora rose (*Rosa multiflora*), and invasive exotic species, can also be found in clumps within the pasture areas. During 2009, cattle had access to the pasture fields and kept edible herbaceous vegetation grazed to a low height.

6.0 REFERENCE WETLANDS

6.1 Hydrological Characterization

The reference wetland site for the project is located on-site within the existing wetland pockets that have been delineated as part of the project (see Jurisdictional Wetlands section). The site is located approximately 200 feet west of the proposed wetland restoration areas in the bottomland parcel.

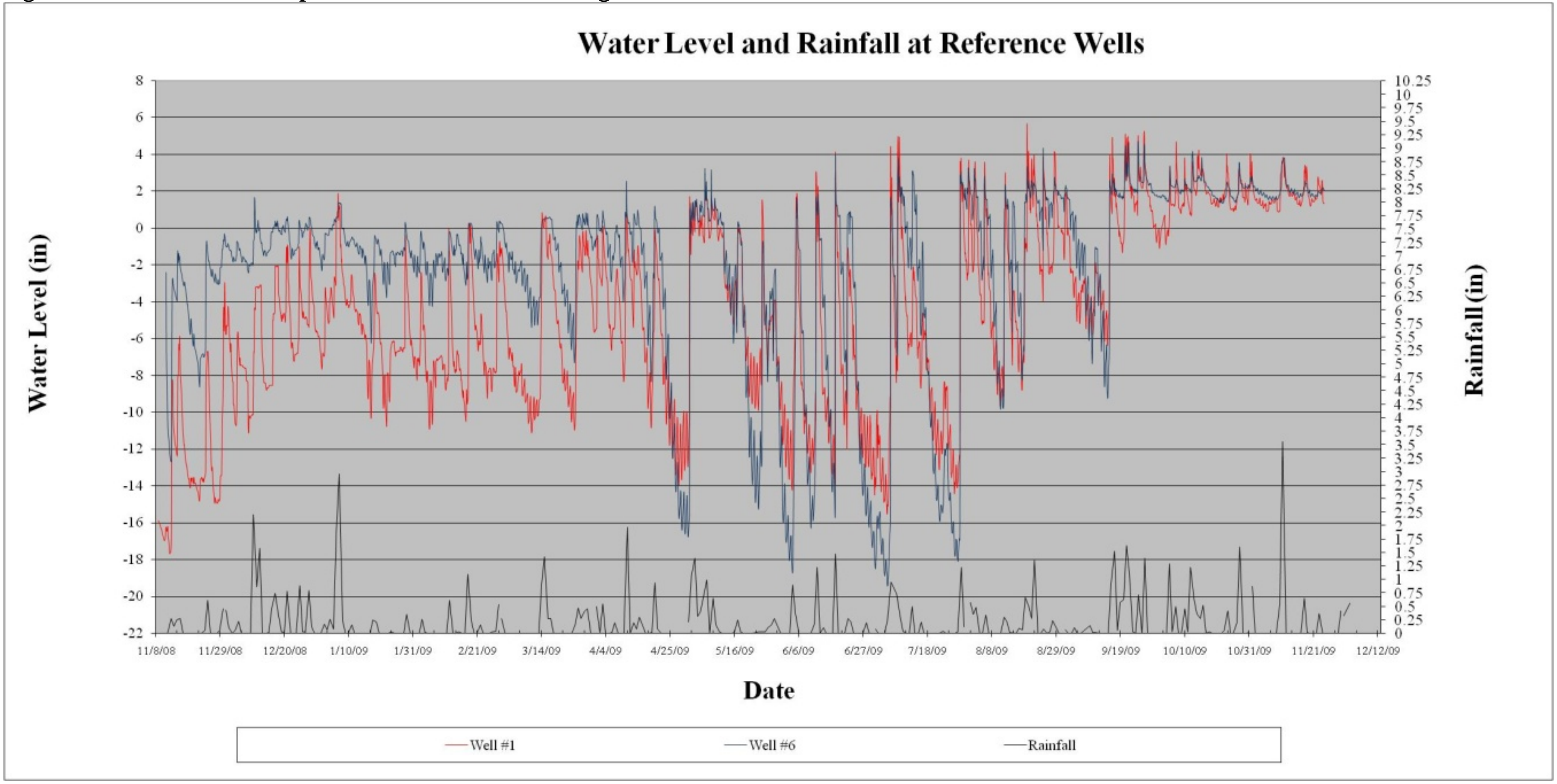
The reference area is currently used as cattle pasture; therefore, the site is disturbed and consists primarily of herbaceous hydrophytic vegetation. The site is proposed as an onsite hydrologic reference, and will not be used to infer appropriate vegetation communities for restoration areas. The hydrology of the reference site will be compared with the restoration site during dry years when the hydrology of the restoration site may not meet defined success criteria, to determine if the dry conditions are climatic in nature.

Hydrology of the reference site is driven by both groundwater discharge and periodic flooding of the tributary stream channels.

6.1.1 Gauge Data Summary

Two automated recording wells (Wells #1 and #6) were installed within the existing wetlands onsite during December 2008. Well #1 is located in the existing wetland pocket in the southwestern corner of the bottomland parcel, while Well #6 is located in the larger wetland area on the northern side of the bottomland parcel. The wells were programmed to record groundwater levels every 2 hours to a maximum depth of 40 inches. During the monitoring period from December 2008 through November 2009, the two well locations documented consistently higher average water table levels than the remaining wells that were installed in the proposed restoration areas. During the monitoring period, Well #6 exhibited wetter conditions during the winter months (dormant season), while Well #1 exhibited wetter conditions during the driest part of the growing season (April –August). One possible conclusion from these data is that the wetland area monitored by Well #1 is driven more strongly from groundwater discharge and hillslope seepage (which would provide more stable water table levels throughout the year), whereas Well #6 is driven more by water supplied from the nearby small tributary, which decreases dramatically during the summer months. This conclusion is supported by the locations of the wells in relation to site features; Well #1 is located at the down-valley edge of a seepage wetland, whereas Well #6 is located near the small tributary the flows south to north across the bottomland parcel. Average water table levels for Well #1 ranged from approximately -8 inches during the spring months to -12 inches during the summer months. Well #6 average water table levels ranged from -3 inches during the spring months to -16 inches during the summer months.

Figure 6.1 Water Table Depths Recorded in Monitoring Wells Installed within the Reference Site.



6.2 Soil Characterization

The soils located in the vicinity of the reference wetland are mapped as the Dillard loam and Arkaqua loam series on past soil map delineation files that are available at the local NRCS office (no Soil Survey is currently available for Cherokee County). Taxonomic classification and profile information for these soils is provided in Section 2.3. Arkaqua soils are considered somewhat poorly drained and hydric by the NRCS, while Dillard soils are moderately well drained and are not hydric. Two of the delineated existing wetland pockets on the bottomland parcel are located within the mapped area of Dillard soils. This indicates that the mapping of Dillard soils in these areas is incorrect.

Soils of the existing wetland areas were examined by ECS Carolinas LLP as part of their wetland delineation of the site. Soils within the boundaries of the existing wetland pockets were described as having low-chroma soil matrix values, aquic moisture regimes, and exhibited redoximorphic features.

7.0 PROJECT SITE MITIGATION PLAN

This section relates the goals and objectives of the Martin Creek mitigation project to the goals identified in the Peachtree-Martins Creek LWP. It also covers the design criteria selected for stream restoration and enhancement on the Martin Creek project site.

The design proposed for the project will include Restoration and Level I and II Enhancement approaches. Enhancement II approaches will address exotic invasive species and localized erosion. The justification for this is to help establish native species that provide terrestrial and aquatic benefits. Minor erosion repair is warranted from prior crossing and livestock impacts or other localized instability. Restoration and enhancement of streams and wetlands at the Martin Creek Site are justified for the following reasons:

1. Streams for which restoration or enhancement work is proposed have been channelized, bermed, and moved against the sides of the valleys or perched up on the hill slope. Most are incised along much of their length. Pattern, profile and dimension adjustments to the channels will reduce erosion, improve floodplain connectivity, and improve floodplain hydrology necessary for wetland restoration.
2. Wetlands have been drained, filled and otherwise manipulated to create more land suitable for agricultural purposes; and
3. There are widespread cattle impacts that have resulted in erosion and sedimentation, silt-clogged stream channels and the loss of woody vegetation within the riparian zone.

A Priority 1 approach, involving construction of a new channel on the existing floodplain, will be applied to Reach 2 of MC-UT1. This work will remove the channel from the toe of the valley wall. Level I Enhancement efforts will be used to create grade control, repair bank erosion and restore proper dimension on Reach 3. For Reach 4, a Priority 1 approach will be used to reconnect the channel to its relic channel and where there is no relic channel a new channel will be constructed that uses the valley elevation as the new floodplain. This project is similar to a Priority 2 project in that the valley floor will be lowered to restore wetlands, but like Priority 1 in that the new channel will be aligned on this new valley floor. We are calling it a Priority I restoration because the valley lowering is associated with the wetland restoration and not the stream restoration. The new stream channel will utilize the new valley as its floodplain. Exotic invasive removal and re-planting with native vegetation will be conducted on all reaches.

On UT1-3, the upper reach (Reach 1) will be restored with an Enhancement I approach, involving grade control structures to improve grade, habitat, and sediment transport, as well as with bank repairs and stream dimension adjustments to achieve stability. Reach 2 will be the same Restoration approach as UT1 Reach 4, will a new valley being constructed to restore wetlands and the pre-impact soil profile. The proposed meandering pattern is appropriate for a low slope stream with adjacent wetlands, and will have structure and habitat elements. Exotic invasive removal and re-planting with native vegetation will be conducted on both reaches.

The stream types for the restored streams will be Rosgen “B” and “C” channels with design dimensions based on reference reaches, hydraulic and sediment transport analyses and geomorphic ratios and guidance from past projects. Tributaries on the hill slopes will have minimal pattern adjustment since they are already located in the lowest part of the valley and are naturally low sinuosity streams. They will have their dimension and profile adjusted to address unstable stream banks and significant changes in profile slope that indicates head cutting.

The restoration and enhancement design for the Martin’s Creek Site will allow stream flows at or larger than bankfull, to spread onto the restored floodplain, dissipating flow energies and reducing the stress on streambanks. Where abandoned, the old stream channels will be backfilled using fill material generated by the grading of new channel and floodplain benches. Any excess fill material generated during construction will be disposed of on-site in designated disposal areas. In-stream structures will be used to control streambed grade, reduce stresses on streambanks, and promote diversity of bedform and habitat. In-stream structures may consist of constructed riffles, boulder drop structures, and rock or log vanes. Reach-wide grade control will be provided by the aforementioned in-stream structures, constructed riffles and by bedrock where present. Structures will be spaced at a maximum distance that results in the downstream header protecting the upstream footer to create a redundancy that will ensure long-term vertical stability. Where possible, both wood and rock will be incorporated into the structures to promote a diversity of habitat features. Streambanks will be stabilized with a combination of bioengineering measures, erosion control matting, bare-root plantings, and live staking. This section discusses the design criteria selected for stream restoration on the Martin's Creek Site.

7.1 Mitigation Project Goals and Objectives

As noted in the Executive Summary, the Martins Creek mitigation project area lies within the focus area of the Peachtree-Martins Creek Local Watershed Plan (LWP) and roughly corresponds to Restoration site # 1 & Preservation site # 1 of the LWP project atlas. Among the goals of the plan is the desire to work with local landowners, resource agencies and nongovernmental groups to implement wetland and stream restoration projects that reduce sources of sediment and nutrients by restoring riparian buffers, stabilizing stream banks, and restoring natural channel geomorphology, particularly in headwater streams. The NCEEP is also placing an emphasis on projects that contribute to the restoration and protection of habitat for priority fish, mussel, snail and crayfish species in the basin (NCEEP, 2008).

To support these watershed goals, several project goals have been established for the Martin's Creek mitigation project:

- Restore geomorphically stable stream channels within the Martin's Creek II mitigation project area,
- Restoration or enhancement of wetlands on- site,
- Exclude livestock from accessing the project streams, wetlands, and riparian zones,
- Improve and restore hydrologic connections and achieve uplift of ecosystem functions,
- Improve water quality within the Martin's Creek II project area through reduction of bank erosion, improved nutrient and sediment removal, and stabilization of streambanks,
- The restoration and preservation of headwater tributaries to the Peachtree-Martins Creek Watershed and the Hiwassee River, and
- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, reduction of water temperature, and restoration of riparian habitat.

In order to accomplish the goals of the project and contribute to the overall success of goals set forth for the greater Peachtree-Martins Creek local watershed planning area, a number of general project objectives followed by design objectives were identified for this project and are listed below:

- Utilize natural channel design concepts to restore or enhance channel profile, pattern and dimension to reduce bank and channel profile degradation and to allow greater floodplain connectivity to aid in the dissipation of energy during bankfull or greater flows;
- Reduce streambank degradation and sediment and nutrient inputs by limiting livestock access of project tributaries to crossings agreed upon between the NCEEP and the landowner;
- Further reduce sediment and nutrient inputs and streambank instability by restoring or enhancing native riparian vegetation along a 30-foot buffer along the project reach.
- Improve bedform function and diversity by installing toe wood structures and grade control structures that also function to improve riffle and scour pool habitat.

Design objectives:

- Make important design decisions based on geomorphic analyses, reference conditions and supporting information from hydraulic modeling,

- Use constructability as a guiding consideration in order to produce a realistic design that is possible to build given field constraints and construction tolerances. Design ideas are discussed with knowledgeable construction personnel to determine the constructability, likely footprint, and severity of impacts to on-site resources,
- Minimize disturbance to ecologically functional and physically stable areas; mimic the character of these areas and borrow materials from them where appropriate to create a more natural design, and
- The over-all design approach, including proposed structures, will attempt to use native materials and minimize materials brought onsite in order to produce habitat favoring native flora and fauna, reduce compaction and site disturbance from material transport, and produce an aesthetically pleasing result.

The Martin's Creek II project site is an appropriate candidate for restoration, as significant erosion will occur before streams in the project area achieve a stable, quasi-equilibrium state. Although aggradation is present, overall stream conditions present on-site reflect varying degrees of incision and continued degradation. Bank erosion will continue contributing sediment to areas downstream of the project site and will cause widening of the stream. If implemented, project restoration and enhancement objectives will help to stabilize the channel, halt incision and widening, and significantly diminish bank erosion. The Martin's Creek II project will also support the LWP and river basin restoration plan priorities and goals by reducing sediment and nutrient loading into tributaries to Martin's Creek through the restoration or enhancement of riparian buffers, stabilizing streambanks and channel morphology through natural channel design concepts, and managing livestock access within the project area. This project will further improve terrestrial and aquatic habitat conditions through the reestablishment of a stable riparian corridor and more stable channel morphology.

The accompanying plans depict the proposed restoration measures. The application of these measures is described below according to reach.

Martin's Creek (Mainstem)

Due to the location of the overhead power lines and the corresponding utility corridor easement, a conservative (low level of effort) approach will be taken to address the mainstem of Martin's Creek. This channel will be restored using an Enhancement II approach, which will consist primarily of the removal of invasive vegetation and replanting with native, woody vegetation, as well as the removal of parts of the berm, thereby restoring floodplain connectivity during lower return interval flood events. In addition, invasive species treatment and reforestation of the riparian zone with low growing woody vegetation will be done to improve overbank flow filtration, shading and rootmass density along the stream corridor.

MC-UT1-1 and MC-UT1-2

These reaches will be protected through preservation. While no restoration work will be done on these reaches they will be protected from future development through the establishment of an conservation easement that will take in the channel and riparian zone.

MC-UT1

Of the four reaches, three are slated for some level of enhancement or restoration. Only Reach 1 is slated for Preservation as described above.

Reach 2 will be addressed with a Restoration approach. A Priority 1 approach, involving construction of a new channel on the existing floodplain, will be applied to remove the channel from the toe of the right valley wall. The design approach calls for dimension, profile and pattern adjustments with grade control used to protect the reach from down cutting, thus providing vertical stability. This will also protect the restored site from headcutting that could move upstream from a transition reach between Reaches 2 and 3 that could not be

- Use constructability as a guiding consideration in order to produce a realistic design that is possible to build given field constraints and construction tolerances. Design ideas are discussed with knowledgeable construction personnel to determine the constructability, likely footprint, and severity of impacts to on-site resources,
- Minimize disturbance to ecologically functional and physically stable areas; mimic the character of these areas and borrow materials from them where appropriate to create a more natural design, and
- The over-all design approach, including proposed structures, will attempt to use native materials and minimize materials brought onsite in order to produce habitat favoring native flora and fauna, reduce compaction and site disturbance from material transport, and produce an aesthetically pleasing result.

The Martin's Creek II project site is an appropriate candidate for restoration, as significant erosion will occur before streams in the project area achieve a stable, quasi-equilibrium state. Although aggradation is present, overall stream conditions present on-site reflect varying degrees of incision and continued degradation. Bank erosion will continue contributing sediment to areas downstream of the project site and will cause widening of the stream. If implemented, project restoration and enhancement objectives will help to stabilize the channel, halt incision and widening, and significantly diminish bank erosion. The Martin's Creek II project will also support the LWP and river basin restoration plan priorities and goals by reducing sediment and nutrient loading into tributaries to Martin's Creek through the restoration or enhancement of riparian buffers, stabilizing streambanks and channel morphology through natural channel design concepts, and managing livestock access within the project area. This project will further improve terrestrial and aquatic habitat conditions through the reestablishment of a stable riparian corridor and more stable channel morphology.

The accompanying plans depict the proposed restoration measures. The application of these measures is described below according to reach.

Martin's Creek (Mainstem)

Due to the location of the overhead power lines and the corresponding utility corridor easement, a conservative (low level of effort) approach will be taken to address the mainstem of Martin's Creek. This channel will be restored using an Enhancement II approach, which will consist primarily of sloping the left stream bank, removal of invasive vegetation and replanting with native, woody vegetation. This sloping will include removal of parts of the berm, restoring floodplain connectivity during lower return interval flood events. In addition, invasive species treatment and reforestation of the riparian zone with low growing woody vegetation will be done to improve overbank flow filtration, shading and rootmass density along the stream corridor.

MC-UT1-1 and MC-UT1-2

These reaches will be protected through preservation. While no restoration work will be done on these reaches they will be protected from future development through the establishment of an conservation easement that will take in the channel and riparian zone.

MC-UT1

Of the four reaches, three are slated for some level of enhancement or restoration. Only Reach 1 is slated for Preservation as described above.

Reach 2 will be addressed with a Restoration approach. A Priority 1 approach, involving construction of a new channel on the existing floodplain, will be applied to remove the channel from the toe of the right valley wall. The design approach calls for dimension, profile and pattern adjustments with grade control used to protect the reach from down cutting, thus providing vertical stability. This will also protect the restored site from headcutting that could move upstream from a transition reach between Reaches 2 and 3 that could not be protected in the mitigation plan because it is either too close to a right-of-way to allow for protection with the easement or it is on another property.

On Reach 3, Level I Enhancement efforts will be used to create grade control, repair bank erosion and restore proper dimension. Eroding banks will be stabilized with structures that will reduce near bank stress and promote grade control. Soil stability will be accomplished by eradicating exotic, invasive vegetation that is limiting the growth of deep rooted, native plant life. Once exotics are removed the site will be planted with native herbaceous and woody plant species that will provide extensive rootmass to stabilize the banks and shade to maintain the cool water habitat.

For Reach 4, a combination of Priority 1 and 2 approaches will be used to relocate this channel in the low point of the valley. The relic channel for this stream is still present in the field adjoining the existing channelized channel. This stream will be reconnected to this relic channel just below where it now flows through a culverted crossing. The old channel will be filled and the existing exotic vegetation eradicated. Where needed a new floodplain at the historic floodplain elevation will be constructed. Due to cattle access there are areas where the old floodplain has been damaged and my need to be repaired. This relic channel has been lost in the existing wetland area at the low point of this drainage slope. From this point a new channel will be constructed with the bankfull elevation at the valley floor elevation. Using the Priority 1 and 2 descriptions for this part of the channel construction is somewhat confusing in this situation. This is because the valley floor will be lowered as a part of this project that has the objective of restoring wetland habitat to this valley. Since the reason for lowering the valley is to establish wetland habitat and functions and not to establish a new floodplain elevation for the stream we are calling this a Priority 1 Restoration; however, we recognize that this is a matter of perspective. The lower end of Reach 4 from the end of the relic channel to its new confluence with Martin’s Creek will be restored with a new meandering channel across the lower valley from which it has been removed. This lowest reach on MC-UT1 will have a new confluence with UT1-3 and then with Martin’s Creek. As this new channel reaches the point where it will confluence with Martin’s Creek a new floodplain will need to be established as the stream drops down to the elevation of the mainstem. Dimension changes will also be made to improve the overall connectivity between the stream and the floodplain as the channel meanders through the wetland complex before converging with Martin’s Creek. This will relocate these channels from where they presently cross onto the adjacent property owner to the north. He has agreed to allow this channel modification.

Where abandoned, old stream channels will be backfilled using fill material generated by the grading of a new channel and floodplain benches or otherwise graded to make them continuous with other local surface features. Any excess fill material generated during construction will be stabilized on-site in locations that are well away from any surface water.

Exotic invasive removal and re-planting with native vegetation will be conducted on Reaches 2-4. This will re-establish a buffer consisting of woody and herbaceous vegetation native to the ecoregion.

MC-UT1-3

Enhancement Level I activities are proposed on MC-UT1-3 from the property boundary to the driveway crossing just upstream of the lower field where Martin’s Creek is located. The Enhancement I design approach on this tributary will entail bank grading and stabilization to correct channel dimension and livestock impacts, and the addition of grade control measures to maintain a more stable channel profile. Pattern adjustments made on this reach will be minimal due to the presence of many mature trees and the fact that existing sinuosity is appropriate for most of the reach. Pattern will be adjusted at three locations to address headcutting and lateral scour that is causing excessive sedimentation of the stream and instability of the stream bank. Profile adjustments will entail removal of headcuts and installation of grade control structures or constructed riffles to improve bedform diversity and regulate channel slope. As part of this effort, exotic invasive vegetation will be removed and native plant communities enhanced through riparian plantings.

A Priority 1 Restoration approach will be applied downstream of the driveway crossing. As described for Reach 4 of MC-UT1, Priority 1 is also here qualified by saying that we are constructing the new channel across a valley floor that will be lowered to enhance wetland functions. Reach2 of MC-UT1-3 was previously channelized across the pasture in a perched channel. Restoration efforts will include a sinuous pattern typical of low slope, wide floodplain settings, with the new channel to be constructed at the appropriate profile and dimensions as it meanders along its new alignment. Given the gradual slope of the reach, grade control structures placed in this section of the stream will primarily serve to reduce bank stress, aid in sediment transport, and to improve bedform diversity and habitat.

As noted earlier, MC-UT1-3 will be relocated within the greater wetland complex proposed and will have a new confluence with MC-UT1 and with Martin's Creek. The new channel will have a high degree of connectivity between the stream and floodplain as the channel meanders through the wetland complex.

Where abandoned, old stream channels will be backfilled using fill material generated by the grading of a new channel and floodplain benches or otherwise graded to make them continuous with other local surface features. Any excess fill material generated during construction will be stabilized on-site in designated disposal areas.

MC-UT2

UT2 is a short reach that flows under Martin's Creek Road and directly into right side of Martin's Creek. Enhancement Level II will be used to improve this channel. Like the mainstem of Martin's Creek opportunities for improvement are limited here because of the state road, overhead power-lines and its short length. Channel dimension will be improved by sloping vertical stream banks to a slope that will allow planting. Riparian enhancement will include the removal of exotic invasive vegetation and re-establishment of a buffer consisting of woody and herbaceous vegetation native to the project area.

Right Prong Martin's Creek (Mainstem)

There are two reaches. Reach 1 contains the vast majority of the stream length on the project property, is forested, and will be placed in preservation. Reach 2 falls along the lower part of the stream after it enters an old field. In this reach, riparian enhancement activities consist of removing exotic invasive vegetation and re-establishing a buffer consisting of woody and herbaceous vegetation native to the project area.

RP-UT1

There are two reaches. Reach 1 includes the vast majority of the length, is forested, and will be placed in preservation. Like the mainstem, Reach 2 of RP-UT1 is the lower part that enters an old field. In this reach, riparian enhancement activities consist of removing exotic invasive vegetation and re-establishing a buffer consisting of woody and herbaceous vegetation native to the project area.

Other Preservation Reaches in the Right Prong Martin's Creek Drainage: RP-UT2, RP-UT2-1, RP-UT3-1, TP-UT4, TP-UT4-1, and RP-UT5

These reaches will be protected through preservation. While no restoration work will be done on these reaches they will be protected from future development through the establishment of an conservation easement that will take in the channel and riparian zone. The right to six stream crossings has been retained by the landowner and the location of these crossings may be determined in the future; however, the area that may be impacted by these crossings is very minimal compared to the area that will be protected.

Riparian Wetland Restoration

The existing pasture in the lower valley is currently drained by the channelized streams MC-UT1, MC-UT1-3, mainstem Martin's Creek and by subsurface drain tiles. To restore wetland hydrology to the site, the soil placed on historic wetland areas will be excavated and removed. This will bring the buried hydric soils to an elevation that will allow them to support wetland functions. Existing streams will be relocated and raised onto the restored wetland floodplain to restore floodplain connectivity and flow dynamics between the restored streams and wetland areas. Excavated material will be placed in stockpile/disposal areas on-site as shown on the plans. The abandoned sections of channelized stream will be completely filled to eliminate the drainage effect caused by these features. Likewise, drain tiles within the fields will be excavated and removed where possible to disrupt drainage from the field.

Grading activities will focus on restoring pre-disturbance valley topography by removing any field crowns, surface drains, or swales that were imposed during agriculture production. The topography of the restored site will be patterned after natural floodplain wetland reference sites, and grading activities will not seek to leave a smooth soil surface. A rough soil surface promotes diversity of hydrologic conditions and habitats common to natural wetland areas. Once design grades have been achieved, the soil surfaces will be tilled to depth of 6 to 10 inches to promote infiltration and better rooting conditions for planted vegetation.

The restoration design for the wetland is based on a targeted “Low Mountain Alluvial Forest” riparian wetland type, as identified by Schafale and Weakley (1990). Hydrology of this system will be palustrine, “seasonally or intermittently flooded”, as the restored channel is designed to carry the bankfull flow, and to flood (flow out of its banks) at discharges greater than bankfull.

The revegetation plan for the overall riparian system will consider the combination of existing onsite native vegetation and riparian communities identified by Schafale and Weakley (1990) that include “Low Mountain Alluvial Forest”, and “Mountain Bottomland Forest”. The planting areas will be designated by wetness zones to represent anticipated site conditions.

Riparian Wetland Enhancement

Multiple pockets of existing jurisdictional wetlands have been delineated within the transitional upland and field areas of the project site. These wetlands, which cumulatively total 1.61 acres, have formed as a result of depressional topography, poor drainage, and hillslope seepage. As described in Section 5, jurisdictional wetlands in the project area that will be temporarily impacted through restoration and enhancement measures will ultimately be higher quality wetlands. These temporary impacts, which total approximately .24 acres, will involve surface roughening, removal of exotic, invasive vegetation, re-establishment of wetland vegetation native to the region and minor adjustments to drainage patterns are necessary to restore channel pattern to MCUT1 and MCUT1-3 and to improve wetland hydrology. Stream and wetland restoration measures will not negatively impact the hydrology, vegetation and soils of the existing wetlands. Efforts to minimize wetland-disturbing activities during the design process have included modifying the alignment of streams near the wetlands in a way that achieves the project stream mitigation objectives (which entails channel pattern and dimension adjustments) while avoiding wetland acreage loss. In fact, the proposed channel alignment of the tributaries to Martin Creek that are located near or adjacent to the existing wetlands was designed to ensure wetland restoration and enhancement objectives were met as well (i.e. improved hydrological connectivity, creation of native riparian vegetation communities).

Through the stream and wetland restoration practices described above, these areas will experience a more natural hydrology and flooding regime once the project is completed. Since existing wetlands are dominated by herbaceous wetland species, the areas will also be planted with native wetland tree species that are tolerant of flooded conditions. Exotic, invasive species will be removed using mechanical and herbicidal methods as appropriate.

7.2 Design Criteria Selection for Stream Restoration

A number of analyses and data were incorporated in the development of site-specific natural channel design approaches. Among these are hydraulic and sediment analyses, existing site conditions data collection, incorporation of reference reach databases, regime equations, and evaluation of results from past projects.

Design criteria are dependent on the general restoration approach determined to be a best fit for the Martin's Creek mitigation site (Table 7.0). The approach for restoration was based on an assessment of each reach and its potential. After selection of the general restoration approach, specific design criteria were developed so that the plan view layout, cross section dimensions, and profile could be described for each reach. These criteria are presented below and in the construction plans.

Assigning an appropriate stream type for the corresponding valley that accommodates the existing and future hydrologic and sediment contributions was considered conceptually prior to selecting reference reach streams. Design criteria for the proposed stream concept were selected based on the range of the reference data and the desired performance of the proposed channel.

Following initial application of the design criteria, refinements were made to accommodate the existing valley morphology, to work around project constraints, to minimize unnecessary disturbance of the riparian area, and to allow for natural channel adjustment following construction. The construction documents have been tailored to produce a cost and resource efficient design that is constructible, using a level of detail that corresponds to the tools of construction. The design also reflects a philosophy that the stream will adapt to the inherent uniformity of the mitigation project and be allowed to adjust over long periods of time under the processes of flooding, re-colonization of vegetation, and local topographic influences.

Table 7.0 Project Design Stream Types
Martin's Creek II Mitigation Project-NCEEP Project #92633

Stream	Reach	Proposed Stream Type	Rationale
Right Prong Martin's Creek	1	A/B	Preservation
	2	B	Level II Enhancement
RP-UT1	1	A/B	Preservation
	2	B	Level II Enhancement
Martin's Creek	1	C	Level II Enhancement, use existing dimensions, improve floodplain connectivity
MC-UT1	1	A/B	Preservation
	2	B	Priority 1 Restoration
	3	B	Level I Enhancement
	4	C	Priority 2 Restoration in low slope valley
MC-UT1-3	1	B	Level I Enhancement in higher slope valley
	2	C	Priority 2 Restoration in low slope valley

Notes: Streams only listed if they have Restoration or Enhancement reaches.

7.3 Stream Project Design & Justification

The primary objective of the restoration design is to construct a stream with a stable dimension, pattern, and profile that has access to its floodplain at bankfull flows while enhancing riparian and aquatic habitat. The approach applied by Baker to the Martin's Creek Site consisted of creating stable B and C-type channels. The proposed design parameters for each of the reaches are detailed in Table 7.1. The design rationale and design parameters for all of the design reaches are presented below.

Dimension

Throughout the entire proposed design, the channel dimensions were adjusted to reduce velocities and near-bank shear stress. The selected design parameters eliminate incision and restore access to the floodplain, increasing the entrenchment ratio. The sloping reaches, design dimensions are for B-type channels that are found in Type II colluvial valleys. These have a lower entrenchment ratio than alluvial streams which means that benching will be slightly sloping and of only moderate width.

For the channels being routed through the lowest part of the main valley, C-type channels were designed and are expected to narrow to an E-type morphology over time as vegetation dominates the channel banks. E-type channels are difficult to construct due to high instability due to the lack of established rootmass immediately after construction. These channels will have high width/depth ratios, wide floodplains and very high entrenchment ratios. They have been kept wider rather than deeper to help maintain hydrology in the adjacent restored wetlands.

In all cases, a bank height ratio (BHR) of 1.0 was chosen to develop a channel with access to its floodplain for relief during events having flows in excess of bankfull. Typical cross sections are shown on the plan sheets.

Pattern

The existing pattern of these project streams is representative of impacts one would expect from stream channelization, relocation and livestock impacts. In general, Reach 2 on MC-UT1 has been designed to dissipate energy vertically in steeper sections, and through meandering along Reach 4 of MC-UT1 that will flow adjacent to a restored wetland in the lower field. The restoration reach on MC-UT1-3 was also designed to dissipate energy through a meandering channel. A meandering morphology is most appropriate for streams that have slopes less than 2% as is the case withMC-UT1-3 and MC-UT1 as it enters the lower field. Reach 2 on MC-UT1, will be restored with a new pattern; however, the sinuosity will be low (1.06) due the slope of this reach (.05). The pattern change associated with this restoration reach will bring the channel away from the valley wall to allow for overbank flow on both sides of the stream and to avoid sedimentation off of the right hill slope into the stream. The sinuosity of MC-UT1, Reach 4 and MC-UT1-3, Reach 2 will increase from 1.0 to 1.4 and 1.0 to 1.42, respectively with the development of the meandering channels. High sinuosity is appropriate where these streams enter the wide, flat valley of the mainstem of Martin’s Creek and flow through the restored wetlands. The radius of curvature for meanders ranged from 20 to 40 and meander length ranged from 80 to 110. These ranges were used to provide a diversity of form in order to avoid a “cookie cutter” appearance.

The proposed enhancement approach for the tributaries is to correct or stabilize existing problem areas relative to dimension, and profile and to maintain the B-type channels with improvements that will provide long-term stability. With the exception of Reach 1 on MC-UT1-3, there will not be a significant modification of pattern on the enhancement reaches (Right Prong Martin’s Creek, RP-UT1, Martin’s Creek, MC-UT1 and MC-UT2). Slight pattern adjustments will be made at three locations on MC-UT1-3; at two sites where meanders are cutting into high clay banks and at another site to avoid a significant headcut. The minor changes to channel alignment on this enhancement reach does not warrant greater mitigation credit than what is given for Enhancement I due to their being short in length and localized in scope.

Profile/Bedform

The profiles for the tributaries with higher slopes slated for restoration and enhancement (MC-UT1 Reaches 2 and 3, and MC-UT1-3 Reach1) have poor habitat and a lack of grade control. A step-pool morphology has been designed to establish a profile and bedform that is typical to B-type channels and to ensure that the bed has colluvial elements that help induce pool formation, create habitat niches, and hold the vertical stability of the profile.

The existing profiles of MC-UT1 Reach 4 and MC-UT1-3 Reach 2 have little diversity of bedform with long riffles and relatively short pools, a characteristic common to channelized streams. The proposed meandering channels will have a regular riffle – pool sequence. These slopes should provide for a diversity of bedform and maintain quality habitat as sediment is moved through the reach. Where structure is used, its purpose is to help hold the channel grade while riffles are developing, reduce bank stress while vegetation matures, and improve habitat.

Table 7.1 Geomorphic Characteristics of the Proposed Martin's Creek II Mitigation Project Martin's Creek II Mitigation Project-NCEEP Project #92633	**MC-UT1**			
	Reach 2 Sta. 0+00 to 10+70		Reach 3-4 Sta. 0+00 to 3+45, 5+48 to 16+97	
	Min	Max	Min (STA 0+00-6+00)	Max (STA 6+00-11+00, 11+00-16+97)
1. Stream Type	B/Cb		B-C	
2. Drainage Area – mi^2	0.09		0.17	0.17, 0.25
3. Bankfull Width (w_{bkf}) – ft	7.7		8.5	8.5, 11
4. Bankfull Mean Depth (d_{bkf}) – ft	0.54		0.71	0.71, 0.81
5. Width/Depth Ratio (w/d ratio)	14.3		12.0	12.0, 13.5
6. Cross-sectional Area (A_{bkf}) – ft^2	4.1		6.0	6.0, 9.0
7. Bankfull Mean Velocity (v_{bkf}) - ft/sec	3.9		4.3	4.3, 4.0
8. Bankfull Discharge (Q_{bkf}) – ft^3/sec	16		26	26, 36
9. Bankfull Max Depth (d_{mbkf}) – ft	0.7		0.9	0.9, 1.0
10. d_{mbkf} / d_{bkf} Ratio	1.3		1.3	1.3, 1.2
11. Low Bank Height to d_{mbkf} ratio	1.0		1.0	1.0
12. Floodprone Area Width (w_{fpa}) – feet	16	40	17	>100
13. Entrenchment Ratio (ER)	2	5.2	2	>11.8
14. Meander Length (L_m) – ft*	N/A		90	90
15. Meander Length to Bankfull Width (L_m/w_{bkf})*	N/A		10.5	10.5
16. Radius of Curvature (R_c) – ft*	N/A	N/A	15-30	20-30
17. Radius of Curvature to Bankfull Width (R_c / w_{bkf})*	N/A	N/A	1.8-3.8	2.3-3.8
18. Belt Width (w_{blt}) – ft*	N/A	N/A	40	40
19. Meander Width Ratio (w_{blt}/W_{bkf})*	N/A	N/A	4.7	4.7
20. Sinuosity (K) (Stream Length / Valley Length)	1.06		1.18	1.4
21. Valley Slope	0.050		0.060	0.038, 0.016
22. Average Channel Slope (S_{bkf})	0.047		0.057	0.027, 0.011
23. Pool Slope (s_{pool})	0	0	0	0
24. Pool Slope to Average Slope (S_{pool} / S_{bkf})	0	0	0	0
25. Maximum Pool Depth (d_{pool}) – ft	1.6		1.6	2.0
26. Ratio of Pool Depth to Average Bankfull Depth (d_{pool}/d_{bkf})	2.9		2.9	2.8
27. Pool Width (w_{pool}) – ft	12		12	13
28. Pool Width to Bankfull Width (w_{pool} / w_{bkf})	1.6		1.4	1.5
29. Pool Area (A_{pool}) – ft^2	11.5		11.5	14.3
30. Pool Area to Bankfull Area (A_{pool}/A_{bkf})	2.8-		1.9	2.4
31. Pool-to-Pool Spacing (p-p) – ft	12	45	14	33
32. Pool-to-Pool Spacing to Bankfull Width (p-p/w_{bkf})	1.5	5.8	1.6	3.9
33. Riffle Slope (s_{riffle})	0.05	0.16	0.06-0.14	0.03-0.076, 0.012-0.02
34. Riffle Slope to Average Slope (s_{riffle}/ s_{bkf})	1.1	3.5	1.1-2.5	1.1-2.5, 1.1-2.0

Table 7.1 (cont.) Geomorphic Characteristics of the Proposed Martin's Creek II Mitigation Project Martin's Creek II Mitigation Project-NCEEP Project #92633	**MC-UT1-3**			
	Reach 1 Sta. 0+00 to 5+16		Reach 2 Sta. 5+78 to 18+64	
	Min	Max	Min (5+78-11+00)	Max (5+78-11+00, 11+00-18+64)
1. Stream Type	B		C	
2. Drainage Area – mi^2	0.07		0.08	
3. Bankfull Width (w_{bkf}) – ft	6		6.5	
4. Bankfull Mean Depth (d_{bkf}) – ft	0.48		0.49	
5. Width/Depth Ratio (w/d ratio)	12.5		12.5	
6. Cross-sectional Area (A_{bkf}) – ft^2	2.85		3.18	
7. Bankfull Mean Velocity (v_{bkf}) - ft/sec	4.9		3.8	
8. Bankfull Discharge (Q_{bkf}) – ft^3/sec	14		12	
9. Bankfull Max Depth (d_{mbkf}) – ft	0.6		0.6	
10. d_{mbkf} / d_{bkf} Ratio	1.25		1.22	
11. Low Bank Height to d_{mbkf} ratio	1.0		1.0	
12. Floodprone Area Width (w_{fpa}) – feet	11	18	11-18	>100
13. Entrenchment Ratio (ER)	3.8	6.3	3.8-6.3	>15.4
14. Meander Length (L_m) – ft*	65-90		80-110	
15. Meander Length to Bankfull Width (L_m/w_{bkf})*	10.8-15		12.3-16.9	
16. Radius of Curvature (R_c) – ft*	15	40	20	40
17. Radius of Curvature to Bankfull Width (R_c / w_{bkf})*	2.5	6.7	3.1	6.15
18. Belt Width (w_{blt}) – ft*	26	50	35	50
19. Meander Width Ratio (w_{blt}/W_{bkf})*	4.3	8.3	5.4	7.7
20. Sinuosity (K) (Stream Length / Valley Length)	1.26		1.42	
21. Valley Slope	0.069		0.067	0.035, 0.007
22. Average Channel Slope (S_{bkf})	0.054		0.047	0.025, 0.005
23. Pool Slope (s_{pool})	0	0	0	0
24. Pool Slope to Average Slope (S_{pool} / S_{bkf})	0		0	
25. Maximum Pool Depth (d_{pool}) – ft	1.6		1.6	1.6
26. Ratio of Pool Depth to Average Bankfull Depth (d_{pool}/d_{bkf})	2.7		2.7	2.7
27. Pool Width (w_{pool}) – ft	9		9	11
28. Pool Width to Bankfull Width (w_{pool} / w_{bkf})	1.5		1.4	1.7
29. Pool Area (A_{pool}) – ft^2	8		8-10.2	
30. Pool Area to Bankfull Area (A_{pool}/A_{bkf})	2.8		2.5-3.2	
31. Pool-to-Pool Spacing (p-p) – ft	10	20	40	60
32. Pool-to-Pool Spacing to Bankfull Width (p-p/w_{bkf})	1.6	3.2	6.1	9.2
33. Riffle Slope (s_{riffle})	0.04	0.08	0.06	0.01
34. Riffle Slope to Average Slope (s_{riffle}/ s_{bkf})	0.7	1.6	1.4	2

7.3.1 Sediment Transport Analysis

The factors that influence sediment transport are critical to the initiation and course of stream evolution. In the dynamic equilibrium that is achieved for stable channels, sediment transport is such that the inflowing and outgoing sediment loads are balanced. As discussed in the channel stability assessment, Lane (1955) describes a generalized relationship of stream stability wherein the product of sediment load and sediment size is proportional to the product of stream slope and discharge. Whereas sediment size, stream slope, and stream discharge are readily measured or calculated, sediment load is much more difficult to accurately quantify because of the numerous and complex processes controlling sediment delivery and movement within the stream system.

Sediment transport is typically assessed by computing channel competency, capacity, or both. In this case, we have addressed sediment capacity by conducting shear stress analyses and looking at empirical data related to particle size mobility. Sediment transport competency is a measure of force per unit area (lbm/ ft^2) that refers to the stream's ability to move a given grain size. Quantitative assessments include shear stress, tractive force, and critical dimensionless shear stress. Since these assessments help determine a size class that is mobile under certain flow conditions, they are most important in gravel bed studies in which the bed material ranges in size from sand to cobble (of which only a fraction are mobile during bankfull conditions). Sediment transport capacity refers to the stream's ability to move a mass of sediment past a cross section per unit of time, expressed in lbs/second or tons/year. In headwater streams and watersheds with good vegetative cover, sediment supply is likely to be a limiting factor in sediment transport capacity. In order to compensate for this condition, larger colluvial particles may protect smaller particles from movement. This armoring effect limits the potential down-cutting of the stream. An intensive assessment of transport capacity is not appropriate in this setting and would not provide any additional design guidance beyond what other methods are able to provide.

The Martin's site has both steep tributary segments (>2%) and gentler slopes (0-2%). In the steeper reaches, the newly constructed channel will be constructed using colluvial-size particles in order to recreate the natural armoring present in a developed channel. At a minimum, these larger-size particles will be used to build grade control structures into the bed that will reduce the chance of vertical erosion of the bed. In the mainstem and tributaries in the flatter valley, riffles will be constructed out of existing bed material, with intermittent grade control (structures or constructed riffles) to hold the grade. The riffle material will incorporate material with low mobility mixed with other more mobile particles. In particular, the head and tail of constructed riffles will have larger size rock mixed in to form keys that will limit downcutting and act like these features do in a natural system.

7.3.1.1 Methodology

To conduct the sediment competency analyses, pavement, subpavement, and bulk sediment samples were collected and weighed to generate cumulative frequency plots. Tributaries to Martin's Creek were found to have median particle sizes in the range of small to medium gravel. The largest particle sizes in these tributaries range from very coarse gravel to small cobble. This sampling is a snapshot of the sediment characteristics in the existing channel, affected by both systematic and local instability, as well as other impacts such as channelization. As such, interpretation of the data should consist of gross observations. Ultimately, the existing conditions sediment data will be one of the pieces of information that will help guide design decisions.

Now that we have sediment characteristics and can assess the relative mobility of particles from a deductive approach, we will assess particle mobility based on an analytical approach. The final channel cross section geometry was used to calculate the shear stress acting on the design channel using the equation :

$\tau = \gamma R S$,

Where τ=average shear stress (lbm/ft2), γ=unit weight water (lbm/ft3), R=hydraulic radius (ft), and S=bed slope, or commonly friction (EGL) slope (ft/ft).

As described earlier, small HEC-RAS models were created for each reach to assess the cross sections collected. The existing conditions shear stresses were observed to compare to those of the design sections. In general, the design uses higher width-to-depth ratios as a conservative approach to natural channel design. This has multiple effects, one of which is the reduction of shear stress in the design channel due to the increased surface area and decreased depth.

For each stream reach, a worksheet that compares multiple methods (all based on empirical data) was used to assess the critical particle size that is of sufficient size (mass) to resist movement when subjected to the critical (e.g. bankfull) shear stress. The methods include a dimensionless method based on Shields Diagram (Julien, 1995), a critical shear stress graph from Lane (1953), an Isbesh Curve method that selects requisite stone size based on velocity, a permissible tractive force graph from Raudkivi (1967), and a critical shear stress curve from Figure 2.6 of EPA WARSSS v1.0 (Reference). The result is a bracketing of the particle size required to resist motion at bankfull.

Sediment capacity is analyzed in the following way for this project. The goal of a capacity analysis is to have sediment transport equilibrium; evidence to the contrary would suggest possible aggradation or degradation of the bed or banks. In this case, the tributaries higher in the watershed have more capacity due to their higher slopes. However, in a system with stable banks and good grade control, the export of material from the upper reaches is expected to be minimal. Material that is exported, or transported through the reach will be handled by building the proposed alluvial reaches with gently sloping side slopes. Large material will deposit in riffles as part of the natural armoring process, smaller materials will deposit on the banks due to the lower shear stress zones in these regions. Subsequent vegetation of the banks will help keep the banks stable and will improve the transport efficiency of the channel to maintain a balance in the system.

7.3.1.2 Sediment Transport Analysis Discussion

The sediment samples were used to determine the range of competent particle sizes and assess the depth and slope required to move the largest particle size. The D50 of the subpavement samples for the smaller tributaries varied from 3.5 – 8 mm, and the D100 from 50 to 130 mm. Both step-pool and meandering geomorphic approaches are being pursued at the site; the applicable approach is determined based on the slope of each particular reach. Higher slope tributaries are built as step-pool channels with grade control features that prevent down-cutting and dissipate energy. While these steeper channels are designed to act predominantly as threshold (non-mobile bed) channels, any bed movement is most likely in the period after construction when particles do not have the degree of armoring and particle inter-locking characteristic of a natural channel. Grade control features are a measure of precaution to protect the investment against such bed movement, enhance habitat diversity through pool formation, and allow for grade drop over protected structures that are designed to be able to withstand vertical flow forces induced by critical flow and hydraulic jumps. Large events will still move particles in a threshold channel – it is the largest colluvial particles that create vertical grade control which protects the channel from incision. The lower slope tributaries are designed to meander through the floodplain shared with the mainstem of Martin’s Creek, transporting alluvial sediments and dissipating energy through meandering. The meandering channels still have some grade control to help ensure the stability of the newly cut channel, Competency analyses in the step-pool systems look at two elements: the riffle or cascade material, and the step-structure material (i.e. large cobble or boulders). In the meandering system, the riffle material is the primary focus of the competency analyses.

The design area for tributary MC-UT1 Reach 2 is 4.2 square feet. Based on the shear stress of the design channel, the existing conditions D84 particle in the existing channel is capable of being mobilized, but the D95 is not. At the full channel flow, the average shear stress is 1.3 lb/square foot. Shear stresses of this magnitude move particles through both suspended load and bedload transport and, based on the multiple empirical methods sets described in the Methods, may move particles that range in size from 70 mm to 300 mm in size. This is consistent with typical natural channel design goals in that it is likely to move particles in the D50 to D84 range, but much less likely to move particles in the D100 size range. Whereas most methods predict the critical particle size to be 100 mm or less for this shear stress, Wildland Hydrology data depicted in the EPA WARSSS literature predicts a much higher value (327 mm). This is based on empirical data from Colorado only with an R^2 of 0.838, whereas other methods are based on field data from various geographic settings and laboratory data, and typically have higher R^2 values (e.g.; Leopold, Wolman and Miller (1964) data has R^2=0.9336). While the surface layer of riffle material should be consistent with the non-Colorado data, it is appropriate to consider sizing structures and riffle keys (requisite non-mobile features) with this upper bound from the Colorado Curve in mind. Practically speaking, this would result in a specification of some class B, 1, and/or 2 material to be included in the riffle keys (structures commonly consist of boulder material larger than class 2). This specification is based on practical experience that riffle keys are critical to prevent grade control failure (riffle keys are an engineered fail-safe). This fail-safe is necessary because constructed riffle material used in restoration projects is often poorly sorted as a practical matter, and provides less particle-to-particle shear resistance than in-situ riffle material. Natural riffles also have the benefit of an armor layer built by the stream through the winnowing process. This basis for the consideration of the Colorado data as an upper bound for conservative engineering of critical structural features applies to all of the project reaches.

The design area for tributary MC-UT1 Reaches 3 and 4 is 6.0 square feet. Based on the shear stress of the design channel, the existing conditions D50 particle in the existing channel is capable of being mobilized, but the D84 and D95 are not. At the full channel flow, the average shear stress is 0.8 lb/square foot. This value is lower than the upper reach because of the change in valley slope. Still, both transport mechanisms are still feasible and based on the multiple empirical methods sets described in the Methods, the mobile particle range is may move particles that range in size from 50 mm to 200 mm in size. Again, this falls in line with typical natural channel design goals in that it is likely to move particles in the D50 to D84 range, but much less likely to move particles in the D100 size range. For this reach, the EPA WARSSS literature predicts 204 mm. It would be appropriate to size structures and riffle keys (requisite non-mobile features) with this upper bound in mind.

For MC-UT1-3 Reach 1, the design channel dimension is 3.0 square feet. The sample collected above the driveway yielded a D50 of 3.5 mm and a D100 of 15.7 mm. With an estimated shear stress of 1.2 lb/square foot based on the design dimensions and slope of 4%, the existing conditions D100 is estimated to be competent under flows much less than bankfull. The empirical critical particle dimension curves indicate that the particle size required for non-mobility is in the range of 70 mm to 300 mm. Since this reach will be built as a step-pool channel, the steps will be built out of material in the upper end of this range (1’ intermediate axis) and constructed riffles/cascades will have a significant percentage of material greater than 70 mm. Where existing channel material is used to backfill the new channel bottom, new material will be mixed into the upper layer to prevent the washout of features that must have a stable grade.

MC-UT1-3 Reach 2 has a design channel dimension of 3.3 square feet. The sample collected above the driveway was used as a representative sample for the analysis in this reach as well. The computed average shear stress is only 0.2 lb/square foot based on a significant decrease in the slope (it is only 0.8% in this reach). In this reach, the D84 from the existing conditions sample is competent but the D95 is not. The empirical critical particle dimension curves indicate that the particle size required for non-mobility is in the range of 15 mm to 50 mm. Since this reach will be built as a meandering alluvial channel, the existing material is deemed appropriate to use for constructing riffles. Some of the riffles, and all of the riffle keys will be built out of imported material. To reduce the risk of headcutting, this material will consist of particle sizes ranging from 15 to 50 mm.

7.3.2 HEC-RAS Analysis

7.3.2.1 Preliminary Modeling and Hydrologic Trespass

The project has both regulated and non-regulated floodplains. The upper reaches of the unnamed tributaries are not regulated and do not pose a flooding threat to any structures or other infrastructure. The lower reaches of the tributaries share a floodplain with Martin's Creek, which is in a special flood hazard zone and must comply with Federal Emergency Management Agency (FEMA) requirements. Grading and other floodplain development activities in the Martin's Creek floodplain will be required to attain a no-impact certification.

The lower portion of the Martin's Creek site, which consists of Martin's Creek and its valley, has been mapped within a Federal Emergency Management Agency (FEMA)-identified flood zone (Zone AE). This is a special flood hazard area with a designated 100-Year Base Flood Elevation (BFE) and non-encroachment areas. Modifications within the non-encroachment areas require a flood study to determine whether the proposed modifications will impact the established BFEs or non-encroachment widths. If the difference in the BFE is between 0 and -0.10 (decrease of 1/10th or less), this is considered "no impact". If a rise is indicated by the proposed changes, this would necessitate a Conditional Letter of Map Revisions (CLOMR) and post-project Letter of Map Revision (LOMR). If a decrease of greater than 0.10' is indicated (not a valid "no impact", but a valid "no rise"), this would require a post-project LOMR as well; typically, in such a case, the flood study demonstrating no rise in the BFEs would be accepted in lieu of a CLOMR and the project could proceed upon local or state review of the study.

Based on the current plans, Baker has conducted preliminary modeling and believes that the project can be permitted with a no-impact certification (i.e. there are no rises, and all decreases are less than 0.10'). Upon acceptance of the restoration plan and drawings, Baker will finalize modeling and submit a report summarizing the project and modeling results to the designated floodplain administrator for Cherokee County. Baker has discussed this project with the county and does not anticipate any other requirements that will affect the project.

7.4 Site Construction

7.4.1 Site Grading, Structure Installation, and Other Project Related Construction

7.4.1.1 Narrative

A construction sequence is provided below and can be found within the accompanying mitigation plan set for the Martin's Creek II project.

1. Equipment and materials shall be mobilized to the site.
2. Utility locations shown on these plans are approximate. The contractor shall have all underground utilities within the project limits located and marked prior to beginning construction. The contractor will be responsible for the repair of any utilities damaged during construction.

3. A gravel "construction entrance" that consists of class A stone, at least 50 feet in length, shall be incorporated into every access point that connects to a public road.

4. Temporary and permanent stream crossings and temporary check dams shall be installed as shown in the plan set. Temporary check dams shall be removed when grading work upstream has been completed.

5. Construction shall proceed upstream to downstream on each stream. Tributaries will be restored prior to the confluence with the mainstem being constructed. Grading of bankfull benches within a work area shall be done before new channels are graded.

6. Temporary coffer dams shall be installed upstream of each work area and flow in the work reach shall be diverted by pumping and piping around the work area. The length of each diversion shall be approximately 300 to 600 linear feet. Pumping will be done when work is required in a channel where the stream is flowing. Much of the mainstem work will be done offline. Existing channel material should be stockpiled and incorporated in constructed offline reaches.

7. Clearing and grubbing required within the grading limits shall be performed so as to limit sediment migration off-site. Logs and root wads from trees larger than 10 inches in diameter shall be stockpiled for use as in-stream structures. Salvageable native vegetation (black willow, tag alder, silky dogwood, etc.) shall be harvested for transplanting or for cutting and live-staking materials. Brush material for toe wood structures should be stockpiled and kept wet. Special attention should be given to the removal of nonnative, exotic species when clearing and grubbing takes place.

8. Wetland grading should be accomplished before stream restoration work is accomplished in the low valley. Graded areas should be tilled to roughen the wetland area and create heterogeneous topography. The site should then be seeded and mulched to stabilize the site.

9. The new channel sections shall be stabilized with in-stream structures, erosion control matting, seed, and transplants before turning water into these sections. Compacted soil channel plugs shall be installed in areas where the new channel diverges from the original channel, and the original, abandoned channel sections will be backfilled.

10. Dewatering of off-line sections shall be diverted through a sediment filter before being discharged into the downstream reach.

11. Earthwork shall be staged such that no more channel will be disturbed than can be stabilized by the end of the work day or before flow is diverted into a new channel segment.

12. Disturbed areas within the first 25 feet of buffer adjacent to the channel will be seeded, mulched or otherwise stabilized with temporary ground cover until a more permanent ground cover is established across the buffer area disturbed during construction. If temporary ground cover is not applied at the end of the workday, straw wattles will be staked down at the top of the bank where erosion control matting ends to prevent sediment loading from upland portions of the buffer that have not stabilized.

13. Excess soil materials shall be stockpiled in designated staging and stockpile areas, with silt fence installed on the downslope side(s) of the base of the stockpiles and maintained when sediment has accumulated above one third of the height of the silt fence and/or the silt fence

has failed. Excess soil shall be hauled outside the conservation easement before de-mobilization.

14. The flow diversions and temporary stream crossings shall be removed when no longer needed and the banks in these areas stabilized with seeding and matting.

15. Bank and floodplain vegetation, including brush materials and live stakes, shall be installed during the dormant season, November to May.

16. Staging and stockpile areas, and silt fences shall be removed and the ground shall be repaired to its original conditions once planting is complete and once they are no longer needed. Construction entrances may also be removed or left in place if the landowner wishes to retain them.

7.4.1.2 In-stream Structures and Other Construction Elements

A variety of in-stream structures are proposed for the Martin's Creek site. Structures such as constructed riffles, log vanes, boulder steps, and rootwads will be used to stabilize the newly-restored streams. This project will primarily utilize those structures which provide grade control and enhance pool habitat. Wood and boulder structures will be used on this site because they represent natural materials observed in the existing system. Some wood will be generated through the construction of this project; woody material that is not generated through the project will be brought to the site. Table 7.2 summarizes the use of in-stream structures at the site.

Table 7.2 Proposed In-Stream Structure Types and Locations
Martin's Creek II Mitigation Project-NCEEP Project #92633

Structure Type	Location
Constructed Riffle	Through straight, steeper sections to provide grade control.
Cover Log	Located along outside bends or against one bank in straight reaches to increase pool diversity and provide cover for fish.
Log/Rock Sequence	In meander bends to turn water to protect outside banks and promote scour to maintain pools.
Toe Wood	Toe of a streambank to create overhead bank cover and improve aquatic habitat.
Rock Cross Vane	Downstream of floodplain constrictions to direct high velocity flow emerging from the constriction to the center of the channel to prevent bank erosion and provide grade control. Near the downstream end of the project to provide grade control to prevent possible downcutting downstream of the project from migrating into the project stream and causing bed erosion.
Boulder Step Structure	In steep channels to control grade and maintain step-pool system.
Vegetated Geolift	To create new banks in areas where cutting a new channel is not an option. Outside of meander bends under particularly high stress or in areas where slight lateral migration is unacceptable.
Rootwads	Outside bank of meander bends to reduce bank shear stress and improve aquatic habitat.

Constructed Riffle

A constructed riffle consists of the placement of coarse bed material in the stream at specific riffle locations along the profile. A buried log or rocks at the upstream and downstream end of riffles may be used to control the slope through the riffle in steeper sections. The purpose of this structure is to provide grade control and establish riffle habitat. Constructed riffles will be placed throughout all reaches. In the higher slope reaches, the constructed riffles and cross vanes will be intermixed to provide diversity of structure and in-stream habitat.

Cover Log

Cover logs are used typically driven into streambanks or secured using rebar and, as noted above, can be used in straight stream reaches as well as the outer bends of streams. The primary purpose of these structures is to improve bed form diversity by creating small pools in addition to those created by boulder steps and vanes. In addition to improving pool habitat, cover logs are also placed to create cover for trout and other fish.

Log/Rock Sequence

A log/rock sequence is used to protect the stream bank. The length of a single vane structure can span one-half to two-thirds the bankfull channel width. Vanes are located either upstream or downstream along a meander bend and function to initiate or complete the redirecting of flow energies resulting in reduced near bank shear stress and alignment maintenance. Vanes are located just downstream of the point where the stream flow intercepts the bank at acute angles. These vanes may also be used outside of meanders on moderate to steep channel gradients for grade control, a primary concern in this restoration project. Logs and or boulders may be used to construct vanes.

Log Sequence

In a log sequence, logs are usually placed in a series and at opposing angles and slopes. These structures are used in riffles to create small meanders within the riffle, diversifying habitat.

Toe Wood

Toe wood will be placed at the toe of streambanks to provide bank stabilization and improve fish habitat. Toe wood is a term for a crib-like structure consisting of wooden planks and wooden spacers nailed together that is staked to the channel bed using re-bar. In addition to providing resting areas for fish, these structures are the also a part of the bank stabilization process. The top of the crib-structure is backfilled using stone and ultimately, a soil base for which to replant riparian vegetation.

Rock Cross Vane

Cross vanes are used to provide grade control, keep the thalweg in the center of the channel, and protect the stream bank. A cross vane consists of two rock vanes joined by a center structure installed perpendicular to the direction of flow. This centering structure sets the invert elevation of the stream bed.

Boulder Step Structure

Boulder step structures consist of boulders placed in the channel in a U-shape constructed similarly to a cross-vane. These structures provide grade control in steep channels, direct high velocity flows to the center of the channel, and promote diverse habitat through the creation of plunge pools immediately downstream of the structure.

Vegetated Geolift

A geolift consists of a layer of biodegradable matting back filled with soil (creating a lift) that is stacked upon a stone toe base. A row of native, riparian, woody vegetation is laid on top of this first soil lift and a second lift is constructed on top of the woody material. This alternating of lift and woody material continues up to the desired elevation. The mesh that makes up the matting acts much like a traditional gabion, but is designed to break down over time and is more economical. Unlike gabions that are filled over with topsoil to create a bank, the geolift actually holds the soil in place between layers of matting that are set perpendicular to the bank slope making it more effective in supporting the slope while vegetation is established. Geolifts also work to retain moisture for live stakes or other vegetation and provide a substrate for the establishment of a root system.

Rootwad

Rootwads are large intact root masses placed at the toe of the stream bank in high stress areas to absorb energy, increase flow roughness and provide a physical barrier to the erosion of vulnerable stream banks. In the process, they can help induce scour-pool formation and serve as habitat for organisms favoring wood or cover. In addition to stream bank protection, they provide structural support to the stream bank and habitat for fish and other aquatic animals. They also increase substrate surface area for aquatic insects and other benthic organisms. Root wads include the root mass or root ball of a tree plus a portion of the trunk which is driven or buried into the bank.

7.4.2 Natural Plant Community Restoration

Native riparian vegetation will be established in the restored stream buffer. Any areas of invasive vegetation will be removed so as not to threaten the newly-established native plants within the conservation easement. Known invasive species to be treated include multiflora rose, chinese privet and japanese honeysuckle.

7.4.2.1 Soil Preparation and Amendments

Soil amendments will be prepared according to the dominant soil types present within the floodplains for UT1 and its unnamed tributaries and subsequent analysis of the soils by the NRCS. Application of soil amendments will occur as temporary site stabilization measures are implemented during construction and during installation of permanent bank and riparian vegetation. The use of soil amendments will be minimized to the extent possible to prevent the accelerated growth of weed species as the native riparian seed mix becomes established.

7.4.2.2 Stream Buffer Vegetation

Bare-root and containerized trees, live stakes, shrubs and permanent seeding will be planted within designated areas of the conservation easement. A preferred 30-foot buffer measured from the top of banks (sometimes slightly less and quite often, substantially more) will be established along the restored stream reaches. In the preservation reach, the combined buffer width for left and right banks will be approximately 100 feet. Bare-root and containerized vegetation (trees and shrubs) will be planted at a target density of 680 stems per acre, or an 8-foot by 8-foot grid. The proposed species to be planted are listed in Table 7.3. Planting of bare-root or containerized trees, live stakes and shrubs will be conducted during the first dormant season following construction. If construction activities are completed in summer/fall of a given year, all vegetation will be installed prior to the start of the growing season of the following calendar year.

Species selection for re-vegetation of the site will generally follow those suggested by Schafale and Weakley (1990) and tolerances cited in the USACE Wetland Research Program (WRP) Technical Note VN-RS-4.1 (1997). Tree species selected for stream restoration areas will generally be weakly tolerant to tolerant of flooding. Weakly tolerant species are able to survive and grow in areas where the soil is saturated or flooded for relatively short periods of time. Moderately tolerant species are able to survive in soils that are saturated or flooded for several months during the growing season. Flood tolerant species are able to survive on sites in which the soil is saturated or flooded for extended periods during the growing season (WRP, 1997).

Observations will be made during construction regarding the relative wetness of areas to be planted. Planting zones will be determined based on these observations, and planted species will be matched according to their wetness tolerance and the anticipated wetness of the planting area.

Live stakes will be installed two to three feet apart using triangular spacing or at a density of 160 to 360 stakes per 1,000 square feet along the stream banks between the toe of the stream bank and bankfull elevation. Site variations may require slightly different spacing.

Permanent seed mixtures will be applied to all disturbed areas of the project site. Table 7.4 lists the species, mixtures, and application rates that will be used. A mixture is provided for floodplain wetland and floodplain non-wetland areas. Mixtures will also include temporary seeding (rye grain during cold season or browntop millet during warm season). The permanent seed mixture specified for floodplain areas will be applied to all disturbed areas outside the banks of the restored stream channel and is intended to provide rapid growth of herbaceous ground cover and biological habitat value. The species provided are deep-rooted and have been shown to proliferate along restored stream channels, providing long-term stability.

Temporary seeding will be applied to all disturbed areas of the site that are susceptible to erosion. These areas include constructed stream banks, access roads, side slopes, and spoil piles. If temporary seeding is applied from November through April, rye grain will be used and applied at a rate of 130 pounds per acre. If applied from May through October, temporary seeding will consist of browntop millet, applied at a rate of 45 pounds per acre.

Table 7.3 Proposed Bare-Root and Live Stake Species (may also include species to be seeded or installed as container plantings)
Martin's Creek II Mitigation Project -NCEEP Project #92633

Common Name	Scientific Name	% Planted by Species	Wetness Tolerance	Planting Location
Riparian Buffer Plantings: Wetland and Floodplain 680 Tree Stems/Acre & 680 Shrub Stems/Acre				
Trees Overstory				
Shingle Oak	*Quercus imbricaria*	12	FAC-	Wetland & Floodplain
River Birch	*Betula nigra*	14	FACW	Wetland & Floodplain
Persimmon	*Diospyros virginiana*	12	FAC	Wetland & Floodplain
Sycamore	*Platanus occidentalis*	10	FACW-	Wetland & Floodplain
Black Willow	*Salix nigra*	12	OBL	Wetland & Floodplain
Trees Understory				
Ironwood	*Carpinus caroliniana*	14	FAC	Wetland & Floodplain
Highland Doghobble	*Leucothoe fontanesiana (axilarris var. editorum)*	14	N/A	Wetland & Floodplain
Tag Alder	*Alnus serrulata*	12	FACW+ or OBL	Wetland & Floodplain
Shrubs				
Rivercane (giant cane)	*Arundinaria gigantea*	30	FACW	Wetland & Floodplain
Spicebush	*Lindera benzoin*	25	FACW	Wetland & Floodplain
Winterberry	*Ilex verticillata*	20	FACW	Wetland & Floodplain
Virginia Sweetspire	*Itea virginica*	25	FACW+	Wetland & Floodplain
Riparian Livestake Plantings				
Ninebark	*Physocarpus opulifolius*	15	FAC-	Wetland & Floodplain
Elderberry	*Sambucus canadensis*	20	FACW-	Wetland & Floodplain
Buttonbush	*Cephalanthus occidentalis*	15	OBL	Wetland & Floodplain
Silky Willow	*Salix sericea*	25	OBL	Wetland & Floodplain
Silky Dogwood	*Cornus amomum*	25	FACW+	Wetland & Floodplain

Note: Species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting Contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

Table 7.3 Proposed Bare-Root and Live Stake Species (may also include species to be seeded or installed as container plantings)
Martin's Creek II Mitigation Project -NCEEP Project #92633

Common Name	Scientific Name	% Planted by Species	Wetness Tolerance	Planting Location
Riparian Buffer Plantings: Upland 680 Tree Stems/Acre & 680 Shrub Stems/Acre				
Trees Overstory				
White Oak	*Quercus alba*	10	FACU	Upland
Black (Sweet) Birch	*Betula lenta*	10	FACU	Upland
Northern Red Oak	*Quercus rubra*	10	FACU	Upland
Mockernut Hickory	*Carya alba (tomentosa)*	12	N/A	Upland
Shagbark Hickory	*Carya ovata*	12	FACU	Upland
Post Oak	*Quercus stellata*	6	N/A	Upland
Trees Understory				
Flame Azalea	*Rhododendron calendulaceum*	6	N/A	Upland
Witch Hazel	*Hamamelis virginiana*	7	FACU	Upland
Sourwood	*Oxydendrum arboreum*	5	FACU	Upland
Flowering Dogwood	*Cornus florida*	10	FACU	Upland
Redbud	*Cercis canadensis*	12	FACU	Upland
Shrubs				
Deerberry	*Vaccinium stamineum*	35	FACU	Upland
Eastern Sweetshrub, Sweetshrub	*Calycanthus floridus, Calycanthus spp.*	40	FACU	Upland
Sweetpepperbush	*Clethra spp.*	25	N/A	Upland
Alternate Species				
Blight-resistant American Chestnut	*Castanea dentata*	N/A	N/A	Upland
American Hazelnut	*Corylus americana*	N/A	FACU	Upland
Blue Ridge Blueberry	*Vaccinium pallidum*	N/A	N/A	Upland

Note: Species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting Contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

Table 7.4 Proposed Permanent Seed Mixture
Martin's Creek II Mitigation Project-NCEEP Project #92633

Common Name	Scientific Name	% Planted by Species	Density (lbs/ac)	Wetness Tolerance
Creeping Bentgrass	*Agrostis stolonifera*	10%	1.5	FACW
Big Bluestem	*Andropogon gerardii*	2%	0.3	N/A
Devil's Beggartick	*Bidens frondosa (or aristosa)*	3%	0.45	FACW
Northern Long Sedge	*Carex folliculata*	2%	0.3	N/A
Nodding Sedge	*Carex gynandra*	5%	0.75	N/A
Upright Sedge	*Carex stricta*	2%	0.3	OBL
Lance-leaved Tick Seed	*Coreopsis lanceolata*	3%	0.45	N/A
Virginia Wildrye	*Elymus virginicus*	15%	2.25	FAC
Soft Rush	*Juncus effusus*	2%	0.3	FACW+
Tioga Deer Tongue	*Panicum clandestinum*	10%	1.5	FACW
Switch Grass	*Panicum virgatum*	15%	2.25	FAC+
Pennsylvania Smartweed	*Polygonum pensylvanicum*	5%	0.75	FACW
Broadleaf Arrowhead	*Sagittaria latifolia var. pubescens*	1%	0.15	OBL
Little Bluestem	*Schizachyrium scoparium*	5%	0.75	FACU
Roundleaf Goldenrod	*Solidago patula*	3%	0.45	OBL
Indian Grass	*Sorghastrum nutans*	10%	1.5	FACU
Eastern Gamma Grass	*Tripsacum dactyloides*	5%	0.75	FAC+
Joe Pye Weed	*Eupatorium fistulosum*	2%	0.3	N/A
	Total	100	15	

Note: Species selection may change due to refinement or availability at the time of planting.

7.4.2.3 On-site Invasive Species Management

The site has some infestation of Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), and Japanese honeysuckle (*Lonicera japonica*). These areas will be treated and monitored so that the invasive species do not threaten the newly-planted riparian vegetation.

Fields within the easement boundaries are predominantly planted in fescue. Fescue will be treated by physical and chemical means in order to reduce competition for native grasses.

The most appropriate means of treating invasive grasses growing in the creek and on the margins of the channel will be assessed and implemented prior to vegetation removal. In many cases, building a new offline channel will reduce or eliminate this issue and the long-term development of a forested creek will shade out this and other invasive grasses.

These areas will initially be treated during construction. Subsequent evaluations of invasives on-site will be performed by the contract monitoring firm who will coordinate additional treatments with the NCEEP as necessary so that the invasive species do not threaten the newly-planted riparian vegetation.

8.0 PERFORMANCE CRITERIA

Baker has been involved in obtaining recent approvals from the regulatory agencies for a series of mitigation plans for NCEEP full-delivery projects. The stream restoration success criteria for the project site will follow accepted and approved success criteria presented in recent mitigation plans developed for these full delivery projects. These plans were based on the Stream Mitigation Guidelines issued in April 2003 by the USACE and NCDWQ. Specific success criteria components are presented below.

8.1 Stream Monitoring

Channel stability and vegetation survival will be monitored on the project site. Post-restoration monitoring will be conducted for five years following the completion of construction to evaluate the effectiveness of the restoration practices. Monitored stream parameters include stream dimension (cross sections), pattern (longitudinal survey), profile (profile survey), and photographic documentation. Although monitoring services are not included in the current scope of work provided by Baker, the methods and success criteria below are what is commonly required by the regulatory entities that will issue permits for the Martin's Creek project.

8.1.1 Bankfull Events

The occurrence of bankfull events within the monitoring period will be documented by the use of crest gauges and photographs. Crest gauges will be installed along the streambanks. The crest gauges will record the highest watermark between site visits, and the gauge will be checked each time there is a site visit to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Two bankfull flow events in separate years must be documented within the 5-year monitoring period. Otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years.

8.1.2 Cross sections

Permanent cross sections will generally be spaced at intervals of approximately 20 combined bankfullwidths or at an average distance interval not exceeding 500 feet. Because riffle cross sections are critical in determining bankfull design parameters, the number of riffle cross sections established will generally outnumber pool cross sections. Each cross section will be marked on both banks with permanent pins to establish the exact transect used. A common benchmark will be used for cross sections and consistently used to facilitate easy comparison of year-to-year data. The annual cross section survey will include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross sections will be classified using the Rosgen Stream Classification System.

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

8.1.3 Longitudinal Profile

A longitudinal profile will be surveyed immediately after construction and annually thereafter for the duration of the five-year monitoring period. The as-built survey will be used as the baseline for year one monitoring. Measurements will include thalweg, water surface, bankfull, and top of low bank.

Each of these measurements will be taken at the head of each channel unit (e.g., riffle, pool) and at the maximum pool depth. The survey will be tied to a permanent benchmark.

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

8.1.4 Bed Material Analyses

Pebble counts will be conducted for at least six permanent cross sections (100-counts per cross section) across the Martin's Creek II project site. Pebble counts will be conducted immediately after construction and annually thereafter at the time the cross section and longitudinal surveys are performed during the five year monitoring period. These samples will reveal any changes in sediment gradation that occur over time as the stream adjusts to upstream sediment loads. Significant changes in sediment gradation will be evaluated with respect to stream stability and watershed changes.

8.1.5 Photo Reference Sites

Photographs will be used to visually document restoration success. Reference stations will be photographed before construction and continued annually for at least five years following construction. Photographs will be taken from a height of approximately five to six feet. Permanent markers will be established to ensure that the same locations (and view directions) on the site are monitored in each monitoring period.

Lateral reference photos. Reference photo transects will be taken at each permanent cross section. Photographs will be taken of both banks at each cross section. The survey tape will be centered in the photographs of the bank. The water line will be located in the lower edge of the frame, and as much of the bank as possible will be included in each photo. Photographers should make an effort to consistently maintain the same area in each photo over time.

Structure photos. Photographs will be taken of grade control structures along the restored stream, and will be limited to boulder and log steps. Photographers will make every effort to consistently maintain the same area in each photo over time.

Photographs will be used to evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures subjectively. Lateral photos should not indicate excessive erosion or continuing degradation of the banks. A series of photos over time should indicate successive maturation of riparian vegetation.

8.2 Storm Water Management Monitoring

No storm water BMPs are proposed at the Martin's Creek II mitigation project site.

8.3 Wetland Monitoring

The wetland restoration areas will be monitored annually for five years following construction or until success criteria are met, whichever comes last.

Five shallow groundwater/surface water gauges will be installed in the restored wetland areas. Two gauges will be placed in the existing wetland pockets at the northwestern and southwestern ends of the project, and will be used as reference gauges to monitor water elevations in these existing wetland areas for comparison to restored conditions. All the gauges will measure surface water and groundwater over a 20-inch or 40-inch vertical column on a daily basis. Data from each of the gauges will be downloaded on a bi-monthly basis.

Hydrologic success will be based on conditions of the on-site reference wetlands. Success will be determined by the following Criterion:

Years One Through Three- Monitoring during 2009 indicates that the reference wetland areas (based on analysis of hydrographs from Well #6) were saturated or inundated continuously for approximately 30 days of the early growing season, and approximately 85 days of the late growing season. This correlates to a hydroperiod range of approximately 15% to 44%. It should be noted that the fall of 2009 was unseasonably wet; therefore, the 44% hydroperiod likely represents the high side of the expected hydroperiod range. Based on information from other Piedmont and Mountain wetland sites, a typical average hydroperiod for these type wetlands is expected to be approximately 25%, which is well within the range documented by the reference wetlands on-site. Hydrologic success criteria at the restored site will be met if the site demonstrates groundwater table levels within 12 inches of the soil surface for a minimum of 13% of the growing season (this criterion reflects a deviation of 50% from the duration of saturation expected for these type wetland systems (~25%). Success for monitoring years one through three will be determined based on this 50% tolerance of deviation from the duration of wetland hydrology at the reference sites.

Years Four and Five- Success for monitoring years four and five will be determined based on a 20% tolerance of deviation from the duration of wetland hydrology at the reference sites. Therefore, it is expected that years four and five the site will achieve a minimum of 20% saturation.

Based on reference conditions and the criterion stated above, it is expected that reference soil saturation for years one through five will continue to exceed the regulatory 12.5% minimum requirement of the growing season for Cherokee County (see Section 5.2.2). In order to attain conditions suitable for the formation of wetland vegetation and hydric soils, the site should be saturated within 12 inches of the surface or inundated for consecutive period equal to 24 days. However, to meet hydrologic success criteria and mimic the reference wetland hydrology, the site should demonstrate wetland hydrology for a minimum of 25 days in years one through three. In years four and five, this will increase to a minimum of 38 days. Overbank flooding from the adjacent channel will also be noted during monitoring.

Reference areas will be monitored for the minimum of five years.

8.4 Vegetation Monitoring

Successful restoration of the vegetation on a site is dependent upon hydrologic restoration, active planting of preferred canopy species, and volunteer regeneration of the native plant community. In order to determine if the criteria are achieved, vegetation monitoring quadrants shall be installed across the mitigation site. The Carolina Vegetation Survey (CVS)-EEP methodology for determining the number of vegetation plots required per mitigation site shall be used to figure the number of quadrants needed for the Martin's Creek II mitigation project. The CVS-EEP vegetation monitoring protocol will also be used in monitoring the post-construction survival of riparian vegetation planted. The size of individual quadrants will vary from 100 square meters for tree species to 1 square meter for herbaceous vegetation. Vegetation monitoring will occur in spring, after leaf-out has occurred. Individual quadrant data will be provided and will include diameter, height, density, and coverage quantities. Relative values will be calculated, and importance values will be determined. Individual seedlings will be marked to ensure that they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

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

Specific and measurable success criteria for plant density on the project site will be based on the recommendations found in the WRP Technical Note and past project experience.

The interim measure of vegetative success for the site will be the survival of at least 320, 3-year old, planted trees per acre at the end of year three of the monitoring period. The final vegetative success criteria will be the survival of 260, 5-year old, planted trees per acre at the end of year five of the monitoring period. While measuring species density is the current accepted methodology for evaluating vegetation success on restoration projects, species density alone may be inadequate for assessing plant community health. For this reason, the vegetation monitoring plan will incorporate the evaluation of additional plant community indices to assess overall vegetative success.

8.5 Schedule/Reporting

Annual monitoring reports containing the information defined herein will be submitted to NCEEP by December 31 of the year during which the monitoring was conducted. Project success criteria must be met by the fifth monitoring year, or monitoring will continue until all success criteria are met.

9.0 SITE PROTECTION AND ADAPTIVE MANAGEMENT STRATEGY

The Martin’s Creek II mitigation project area will be protected by a permanent conservation easement that will be held by the state. The NCEEP will select a professional environmental engineering firm to monitor the project site for a minimum of five years following construction. Post-construction monitoring activities will be conducted to evaluate site performance, to identify maintenance and/or repair concerns, and to maintain the integrity of the project boundaries. If during the post-construction monitoring period it is determined project compliance is jeopardized, then the firm contracted to perform project monitoring review the monitoring results and if necessary, shall take action to resolve the project concerns and bring the project back into compliance. If maintenance or site repairs become necessary, the NCEEP will evaluate the level of response required, secure a contractor to make the repairs and monitor the work performed by the construction contractor.

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

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

Maintenance issues and recommended remediation measures will be detailed and documented in monitoring reports. The conditions listed above and any other factors that may have necessitated maintenance should be discussed.

10.0 REFERENCES

Adams, W.F. 1987. Indiana bat. In: Clark, M.K. (ed.). Endangered, Threatened and Rare Fauna of North Carolina, Part I. A Re-evaluation of the Mammals. Occasional Papers of the North Carolina Biological Survey. North Carolina State Museum of Natural Science, Raleigh.

Biedenharn, David S., Ronald R. Copeland, Colin R. Thorne, Philip J. Soar, Richard D. Hey, and Chester C. Watson. 2000. United States Army Corps of Engineers (USACOE), Coastal and Hydraulics Laboratory. Effective Discharge Calculation: A Practical Guide. ERDC/CHL TR-00-15. Washington, DC.

Bratton, S. P. 1976. Resource Division in an Understory Herb Community: Responses to Temporal and Microtopographic Gradients. The American Naturalist 110 (974):679-693.

Bruner, Gary W. 2002. HEC-RAS, River Analysis System Hydraulic Reference Manual. 2005. United States Army Corps of Engineers Hydrologic Engineering Center. Davis, CA.

Churchill, E. P., Jr., and S. I. Lewis. 1924. Food and feeding in freshwater mussels. Bulletin of the Bureau of Fisheries 39:439-471.

Clarke, A. H. 1981. The Tribe Alasmidontini (Unionidae: Anodontinae), Part 1: Pegias, Alasmidonta, and Arcidens. Smithsonian Contributions to Zoology, 326:1-101.

Cooper, J.E., S.S. Robinson, and J.B. Funderburg (eds.). 1977. Endangered and Threatened Plants and Animals of North Carolina. North Carolina State Museum of Natural History, Raleigh.

Copeland, R.R, D.N. McComas, C.R. Thorne, P.J. Soar, M.M. Jones, and J.B. Fripp. 2001. United States Army Corps of Engineers (USACOE). Hydraulic Design of Stream Restoration Projects. Washington, DC.

Earley, L.S. 1991. Going, going...? Wildlife in North Carolina 55(3):14-19.

Ehrnfield, J. G., 1995. Microsite Differences in Surface Substrate Characteristics in Chamaecyparis Swamps of the New Jersey Pinelands. Wetlands 15(2):183-189.

Federal Interagency Stream Restoration Working Group (FISRWG). 1998. Stream corridor restoration: Principles, processes and practices. National Technical Information Service. Springfield, VA.

Hadley, J.B. and Nelson, A.E., 1971, Geologic map of the Knoxville quadrangle, North Carolina, Tennessee, and South Carolina: U.S. Geological Survey, Miscellaneous Geologic Investigations Map I-654, scale 1:250000.

Hardin, J.W. 1977. Vascular plants. In: Cooper, J.E., S.S. Robinson, and J.B. Funderburg (eds.). Endangered and Threatened Plants and Animals of North Carolina. North Carolina State Museum of Natural History, Raleigh.

Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. *Wildland Hydrology.* AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Harman, W.A., D.E. Wise, M.A. Walker, R. Morris, M.A. Cantrell, M. Clemmons, G.D. Jennings, D. Clinton, and J. Patterson. 2000. Bankfull Regional Curves for North Carolina Mountain Streams. In Proc. AWRA Conf. Water Resources in Extreme Environments, Anchorage, Alaska, ed. D.L. Kane, pp.185-190. Middleburg, Va.: American Water Resources Association.

Henson, T.H. 1990. Bald eagle. In: Lee, D.S. and J.F. Parnell (eds.). Endangered, Threatened and Rare Fauna of North Carolina, Part III. A Re-evaluation of the Birds. Occasional Papers of the North Carolina Biological Survey. North Carolina Museum of Natural Sciences, Raleigh.

Julien, P. Y. 1995. Erosion and sedimentation. Cambridge University Press, 280p.

Lane, E. W. 1955. Design of stable channels. Transactions of the American Society of Civil Engineers. Paper No. 2776: 1234-1279.

Leopold, Luna B. M. Gordon Wolman, and John P. Miller. 1964. Fluvial Processes in Geomorphology. San Francisco, CA. (151).

Lowe, D.W., J.R. Matthews, and C.J. Mosely (eds.). 1990. Official World Wildlife Fund Guide to Endangered Species of North America. Beacham Publishing, Washington, D.C.

Lutz, H. J., 1940. Disturbance of Forest Soil Resulting from the Uprooting of Trees. Yale University School of Forestry Bulletin No. 45.

McGrath, C. Personal Communication. 1996.

Murdock, N. U.S. Fish and Wildlife Service. Ashville Field Office. Personal communication.

National Oceanic and Atmospheric Administration (NOAA). National Weather Service Hydrometeorological Design Studies Center, Precipitation Frequency Data Server. 2007. [Online WWW]. Available URL: http://hdsc.nws.noaa.gov/hdsc/pfds/orb/nc_pfds.html).

North Carolina Floodplain Mapping Program.2009. [Online WWW]. Available URL: http://www.ncfloodmaps.com.

North Carolina Division of Water Quality (NCDWQ) Basinwide Planning Program. Hiwassee River Basinwide Water Quality Plan (March 2007). North Carolina Department of Environment and Natural Resources. Raleigh, North Carolina. [Online WWW]. Available URL: http://h2o.enr.state.nc.us/basinwide/Hiwassee2007.htm

North Carolina Ecosystem Enhancement Program and Equinox Environmental Consultation and Design. 2007. Peachtree-Martins Creek Local Watershed Plan (Phase3), Hiwassee River Basin, Cherokee and Clay Counties, North Carolina. October 2007 Watershed Management Plan. [Online WWW]. Available URL: http://www.nceep.net/services/lwps/pull_down/by_basin/Hiwassee_RB.html.

North Carolina Ecosystem Enhancement Program. 2008. Hiwassee River Basin Restoration Priorities (2008). [Online WWW]. Available URL: http://www.nceep.net/services/lwps/pull_down/by_basin/Hiwassee_RB.htmlNorth Carolina Natural Heritage Program (NHP) Element Occurrence Database (Listing of State and Federally Endangered and Threatened Species of North Carolina). North Carolina Department of Environment and Natural Resources. Raleigh, North Carolina. 2006, 2008. [Online WWW]. Available URL:

http://149.168.1.196/nhp/.

North Carolina Natural Heritage Program (NHP) Element Occurrence Database (Listing of State and Federally Endangered and Threatened Species of North Carolina). North Carolina Department of Environment and Natural Resources. Raleigh, North Carolina, USA. 2006, 2008. [Online WWW]. Available URL: http://149.168.1.196/nhp/.

Potter, E.F., J.F. Parnell, and R.T. Teulings. 1980. Birds of the Carolinas. University of North Carolina Press, Chapel Hill, NC.

Radford, A.E., H.E. Ahles, and C.R. Bell. 1964. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill.

Raudkivi, A.J. 1967. Loose Boundary Hydraulics. Oxford, England: Pergramon Press. 331pp.

Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.

___. 1996. Applied River Morphology. Pagosa Springs, CO: Wildland Hydrology Books.

___. 1997. A geomorphological approach to restoration of incised rivers. Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision. Wang, S.S.Y, E.J. Langendoen, and F.D. Shields, Jr., eds. 12-22.

___. 1998. The reference reach - A blueprint for natural channel design (draft). ASCE Conference on River Restoration. Denver CO. March, 1998. ASCE. Reston, VA.

___. 2001a. A stream channel stability assessment methodology. Proceedings of the Federal Interagency Sediment Conference. Reno, NV. March, 2001.

___. 2001b. The cross-vane, w-weir and j-hook vane structures…their description, design and application for stream stabilization and river restoration. ASCE conference. Reno, NV. August, 2001.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. North Carolina Natural Heritage Program. Division of Parks and Recreation, NCDENR. Raleigh, NC.

Simon, A. 1989. A model of channel response in disturbed alluvial channels. *Earth Surface Processes and Landforms* 14(1):11-26.

Stephens, E. P., 1956. The Uprooting of Trees: a Forest Process. Soil Science Society of America Proceedings 20:113-116.

Terwilliger, K., J.R. Tate, and S.L. Woodward (eds.). 1995. A Guide to Endangered and Threatened Species in Virginia. The McDonald & Woodward Publishing Company, Blacksburg, Va.

United States Army Corps of Engineers. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. Environmental Laboratory. US Army Engineer Waterways Experiment Station. Vicksburg, MS.

___. 1997. Corps of Engineers Wetlands Research Program. Technical Note VN-rs-4.1. Environmental Laboratory. US Army Engineer Waterways Experiment Station. Vicksburg, MS.

United States Department of Agriculture, Natural Resources Conservation Service Soil Survey Division. Official Soil Series Descriptions, [Online WWW]. Available URL: (http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi).

United States Department of Agriculture, Natural Resources Conservation (NRCS). Soil Data Mart [Online WWW]. Available URL: http://soildatamart.nrcs.usda.gov/Default.aspx.

___. Official Soil Series Descriptions. [Online WWW]. Available URL: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

United States Department of Interior, Fish and Wildlife Service (USFWS). Threatened and Endangered Species in North Carolina. Cherokee County. 2006-2008. [Online WWW]. Available URL: http://www.fws.gov/nc-es/es/countyfr.html.

___. 1992a. Endangered and Threatened Species of the Southeastern United States (The Red Book). Prepared by Ecological Services, Division of Endangered Species, Southeast Region. Government Printing Office, Washington, D.C.

___. 1997a. Endangered and Threatened Wildlife and Plants: Bog Turtle determined to be a Threatened Species. *Federal Register* 62(213):59605-59623.

United States Environmental Protection Agency (USEPA). *Watershed Assessment of River Stability & Sediment Supply (WARSSS).* Dr. David L. Rosgen and the United States Environmental Protection Agency, 2008. [Online WWW]. Available URL: http://www.epa.gov/warsss/about.htm.

United States Geological Survey (USGS) Land Cover Data. 2002. [Online WWW]. Available URL: http://seamless.usgs.gov/.

Wolman, M.G. *Geografiska Annaler. Series A, Physical Geography*, Vol. 49, No. 2/4, Landscape and Processes: Essays in Geomorphology (1967), pp. 385-395

Yang, C.T. 1973. “Incipient Motion and Sediment Transport,” Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 99, No HY10, October, 1973, pp 1679-1704.

___. “Unit Stream Power Equations for Gravel,” Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 110, No. 12, December, 1984, pp 1783-1797.

APPENDIX A. NCDWQ Stream Identification Forms

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/9/09	**Project:** MARTIN	**Latitude:**
Evaluator: CHM	**Site:** Mainstem of Martin Cr.	**Longitude:**
Total Points: 50.0 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name*:

A. Geomorphology (Subtotal = 24.5)	**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 <u>existing</u> 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 = 9.5)				
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. Leaf litter	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 = 16)				
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 of form for additional notes)

Perennial stream as it passes through property

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1 Mainstem below UT-3

Date: 11/11/08	**Project:** Martin	**Latitude:**
Evaluator: MMC/CHM	**Site:** RIGHT PRONG	**Longitude:**
Total Points: 36 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 24)	**Absent**	**Weak**	**Moderate**	**Strong**
1ª. 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
9ª. 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]	

ªMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)					
14. Groundwater flow/discharge	0	1	2	[✓ 3]	
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	1	2	[✓ 3]	
16. Leaf litter	1.5	1	0.5	[✓ 0]	drought
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 = 5)					
20ᵇ. Fibrous roots in channel	3	2	1	[✓ 0]	
21ᵇ. Rooted plants in channel	[✓ 3]	2	1	0	
22. Crayfish	[✓ 0]	0.5	1	1.5	Time of year
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	
29ᵇ. Wetland plants in streambed	FAC=0.5 FACW=0.75 OBL=1.5 SAV= 2.0 Other = [✓ 0]				none

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 of form for additional notes)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08	**Project:** MARTIN	**Latitude:**
Evaluator: MMC / CHM	**Site:** RIGHT PRONG	**Longitude:**
Total Points: 19 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** MARTIN CR. CHEROKEE	**Other** *e.g. Quad Name*:

A. Geomorphology (Subtotal = 11)	**Absent**	**Weak**	**Moderate**	**Strong**
1ª. 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
9ª. 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 <u>existing</u> USGS or NRCS map or other documented evidence.	No = [✓ 0]		Yes = 3	

ªMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 2.5)				
14. Groundwater flow/discharge	0	[✓ 1]	2	3
15. Water in channel and > 48 hrs since rain, **<u>or</u>** Water in channel -- dry or growing season	0	[✓ 1]	2	3
16. Leaf litter	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 = 5.5)				
20ᵇ. Fibrous roots in channel	3	2	[✓ 1]	0
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08	**Project:** MARTIN	**Latitude:**
Evaluator: MMC / CHM	**Site:** RIGHT PRONG MARTIN CR.	**Longitude:**
Total Points: 5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 3)	**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 = 0)				
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. Leaf litter	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 = 2)				
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 of form for additional notes)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/11/08

Project: MARTIN

Latitude:

Evaluator: MWC/CHM

Site: RP-UT1 "Old Home" Trib

Longitude:

Total Points: 35.5
Stream is at least intermittent if ≥ 19 or perennial if ≥ 30

County: CHEROKEE

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	DROUGHT
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 = 6.5)					
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. Leaf litter	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	DROUGHT
19. Hydric soils (redoximorphic features) present?	No = [✓ 0]		Yes = 1.5		

C. Biology (Subtotal = 10)				
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 SALAMANDER	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 of form for additional notes)

Perennial through project area

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 2/23/10	**Project:** MARTIN CR.	**Latitude:**
Evaluator: CHM, AL	**Site:** RP UT2	**Longitude:**
Total Points: 36.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 19)	**Absent**	**Weak**	**Moderate**	**Strong**	
1ª. 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	step/pool to cascade
4. Soil texture or stream substrate sorting	0	1	[✓ 2]	3	
5. Active/relic floodplain	0	[✓ 1]	2	3	steep
6. Depositional bars or benches	0	[✓ 1]	2	3	
7. Braided channel	0	[✓ 1]	2	3	
8. Recent alluvial deposits	0	[✓ 1]	2	3	
9ª. 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]		

ªMan-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. Leaf litter	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 = 8.5)				
20ᵇ. Fibrous roots in channel	3	[✓ 2]	1	0
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

Sketch:

RP-UT-2

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	**Project:** MARTIN	**Latitude:**
Evaluator: MMC/CHM	**Site:** RP-UT2	**Longitude:**
Total Points: 26.0 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17.5)	**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 <u>existing</u> 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 = 4)				
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. Leaf litter	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 = 4.5)				
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/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 of form for additional notes)

Pto I BREAK

Sketch:

RP- UT-2

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	**Project:** MARTIN	**Latitude:**
Evaluator: MMC/CHM	**Site:** RP-UT2	**Longitude:**
Total Points: 13.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 9)	**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 = 2.5)				
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. Leaf litter	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 = 2)				
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 of form for additional notes)
I to E BREAK

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 2/23/10

Project: MARTIN CR

Latitude:

Evaluator: CHM, AL

Site: RP UT2-1

Longitude:

Total Points: 23,25
Stream is at least intermittent if ≥ 19 or perennial if ≥ 30

County: CHEROKEE

Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 10.5)	**Absent**	**Weak**	**Moderate**	**Strong**	
1ª. 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	steep
6. Depositional bars or benches	[✓ 0]	1	2	3	
7. Braided channel	[✓ 0]	1	2	3	
8. Recent alluvial deposits	0	[✓ 1]	2	3	
9ª. 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 <u>existing</u> USGS or NRCS map or other documented evidence.	[✓ No = 0]		Yes = 3		

ªMan-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. Leaf litter	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 = 3.75)

20ᵇ. Fibrous roots in channel	3	2	[✓ 1]	0	
21ᵇ. 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	
29ᵇ. Wetland plants in streambed	FAC=0.5 FACW=[✓ 0.75] OBL=1.5 SAV= 2.0 Other = 0				- some ferns

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 of form for additional notes)

Sketch:

RP-UT2-1

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09

Project: MARTIN

Latitude:

Evaluator: MMC /CHM

Site: RP-UT2-1

Longitude:

Total Points: 7.5
Stream is at least intermittent
if ≥ 19 or perennial if ≥ 30

County: CHEROKEE

Other
e.g. Quad Name:

A. Geomorphology (Subtotal = 4 **)**

	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 = 2.5 **)**

14. Groundwater flow/discharge	0	[✓ 1]	2	3
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	[✓ 1]	2	3
16. Leaf litter	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 = 1 **)**

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 of form for additional notes)

I to E BREAK

Ephemeral channel appears to be ~ 100 yards from source to where it becomes intermittent.

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08	**Project:** Martin	**Latitude:**
Evaluator: MMC/CHm	**Site:** RP-UT3	**Longitude:**
Total Points: 30.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 24)	**Absent**	**Weak**	**Moderate**	**Strong**
1ᵃ. 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
9ᵃ. 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	

ᵃMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 3.5)				
14. Groundwater flow/discharge	0	1	[✓ 2]	3
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	[✓ 1]	2	3
16. Leaf litter	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)				
20ᵇ. Fibrous roots in channel	3	2	1	[✓ 0]
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

Dry (mostly) channel - defined by Gr. W. flow

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08
Project: Martin
Latitude:
Evaluator: MMC/CHM
Site: RP-UT3
Longitude:
Total Points: 19.5
Stream is at least intermittent if ≥ 19 or perennial if ≥ 30
County: CHEROKEE
Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 13.5)	**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 <u>existing</u> 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 = 2.5)				
14. Groundwater flow/discharge	0	[✓ 1]	2	3
15. Water in channel and > 48 hrs since rain, <u>or</u> Water in channel -- dry or growing season	0	[✓ 1]	2	3
16. Leaf litter	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/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 of form for additional notes)
Dry (mostly), but defined by groundwater flow

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08	**Project:** Martin	**Latitude:**
Evaluator: MMC/CHM	**Site:** RP-UT3	**Longitude:**
Total Points: 4 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	3rd Trib coming up main UT **Other** *e.g. Quad Name*:

A. Geomorphology (Subtotal = 4)	**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 = 0)				
14. Groundwater flow/discharge	[✓ 0]	1	2	3
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	[✓ 0]	1	2	3
16. Leaf litter	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 = 0)				
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 of form for additional notes)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 2/23/10	**Project:** MARTIN CREEK	**Latitude:**
Evaluator: CAM, KL	**Site:** RP UT3-1	**Longitude:**
Total Points: 27 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 10)	**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	step-pool/ cascade
4. Soil texture or stream substrate sorting	0	[✓ 1]	2	3	
5. Active/relic floodplain	[✓ 0]	1	2	3	steep
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. Leaf litter	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)				
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 of form for additional notes)

step-pool to cascade channel structure

Sketch:

RP-U15-1

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	**Project:** MARTIN	**Latitude:**
Evaluator: MMC/CHM	**Site:** RP-U73-1	**Longitude:**
Total Points: 4.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 4.5)	**Absent**	**Weak**	**Moderate**	**Strong**
1ª. 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
9ª. 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 <u>existing</u> USGS or NRCS map or other documented evidence.	[✓ No = 0]		Yes = 3	

ªMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 0)				
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. Leaf litter	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 = 0)				
20ᵇ. Fibrous roots in channel	3	2	1	[✓ 0]
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

Sketch:

RP-UT4

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08	**Project:** MARTIN	**Latitude:**
Evaluator: MMC / CHM	**Site:** RP-UT4	**Longitude:**
Total Points: 32 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROEE	**Other** *e.g. Quad Name*:

A. Geomorphology (Subtotal = 21.5)	**Absent**	**Weak**	**Moderate**	**Strong**
1ᵃ. 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
9ᵃ. 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	

ᵃMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4)				
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. Leaf litter	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 = 6.5)				
20ᵇ. Fibrous roots in channel	3	2	1	[✓ 0]
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

Sketch:

Left Fork 1 - Top of
Mainstem Martins Cr
(Facing downstream)

RP-UT4

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08	**Project:** MARTIN	**Latitude:**
Evaluator: MC/CHM	**Site:** RP-UT4	**Longitude:**
Total Points: 29.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:**	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 21)	**Absent**	**Weak**	**Moderate**	**Strong**
1ª. 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
9ª. 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	

ªMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 3)				
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. Leaf litter	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 = 5.5)				
20ᵇ. Fibrous roots in channel	3	2	1	[✓ 0]
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

Sketch: 29.5
P/I Break Pt

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08	**Project:** MARTIN	**Latitude:**
Evaluator: MMC/CHM	**Site:** RP-UT4	**Longitude:**
Total Points: 7.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** e.g. *Quad Name:*

A. Geomorphology (Subtotal = 4.5)	**Absent**	**Weak**	**Moderate**	**Strong**
1ª. 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
9ª. 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 <u>existing</u> USGS or NRCS map or other documented evidence.	No = [✓ 0]		Yes = 3	

ªMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 0)				
14. Groundwater flow/discharge	[✓ 0]	1	2	3
15. Water in channel and > 48 hrs since rain, **<u>or</u>** Water in channel -- dry or growing season	[✓ 0]	1	2	3
16. Leaf litter	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)				
20ᵇ. Fibrous roots in channel	3	2	1	[✓ 0]
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

Sketch:

RP-UT4-1

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/19/08	**Project:** Martin	**Latitude:**
Evaluator: MMC/CHM	**Site:** RP-UT4-1	**Longitude:**
Total Points: 32 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** Cherokee	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17.5)

	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. Leaf litter	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 = 6)

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 of form for additional notes)

Ephemeral upstream of P break point

Sketch:

RP-UT4-1

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08	**Project:** MARTIN	**Latitude:**
Evaluator: MMC /CHM	**Site:** 4TH TRIB OF MAINSTEM	**Longitude:**
Total Points: 7.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	RP-UT4-1 **County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 4.5)	**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 = 0)				
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. Leaf litter	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)				
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 of form for additional notes)

Rhodo (mostly in valley along creek), White Pine, Scattered Sourwood + Oaks

Holly, Mt. Laurel (thick) on slopes

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08	**Project:** MARTIN	**Latitude:**
Evaluator: MMC/CHM	**Site:** RP-UT5	**Longitude:**
Total Points: 30 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 16.5)	**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 = 5.5)				
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. Leaf litter	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)				
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 of form for additional notes)

P-E BREAK

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 11/18/08
Project: MARTIN
Latitude:
Evaluator: MMC/CHM
Site: RP-VT5
Longitude:

Total Points: 9.5
Stream is at least intermittent if ≥ 19 or perennial if ≥ 30

County: CHEROKEE
Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 5.5)	**Absent**	**Weak**	**Moderate**	**Strong**
1ª. 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
9ª. 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 <u>existing</u> USGS or NRCS map or other documented evidence.	[✓ No = 0]		Yes = 3	

ªMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 2)				
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. Leaf litter	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 = 2)				
20ᵇ. Fibrous roots in channel	3	2	1	[✓ 0]
21ᵇ. 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
29ᵇ. 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 of form for additional notes)
P-E BREAK

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 2/23/10	**Project:** MARTIN CREEK	**Latitude:**
Evaluator: CHM, AL	**Site:** RP UT6	**Longitude:**
Total Points: 31.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	(confluence w/ RP below RPUT2) **County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15)	**Absent**	**Weak**	**Moderate**	**Strong**
1ª. 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
9ª. 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	

ªMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9.5)

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. Leaf litter	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)

20ᵇ. Fibrous roots in channel	3	[✓ 2]	1	0
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

Winter stoneflies

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 2/24/10	**Project:** MARTIN CR.	**Latitude:**
Evaluator: CHM, AL	**Site:** RP UT7	**Longitude:**
Total Points: 32 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 18)	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]
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	1	2	[✓ 3]
16. Leaf litter	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 = 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/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 of form for additional notes)

Winter stoneflies

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09
Evaluator: MMC / CHM
Total Points: 34.5
Stream is at least intermittent if ≥ 19 or perennial if ≥ 30

Project: MARTIN
Site: MC - UT 1
County: CHEROKEE
Latitude:
Longitude:
Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 18.5)

	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 <u>existing</u> 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 = 7.5)

14. Groundwater flow/discharge	0	1	2	[✓ 3]
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	1	2	[✓ 3]
16. Leaf litter	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 = 8.5)

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/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 of form for additional notes)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	**Project:** MARTIN	**Latitude:**
Evaluator: MMC / CHM	**Site:** MC-UT1	**Longitude:**
Total Points: 26 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 18.5)	**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 = 4)				
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. Leaf litter	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/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 of form for additional notes)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	**Project:** MARTIN	**Latitude:**
Evaluator: MMC/CHM	**Site:** MC-UT1	**Longitude:**
Total Points: 16.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	(TRIB TO LEFT FORK-1 ON FIELD MAP-PENCILED IN) **County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 11)	**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 = 2)				
14. Groundwater flow/discharge	0	[✓ 1]	2	3
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	[✓ 1]	2	3
16. Leaf litter	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/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 of form for additional notes)

Labeled left-frk-ebrk on trib coming into left-frk-1

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	**Project:** MARTIN	**Latitude:**
Evaluator: MMC/CHM	**Site:** MC-UT I-1	**Longitude:**
Total Points: 30 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17.5)	**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 <u>existing</u> 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 = 6)				
14. Groundwater flow/discharge	0	1	2	[✓ 3]
15. Water in channel and > 48 hrs since rain, **<u>or</u>** Water in channel -- dry or growing season	0	1	[✓ 2]	3
16. Leaf litter	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 = 6.5)				
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/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 of form for additional notes)

(Labeled as I-break on GPS unit)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	**Project:** MARTIN **Latitude:**
Evaluator: MMC / CMM	**Site:** MC-UT1-1 **Longitude:**
Total Points: 20.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	(LEFT FRK-1 ON FIELD MAP) **County:** CHEROKEE **Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 14)

	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 = 5)

	Absent	Weak	Moderate	Strong
14. Groundwater flow/discharge	0	1	[✓ 2]	3
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	[✓ 1]	2	3
16. Leaf litter	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)

	Absent	Weak	Moderate	Strong
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 of form for additional notes)

(Reach above pt. labeled "1 break" on GPS)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/9/09
Project: MARTIN
Latitude:
Evaluator: MMC/CHM
Site: MC-UT1-1
Longitude:
Total Points: 12
Stream is at least intermittent if ≥ 19 or perennial if ≥ 30
(Left FRK-1 ON FIELD MAP)
County:
Other
e.g. Quad Name:

A. Geomorphology (Subtotal = 7)	**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 = 2)				
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. Leaf litter	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)				
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 of form for additional notes)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	**Project:** MARTIN	**Latitude:**
Evaluator: CHM	**Site:** MC-UT1-2	**Longitude:**
Total Points: 28 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	"GIRAFFE" FIELD MAP **County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17.5)	**Absent**	**Weak**	**Moderate**	**Strong**
1ª. Continuous bed and bank	0	1	2	[✓ 3]
2. Sinuosity (channel altered - rd. adjacent to stream)	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
9ª. 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	

ªMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
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. Leaf litter	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 = 4)				
20ᵇ. Fibrous roots in channel	3	[✓ 2]	1	0
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	**Project:** MARTIN	**Latitude:**
Evaluator: CHM	**Site:** MC-UT1-2	**Longitude:**
Total Points: 10 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	"GIRAFFE" FIELD MAP **County:** CHEROKEE	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 5.5)

	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 = 3)

14. Groundwater flow/discharge	0	[✓ 1]	2	3
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	[✓ 1]	2	3
16. Leaf litter	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 = 1.5)

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/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 of form for additional notes)

House on hill close to Ephemeral break

I-E break

Sketch:

MC-UT1-3

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 1/8/09	Project: MARTIN	Latitude:
Evaluator: MMC/CHM	Site: MC-UT1-3	Longitude:
Total Points: 42.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	(LEFT FORK ON FIELD MAP) County:	Other *e.g. Quad Name*:

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 = 7.5)				
14. Groundwater flow/discharge	0	1	2	[✓ 3]
.5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	1	2	[✓ 3]
16. Leaf litter	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 = 11)				
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 of form for additional notes)

p-to property line

Sketch:

North Carolina Division of Water Quality Stream Identification Form. Version 3.1

Date: 7/27/09	**Project:** MARTIN	**Latitude:**	
Evaluator: CHM	**Site:** MC-UT2	**Longitude:**	
Total Points: 32.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*	**County:** CHEROKEE	**Other** *e.g. Quad Name:*	

A. Geomorphology (Subtotal = 12)	**Absent**	**Weak**	**Moderate**	**Strong**
1ª. 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 Incised
6. Depositional bars or benches	[✓ 0]	1	2	3
7. Braided channel	[✓ 0]	1	2	3
8. Recent alluvial deposits	[✓ 0]	1	2	3
9ª. 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 <u>existing</u> USGS or NRCS map or other documented evidence.	No = [✓ 0]		Yes = 3	

ªMan-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 11)				
14. Groundwater flow/discharge	0	1	2	[✓ 3]
5. Water in channel and > 48 hrs since rain, **or** Water in channel -- dry or growing season	0	1	2	[✓ 3]
16. Leaf litter	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 = 9.5)				
20ᵇ. Fibrous roots in channel	3	[✓ 2]	1	0
21ᵇ. 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
29ᵇ. 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 of form for additional notes)

THICK W/ BANK VEG + DEBRIS

PERENNIAL THROUGH PROJECT AREA

Sketch:

APPENDIX B. Regulatory Agency Correspondence

Categorical Exclusion Form for Ecosystem Enhancement Program Projects

Part 1: General Project Information	
Project Name:	Martin Creek Stream and Wetland Restoration Project
County Name:	Cherokee County
EEP Number:	S-D09010S
Project Sponsor:	Michael Baker Engineering, Inc. ("Baker")
Project Contact Name:	Micky Clemmons
Project Contact Address:	797 Haywood Rd., Suite 201 Asheville, NC 28806
Project Contact E-mail:	mclemmons@mbakercorp.com
EEP Project Manager:	Paul Wiesner

Project Description

Michael Baker Engineering, Inc., proposes to conduct stream restoration, enhancement and preservation activities on Martin Creek and its tributaries, 2.5 miles south of Murphy in Cherokee County. Martin Creek is a Class C water within cataloging unit 06020002 and DENR sub-basin 04-05-02 of the Hiwassee River Basin. Project goals include the restoration or enhancement of approximately 5,540 linear feet of stream. An additional 7,725 linear feet of high quality streams that converge with Martin Creek will also be preserved during the course of this project. The Martin Creek project site is also the location of several small wetlands that have been previously disturbed. This project will also include the restoration and enhancement of between 1.5 to 4 acres of wetlands. This work will be done for the purpose of obtaining stream mitigation credit in the Hiwassee River Basin.

For Official Use Only

Reviewed By:

9/14/09
Date

Paul Wiesner
EEP Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

9-10-09
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?	☐ 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?	☐ 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 local 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

Categorical Exclusion – Summary

Project Background

The Martin Creek Stream and Wetland Restoration Project involves the restoration or enhancement of approximately 5,540 linear feet in Cherokee County. In addition to restoration and enhancement activities, approximately 7,725 linear feet of stream will be preserved. The Martin Creek project site also hosts several small wetlands previously disturbed by agricultural land use. In addition to stream restoration and enhancement activities proposed, between 1.5 to 4 acres of wetlands will be restored, enhanced or preserved under this project. This work is being done for the purpose of obtaining stream mitigation credit for the NC Ecosystem Enhancement Program (NCEEP). Land cover on the property is predominantly forested with the exception of pasture land and residential development in the lower elevations of the project area. Three unnamed tributaries (UTs) are located in pastureland while the remaining unnamed tributaries in the project area are located in the forested upland portion of the project area near the source of Martin Creek and the Right Prong of Martin Creek.

This project will involve riparian corridor preservation and enhancement in the upper extent of the project area with measurable improvements to channel pattern and profile on the tributaries located in and adjacent to pastureland. Due to the extent of exposed bedrock present and other site constraints such as a secondary road and overhead powerline, enhancement work performed on the mainstem of Martin Creek will consist of improvements to channel dimension and riparian enhancement through the removal of exotic, invasives and re-establishment of a buffer consisting of woody material and other vegetation native to the ecoregion.

The National Environmental Policy Act of 1969 (NEPA) requires agencies to use an interdisciplinary approach in planning and decision-making for actions that will have an impact on the environment. The Federal Highway Administration (FHWA) and NC Department of Transportation (NCDOT) have determined that NCEEP projects will not involve significant impacts and therefore a Categorical Exclusion (CE) is the appropriate type of environmental document for this project. FHWA has also determined that stream restoration projects are considered land disturbing activities, so Parts 2 and 3 of the NCEEP checklist and the following environmental laws are applicable to this project (supporting information is located in the Appendix):

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

Environmental Data Resources, Inc. (EDR) prepared a Radius Map Report with GeoCheck on October 17, 2008. Based on the EDR report, there are no known or potential hazardous waste sites within or adjacent to the project area. The Executive Summary of the EDR report is included in the Appendix.

National Historic Preservation Act (Section 106)

Baker requested review and comment from the North Carolina State Historic Preservation Office (SHPO) on any possible issues that might emerge with respect to architectural or archaeological resources from the restoration project on November 20, 2008. Baker also requested review and comment from the Tribal Historic Preservation Office of the Eastern Band of Cherokee Indians on November 20, 2008. The SHPO responded on January 8, 2009, and requested that a Phase I Archaeological Survey be completed based on the high probability that prehistoric or historic archaeological sites may be present due to the topography and hydrological features of the area. The NCEEP contracted with Robert J. Goldstein & Associates, Inc. to perform a Phase I archaeological survey which was completed in May, 2009. The archaeological consulting group did locate one site within the project area; however it was determined that the site is not eligible for listing in the National Register of Historic Places. Other findings in the archaeological report included a recommendation that no further archaeological investigations be conducted for the purposes of this project. On June 10, 2009, the SHPO submitted correspondence to Baker agreeing with the findings.

As of June 30, 2009, the Tribal Historic Preservation Office has not commented with concerns. All correspondence on this issue is included in the Appendix.

Uniform Relocation Assistance and Real Property Act
Since this project is not a “full delivery” project compliance with the Uniform Act is not required at this stage by NCEEP. Compliance with the Uniform Act will be the responsibility of the State Property Office during the easement acquisition process.

American Indian Religious Freedom Act (AIRFA)
Baker requested review and comment from the Eastern Band of Cherokee Indians’ Tribal Historic Preservation Office (THPO) on any possible issues that might emerge with respect to any architectural or archaeological resources from the restoration project on November 20, 2008. At this time, the THPO has not commented on the project. Baker will continue working with the THPO to ensure they do not have any concerns regarding the project. All correspondence on this issue is included in the Appendix.

Endangered Species Act (ESA)
Baker reviewed both the NC Natural Heritage Program (NCNHP) and the US Fish and Wildlife Service (USFWS) lists of rare and protected animal and plant species and found that seven federally listed species are known to occur in Cherokee County: Bald Eagle (*Haliaeetus leucocephalus*), Bog Turtle (*Clemmys muhlenbergii)*, Indiana Bat (*Myotis sodalis*), Cumberland Bean (*Villosa trabalis*), Little-wing Pearlymussel (*Pegias fibula),* Tan Riffleshell (*Epioblasma florentina walkeri* (=E. *walkeri)*), and the Small Whorled Pogonia (*Isotria medeoloides*).

It was determined that suitable habitat was not present for any of the seven species listed for Cherokee County. Although some habitat features for the bog turtle were present in the wetlands at the Martin Creek site, overall habitat conditions were not favorable and no bog turtles were observed with the project area during preliminary site surveys in the spring and fall of 2008. Initially, the USFWS indicated a concern over the potential impacts to any Indiana bat populations that may be present in or around the project site. To alleviate concerns, Baker and the USFWS have reached an agreement on certain avoidance and mitigation measures summarized below to ensure the project will not adversely impact this federally listed species. Therefore, a “no effect” determination was made for all seven species listed.

Access to restoration and enhancement reach sites will be achieved by utilizing previously established access routes on-site. Preservation of existing trees and vegetation enhancement within the stream riparian corridor will serve to protect and promote habitat for these species. More detail on each species and their habitat is listed in the following paragraphs.

<u>Bald Eagle, (Federally Protected)</u>: Bald eagles have been sighted in Cherokee County where large open waters such as the Hiwassee Lake are present. According to the NC Natural Heritage Program website, bald eagle habitat in the southeast typically consists of “dominant live pines or cypress trees that provide a clear flight path and are located within 0.5 miles of open water. Winter roosting usually occurs farther inland, within dominant tree types that are also used for nesting in warmer seasons. Based on information posted on the NC Natural Heritage Program website, there are no occurrences of the bald eagle that have been recorded within 2 miles of the project area. With the exception of Martin Creek, the project area consists of headwater streams with small drainage areas. The streams within the project area are not identified as trout supporting streams and are unlikely to hold prey-sized fish to support bald eagle populations.

Biological Conclusion: No Effect
Improvements made through this project will not adversely impact any bald eagle populations or habitat. Canopy improvements made to the riparian zone within the restoration and enhancement reaches of the project area could actually support bald eagles in the long term should any of the planted trees become dominant canopy trees. Stream

preservation, restoration and enhancement activities will ultimately result in improved channel stability and water quality downstream through a reduction in sediment loading. Therefore, a determination was made that the proposed project will have no effect on this species.

Bog Turtle, (Threatened): The NCNHP lists the preferred habitat for bog turtles as "*shallow, spring-fed fens, sphagnaceous bogs, marshy meadows and pasture, with thick, grassy cover and crossed by slow, muddy bottomed streams, and swamps with aquatic and semiaquatic plants.*" The lower section of the Martin Creek project site is predominantly pastureland with pocket wetlands. These wetlands were found to have shallow, standing water during field surveys conducted in the spring and fall of 2008. These pocket wetlands contain both exotic, invasive plant vegetation, but also possess some hydrophytic vegetation such as sedges. Cattle had open access to these wetlands until the end of 2008. No evidence of bog turtle habitation or observations of bog turtles were made during the aforementioned field surveys during which site assessments were conducted. A search of the NCNHP database did not reveal any recorded observations of the bog turtle within two miles of the project area.

Biological Conclusion: No Effect
Correspondence was submitted to the USFWS December 2, 2008 that indicated the potential habitat present within the project area. Correspondence received from the USFWS March 10, 2009 and June 23, 2009 did not indicate concern over impacts the project might have on the bog turtle. Based on the lack of bog turtle observations made during on-site visits as well as a lack of recorded species observation in the NCNHP database, it was determined that this project will not impact the bog turtle or any known populations that may occur within Cherokee County. Furthermore, between 1.5 and 4 acres of wetlands will be restored through this project. While restoration activities will not result in the current wetland being converted to a bog, wetland functions will be restored to the site, which may enhance some habitat conditions favored by the bog turtle as well as other wildlife and plant communities.

Indiana Bat, (Endangered): The NCNHP lists the preferred summer habitat as "*females and young (maternity colonies) roost under loose bark and in tree hollows of shagbark hickory (Carya ovata) and oak near small-to medium-sized streams.*" Riparian corridors within the Martin Creek project may provide suitable summer foraging habitat for the Indiana bat; however there are no loose-barked trees within the project area or other habitat suitable for maternity colonies of the bat. There are also no mines or caves within the project area for winter hibernation. Clearing within the enhancement reaches of the project area will be limited to the removal of exotic, invasive vegetation such as multiflora rose and privet. Incidental removal of smaller, understory trees while removing exotic vegetation will be minimized to the extent possible.

Biological Conclusion: No Effect
As noted previously, the USFWS indicated concern over the potential impact the project might have on habitat or populations of the Indiana bat. In response, Baker submitted a letter to the USFWS outlining measures designed to minimize and avoid project impacts on the Indiana bat. These measures include performing tree and vegetation removal outside of the Indiana bat's maternity/roosting period, walking the site with the construction manager and marking any trees within the project area that may be favored by the bat. Trees that may be favored by the bat will be avoided to the extent possible. Baker has also proposed to incorporate trees favored by the Indiana bat into a planting plan for the site. Based on measures proposed, the USFWS submitted their concurrence for the project June 23, 2009. Therefore a "no effect" determination was made.

Cumberland Bean (Mussel), (Endangered): The Cumberland bean is a medium-sized freshwater mussel or bivalve mollusk with an olive-colored shell displaying faint wavy green lines. This mussel can be found in sand, gravel, and cobble substrates in moderate to fast-moving waters at depths less than a meter. As is typical with many mussels, the Cumberland bean favors clean shoal areas and silt-free riffles consisting of relatively firm rubble, gravel, and sand. Its current range exists in the Hiwassee River in Polk County, Tennessee and North Carolina.

Many intermittent and perennial streams within the project area that were found to contain water during field surveys also contained moderate amounts of silt and had slow to moderate currents. Some of these tributaries were also found to go subsurface for short distances as well. Historical agricultural land use practices of the project area and passage to perennial unnamed tributaries that have been affected by culvert installation and headcutting make it unlikely that any populations which may have existed prior to the conversion of the surrounding landscape would have survived.

Biological Conclusion: No Effect

Martin Creek is a targeted watershed within the Hiwassee River Basin and is known for its excessive sediment and nutrient loading problems, making it unlikely that the Cumberland bean is located on Martin Creek which is the largest waterbody within the project site. There are no recorded observations of the Cumberland bean within two miles of the project site and none were observed during site surveys.

Stormwater and erosion control best management practices will be applied during construction activities associated with stream and wetland restoration and enhancement, minimizing impacts to any potential habitat or populations of the Cumberland bean on Martin Creek downstream of the project area. Furthermore, the project will not affect the ability of the mussel to migrate upstream or downstream of the project area on Martin Creek. Due to a lack of suitable mussel habitat, and the application of adequate erosion control measures during project construction, this project will not impact habitat for the Cumberland bean.

Little-Wing Pearlymussel, (Endangered): The little-wing pearlymussel is a freshwater bivalve mollusk that reaches an average length of 24-millimeters at maturity. Immature little-wing pearlymussels possess dark rays at the base of their shell. By the time the mussel reaches adulthood, its outer shell is usually eroded away. This species is found in small, cool streams at the head of riffles, although it has been found to inhabit other areas in and below riffles in substrate consisting of sand or gravel and scattered cobbles. It has also been observed in silt-free environments underneath large rocks and is known to occupy sand pockets between rocks, cobbles and boulders. This mussel is most often found submerged on top or partially buried within substrate as previously described in approximately 6 to 10 inches of water.

The mussel has been cited as occurring in the Hiwassee and Little Tennessee River basins in North Carolina. Specifically, it was formerly observed in the Valley River in Cherokee County and the Little Tennessee River in North Carolina. Based on state species account information provided by the NHP and the NC Wildlife Resource Commission's state atlas of freshwater mussels, it appears this species now only inhabits a section of the Little Tennessee River basin between Swain and Macon counties.

Biological Conclusion: No Effect

Based on the lack of observations made during on-site visits and information provided by the NCNHP and NC Wildlife Resources Commission, the little-wing pearlymussel does not inhabit the project site or waters within at least two miles of the project. Therefore, this project will not impact habitat or known populations of the little-wing pearlymussel in western North Carolina.

Tan Riffleshell, (Endangered): Like the Cumberland bean, the tan riffleshell is a medium-sized freshwater mussel that has multiple green rays and a brown to yellow colored shell. Its habitat requirement are also similar to the cumberland bean as it is found in headwaters, riffles, and shoals made up of sand and gravel substrates. While it is possible that populations of this mussel may still exist in the Hiwassee River, recorded populations of this species are located outside of the state, primarily within the Clinch River drainage in Tennessee. Based on population declines, it appears this mussel is particularly sensitive to poor water quality and habitat disturbance including the loss of glochidial hosts.

Biological Conclusion: No Effect

The Martin Creek project will not affect any tan riffleshell populations which may exist in the Hiwassee for the same factors listed in the biological conclusion for the Cumberland bean. According to the NCNHP database, there have been no recorded observations of the tan riffleshell within two miles of the project area which covers a segment of the Hiwassee River in the vicinity of the site. A review of the US Fish and Wildlife Service, Asheville Ecological Field Office website (last updated May 15, 2008) on threatened and endangered species associated with the North Carolina lists the tan riffleshell as being extirpated from the state.

Small-Whorled Pogonia (Threatened): The small-whorled pogonia is a small, perennial member of the Orchidaceae. These plants arise from long slender roots, with hollow stems terminating in a whorl of five or six light green leaves. The single flower is approximately one inch long, with yellowish-green to white petals and three longer green sepals. This orchid blooms in late spring, from mid-May to mid-June. Populations of this plant are reported to have extended periods of dormancy and to bloom sporadically. This small spring ephemeral orchid is not observable outside of the spring growing season. When not in flower, young plants of Indian cucumber-root (*Medeola virginiana*) also resemble small-whorled pogonia; however, the hollow stout stem of *Isotria* separates it from the genus *Medeola*, which has a solid, more slender stem (U.S. Fish and Wildlife Service County Listing, 2008).

Small-whorled pogonias may occur in young as well as maturing forests, but typically grows in open, dry, deciduous woods and areas along streams with acidic soil. It also grows in rich, mesic woods in association with white pine and rhododendron.

Biological Conclusion: No Effect

Suitable habitat as described above does not exist for the small-whorled pogonia in the restoration and enhancement reaches of the Martin Creek project area. No plants were located during field assessments performed; a review of the NCNHP database did not reveal any recorded observations within two miles of the project limits. Therefore this project will not have an impact on any small-whorled pogonia populations occurring in Cherokee County.

The North Carolina Wildlife Resource Commission (NCWRC) was notified of the project via letter on November 24, 2008. A letter was submitted to the USFWS December 3, 2008. Baker received comments from NCWRC on December 9, 2008, which indicated that Martin Creek supports sensitive aquatic life like the sicklefin redhorse, mountain creekshell, and hiwassee crayfish. According to the NCWRC, these and several other sensitive species are found in the Hiwassee River further downstream. In addition to recommending minimization of site disturbance and implementation of effective erosion control measures, the NCWRC also anticipates requesting that stream construction be avoided from April 1st to June 15th during the spawning season for any sicklefin redhorse populations that may exist in Martin Creek. After discussions were held regarding impact avoidance measures to protect any Indiana bat colonies present on or near the project site, the USFWS submitted their concurrence for this project June 23, 2009. Correspondence on this issue is included in the Appendix.

Farmland Protection Policy Act (FPPA)

On December 15, 2008, Baker submitted the AD-1006 form for the Martin Creek project site to the Regional Natural Resources Conservation Service (NRCS) office in Waynesville, NC. The NRCS responded on January 7, 2009, with the determination that implementation of this restoration project would result in the conversion of 9.1 acres of prime farmland or farmland of state or local importance. The completed AD-1006 form and other correspondence on this issue is included in the Appendix.

Fish and Wildlife Coordination Act (FWCA)

A letter was sent by Baker to the NCWRC on November 24, 2008, requesting their comment and review on the Martin Creek restoration and enhancement project. The NCWRC responded on December 9, 2008, and expressed no concerns regarding anticipated impacts to federally listed species for the county. However, as stated above, the letter did indicate that less impacted segments of Martin Creek have been found to support sensitive aquatic life such as the sicklefin redhorse, mountain creekshell, and hiwassee crayfish.

According to the NCWRC, these and several other sensitive species are found in the Hiwassee River further downstream. Correspondence pertaining to project permitting and design plans will be submitted to the NCWRC at a later time. Correspondence on this issue is included in the Appendix.

Baker submitted a letter to the USFWS on December 3, 2008 requesting their comment and review of the Martin Creek restoration project site. On June 23, 2009, Baker received correspondence from the USFWS indicating their conditional concurrence with the project. All correspondence on this issue is included in the Appendix.

Migratory Bird Treaty Act (MBTA)

A letter was sent by Baker to the USFWS on December 3, 2008 requesting their comment and review on the Martin Creek Restoration and Enhancement Project in relation to migratory birds. On June 23, 2009, Baker received the USFWS' concurrence for the project. All correspondence on this issue is included in the Appendix.

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:	Martin Creek Stream and Wetland Restoration
Name of stream or feature:	Martin Creek and tributaries to Martin Creek
County:	Cherokee
Name of river basin:	Hiawassee
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Town of Murphy / Cherokee County
DFIRM panel number for entire site:	4591
Consultant name:	Michael Baker Engineering, Inc. ("Baker")
Phone number:	828-350-1408 ext. 2007 (Jake McLean, PE, CFM)
Address:	797 Haywood Road, Suite 201 Asheville, NC 28806

Table ES.1 Mitigation Plan Overview

Martin's Creek Mitigation Project--NCEEP Project #92633

Reach	Design Approach	Existing Reach (LF)	Design Reach (LF)	Potential SMUs/ WMUs	SMU/WMU Credit Ratio	Watershed Drainage Area (square miles)
Right Prong Martin's Creek (RP) Unnamed Tributaries						
RP-UT1	Preservation	541	541	108	5:1	0.162
RP-UT1	Enhancement II	399	399	159	2.5:1	.169
RP-UT2	Preservation	2,472	2,472	494	5:1	0.076
RP-UT2-1	Preservation	1,366	1,366	273	5:1	0.037
RP-UT3	Preservation	1,379	1,379	276	5:1	0.097
RP-UT3-1	Preservation	1,060	1,060	212	5:1	0.027
RP-UT4	Preservation	1,832	1,832	366	5:1	0.073
RP-UT4-1	Preservation	698	698	140	5:1	0.019
RP-UT5	Preservation	818	818	164	5:1	0.016
RP-UT6	Preservation	1,069	1,069	214	5:1	0.036
RP-UT7	Preservation	791	791	158	5:1	0.013
Right Prong Martin's Creek (Reach 1)	Preservation	5,208	5,208	1,042	5:1	0.413
Right Prong Martin's Creek (Reach 2)	Enhancement II	572	572	229	2.5:1	0.603
Martin's Creek (MC) Unnamed Tributaries						
MC-UT1 (Reach 1)	Preservation	2,482	2,482	496	5:1	0.065
MC-UT1 (Reach 2)	Restoration	1,070	1,070	1,070	1:1	0.092
MC-UT1 (Reach 3)	Enhancement I	345	345	230	1.5:1	0.161
MC-UT1 (Reach 4)	Restoration	332	1,149	1,149	1:1	0.176
MC-UT1-1	Preservation	689	689	138	5:1	0.018
MC-UT1-2	Preservation	923	923	185	5:1	0.019
MC-UT1-2-1	Preservation	202	202	40	5:1	0.005
MC-UT1-3 (Reach 1)	Enhancement I	516	516	344	1.5:1	0.07
MC-UT1-3 (Reach 2)	Restoration	1,068	1,286	1,286	1:1	0.08
MC-UT2	Enhancement II	75	75	30	2.5:1	0.385
Martin's Creek	Enhancement II	857	857	343	2.5:1	6.81
TOTAL STREAM FOOTAGE BY TYPE		26,764	27,799	9,146		
Stream Design Approach						
Stream Length/SMUs	Restoration	2,470	3,505	3,505	1:1	
	Enhancement I	861	861	574	1.5:1	
	Enhancement II	1,903	1,903	761	2.5:1	
	Preservation	21,530	21,530	4,306	5:1	
		26,764	27,799	9,146		
TOTAL WETLAND ACREAGE						
Wetland Design Approach (Acres)						
Total Wetland Acreage	Restoration	-	5.2	5.2	1:1	
	Enhancement	1.53	1.53	.77	2:1	

MC-UT1-3 (Reach 1)	516	LI	E	516	1.5:1	344	0+00-5+16	Improve channel profile, sediment transport function and bank stability where needed and adjust channel dimension
MC-UT1-3 (Reach 2)	1,068	PI	R	1,286	1:1	1,286	5+78-18+64	Restore wetland hydrology and restore geomorphic form to channel by relocating channel within greater wetland complex and adjusting confluence of tributary with UT1
MC-UT2	75	LII	E	75	2.5:1	30	Refer to Plan Sheet Pg. 16	Improve riparian buffer by removing invasive/exotic vegetation; replanting with native vegetation.
Martin's Creek	857	LII	E	857	2.5:1	343	Refer to Plan Sheet Pg. 16	Improve riparian buffer by removing invasive/exotic vegetation; replanting with native vegetation.

Mitigation Unit Summations

Stream (LF)	Riparian Wetland (Ac)	Nonriparian Wetland (Ac)	Total Wetland (Ac)	Buffer (Ac)	Comment
9,146	6.73	NA	6.73	93.87	

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

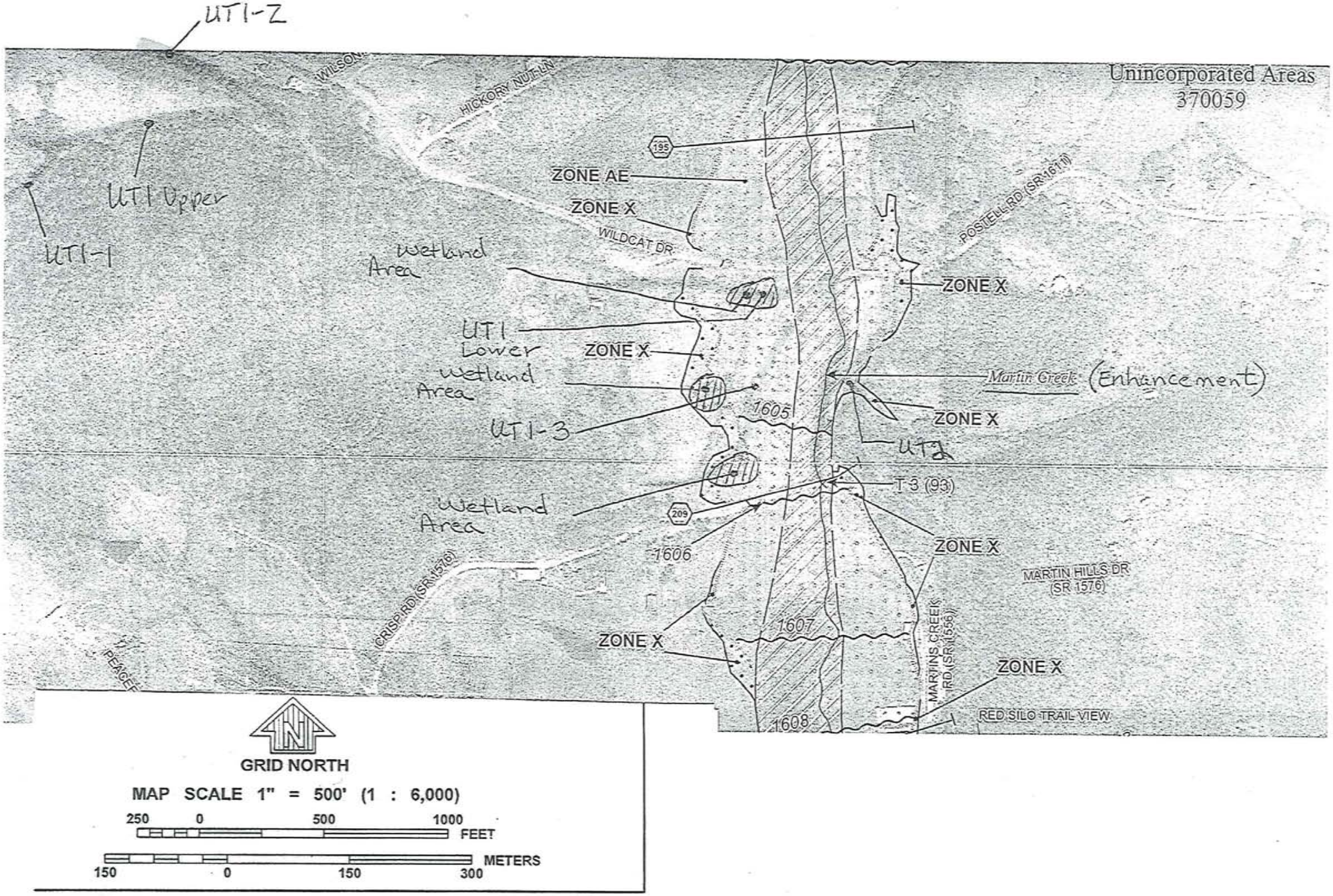
59 Hiwassee Street
Murphy, NC 28906
(828) 837-6730

Comments:
Baker: A no rise certificate and supporting documentation has been prepared. The main efforts are the restoration of two tributaries that share a floodplain with Martin Creek and grading to excavate buried wetland soil horizons as part of wetland restoration activities. There will be minor work on the mainstem to breach the existing levy in a couple of locations in order to restore hydrologic connectivity of the bankfull flow to the larger floodplain. In addition, the project entails work on tributaries higher in the watershed where no regulatory floodplain exists. Please refer to the No Impact Certification Report for more details.

***Per Silas Allen*: Although these UT"s lie outside any SFHA, we respectfully request that a twenty-five to thirty foot undisturbed buffer be left intact when possible. This area has been and still is part of a previously protected and classed NCDWQ watershed for the Town of Murphy.**

Name: Jacob P. McLean Signature: Jacob P McLean
Title: PE, CFM Date: 9/18/10

* Right Prong not shown : mostly preservation and not located in regulatory flood zone



NC State Historic Preservation Office
Attn: Ms. Renee Gledhill-Earley
4617 Mail Service Center
Raleigh, NC 27699-4617

November 20, 2008

Subject: North Carolina Ecosystem Enhancement Program (NCEEP) Stream Mitigation Project on Martin Creek and Tributaries, Cherokee County, NC.

Dear Ms. Gledhill-Earley,

The North Carolina Ecosystem Enhancement Program (EEP) requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with a potential stream restoration project area identified on the maps attached (a vicinity map, a USGS site map, and a restoration plan figure with areas of potential ground disturbance are enclosed).

The Martin Creek site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. The project will involve restoration, enhancement or preservation of a section of Martin Creek, the Right Prong of Martin Creek and sections of four unnamed tributaries (UTs) that have been identified as being significantly degraded. Project goals include the restoration or enhancement of 5,540 linear feet of stream for the purpose of obtaining stream mitigation credit in the Hiwassee River Basin. Stream mitigation credits are also being extended to an additional 7,725 linear feet of stream being preserved.

Preliminary visual assessments and data provided by the NCEEP indicate the presence of approximately 2.0 acres of mapped wetlands that will be protected under the proposed project. Buried hydric soils have also been located on-site in the vicinity of the existing wetlands and were likely filled to increase agricultural production. To determine the extent of wetland restoration work required, further analysis of the site is proposed. The location where wetland restoration may occur is provided in Restoration Plan Figure 1.3.

No architectural structures or archaeological artifacts have been observed or noted during preliminary surveys of the site. The project area consists of moderate to steeply forested slopes and valleys with elevations ranging from 2,245’ above sea level (ASL), in upland project reaches to approximately 1,600’ ASL in the floodplain along Martin Creek. The majority of the project site on the floodplain and sections of the upland project area has historically been disturbed by agricultural land uses. As the enclosed aerial photograph shows, the majority of the area within the construction limits of the site consists of upland forest with the lower project area consisting of floodplain, pastureland and straightened stream channels.

Mapped soils within the upland portion of the project area include the Thurmont-Dillard complex (8 to 15% slopes) and Junaluska-Tsali complexes (ranging from 15% to 50% slopes). Soils mapped within the pasture and floodplain portion of the project area consist of the Ark aqua loam and the Dillard loam series. Soils of the Thurmont-Dillard complex are dominant in areas adjacent to the streams in the forested area of the project. These soils are located on moderate slopes in the valley of the project, are well drained and lie above the seasonal high water table. In the lower section of the valley, project streams course through both Dillard loams and Ark aqua loams. Dillard loams are located in the project area in the transitional zone between the upland forested areas and the floodplain. This soil series is defined as being moderately well drained, rarely flooded and typically 24 to 36 inches above the water table. The Ark aqua loam soils are located in the lower valley of the Martin Creek watershed and are primarily within the floodplain for Martin Creek. As evidenced by the presence and location of wetlands on-site, the Ark aqua loams within the project area are somewhat poorly drained and are occasionally flooded. Whereas the depth to the water table in the upper extent of the project area ranges from 36 to 72 inches, the depth to the water table where Ark aqua loams are present is approximately 18 to 24 inches; however, water is at the ground surface in some wetland areas. Soils data presented in this letter were assembled from information provided by the Natural Resources Conservation Service office in Cherokee County and from the USDA-NRCS Soil Data Mart website (http://soildatamart.nrcs.usda.gov/Default.aspx).

We ask that you review this site based on the attached information to determine the presence of any historic properties or other objects of cultural significance. Thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.
Sincerely,

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806
Phone: 828.350.1408 xt. 2010, Email: cmcintyre@mbakercorp.com

Cc:

Mr. Paul Wiesner
NC Ecosystem Enhancement Program (EEP)
2090 U. S. Highway 70
Swannanoa, NC 28778

Mr. Tyler Howe
EBCI Tribal Historic Preservation Office
P.O. Box 455
Cherokee, NC 28719

Eastern Band of Cherokee Indians
Attn: Mr. Tyler Howe
Tribal Historic Preservation Office
P.O. Box 455
Cherokee, NC 28719

November 20, 2008

Subject: North Carolina Ecosystem Enhancement Program (NCEEP) Stream Mitigation Project on Martin Creek and Tributaries, Cherokee County, NC.

Dear Mr. Howe,

The North Carolina Ecosystem Enhancement Program (EEP) requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with a potential stream restoration project area identified on the maps attached (a vicinity map, a USGS site map, and a restoration plan figure with areas of potential ground disturbance are enclosed).

The Martin Creek site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. The project will involve restoration, enhancement or preservation of a section of Martin Creek, the Right Prong of Martin Creek and sections of four unnamed tributaries (UTs) that have been identified as being significantly degraded. Project goals include the restoration or enhancement of 5,540 linear feet of stream for the purpose of obtaining stream mitigation credit in the Hiwassee River Basin. Stream mitigation credits are also being extended to an additional 7,725 linear feet of stream being preserved.

Preliminary visual assessments and data provided by the NCEEP indicate the presence of approximately 2.0 acres of mapped wetlands that will be protected under the proposed project. Buried hydric soils have also been located on-site in the vicinity of the existing wetlands and were likely filled to increase agricultural production. To determine the extent of wetland restoration work required, further analysis of the site is proposed. The location where wetland restoration may occur is provided in Restoration Plan Figure 1.3.

No architectural structures or archaeological artifacts have been observed or noted during preliminary surveys of the site. The project area consists of moderate to steeply forested slopes and valleys with elevations ranging from 2,245’ above sea level (ASL), in upland project reaches to approximately 1,600’ ASL in the floodplain along Martin Creek. The majority of the project site on the floodplain and sections of the upland project area has historically been disturbed by agricultural land uses. As the enclosed aerial photograph shows, the majority of the area within the construction limits of the site consists of upland forest with the lower project area consisting of floodplain, pastureland and straightened stream channels.

Mapped soils within the upland portion of the project area include the Thurmont-Dillard complex (8 to 15% slopes) and Junaluska-Tsali complexes (ranging from 15% to 50% slopes). Soils mapped within the pasture and floodplain portion of the project area consist of the Ark aqua loam and the Dillard loam series. Soils of the Thurmont-Dillard complex are dominant in areas adjacent to the streams in the forested area of the project. These soils are located on moderate slopes in the valley of the project, are well drained and lie above the seasonal high water table. In the lower section of the valley, project streams course through both Dillard loams and Ark aqua loams. Dillard loams are located in the project area in the transitional zone between the upland forested areas and the floodplain. This soil series is defined as being moderately well drained, rarely flooded and typically 24 to 36 inches above the water table. The Ark aqua loam soils are located in the lower valley of the Martin Creek watershed and are primarily within the floodplain for Martin Creek. As evidenced by the presence and location of wetlands on-site, the Ark aqua loams within the project area are somewhat poorly drained and are occasionally flooded. Whereas the depth to the water table in the upper extent of the project area ranges from 36 to 72 inches, the depth to the water table where Ark aqua loams are present is approximately 18 to 24 inches; however, water is at the ground surface in some wetland areas. Soils data presented in this letter were assembled from information provided by the Natural Resources Conservation Service office in Cherokee County and from the USDA-NRCS Soil Data Mart website (http://soildatamart.nrcs.usda.gov/Default.aspx).

We ask that you review this site based on the attached information to determine the presence of any historic properties or other objects of cultural significance. Thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806
Phone: 828.350.1408, Email: cmcintyre@mbakercorp.com

Cc:

Mr. Paul Wiesner
NC Ecosystem Enhancement Program (EEP)
2090 U. S. Highway 70
Swannanoa, NC 28778

Ms. Renee Gledhill-Earley
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

North Carolina Department of Cultural Resources
State Historic Preservation Office
Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

January 8, 2009

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Road, Suite 201
Asheville, NC 28806

Re: Martin Creek and Tributaries Stream Mitigation, Cherokee County, ER 08-2843

Dear Ms. Horne-McIntyre:

Thank you for your letter concerning the above project. We apologize for the delay in our response.

There are no known recorded archaeological sites within the project boundaries. However, the project area has never been systematically surveyed to determine the location or significance of archaeological resources. Based on the topographic and hydrological situation, there is a high probability for the presence of prehistoric or historic archaeological sites.

We recommend that a comprehensive survey be conducted by an experienced archaeologist to identify and evaluate the significance of archaeological remains that may be damaged or destroyed by the proposed project. The archaeological survey should be undertaken only at those portions of the project area where ground disturbance is proposed. Potential effects on unknown resources must be assessed prior to the initiation of construction activities.

Two copies of the resulting archaeological survey report, as well as one copy of the appropriate site forms, should be forwarded to us for review and comment as soon as they are available and well in advance of any construction activities.

A list of archaeological consultants who have conducted or expressed an interest in contract work in North Carolina is available at www.arch.dcr.state.nc.us/consults.htm. The archaeologists listed, or any other experienced archaeologist, may be contacted to conduct the recommended survey.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/807-6579. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Peter Sandbeck

North Carolina Department of Cultural Resources
State Historic Preservation Office
Peter B. Sandbeck, Administrator

Beverly Eaves Perdue, Governor
Linda A. Carlisle, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

June 11, 2009

Dawn Reid
Archaeological Consultants of the Carolinas, Inc.
121 East First Street
Clayton, NC 27520

Re: Martin Creek and Tributaries Stream Mitigation, Cherokee County, ER 08-2843

Dear Ms. Reid:

Thank you for your letter of May 15, 2009, transmitting the archaeological survey report by Michael O'Neal for the above project.

During the course of the survey, one site was located within the project area. For purposes of compliance with Section 106 of the National Historic Preservation Act, we concur that the following property is not eligible for listing in the National Register of Historic Places under criterion D:

31CE767

This site does not retain sufficient subsurface integrity or artifact density to yield information important to history or prehistory.

Mr. O'Neal has recommended that no further archaeological investigation be conducted in connection with this project. We concur with this recommendation since the project will not involve significant archaeological resources.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/807-6579. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

cc: Michael Baker Engineering, Inc.

Baker

Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, North Carolina 28806

828-350-1408
FAX 828-350-1409

December 2, 2008

U. S. Fish and Wildlife Service
Attn: Ms. Marella Buncick
Asheville Field Office
Asheville, NC 28801

Subject: North Carolina Ecosystem Enhancement Program (NCEEP) Stream Mitigation Project on Martins Creek and Tributaries, Cherokee County, NC.

Dear Ms. Buncick,

The North Carolina Ecosystem Enhancement Program (EEP) requests review and comment on the presence of federally listed species, their habitat, and any other issues that might emerge with respect to a potential stream restoration project area identified on the maps attached (a vicinity map, a USGS site map, and a restoration plan figure with areas of potential ground disturbance are enclosed).

The Martins Creek site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. The project will involve restoration, enhancement or preservation of a section of Martins Creek, the Right Prong of Martins Creek and sections of four unnamed tributaries (UTs) that have been identified as being significantly degraded. In addition, approximately 5 acres of wetlands will be restored and preserved under this project. Project goals include the restoration or enhancement of 5,540 linear feet of stream for the purpose of obtaining stream mitigation credit in the Hiwassee River Basin. Stream mitigation credits are also being extended to an additional 7,725 linear feet of stream being preserved.

We have already obtained an updated species list for Cherokee County from your web site (http://www.fws.gov/nc-es/es/countyfr.html). The threatened, endangered or otherwise federally protected species for this county are: Bald Eagle (*Haliaeetus leucocephalus*), Bog Turtle (*Clemmys muhlenbergii*), Indiana Bat (*Myotis sodalis*), Cumberland bean (pearlymussel) (*Villosa trabalis),*Tan riffleshell (*Epioblasma florentina walkeri* (=E. *walkeri)),*and the Small whorled pogonia (*Isotria medeoloides*). Although there are no critical habitat areas listed for Cherokee County, favorable conditions for the bog turtle may be present on site. The potential bog turtle habitat consists of nearly two acres of wetlands present within the project area that are located in frequently used pastureland. Further site analysis will be required to confirm the wetland status of the three remaining acres assumed to be a filled wetland area.

We are requesting that you please provide any known information for each species in the county. The USFWS will be contacted immediately if the agency determines that suitable habitat for a federally listed species exists within the project area or if the agency has records indicating the presence of a federally listed species on-site.

Please provide comments on any possible issues that might emerge with respect to endangered species, migratory birds or other trust resources from the construction of a stream and wetland restoration project on the subject property.

If we have not heard from you in 30 days, we will assume that our species list is correct, that you do not have any comments regarding associated laws, and that you do not have any information relevant to this project at the current time.

Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project. I can be reached at 828.350.1408 ext. 2010 or by email at cmcintyre@mbakercorp.com . We thank you in advance for your timely response and cooperation.

Sincerely,

CARMEN HORNE-McINTYRE

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806
Phone: 828.350.1408, Email: cmcintyre@mbakercorp.com

Cc:
Mr. Paul Wiesner
NC Ecosystem Enhancement Program (EEP)
2090 U.S. Highway 70
Swannanoa, NC 28778

From: Carmen McIntyre
To: Marella_Buncick@fws.gov
Date: 1/5/2009 11:52 AM
Subject: Review of stream mitigation projects in Cherokee County

Hi Marella,
Do you happen to know the status of the USFWS review for two stream restoration projects Michael Baker Engineering, Inc. has in Cherokee County? These projects have been proposed for completion on behalf of the NC Ecosystem Enhancement Program for stream and wetland impacts in the Hiwassee River Basin. I submitted a request for comment to the USFWS about 30 days ago for the Martin Creek Project and the Unnamed Tributary (UT) to Martin Creek Project (also known as the Contreras Site). Please note that the letter originally submitted for the Contreras Site refers to Contreras Creek. "Contreras Creek" is actually an unnamed tributary to Martin Creek, whereas the project area as a whole is referred to as the Contreras Site. Therefore the project consists of three unnamed tributaries including the aforementioned UT to Martin Creek.

As we finalize the environmental review documents, I wanted ensure any concerns held by the USFWS about the two projects had been met. If you know when we can expect to receive comment or if there are any project concerns, please contact me at your earliest convenience at 828.350.1408 x. 2010 or by email.

Thanks in advance for your assistance!

Best,
Carmen

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806
P: 828.350.1408 x. 2010
F: 828.350.1409

From: Carmen McIntyre
To: Marella_Buncick@fws.gov
Date: 3/10/2009 2:05 PM
Subject: Re: mitigation sites, Cherokee Co

Hi Marella,
I apologize for not getting back to you sooner. We've visited the project site a few more times since you and I spoke, and we're still doubtful as to the presence of habitat within the construction corridor for the Contreras and Martin Creek projects. However, if we did miss a snag or hollow tree (which would be the closest thing to habitat you'll find where we are), I think we should still be able to meet your concerns. I spoke with our Project Manager, Micky Clemmons, regarding the construction schedule and others ways in which we could avoid adversely impacting any potential habitat or populations of the Indiana bat. Construction and tree removal work is scheduled for November and will continue into the beginning of 2010.

Here are a few other thoughts we had as well: If we did locate any trees within the project area that may be favored by the Indiana bat we can mark them and instruct construction crews to avoid them to the extent possible. We are also willing to incorporate tree types favored by the Indiana bat into the planting list developed for the project site.
Would following the recommended time frame for construction activities (mid Oct-mid April) and implementation of the other measures noted sufficiently address your concerns? If so, I'll submit a letter to the USFWS proposing these measures for your concurrence. If you still have any concerns, please feel free to contact me by phone (828.350.1408 ext.2010) or email.

Thanks,
Carmen

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806
P: 828.350.1408 x. 2010
F: 828.350.1409

>>> < Marella_Buncick@fws.gov > 1/26/2009 3:10 PM >>>
Carmen,

Based on our conversation today regarding the Contreras and Martin Creek proposed mitigation sites in Cherokee Co., NC, I believe that you need to further address potential impacts to Indiana bat. For the areas where trees will be removed, we want to be sure that all suitable Indiana bat maternity/roosting trees are considered in the impacts analysis of the project. We consider all snags and hollow cavity trees; any trees with more than 25 percent exfoliating bark; and all shellbark, shagbark, and bitternut hickory trees (regardless of size or condition) as suitable roosting/maternity habitat for the Indiana bat. Further, Indiana bats are known to roost in trees as small as 3 inches in diameter at breast height.

We believe that the activities of this project could result in direct, indirect, and/or cumulative impacts; and could result in the "take" of Indiana bats that may be roosting in trees located within and along the edges of the construction area. To avoid impacts to Indiana bats, any tree removal and construction activities should occur between October 15 and April 15 (outside the maternity/roosting period). If this recommendation is followed, we do not believe the project will impact the Indiana bat. (Alternatively, mist-netting surveys could also be conducted to determine the presence/absence of the species.) We would appreciate the opportunity to review any measures or guidelines that will be implemented to further avoid direct, indirect, and cumulative impacts to the Indiana bat and its habitat. Until an assessment of the direct, indirect, and cumulative impacts of this project to Indiana bats has been completed, we cannot conclude that the requirements of section 7 of the Act have been fulfilled.

If you have further questions, please call or e-mail.

marella

marella buncick
USFWS
160 Zillicoa St.
Asheville, NC 28801
828-258-3939 ext 237

People don't resist change, they resist being changed.

Baker

Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, North Carolina 28806

828-350-1408
FAX 828-350-1409

April 28, 2009

U.S. Fish and Wildlife Service
Asheville Field Office
Attn: Ms. Marella Buncick
160 Zillicoa Street
Asheville, NC 28801

Subject: NCEEP Stream mitigation projects in Cherokee County

Dear Ms. Buncick,

Thank you for your response to our request for comment regarding the following two stream mitigation projects currently proposed in Cherokee County by the NC Ecosystem Enhancement Project:

1) Martin Creek Stream & Wetland Restoration Project; and
2) Unnamed Tributary (UT) to Martin Creek (Contreras Site) and associated UTs.

This letter is intended to satisfy agency concerns regarding the potential projects impacts to the Indiana bat (*Myotis sodalis*). An additional account of existing features as well as mitigation and avoidance measures is provided below for the project sites.

Stream restoration and enhancement work proposed at both sites is primarily located in pasture land. Woody vegetation in pastures on-site primarily consists of poplar, holly, alders, locust and red maple. These buffer areas are also made up of multiflora rose and privet as well as various grasses, weeds and rushes such as juncus. Restoration and enhancement reaches with denser stands of woody vegetation were found to lack habitat favored by the Indiana bat. Enhancement reaches in the Martin Creek project area that border forested upland areas will require minimal tree clearing. Enhancement activities proposed in these areas will primarily involve relocating the existing channel away from the edge of the valley wall back to the low point of the valley most recently managed as pastureland. Other enhancement work will consist of the removal of exotic, invasive vegetation and establishment of vegetation native to this region. The remaining restoration and enhancement work to be conducted is located in pastureland where the stream corridor does not present suitable maternity/roosting habitat for the Indiana bat.

Based on a review of the schedule for each project, vegetation removal is slated to occur during November 2009 and will continue into the beginning of 2010. Prior to vegetation removal work, the restoration and enhancement reaches will be walked with personnel involved in construction oversight for the project. Any trees located within the project area that may be favored by the Indiana bat will be marked and avoided to the extent possible. Vegetation removal activities will be completed by April 15th, thereby avoiding impacts to roosting/maternity colonies of the Indiana bat.

Baker also proposes to incorporate tree types favored by the Indiana bat into the planting list developed for the project site. In addition to habitat considerations, selection of tree types will be based upon their occurrence and range within this region of the Hiwassee River Basin.

We hope these efforts will satisfy your concerns regarding the protection of potential bat colonies and/or bat habitat present within Cherokee County. If you have any more questions or would like to discuss these projects in further detail, please contact me at your earliest convenience at 828.350.1408 ext. 2010 or by email at cmcintyre@mbakercorp.com.

Sincerely,
Michael Baker Engineering, Inc.

Carmen Horne-McIntyre

Carmen Horne-McIntyre
Environmental Scientist

From: <Marella_Buncick@fws.gov>
To: "Carmen McIntyre" <Cmcintyre@mbakercorp.com>
Date: 6/23/2009 11:11 AM
Subject: Re: NCEEP Stream Restoration Sites on Martin Creek and UTs-Cherokee Co.

Carmen,

As we discussed previously, if you are conducting tree removal during the time Indiana bats are hibernating and also given the nature and location of the project, this should satisfy our concerns for Indiana bat for this stream restoration project.

marella

marella buncick
USFWS
160 Zillicoa St.
Asheville, NC 28801
828-258-3939 ext 237

People don't resist change, they resist being changed.

"Carmen McIntyre" <Cmcintyre@mbakercorp.com>
06/15/2009 08:47 AM

To
"Marella Buncick" <Marella_Buncick@fws.gov>
cc

Subject
NCEEP Stream Restoration Sites on Martin Creek and UTs-Cherokee Co.

Hi Marella,
Just wanted to touch base with you to see if you guys had any further comment regarding the two stream restoration sites Baker will be working on with the NCEEP in Cherokee County. There were some earlier concerns regarding potential impacts to the Indiana bat; we attempted to alleviate these concerns as noted in a response letter submitted at the end of April. In short, vegetation removal work will take place within the time period (mid-Oct to mid-April) recommended by the USFWS. If you wouldn't mind emailing me or sending us a response back, that'd be great. I should be around for most of the week if we need to discuss the projects any further. Thanks for your assistance!

Carmen

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806
P: 828.350.1408 x. 2010
F: 828.350.1409

[attachment "USFWS_Letter Response.pdf" deleted by Marella Buncick/R4/FWS/DOI]

Baker

Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, North Carolina 28806

828-350-1408
FAX 828-350-1409

November 24, 2008

North Carolina Wildlife Resources Commission
Balsam Depot
Attn: Mr. David McHenry
20830 Great Smoky Mountain Expressway
Waynesville, NC 28786

Subject: North Carolina Ecosystem Enhancement Program (NCEEP) Stream Mitigation Project on Martins Creek and Tributaries, Cherokee County, NC.

Dear Mr. McHenry,

The North Carolina Ecosystem Enhancement Program (EEP) requests review and comment on any possible issues that might emerge with respect to fish and wildlife resources in the vicinity of a potential stream and wetland restoration project in the Martins Creek watershed, a drainage of the Hiwassee River. The potential stream restoration project area is identified on the attached maps which consist of a vicinity map, a U.S. Geological Survey site map and a restoration plan figure with areas of potential ground disturbance identified.

The Martin Creek site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. The project will involve restoration, enhancement or preservation of a section of Martin Creek, the Right Prong of Martin Creek and sections of four unnamed tributaries (UTs) that have been identified as being significantly degraded. Project goals include the restoration or enhancement of 5,540 linear feet of stream for the purpose of obtaining stream mitigation credit in the Hiwassee River Basin. Stream mitigation credits are also being extended to an additional 7,725 linear feet of stream being preserved.

We thank you in advance for your timely response and cooperation. Please feel free to contact Baker Engineering with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

CARMEN HORNE-McINTYRE

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806
Phone: 828.350.1408, Email: cmcintyre@mbakercorp.com

Cc:
Mr. Paul Wiesner
NC Ecosystem Enhancement Program (EEP)
2090 U.S. Highway 70
Swannanoa, NC 28778

North Carolina Wildlife Resources Commission
Gordon Myers, Executive Director

December 9, 2008

Carmen Horne-McIntyre
Baker Engineering NY, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806

SUBJECT: EEP Stream Mitigation Projects in Cherokee County, Martins Creek

Dear Ms. Horne-McIntyre:

Biologists with the North Carolina Wildlife Resources Commission (Commission) received your letters dated November 24, 2008 regarding the Ecosystem Enhancement Program projects in the Martins Creek watershed in Cherokee County. Comments from the Commission are provided under provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

Cherokee County is a "trout county" per an agreement between the U.S. Army Corps of Engineers (ACOE) and the Commission. As such, Commission biologists review all Nationwide Permit applications there and make recommendations to minimize the adverse resource effects of some activities, including restoration work. Once a permit application is prepared for this project, a copy must be sent to me in order to solicit Commission concurrence and recommendations for consideration by the ACOE.

Martins Creek supports sensitive aquatic life like the sicklefin redhorse, mountain creekshell (*Villosa vanuxemensis* (NCT)), and Cambarus hiwasseensis (NC watch list, Federal candidate). These and several other sensitive species are found in the Hiwassee River further downstream. The projects may improve habitat for aquatic life over time, but they also may initially degrade habitat depending upon the amount of construction disturbance and sedimentation they cause. As part of the 404 permits, the Commission will likely request that in stream construction be avoided from April 1 to June 15 when sicklefin redhorse should be spawning in Martins Creek.

The Commission recommends that effective sediment and erosion controls be used and channel disturbance be avoided as much as possible during construction. Also, existing mature vegetation should be preserved as much as possible because it promotes the stability of channel work and provides seed sources for natural regeneration, organic material to the streams, and riparian habitat complexity until planted vegetation matures. The use of balled or container grown trees is recommended in the outside of channel bends to expedite long-term bank stability. Also, any stream channel modifications should create dimensions, patterns, and profiles that mimic stable, reference conditions. Overly and unnaturally sinuous stream channels should be avoided.

Thank you for the opportunity to review and comment on this project. If there are any questions regarding these comments, please contact me at (828) 452-2546 ext. 24.

Sincerely,

Dave McHenry
Mountain Region Coordinator
Habitat Conservation Program

Baker

Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, North Carolina 28806

828-350-1408
FAX 828-350-1409

December 15, 2008

Mr. M. Kent Clary
USDA-NRCS Area Resource Soil Scientist
589 Raccoon Road, Suite 246
Waynesville, NC 28786

Subject: Prime and Important Farmland Soils RE: NCEEP On-Call Project, on Martin Creek and Tributaries, Cherokee County, NC

Dear Mr. Clary,

The North Carolina Ecosystem Enhancement Program (NCEEP) requests your review and assistance in completing a Farmland Conversion Impact Rating form for the subject site. Enclosed please find a copy of the AD-1006 form, and site and location mapping for the project. The Martin Creek site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel impacts in the Hiwassee River Basin. The project will involve restoration, enhancement or preservation of a section of Martins Creek, the Right Prong of Martins Creek, and sections of four unnamed tributaries (UTs) that have been identified as being significantly degraded. Project goals include the restoration or enhancement of 5,540 linear feet of stream. Stream mitigation credits are also being extended to an additional 7,725 linear feet of stream being preserved.

Preliminary visual assessments and data provided by the NCEEP indicate the presence of approximately 2.0 acres of mapped wetlands that will be protected under the proposed project. Buried hydric soils have also been located on-site in the vicinity of the existing wetlands and were likely filled to increase agricultural production. To determine the extent of wetland restoration work required, further analysis of the site is proposed. The location where wetland restoration may occur is provided in Restoration Plan Figure 1.3.

Mapped soils within the upland portion of the project area include the Thurmont-Dillard complex (8 to 15% slopes) and Junaluska-Tsali complexes (ranging from 15% to 50% slopes). Soils mapped within the pasture and floodplain portion of the project area consist of the Ark aqua loam and the Dillard loam series. Soils of the Thurmont-Dillard complex are dominant in areas adjacent to the streams in the forested area of the project. These soils are located on moderate slopes in the valley of the project, are well drained and lie above the seasonal high water table. In the lower section of the valley, project streams course through both Dillard loams and Ark aqua loams. Dillard loams are located in the project area in the transitional zone between the upland forested areas and the floodplain. This soil series is defined as being moderately well drained, rarely flooded and typically 24 to 36 inches above the water table. The Ark aqua loam soils are located in the lower valley of the Martin Creek watershed and are primarily within the floodplain for Martin Creek. As evidenced by the presence and location of wetlands on-site, the Ark aqua loams within the project area are somewhat poorly drained and are occasionally flooded. Whereas the depth to the water table in the upper extent of the project area ranges from 36 to 72 inches, the depth to the water table where Ark aqua loams are present is approximately 18 to 24 inches; however, water is at the ground surface in some wetland areas. Soils data presented in this letter were assembled from information provided by the Natural Resources Conservation Service office in Cherokee County and from the USDA-NRCS Soil Data Mart website (http://soildatamart.nrcs.usda.gov/Default.aspx).

The total project area within the proposed conservation easement boundary is approximately 24.89 acres. Sections of the land within the easement are mapped as the Ark aqua loam series. Based on our review, this soil is considered to be Prime Farmland soil. No additional prime and important farmland designations were listed on the Soil Data Mart for Cherokee County, NC. The total acreage of Prime and Important Farmland that would be directly converted under this project is approximately 2.94 acres.

We ask that you review this site based on the attached information to determine if you know of any other existing resources that we need to know about. We know that you have greater familiarity with farmland issues in this area than we do, and we will be happy to make any changes to the form that you deem appropriate. Please return the form to us with your determinations and we will complete the remainder of the form if needed. In addition, please let us know the level of involvement you may require (if needed), as it is anticipated this project will be implemented in the Summer of 2009. If we have not received a response from you within 30 days, we will assume that you have no comment regarding the project. This letter is intended to satisfy any requirements of the Farmland Protection Policy Act.

If you have any questions, please feel free to contact me at cmcintyre@mbakercorp.com or by phone at 828.350.1408 ext. 2010. Our fax number is 828.350.1409.
Thank-you for your assistance in this matter.

Sincerely,

CARMEN HORNE- McIN-TYRE
Carmen Horne-McIntyre
Environmental Scientist
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806

Cc:
Mr. Guy Pearce
NC Ecosystem Enhancement Program (EEP)
1652 Mail Service Center
Raleigh, NC 27699

Mr. Glenn Carson, District Conservationist
USDA-NRCS
225 Valley River Ave., Suite J.
Murphy, NC 28789

From: Carmen McIntyre
To: kent.clary@nc.usda.gov
Date: 1/6/2009 4:36 PM
Subject: Cherokee Co. Stream Restoration Projects

Sorry Kent-our server held the email due to its size. Here's the table I told you about earlier. I'll send the pdfs in another email in case you need those as well.

Carmen

Hi Kent,
Thanks for getting back to me regarding the Farmland Conversion Impact Rating form for the Martin Creek and Contreras Site stream restoration projects. I’ve included a table below which provides the total acreage of soils within the project disturbance limits per soil type. Hopefully this will help. I'm also sending a pdf version of the project reach figures which were originally submitted in hard copy form in case you need those as well. Please let me know if you have any questions.

Martin Creek Site

Soil Type	Site	Area	Acreage	
131D	Martin	153648.7800	3.5273	
134E	Martin	34489.0385	0.7918	
233B	Martin	64003.4482	1.4693	
310D	Martin	16727.5613	0.3840	
310E	Martin	26719.8168	0.6134	
382E	Martin	2039.5538	0.0468	
45A	Martin	39153.1718	0.8988	
85A	Martin	124696.2277	2.8626	*PRIME FARMLAND SOIL*

Total Acreage: 10.59

Contreras Site

Type	Site	Area	Acreage	
131B	Contreras	54032.6223	1.2404	
131D	Contreras	72045.0093	1.6539	
310D	Contreras	154.1172	0.0035	
310E	Contreras	57021.9360	1.3090	
382D	Contreras	5220.6719	0.1199	
382E	Contreras	10092.0264	0.2317	
382F	Contreras	335.2609	0.0077	
72A	Contreras	16152.2809	0.3708	
85A	Contreras	424894.7805	9.7542	*PRIME FARMLAND SOIL*

Total Acreage: 14.69

Best,
Carmen

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806
P: 828.350.1408 x. 2010
F: 828.350.1409

From: Carmen McIntyre
To: Kent - Waynesville NC Clary
Date: 1/7/2009 1:15 PM
Subject: RE: AD-1006 Form for Stream Projects in Cherokee Co.

Thanks Kent. Have a good afternoon!
Carmen

>>> "Clary, Kent - Waynesville, NC" < Kent.Clary@nc.usda.gov > 1/7/2009 1:01 PM >>>
Carmen,

Attached are the AD-1006's for the Martin Creek and Contreras Restoration and Enhancement sites in Cherokee County. Parts II, IV, and V have been completed as required of NRCS.

Based on the information you provided, it appears that 9.1 acres of important farmlands (5.2 acres of prime and 3.9 acres of state-wide important) will be impacted at the Martin Creek site, and 13.1 acres of important farmlands (11.4 of prime and 1.7 of state-wide important) will be impacted at the Contreras site.

If you have any questions or if I can be of further assistance, please feel free to contact me.

Kent Clary
Area Resource Soil Scientist
USDA-NRCS
589 Raccoon Road Suite 246
Waynesville, NC 28786
828.456.6341 ext. 105

-----Original Message-----
From: Carmen McIntyre [mailto:Cmcintyre@mbakercorp.com]
Sent: Monday, December 15, 2008 3:00 PM
To: Clary, Kent - Waynesville, NC
Cc: Carson, Glenn - Murphy, NC
Subject: AD-1006 Form for Stream Projects in Cherokee Co.

Hi Kent,
Here's the information on the projects I mentioned earlier. I'm also attaching the soils maps we used for the project area. Soil maps I-19 and I-21 were used for the Martin Creek project. Soil maps J-23 and J-25 were used for the Contreras site. If you have any questions about the project, I can be reached at 828.350.1408, etc. 2010 or by email at cmcintyre@mbakercorp.com .
Thanks in advance for your assistance!

Carmen Horne-McIntyre
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806
P: 828.350.1408 x. 2010
F: 828.350.1409

Baker

Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, North Carolina 28806

828-350-1408
FAX 828-350-1409

April 2, 2009

Mr. M. Kent Clary
USDA-NRCS Area Resource Soil Scientist
589 Raccoon Road, Suite 246
Waynesville, NC 28786

Subject: Prime and Important Farmland Soils RE: NCEEP On-Call Project, on Martin Creek and Unnamed Tributaries, Cherokee County, NC

Dear Mr. Clary,

Thank-you for your assistance in completing a Farmland Conversion Impact Rating form for the subject sites. As noted in earlier correspondence, the Martin Creek and Contreras Site stream mitigation projects have been proposed as mitigation projects for unavoidable stream channel impacts in the Hiwassee River Basin. Enclosed you will find a final copy of the form based on our evaluation of the sites in accordance with Part VI, "Site Assessment Criteria." If you have any questions regarding the cumulative scoring value for each site, please feel free to contact me at cmcintyre@mbakercorp.com or by phone at 828.350.1408 ext. 2010.

Kind Regards,

Carmen Horne-McIntyre

Carmen Horne-McIntyre
Environmental Scientist
Michael Baker Engineering, Inc.
797 Haywood Rd., Suite 201
Asheville, NC 28806

Cc:
Mr. Glenn Carson, District Conservationist
USDA-NRCS
225 Valley River Ave., Suite J.
Murphy, NC 28789

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 12/15/08
Name Of Project Martin Creek Restoration and Enhancement	Federal Agency Involved FHWA
Proposed Land Use Stream and Riparian Enhancement	County And State Cherokee, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland?
(If no, the FPPA does not apply -- do not complete additional parts of this form). Yes ☑ No ☐

Acres Irrigated -

Average Farm Size 85 Acres

Major Crop*(s)* Corn, Hay

Farmable Land In Govt. Jurisdiction Acres: 103,357 % 35

Amount Of Farmland As Defined in FPPA Acres: 84,075 % 28

Name Of Land Evaluation System Used Cherokee Cales

Name Of Local Site Assessment System

Date Land Evaluation Returned By NRCS 1/7/09

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		10.6			
B. Total Acres To Be Converted Indirectly					
C. Total Acres In Site		10.6	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland		5.2			
B. Total Acres Statewide And Local Important Farmland		3.9			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted		0.0			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value		5.5			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*		63	0	0	0
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use		15			
2. Perimeter In Nonurban Use		9			
3. Percent Of Site Being Farmed		10			
4. Protection Provided By State And Local Government		20			
5. Distance From Urban Builtup Area		15			
6. Distance To Urban Support Services		10			
7. Size Of Present Farm Unit Compared To Average		9			
8. Creation Of Nonfarmable Farmland		0			
9. Availability Of Farm Support Services		3			
10. On-Farm Investments		2			
11. Effects Of Conversion On Farm Support Services		0			
12. Compatibility With Existing Agricultural Use		0			
TOTAL SITE ASSESSMENT POINTS	160	93	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	63	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	93	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	156	0	0	0

Site Selected:

Date Of Selection

Was A Local Site Assessment Used? Yes ☐ No ☒

Reason For Selection:

On-call contract with NC-Ecosystem Enhancement Program to improve watershed health and obtain mitigation credits within the Hiwassee River Basin.

(See Instructions on reverse side) **Form AD-1006 (10-83)**

This form was electronically produced by National Production Services Staff

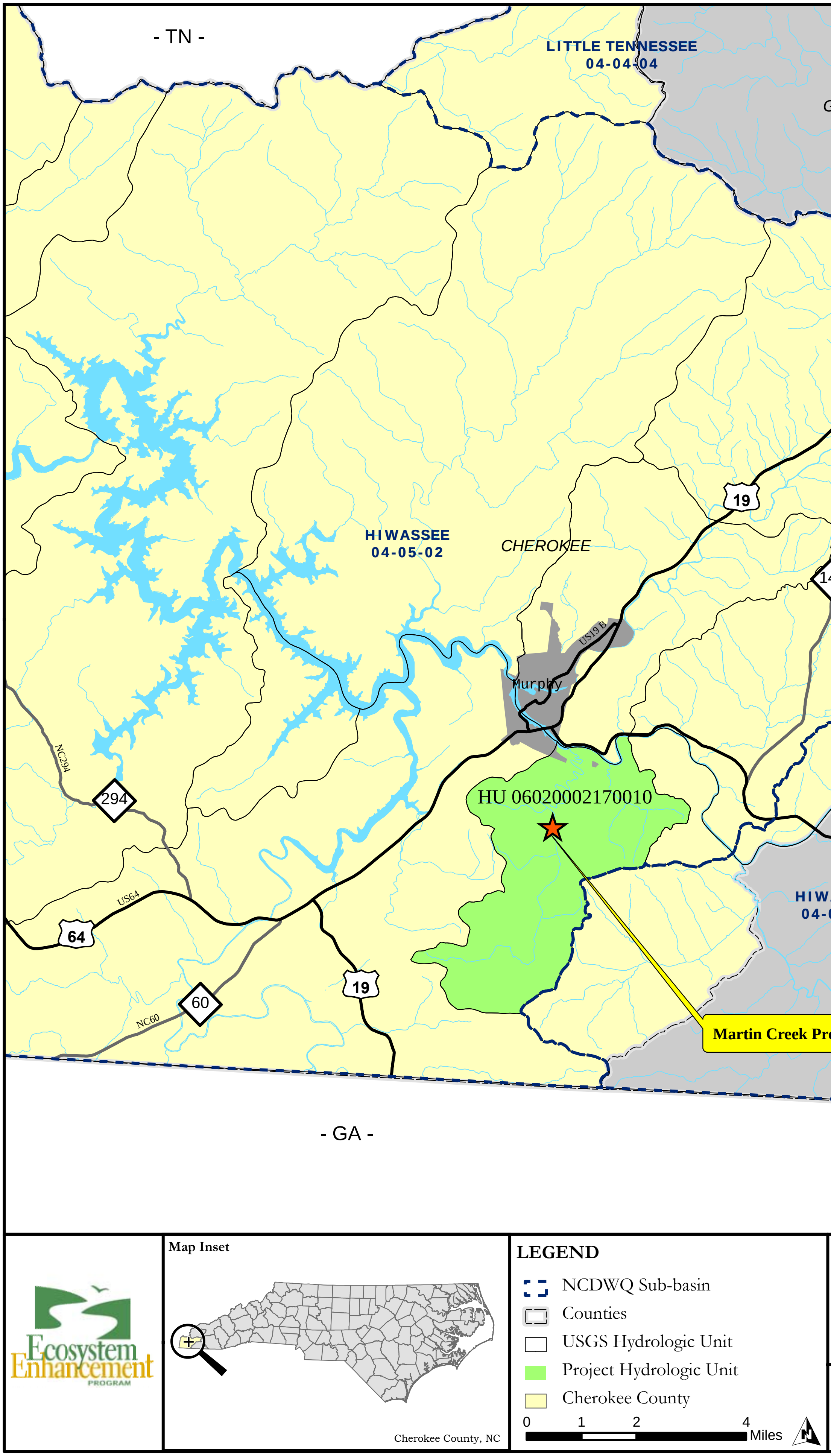
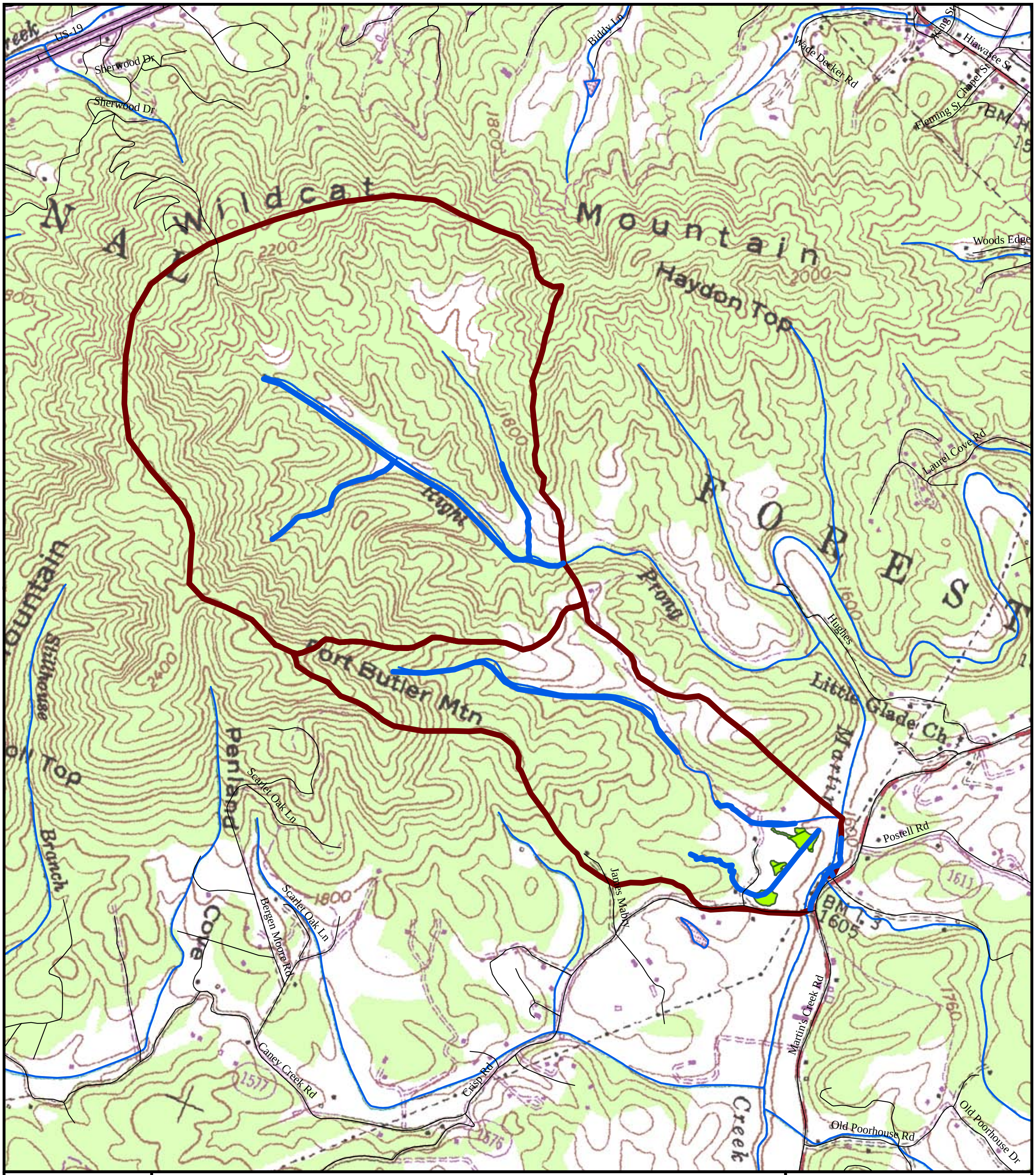


Figure 1.1 Project Location Map

Martin Creek Restoration Project
Cherokee County, NC



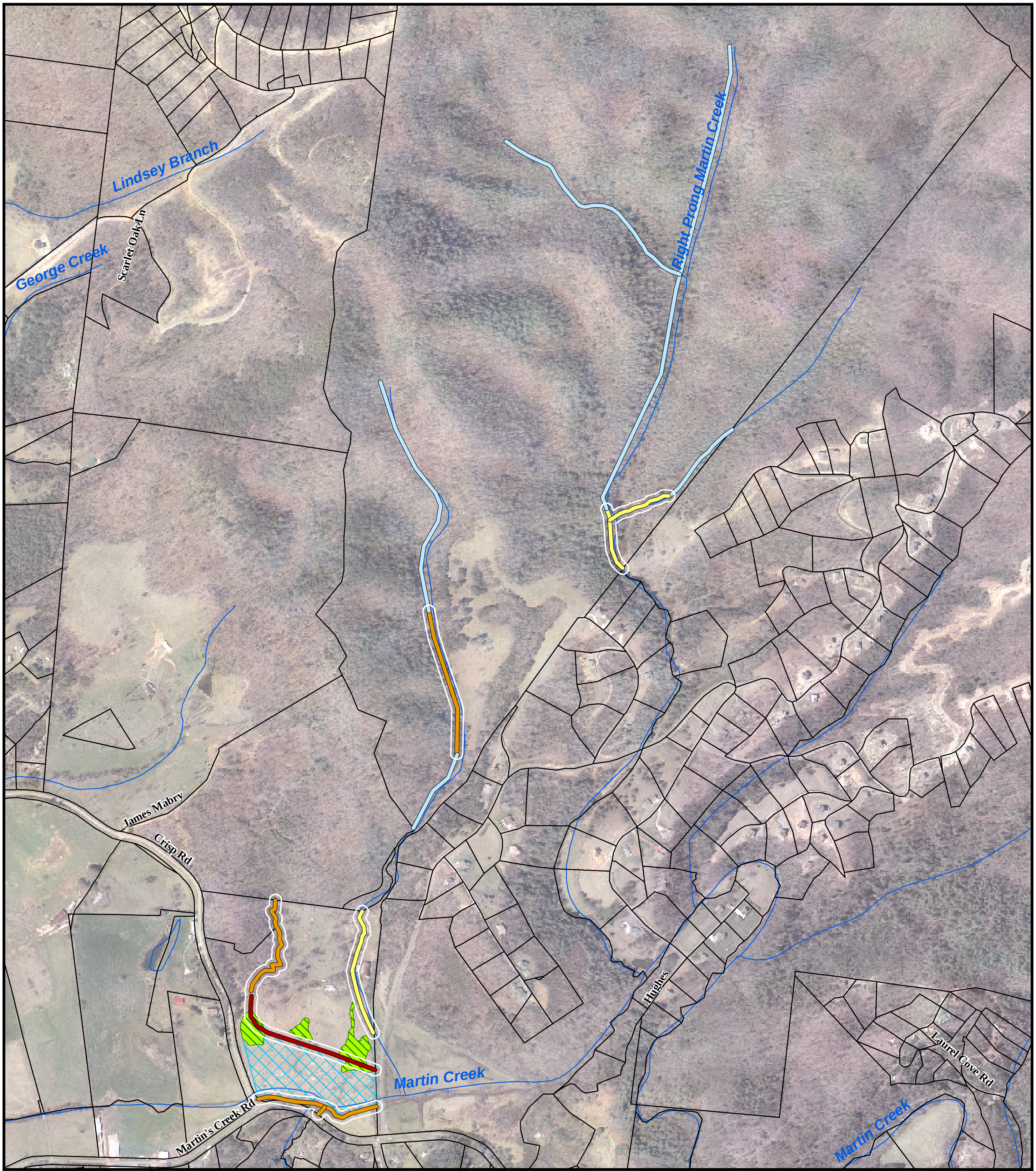
LEGEND:

- Project Reach
- Proposed Easement Boundary
- Streams
- Watershed Boundary

0 200400 800 Feet

Figure 1.2 USGS Topographic Map

Martin Creek Restoration Project
Cherokee County, NC



LEGEND

Proposed Restoration Type (Recommendation)

▬	Restoration-P1
▬	Restoration-P2
▬	Enhancement-I
▬	Enhancement-II
▬	Preservation
🟩	Jurisdictional Wetlands
▨	Proposed Disturbance Limits
☒	Proposed Soil Removal Area
☐	Parcels

0 200 400 800
Feet

Figure 1.3 Proposed Restoration Plan

Martins Creek Restoration Project
Cherokee County, NC

APPENDIX C. EDR Transaction Screen Map Report

Martin Creek Restoration Project
100 Pinebrook Road
Murphy, NC 28906

Inquiry Number: 02342808.1r
October 17, 2008

The EDR Radius Map™ Report with Geocheck®

with ToxiCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

SECTION **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. **NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT.** Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2008 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR).
The results of this search follow:

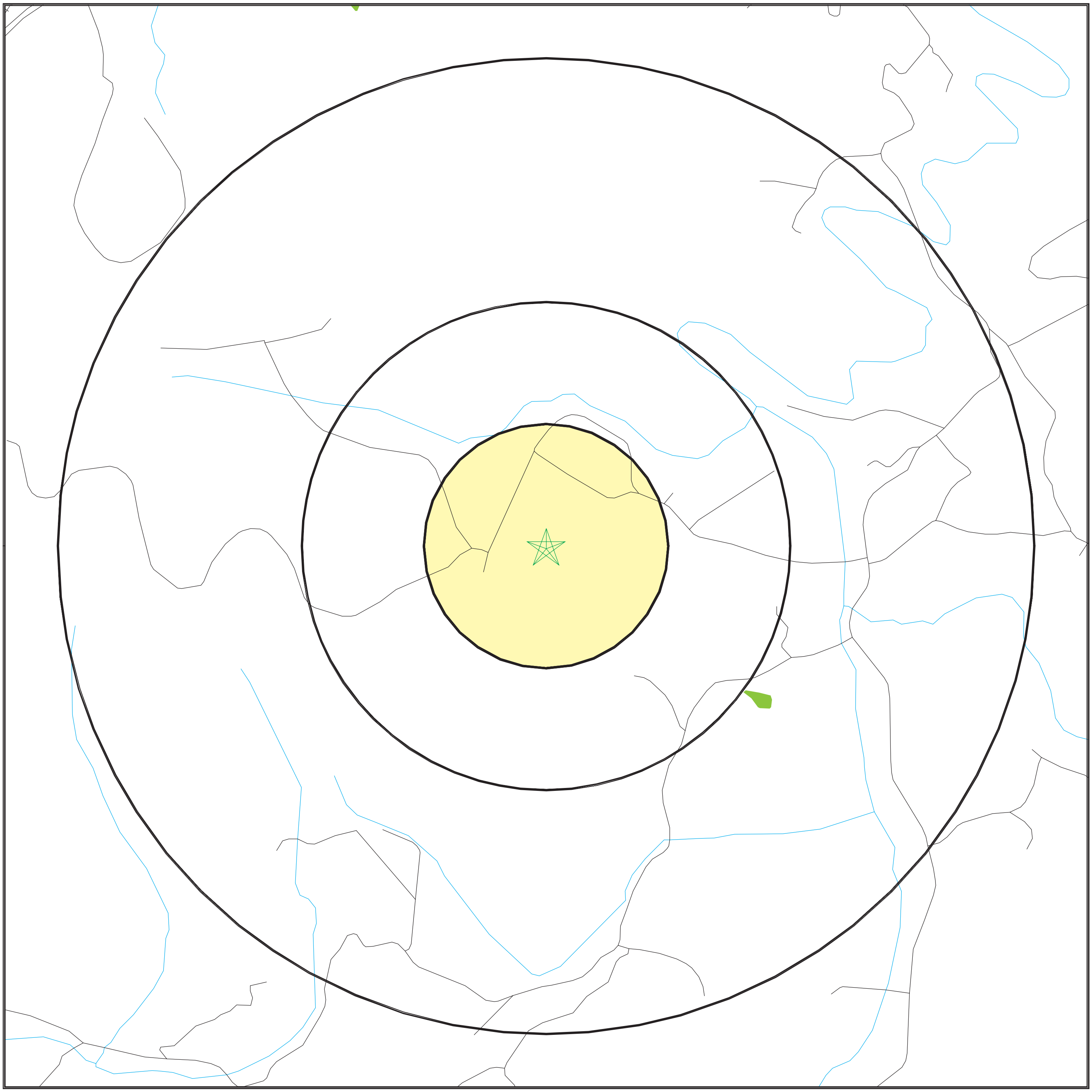
TARGET PROPERTY ADDRESS

MARTIN CREEK RESTORATION PROJECT
100 PINEBROOK ROAD
MURPHY, NC 28906
Elevation: 1757 ft.
EDR Inquiry Number: 02342808.1r

TARGET PROPERTY SEARCH RESULTS	Direction Distance Distance ft.	**FEDERAL RECORDS**																																									**STATE AND LOCAL RECORDS**															**TRIBAL RECORDS**					**EDR PROPRIETARY RECORDS**
Site		NPL	Proposed NPL	Delisted NPL	NPL LIENS	CERCLIS	CERC-NFRAP	LIENS 2	CORRACTS	RCRA-TSDF	RCRA-LQG	RCRA-SQG	RCRA-CESQG	RCRA-NonGen	US ENG CONTROLS	US INST CONTROL	ERNS	HMIRS	DOT OPS	US CDL	US BROWNFIELDS	DOD	FUDS	LUCIS	CONSENT	ROD	UMTRA	ODI	DEBRIS REGION 9	MINES	TRIS	TSCA	FTTS	HIST FTTS	SSTS	ICIS	PADS	MLTS	RADINFO	FINDS	RAATS	SCRD DRYCLEANERS	SHWS	NC HSDS	IMD	SWF/LF	OLI	HIST LF	LUST	LUST TRUST	UST	AST	INST CONTROL	VCP	DRYCLEANERS	BROWNFIELDS	NPDES	INDIAN RESERV	INDIAN ODI	INDIAN LUST	INDIAN UST	INDIAN VCP	EDR MGP

Surrounding sites were not identified.

OVERVIEW MAP - 02342808.1r

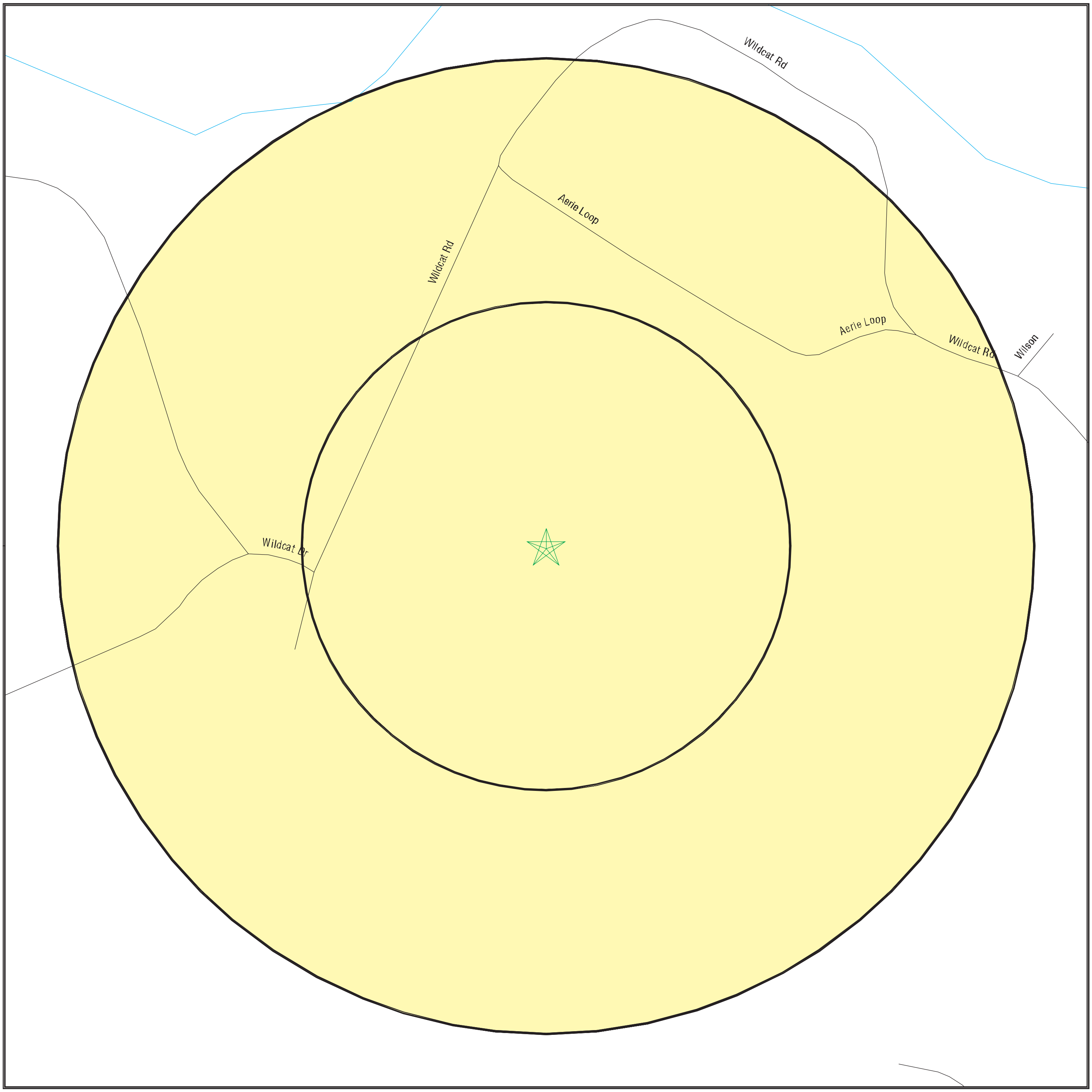


0 1/4 1/2 1 Miles

- ☆ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- ♟ Manufactured Gas Plants
- ▨ National Priority List Sites
- ▨ Dept. Defense Sites
- ▨ Indian Reservations BIA
- ⚡ Oil & Gas pipelines
- 🟩 National Wetland Inventory
- 🟩 State Wetlands
- ▨ Hazardous Substance Disposal Sites

SITE NAME:	Martin Creek Restoration Project	CLIENT:	Michael Baker Engineering, Inc.
ADDRESS:	100 Pinebrook Road Murphy NC 28906	CONTACT:	Carmen Horne-McIntyre
		INQUIRY #:	02342808.1r
LAT/LONG:	35.0563 / 84.0353	DATE:	October 17, 2008 12:18 pm

DETAIL MAP - 02342808.1r



- ☆ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- ♟ Manufactured Gas Plants
- Sensitive Receptors
- ▨ National Priority List Sites
- ▨ Dept. Defense Sites
- ▨ Indian Reservations BIA
- Oil & Gas pipelines
- ▨ Hazardous Substance Disposal Sites

SITE NAME: Martin Creek Restoration Project
ADDRESS: 100 Pinebrook Road
Murphy NC 28906
LAT/LONG: 35.0563 / 84.0353

CLIENT: Michael Baker Engineering, Inc.
CONTACT: Carmen Horne-McIntyre
INQUIRY #: 02342808.1r
DATE: October 17, 2008 12:18 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FEDERAL RECORDS								
NPL		1.000	0	0	0	0	NR	0
Proposed NPL		1.000	0	0	0	0	NR	0
Delisted NPL		1.000	0	0	0	0	NR	0
NPL LIENS		TP	NR	NR	NR	NR	NR	0
CERCLIS		0.500	0	0	0	NR	NR	0
CERC-NFRAP		0.500	0	0	0	NR	NR	0
LIENS 2		TP	NR	NR	NR	NR	NR	0
CORRACTS		1.000	0	0	0	0	NR	0
RCRA-TSDF		0.500	0	0	0	NR	NR	0
RCRA-LQG		0.250	0	0	NR	NR	NR	0
RCRA-SQG		0.250	0	0	NR	NR	NR	0
RCRA-CESQG		0.250	0	0	NR	NR	NR	0
RCRA-NonGen		0.250	0	0	NR	NR	NR	0
US ENG CONTROLS		0.500	0	0	0	NR	NR	0
US INST CONTROL		0.500	0	0	0	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
HMIRS		TP	NR	NR	NR	NR	NR	0
DOT OPS		TP	NR	NR	NR	NR	NR	0
US CDL		TP	NR	NR	NR	NR	NR	0
US BROWNFIELDS		0.500	0	0	0	NR	NR	0
DOD		1.000	0	0	0	0	NR	0
FUDS		1.000	0	0	0	0	NR	0
LUCIS		0.500	0	0	0	NR	NR	0
CONSENT		1.000	0	0	0	0	NR	0
ROD		1.000	0	0	0	0	NR	0
UMTRA		0.500	0	0	0	NR	NR	0
ODI		0.500	0	0	0	NR	NR	0
DEBRIS REGION 9		0.500	0	0	0	NR	NR	0
MINES		0.250	0	0	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
FTTS		TP	NR	NR	NR	NR	NR	0
HIST FTTS		TP	NR	NR	NR	NR	NR	0
SSTS		TP	NR	NR	NR	NR	NR	0
ICIS		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
RADINFO		TP	NR	NR	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
SCRD DRYCLEANERS		0.500	0	0	0	NR	NR	0
STATE AND LOCAL RECORDS								
SHWS		1.000	0	0	0	0	NR	0
NC HSDS		1.000	0	0	0	0	NR	0
IMD		0.500	0	0	0	NR	NR	0
SWF/LF		0.500	0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
OLI		0.500	0	0	0	NR	NR	0
HIST LF		0.500	0	0	0	NR	NR	0
LUST		0.500	0	0	0	NR	NR	0
LUST TRUST		0.500	0	0	0	NR	NR	0
UST		0.250	0	0	NR	NR	NR	0
AST		0.250	0	0	NR	NR	NR	0
INST CONTROL		0.500	0	0	0	NR	NR	0
VCP		0.500	0	0	0	NR	NR	0
DRYCLEANERS		0.250	0	0	NR	NR	NR	0
BROWNFIELDS		0.500	0	0	0	NR	NR	0
NPDES		TP	NR	NR	NR	NR	NR	0
TRIBAL RECORDS								
INDIAN RESERV		1.000	0	0	0	0	NR	0
INDIAN ODI		0.500	0	0	0	NR	NR	0
INDIAN LUST		0.500	0	0	0	NR	NR	0
INDIAN UST		0.250	0	0	NR	NR	NR	0
INDIAN VCP		0.500	0	0	0	NR	NR	0
EDR PROPRIETARY RECORDS								
Manufactured Gas Plants		1.000	0	0	0	0	NR	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

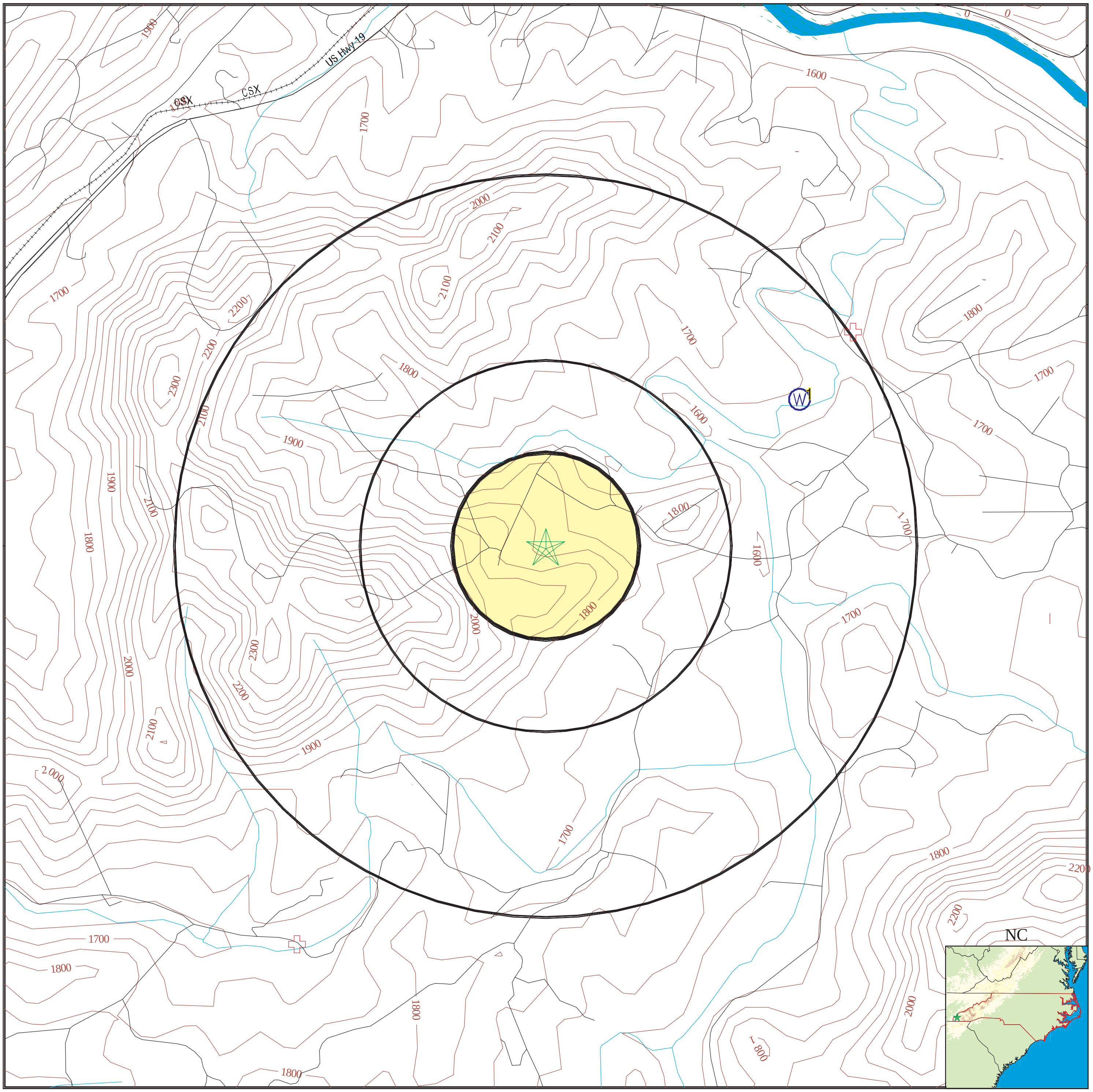
Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

NO SITES FOUND

PHYSICAL SETTING SOURCE MAP - 02342808.1r



0 1/4 1/2 1 Miles

- County Boundary
- Major Roads
- Contour Lines
- ◎ Earthquake epicenter, Richter 5 or greater
- Ⓦ Water Wells
- Ⓟ Public Water Supply Wells
- ● Cluster of Multiple Icons
- ↑ Groundwater Flow Direction
- (G I) Indeterminate Groundwater Flow at Location
- (G V) Groundwater Flow Varies at Location
- ▨ Wildlife Areas
- ▨ Natural Areas
- ✚ Rare & Endangered Species

SITE NAME: Martin Creek Restoration Project
ADDRESS: 100 Pinebrook Road
Murphy NC 28906
LAT/LONG: 35.0563 / 84.0353

CLIENT: Michael Baker Engineering, Inc.
CONTACT: Carmen Horne-McIntyre
INQUIRY #: 02342808.1r
DATE: October 17, 2008 12:18 pm

EDR LoanCheck® Basic: Environmental Risk Review

October 17, 2008

Property Name

MARTIN CREEK RESTORATION PROJECT
100 PINEBROOK ROAD
MURPHY, NC 28906

440 Wheelers Farms Road
Milford, CT 06460
Phone:800-352-0050
Fax:800-231-6802
Web:www.edrnet.com

EDR® Environmental Data Resources Inc

ENVIRONMENTAL RISK LEVEL

To help evaluate environmental risk, the *EDR LoanCheck® Basic* provides an Environmental Risk Level, based on a search of current government records requested to be searched by Michael Baker Engineering, Inc..

☐	**ELEVATED RISK**	Based on the records found in this report, the environmental risk level for this property is elevated.
☒	**LOW RISK**	Based on the records found in this report, the environmental risk level for this property is minimal.

User Instructions

For more information regarding this Environmental Risk Level, please refer to page 2 and other supporting reports.

User Comments

Reports and Databases

The following reports an/or databases were requested by customer and were included in the Environmental Risk Level where available:

- EDR Radius Map Report

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. **NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT.** Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2008 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

EDR LoanCheck® Basic: Environmental Risk Review

FINDINGS CONTRIBUTING TO THE ENVIRONMENTAL RISK LEVEL

The environmental LOW RISK is based upon the findings listed below. Refer to the supporting report(s) for additional detail.

TARGET PROPERTY

Current Govt. Records

No records identified (if any) were determined to be of elevated risk.

EDR Proprietary Records

No records identified (if any) were determined to be of elevated risk.

SURROUNDING PROPERTIES

Current Govt. Records

No records identified (if any) were determined to be of elevated risk.

EDR Proprietary Records

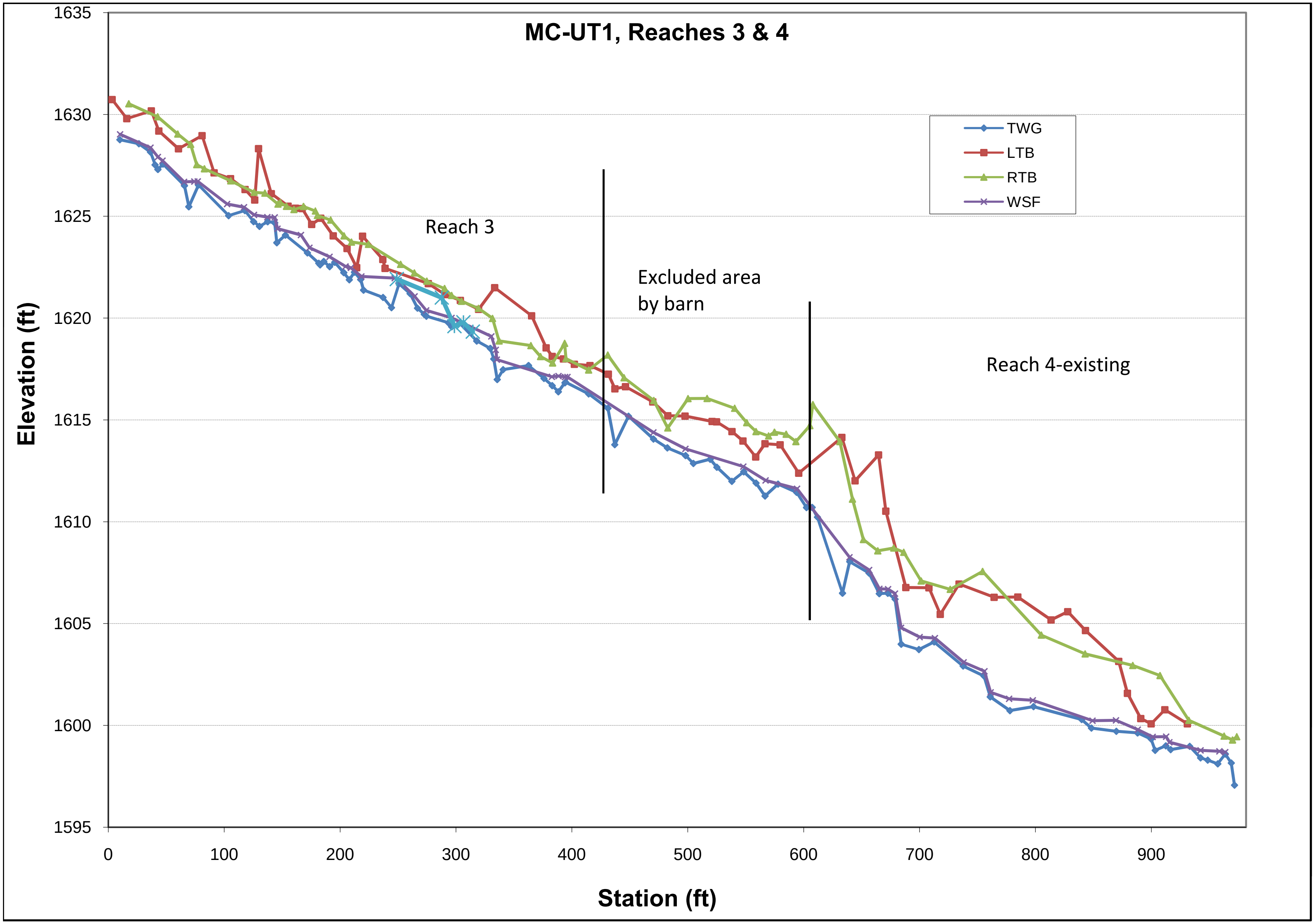
No records identified (if any) were determined to be of elevated risk.

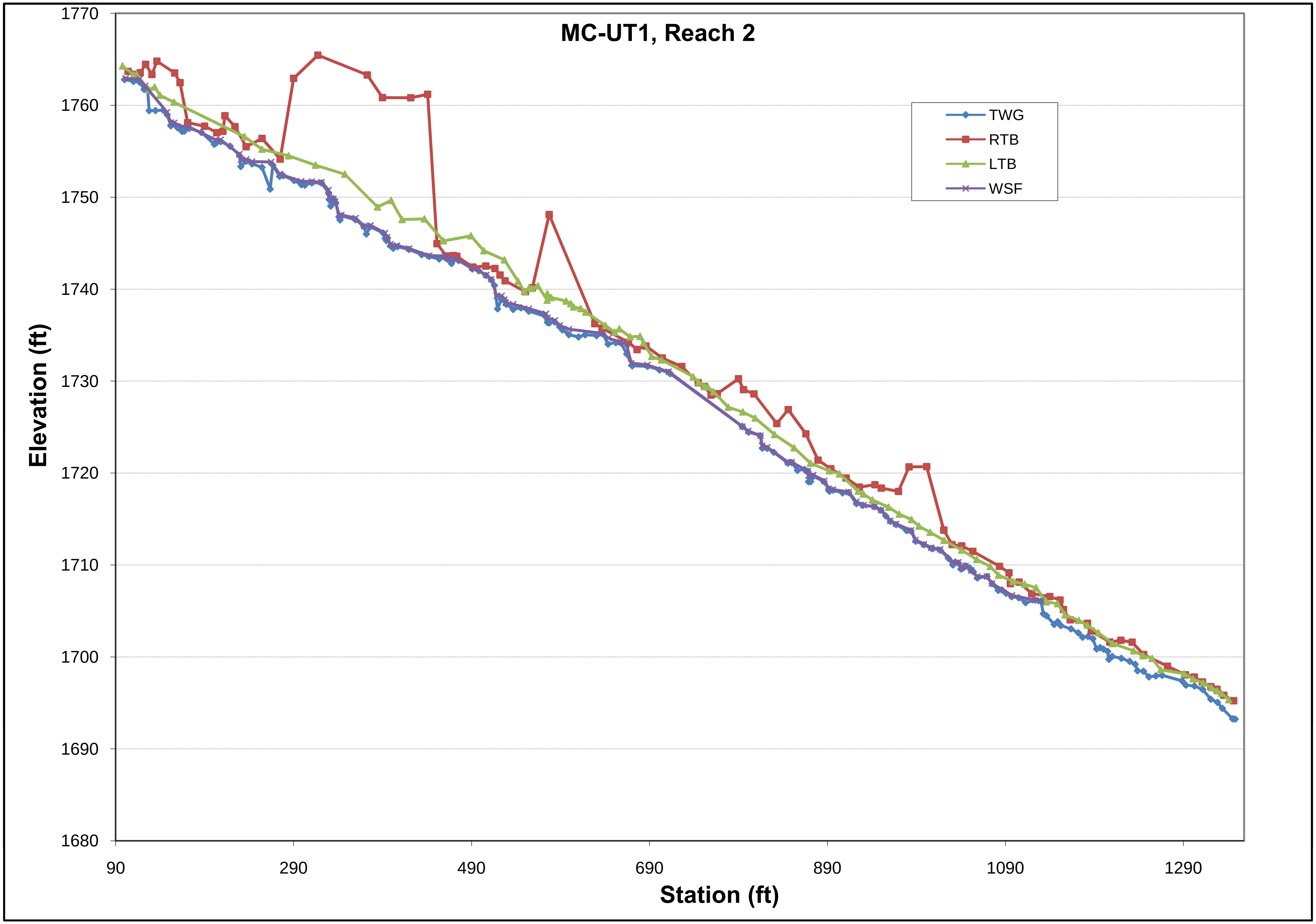
APPENDIX D. Existing Conditions Geomorphic Data

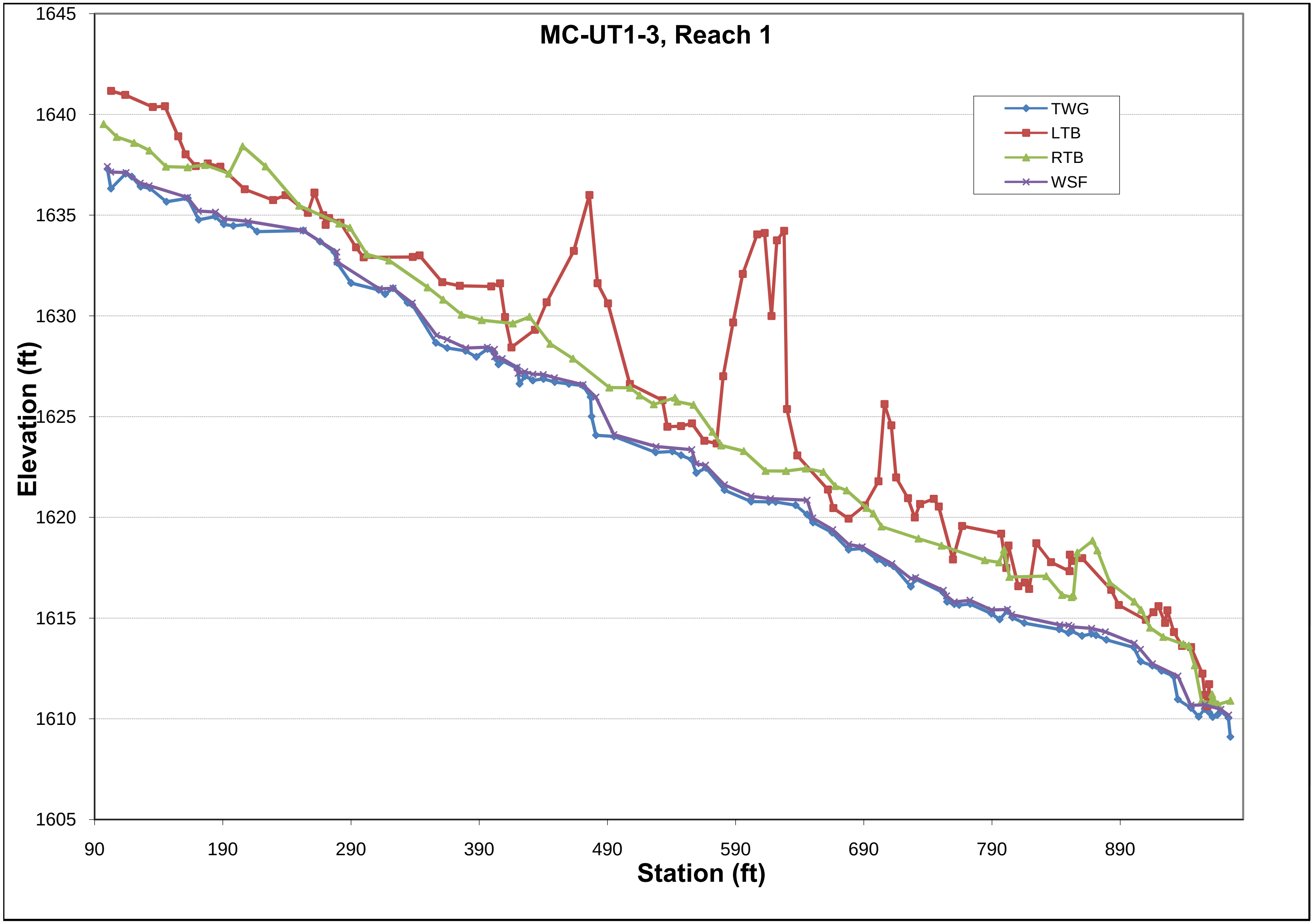
Table D1. Eroding bank proportions BEHI/NBS and Sediment Export Estimate for Project Site Streams: Martin's Creek II Mitigation Project

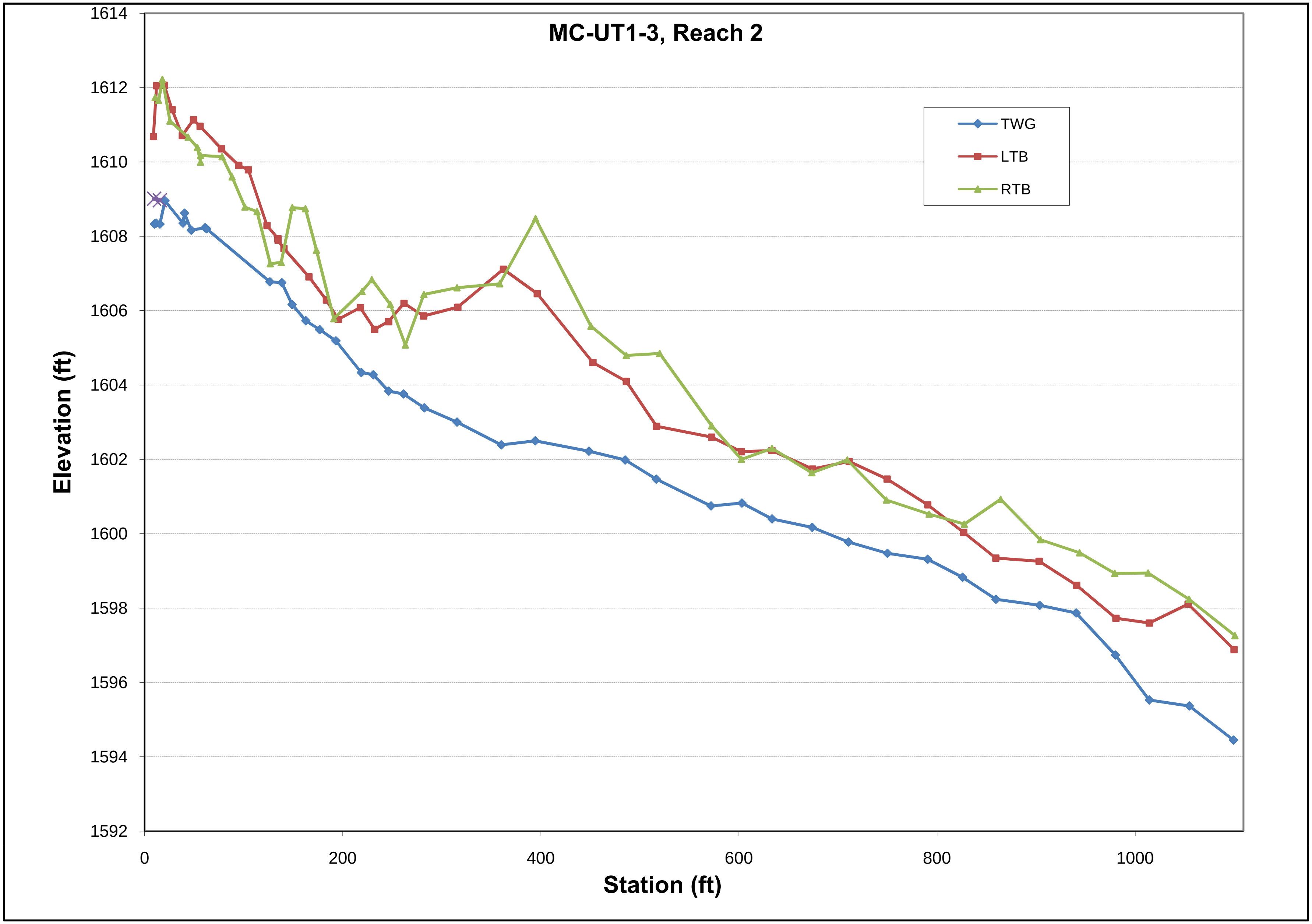
Time Point	Segment/ Reach	Linear Footage or Acreage^2	Extreme		Very High		High		Mod-High		Moderate		Low-Mod		Low		Very Low		Other^1		Sediment Export	
			ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	Ton/y	Ft^3/y
Pre-Construction	RP-UT1 Reach 1	480									23	2	20	2	199	21	299	31	419	44	2.0	0.1
	RP-Reach 2	540									95	9	44	4	167	15	229	21	545	50	5.9	0.2
	MC-UT1 Reach 2	1,372					24	2	77	3	120	5	186	7	639	24	435	16	1,153	43	18.9	0.6
	MC-UT1 Reach 3	420							30	4	34	4	108	13	224	27	80	10	364	43	6.5	0.3
	MC-UT1 Reach 4	340							21	3			11	2	261	38	98	14	289	43	4.9	0.3
	MC-UT1-3 Reach 1	780					71	5	74	5	82	5	62	4	199	13	161	10	911	58	13.2	0.4
	MC-UT1-3 Reach 2	1,099															1,256	57	942	43	1.8	0.0
	MC-UT2	75											100	67	50	33					4.2	1.2
	MC Mainstem	815					148	9	126	8	349	21	342	21	558	34			107	7	72.3	1.8
																				Total	129.7	4.9

Notes: (1) Other includes areas of deposition, bedrock, boulders,rootmass, or wetlands. Total linear footage is approximate and was totaled using a hip chain as the streams were assessed. (2) Linear footage is the "centerline" length of reach measured. Linear footage calculated for each BEHI category provided is the cumulative total of BEHI scores for left and right banks.


MC-UT1, Reaches 3 & 4
TWG
LTB
RTB
WSF
Reach 3
Excluded area
by barn
Reach 4-existing
Elevation (ft)
1635
1630
1625
1620
1615
1610
1605
1600
1595
Station (ft)
0
100
200
300
400
500
600
700
800
900

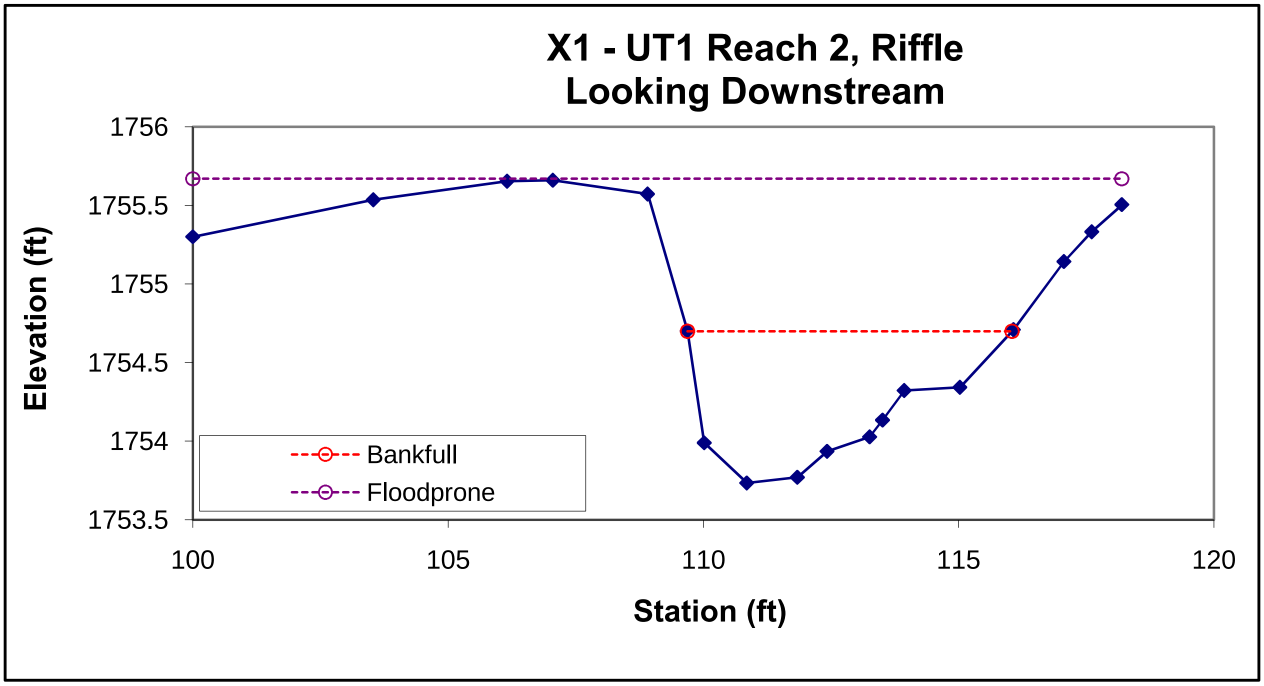

MC-UT1, Reach 2
Elevation (ft)
Station (ft)
1770
1760
1750
1740
1730
1720
1710
1700
1690
1680
90
290
490
690
890
1090
1290
TWG
RTB
LTB
WSF


MC-UT1-3, Reach 1
TWG
LTB
RTB
WSF
Elevation (ft)
1645
1640
1635
1630
1625
1620
1615
1610
1605
Station (ft)
90
190
290
390
490
590
690
790
890


MC-UT1-3, Reach 2
Elevation (ft)
1614
1612
1610
1608
1606
1604
1602
1600
1598
1596
1594
1592
0
200
400
600
800
1000
Station (ft)
TWG
LTB
RTB

Cross-section Data: X1 (UT1 Reach 2, STA 1+44)

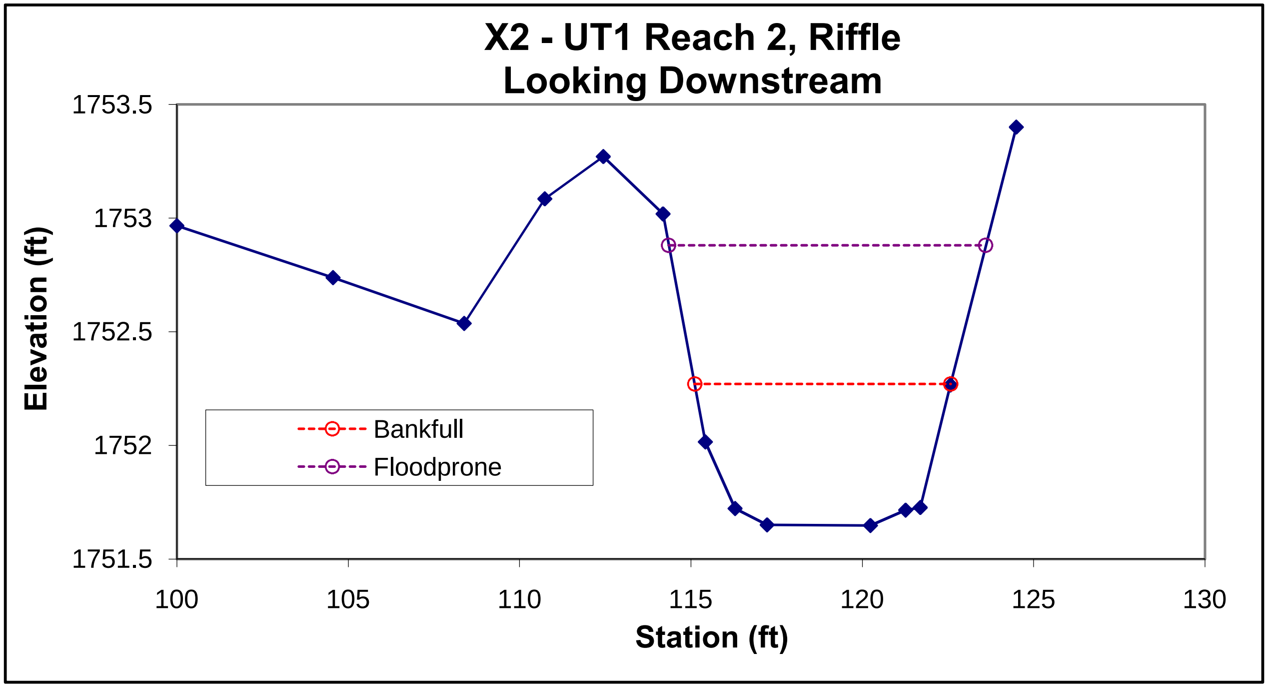
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Eb*	3.8	6.4	0.60	0.97	10.68	1.8	2.9	1754.70	1755.51



* E-type channel functioning like "G" due to high bank height ratio

Cross-section Data: X2 (UT1 Reach 2, STA 2+03)

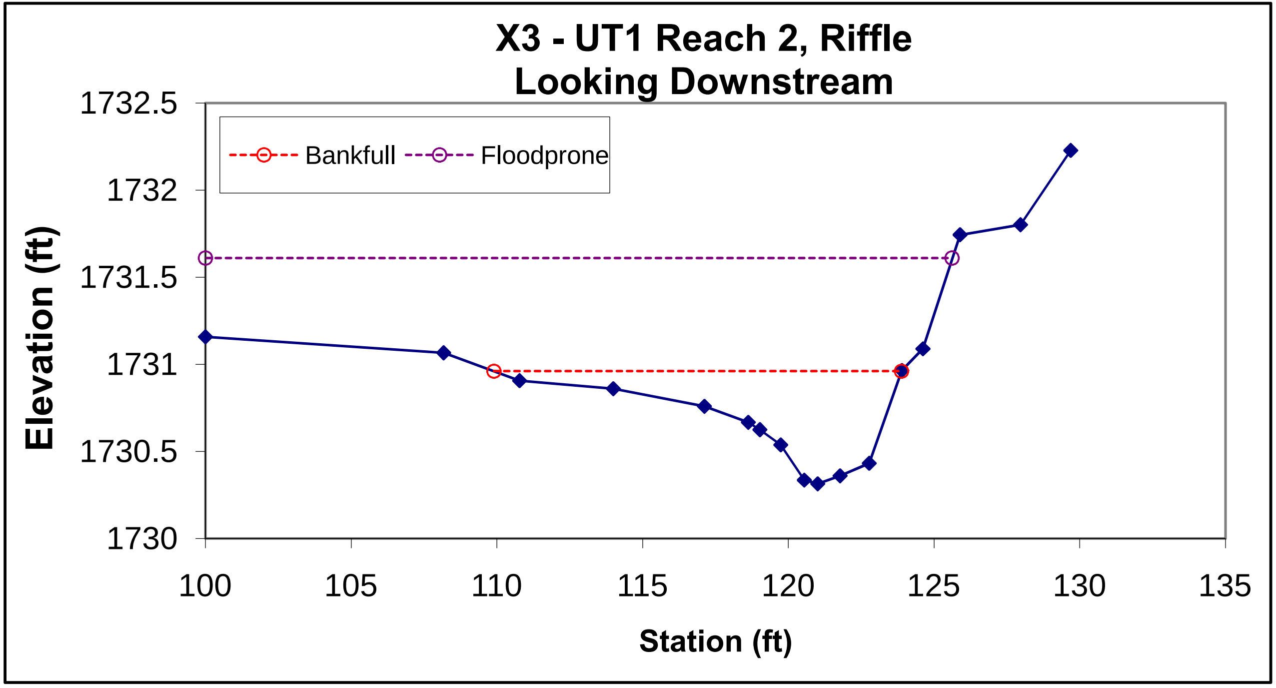
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Fb*	3.9	7.5	0.52	0.62	14.45	2.2	1.2	1752.3	1753.02



* Function and shape of channel similar to "G", is probably in widening stage (G-->F)

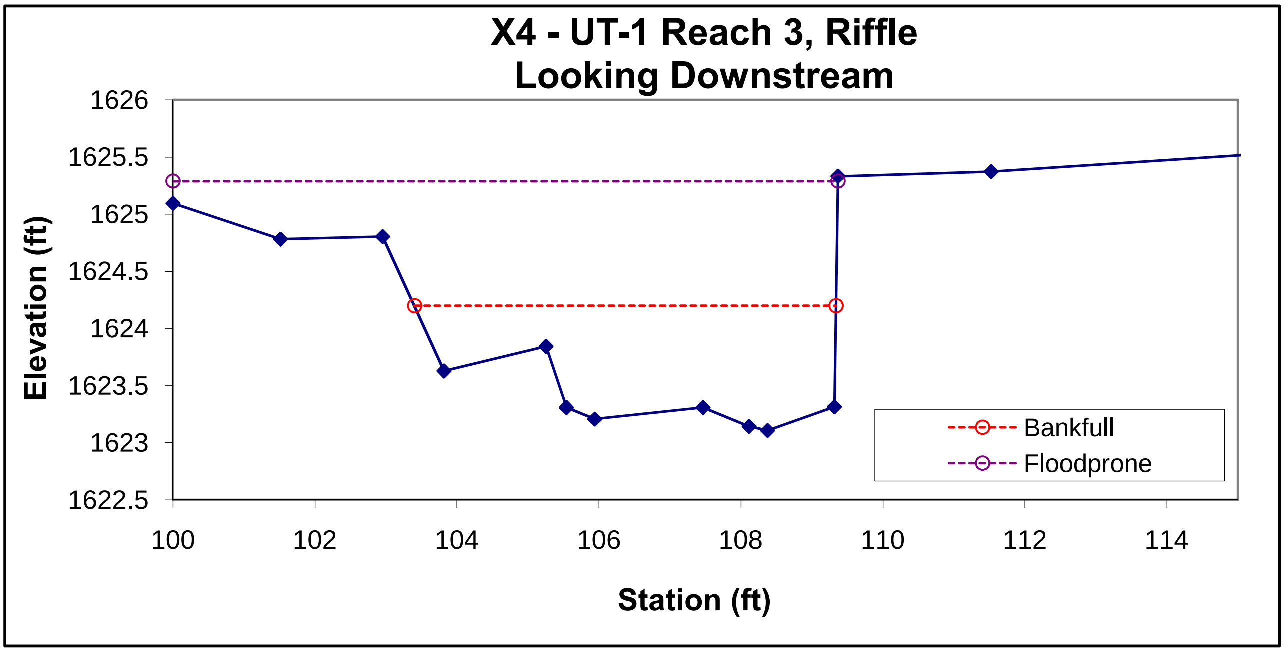
Cross-section Data: X3 (UT1 Reach 2, STA 5+70)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	3.6	14.0	0.25	0.65	55.0	1.3	>2.2	1730.96	1731.16



Cross-section Data: X4 (UT1 Reach 3, STA 0+87)

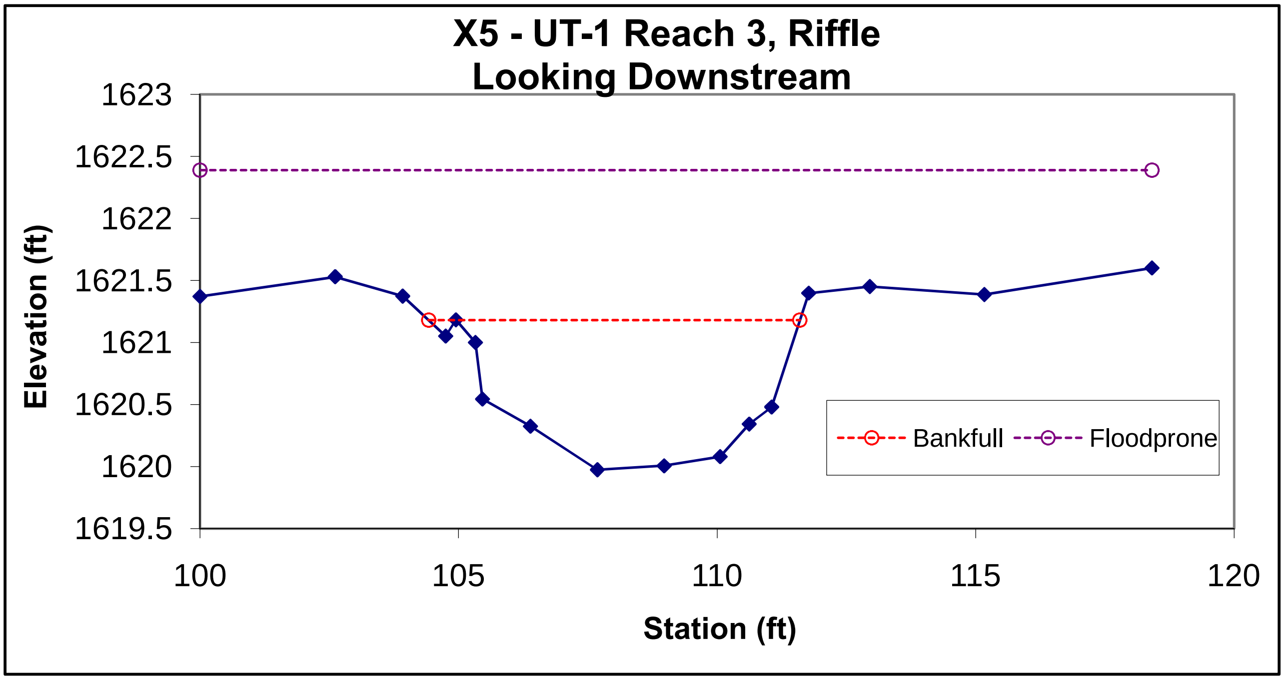
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	G	4.6	5.9	0.78	1.09	7.6	1.8	1.6 [1]	1624.20	1625.10



[1] Entrenchment ratio can vary by +/- 0.2, assume that 1.6 is extreme end of range for G-type channel classification; in this steeper setting, the sinuosity is on the low end of the range

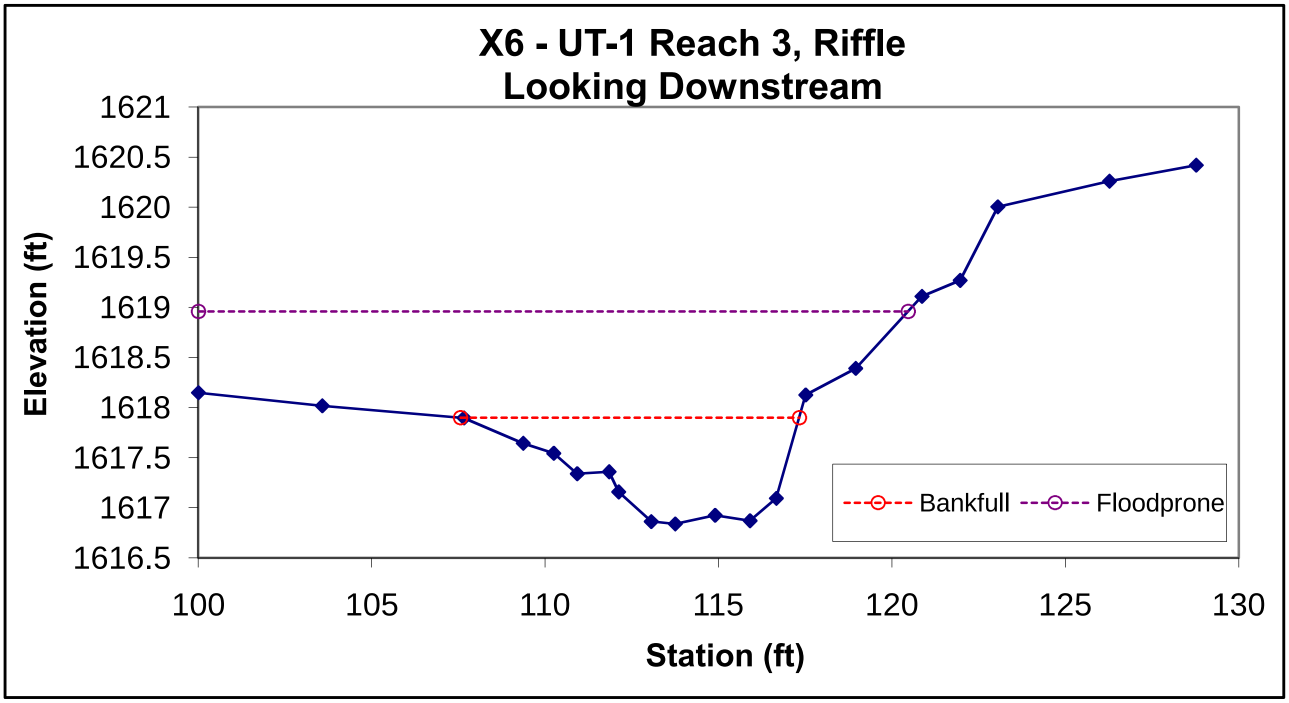
Cross-section Data: X5 (UT1 Reach 3, STA 2+01)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	6.0	7.2	0.83	1.21	8.6	1.2	>2.6	1621.18	1621.45



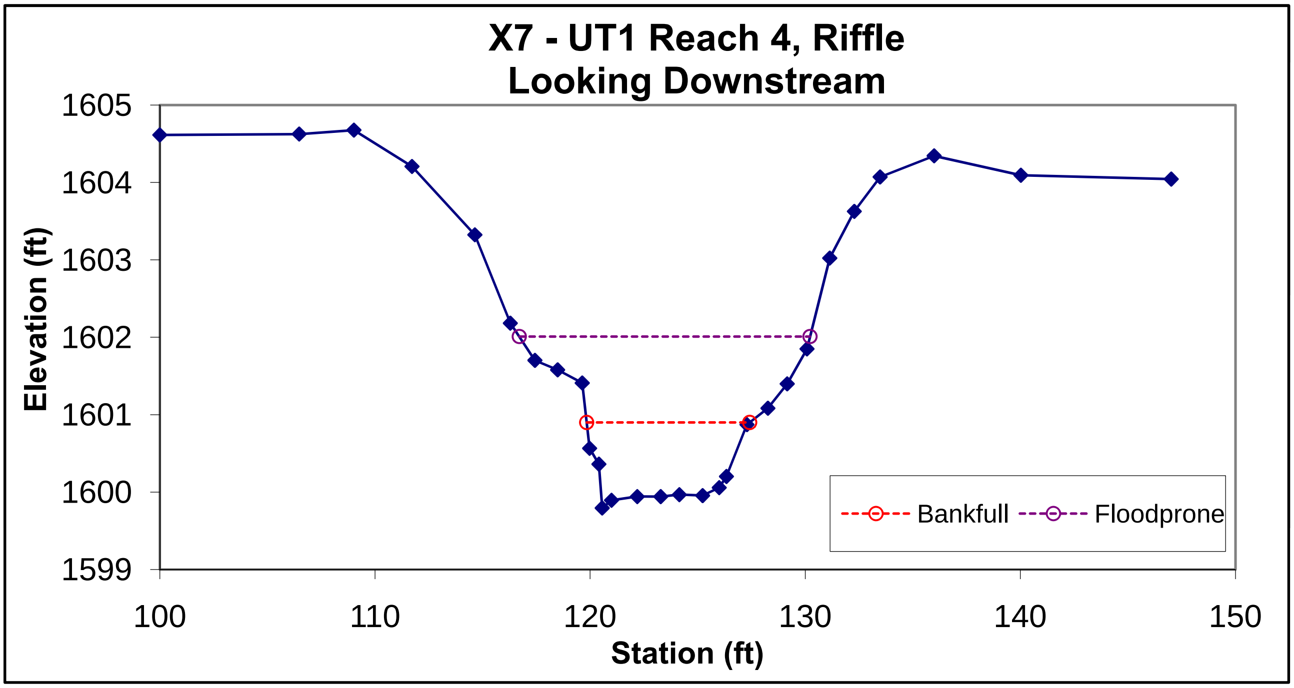
Cross-section Data: X6 (UT1 Reach 3, STA 3+10)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Cb	6.2	9.8	0.63	1.06	15.4	1.0	>2.1	1617.90	1617.90



Cross-section Data: X7 (UT1 Reach 4, STA 7+75)

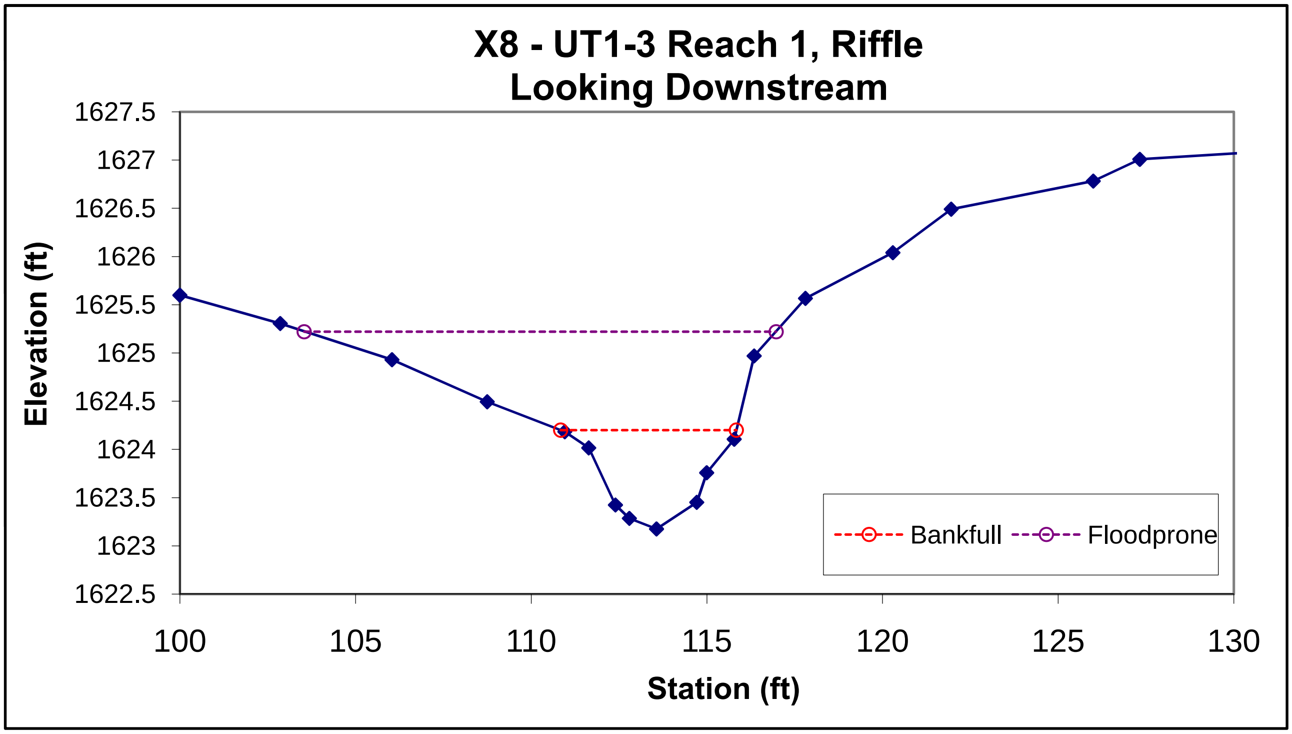
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	G*	6.1	7.6	0.81	1.11	9.4	4.1	1.8	1600.90	1604.35



*Doesn't fit well into classification scheme, but functions as moderately entrenched G channel

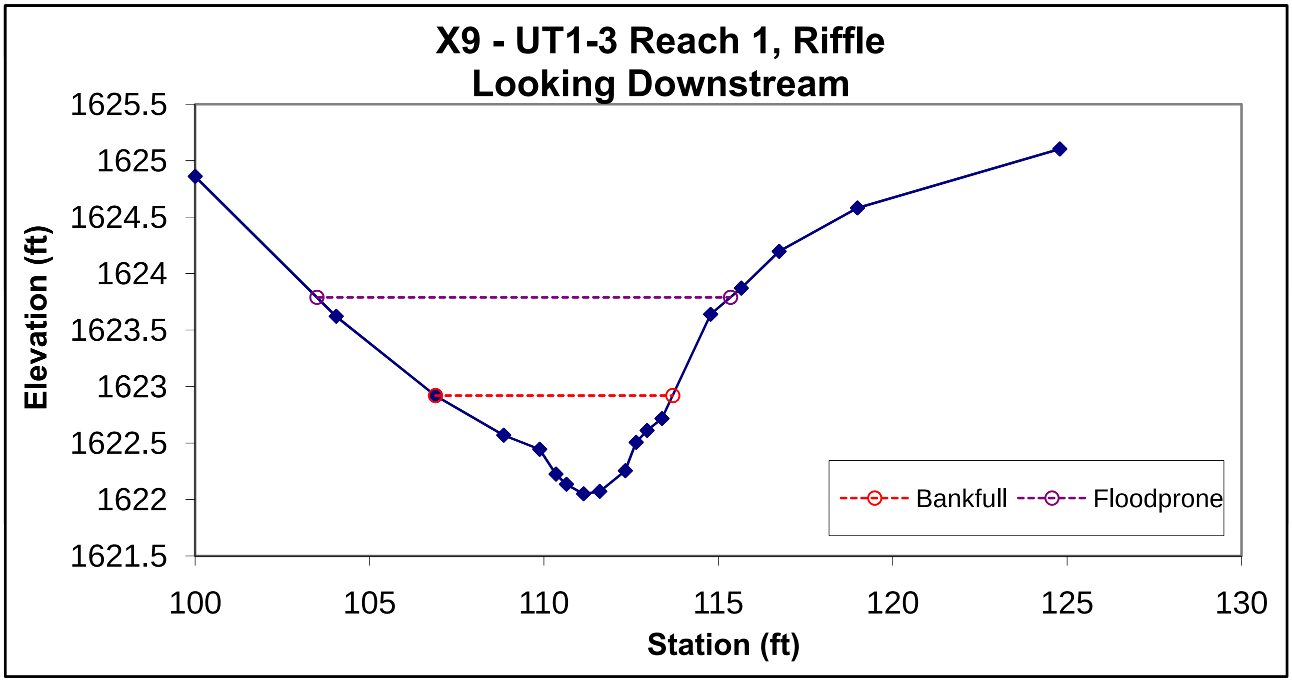
Cross-section Data: X8 (UT1-3 Reach 1, STA 1+46)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Eb	2.9	5.0	0.58	1.02	8.6	1.0	2.7	1624.20	1624.18



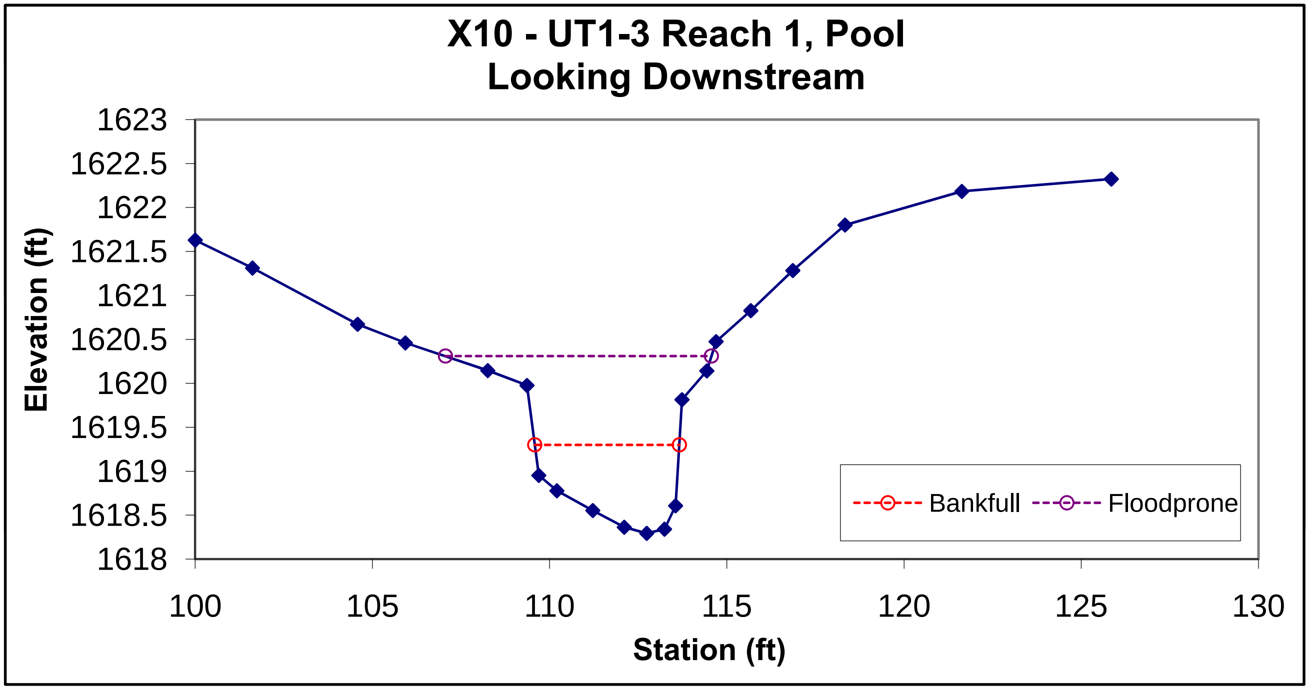
Cross-section Data: X9 (UT1-3 Reach 1, STA 1+74)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	3.0	6.8	0.45	0.87	15.2	1.8	1.7	1622.92	1623.639



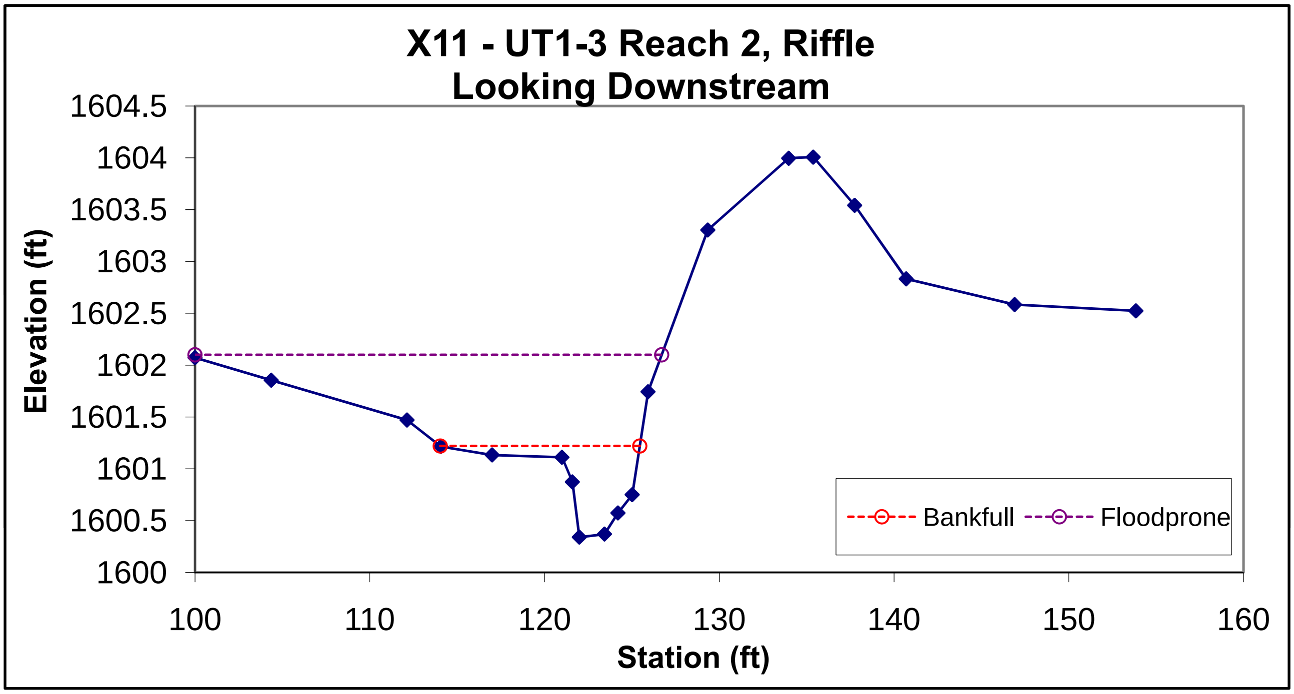
Cross-section Data: X10 (UT1-3 Reach 1, STA 2+67)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	N/A	3.0	4.1	0.74	1.01	5.5	1.5	1.8	1619.30	1619.81



Cross-section Data: X11 (UT1-3 Reach 2, STA 15+09)

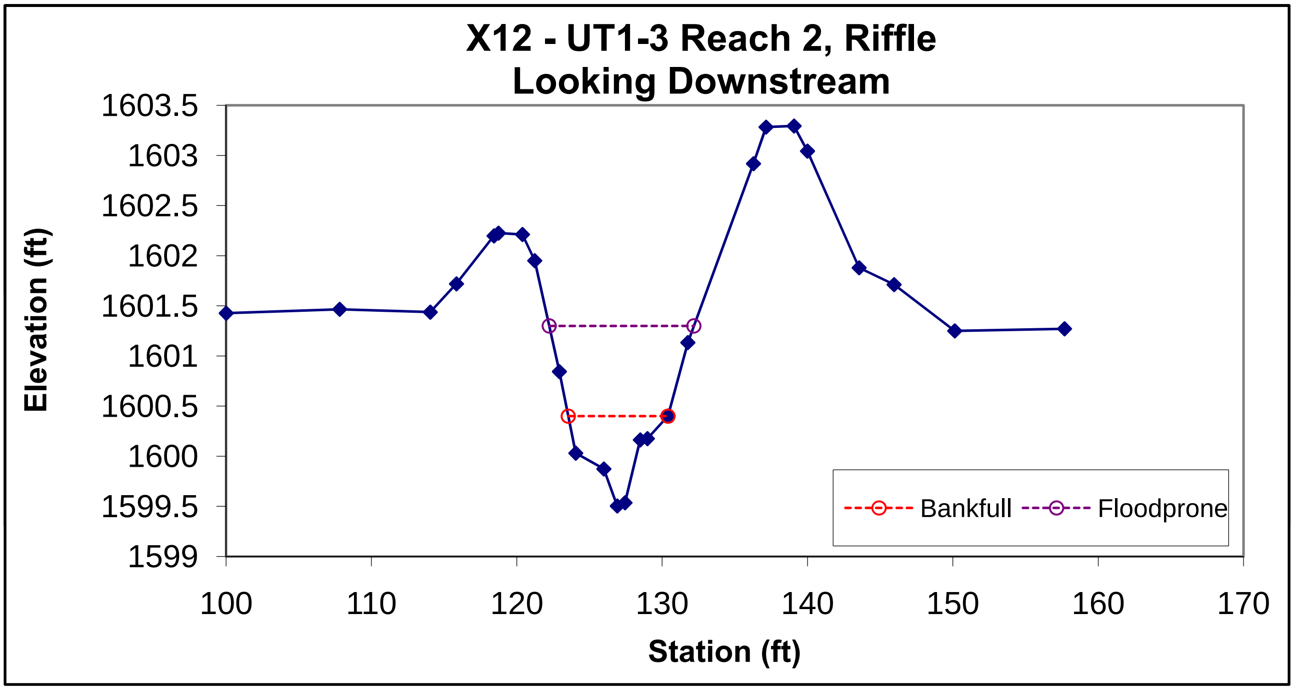
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C*	3.3	11.4	0.29	0.88	39.7	1.0	2.3	1601.22	1601.47



* Appears to be evolving from C-->E. Subsequent bankfull flows are likely to deposit material on bench and result in narrowing of the bankfull channel towards an E.

Cross-section Data: X12 (UT1-3 Reach 2, STA 16+09)

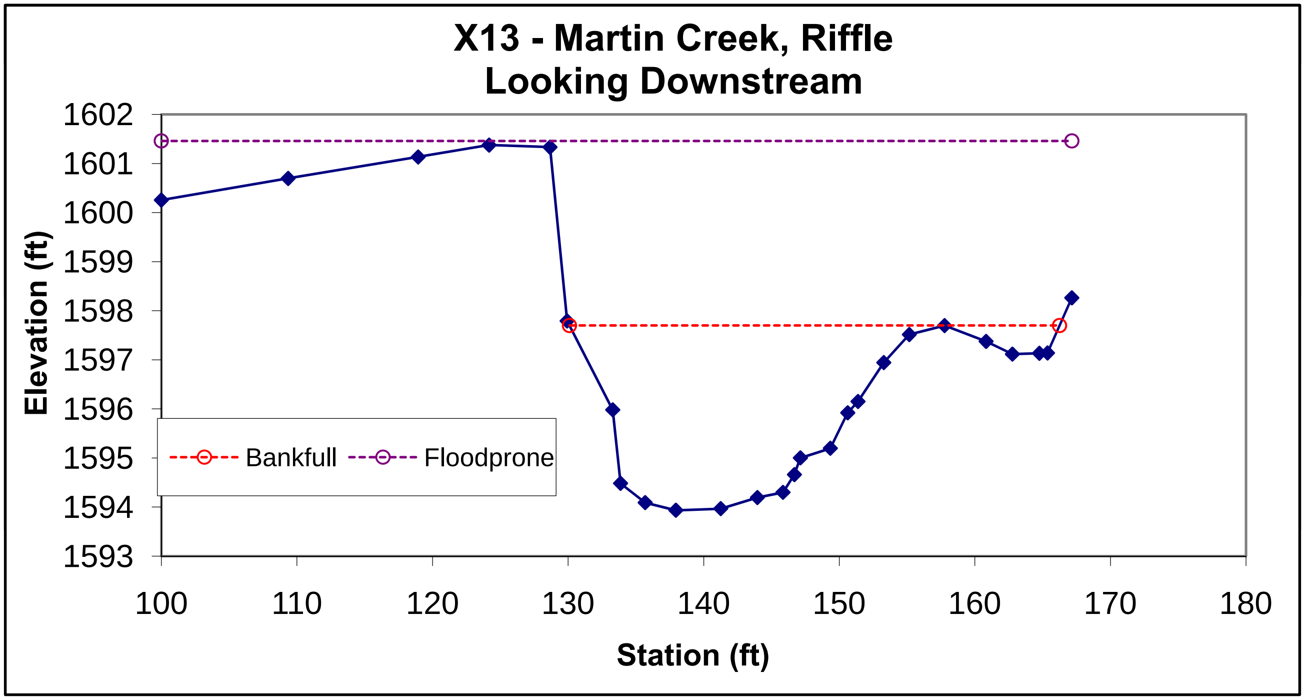
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	F*	2.9	6.9	0.43	0.90	16.0	3.0	1.5	1600.4	1602.21



* Moderately entrenched F channel.

Cross-section Data: X13 (Martin Creek)

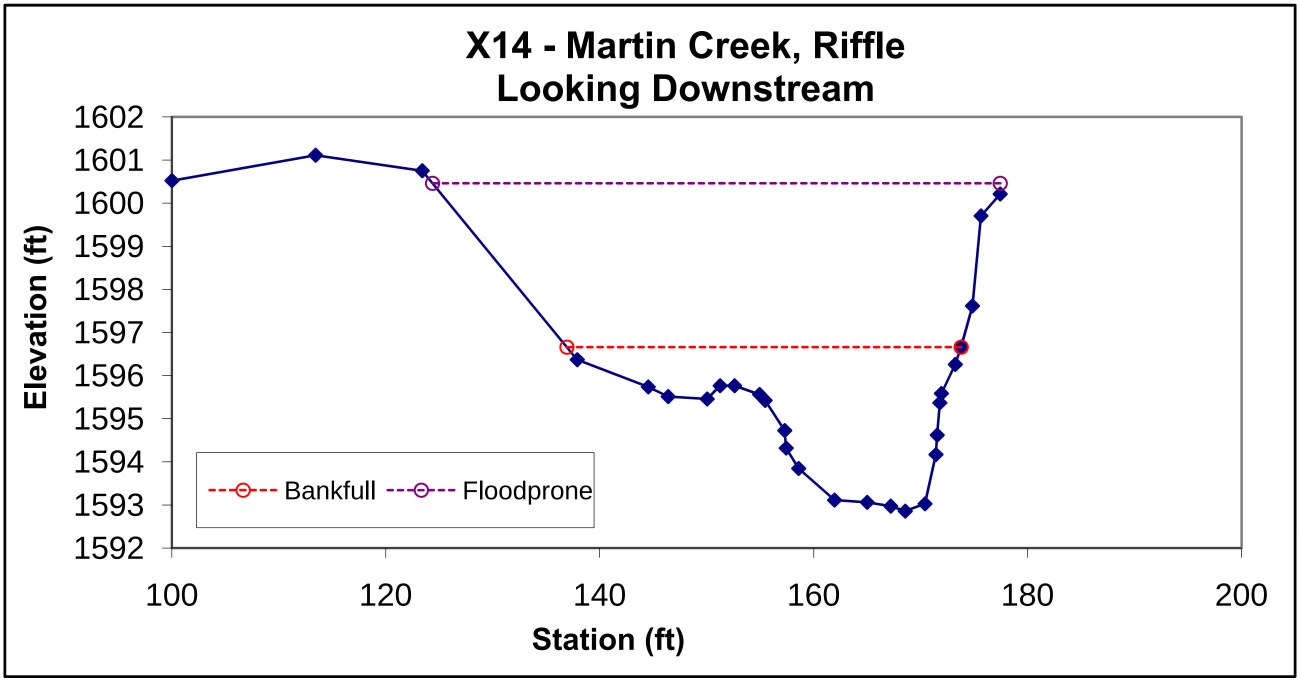
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	67.6	36.2	1.87	3.76	19.4	1.1	>1.9	1597.7	1598.26



* Note manmade levy on left bank

Cross-section Data: X14 (Martin Creek)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	N/A	68.6	36.9	1.86	3.8	19.8	1.9	1.4	1596.66	1595.56



* Note manmade levy on left bank

APPENDIX E. Photo Log of Existing Conditions

Martin's Creek II Mitigation Project Site
Photo Log

Notes: Photos on Pages 1-4 depict Right Prong Martin Creek and tributaries in the upper extent of the project area. The region had been experiencing drought conditions at the time of surveys.

Well defined ephemeral channel typical of project tributaries.

Ephemeral reach in headwaters of Right Prong drainage.

Perennial-intermittent break in Right Prong Martin Creek drainage.

Ephemeral-intermittent break in Right Prong Martin Creek drainage.

	
Channel features on mainstem of Right Prong above confluence with UT4.	Good channel dimension in perennial, upper reach of Right Prong Martin Creek.
	
Bank dimension in strong intermittent reach of Right Prong Martin Creek.	Bank dimension in intermittent reach of Right Prong Martin Creek.

Channel dimension of tributary in headwaters of MC-UT1.

Cascading channel profile present in parts of Right Prong drainage.

Cascading channel profile section present on Right Prong Martin Creek.

Channel dimension as valley slope becomes less steep in RP drainage.

Examples of other channel dimensions in more gently sloping sections of Right Prong drainage.

Mainstem of Right Prong Martin Creek in lower section of valley.

Martin's Creek II Mitigation Project Site
Photo Log

Notes: Photos on Pages 5-8 depict Martin Creek and tributaries in the lower half of the project area.

Pattern adjustment is proposed along this reach of UT1 to Martin Cr.

MC-UT1 in preservation reach.

Invasive plant removal and bank repair are proposed along this reach of MC-UT1 upstream of the barn.

Streambank conditions along MC-UT1 near barn.

Instream view of riparian conditions along MC-UT1. Native vegetation will be replanted that promotes better bank stabilization

MC-UT1 makes a 90° turn into this box culvert near the barn.

Upper extent of UT1-3. Cattle have trampled banks in this reach.

Bank erosion along sharp bend in MC-UT1-3.

Confluence of UT1-4 and Martin Creek

Overhead utility lines pose constraints to stream restoration approach and potentially crediting.

Enhancement efforts on Martins Creek will include removal of exotic, invasive vegetation and bank stabilization.


Channel incision on Martin Creek has been limited by bedrock


Low-canopy trees and shrubs will be replanted along Martin Creek

APPENDIX F. Wetland Delineation Findings

ECS CAROLINAS, LLP
Geotechnical • Construction Materials • Environmental • Facilities

December 29, 2008

Mickey Clemmons
Baker Engineering NY, Inc.
797 Haywood Road
Suite 201
Asheville, North Carolina 28806

Reference: Report of Hydric Soil Delineation
Lower Martin's Creek II Site
Martin's Creek Road and Crisp Road
Murphy, North Carolina
ECS Project 31-1219

Dear Mr. Clemmons:

ECS Carolinas, LLP (ECS) is pleased to provide you with our Report of Hydric Soil Delineation for the site located at the intersection of Martin's Creek Road and Crisp Road in Murphy, North Carolina. Our services were provided in general accordance with ECS Proposal No. 31-315-P.

BACKGROUND

The site is located at the intersection of Martin's Creek Road and Crisp Road in Murphy, North Carolina. The site is being evaluated for a potential wetland restoration project for the North Carolina Ecosystem Enhancement Program.

SCOPE OF SERVICES

ECS has conducted an investigation of the soils to determine the depth of hydric soil conditions and the depth of buried hydric soils within the area along the creek and adjacent to the drainage ditch. The assessment was conducted in accordance with current soil science practices and technology and field guides from the Natural Resources Conservation Service, USDA. To establish soil conditions, ECS dug holes using a hand auger approximately every 50 feet along transects across the field and excavated ten test pits to a depth of approximately 2 feet with a back hoe to confirm the hand auger holes. The locations of the hand augers holes and test pits and a diagram of the findings are depicted on an aerial photo provided by Baker Engineering NY, Inc (attached). A photo log of the excavation pits is also attached.

REPORT OF FINDINGS

PINK/BLACK A The surface layer has a texture of loam, 6 to 10 inches deep. The structure appears to be granular. The consistence is friable. The subsurface layer from 10 to 48 inches has textures of clay loam and clay. The consistence is firm, sticky, and plastic to very plastic. The subsurface layer from 40 inches to 48 inches has low chroma mottles of less than 2. The depth to the seasonal high water table is greater than 40 inches. Sample sites and pits are flagged with pink/black survey tape.

ORANGE O The surface layer has a texture of loam, 7 to 10 inches deep. The structure appears to be granular. The consistence is friable. The subsurface layer from 10 to 39 inches has textures of clay loam and clay. The consistence is firm, sticky, and plastic to very plastic. The subsurface layer from 27 inches to 39 inches has low chroma mottles of less than 2. The depth to the seasonal high water table is greater than 27 inches. Sample sites and pits are flagged with orange wooden stakes.

RED R The surface layer has a texture of loam, 5 to 9 inches deep. The structure appears to be granular. The consistence is friable. The subsurface layer from 9 to 39 inches has textures of clay loam and clay. The consistence is firm, sticky, and plastic to very plastic. The subsurface layer from 15 inches to 22 inches has low chroma mottles of less than 2. The depth to the seasonal high water table is greater than 15 inches. Sample sites and pits are flagged with red wooden stakes.

RED B The surface layer has a texture of loam, 14 to 18 inches deep. The structure appears to be granular. The consistence is friable. The subsurface layer from 14 to 22 inches has textures of dark grayish loam. The subsurface layer from 22 to 39 inches has textures of clay loam and clay. The consistence is firm, sticky, and plastic to very plastic. The subsurface layer from 22 inches to 39 inches has low chroma mottles of less than 2. The depth to the seasonal high water table is greater than 14 inches. Sample sites and pits are flagged with red wooden stakes.

RED/BLACK P Excavation of the pit exposed a terra cotta pipe used for drainage. Water was freely moving through the pipe. The pit is flagged with a red/black survey tape.

CONCLUSIONS

PINK/BLACK A Mottles with chroma of less than 2 were observed at depths greater than 40 inches.

ORANGE O Mottles with chroma of less than 2 were observed at depths of 27 to 34 inches.

RED R Mottles with chroma of less than 2 were observed at depths of 15 to 22 inches.

RED B A dark grayish loam A horizon was observed from 14 to 22 inches. The texture of the overlying material was found to be loam and sandy loam. The dark grayish color (chroma of less than 2) in the A horizon indicates that this soil formed under conditions of saturation, flooding, and/or ponding long enough to develop anaerobic conditions.

RED/BLACK P A terra cotta pipe installed for subsurface drainage was observed with water flowing freely.

CLOSING

ECS is pleased to offer you our professional services and we look forward to assisting in any of your site analysis needs in the future. If you have any questions or require further assistance, please contact Lauren Sicarelli at 828-665-2307 or Joe Hinton at (336) 362-4906.

Respectfully,

ECS CAROLINAS, LLP

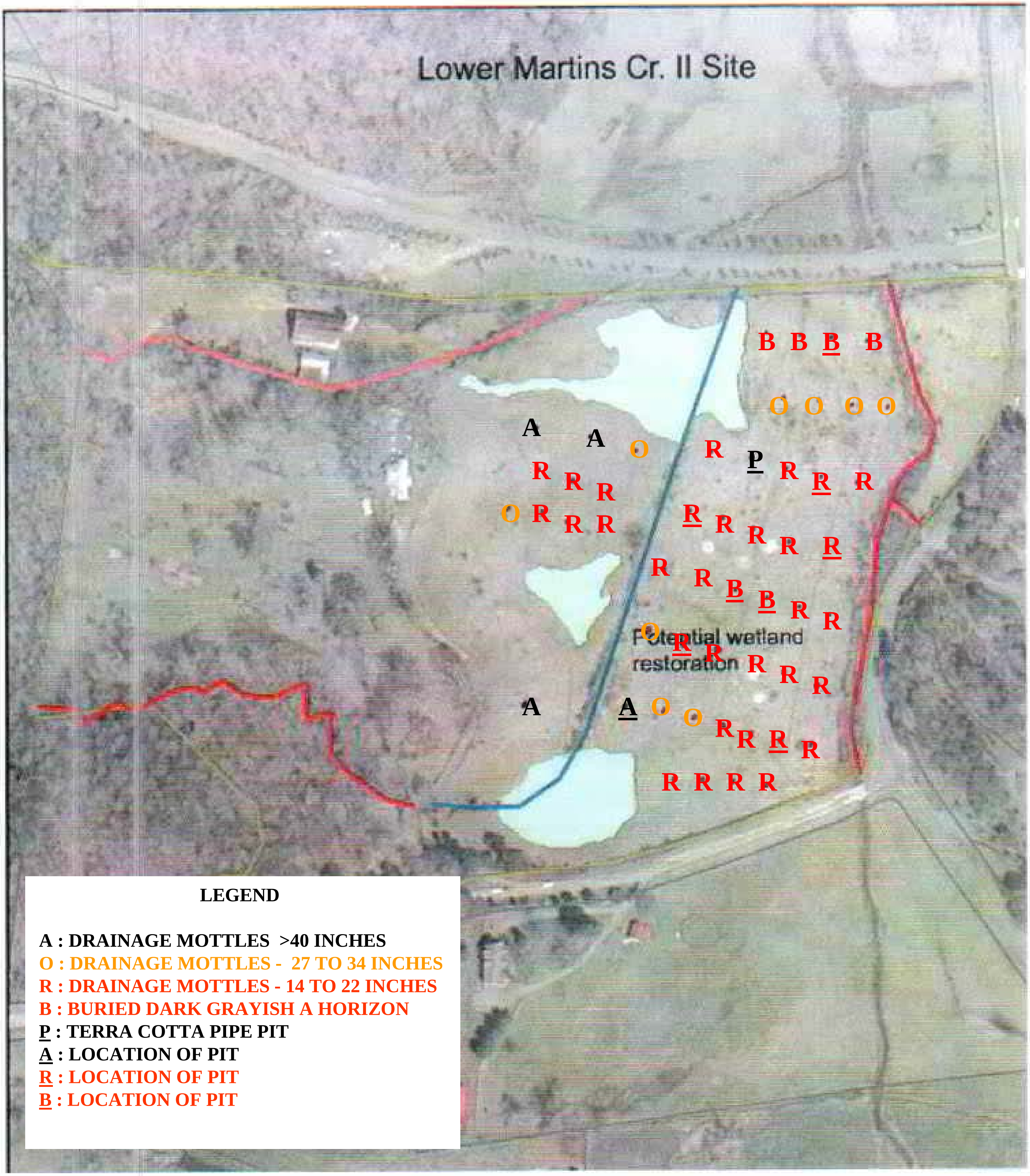
Joseph A Hinton

Denise M. Poulos -cla

Joseph A. Hinton, LSS
Senior Soil Scientist

Denise M. Poulos, LSS
Principal Scientist

Attachments:
- Figure 1 – Site Plan
- Figure 2 – Exploration Location Diagram
- Photo Log of Test Pits



LEGEND

A : DRAINAGE MOTTLES >40 INCHES
O : DRAINAGE MOTTLES - 27 TO 34 INCHES
R : DRAINAGE MOTTLES - 14 TO 22 INCHES
B : BURIED DARK GRAYISH A HORIZON
P : TERRA COTTA PIPE PIT
A : LOCATION OF PIT
R : LOCATION OF PIT
B : LOCATION OF PIT

SOURCE:

BAKER ENGINEERING NY, INC.

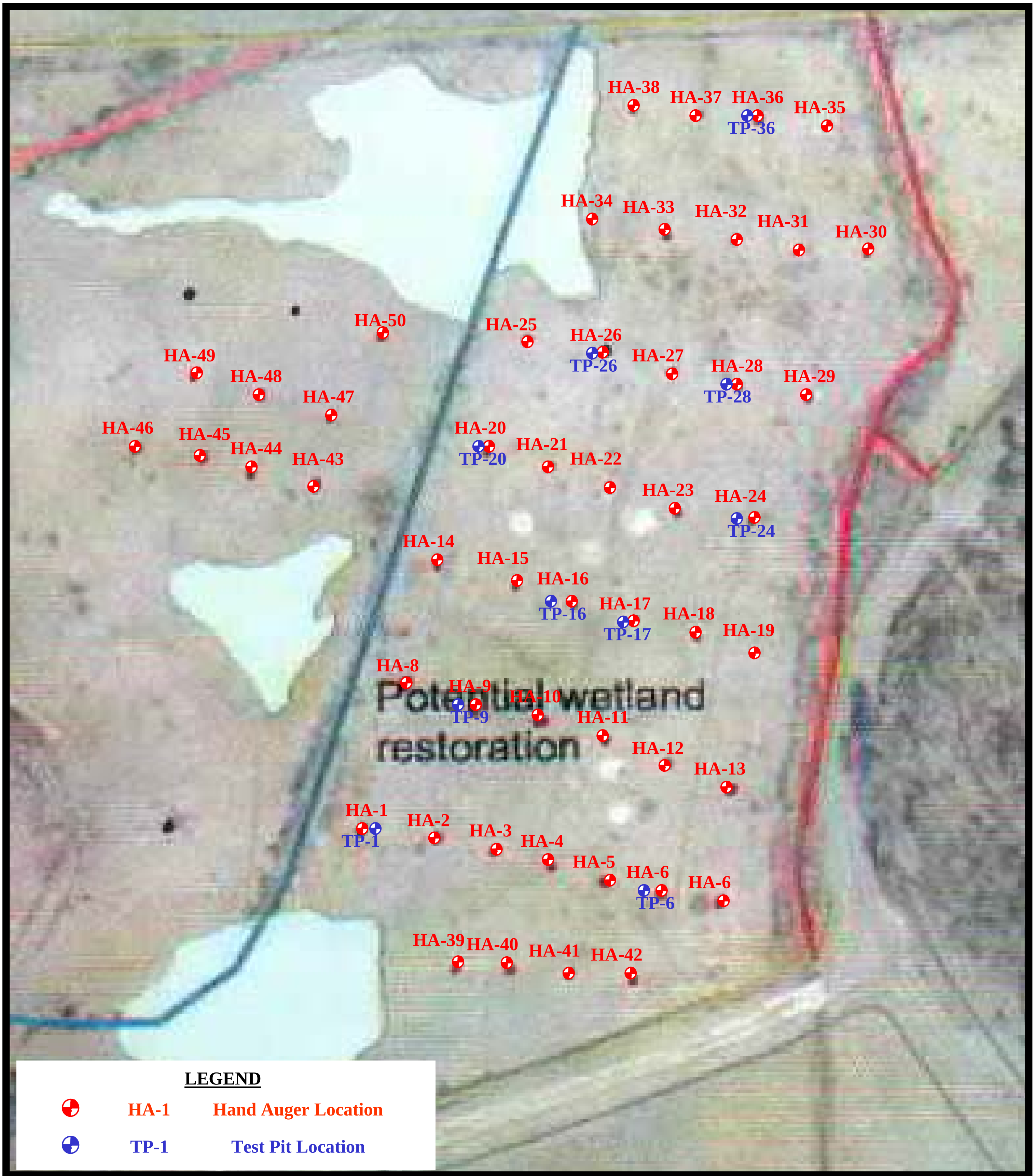
SCALE 1 INCH = ~200 FEET

ECS LLP
CAROLINAS

FIGURE 1

SITE PLAN
LOWER MARTIN'S CREEK II SITE
MARTIN'S CREEK ROAD & CRISP ROAD
MURPHY, NORTH CAROLINA

ECS PROJECT 31-1219



SOURCE:

BAKER ENGINEERING NY, INC.

SCALE 1 INCH = ~100 FEET

ECS LLP
CAROLINAS

FIGURE 2

EXPLORATION LOCATION DIAGRAM
LOWER MARTIN'S CREEK II SITE
MARTIN'S CREEK ROAD & CRISP ROAD
MURPHY, NORTH CAROLINA

ECS PROJECT 31-1219

Photo 1: Test Pit TP-1

Photo 2: Test Pit TP-1

Photo 3: Test Pit TP-6

Photo 4: Test Pit TP-6

Photo 5: Test Pit TP-16

Photo 6: Test Pit TP-16

Photo 7: Test Pit TP-17

Photo 8: Test Pit TP-17

Photo 9: Test Pit TP-24

Photo 10: Test Pit TP-24

Photo 11: Test Pit TP-26

Photo 12: Test Pit TP-26

Photo 13: Test Pit TP-36

Photo 14: Test Pit TP-36

Photo 15: Test Pit TP-20

Photo 16: Test Pit TP-20

WETLAND JURISDICTIONAL REVIEW

LOWER MARTIN’S CREEK II SITE

MARTIN’S CREEK ROAD AND CRISP ROAD
MUPRHY, CHEROKEE COUNTY, NORTH CAROLINA

ECS CAROLINAS, LLP
Geotechnical • Construction Materials • Environmental • Facilities

January 22, 2009

Ms. Loretta Beckwith
U.S. Army Corps of Engineers
Asheville Regulatory Field Office
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006

RE: Wetland Jurisdictional Review
Lower Martin's Creel II Site
Martin's Creek Road and Crisp Road
Murphy, Cherokee County, North Carolina
ECS Carolinas, LLP Project No. 31:1219

Dear Ms. Beckwith:

Please review the attached material included for a wetland jurisdictional determination for the above-mentioned property. The site is located in the northwest quadrant of the intersection of Martin's Creek Road and Crisp Road in Murphy, Cherokee County, North Carolina, and is further identified as a portion of Cherokee County Tax Parcel No. 459100146624000. At the time of the wetland delineation the subject site, was in use as a cattle pasture. According to the U.S. Environmental Protection Agency's (EPA), *Enviromapper* website, the site is located in the Hiawassee River Basin (HUC Code 06020002).

On December 4, 2008, ECS Carolinas, LLP (ECS) delineated three wetland areas located on the site, labeled as Wetland A, Wetland B, and Wetland C. The three wetland areas are situated from south to north along an agricultural ditch in the central portion of the site. Vegetation in the wetland areas consisted of *Juncus effusus*, *Ponterderia cordata, Polygonum spp*., *Phragmites australis* and *Carex spp*. Soils for the site were not available on the USDA Web Soil Survey, however, soils in the wetland exhibited hydric conditions and were consistently a 10YR 6/1 on the Munsell Soil Color Chart. The ditch exhibited characteristics of an ordinary high water mark and flowed directly into Martin's Creek, a perennial stream.

The delineation was performed based upon the hydrology of the wetland, hydric characteristics of the soil and hydrophytic vegetation, as described in the 1987, U.S. Corps of Engineers, Wetland Delineation Manual. ECS also performed Routine Wetland Delineation Data Form test plots (copies enclosed) to verify the difference between the wetland and upland areas located at the site.

As requested by the client, Mr. Micky Clemmons of Michael Baker Engineering, Inc, ECS is enclosing the following materials to assist with your jurisdictional review of the wetland boundary:

- Copies of the Routine Wetland Delineation Data Forms;
- Jurisdictional Determination Form;
- Property owner's signed letter of authorization for allowed site visits;
- Driving directions and map to the site;
- Map showing the location of the site (**Figure 1**), a USGS Quad map with site boundaries depicted and the coordinates for the center of the site shown in deci-degrees (**Figure 2**), the US Fish and Wildlife Service National Wetland Inventory Map (**Figure 3**), and field sketch of the wetland delineation (**Figure 4**);
- Photo Log.

Applicant/Address:
Mr. Micky Clemmons
Michael Baker Engineering, Inc.
797 Haywood Road
Asheville, North Carolina 28806

ECS' objective is to have a final determination by your office as to the delineated, jurisdictional boundaries of the wetlands. Thank you in advance for your assistance with this project. If you have any questions or need additional information please contact Lauren Sicarelli at (828) 989-6911.

ECS Carolinas, LLP

Lauren Sicarelli

Lauren Sicarelli
Environmental Scientist

Enclosures: Appendices

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

Project/Site: Lower Martin's Creek
Applicant/Owner: Baker Engineering
Investigator: LTS

Date: [illegible]/5/08
County: Cherokee
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 : WA
Transect ID: wet
Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Carex sp.	herb	FACW	9.		
2. Juncus effusus	herb	FACW	10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

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

Remarks: no trees or vines

HYDROLOGY

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

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: N/A (in.)

Depth to Free Water in Pit: 4" (in.)

Depth to Saturated Soil: 0" (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"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): unknown

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/Contrast	Texture, Concretions, Structure, etc.
0-2	O	10YR 2/2	–		high OM
2-8	A	10YR 5/1	10YR 4/4	fine, many	loam
8-12	B	10YR 5/3	–		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 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: Site is located in a pasture currently used for cattle. Site has ditch running through the middle and portions of the pasture have been drained w/ tiles.

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

Project/Site: Lower Martins Creek
Applicant/Owner: Baker Engineering
Investigator: LTS

Date: 1/25/08
County: Cherokee
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 : WA
Transect ID: upland
Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. pasture grasses	herb	?	9.		
2. rosa multiflora	vine	FACU	10.		
3.			11.		
4.			12.		
5.			13.		
6.			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: N/A (in.)

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

Depth to Saturated Soil: >12" (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"
- ____ Water-Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name
(Series and Phase): unknown

Drainage Class: ____
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): ____

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	O	10YR2/2			
2-12	A	10YR 6/4	—	—	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 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:

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

Project/Site: Lower Martins Creek
Applicant/Owner: Baker Engineering
Investigator: LTS

Date: 12/15/08
County: Cherokee
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 : WB
Transect ID: wet
Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. carex sp.	herb	FACW	9.		
2. juncus effusus	herb	FACW	10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

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

Remarks: No trees or vines

HYDROLOGY

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

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: NA (in.)

Depth to Free Water in Pit: 1 (in.)

Depth to Saturated Soil: 0 (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"
- ✓ Water-Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name
(Series and Phase): Unknown

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/Contrast	Texture, Concretions, Structure, etc.
0-2	O	10YR 3/3			High OM
2-12	A	10YR 4/1	10YR 4/4	Many, distinct	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 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:

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

Project/Site: Lower Martins Creek
Applicant/Owner: Baker Engineering
Investigator: LTS

Date: 12/5/08
County: Cherokee
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 : WC
Transect ID: wet
Plot ID: ______

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Carex sp.	herb	FACW	9.		
2. Juncus effusus	herb	FACW	10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

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

Remarks: No trees or vines

HYDROLOGY

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

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: N/A (in.)

Depth to Free Water in Pit: 1 (in.)

Depth to Saturated Soil: 0 (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"
- ✓ Water-Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name
(Series and Phase): unknown

Drainage Class: ________________
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): ________________

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	O	10YR 3/3			High OM
2-12	A	10YR 4/1	10YR 4/4	Many distinct	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 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:

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

Project/Site: Lower Martin's Creek
Applicant/Owner: Baker Engineering
Investigator: LTS

Date: 12/5/08
County: ____
State: ____

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 : UBTWC
Transect ID: upland
Plot ID: ____

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. pasture grasses	herb	?	9.		
2. rosa multiflora	vine	FACU	10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 750%

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: N/A (in.)

Depth to Free Water in Pit: 712" (in.)

Depth to Saturated Soil: 712" (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"
- ____ Water-Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name
(Series and Phase): unknown

Drainage Class: ___
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): ___

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	O	10YR2/2			
2-12	A	10YR5/2	10YR4/4	faint, many	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 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

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD):

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State: County/parish/borough: City:
Center coordinates of site (lat/long in degree decimal format): Lat. -84.025° **N**, Long. 35.054° **W**.
Universal Transverse Mercator:
Name of nearest waterbody: Martin Creek

Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Hiawassee River
Name of watershed or Hydrologic Unit Code (HUC):
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:
☐ Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]

☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☒ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☐ Non-RPWs that flow directly or indirectly into TNWs
      ☒ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: 850 linear feet: 3-4 width (ft) and/or acres.
      Wetlands: ~2-3 acres.

   c. **Limits (boundaries) of jurisdiction** based on: **1987 Delineation Manual**
      Elevation of established OHWM (if known): .

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☐ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional. Explain: .

---

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. **TNW**
   Identify TNW: .

   Summarize rationale supporting determination: .

2. **Wetland adjacent to TNW**
   Summarize rationale supporting conclusion that wetland is "adjacent":   .

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. **Characteristics of non-TNWs that flow directly or indirectly into TNW**

   (i) General Area Conditions:
   Watershed size: 20 **acres**
   Drainage area: 10 **Pick List**
   Average annual rainfall: 57 inches
   Average annual snowfall: 5 inches

   (ii) Physical Characteristics:
   (a) Relationship with TNW:
   ☐ Tributary flows directly into TNW.
   ☒ Tributary flows through **2** tributaries before entering TNW.

   Project waters are **2-5** river miles from TNW.
   Project waters are **1 (or less)** river miles from RPW.
   Project waters are **1-2** aerial (straight) miles from TNW.
   Project waters are **1 (or less)** aerial (straight) miles from RPW.
   Project waters cross or serve as state boundaries. Explain: .

   Identify flow route to TNW[5]: wetlands flow into agricultural ditch (which was created in wetlands) and then flows into Martin's Creek Martin's Creek flows directly into the Hiawasse River.

---

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

Tributary stream order, if known: 1st.

(b) General Tributary Characteristics (check all that apply):

Tributary is:
☐ Natural
☐ Artificial (man-made). Explain: .
☒ Manipulated (man-altered). Explain: Stream was likely moved or ditch was created to drain wetlands.

Tributary properties with respect to top of bank (estimate):
Average width: 3-4 feet
Average depth: 2-3 feet
Average side slopes: **Vertical (1:1 or less).**

Primary tributary substrate composition (check all that apply):
☒ Silts
☒ Cobbles
☐ Bedrock
☐ Other. Explain: .
☐ Sands
☐ Gravel
☐ Vegetation. Type/% cover:
☐ Concrete
☐ Muck

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: poor condition, has been ditched.
Presence of run/riffle/pool complexes. Explain: no run/riffle/pool complexes.
Tributary geometry: **Relatively straight**
Tributary gradient (approximate average slope): ~1 %

(c) Flow:

Tributary provides for: **Intermittent but not seasonal flow**
Estimate average number of flow events in review area/year: **11-20**
Describe flow regime: .
Other information on duration and volume: .

Surface flow is: **Discrete and confined.** Characteristics: .

Subsurface flow: **No**. Explain findings: .
☐ Dye (or other) test performed: .

Tributary has (check all that apply):
☒ Bed and banks
☐ OHWM[6] (check all indicators that apply):
  ☐ clear, natural line impressed on the bank
  ☒ changes in the character of soil
  ☐ shelving
  ☒ vegetation matted down, bent, or absent
  ☐ leaf litter disturbed or washed away
  ☐ sediment deposition
  ☒ water staining
  ☐ other (list):
  ☒ the presence of litter and debris
  ☐ destruction of terrestrial vegetation
  ☐ the presence of wrack line
  ☐ sediment sorting
  ☐ scour
  ☐ multiple observed or predicted flow events
  ☐ abrupt change in plant community
☐ Discontinuous OHWM.[7] Explain: .

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):
☐ High Tide Line indicated by:
  ☐ oil or scum line along shore objects
  ☐ fine shell or debris deposits (foreshore)
  ☐ physical markings/characteristics
  ☐ tidal gauges
  ☐ other (list):
☐ Mean High Water Mark indicated by:
  ☐ survey to available datum;
  ☐ physical markings;
  ☐ vegetation lines/changes in vegetation types.

(iii) Chemical Characteristics:

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain: ditch was over-grown with briars and flow was low, but wate was present.
Identify specific pollutants, if known: .

---

[6] A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.

[7] Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

☐ Riparian corridor. Characteristics (type, average width): .
☒ Wetland fringe. Characteristics: three wetland pockets were delineated along ditch.
☐ Habitat for:
  ☐ Federally Listed species. Explain findings: .
  ☐ Fish/spawn areas. Explain findings: .
  ☐ Other environmentally-sensitive species. Explain findings: .
  ☐ Aquatic/wildlife diversity. Explain findings: .

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:
Properties:
Wetland size:2-3 acres
Wetland type. Explain: palustrine .
Wetland quality. Explain:fairly good qualtiy with well established wetland species.
Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:
Flow is: **Intermittent flow**. Explain: .

Surface flow is**: Discrete and confined**
Characteristics: .

Subsurface flow: **Yes**. Explain findings: wetland hydrology appeared to come from base of hill side, rather than from ditch. Ditch hydrology was from wetlands.
☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:
☒ Directly abutting
☐ Not directly abutting
  ☐ Discrete wetland hydrologic connection. Explain: .
  ☐ Ecological connection. Explain: .
  ☐ Separated by berm/barrier. Explain: .

(d) Proximity (Relationship) to TNW
Project wetlands are **2-5** river miles from TNW.
Project waters are **1-2** aerial (straight) miles from TNW.
Flow is from: **Wetland to navigable waters.**
Estimate approximate location of wetland as within the **10 - 20-year** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: wetland plants well established, little impact/ erosion from cattle.
Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):

☒ Riparian buffer. Characteristics (type, average width): .
☐ Vegetation type/percent cover. Explain: .
☐ Habitat for:
  ☐ Federally Listed species. Explain findings: .
  ☐ Fish/spawn areas. Explain findings: .
  ☐ Other environmentally-sensitive species. Explain findings: .
  ☐ Aquatic/wildlife diversity. Explain findings: .

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **3**
Approximately (2-3) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)		Size (in acres)	Directly abuts? (Y/N)	Size (in acres)
Wetland A	Y	1.5-2.0		
Wetland B	Y	0.75		
Wetland C	Y	0.25		

Summarize overall biological, chemical and physical functions being performed:
Primary beneficial function is nutrient removal as the wetlands are located in a cattle pasture .

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D: .

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: wetland areas and ditch flow into Lower Martin's Creek which flows directly into the Hiawassee River approximately 4 river miles away. The wetlands provide nutrient removal from the cattle pasture they are a part of.

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   ☐ TNWs: linear feet width (ft), Or, acres.
   ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   ☐ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial: .

☒ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: first order ditch with hydric soils and substrate differs from surrounding uplands.

Provide estimates for jurisdictional waters in the review area (check all that apply):
☒ Tributary waters: **850** linear feet **3-4**width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**

☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: **.**

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**

☐ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.

☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: **.**

☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**

☒ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: **2-3** acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**

☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.[9]**

As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
☐ Demonstrate that impoundment was created from "waters of the U.S.," or
☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]

☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.

---

[8] See Footnote # 3.

[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.

[10] **Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.***

☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain: .
☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: **.**
☐ Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based <u>solely</u> on the "Migratory Bird Rule" (MBR).
☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: **.**
☐ Other: (explain, if not covered above): **.**

Provide acreage estimates for non-jurisdictional waters in the review area, where the <u>sole</u> potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

<u>SECTION IV: DATA SOURCES</u>.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  ☐ Office concurs with data sheets/delineation report.
  ☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps: .
☐ Corps navigable waters' study: .
☐ U.S. Geological Survey Hydrologic Atlas: .
  ☐ USGS NHD data.
  ☐ USGS 8 and 12 digit HUC maps.
☒ U.S. Geological Survey map(s). Cite scale & quad name: Murphy, NC 7.5 min.
☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
☒ National wetlands inventory map(s). Cite name: Murphy, NC.
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps: .
☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
☒ Photographs: ☒ Aerial (Name & Date):Obtained from Google Earth, dated July 2006.
or ☒ Other (Name & Date):Photo log from December 5, 2008 during delineation.
☐ Previous determination(s). File no. and date of response letter: .
☐ Applicable/supporting case law: .
☐ Applicable/supporting scientific literature: .
☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD: .

January 2, 2009

Ms. Loretta Beckwith, Project Manager
Asheville Regulatory Field Office
U.S. Army Corps of Engineers
151 Patton Avenue, Room 208
Asheville, North Carolina 28801

Reference: Agent Authorization and Site Access Authorization
Jurisdictional Wetland Determination
Lower Martin's Creek II Site
Lower Martin's Creek Road and Crisp Road
Murphy, Cherokee County, North Carolina
EEP Contract #D09010S, Baker Project #114414, ECS Project # 31-1219

Dear Ms. Beckwith:

As the property owner, I am hereby authorizing you and/or other employees of the U.S. Army Corps of Engineers (USACE), Asheville Regulatory Field Office, to enter and inspect the above-referenced project site. I understand that this site inspection will result in determination of the jurisdictional status of the property's wetlands/surface waters under the USACE Section 404/401 Regulatory Program.

Additionally, as the property owner, I hereby authorize Michael Baker Engineering, Inc. to act as my authorized agent regarding wetlands and streams on my property and for their subconsultant, ECS Carolinas, LLP, to make a formal request for a wetland determination on my property.

Please contact me if you need additional information.

Sincerely,

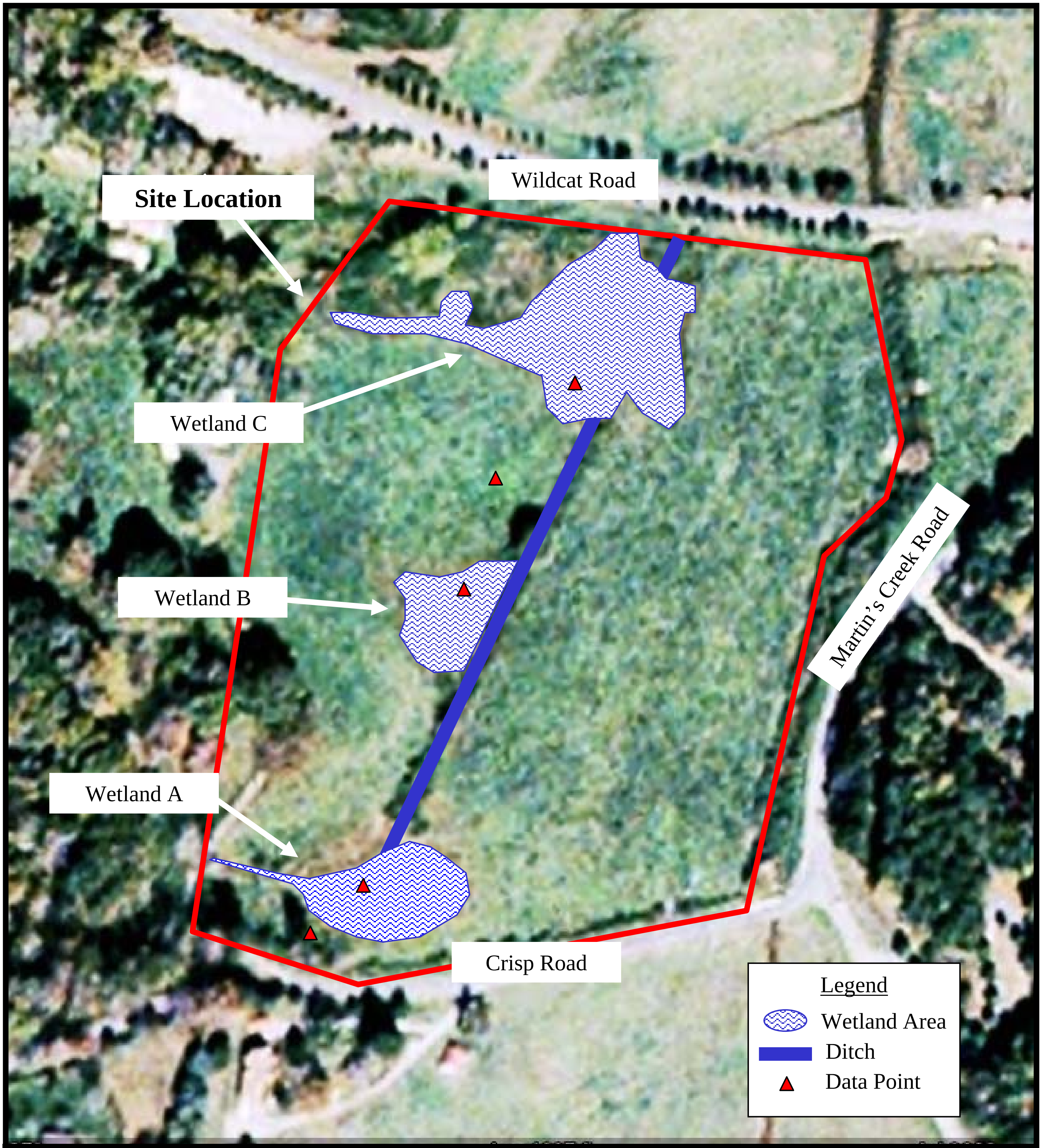
Barbara Lutz
(Owner Signature)

Barbara Lutz
(Print Name)

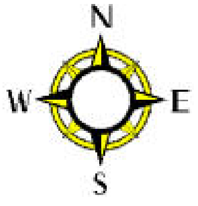
1-8-09
(Date)

100 Pine Brook Rd.
East Hampton, CT
06424
(Address)

860 365-0388
(Phone No.)



CAROLINAS



Not to Scale

Approximate Stream Locations
Google Earth

Wetland Assessment
Lower Martin's Creek II Site
Martin's Creek Road and Crisp Road
Murphy, Cherokee County, North Carolina

Figure No.
4

ECS Project #
31:1219

Photo 1: A view of Wetland A, looking east.

Photo 2: A view of Wetland A, looking south.

Photo 3: A view of Wetland A, looking southwest.

Photo 4: A view of Wetland A, looking west.

Photo 5: A view of a Wetland B, looking north.

Photo 6: A view of Wetland B, looking northeast.

Photo 5: A view of a Wetland B, looking west.

Photo 6: A view of Wetland B, looking south.

Photo 5: A view of the boundary of Wetland C, looking west.

Photo 6: A view from within Wetland C, looking south.

Photo 5: A view of Wetland C, looking southwest.

Photo 6: A view of a Wetland C, looking northwest.

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **2009-00209** County: **Cherokee**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: **Ms. Barbara Lutz**
Address: **100 Pine Brook Road**
East Hampton, CT 06424

Agent: **Michael Baker Engineering, Inc.**
Attn: Mr. Micky Clemmons
Address: **797 Haywood Road**
Asheville, NC 28806

Property description:

Size (acres)	**29.3-acre review area**	Nearest Town	**Murphy**
Nearest Waterway	**Martin's Creek**	River Basin	**Hiwassee**
USGS HUC	**06020002**	Coordinates	**35.054 west / -84.025 north**

Location description: **The property is located in the northwest quadrant of the intersection of Martin's Creek Road and Crisp Road in Murphy, Cherokee County, North Carolina.**

Indicate Which of the Following Apply:

A. Preliminary Determination

Based on preliminary information, there may be waters of the United States (U.S.) 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 U.S. 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.

X There are waters of the U.S. 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 of the U.S. 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 of the U.S. 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 of the U.S. 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.

Placement of dredged or fill material within waters of the U.S. 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 **Lori Beckwith** at **828-271-7980, ext. 226**.

KAB

C. Basis For Determination
The site contains wetlands as determined by the USACE 1987 Wetland Delineation Manual and they abut a stream channel (an unnamed tributary to Martin's Creek) on the property that exhibits indicators of an ordinary high water mark. The stream channels on the property are an unnamed tributary to Martin's Creek and Martin's Creek. Martin's Creek eventually flows into the Hiwassee River which flows into the Tennessee River; the Tennessee River is a Section 10 water.

D. Remarks: Waters of the U.S. on-site are 3 wetlands and 2 streams.

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: Lori Beckwith, Regulatory Specialist
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 May 11, 2009.

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: Lori Beckwith

Issue Date: **March 12, 2009**

Expiration Date: **March 11, 2014**

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

Copy Furnish: ECS Carolinas LLP, Attention: Ms. Lauren Sicarelli, 200 Ridgefield Court, Suite 222, Asheville, NC, 28806

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Ms. Barbara Lutz	File Number: 2009-00209	Date: March 12, 2009
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:

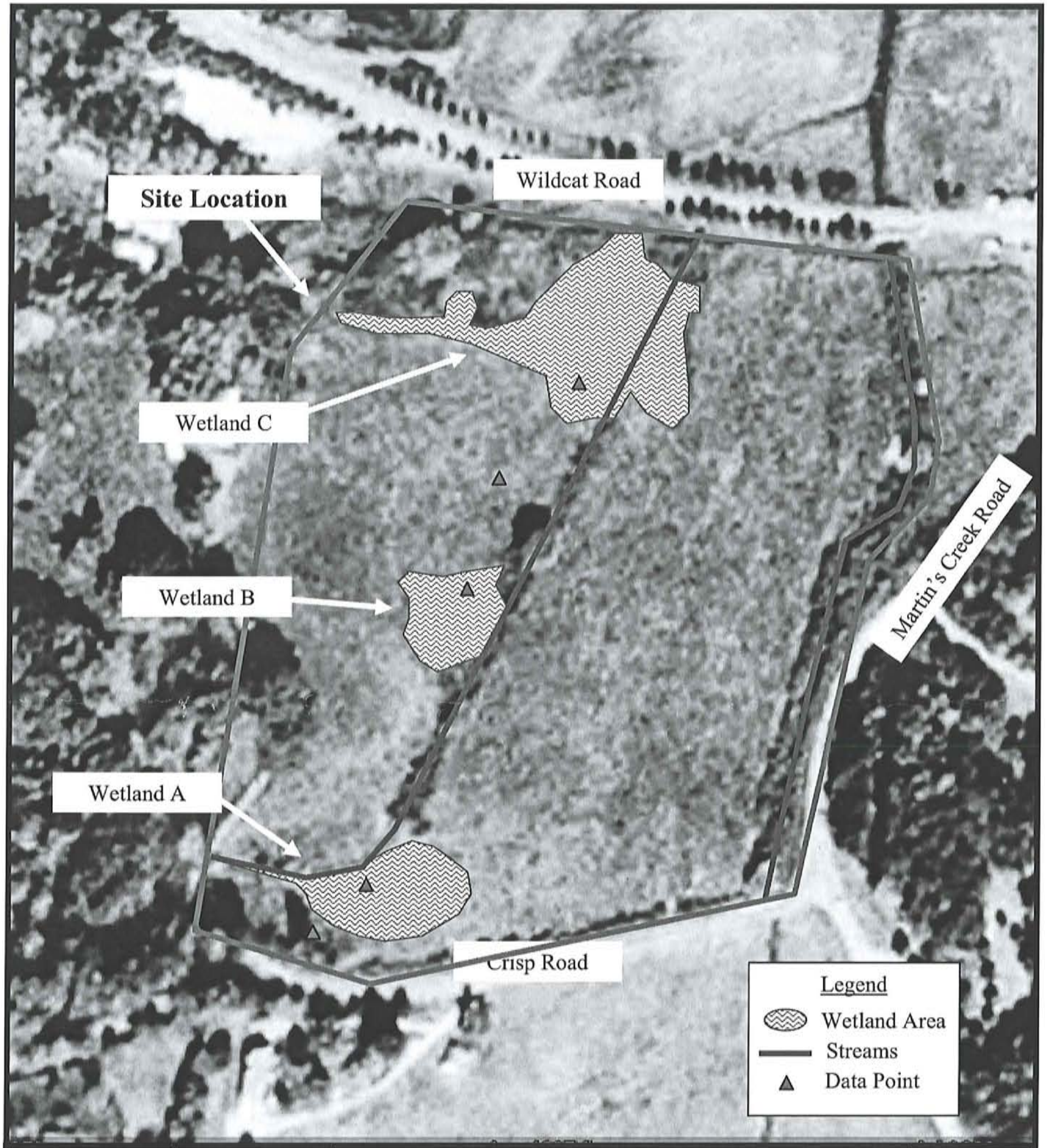
If you have questions regarding this decision and/or the appeal process you may contact: Lori Beckwith, Regulatory Specialist USACE, Asheville Regulatory Field Office 151 Patton Ave RM 208 Asheville, NC 28806 828-271-7980	If you only have questions regarding the appeal process you may also contact: Mr. 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: Lori Beckwith, Regulatory Specialist, Asheville Regulatory Field Office, 151 Patton Avenue, Room 208, Asheville, NC 28801.



ECS LLP
CAROLINAS

N
W E
S
Not to Scale

Approximate Stream Locations
Google Earth

Figure No.
4

Wetland Assessment
Lower Martin's Creek II Site
Martin's Creek Road and Crisp Road
Murphy, Cherokee County, North Carolina

ECS Project #
31:1219

Martin's Creek II

NC EEP PROJECT: 92633

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	114412	1	34

SCO PROJECT NO. XXXX92633

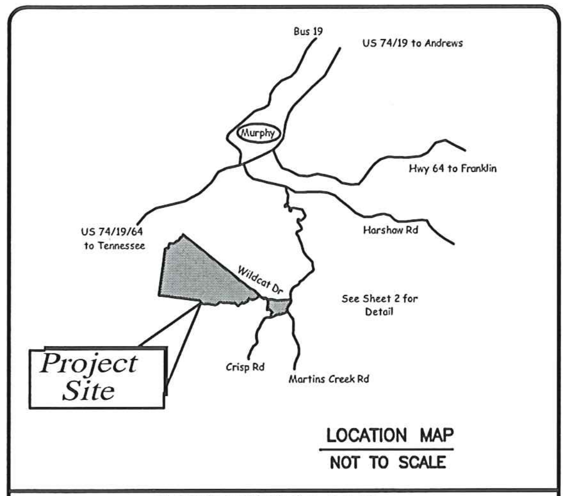
NC ECOSYSTEM ENHANCEMENT PROGRAM

Martin's Creek II Stream and Wetland Restoration Project

Cherokee County, North Carolina

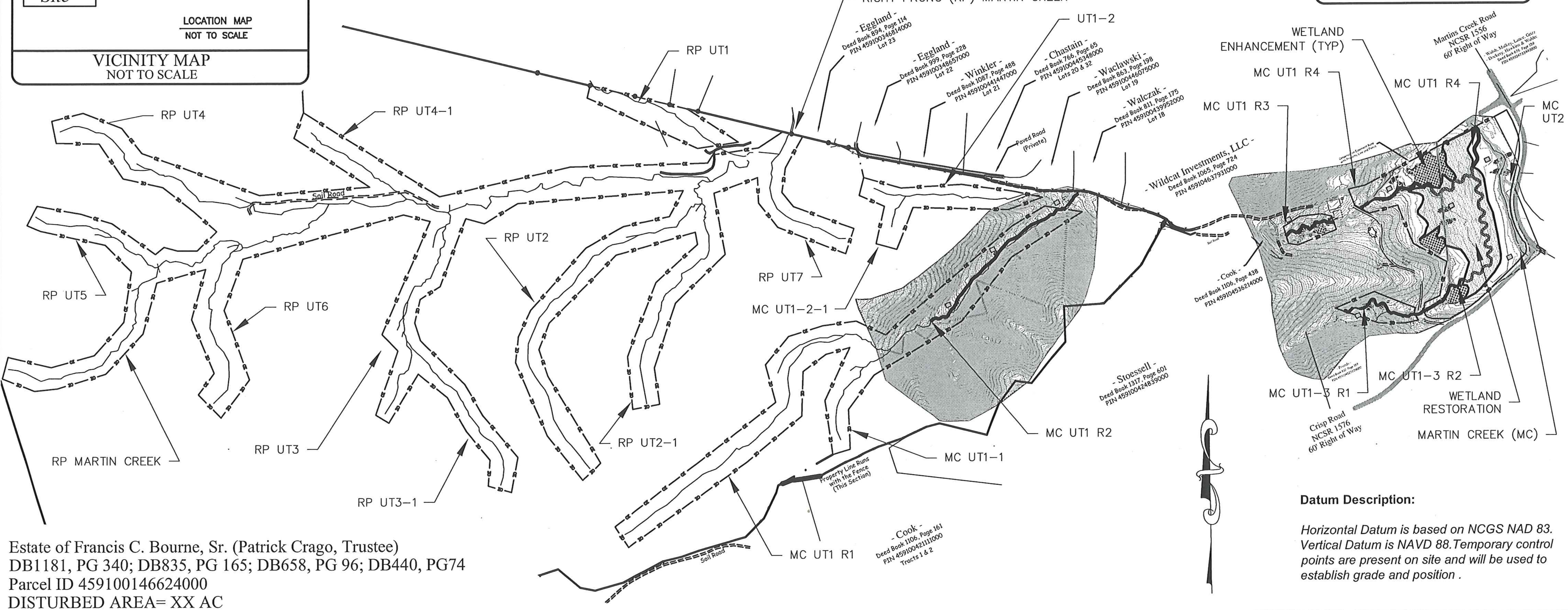
Type of Work: Stream & Wetland Restoration & Enhancement

INDEX OF SHEETS



VICINITY MAP
NOT TO SCALE

SCALE
1"=600' at 11x17



Estate of Francis C. Bourne, Sr. (Patrick Crago, Trustee)
DB1181, PG 340; DB835, PG 165; DB658, PG 96; DB440, PG74
Parcel ID 459100146624000
DISTURBED AREA= XX AC

Datum Description:

Horizontal Datum is based on NCGS NAD 83. Vertical Datum is NAVD 88.Temporary control points are present on site and will be used to establish grade and position .

GRAPHIC SCALES

20 0 20 40
PLANS

20 0 20 40
PROFILE (HORIZONTAL)

2 0 2 4
PROFILE (VERTICAL)

DESIGN SUMMARY

Inside and Outside of Conservation Easements:

Method: Restoration	3629 LF
Method: Enhancement I	925 LF
Method: Enhancement II.	1903 LF
Method: Preservation	21530 LF
Wetlands Restoration	5.2 Acres
Wetlands Enhancement	1.53 Acres

(SEE SHEET 2 FOR STREAM LENGTHS)

PREPARED FOR THE OFFICE OF:

Ecosystem Enhancement PROGRAM

NCDENR - ECOSYSTEM ENHANCEMENT PROGRAM
2728 CAPITAL BLVD., SUITE 1H 103
RALEIGH, NC 27604

NCEEP CONTACT: PAUL WIESNER
PROJECT MANAGER

PREPARED IN THE OFFICE OF:

Baker

Michael Baker Engineering Inc.
NC Eng License F-1084
797 Haywood Road
Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

JAKE MCLEAN, PE
PROJECT ENGINEER

MICKY CLEMMONS, OFFICE PRINCIPAL
PROJECT MANAGER

June 15, 2010
DATE

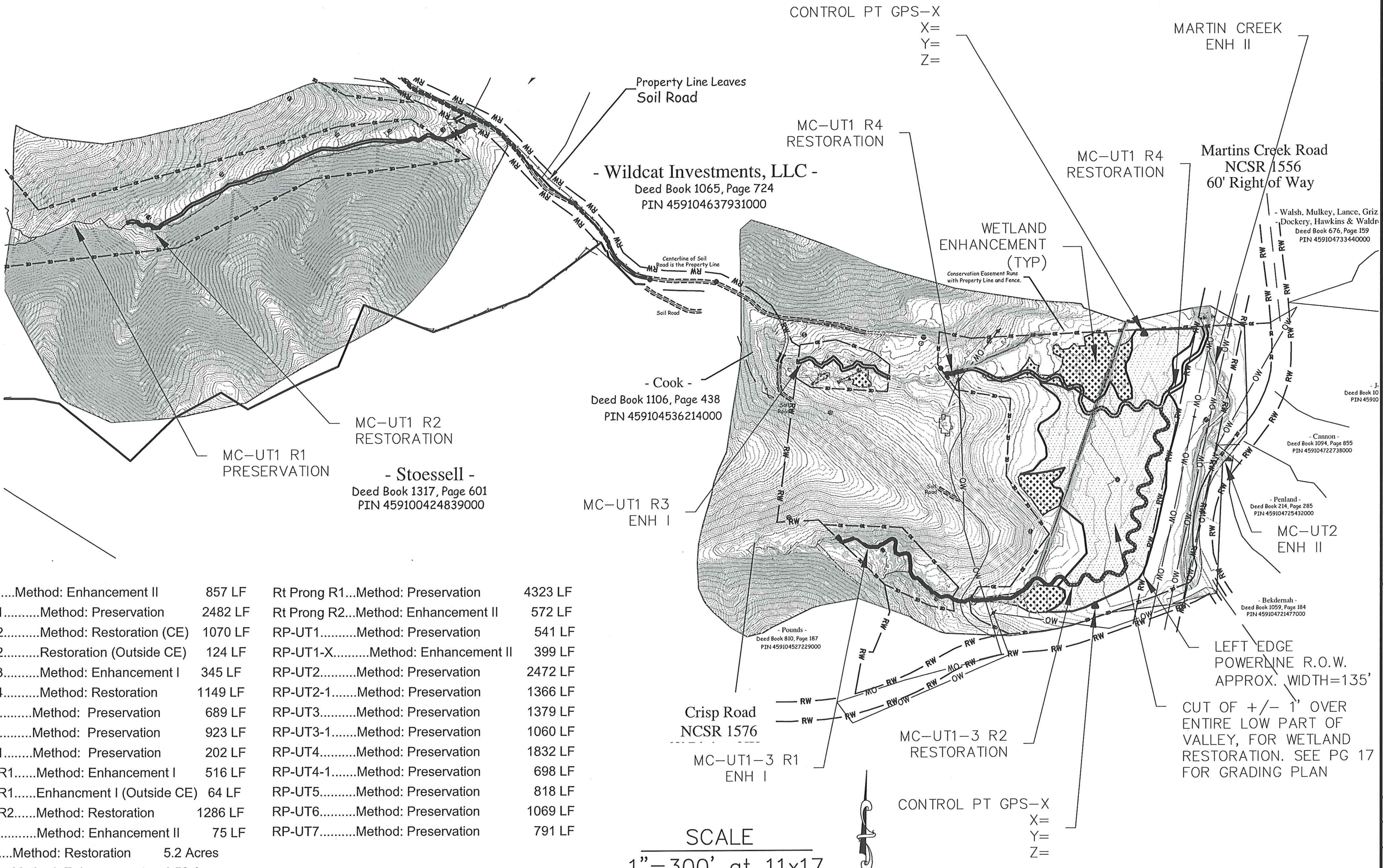
PROJECT ENGINEER

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

P.E.

SIGNATURE:

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



SCALE
1"=300' at 11x17

*Martin Ck......	Method: Enhancement II	857 LF	Rt Prong R1...	Method: Preservation	4323 LF
*MC-UT1R1..........	Method: Preservation	2482 LF	Rt Prong R2...	Method: Enhancement II	572 LF
*MC-UT1R2..........	Method: Restoration (CE)	1070 LF	RP-UT1..........	Method: Preservation	541 LF
*MC-UT1R2..........	Restoration (Outside CE)	124 LF	RP-UT1-X..........	Method: Enhancement II	399 LF
*MC-UT1R3..........	Method: Enhancement I	345 LF	RP-UT2..........	Method: Preservation	2472 LF
*MC-UT1R4..........	Method: Restoration	1149 LF	RP-UT2-1.......	Method: Preservation	1366 LF
MC-UT1-1...........	Method: Preservation	689 LF	RP-UT3..........	Method: Preservation	1379 LF
MC-UT1-2...........	Method: Preservation	923 LF	RP-UT3-1.......	Method: Preservation	1060 LF
MC-UT1-2-1........	Method: Preservation	202 LF	RP-UT4..........	Method: Preservation	1832 LF
*MC-UT1-3R1......	Method: Enhancement I	516 LF	RP-UT4-1.......	Method: Preservation	698 LF
*MC-UT1-3R1......	Enhancment I (Outside CE)	64 LF	RP-UT5..........	Method: Preservation	818 LF
*MC-UT1-3R2......	Method: Restoration	1286 LF	RP-UT6..........	Method: Preservation	1069 LF
*MC-UT2.............	Method: Enhancement II	75 LF	RP-UT7..........	Method: Preservation	791 LF
*Wetlands......	Method: Restoration	5.2 Acres			
*Wetlands......	Method: Enhancement	1.53 Acres			

* SHOWN ON THIS SHEET

RIGHT PRONG AND ITS
TRIBUTARIES NOT SHOWN

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
SITE PLAN & CONTROL POINTS

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

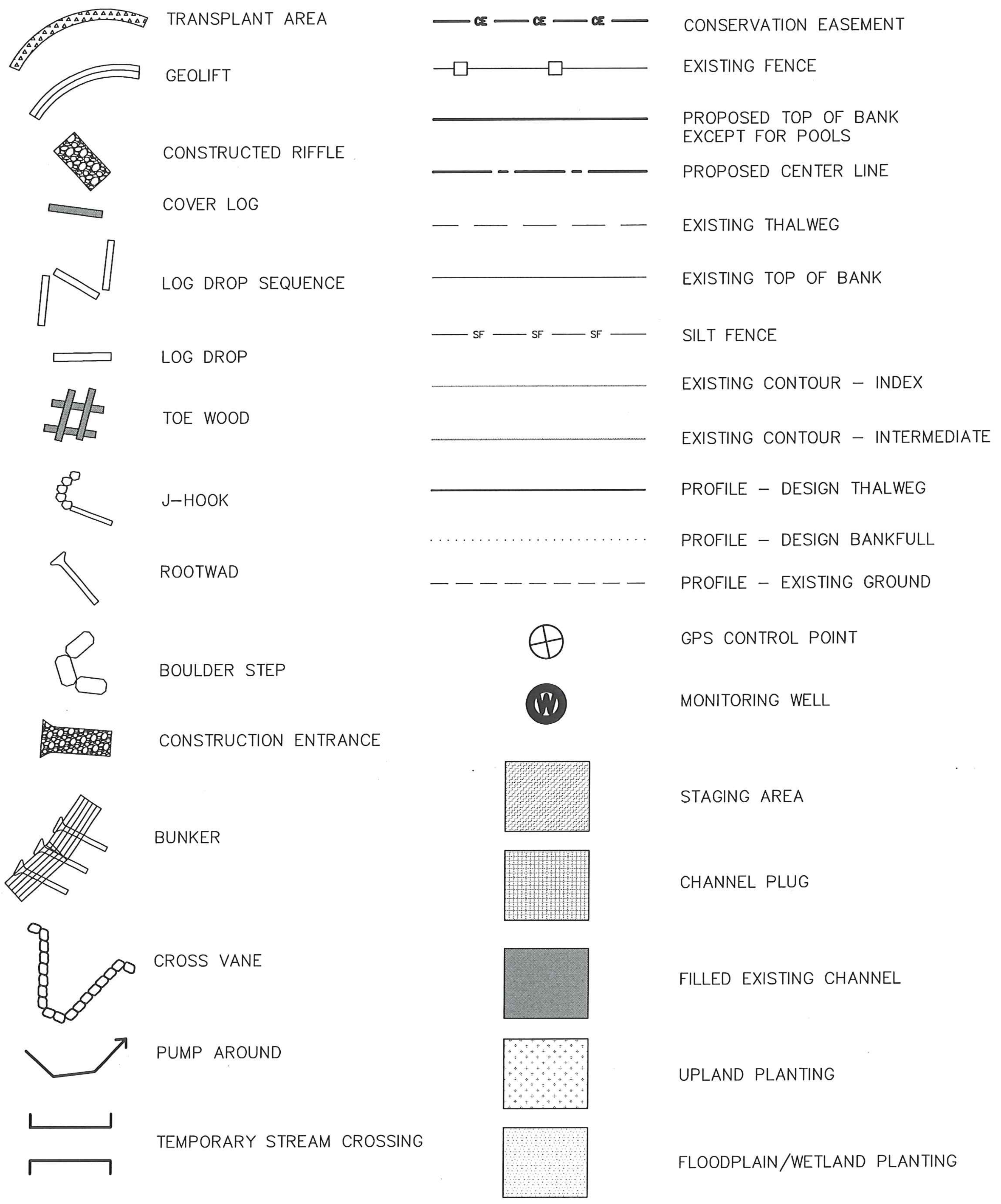
Date:
6/15/2010

File Name
TITLE.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
2 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
SEQUENCE & SYMBOLS

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412
Date:
6/15/2010
File Name
TITLE.dwg
DESIGNED: DH
DRAWN: MR
APPROVED: JM
Drawing No.
3 of 34

GENERAL CONSTRUCTION SEQUENCE

1. Equipment and materials shall be mobilized to the site.
2. Utility locations shown on these plans are approximate. The Contractor shall have all underground utilities within the project limits located and marked prior to beginning construction. The Contractor will be responsible for the repair of any utility damaged during construction, including any new stock watering waterlines crossing the project area.
3. A gravel "construction entrance" that consists of class A stone, at least 50 feet in length, shall be incorporated into every access point that connects to a public road.
4. Temporary and permanent stream crossings and temporary check dams shall be installed as shown in the plans. Temporary check dams shall be removed when grading work upstream has been completed.
5. Construction shall proceed upstream to downstream. Tributaries will be constructed as the confluence with the mainstem is constructed. Grading of bankfull benches within a work area shall be done before new channels are graded.
6. Temporary coffer dams shall be installed upstream of each work area and flow in the work reach shall be diverted by pumping and piping around the work area. The length of each diversion shall be approximately 300 to 600 linear feet. Pumping will be done when work is required in a channel where the stream is flowing. Much of the mainstem work will be done offline. Existing channel material should be stockpiled and incorporated in constructed offline reaches.
7. The limited clearing and grubbing required within the grading limits shall be performed so as to limit sediment migration off-site. Logs and root wads from trees larger than 8 inches in diameter shall be stockpiled for use as in-stream structures. Salvageable native vegetation (black willow, tag alder, silky dogwood, etc.) shall be harvested for transplanting or for cutting and live-staking materials.
8. The new channel sections shall be stabilized with in-stream structures, erosion control matting, seed, and transplants before turning water into these sections. Compacted soil channel plugs shall be installed in areas where the new channel diverges from the original channel, and the original, abandoned channel sections will be backfilled.
9. Dewatering of off-line sections shall be diverted through a sediment filter before being discharged into the downstream reach.
10. Earthwork shall be staged such that no more channel will be disturbed than can be stabilized by the end of the work day or before flow is diverted into a new channel segment.
11. Disturbed areas within the first 25 feet of buffer adjacent to the channel will be seeded, mulched or otherwise stabilized with temporary ground cover until a more permanent ground cover is established across the buffer area disturbed during construction. If temporary ground cover is not applied at the end of the workday, straw wattles will be staked down at the top of the bank where erosion control matting ends to prevent sediment loading from upland portions of the buffer that have not stabilized.
12. Excess soil materials may be stockpiled in designated staging and stockpile areas, with silt fence installed on the stream side(s) at the base of the stockpiles and maintained so that sediment does not accumulate above one third of the height of the silt fence or the silt fence has failed. Excess soil shall be hauled outside the conservation easement before demobilization.
13. The flow diversions and temporary stream crossings shall be removed when no longer needed and the banks in these areas stabilized with seeding and matting.
14. Bank and floodplain vegetation, including brush materials and live stakes, shall be installed during the dormant season, November to May.
15. Staging and stockpile areas, and silt fences shall be removed and the ground shall be repaired to its original conditions once planting is complete or once they are no longer needed. Construction entrances may also be removed or left in place if the land owner wishes to retain them.

STRUCTURE TABLE

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

(INSERT STRUCTURE TABLE HERE)

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
STRUCTURE TABLE

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

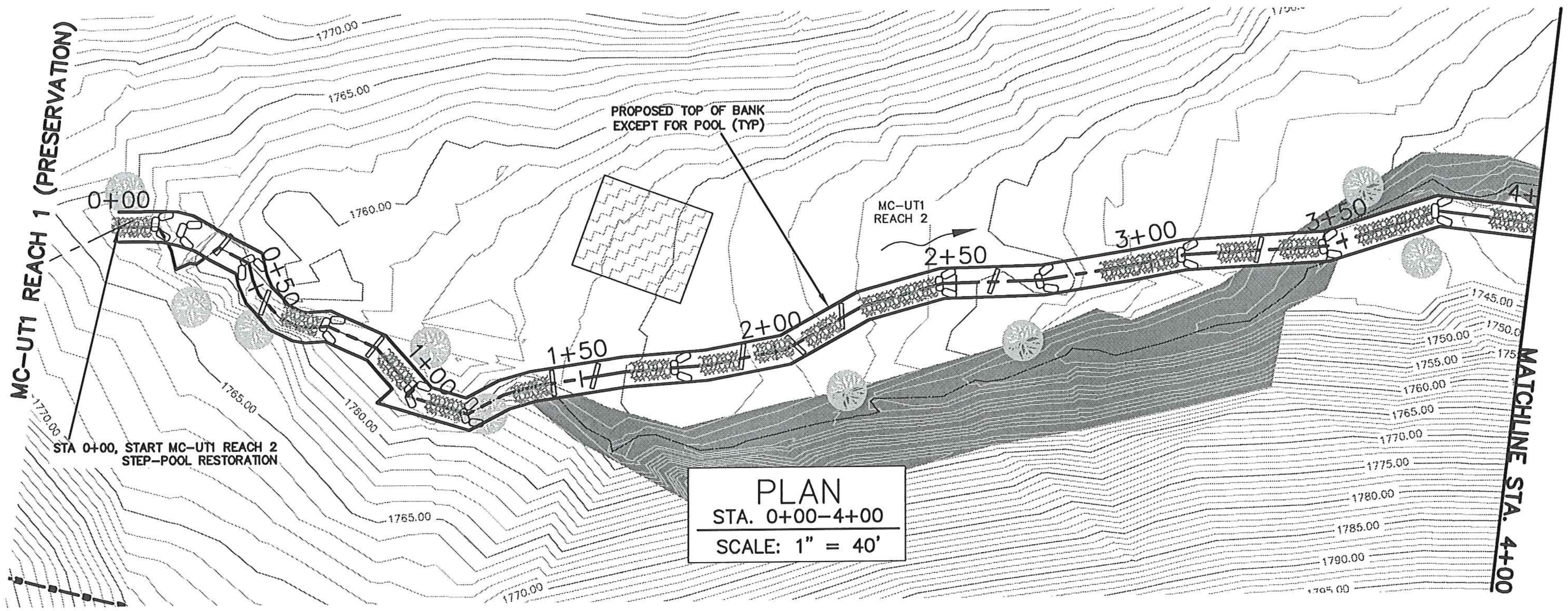
Date:
6/15/2010

File Name
TITLE.dwg

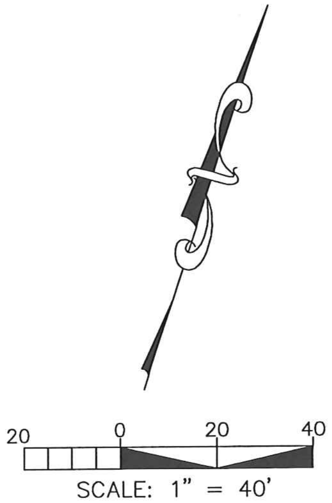
DESIGNED: DH
DRAWN: MR
APPROVED: JM

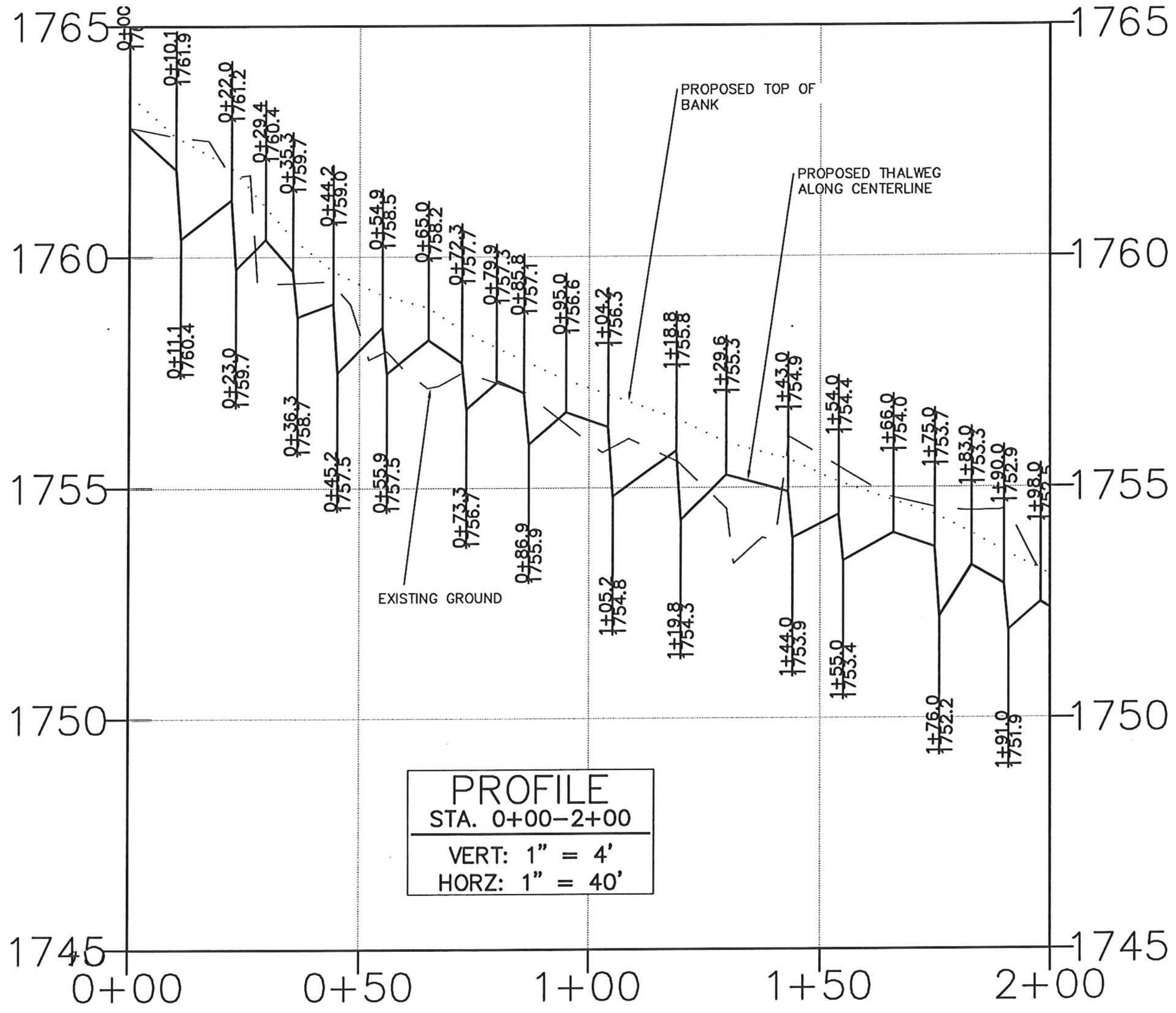
Drawing No.
4 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

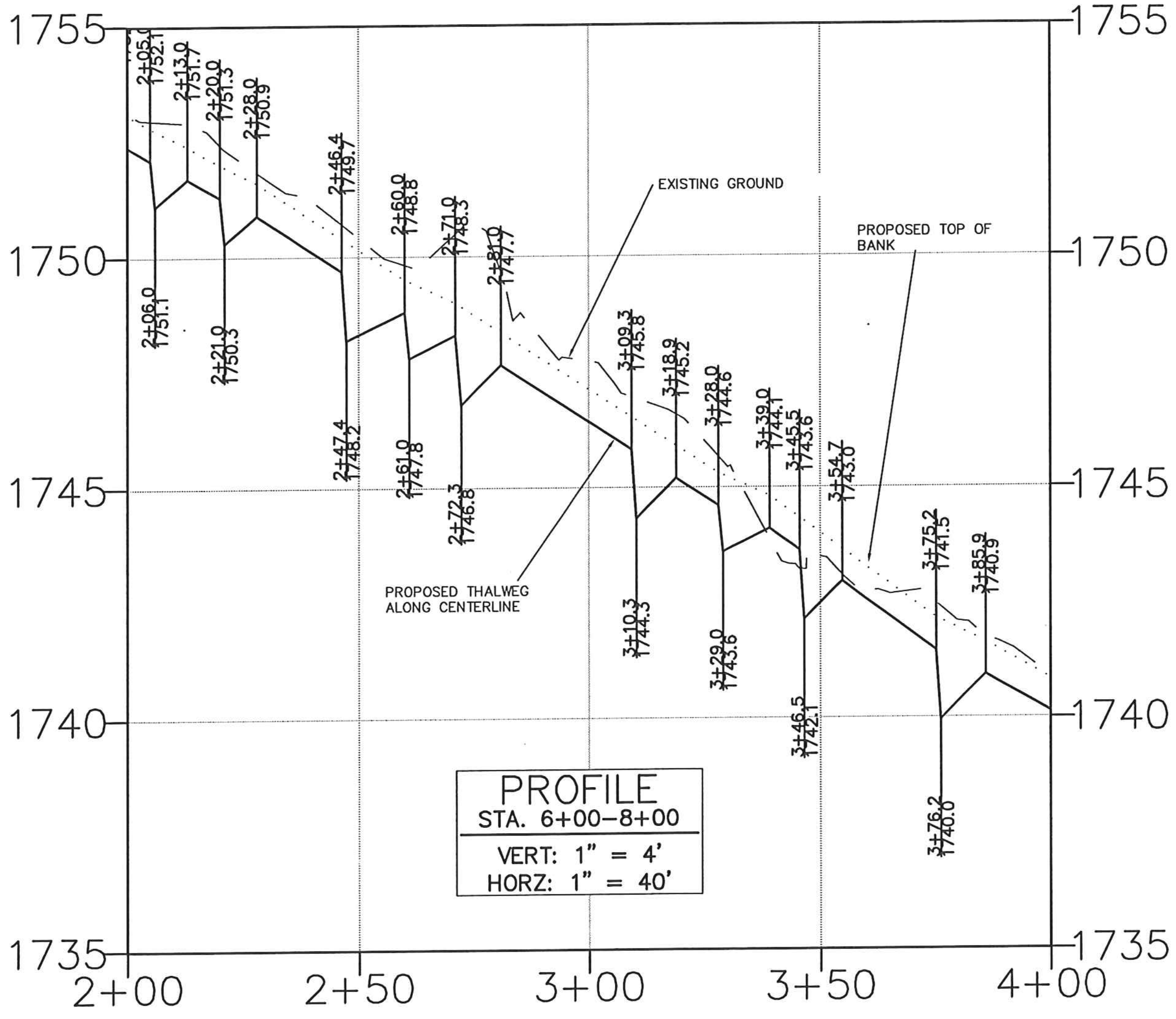


PLAN
STA. 0+00–4+00
SCALE: 1" = 40'





PROFILE
STA. 0+00–2+00
VERT: 1" = 4'
HORZ: 1" = 40'



PROFILE
STA. 6+00–8+00
VERT: 1" = 4'
HORZ: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

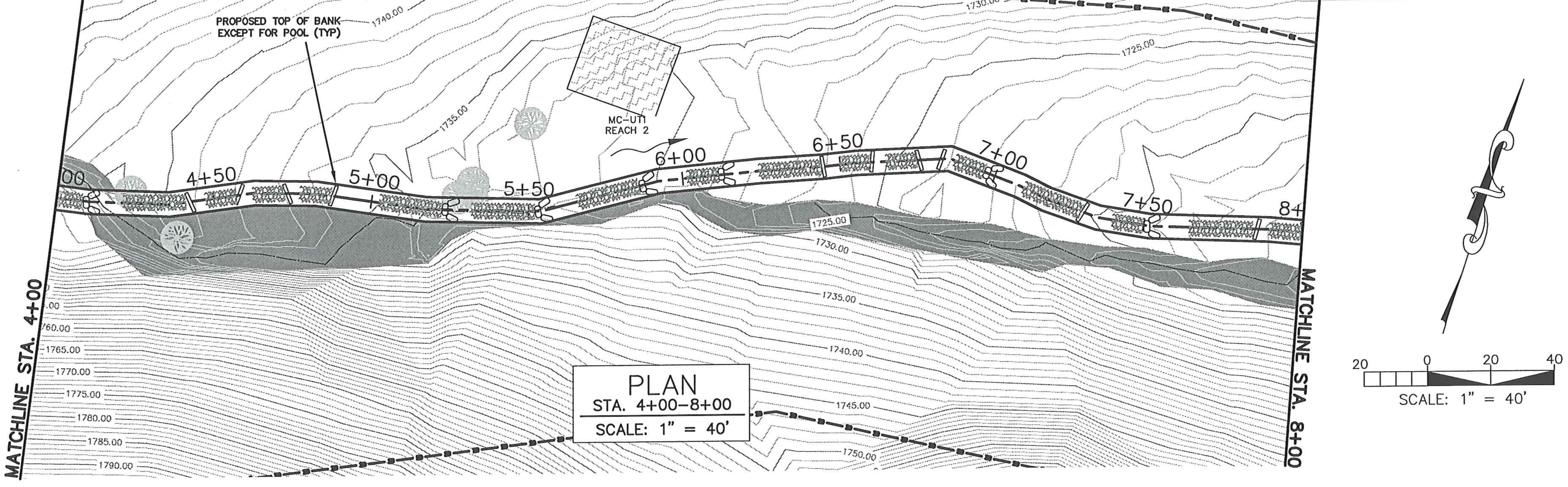
Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1 REACH 2 PLAN AND PROFILE

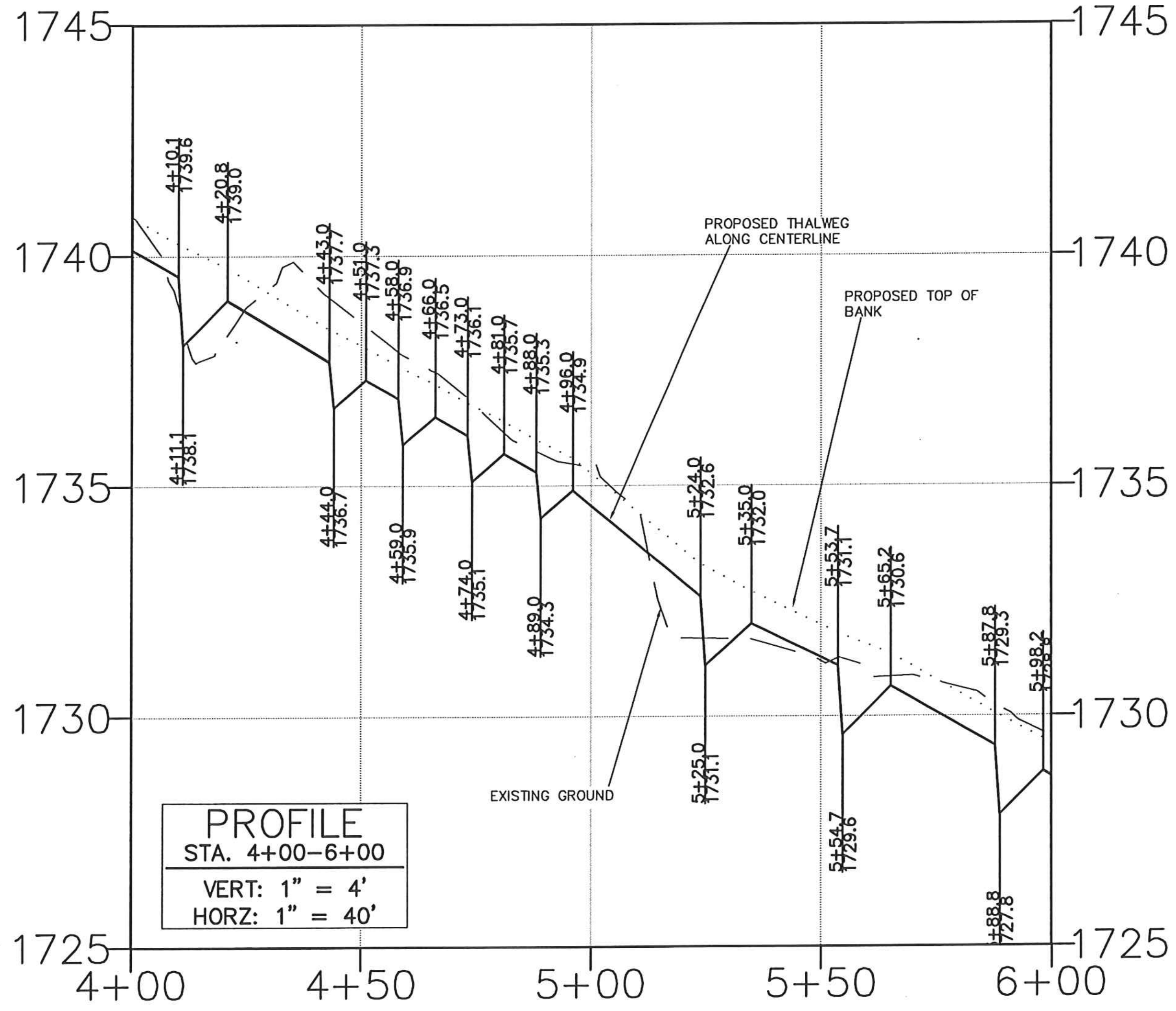
Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.	114412
Date:	6/15/2010
File Name	PLANSHEETS_MDR.dwg
DESIGNED:	DH
DRAWN:	MR
APPROVED:	JM
Drawing No.	5 of 34

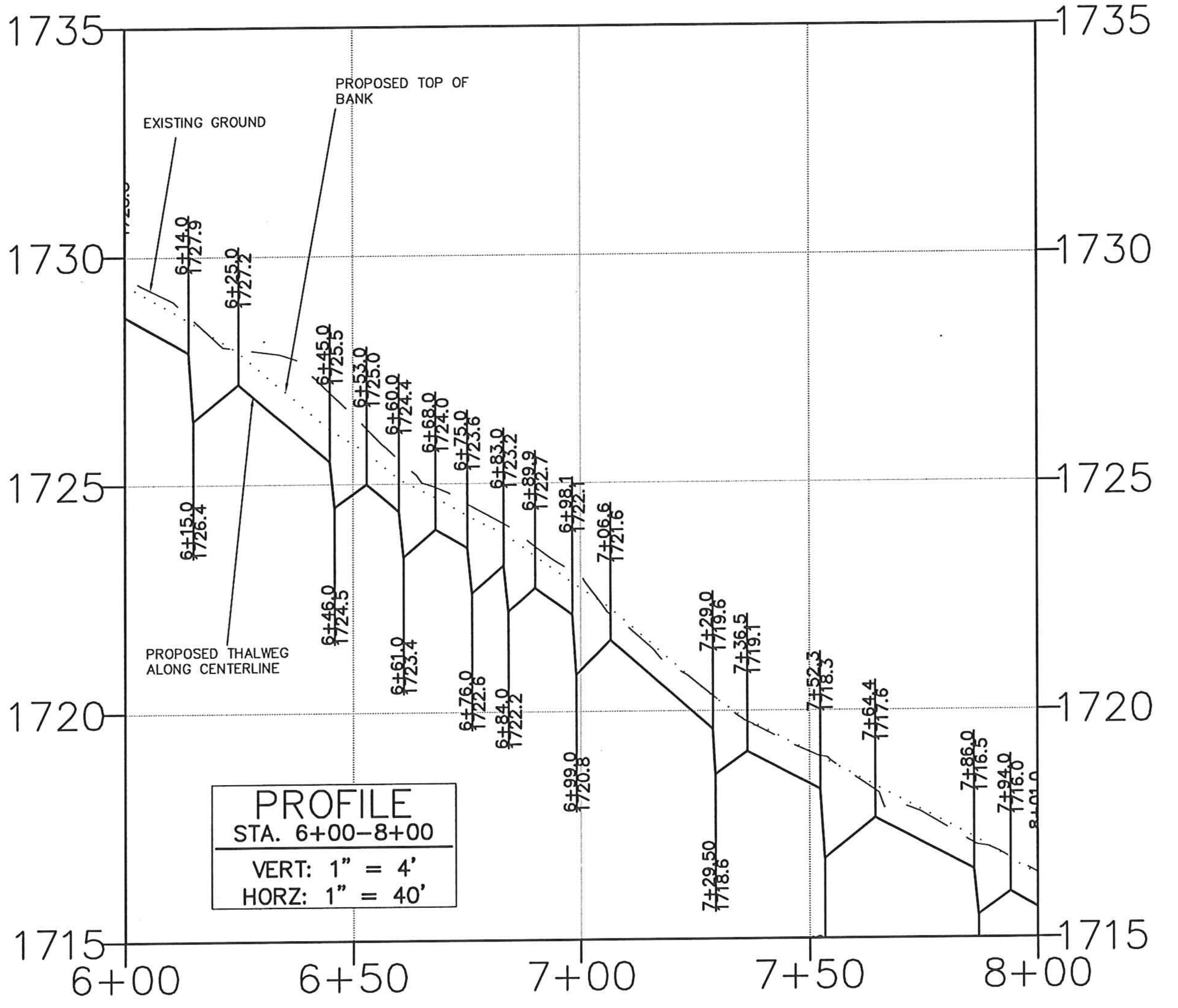
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



PLAN
STA. 4+00–8+00
SCALE: 1" = 40'



PROFILE
STA. 4+00–6+00
VERT: 1" = 4'
HORZ: 1" = 40'



PROFILE
STA. 6+00–8+00
VERT: 1" = 4'
HORZ: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1 REACH 2 PLAN AND PROFILE

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

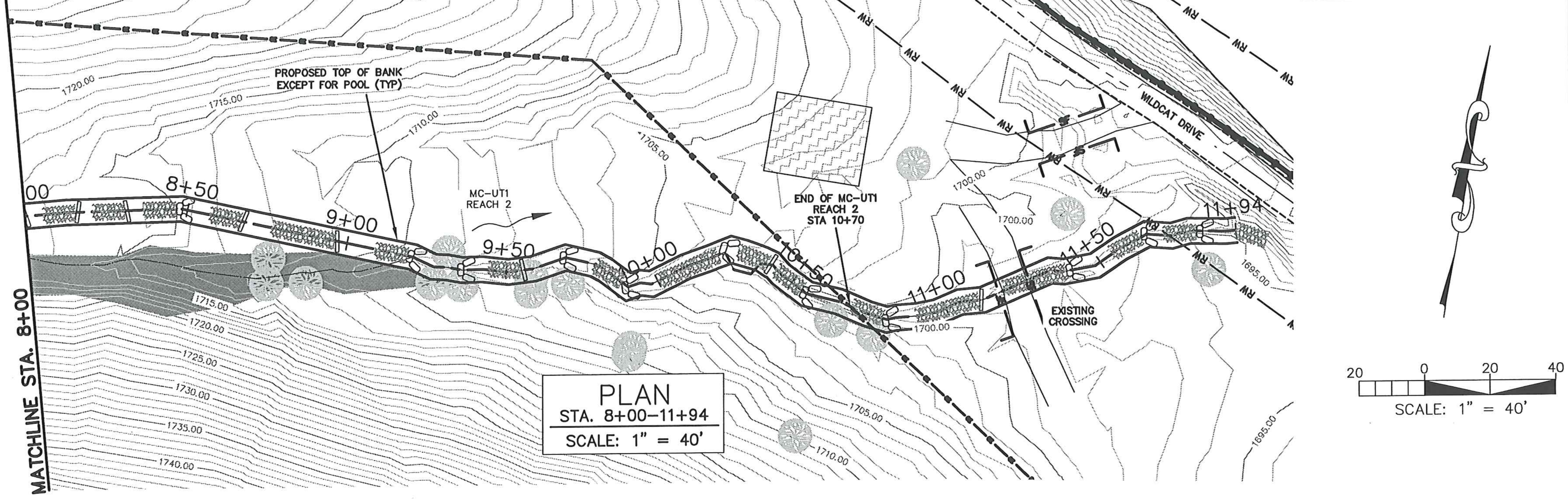
Date:
6/15/2010

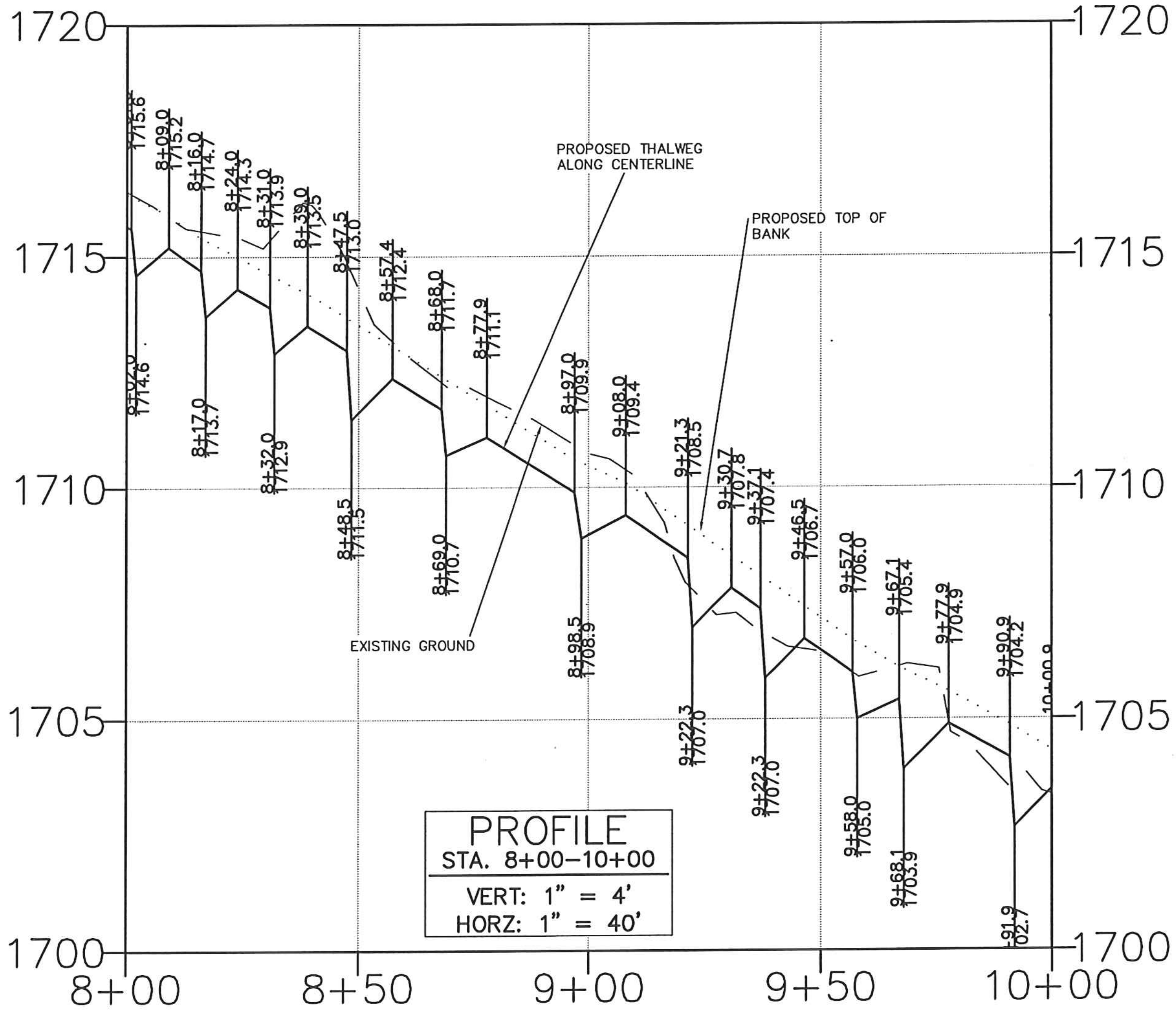
File Name
PLANSHEETS_MDR.dwg

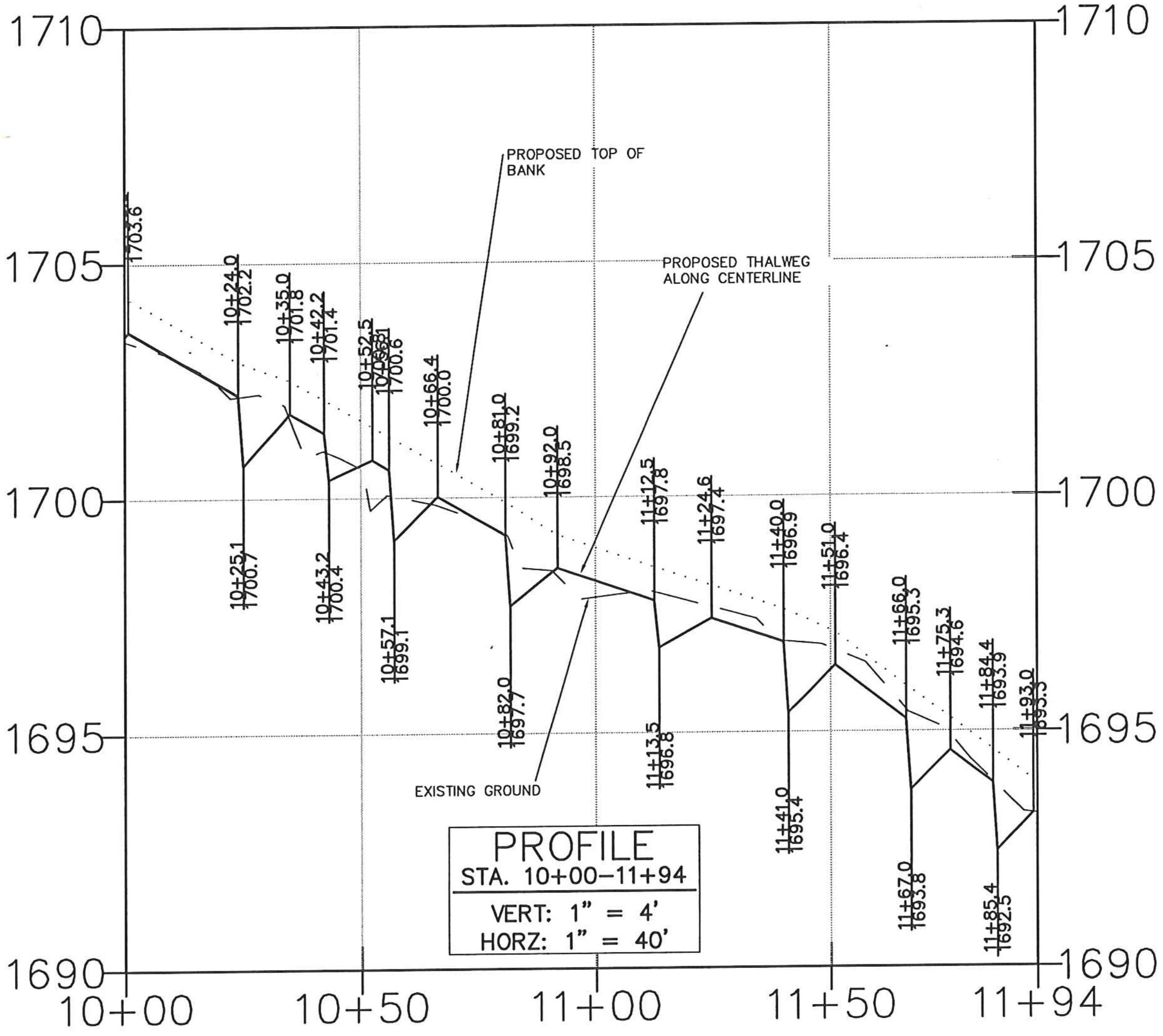
DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
6 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION







Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1 REACH 2 PLAN AND PROFILE

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

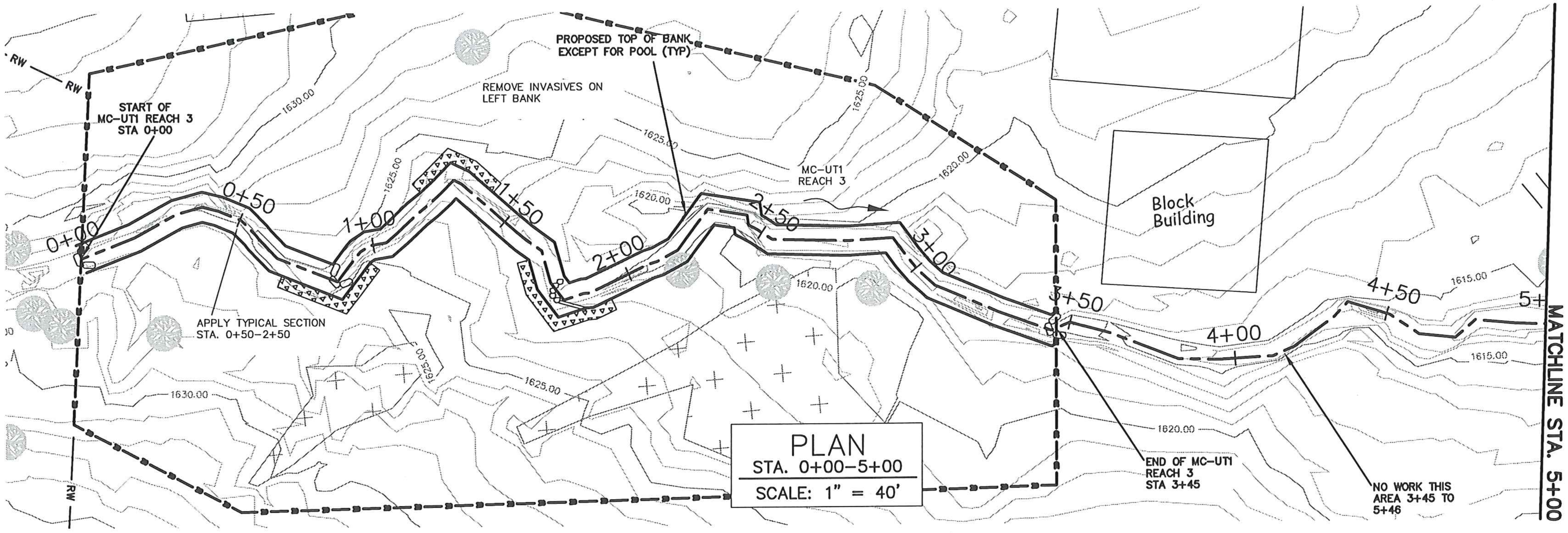
Date:
6/15/2010

File Name
PLANSHEETS_MDR.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

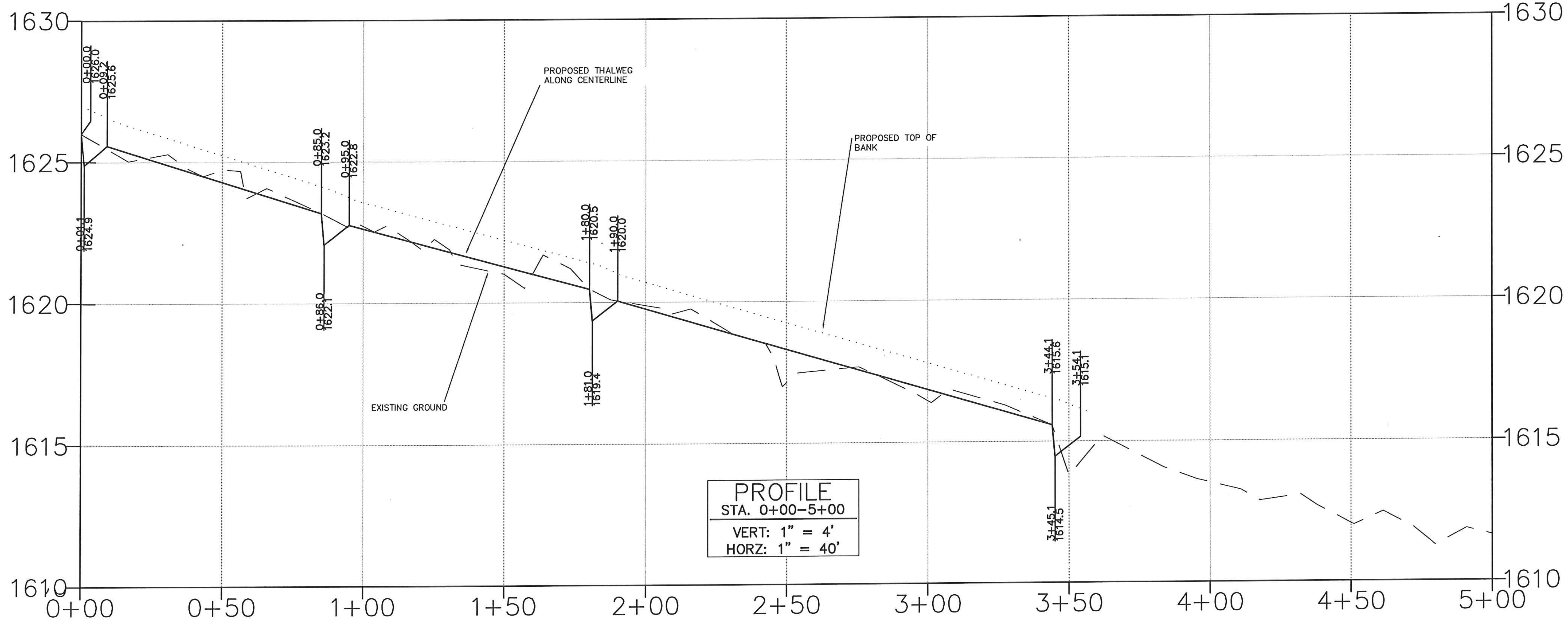
Drawing No.
7 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



PLAN
STA. 0+00–5+00
SCALE: 1" = 40'

20 0 20 40
SCALE: 1" = 40'



PROFILE
STA. 0+00–5+00
VERT: 1" = 4'
HORZ: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1 REACH 3 PLAN AND PROFILE

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

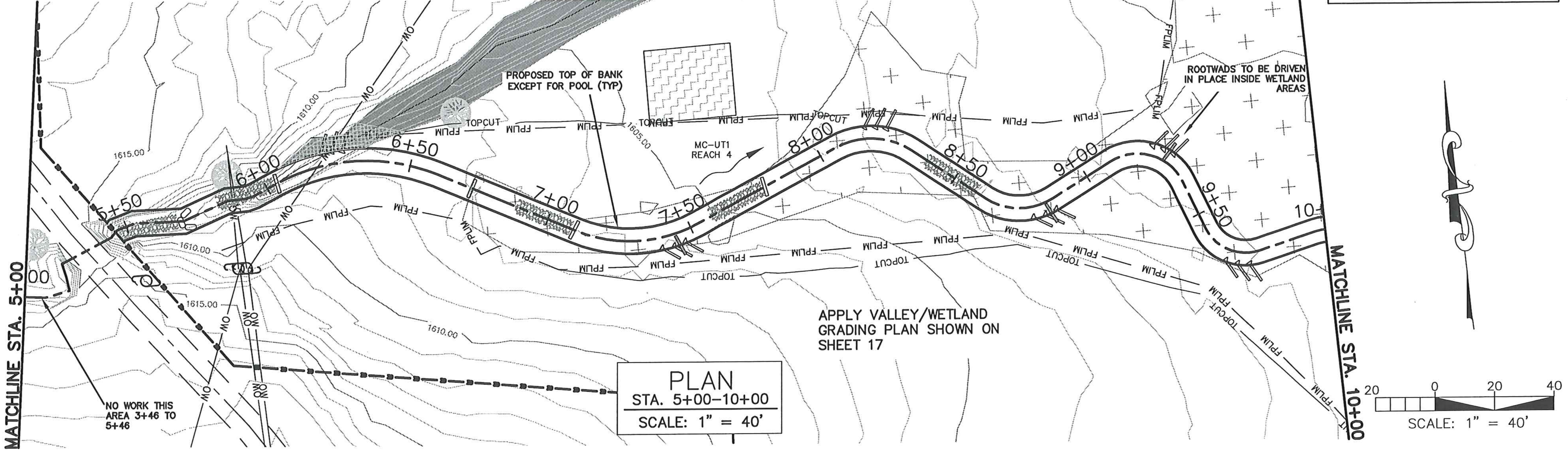
Date:
6/15/2010

File Name
PLANSHEETS_MDR.dw

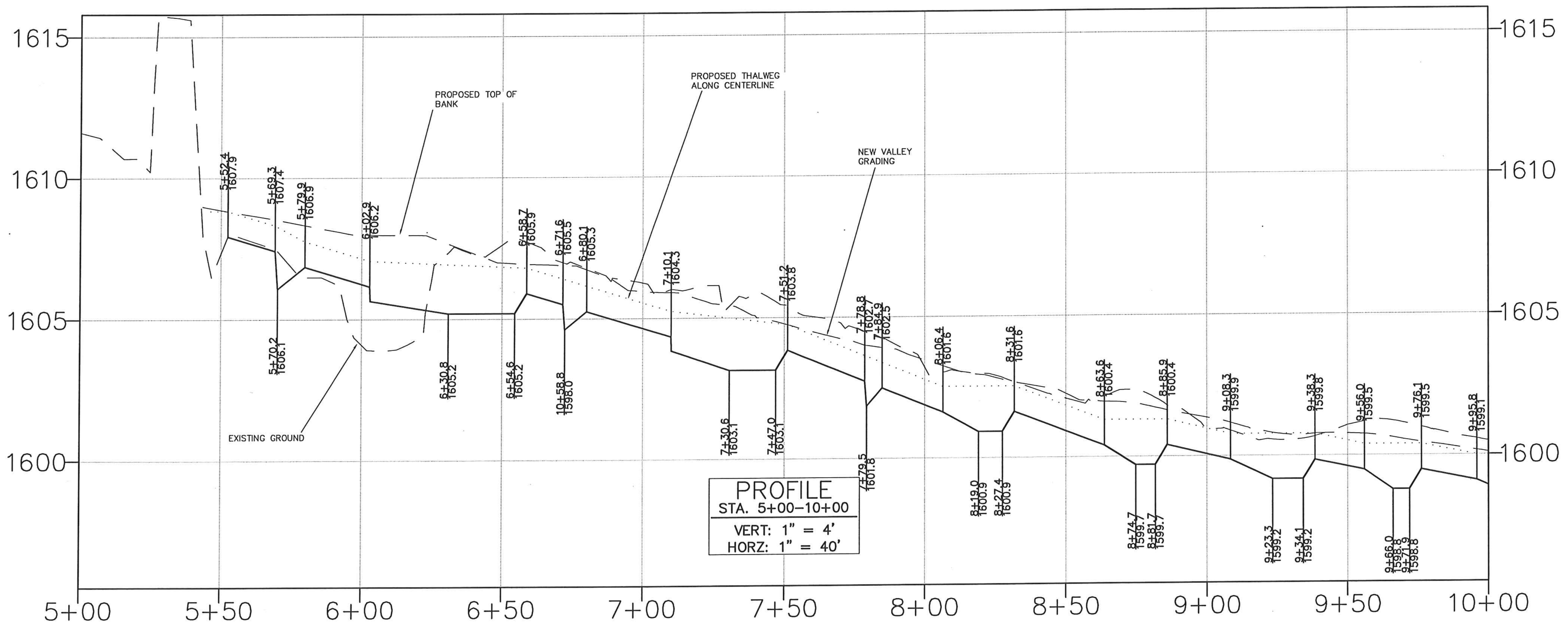
DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
8 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



PLAN
STA. 5+00–10+00
SCALE: 1" = 40'



PROFILE
STA. 5+00–10+00
VERT: 1" = 4'
HORZ: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1 REACH 4 PLAN AND PROFILE

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

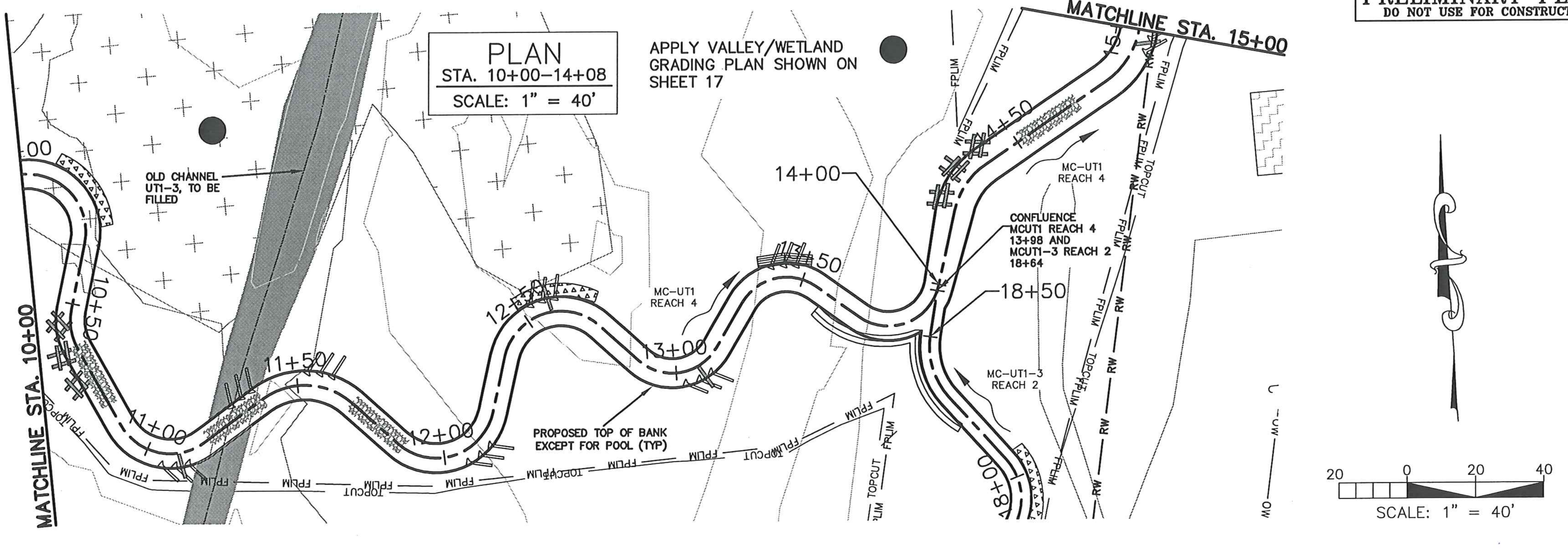
Date:
6/15/2010

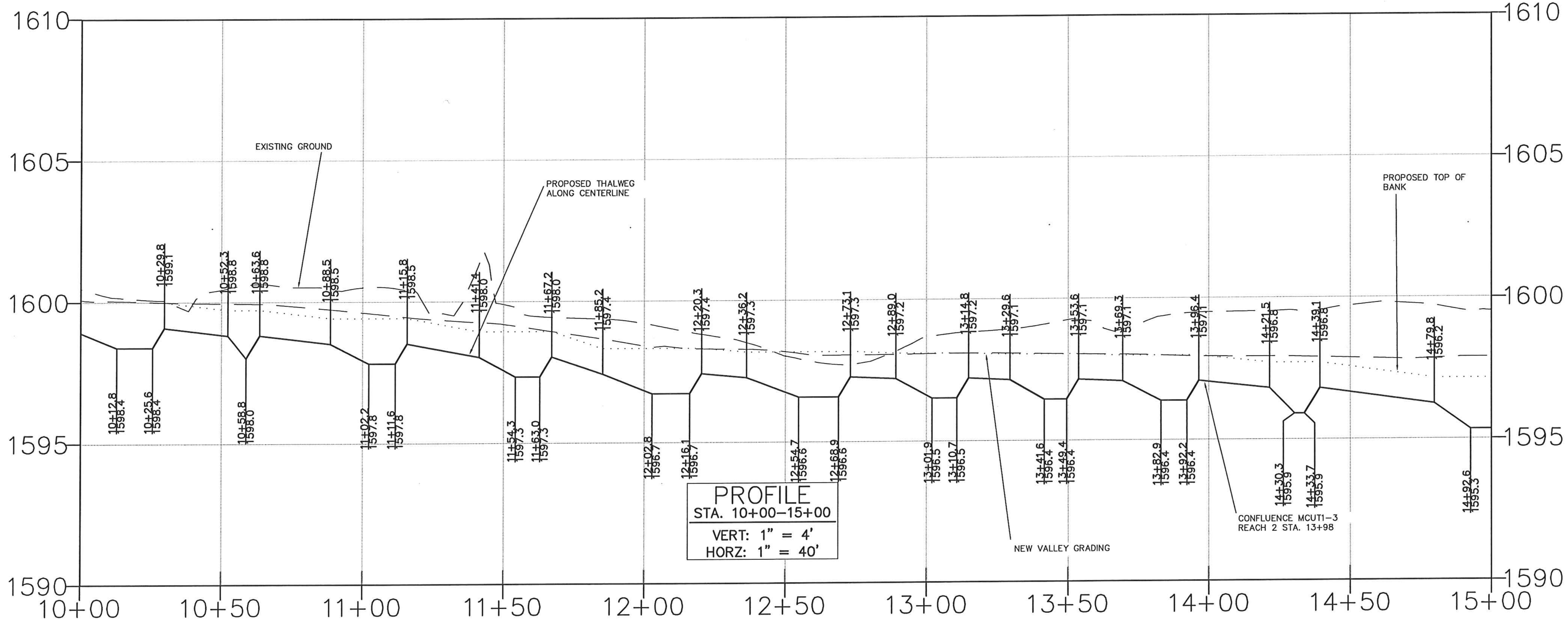
File Name
PLANSHEETS_MDR.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
9 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION





Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

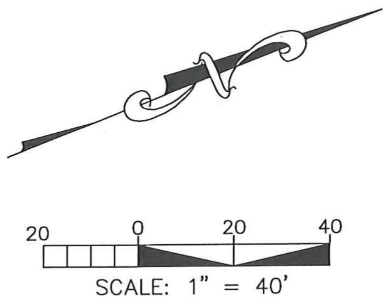
Baker

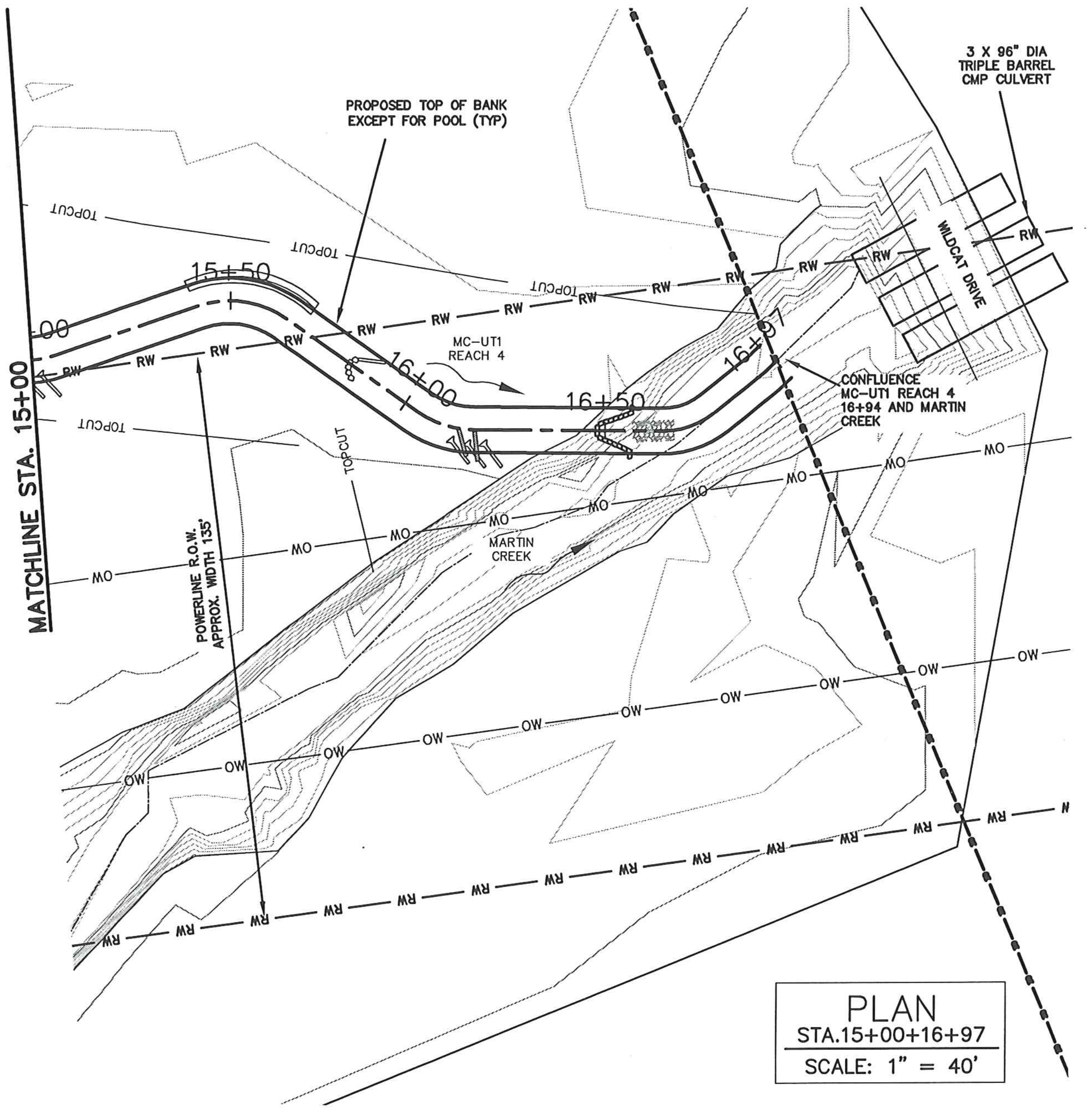
MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1 REACH 4 PLAN AND PROFILE

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

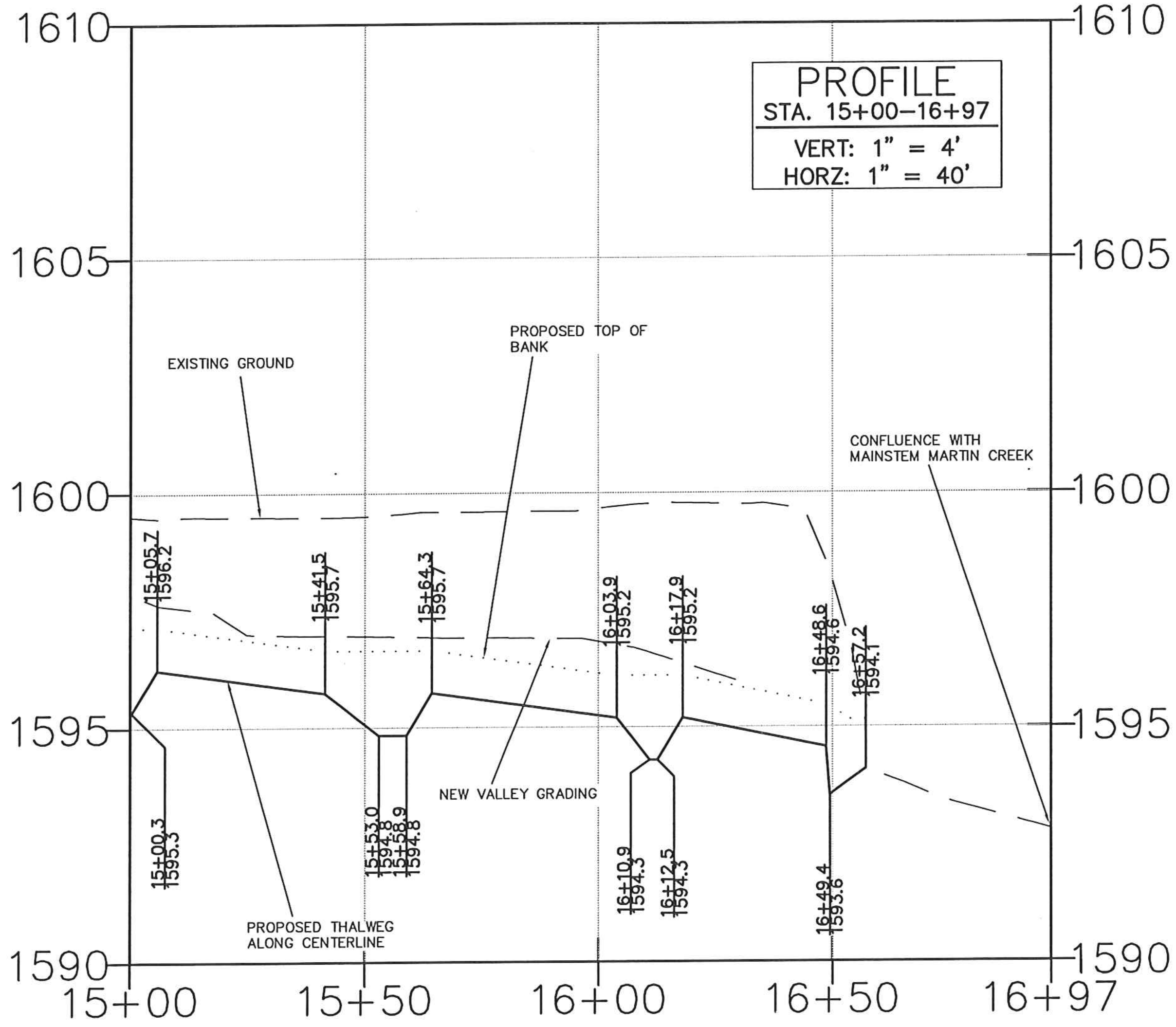
Project No.	114412
Date:	6/15/2010
File Name	PLANSHEETS_MDR.dwg
DESIGNED:	DH
DRAWN:	MR
APPROVED:	JM
Drawing No.	10 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION





PLAN
STA.15+00+16+97
SCALE: 1" = 40'



PROFILE
STA. 15+00–16+97
VERT: 1" = 4'
HORZ: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1 REACH 4 PLAN AND PROFILE

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

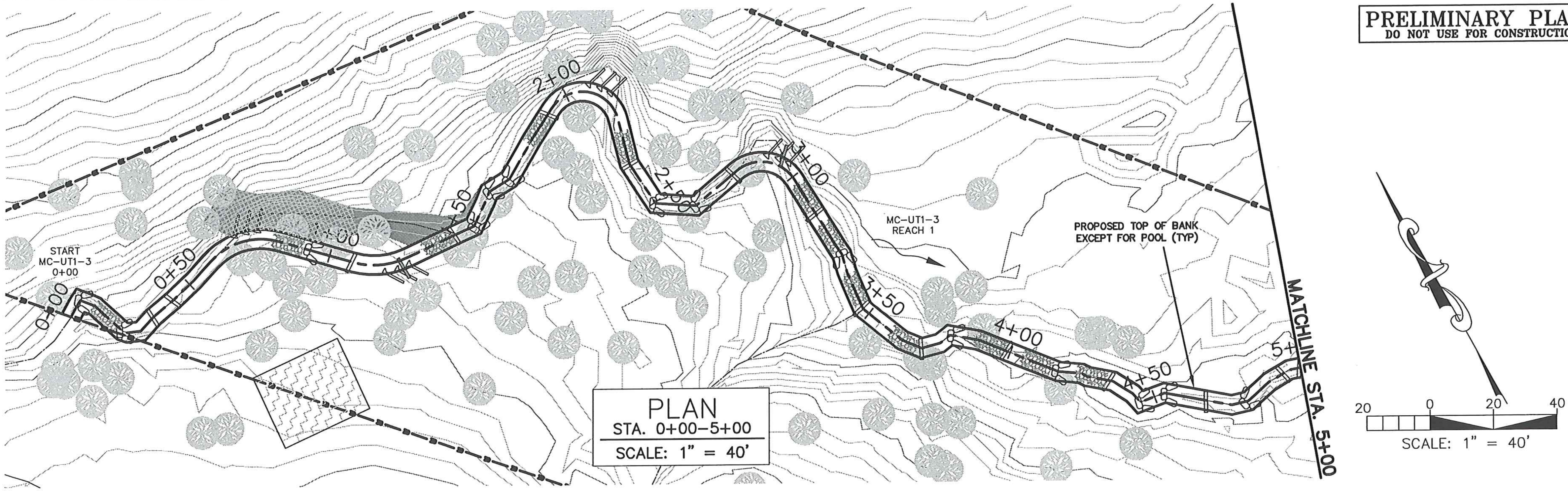
Date:
6/15/2010

File Name
PLANSHEETS_MDR.dwg

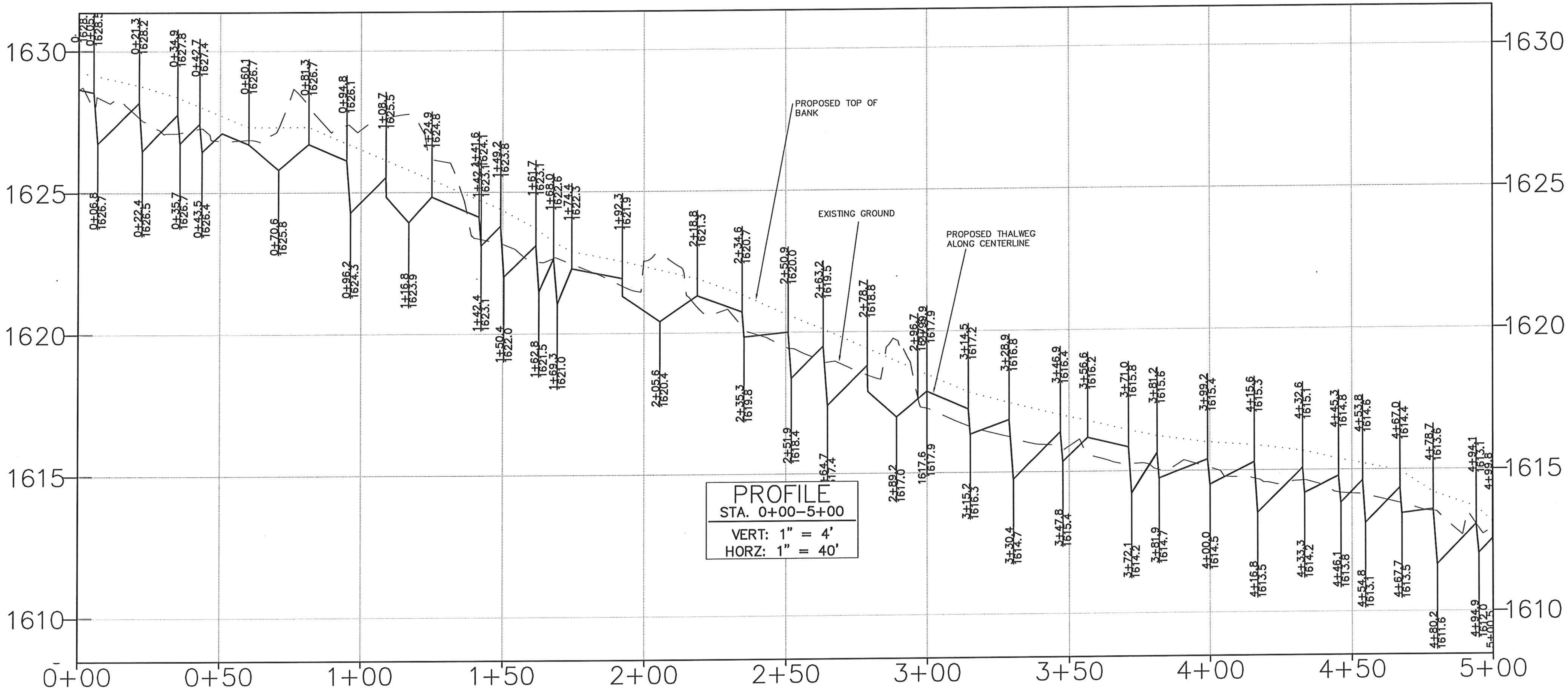
DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
11 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



PLAN
STA. 0+00–5+00
SCALE: 1" = 40'



PROFILE
STA. 0+00–5+00
VERT: 1" = 4'
HORZ: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

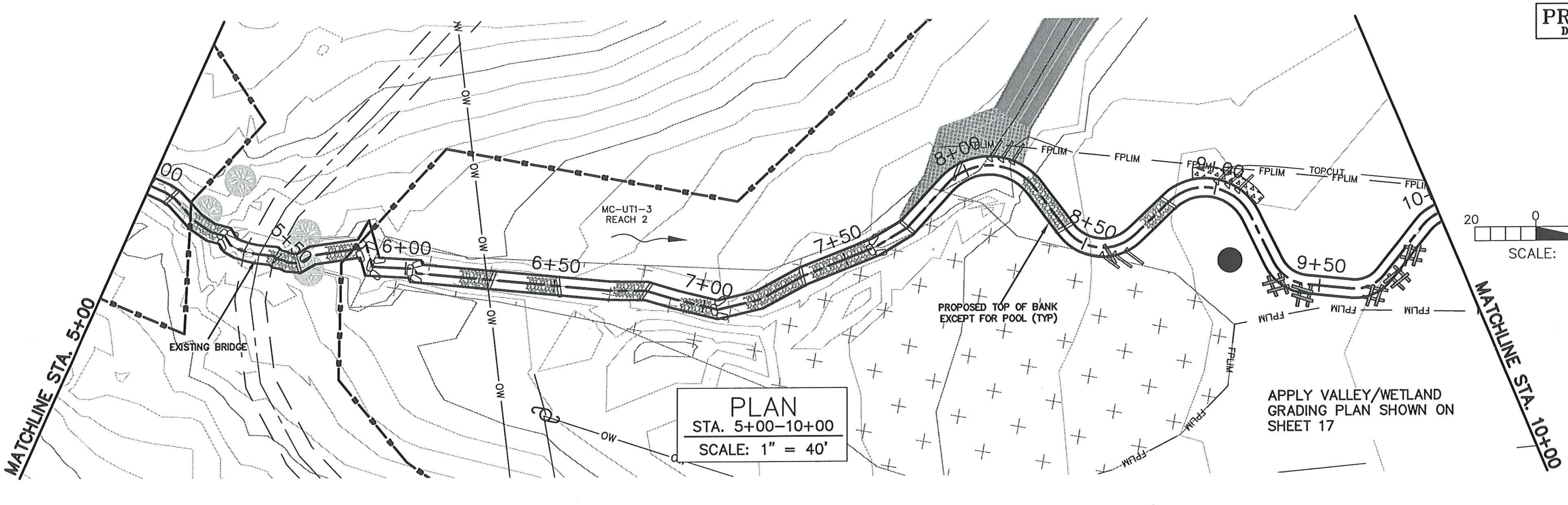
Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1-3 REACH 1 PLAN AND PROFILE

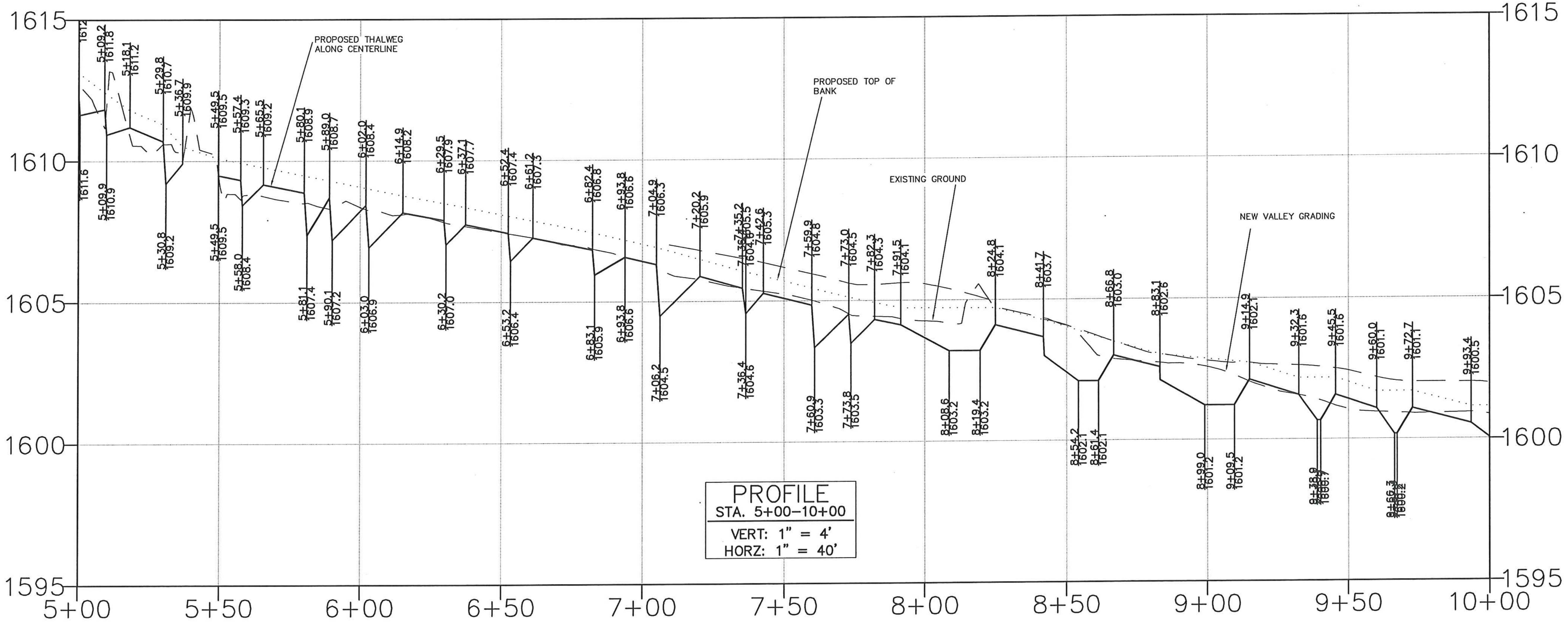
Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No:	114412
Date:	6/15/2010
File Name	PLANSHEETS_MDR.dwg
DESIGNED:	DH
DRAWN:	MR
APPROVED:	JM
Drawing No.	12 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



PLAN
STA. 5+00–10+00
SCALE: 1" = 40'



PROFILE
STA. 5+00–10+00
VERT: 1" = 4'
HORZ: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1-3 REACH 2 PLAN AND PROFILE

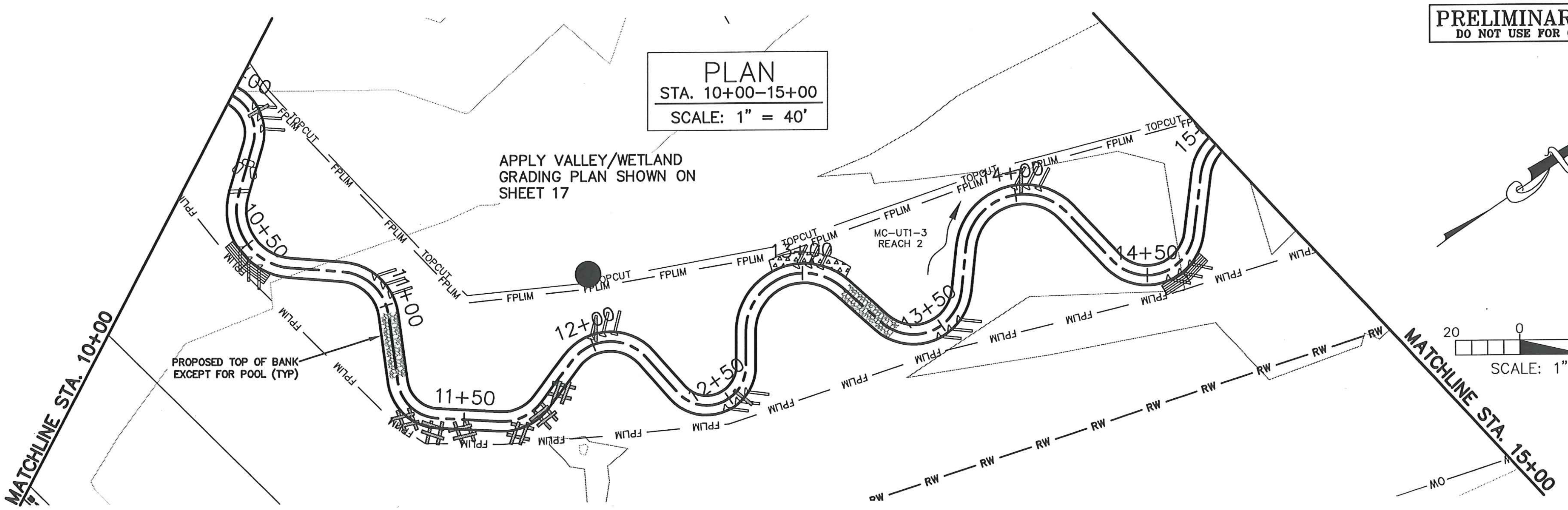
Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412
Date:
6/15/2010
File Name
PLANSHEETS_MDR.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

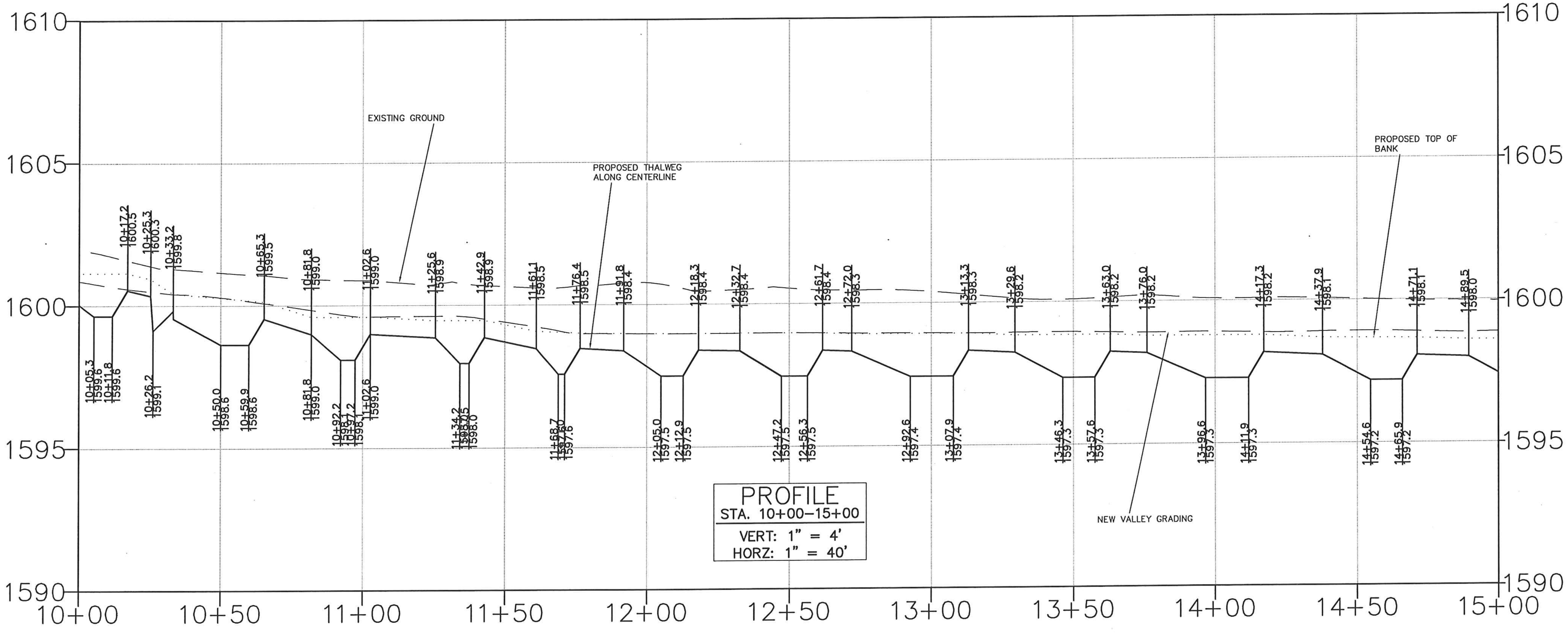
Drawing No.
13 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



PLAN
STA. 10+00–15+00
SCALE: 1" = 40'

APPLY VALLEY/WETLAND GRADING PLAN SHOWN ON SHEET 17



PROFILE
STA. 10+00–15+00
VERT: 1" = 4'
HORZ: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

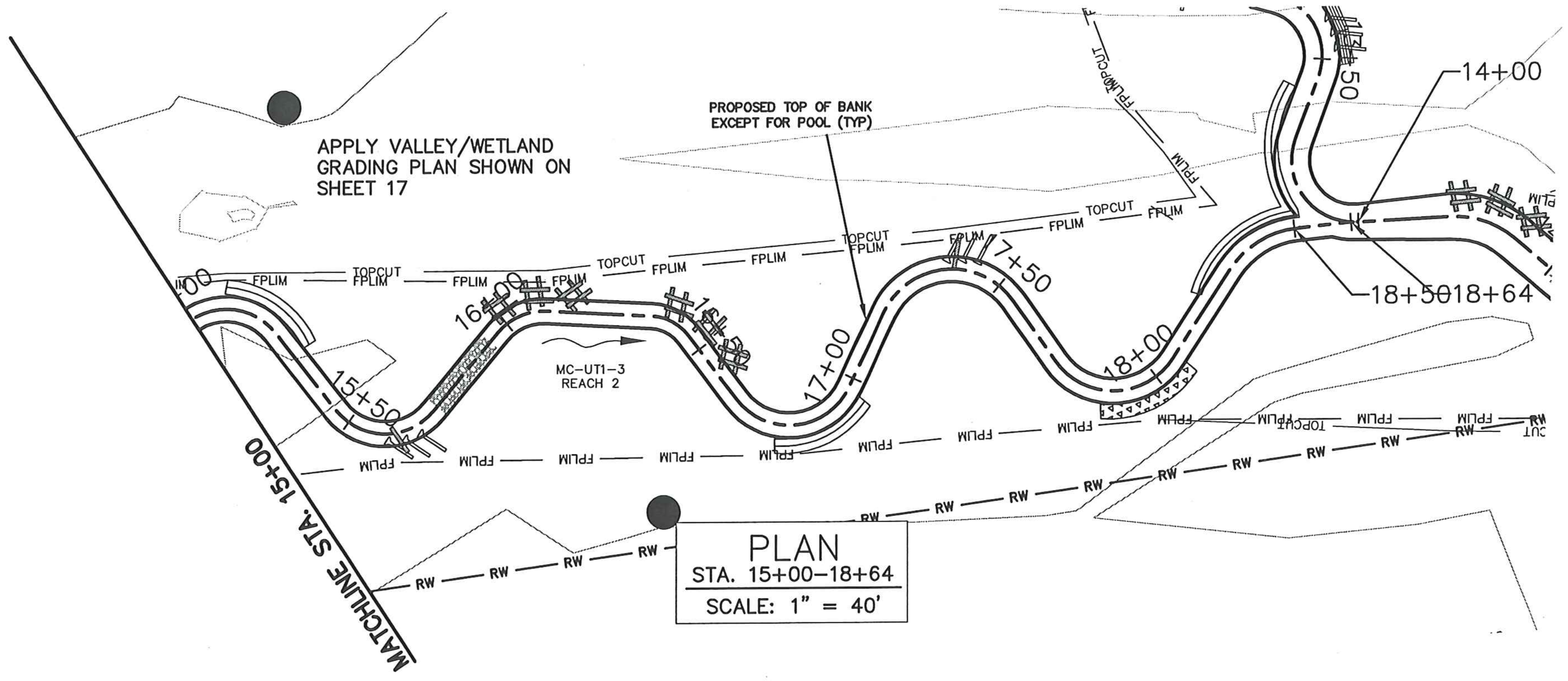
Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1-3 REACH 2 PLAN AND PROFILE

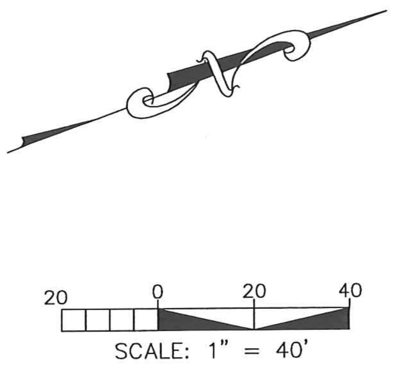
Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.: 114412
Date: 6/15/2010
File Name: PLANSHEETS_MDR.dwg
DESIGNED: DH
DRAWN: MR
APPROVED: JM
Drawing No.: 14 of 34

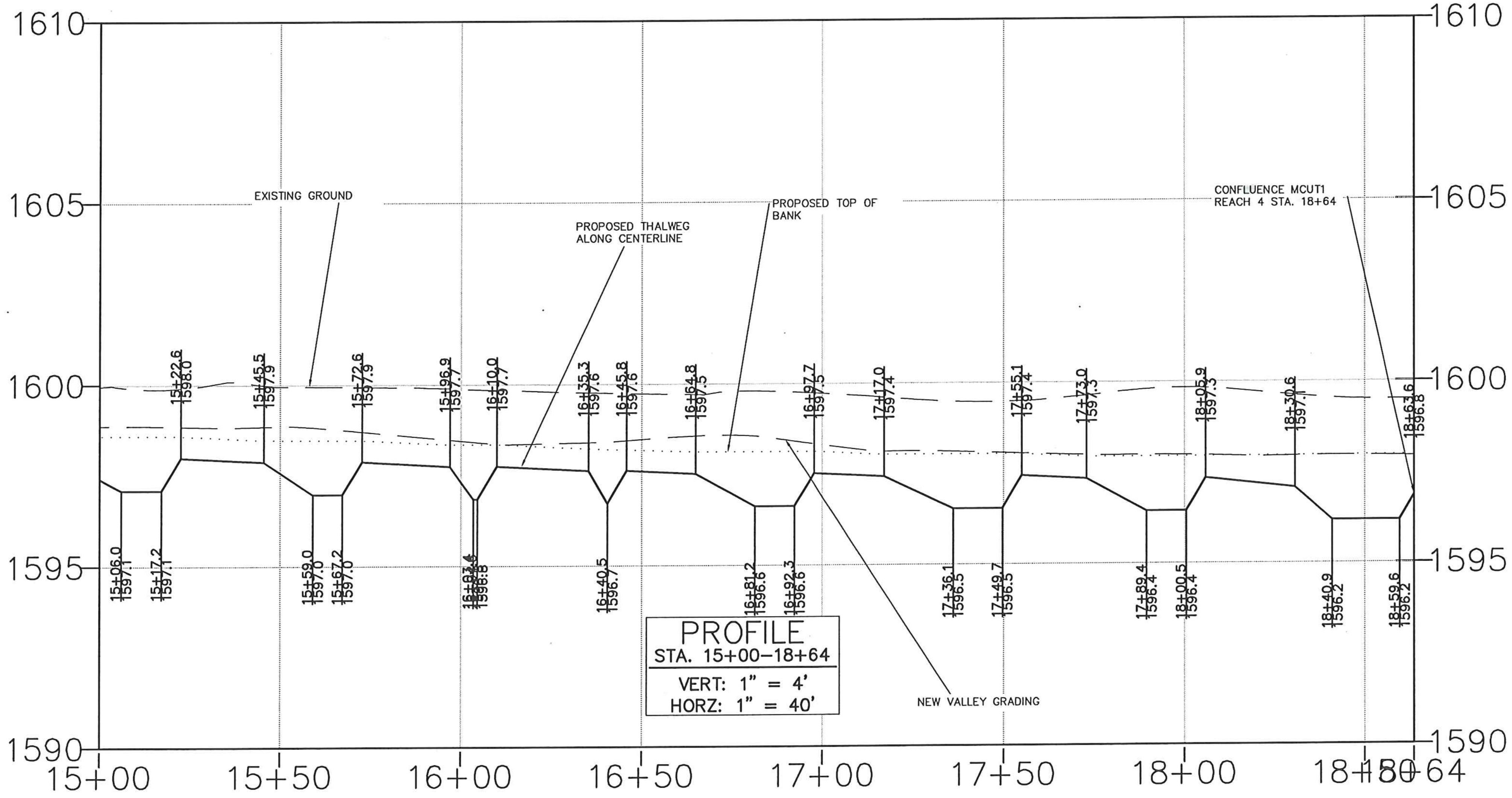
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



PLAN
STA. 15+00–18+64
SCALE: 1" = 40'



SCALE: 1" = 40'



PROFILE
STA. 15+00–18+64
VERT: 1" = 4'
HORZ: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1-3 REACH 2 PLAN AND PROFILE

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

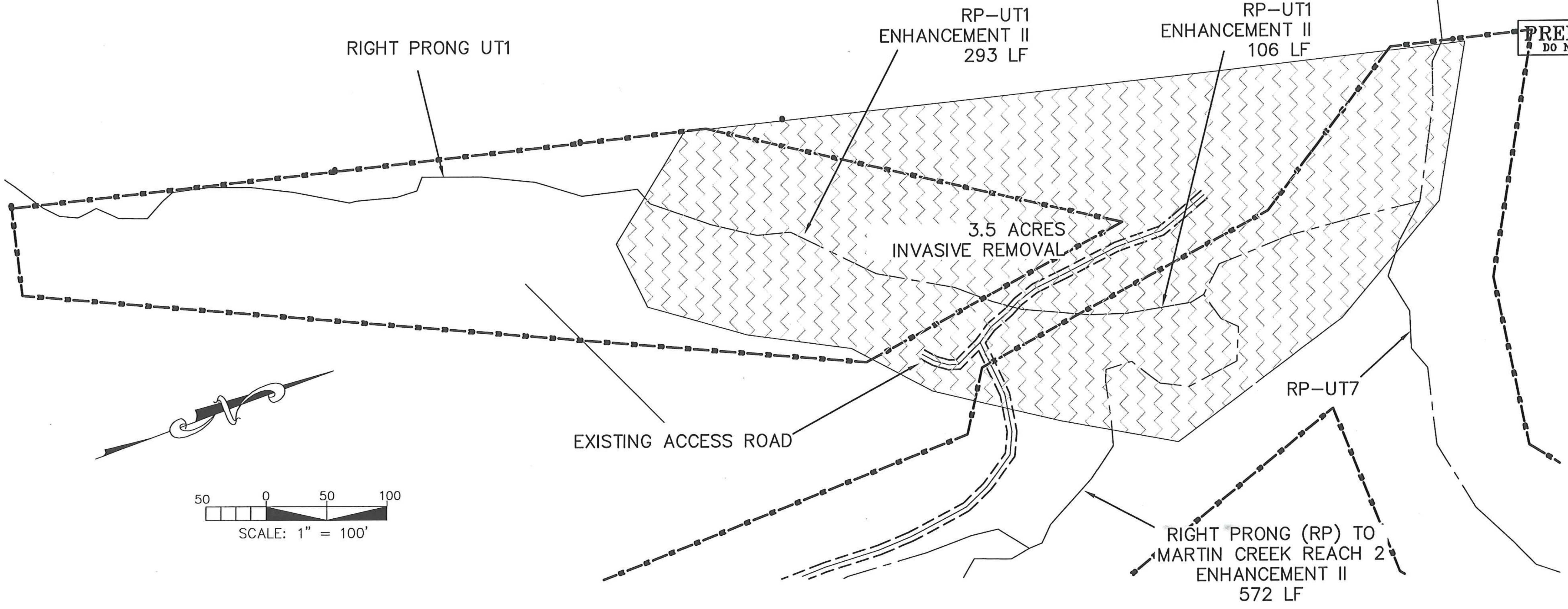
Date:
6/15/2010

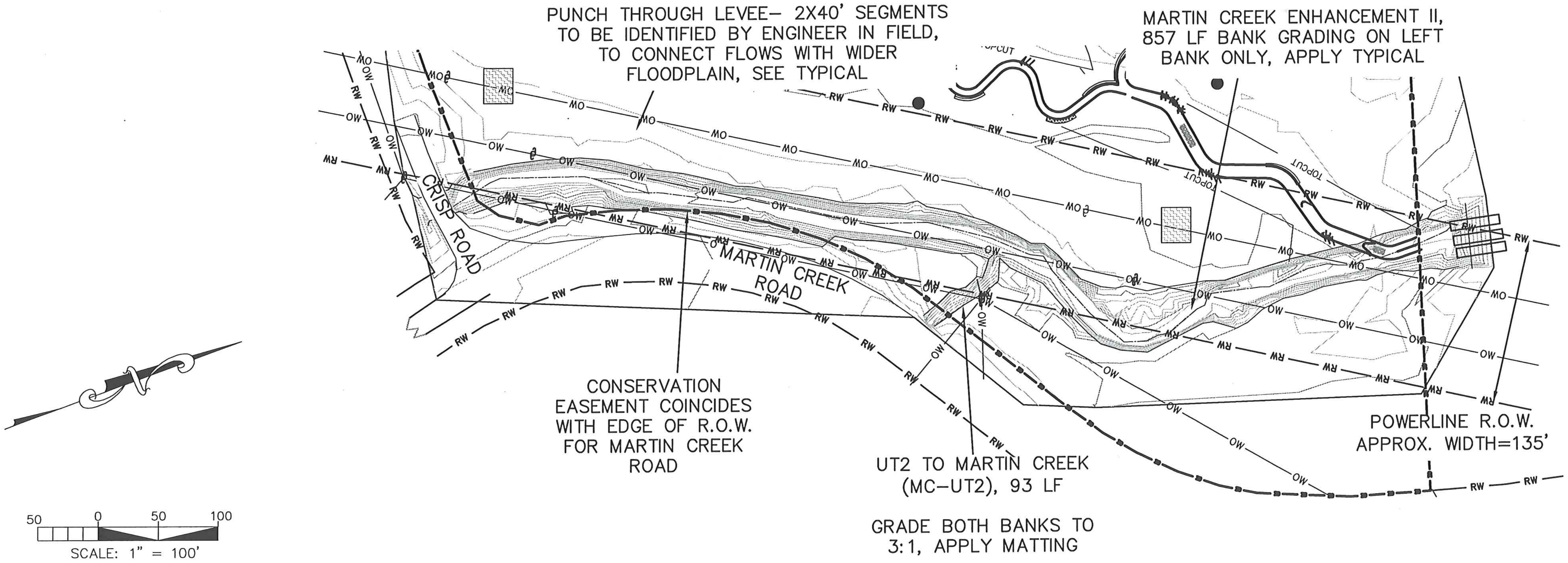
File Name
PLANSHEETS_MDR.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
15 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION





Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
ENHANCEMENT II

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

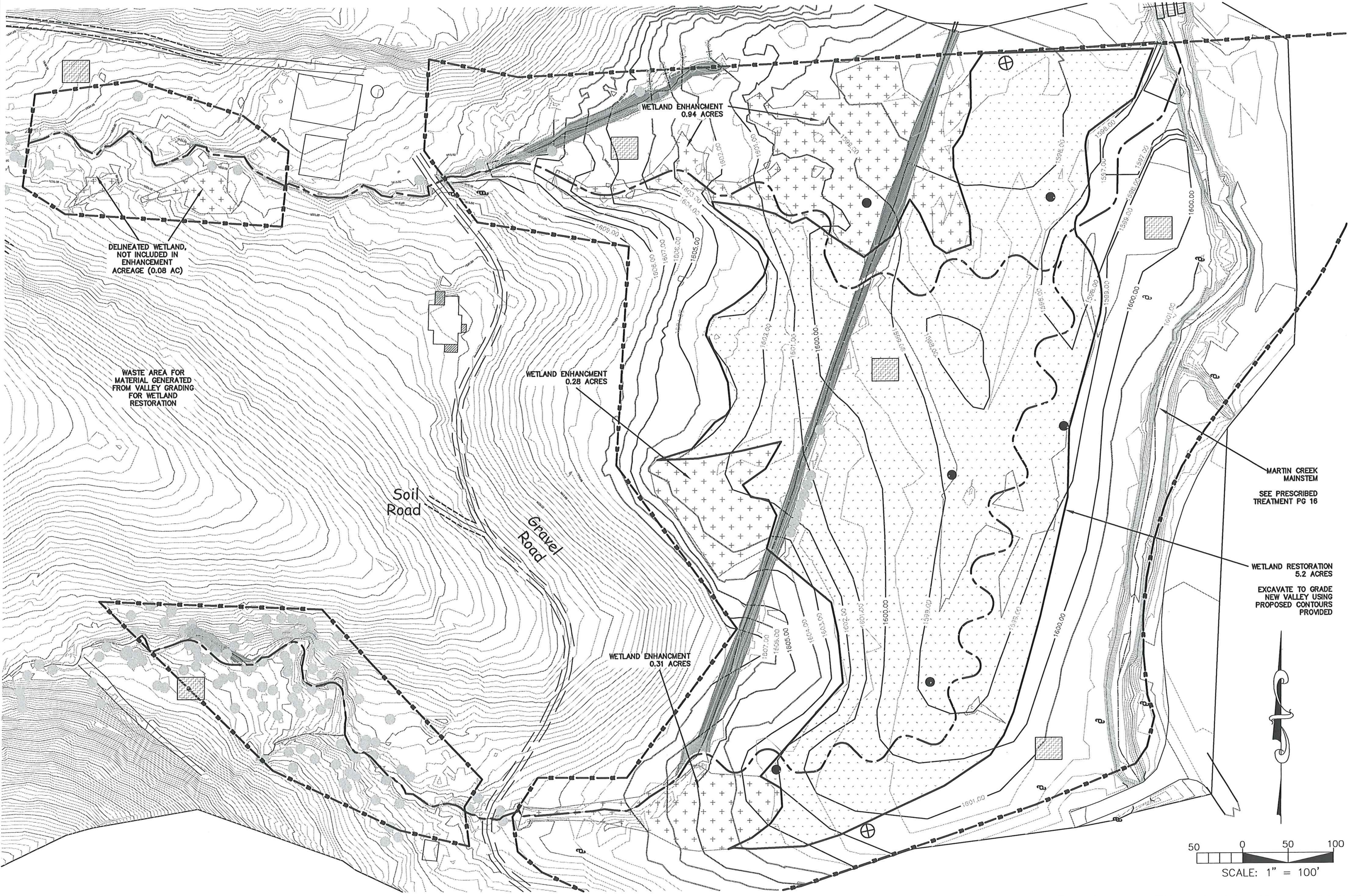
Date:
6/15/2010

File Name
PLANSHEETS_MDR.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
16 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
WETLAND RESTORATION & ENHANCEMENT

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

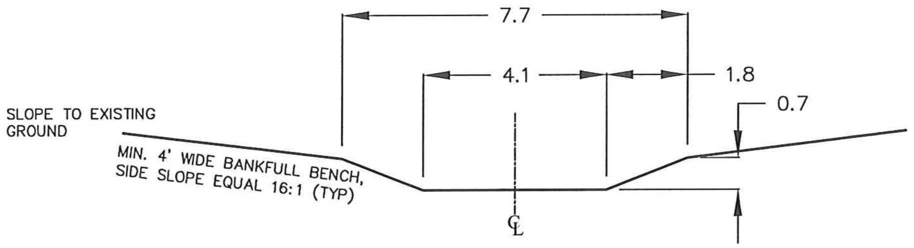
Date:
6/15/2010

File Name
PLANSHEETS_MDR.dwg

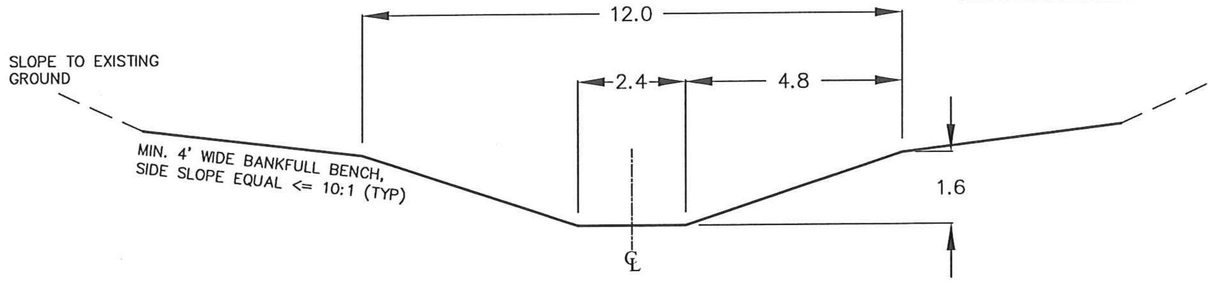
DESIGNED:	DH
DRAWN:	MR
APPROVED:	JM

Drawing No.
17 of 34

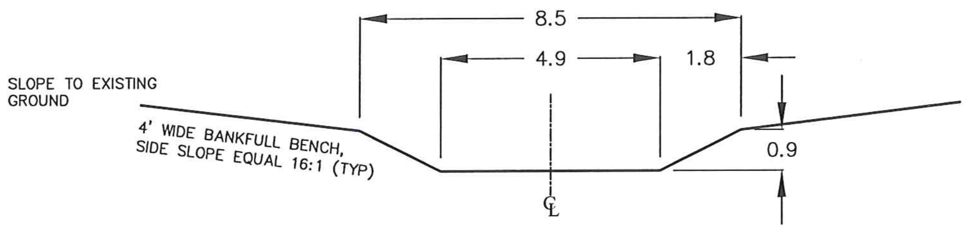
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



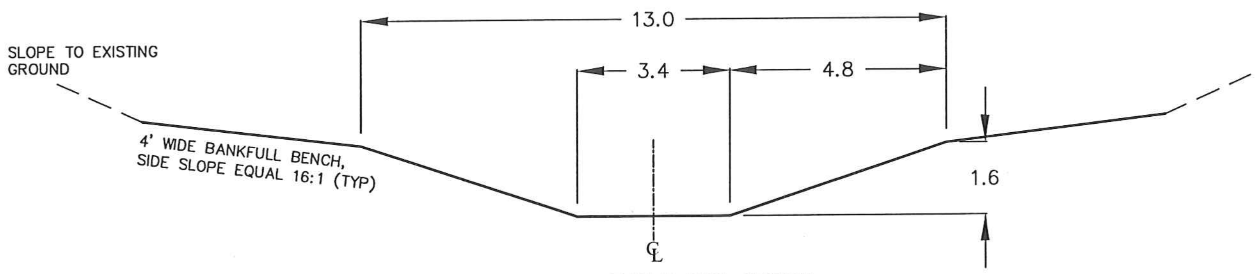
1/18 TYPICAL RIFFLE SECTION
MC–UT1 REACH 2
SCALE 1:1



2/18 TYPICAL POOL SECTION
MC–UT1 REACH 2
SCALE 1:1

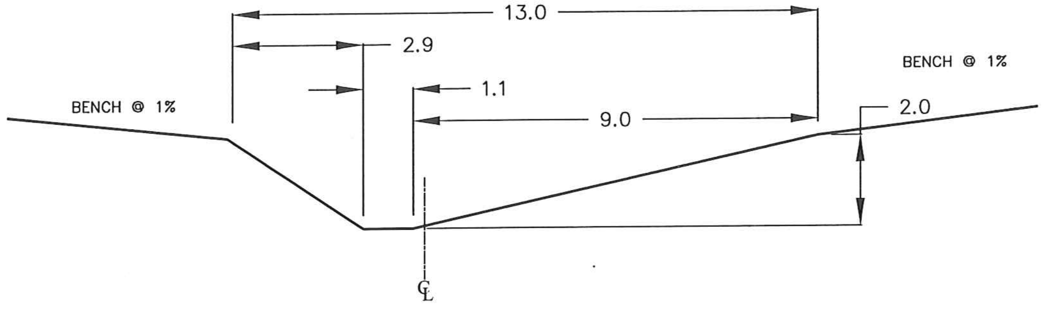


3/18 TYPICAL RIFFLE SECTION
MC–UT1 REACHES 3–4
SCALE 1:1



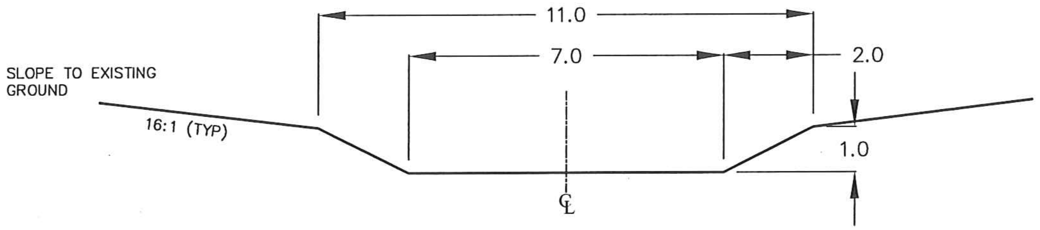
4/18 TYPICAL POOL SECTION
MC–UT1 REACHES 3–4 STEP POOL
SCALE 1:1

APPLIES TO ALL POOLS STATIONS 0+00 TO 6+00
APPLIES TO NON MEANDER POOLS STATIONS 6+00 TO END

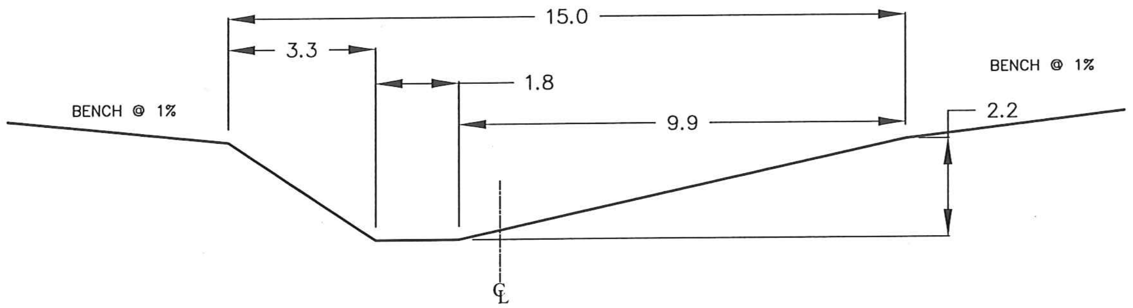


5/18 TYPICAL POOL SECTION
MC–UT1 REACH 4 – MEANDERING
SCALE 1:1

APPLIES IN ALL MEANDER BENDS STATIONS 6+00 TO CONFLUENCE WITH MC–UT1–3



6/18 TYPICAL RIFFLE SECTION
MC–UT1 BELOW CONFLUENCE
SCALE 1:1



7/18 TYPICAL POOL SECTION
MC–UT1 BELOW CONFLUENCE
SCALE 1:1

APPLIES IN ALL MEANDER BENDS FROM CONFLUENCE TO END

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
TYPICAL CROSS SECTIONS MC-UT1

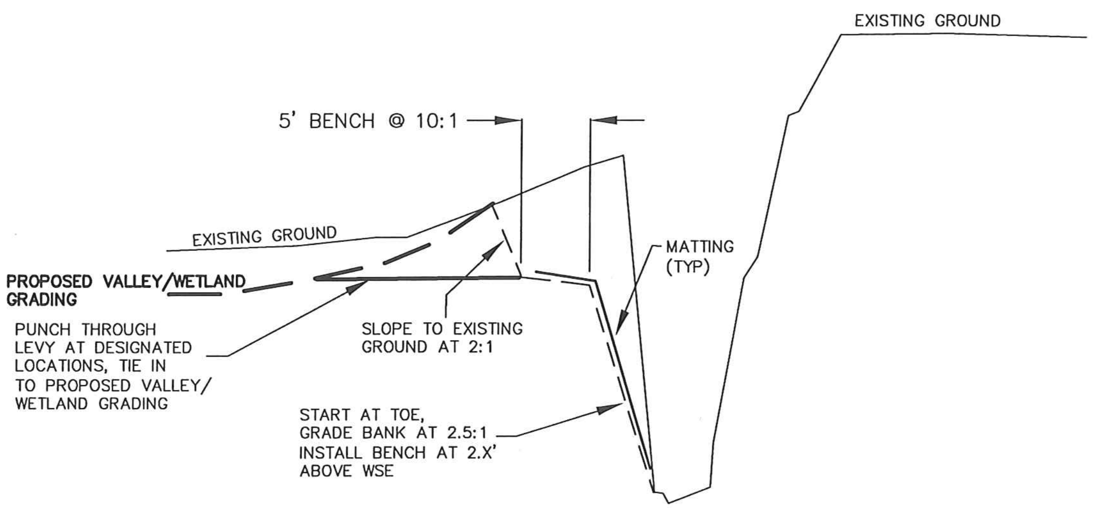
Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No. 114412
Date: 6/15/2010
File Name PLANSHEETS_MDR.dw

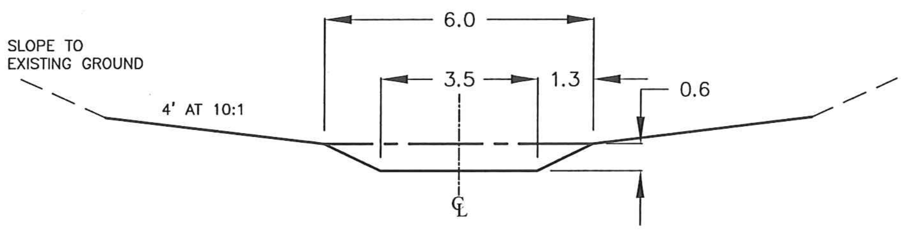
DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No. 18 of 34

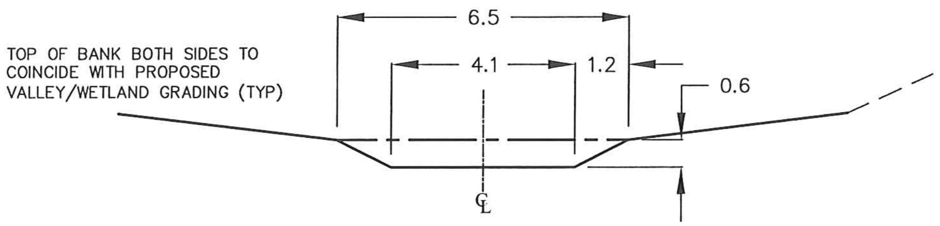
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



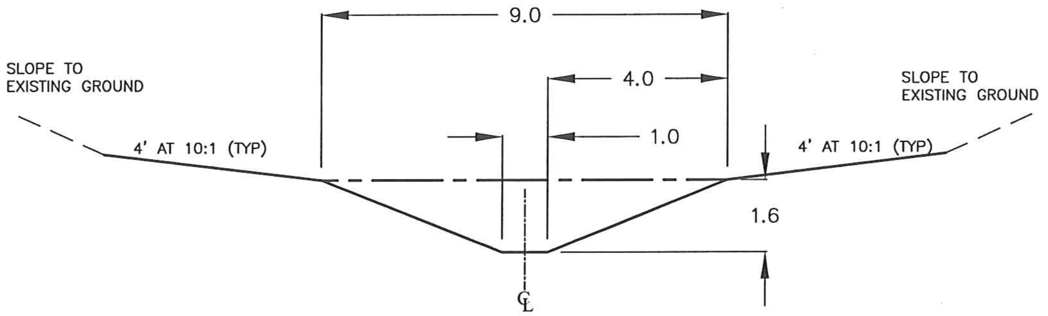
1/19 TYPICAL SECTION (BANK GRADING)
MARTIN CREEK MAINSTEM
NOT TO SCALE



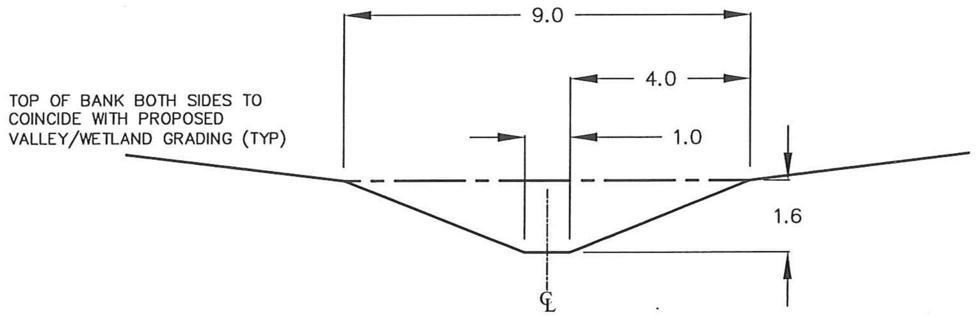
1/19 TYPICAL RIFFLE SECTION
UT1-3 REACH 1
SCALE 1:1



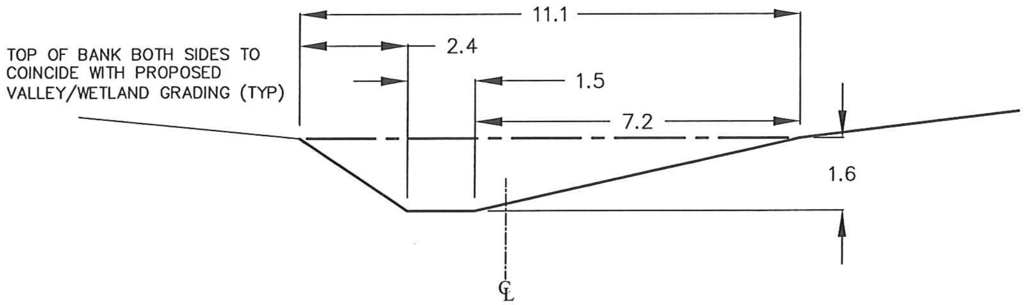
3/19 TYPICAL RIFFLE SECTION
UT1-3 REACH 2
SCALE 1:1
APPLY 5+16 TO CONFLUENCE WITH MC-UT1



2/19 TYPICAL POOL SECTION
UT1-3 REACH 1
SCALE 1:1



2/19 TYPICAL POOL SECTION
UT1-3 REACH 2
SCALE 1:1
APPLIES TO NON MEANDER POOLS STATIONS 5+16 TO CONFLUENCE WITH MC-UT1



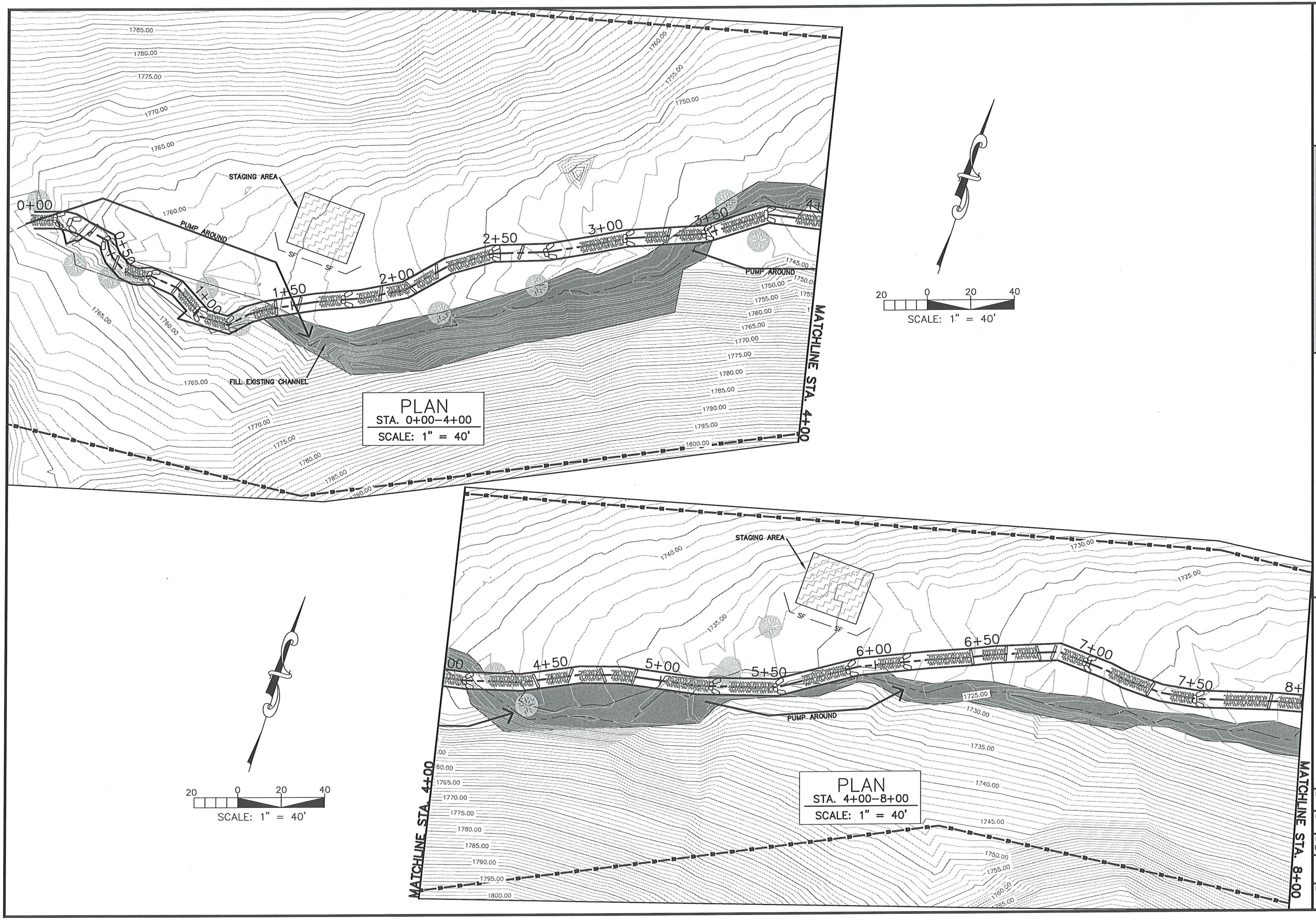
4/19 TYPICAL POOL SECTION
UT1-3 REACH 2
SCALE 1:1
APPLIES IN ALL MEANDER BENDS STATIONS 5+16 TO CONFLUENCE WITH MC-UT1

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
TYPICAL CROSS SECTIONS MC-UT1-3

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No. 114412
Date: 6/15/2010
File Name PLANSHEETS_MDR.dw
DESIGNED: DH
DRAWN: MR
APPROVED: JM
Drawing No. 19 of 34



PLAN
STA. 0+00–4+00
SCALE: 1" = 40'

PLAN
STA. 4+00–8+00
SCALE: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
UT1 R2 & R3 EROSION CONTROL & PLANTING

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

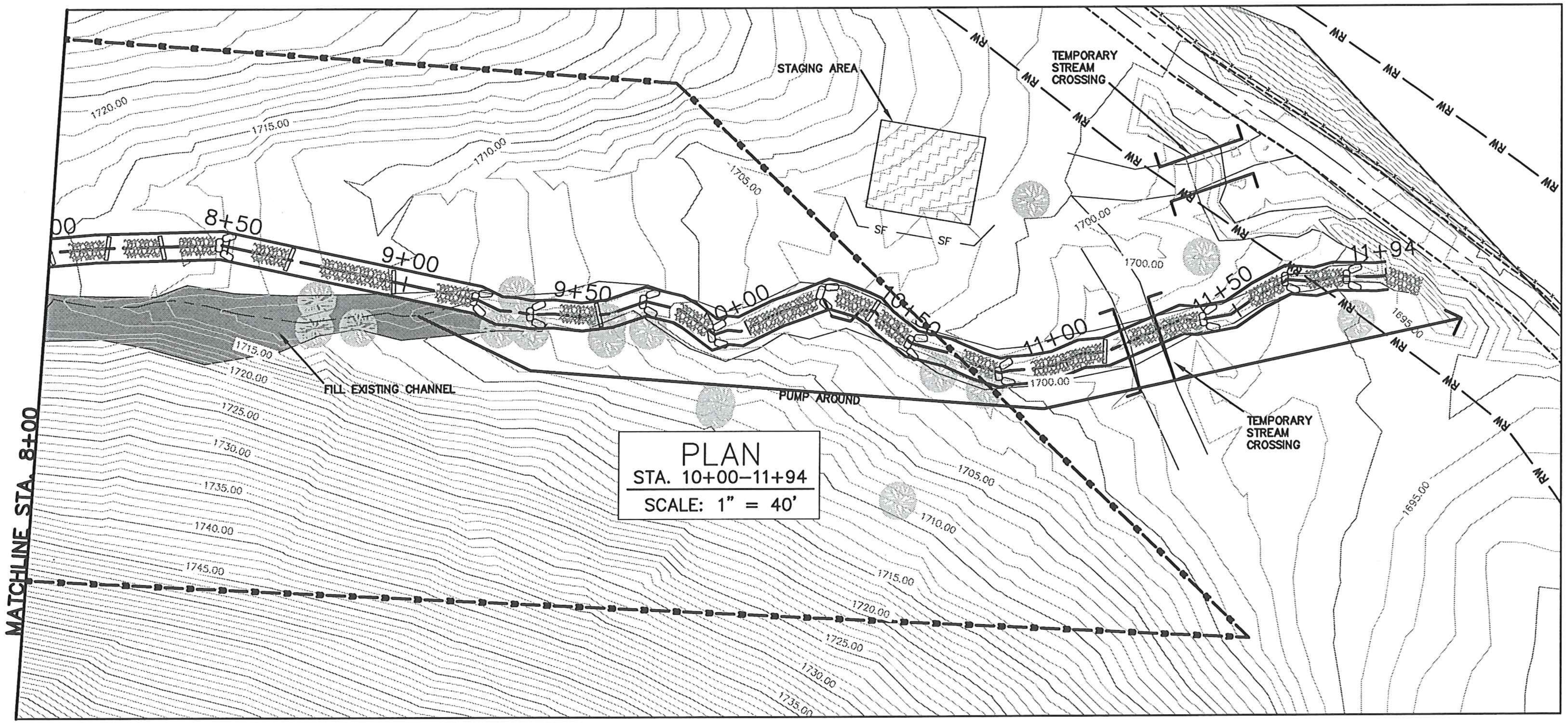
Project No.
114412

Date:
6/15/2010

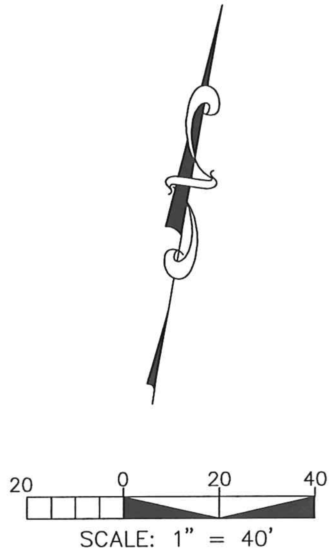
File Name
ESC.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
20 of 34



PLAN
STA. 10+00–11+94
SCALE: 1" = 40'

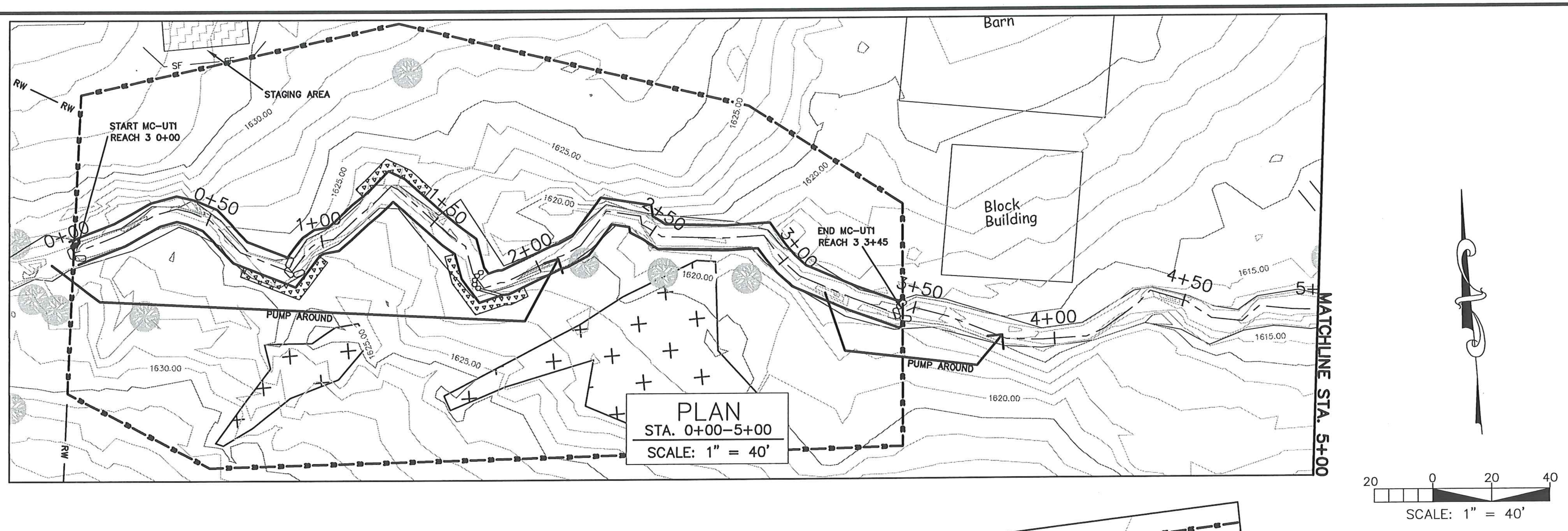


Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

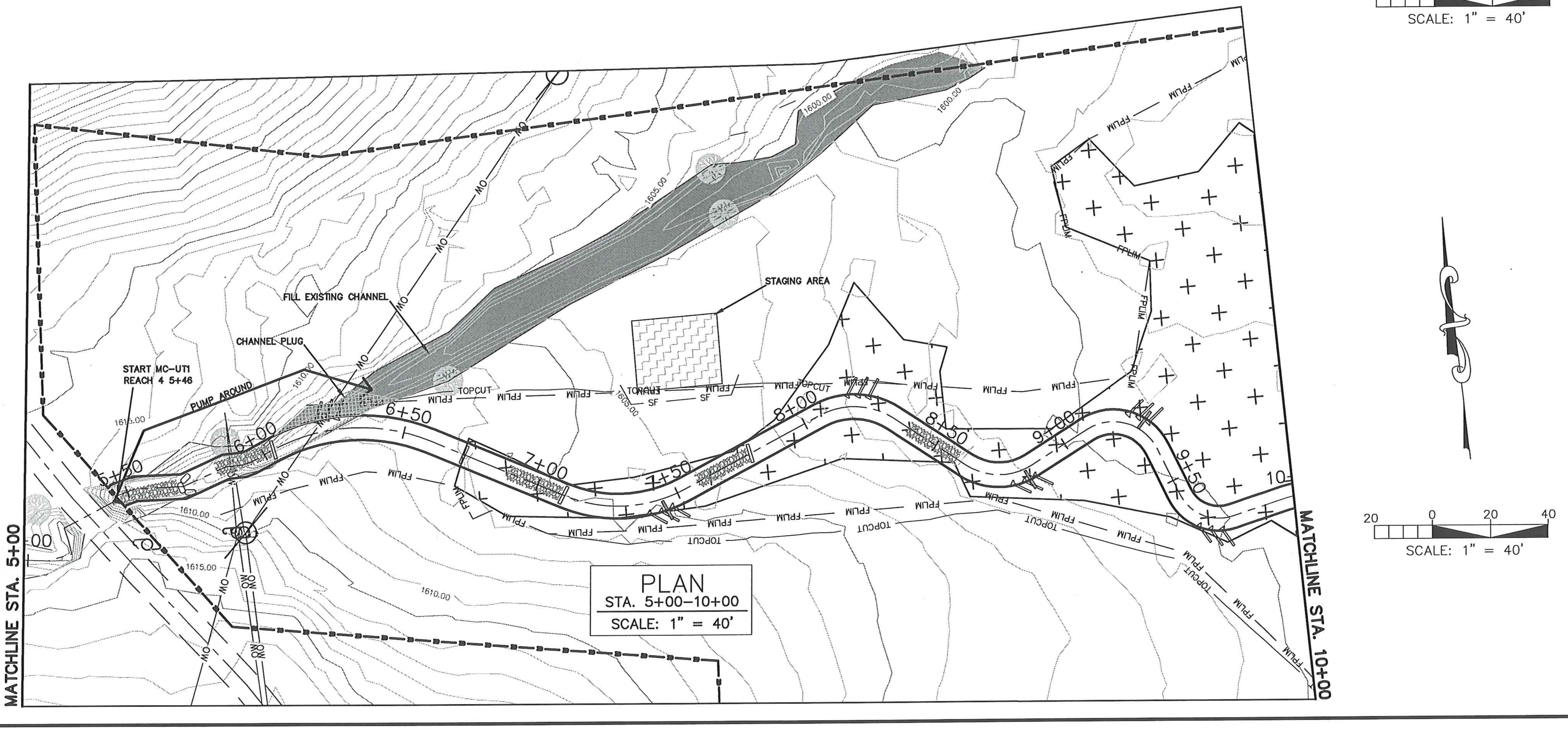
MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
UT1 R3 EROSION CONTROL & PLANTING

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.	114412
Date:	6/15/2010
File Name	ESC.dwg
DESIGNED:	DH
DRAWN:	MR
APPROVED:	JM
Drawing No.	21 of 34



PLAN
STA. 0+00–5+00
SCALE: 1" = 40'



PLAN
STA. 5+00–10+00
SCALE: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
MC-UT1 R3 & R4 EROSION CONTROL & PLANTING

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

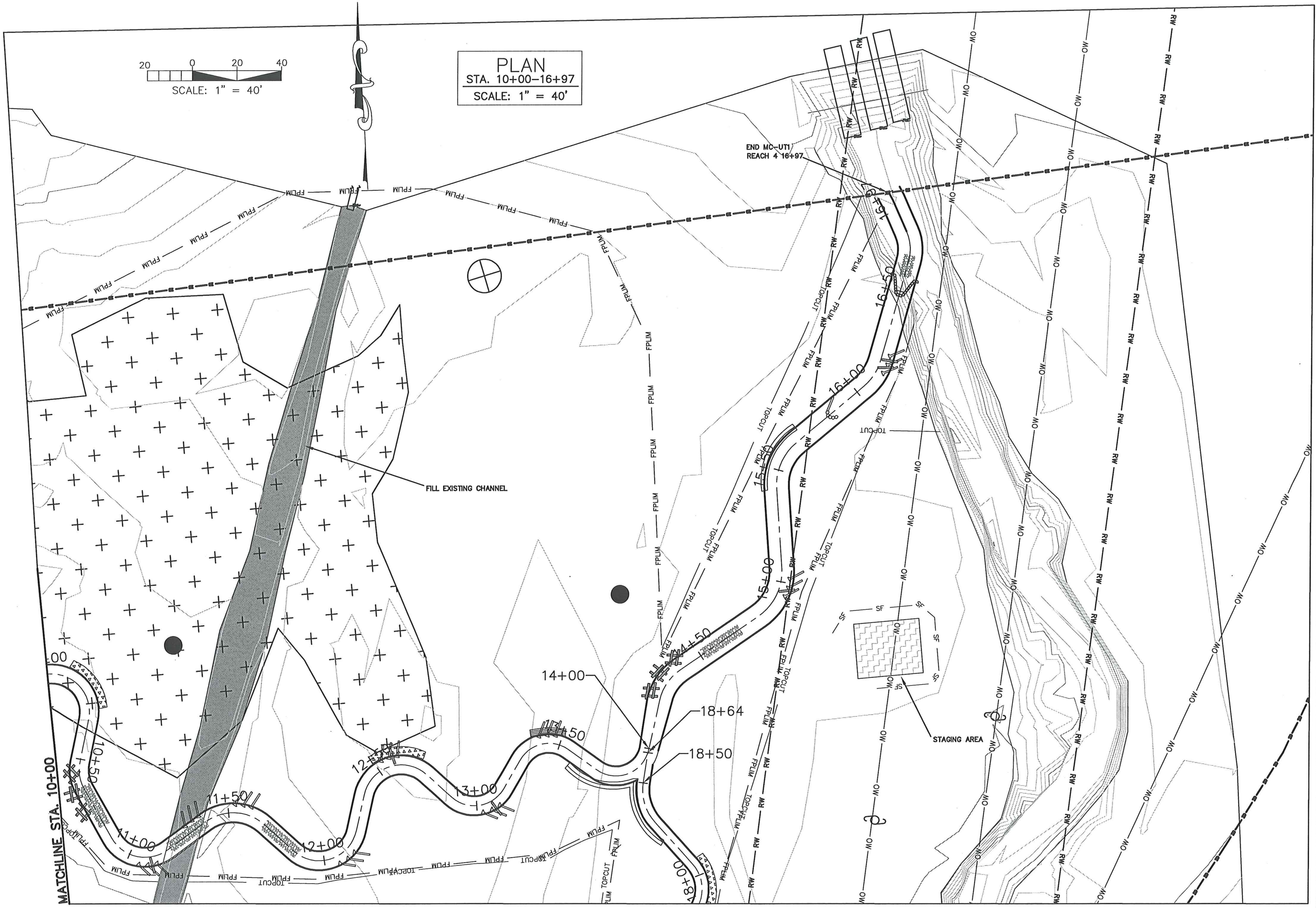
Date:
6/15/2010

File Name
ESC.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
22 of 34

PLAN
STA. 10+00–16+97
SCALE: 1" = 40'



Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
UT1 R4 EROSION CONTROL & PLANTING

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

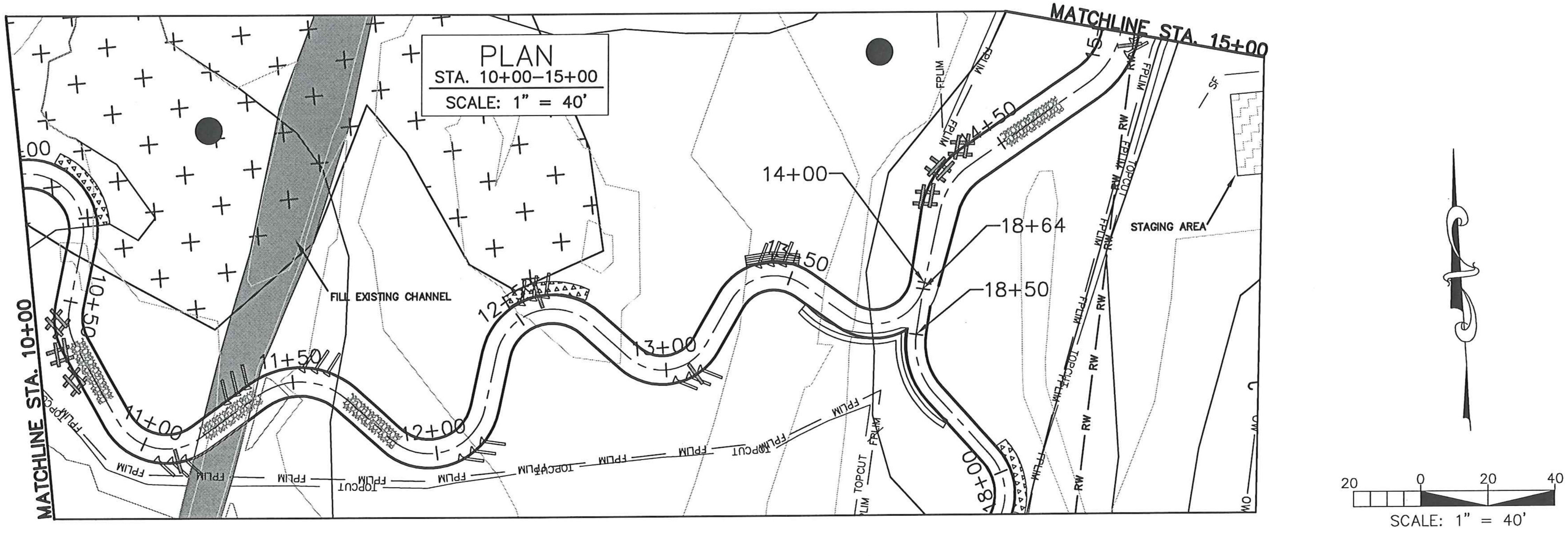
Project No.
114412

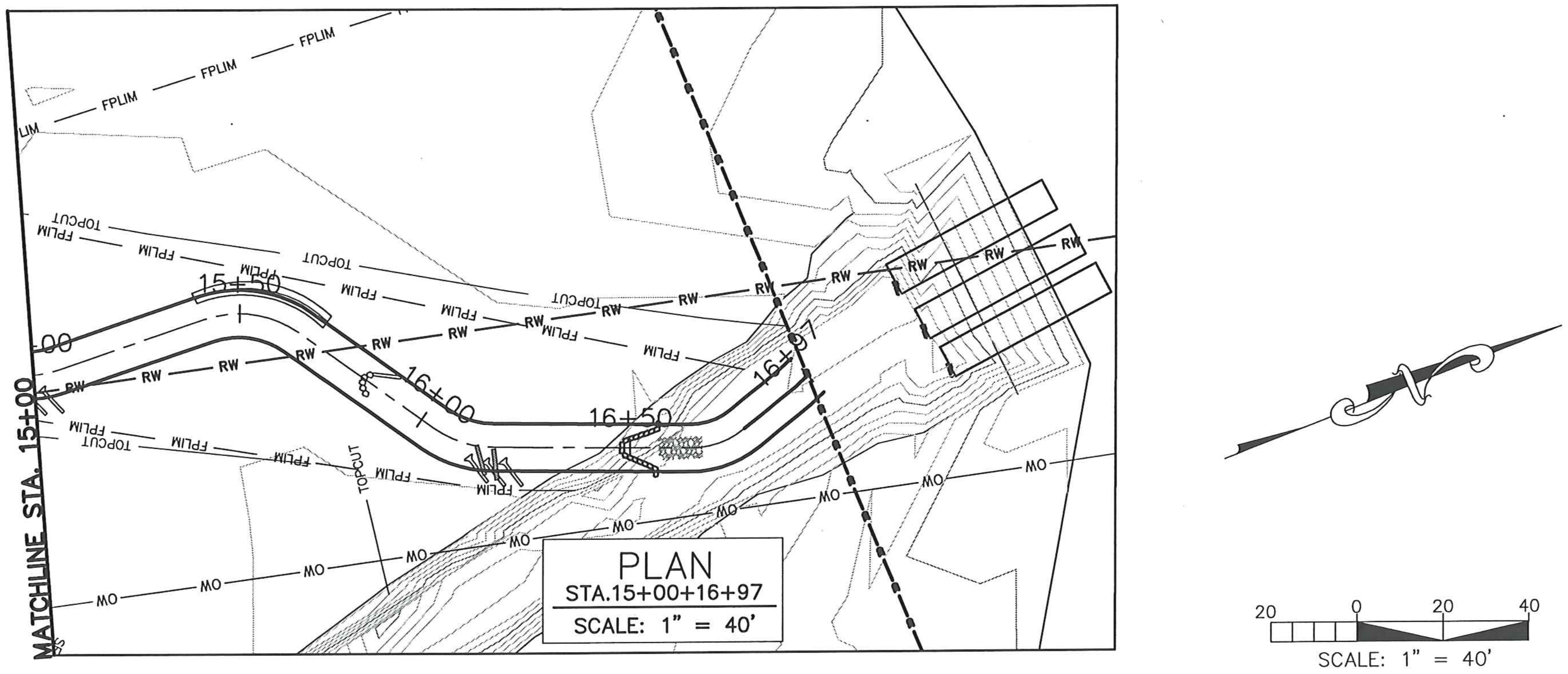
Date:
6/15/2010

File Name
ESC.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
23 of 34





Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
UT1 R5 EROSION CONTROL & PLANTING

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

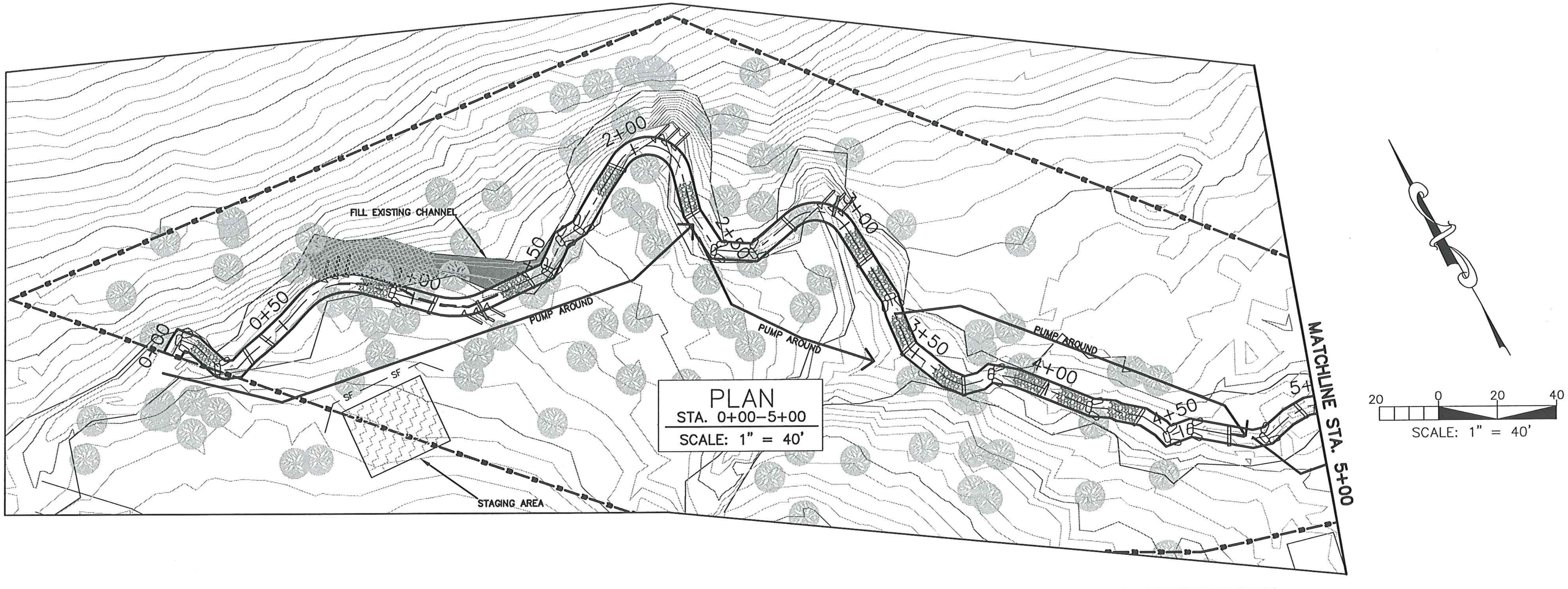
Project No.
114412

Date:
6/15/2010

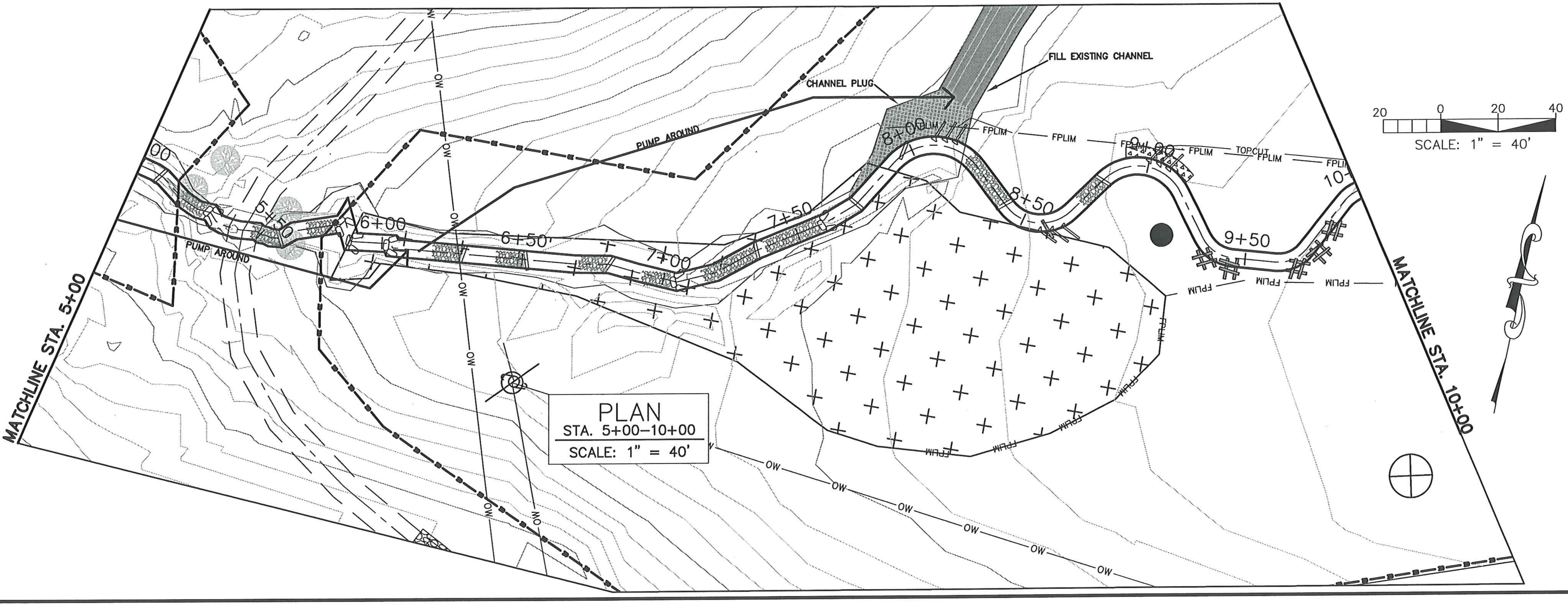
File Name
ESC.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
24 of 34



PLAN
STA. 0+00–5+00
SCALE: 1" = 40'



PLAN
STA. 5+00–10+00
SCALE: 1" = 40'

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
UT1-3 R1 & R2 EROSION CONTROL & PLANTING

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

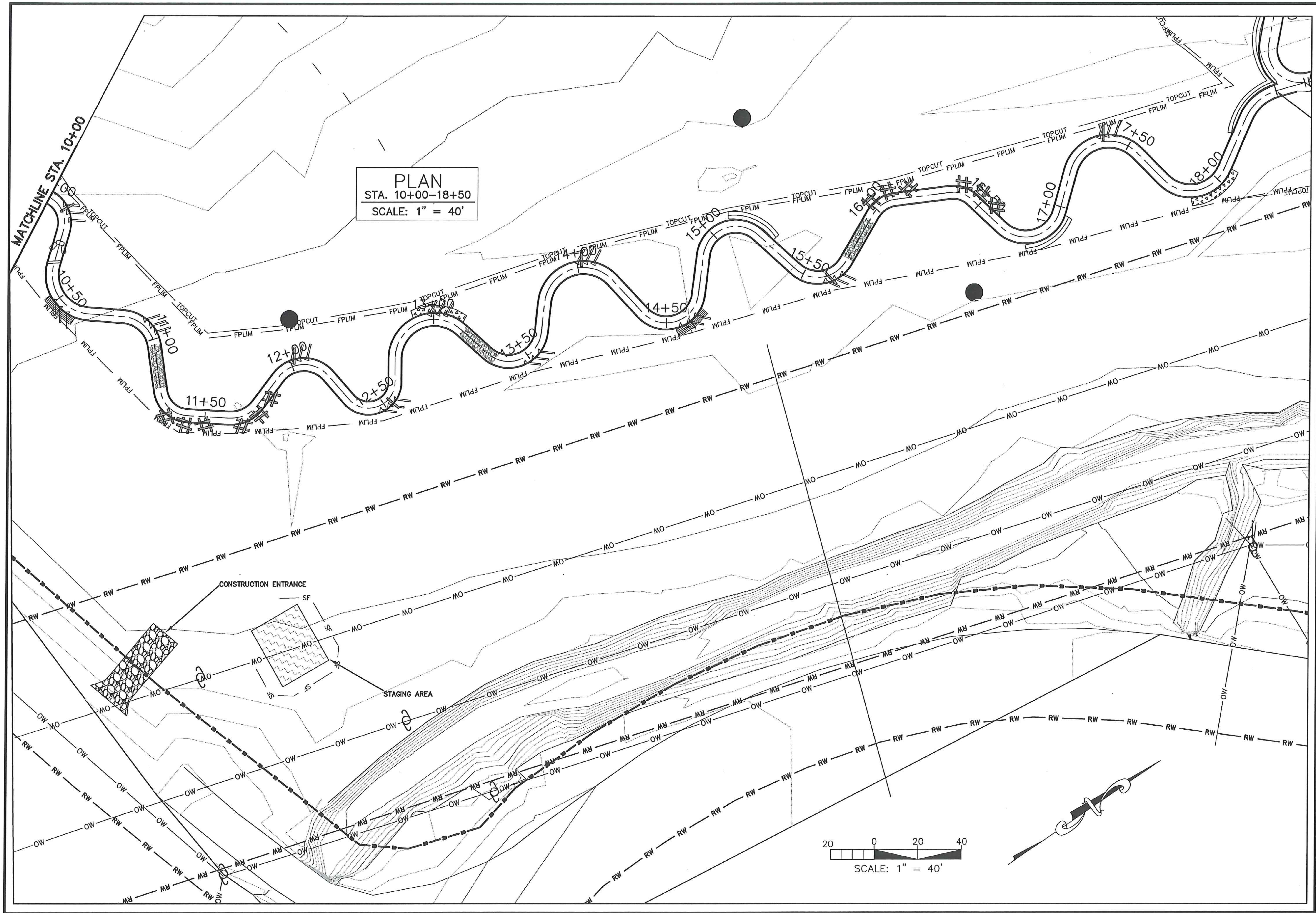
Project No.
114412

Date:
6/15/2010

File Name
ESC.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
25 of 34



Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
UT1-3 R2 EROSION CONTROL & PLANTING

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd. Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

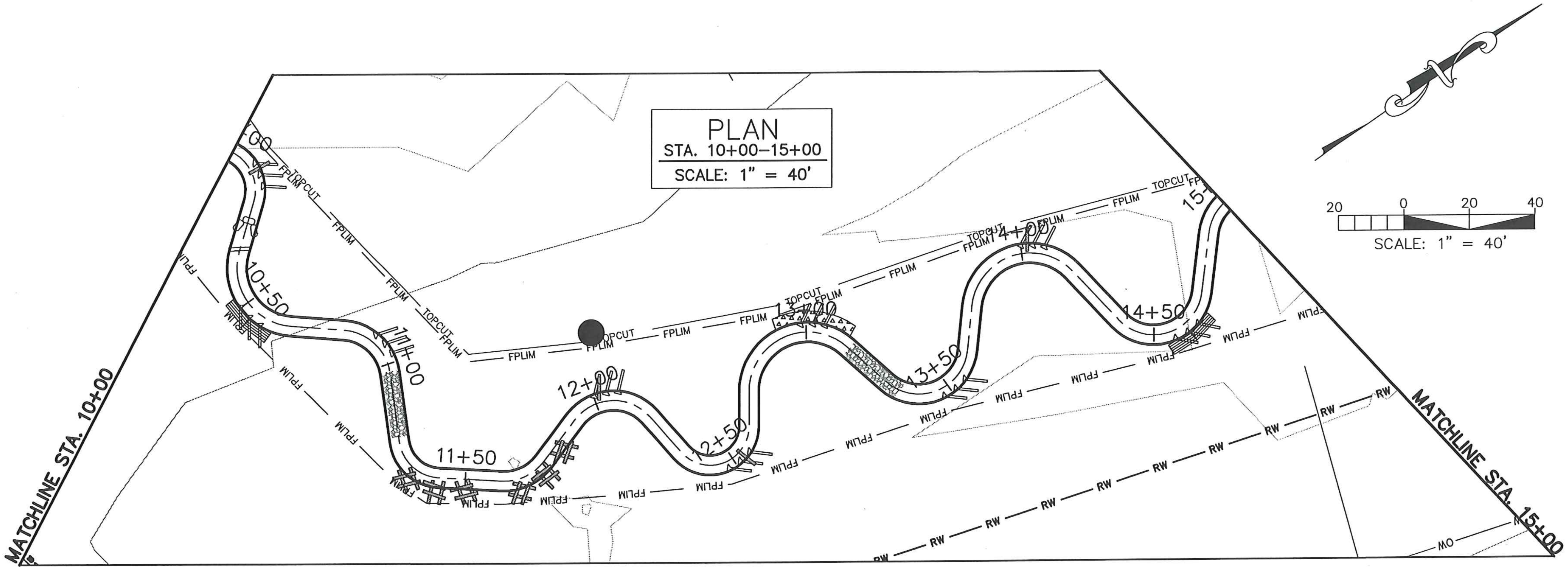
Project No.
114412

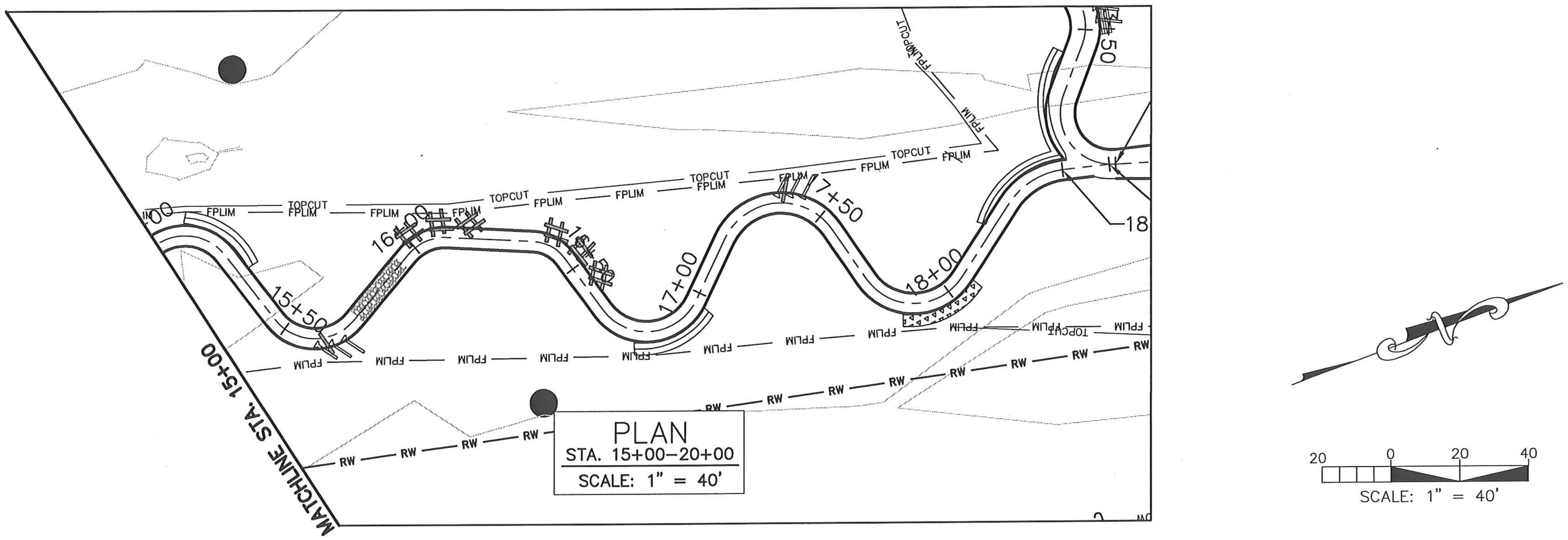
Date:
6/15/2010

File Name
ESC.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
26 of 34





Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
UT1-3 R2 EROSION CONTROL & PLANTING

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.	114412
Date:	6/15/2010
File Name	ESC.dwg
DESIGNED:	DH
DRAWN:	MR
APPROVED:	JM
Drawing No.	27 of 34

Proposed Bare-Root Species: 8'x8' Spacing for Trees & 8'x8' Spacing in between for Shrubs (Use for containerized species also)

UT to Martin Creek (Contreras) Mitigation Project -NCEEP Project #92766

Common Name	Scientific Name	% Planted by Species	Wetness Tolerance	Planting Location
Riparian Buffer Plantings: 680 Tree Stems/Acre & 680 Shrub Stems/Acre				
Trees Overstory (55%)				
Red Maple	*Acer rubrum*	3	FAC	Wetland & Floodplain
Tulip Poplar	*Liriodendron tulipifera*	2	FAC	Wetland & Floodplain
Persimmon	*Diospyros virginiana*	5	FAC	Wetland & Floodplain
River Birch	*Betula nigra*	7	FACW	Wetland & Floodplain
Sycamore	*Platanus occidentalis*	5	FACW-	Wetland & Floodplain
Black Willow	*Salix nigra*	5	OBL	Wetland & Floodplain
White Oak	*Quercus alba*	5	FACU	Upland
Black (Sweet) Birch	*Betula lenta*	3	FACU	Upland
Northern Red Oak	*Quercus rubra*	5	FACU	Upland
Yellow Birch	*Betula alleghaniensis (lutea)*	3	FACU+	Upland
Mockernut Hickory	*Carya alba (tomentosa)*	10	N/A	Upland
Scarlet Oak	*Quercus coccinea*	2	N/A	Upland
Trees Understory (45%)				
Ironwood	*Carpinus caroliniana*	3	FAC	Wetland & Floodplain
Tag Alder	*Alnus serrulata*	7	FACW+ or OBL	Wetland & Floodplain
Highland Doghobble	*Leucothoe fontanesiana (axilarris var. editorum)*	5	N/A	Wetland & Floodplain
Witch Hazel	*Hamamelis virginiana*	4	FACU	Upland
Sourwood	*Oxydendrum arboreum*	5	FACU	Upland
Flowering Dogwood	*Cornus florida*	10	FACU	Upland
Redbud	*Cercis canadensis*	8	FACU	Upland
Flame Azalea	*Rhododendron calendulaceum*	3	N/A	Upland
Shrubs (100%)				
Rivercane (giant cane)	*Arundinaria gigantea*	15	FACW	Wetland & Floodplain
Spicebush	*Lindera benzoin*	15	FACW	Wetland & Floodplain
Winterberry	*Ilex verticillata*	10	FACW	Wetland & Floodplain
Virginia Sweetspire	*Itea virginica*	15	FACW+	Wetland & Floodplain
Deerberry	*Vaccinium stamineum*	15	FACU	Upland
Eastern Sweetshrub, Sweets	*Calycanthus floridus, Calycanthus spp.*	10	FACU	Upland
Sweetpepperbush	*Clethra spp.*	15	N/A	Upland
Chokeberry	*Photinia*	5	N/A	Upland
Alternate Species				
Blight-resistant American Chestnut	*Castanea dentata*	N/A	N/A	Upland
American Hazelnut	*Corylus americana*	N/A	FACU	Upland
Blue Ridge Blueberry	*Vaccinium pallidum*	N/A	N/A	Upland

Note: Species selection may change due to refinement or availability at the time of planting.

Proposed Permanent Seed Mixture

UT to Martin Creek (Contreras) Mitigation Project -NCEEP Project #92766

Common Name	Scientific Name	% Planted by Species	Density (lbs/ac)	Wetness Tolerance
Creeping Bentgrass	*Agrostis stolonifera*	10%	1.5	FACW
Big Bluestem	*Andropogon gerardii*	2%	0.3	N/A
Devil's Beggartick	*Bidens frondosa (or aristosa)*	3%	0.45	FACW
Northern Long Sedge	*Carex folliculata*	2%	0.3	N/A
Nodding Sedge	*Carex gynandra*	5%	0.75	N/A
Upright Sedge	*Carex stricta*	2%	0.3	OBL
Lance-leaved Tick Seed	*Coreopsis lanceolata*	3%	0.45	N/A
Virginia Wildrye	*Elymus virginicus*	15%	2.25	FAC
Soft Rush	*Juncus effusus*	2%	0.3	FACW+
Tioga Deer Tongue	*Panicum clandestinum*	10%	1.5	FACW
Switch Grass	*Panicum virgatum*	15%	2.25	FAC+
Pennsylvania Smartweed	*Polygonum pensylvanicum*	5%	0.75	FACW
Broadleaf Arrowhead	*Sagittaria latifolia var. pubescens*	1%	0.15	OBL
Little Bluestem	*Schizachyrium scoparium*	5%	0.75	FACU
Roundleaf Goldenrod	*Solidago patula*	3%	0.45	OBL
Indian Grass	*Sorghastrum nutans*	10%	1.5	FACU
Eastern Gamma Grass	*Tripsacum dactyloides*	5%	0.75	FAC+
Joe Pye Weed	*Eupatorium fistulosum*	2%	0.3	N/A
	Total	100	15	

Note: Species selection may change due to refinement or availability at the time of planting.

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
PLANTING TABLE

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

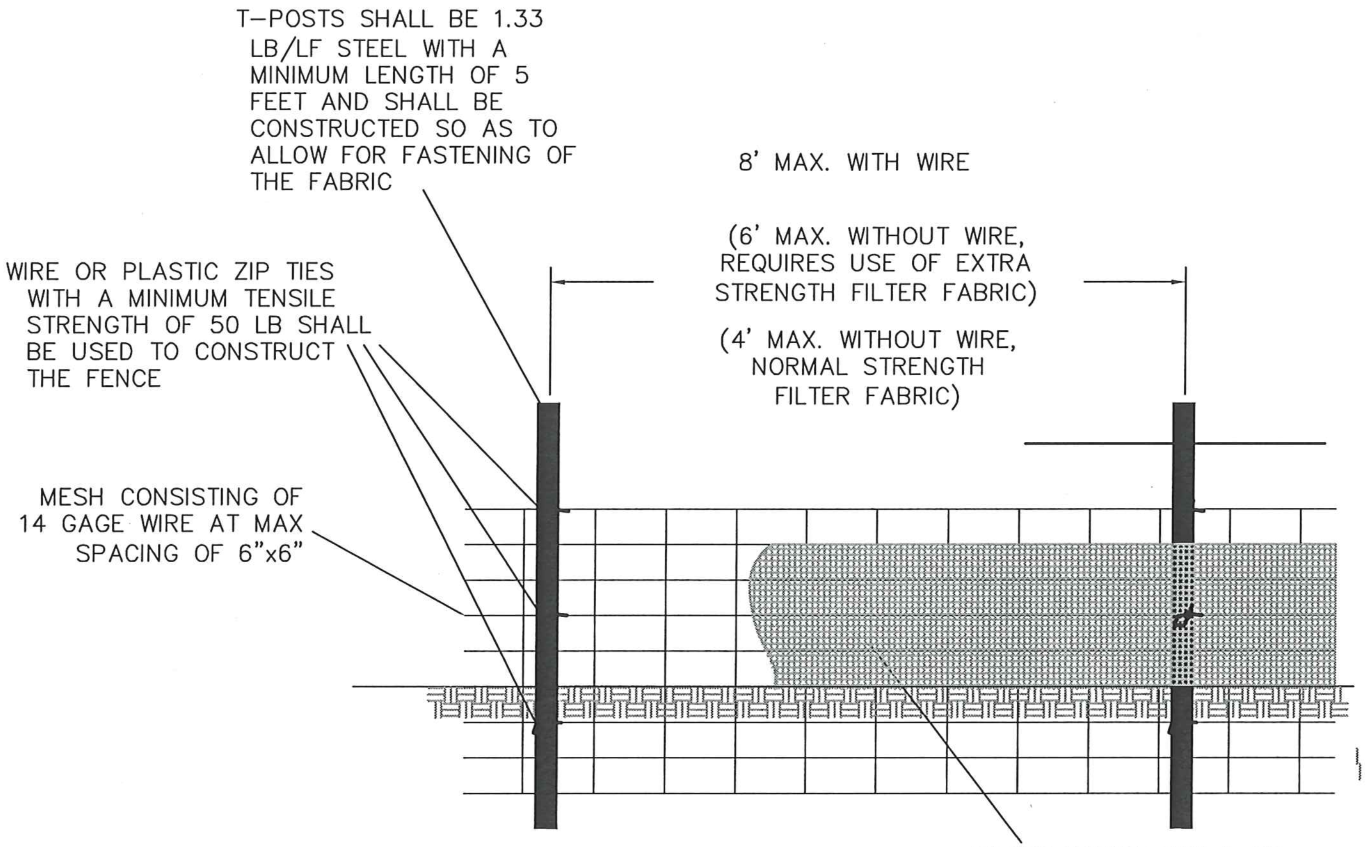
Date:
6/15/2010

File Name
ESC.dwg

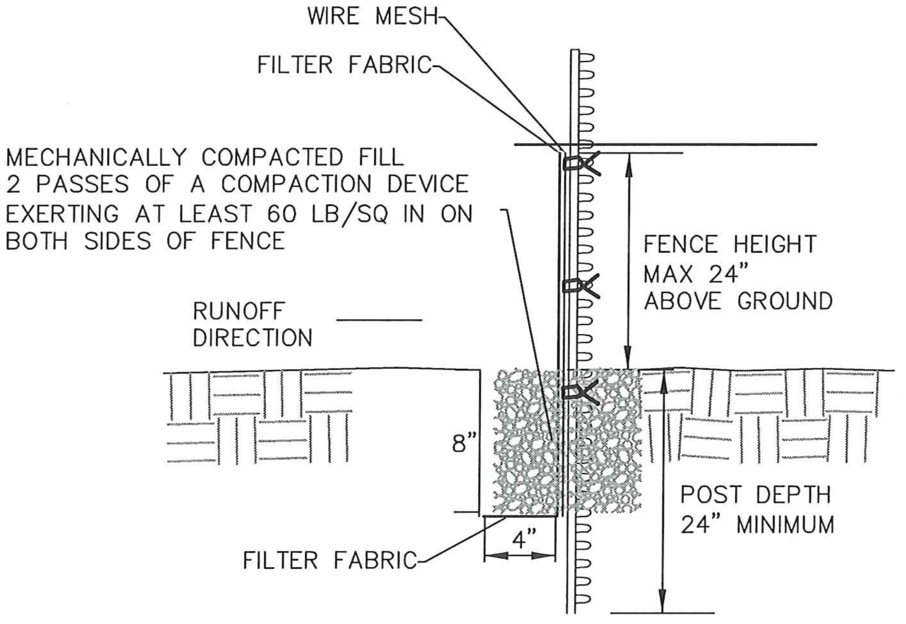
DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
28 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



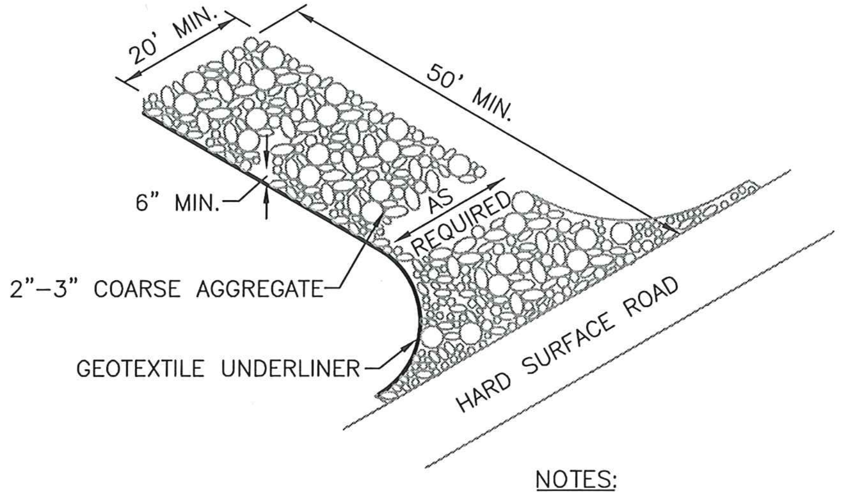
FILTER FABRIC SHALL BE STANDARD OR EXTRA STRENGTH SYNTHETIC FIBER CERTIFIED BY THE MANUFACTURER TO COMPLY WITH MATERIAL REQUIREMENTS IN ASTM STANDARDS D 6461, 4632, 4491, 4751, AND 4355.



NOTES:

1) AVOID JOINTS, UNAVOIDABLE JOINTS MUST HAVE 4 FEET OF CLOTH OVERLAP AND SHOULD TIE INTO THE NEXT ADJACENT POST
2) PLACE ON CONTOUR EXCEPT ENDS WHICH SHOULD BE 1' ABOVE GRADE TO PREVENT CUT AROUND
3) WRAP APPROX. 6" OF FABRIC AROUND END POSTS AND SECURE WITH TIES
4) REMOVE ONCE AREA IS STABLE

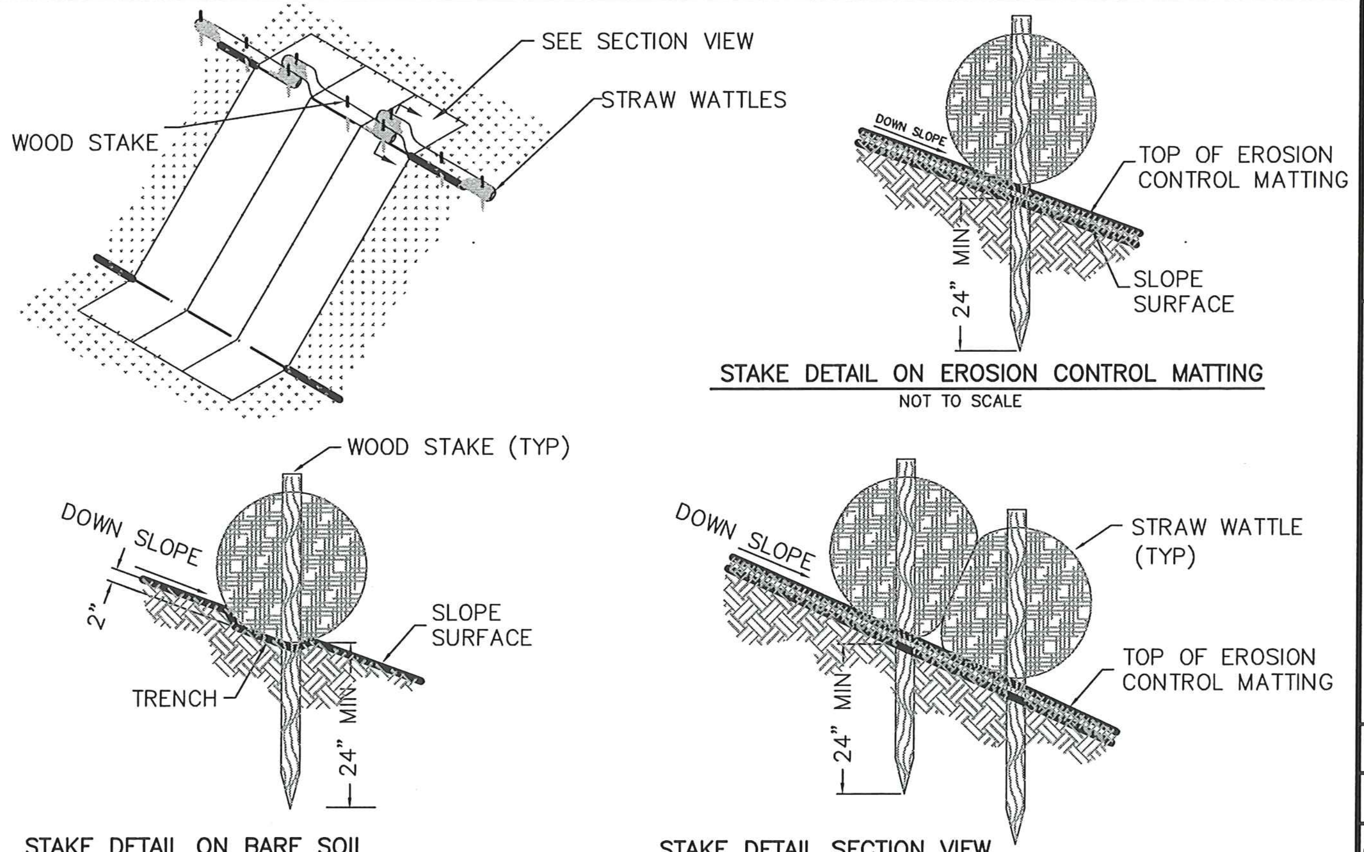
1
28
SILT FENCE
NOT TO SCALE



NOTES:

1) ENTRANCE OFF STATE MAINTAINED ROAD MUST BE MAINTAINED IN COMPLIANCE WITH STATE STORMWATER STANDARDS.
2) UPON COMPLETION, ALL PRIVATE ROADS SHALL BE RETURNED TO PRE-EXISTING CONDITION.
3) MUD TRACKED ONTO STATE ROADS SHALL BE REMOVED IMMEDIATELY.
4) STONE SHALL BE REPLACED IF IT IS FILLED WITH MUD

2
28
CONSTRUCTION ENTRANCE
NOT TO SCALE



STAKE DETAIL ON EROSION CONTROL MATTING
NOT TO SCALE

STAKE DETAIL ON BARE SOIL
NOT TO SCALE

STAKE DETAIL SECTION VIEW
NOT TO SCALE

3
28
STRAW WATTLE
NOT TO SCALE

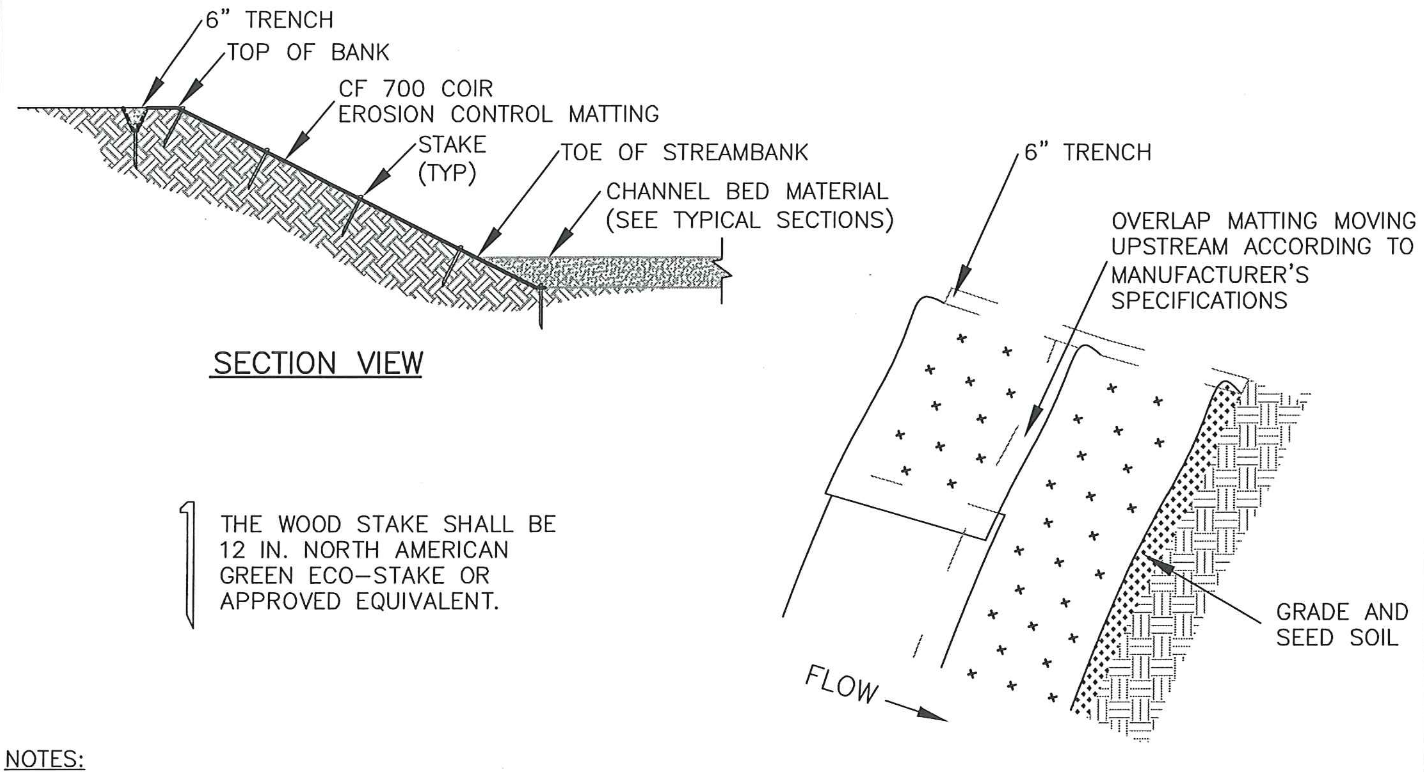
Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
DETAILS

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

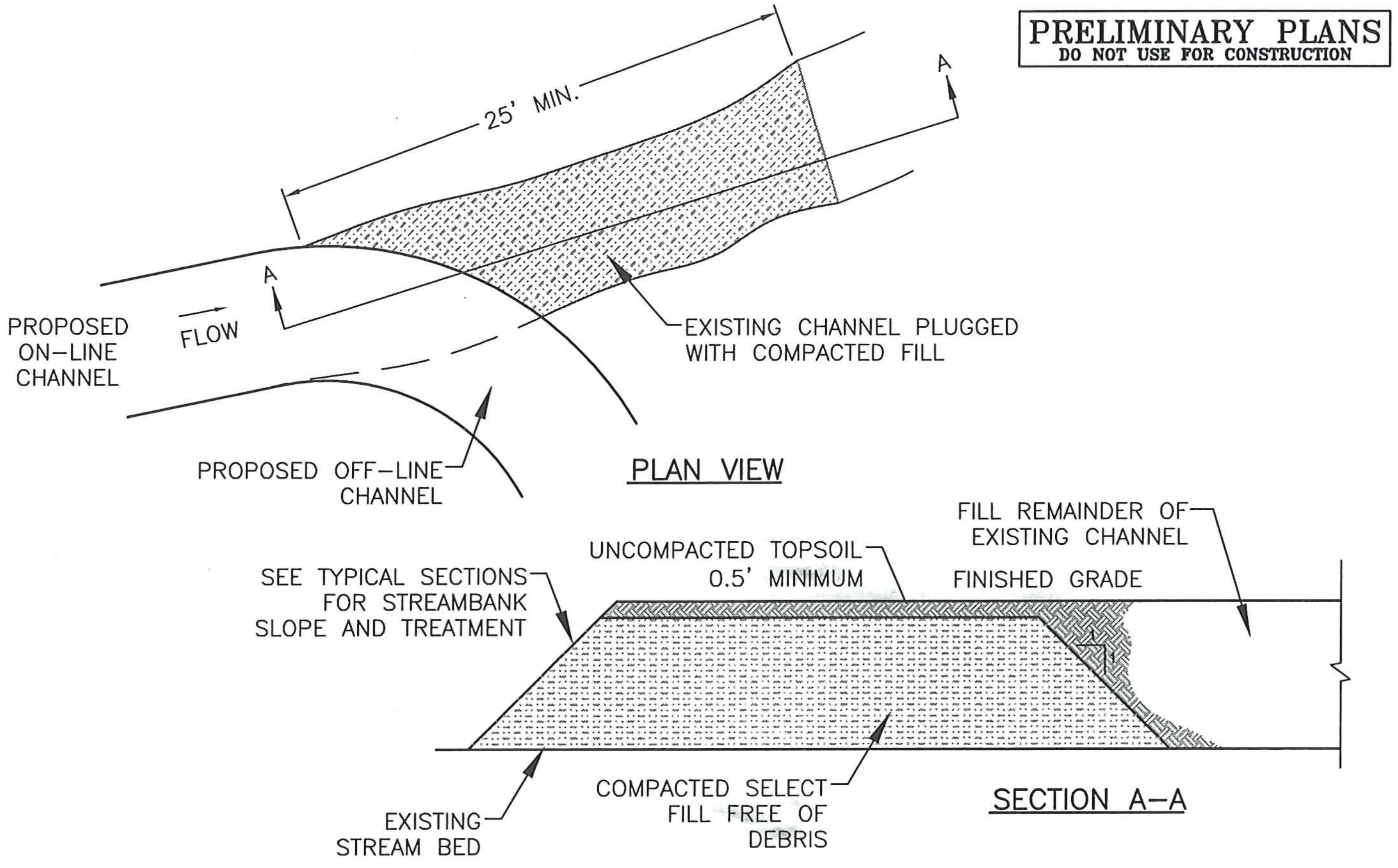
Project No. 114412
Date: 6/15/2010
File Name Details.dwg
DESIGNED: DH
DRAWN: MR
APPROVED: JM
Drawing No. 29 of 34



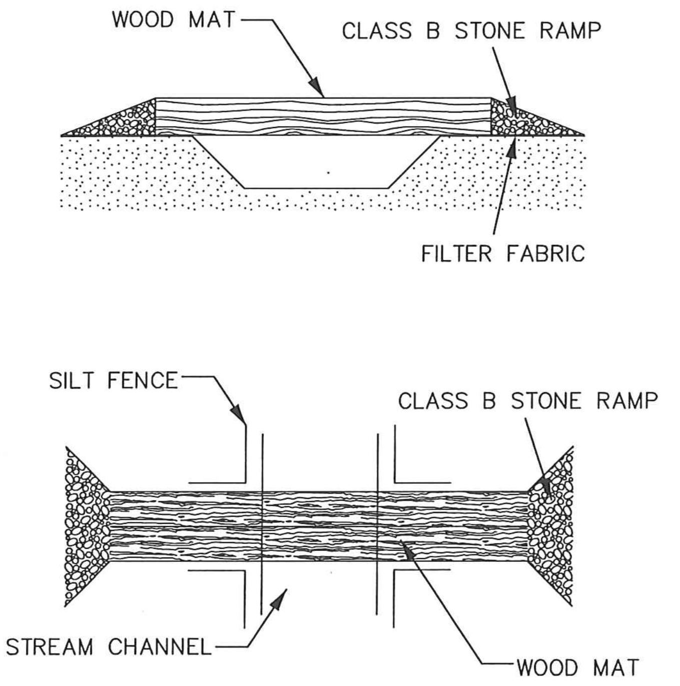
NOTES:
1) BANKS SHALL BE SEEDED AND MULCHED PRIOR TO INSTALLATION OF MATTING
2) MATTING SHALL BE PLACED ACCORDING TO MANUFACTURER'S SPECIFICATIONS
3) MATTING SHALL BE STAKED IN DIAMOND PATTERN
4) AT TOP OF BANK, MATTING SHALL BE PLACED IN 6" DEEP TRENCH, STAKED, BACKFILLED, AND COMPACTED

1/29 COIR MATTING
NOT TO SCALE

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



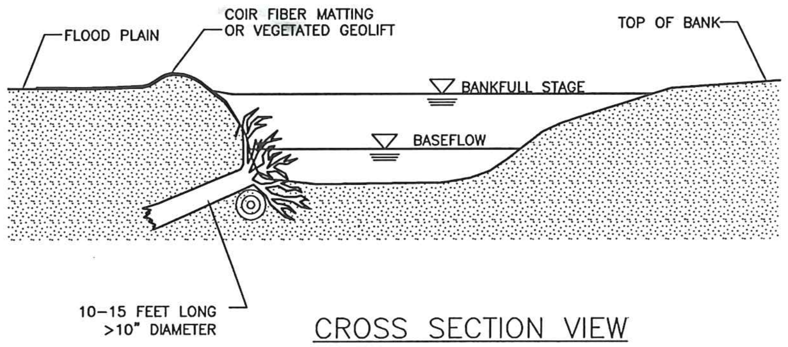
2/29 CHANNEL PLUG
NOT TO SCALE



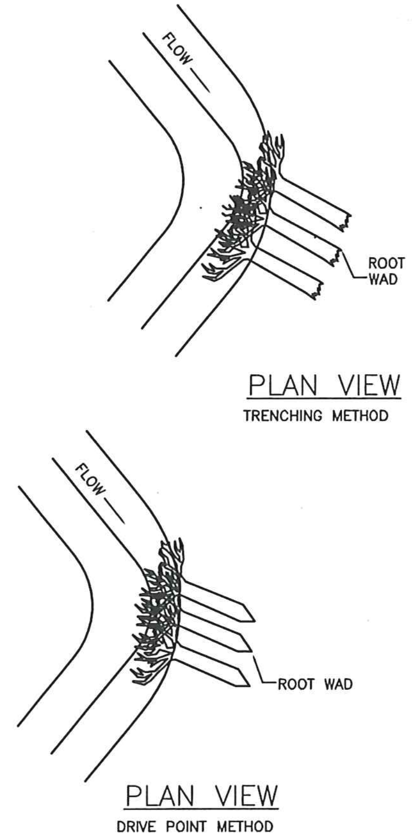
NOTES:

1. CONSTRUCT AT LOW FLOW JUST PRIOR TO BEGINNING WORK.
2. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM
3. LINE STREAMBANK AND ACCESS RAMP AREA WITH NON-WOVEN FILTER FABRIC.
4. CREATE STREAM CROSSING AT RIGHT ANGLE TO THE FLOW
5. PREVENT RUNOFF FROM HAUL ROAD INTO CHANNEL– USE SILT FENCE OR SEDIMENT BARRIER ON ALL FOUR CORNERS AS SHOWN.
6. THE WOOD MAT SHALL BE OF SUFFICIENT SIZE AND WIDTH TO SUPPORT THE LARGEST VEHICLE CROSSING
7. CONTRACTOR TO DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT USED (5:1 RECOMMENDED)
8. REMOVE UPON COMPLETION, RESTABILIZE DISTURBED AREA.

3/29 TEMPORARY STREAM CROSSING
NOT TO SCALE



CROSS SECTION VIEW



PLAN VIEW
TRENCHING METHOD

PLAN VIEW
DRIVE POINT METHOD

NOTE:
DRIVE POINT METHOD (PREFERRED METHOD):
SHARPEN THE END OF THE LOG WITH A CHAINSAW BEFORE "DRIVING" IT INTO THE BANK. ORIENT ROOT WADS UPSTREAM SO THAT THE STREAM FLOW MEETS THE ROOT WAD AT A 90-DEGREE ANGLE, DEFLECTING THE WATER AWAY FROM THE BANK. A TRANSPLANT OR BOULDER SHOULD BE PLACED ON THE DOWNSTREAM SIDE OF THE ROOT WAD IF A BACK EDDY IS FORMED BY THE ROOT WAD. THE BOULDER SHALL BE APPROXIMATELY 4' X 3' X 2' OR THE MIN PROJECT SPECIFIC BOULDER SIZE SPECIFIED IN OTHER DETAILS

TRENCHING METHOD:
IF THE ROOT WAD CANNOT BE DRIVEN INTO THE BANK OR THE BANK NEEDS TO BE RECONSTRUCTED, THE TRENCHING METHOD SHOULD BE USED. THIS METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. IN THIS CASE, A FOOTER LOG SHOULD BE INSTALLED UNDERNEATH THE ROOT WAD IN A TRENCH EXCAVATED PARALLEL TO THE BANK AND WELL BELOW THE STREAMBED. ONE-THIRD OF THE ROOT WAD SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS.

4/29 ROOTWAD
NOT TO SCALE

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
DETAILS

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

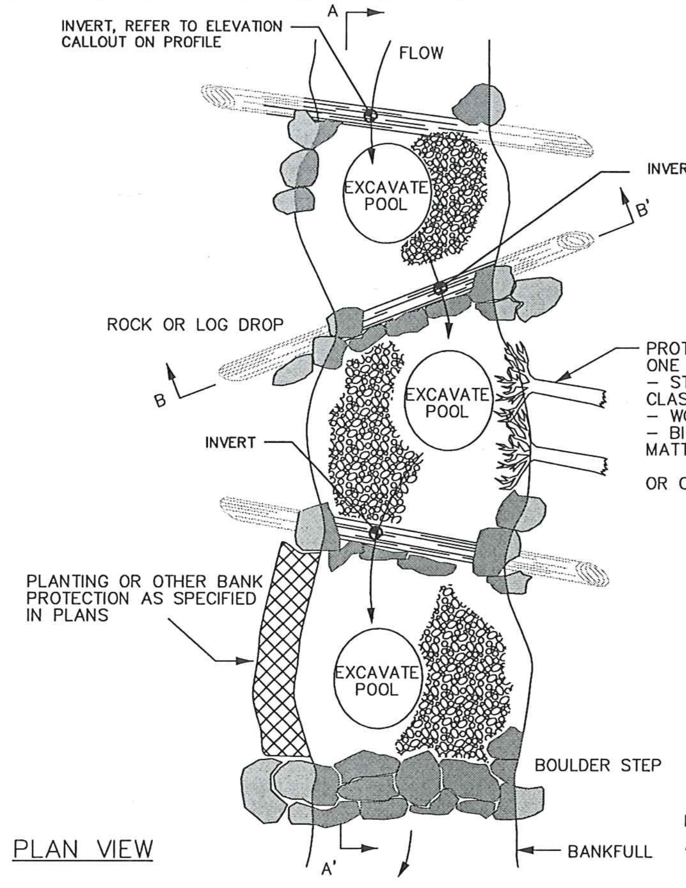
Date:
6/15/2010

File Name
Details.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
30 of 34

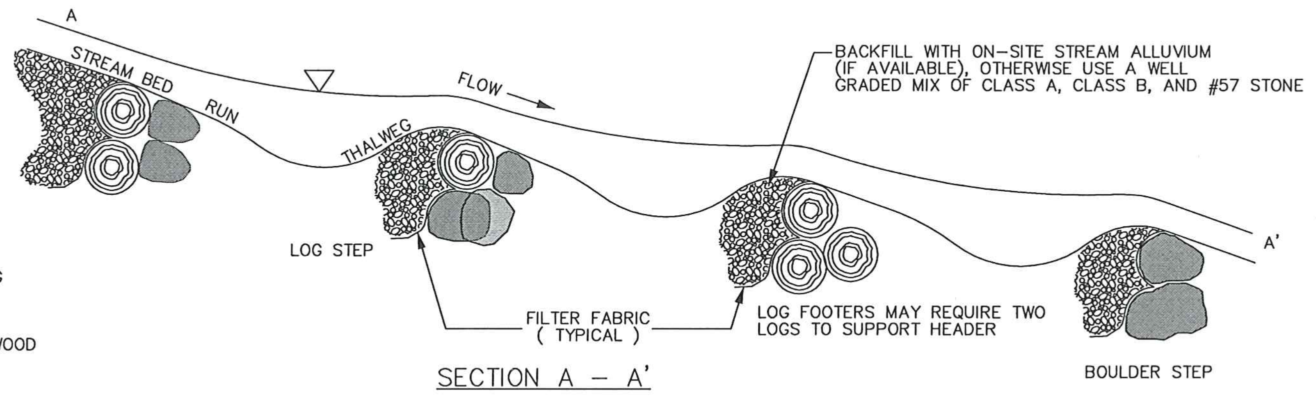
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



PLAN VIEW

PROTECT BANK TYPICALLY USING ONE OR MORE OF THESE:
- STONE: BOULDERS, CLASS 1, CLASS 2,
- WOOD: ROOT WADS OR TOE WOOD
- BIOENGINEERING: BRUSH MATTRESS, TRANSPLANTS

OR OTHER AS SPECIFIED IN PLANS

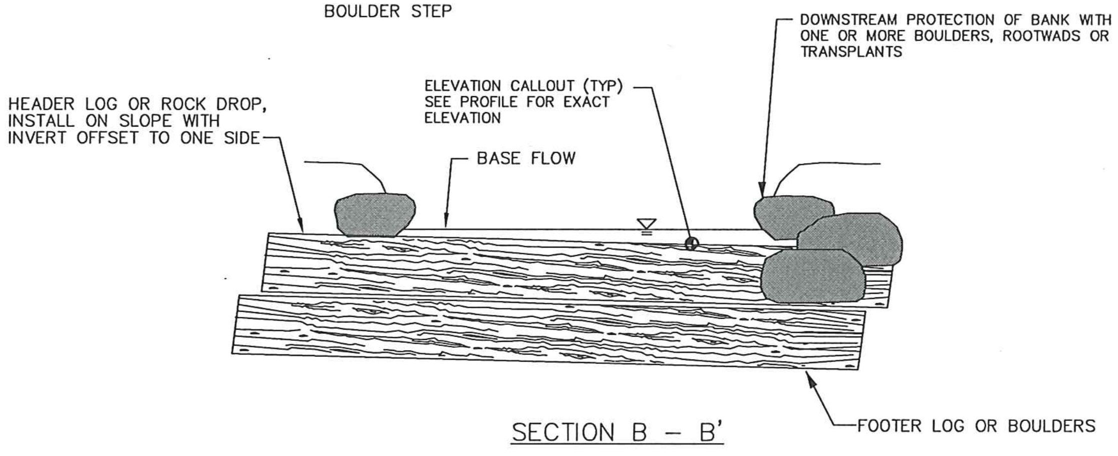


SECTION A – A'

NOTES:
1. LOGS SHOULD BE RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED AND EXTENTING INTO THE BANK ON EACH SIDE AT MINIMUM DISTANCE SPECIFIED BELOW.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
3. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
4. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
5. TRANSPLANTS CAN BE USED INSTEAD OF BOULDERS WITH ENGINEER'S APPROVAL.

MARTIN PROJECT SPECIFIC SPECS

MINIMUM BOULDER SIZE 2.5x1.5x1 FT
MINIMUM LOG DIAMETER 10 IN
MINIMUM LOG EXTEND INTO BANKS 3 FT
AVERAGE CHANNEL BOTTOM WIDTH 5 FT (LESS FOR SMALLER TRIBS, ~3 FT)
APPROXIMATE LOG LENGTHS 11+ FT

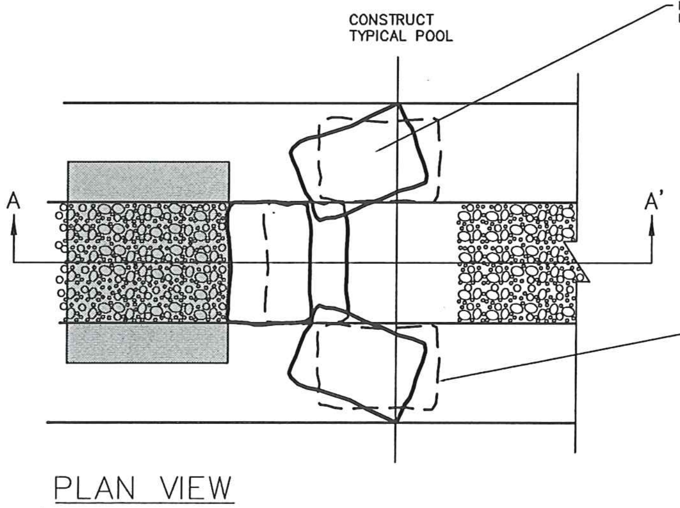


SECTION B – B'

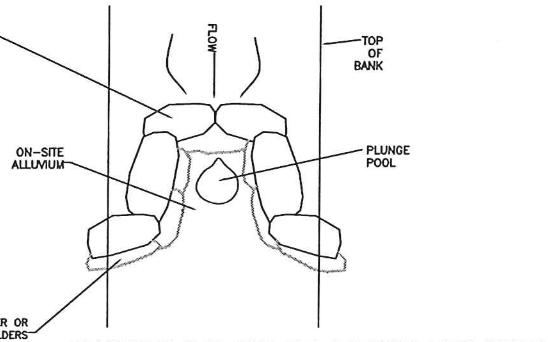
LOG/ROCK DROP SEQUENCE

1
30

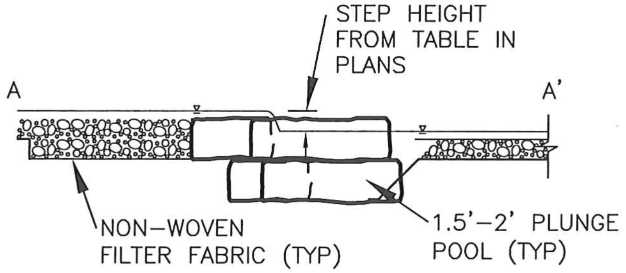
NOT TO SCALE



PLAN VIEW



ALTERNATIVE PLAN VIEW: TWO BOULDERS FORM INVERT



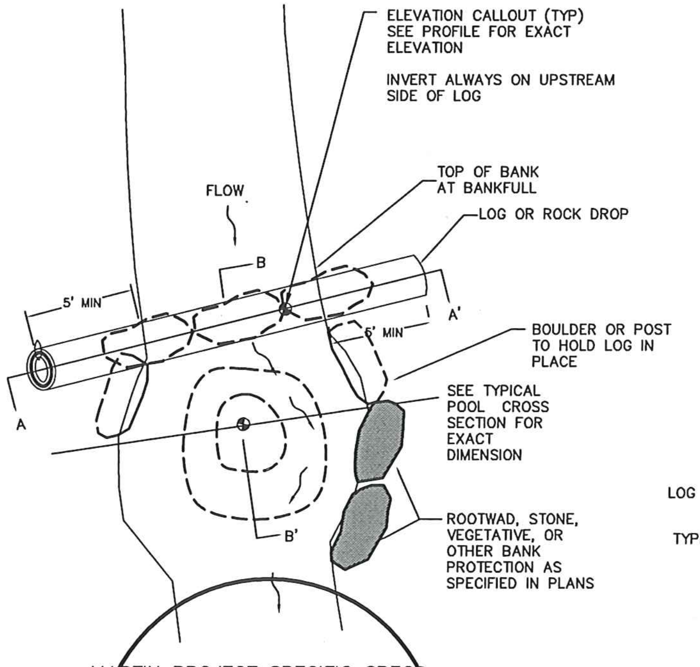
LEGEND:

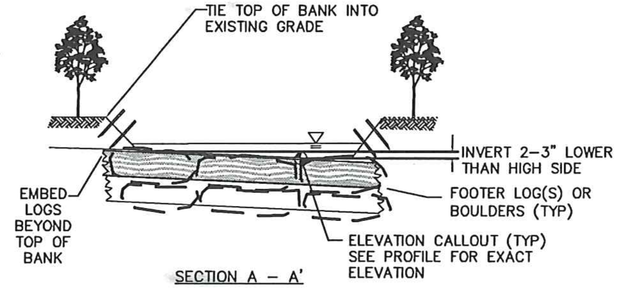
▽	APPROXIMATE LEVEL OF BASEFLOW WATER SURFACE
—	CHANNEL THALWEG / CONTROL LINE
⁂	CHANNEL BED MATERIAL
▩	CHANNEL SEDIMENT
▨	UNDISTURBED IN-SITU SOIL
■	NON-WOVEN FILTER FABRIC
▢	BOULDER: 2'x1.5'x1' to 3'x3'x2

BOULDER STEP

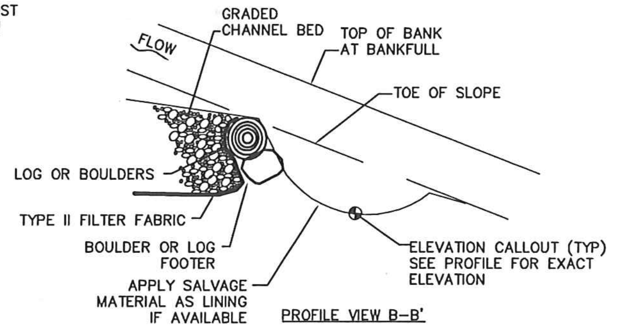
2
30

NOT TO SCALE





SECTION A – A'



PROFILE VIEW B-B'

MARTIN PROJECT SPECIFIC SPECS

MINIMUM BOULDER SIZE 2.5x1.5x1 FT
MINIMUM LOG DIAMETER 10 IN
MINIMUM LOG EXTEND INTO BANKS 3 FT
AVERAGE CHANNEL BOTTOM WIDTH 5 FT (LESS FOR SMALLER TRIBS, ~3 FT)
APPROXIMATE LOG LENGTHS 11+ FT

NOTES
1. LOGS SHALL BE AT LEAST 10 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. TOP OF LOG SHALL BE SET AT SAME ELEVATION AS THE STREAMBED.
3. FILTER FABRIC SHALL BE NAILED USING 3" 10d GALVANIZED COMMON NAIL AT TWO-FOOT SPACING ALONG THE LOG.
4. SEE LOG OR ROCK SEQUENCE DETAIL FOR MULTIPLE CONSECUTIVE DROPS
4. INVERT IS OFFCENTERED BECAUSE LOG OR STONES SLOPE TO PUSH WATER TO ONE SIDE OF THE CHANNEL, THAT SIDE IS THEN PROTECTED ON THE DOWNSTREAM OF THE STRUCTURE TO ABSORB THE ADDITIONAL FLOW

LOG OR ROCK DROP

3
30

NOT TO SCALE

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

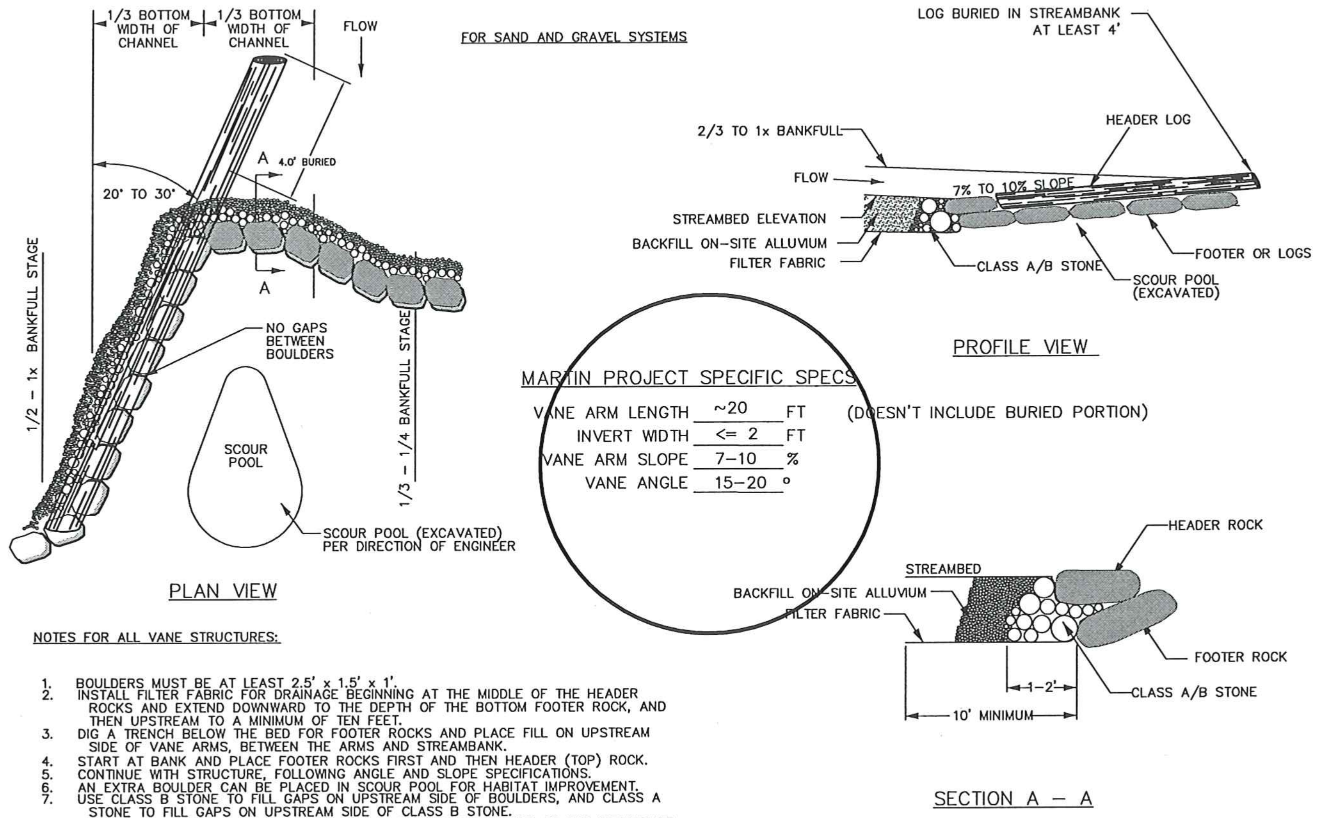
Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
DETAILS

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No. 114412
Date: 6/15/2010
File Name Details.dwg
DESIGNED: DH
DRAWN: MR
APPROVED: JM
Drawing No. 31 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



MARTIN PROJECT SPECIFIC SPECS

VANE ARM LENGTH ~20 FT (DOESN'T INCLUDE BURIED PORTION)
INVERT WIDTH <= 2 FT
VANE ARM SLOPE 7–10 %
VANE ANGLE 15–20 °

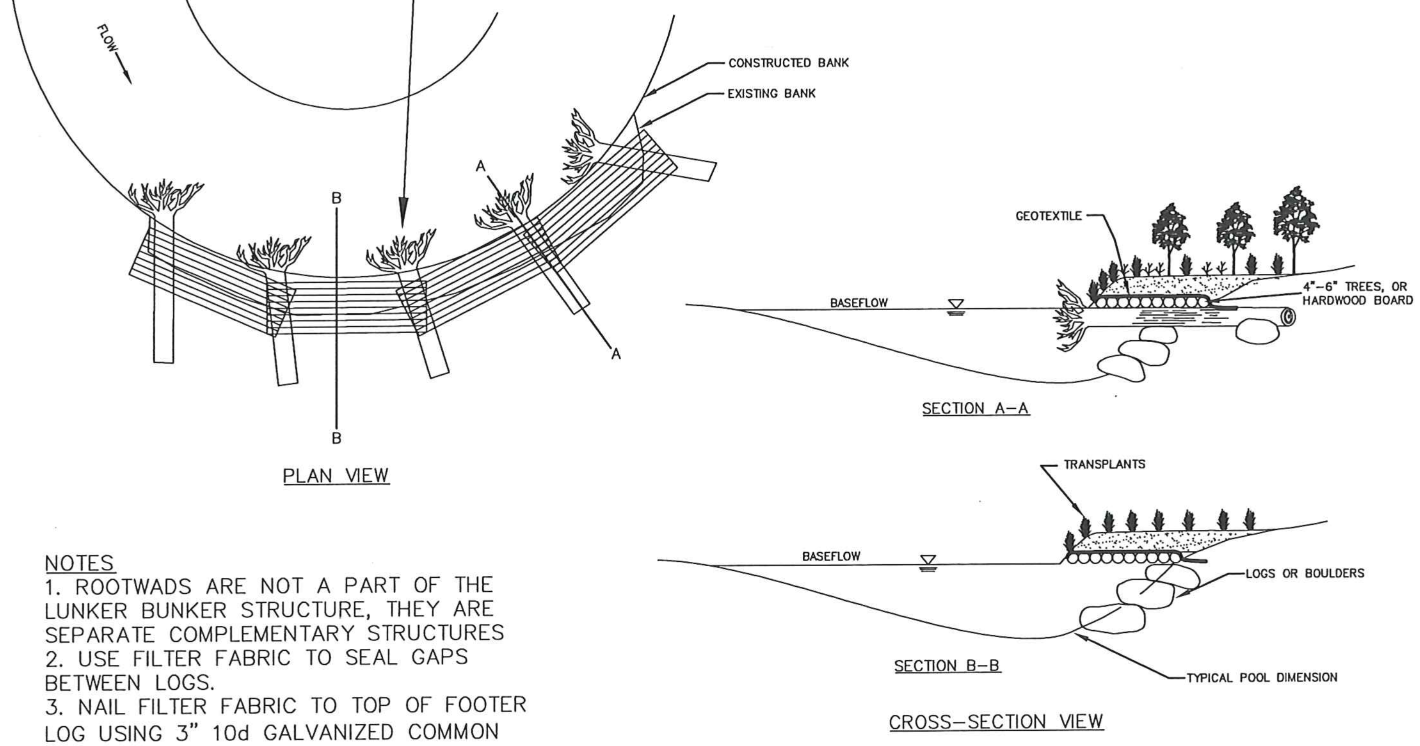
NOTES FOR ALL VANE STRUCTURES:

1. BOULDERS MUST BE AT LEAST 2.5' x 1.5' x 1'.
2. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARMS, BETWEEN THE ARMS AND STREAMBANK.
4. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
5. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. AN EXTRA BOULDER CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
7. USE CLASS B STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS, AND CLASS A STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS B STONE.
8. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

1/31 GRADE CONTROL J–HOOK COMBO VANE

NOT TO SCALE

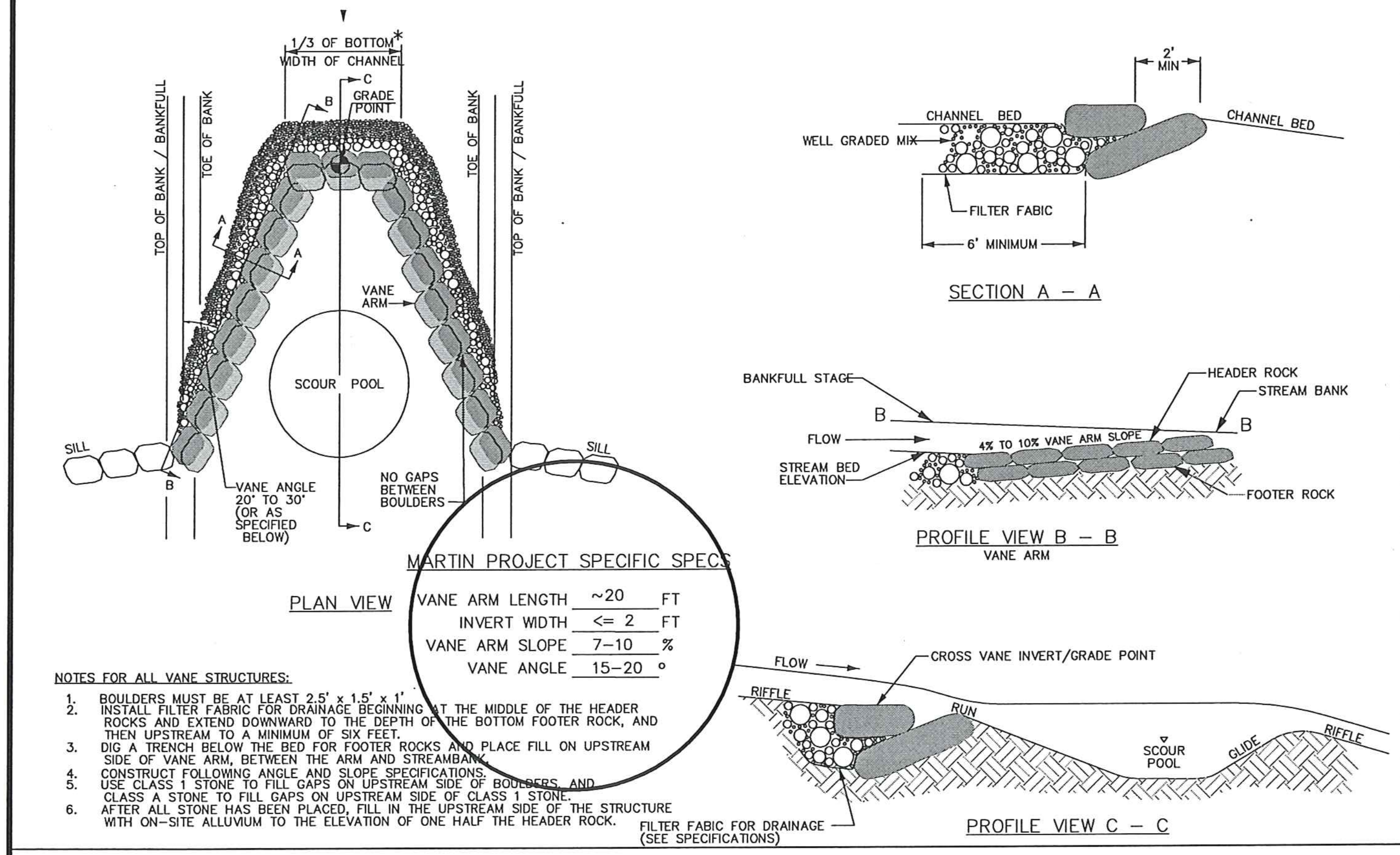
COVER LOGS OR ROOTWADS TO BE BID AND INSTALLED PER THEIR RELATIVE DETAILS AS A SEPARATE STRUCTURE COMPONENT AND LOCATED WHERE SPECIFIED BY THEIR RESPECTIVE SYMBOLS IN THE PLANS



NOTES
1. ROOTWADS ARE NOT A PART OF THE LUNKER BUNKER STRUCTURE, THEY ARE SEPARATE COMPLEMENTARY STRUCTURES
2. USE FILTER FABRIC TO SEAL GAPS BETWEEN LOGS.
3. NAIL FILTER FABRIC TO TOP OF FOOTER LOG USING 3" 10d GALVANIZED COMMON NAIL ON 2' SPACING ALONG LOG.

2/31 LUNKER BUNKER

NOT TO SCALE



MARTIN PROJECT SPECIFIC SPECS

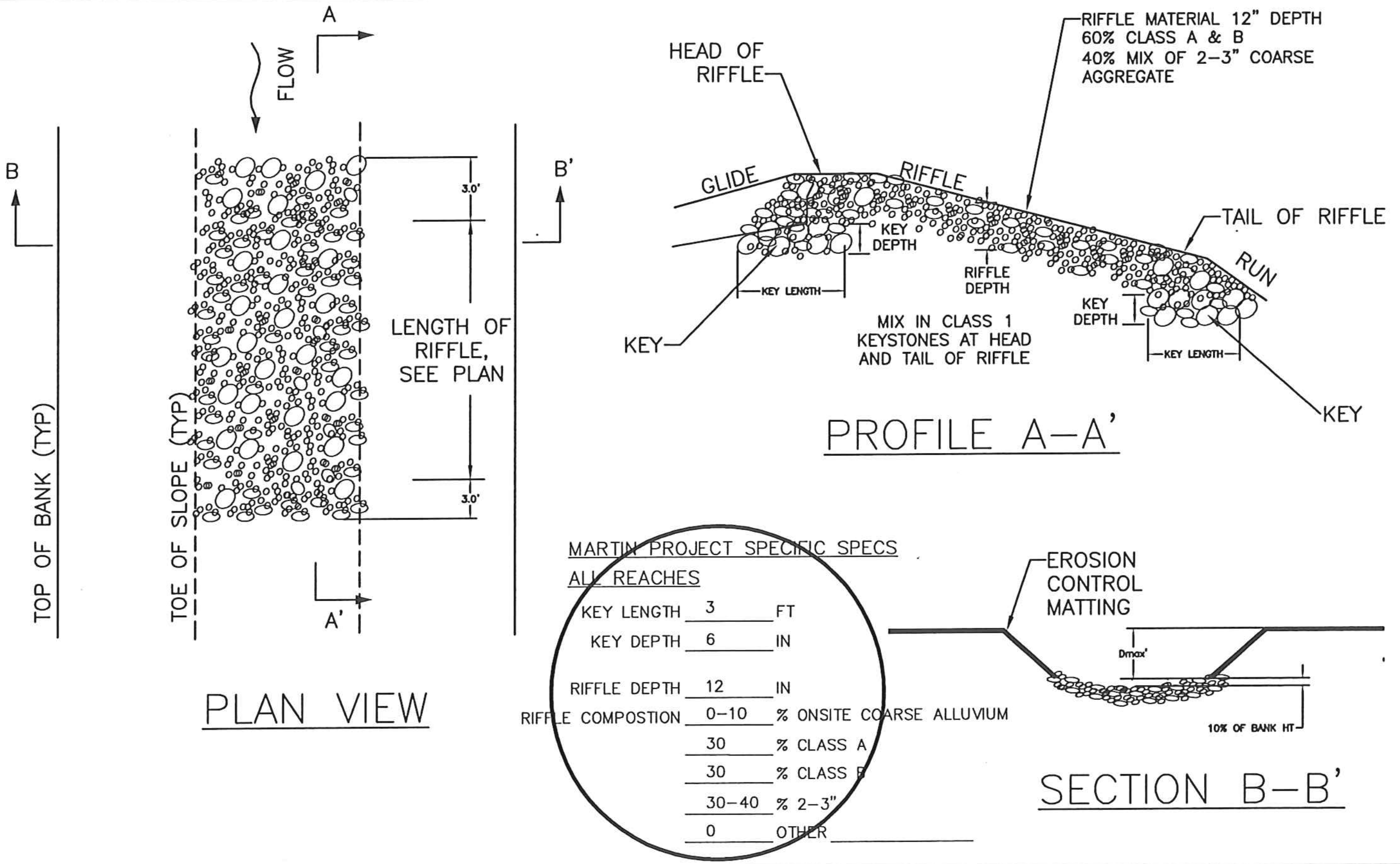
VANE ARM LENGTH ~20 FT
INVERT WIDTH <= 2 FT
VANE ARM SLOPE 7–10 %
VANE ANGLE 15–20 °

NOTES FOR ALL VANE STRUCTURES:

1. BOULDERS MUST BE AT LEAST 2.5' x 1.5' x 1'
2. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
4. CONSTRUCT FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
5. USE CLASS 1 STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS, AND CLASS A STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS 1 STONE.
6. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF ONE HALF THE HEADER ROCK.

3/31 ROCK CROSS VANE

NOT TO SCALE



MARTIN PROJECT SPECIFIC SPECS
ALL REACHES

KEY LENGTH 3 FT
KEY DEPTH 6 IN

RIFFLE DEPTH 12 IN
RIFFLE COMPOSTION 0–10 % ONSITE COARSE ALLUVIUM
30 % CLASS A
30 % CLASS B
30–40 % 2–3"
0 OTHER

4/31 CONSTRUCTED RIFFLE

NOT TO SCALE

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
DETAILS

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

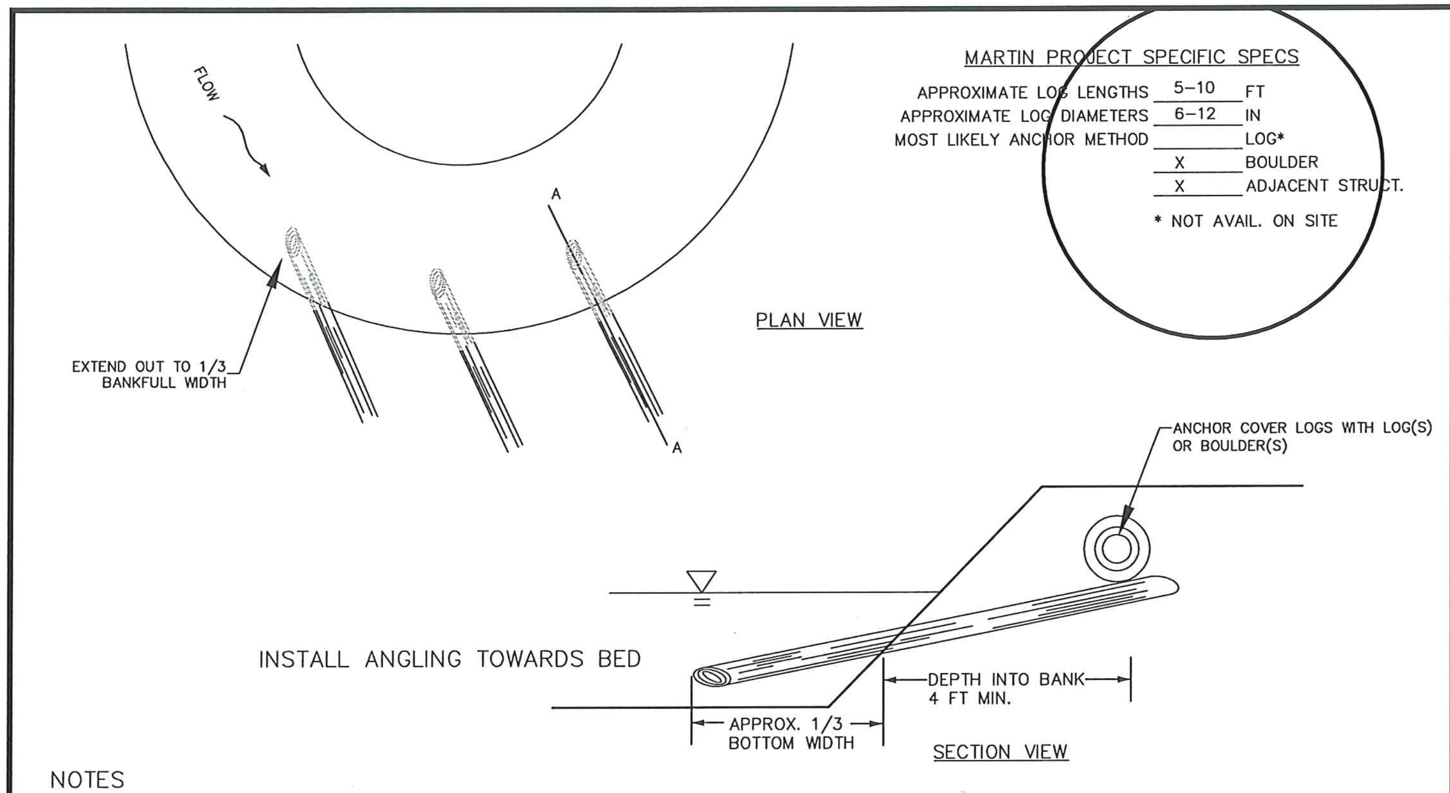
Project No.
114412

Date:
6/15/2010

File Name
Details.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
32 of 34



MARTIN PROJECT SPECIFIC SPECS

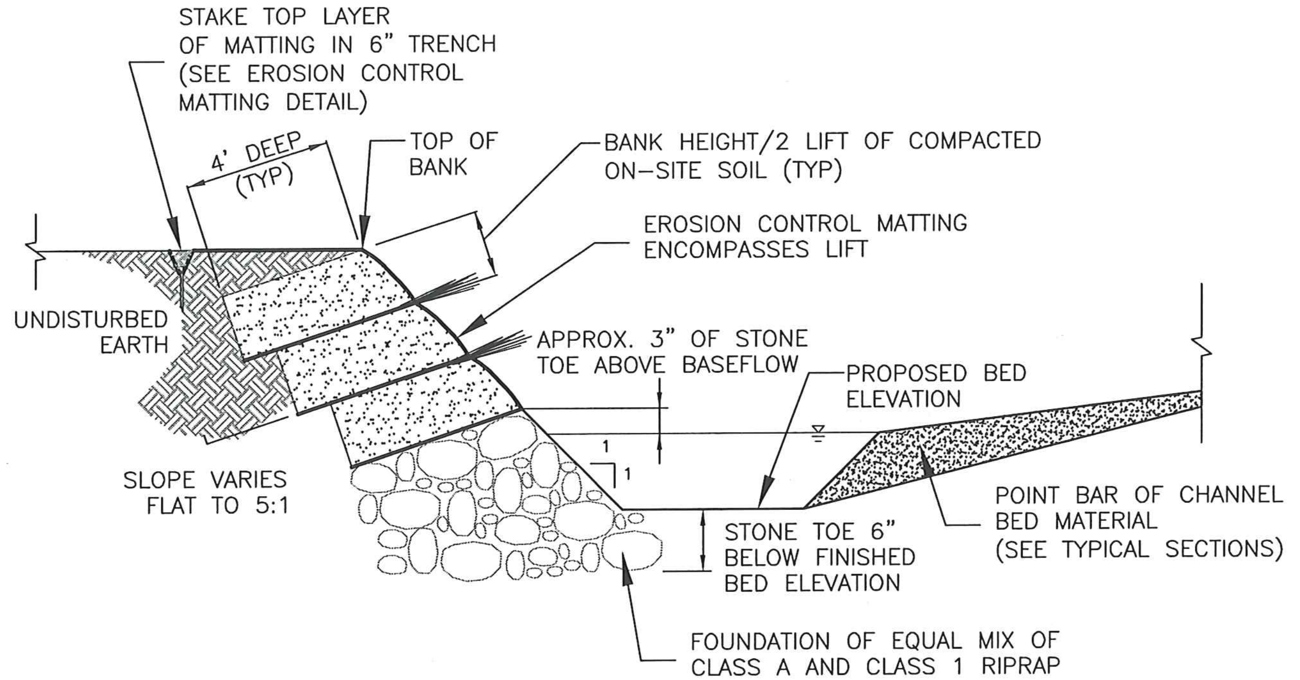
APPROXIMATE LOG LENGTHS	5–10	FT
APPROXIMATE LOG DIAMETERS	6–12	IN
MOST LIKELY ANCHOR METHOD		LOG*
	X	BOULDER
	X	ADJACENT STRUCT.

* NOT AVAIL. ON SITE

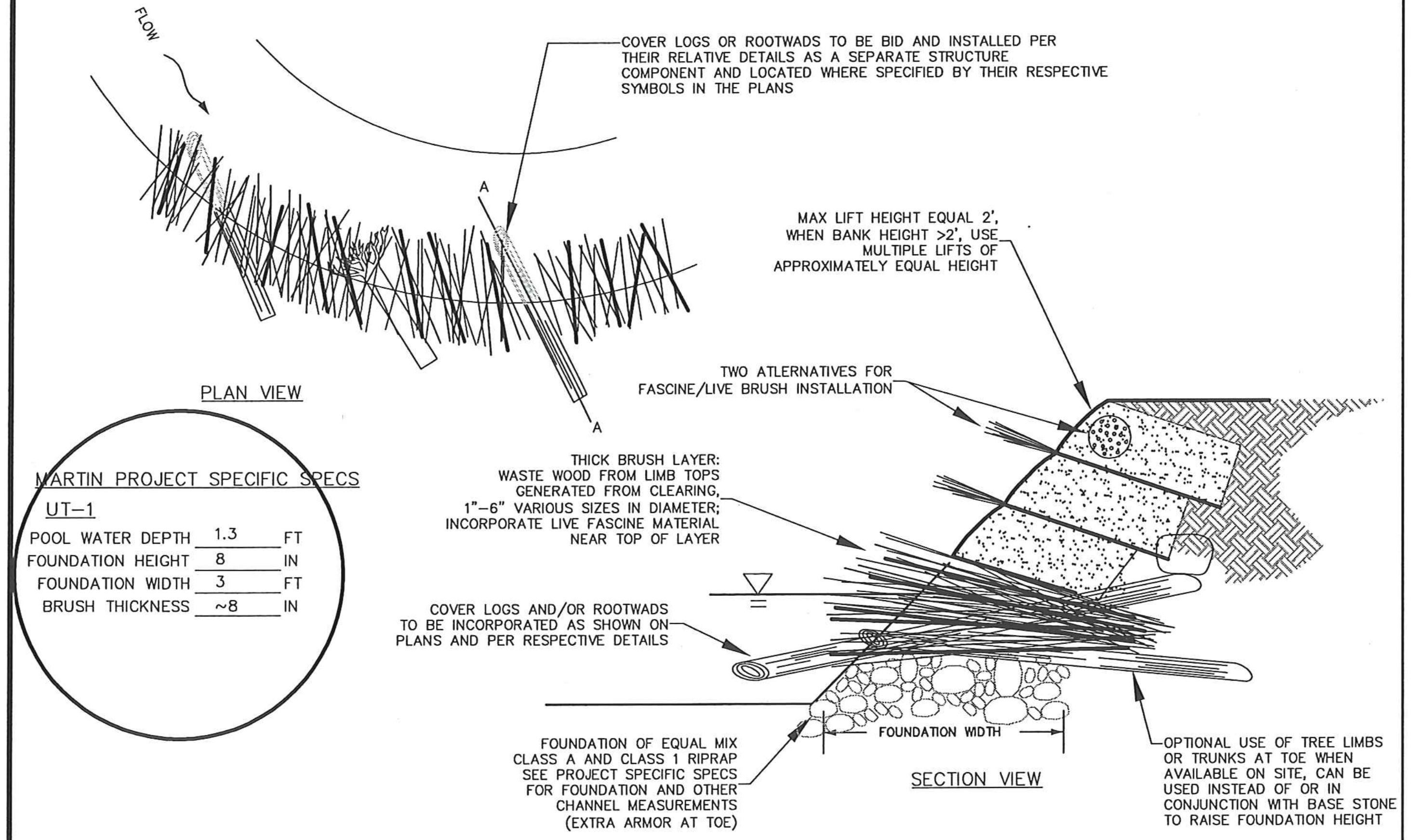
NOTES
1. INSTALL BELOW THE LOW FLOW WATER SURFACE
2. WHEN APPLICABLE, USE ADJACENT STRUCTURE ELEMENTS (I.E. ROOTWAD OR VANE) TO ANCHOR COVER LOG

1/32
COVER LOG
NOT TO SCALE

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



2/32
VEGETATED GEOLIFT
NOT TO SCALE



MARTIN PROJECT SPECIFIC SPECS
UT-1

POOL WATER DEPTH	1.3	FT
FOUNDATION HEIGHT	8	IN
FOUNDATION WIDTH	3	FT
BRUSH THICKNESS	~8	IN

3/32
TOE WOOD
NOT TO SCALE

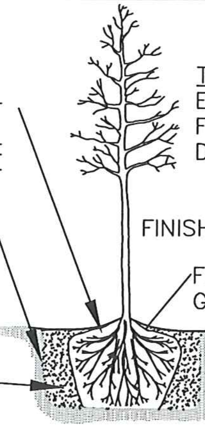
Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
DETAILS

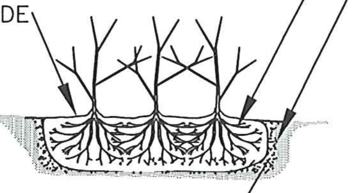
Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No. 114412
Date: 6/15/2010
File Name Details.dwg
DESIGNED: DH
DRAWN: MR
APPROVED: JM
Drawing No. 33 of 34



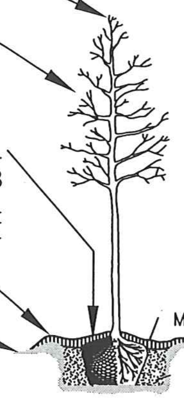
SINGLE TRANSPLANT

TRANSPLANT NOTE:
EXCAVATE TRANSPLANTS USING A FRONT END LOADER OR TRACKHOE, DEPENDING ON ROOT DEPTH



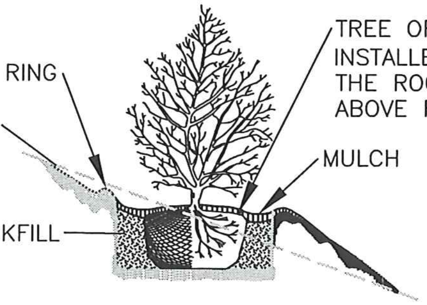
TRANSPLANT CLUSTER

GROUND COVER TRANSPLANT



CONTAINERIZED PLANTING

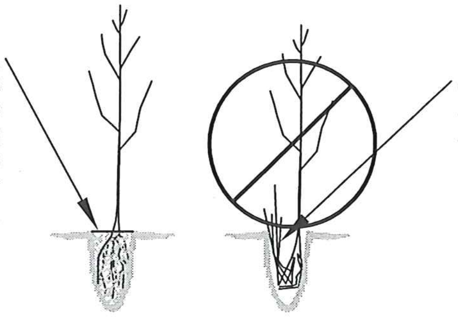
GROUND LEVEL



CONTAINERIZED PLANTING

SLOPING GROUND

CONTAINERIZED PLATING NOTES:
1. WHEN PREPARING THE HOLE FOR A CONTAINERIZED PLANT, EXCAVATE THE HOLE 8 –12 INCHES LARGER THAN THE DIAMETER OF THE POT AND THE SAME DEPTH AS THE POT.
2. REMOVE THE PLANT FROM THE POT. LAY THE PLANT ON ITS SIDE IF NECESSARY TO REMOVE THE POT.
3. IF THE PLANT IS ROOTBOUND (ROOTS GROWING IN A SPIRAL AROUND THE ROOT BALL), MAKE VERTICAL CUTS WITH A KNIFE OR SPADE JUST DEEP ENOUGH TO CUT THE NET OF ROOTS. ALSO MAKE A CRISS-CROSS CUT ACROSS THE BOTTOM OF THE BALL.
4. PLACE THE PLANT IN THE HOLE.
5. FILL HALF OF THE HOLE WITH SOIL (SAME SOIL REMOVED FOR BACKFILL).
6. WATER THE SOIL TO REMOVE AIR POCKETS AND FILL THE REST OF THE HOLE WITH THE REMAINING SOIL.



BARE ROOT TREE PLANTING

PRUNING CUTS

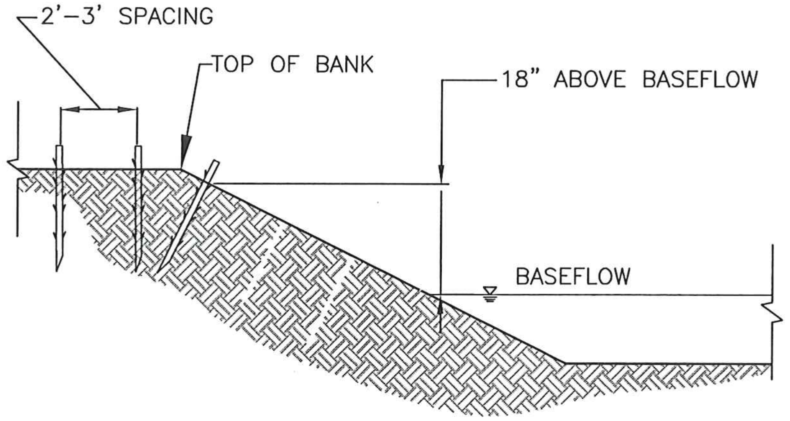
GENERAL NOTES:
1. KEEP ROOTS MOIST WHILE DISTRIBUTING OR WAITING TO PLANT BY MEANS OF WET CANVAS, BURLAP, OR STRAW.
2. HEEL-IN PLANTS IN MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL TO PROJECT SITE.
3. PRUNE ANY BROKEN LIMBS AND TREAT TORN BARK WITH TREE WOUND DRESSING.
4. EVERY EFFORT SHOULD BE MADE TO KEEP SOIL EXCAVATED FOR PLANTING FROM ENTERING STREAM. ACCIDENTAL FILL SHOULD BE REMOVED IMMEDIATELY

1/33 TREE & SHRUB PLANTING

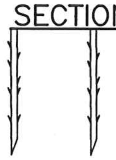
NOT TO SCALE

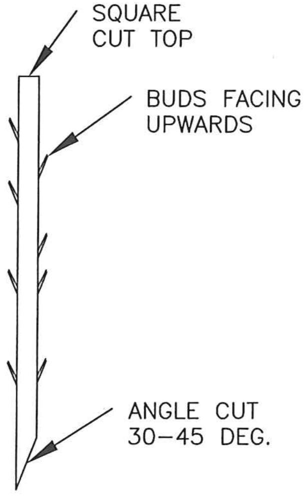
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

NOTES:
1. STAKES SHALL BE CUT AND INSTALLED ON THE SAME DAY
2. STAKES THAT HAVE BEEN SPLIT SHALL BE REJECTED AND NOT USED FOR CONSTRUCTION
3. STAKES SHALL BE INSTALLED WITH BUDS POINTING UPWARD
4. STAKES SHALL BE INSTALLED PERPENDICULAR TO BANK
5. STAKES SHALL BE 1/2 TO 2 INCHES IN DIAMETER AND 2 TO 3 FT LONG
6. STAKES SHALL BE INSTALLED WITH 1/3 TO 1/5 OF STAKE REMAINING ABOVE GROUND

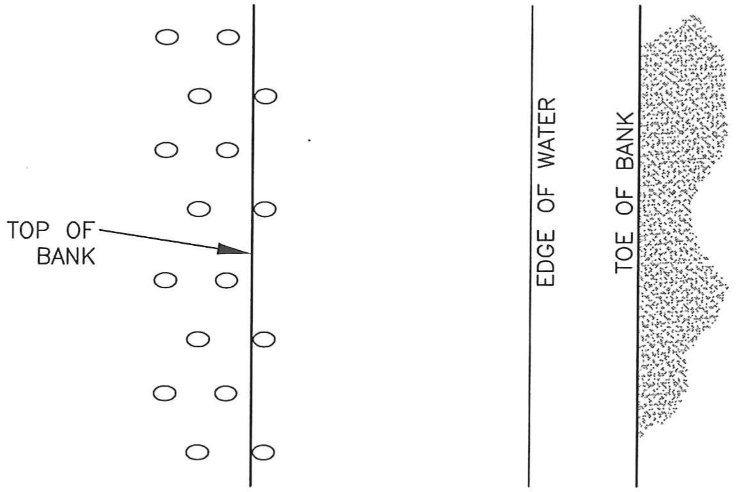


SECTION VIEW





LIVE STAKE DETAIL



PLAN VIEW

2/33 LIVE STAKING

NOT TO SCALE

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

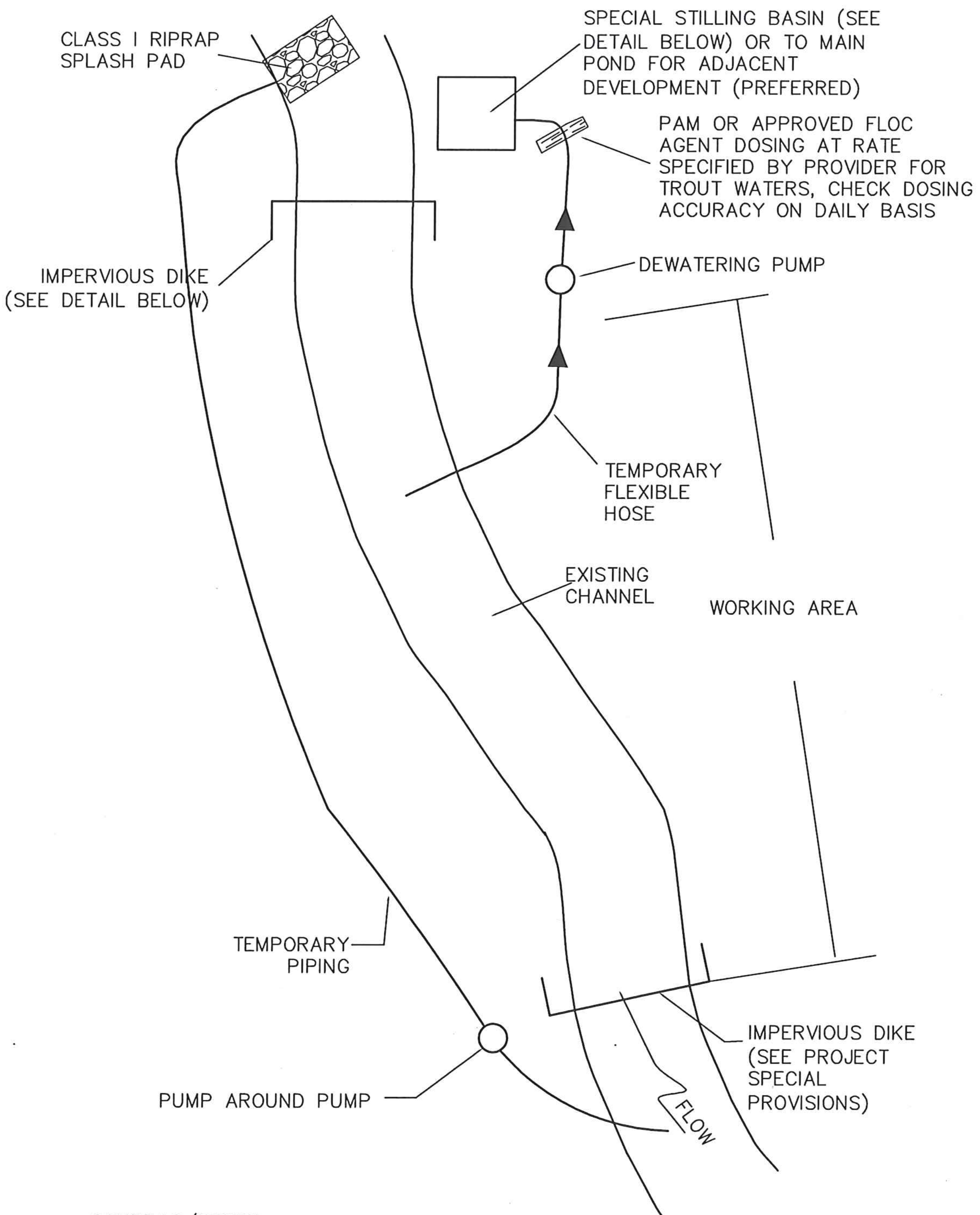
Baker

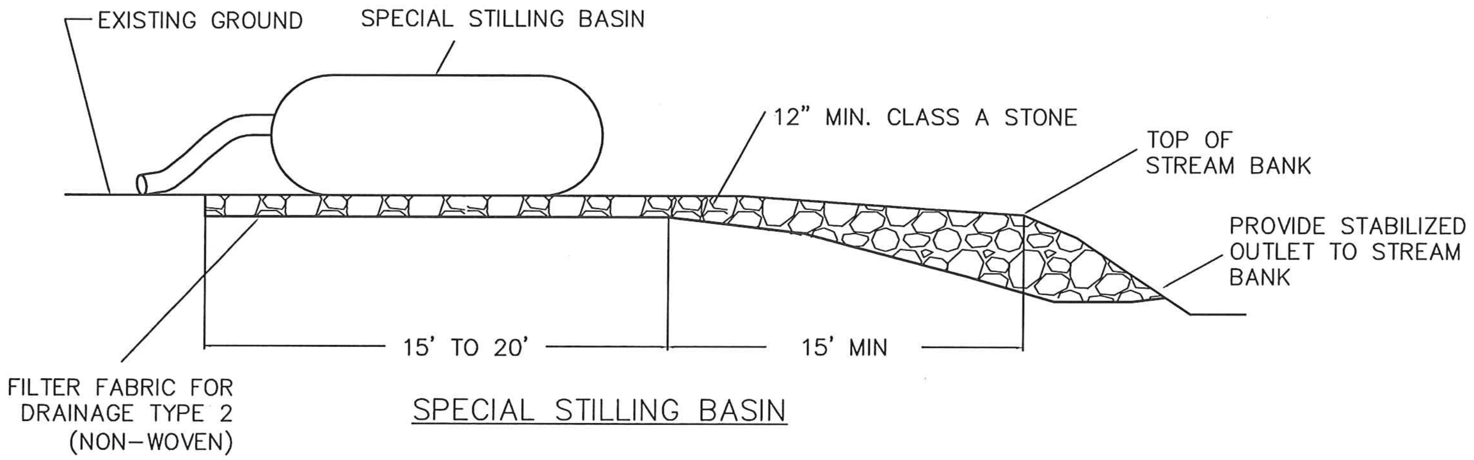
MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
DETAILS

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No. 114412
Date: 6/15/2010
File Name Details.dwg
DESIGNED: DH
DRAWN: MR
APPROVED: JM
Drawing No. 34 of 34

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION





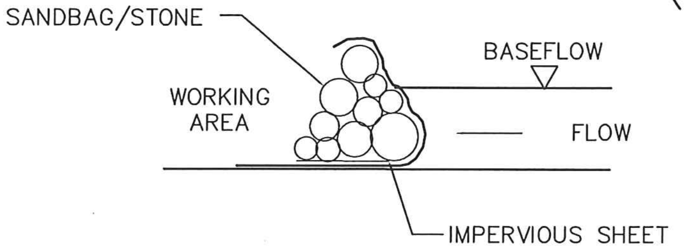
SPECIAL STILLING BASIN

SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP AROUND

1. INSTALL SPECIAL STILLING BASINS AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR WILL INSTALL THE PUMP AROUND AND THE TEMPORARY PIPING THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK SITE.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS IF NEEDED TO DEWATER THE ENTRAPPED AREA. THE PUMP AND HOSE FOR THIS PURPOSE SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. THIS WATER WILL FLOW INTO A SPECIAL STILLING BASIN.
5. THE CONTRACTOR WILL PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLAN AND FOLLOWING THE GENERAL CONSTRUCTION SEQUENCE.
6. THE CONTRACTOR WILL EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE/PIPING STARTING WITH THE DOWNSTREAM DIKE FIRST.
7. ONCE THE WORKING AREA IS COMPLETED, REMOVE THE STILLING BASINS AND STABILIZE DISTURBED AREAS WITH SEED AND MULCH.

NOTES:

1. EXCAVATION SHALL BE PERFORMED IN ONLY DRY SECTIONS OF CHANNEL.
2. IMPERVIOUS DIKES SHOULD BE USED TO ISOLATE WORK AREAS FROM STREAM FLOW.
3. THE CONTRACTOR SHALL NOT DISTURB MORE AREA THAN CAN BE STABILIZED IN ONE WORKING DAY.
4. THE PUMP AROUND PUMP SHOULD ADEQUATELY CONVEY 3 CFS FOR MAINSTEM.
5. PROVIDE STABILZED OUTLET TO STREAM BANK.



IMPERVIOUS DIKE

1
34

PUMP AROUND OPERATION

NOT TO SCALE

Michael Baker Engineering Inc.
NC Engineering License F-1084
797 Haywood Road, Suite 201
Asheville, North Carolina 28806
Phone: 828.350.1408
Fax: 828.350.1409

Baker

MARTIN'S CREEK II STREAM & WETLAND
RESTORATION PROJECT
CHEROKEE COUNTY, NORTH CAROLINA
DETAILS

Prepared for:
Ecosystem Enhancement Program
2728 Capitol Blvd., Suite 1H 103
Raleigh, NC 27604
Phone: 919-715-0476
Fax: 919-715-2219

Project No.
114412

Date:
6/15/2010

File Name
Details.dwg

DESIGNED: DH
DRAWN: MR
APPROVED: JM

Drawing No.
35 of 34