MITIGATION PLAN
HERMAN DAIRY
STREAM AND WETLAND RESTORATION SITE
Alexander County, North Carolina
Full Delivery Contract No. 003271

Catawba River Basin
Cataloging Unit and Targeted Local Watershed
03050101120030

Prepared for:

NCDENR-Ecosystem Enhancement Program
2728 Capital Boulevard, Suite 1H 103
Raleigh, North Carolina 27604

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February 2011

EXECUTIVE SUMMARY

The Herman Dairy Stream and Wetland Mitigation Site (Site) is located approximately 1.5 miles northwest of Taylorsville, in central Alexander County within 14-digit Cataloging Unit and Targeted Local Watershed 03050101120030 of the Catawba River Basin. The Site encompasses approximately 32 acres of agricultural land used for row crop production and the spray application of sludge from a lagoon associated with a dairy cattle operation. The Site was identified to assist the North Carolina Ecosystem Enhancement Program (NCEEP) in meeting its stream and wetland restoration goals.

This document details planned stream and wetland restoration activities. The Site is encompassed within one parcel owned by the Herman Family. The Site is situated in the floodplain of Muddy Fork encompassing portions of three unnamed tributaries to Muddy Fork. The Site has been cleared of native forest vegetation, streams have been relocated, ditched, and straightened, and groundwater hydrology has been lowered due to entrenchment of Site streams. Based on preliminary analyses, the Site is best suited for the removal of agricultural practices, restoration and enhancement of Site streams, restoration of groundwater hydrology to drained riparian and nonriparian hydric soils by restoring streams to the historic floodplain elevations and filling ditches, and revegetation with native, forest communities.

This project is located within a Targeted Local Watershed that has been identified for of stream and buffer restoration opportunities (NCEEP 2009). Existing Site streams are impaired as indicated by declines in fish and benthic bioclassification scores resulting from degraded or nonexistent buffers and sediment inputs from unstable streambanks, in-stream sediment mining, and agricultural practices (NCEEP 2009, NCDWQ 2010a).

The primary goals of this stream and wetland restoration project focus on improving water quality, enhancing flood attenuation, and restoring wildlife habitat and will be accomplished by the following.

1. Removing nonpoint sources of pollution associated with agricultural production including a) cessation of broadcasting sludge, fertilizer, pesticides, and other agricultural materials into and adjacent to Site streams/wetlands and b) restoration of a forested riparian buffer adjacent to streams and wetlands to treat surface runoff.
2. Reducing sedimentation within onsite and downstream receiving waters through a) reduction of bank erosion, vegetation maintenance, and plowing to Site streams and wetlands and b) restoration of a forested riparian buffer adjacent to Site streams and wetlands.
3. Reestablishing stream stability and the capacity to transport watershed flows and sediment loads by restoring stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
4. Promoting floodwater attenuation by a) reconnecting bankfull stream flows to the abandoned floodplain, b) restoring secondary, entrenched tributaries thereby reducing floodwater velocities within smaller catchment basins, c) restoring depressional floodplain wetlands to increase the floodwater storage capacity within the Site, and d)

revegetating Site floodplains to increase frictional resistance on floodwaters crossing Site floodplains.

5. Improving aquatic habitat by enhancing stream bed variability and the use of in-stream structures.
6. Providing a terrestrial wildlife corridor and refuge in an area extensively developed for agricultural production.
7. Restoring and reestablishing natural community structure, habitat diversity, and functional continuity.
8. Enhancing and protecting the Site's full potential of stream and wetland functions and values in perpetuity.

These goals will be achieved by the following.

- Restoring approximately 4686 linear feet of stream channel through construction of stable channel at the historic floodplain elevation.
- Restoring approximately 110 linear feet of braided stream channel by redirecting diffuse flow across riparian wetlands.
- Enhancing (Level I) approximately 468 linear feet of stream channel through cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
- Restoring approximately 7.2 acres of riparian wetland by removing spoil castings, restoring stream inverts to historic elevations to rehydrate stream-side wetlands, filling ditches and abandoned channels, eliminating land use practices, and planting with native forest vegetation.
- Enhancing approximately 2.2 acres of riparian wetland by filling ditches/abandoned channels and supplemental planting.
- Restoring approximately 1.2 acres of nonriparian wetland by removing spoil castings, filling abandoned ditches to rehydrate slope wetlands, eliminating land use practices, and planting with native forest vegetation.
- Enhancing approximately 0.1 acres of riparian wetland through supplemental plantings.
- Revegetating floodplains and slopes adjacent to restored streams and wetlands.
- Protecting the Site in perpetuity with a conservation easement.

This mitigation plan has been written in conformance with the requirements of the following documents, which govern NCEEP operations and procedures for the delivery of compensatory mitigation.

- 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).
- NCDENR Ecosystem Enhancement Program In-Lieu Fee Instrument signed and dated July 28, 2010.

This document represents a detailed restoration plan summarizing activities proposed for the Site. The plan includes 1) descriptions of existing conditions; 2) reference stream, wetland, and forest studies; 3) restoration plans; and 4) monitoring and success criteria. Upon approval of this plan by the NCEEP, engineering construction plans will be prepared and activities implemented as outlined. Proposed restoration activities may be modified during the design stage to address constraints such as access issues, sediment-erosion control measures, drainage needs (floodway constraints), or other design considerations.

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APPENDICES

1.0 PROJECT SITE IDENTIFICATION AND LOCATION

The Herman Dairy Restoration Site (Site) is located approximately 1.5 miles northwest of Taylorsville, in central Alexander County (Figure 1, Appendix A). The Site is situated northeast of Three Forks Church Road on the north bank of Muddy Fork.

This document details planned stream and wetland restoration activities at the Site. A 32-acre conservation easement will be placed on the Site to incorporate all mitigation activities. The Site contains 10.6 acres of hydric soil, three unnamed tributaries (UTs) to Muddy Fork, associated floodplains, and upland slopes.

1.1 Directions to Project Site

Directions to the Site from Statesville, North Carolina:

- From Interstate 40 take exit 148 onto NC 64 north, travel ~ 17 miles
- Turn north (right) on NC 16 (towards Taylorsville), travel ~ 1 mile
- Turn west (left) on NC 90, travel ~ 1.5 miles
- Turn right on Three Forks Ch. Road, travel ~2 miles
- Site is on right
    - Site Latitude, Longitude at access from Three Forks Church Road 35.931617ºN, 81.206949ºW (NAD83/WGS84)

1.2 USGS Hydrologic Unit Code and NCDWQ River Basin Designation

The Site is located within the Catawba River Basin in 14-digit United States Geological Survey (USGS) Cataloging Unit and Targeted Local Watershed 03050101120030 of the South Atlantic/Gulf Region (North Carolina Division of Water Quality [NCDWQ] subbasin number 03-08-32) [Figure 2, Appendix A]). The Site is located on tributaries to Muddy Fork, which has been assigned Stream Index Number 11-69-4.

1.3 Project Components and Structure

Proposed Site restoration activities include the construction of meandering, E/C-type stream channel resulting in 4686 linear feet of Priority I stream restoration, 110 linear feet of braided stream restoration, 468 linear feet of stream enhancement (Level I), 7.2 acres of riparian wetland restoration, 1.2 acres of nonriparian wetland restoration, 2.2 acres of riparian wetland enhancement, and 0.1 acres of nonriparian wetland enhancement (Table 1).

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

Table 1. Project Components and Mitigation Credits
Herman Dairy Restoration Site

Mitigation Credits					
Stream		Riparian Wetland		Nonriparian Wetland	
Restoration	Restoration Equivalent	Restoration	Restoration Equivalent	Restoration	Restoration Equivalent
4796	312	7.2	1.1	1.2	0.05

Projects Components

Station Range	Existing Linear Footage/ Acreage	Priority Approach	Restoration/ Restoration Equivalent	Restoration Linear Footage/ Acreage	Mitigation Ratio	Comment
--	4540	I	Restoration	4686	1:1	Priority I stream restoration through construction of stable channel at the historic floodplain elevation.
--		--	Restoration	110	1:1	Braided stream restoration by redirecting diffuse flow across riparian wetlands.
--	468	Level I	Enhancement	468	1.5:1	Level I stream enhancement through cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
--	0	--	Restoration	7.2	1:1	Restoration of riparian wetlands within the floodplain as the result of stream restoration activities, filling abandoned channels and ditches, removing spoil castings, and planting with native forest vegetation.
--	2.2	--	Enhancement	2.2	2:1	Enhancement of existing riparian wetlands characterized by disturbed pasture by planting with native forest vegetation.
--	0	--	Restoration	1.2	1:1	Restoration of nonriparian wetlands by removing spoil castings, filling abandoned ditches to rehydrate hydric soils along the slope, eliminating land use practices, and planting with native forest vegetation.
--	0.1	--	Enhancement	0.1	2:1	Enhancement of existing nonriparian wetlands characterized by disturbed pasture by planting with native forest vegetation.

Component Summation

Restoration Level	Stream (linear footage)	Riparian Wetland (acreage)	Nonriparian Wetland (acreage)
Restoration	4796	7.2	1.2
Enhancement (Level 1)	468	--	--
Enhancement	--	2.2	0.1
Totals	**5264**	**9.4**	**1.3**
Mitigation Units	**5108 SMUs**	**8.3 Riparian WMUs**	**1.3 Nonriparian WMUs**

Table 2. Project Activity and Reporting History
Herman Dairy Restoration Site

Activity or Deliverable	**Data Collection Complete**	**Completion or Delivery**
Technical Proposal (RFP No. 16-002830)	--	March 2010
EEP Contract No. 003271	--	July 23, 2010
Restoration Plan	--	January 2011
Construction Plans	--	---

Table 3. Project Contacts Table
Herman Dairy Restoration Site

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 George Howard and John Preyer 919-755-9490
Designer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Attribute Table
Herman Dairy Restoration Site

Project County	Alexander County, North Carolina		
Physiographic Region	Northern Inner Piedmont		
Ecoregion	Carolina Slate Belt		
Project River Basin	Catawba		
USGS HUC for Project (14 digit)	03050101120030		
NCDWQ Sub-basin for Project	03-08-32		
Identify planning area (LWP, RBRP, other)?	Yes – Upper Catawba River Basin Restoration Priorities 2009		
WRC Class (Warm, Cool, Cold)	Warm		
% of project easement fenced or demarcated	100		
Beaver activity observed during design phase?	Yes		
	Unnamed Tributaries to Muddy Fork		
	UT 1	**UT 2**	**UT 3**
Drainage Area	1.0	0.06	0.04
Stream Order (USGS topo)	2nd	1st	1st
Restored Length (feet)	2156	1684	760
Perennial (P) or Intermittent (I)	P	P	I
Watershed Type	Rural	Rural	Rural
Watershed impervious cover	<5%	<5%	<5%
NCDWQ AU/Index number	11-69-4	11-69-4	11-69-4
NCDWQ Classification	C	C	C
303d listed?	No	No	No
Upstream of a 303d listed	Yes	Yes	Yes
Reasons for 303d listed segment	aquatic life/sediment	aquatic life/sediment	aquatic life/sediment
Total acreage of easement	32	32	32
Total existing vegetated acreage of easement	8	8	8
Total planted restoration acreage	31.5	31.5	31.5
Rosgen Classification of preexisting	Cd5	Fc5/6	Fc5/6
Rosgen Classification of As-built	E/C 4/5	E/C 4/5	E/C 4/5
Valley type	VIII	VIII	VIII
Valley slope	0.0066	0.0052	0.0013
Cowardin classification of proposed	R3UB1/2	R3UB1/2	R4SB3/4
Trout waters designation	NA	NA	NA
Species of concern, endangered etc.	NA	NA	NA
Dominant Soil Series	Codorus/Hatboro	Codorus/Hatboro	Codorus/Hatboro

2.0 WATERSHED CHARACTERIZATION

2.1 Drainage Area

The Herman Dairy Restoration Site drainage area is 708 acres (1.1 square miles) at the Site outfall (Figures 3A-3B, Appendix A). The Site watershed is characterized by agricultural production, narrow riparian corridors, and sparse residential development.

2.2 Surface Water Classification/Water Quality

The Site is located within the Catawba River Basin in 14-digit USGS Cataloging Unit 03050101120030 of the South Atlantic/Gulf Region (NCDWQ subbasin number 03-08-32) (Figure 2, Appendix A). The Site is located on tributaries to Muddy Fork, which has been assigned Stream Index Number 11-69-4, a Best Usage Classification of C, and is Fully Supporting its intended uses (NCDWQ 2010b). Streams classified as C are suitable for aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture. Secondary recreation includes wading, boating, and other uses not involving human body contact with waters on an organized or frequent basis.

Site streams are listed on the NCDWQ final 2010 Section 303(d) list of impaired streams in the state due to declines in the ecological and biological integrity of benthic communities and aquatic life (NCDWQ 2010a).

2.3 Physiography, Geology, and Soils

The Site is located within the Northern Inner Piedmont ecoregion of North Carolina. This ecoregion is characterized by dissected irregular plains, low to high hills, ridges, and isolated monadnocks; low to moderate gradient streams with mostly cobble, gravel, and sandy substrates (Griffith 2002). Onsite elevations are moderately steep with a high of 1100 feet on slopes in the upper extents of the Site and a low of 1080 feet National Geodetic Vertical Datum (NGVD) at the Site outfall (Taylorsville, North Carolina USGS 7.5-minute topographic quadrangle).

The Site is located within the Inner Piedmont Geologic Belt and is underlain primarily by metamorphic bedrock consisting of Mica and Schist. Site soils are primarily alluvium developed from Mica and Schist, and upstream Metamorphosed Granitic Rock. These soils are acidic in nature and greater than 5 feet in depth.

Soils that occur within the Site, according to the *Web Soil Survey* (USDA 2010) are depicted in Figure 4 (Appendix A) and described in Table 5.

Table 5. Site Soils
Herman Dairy Restoration Site

Soil Series	Hydric Status*	Family	Description
Codurus loam	Class B	*Fluvaquentic Dystrodepts*	This series consists of nearly level, somewhat poorly drained soils on floodplains that are frequently flooded. The seasonal high water table occurs at a depth of 0.5-2.0 feet.
Dan River and Comus soils	Class B/ Nonhydric	*Oxyaquic Dystrudepts/ Fluventic Dystrudepts*	This series consists of well-drained, moderately permeable soils on floodplains with 0-4 percent slopes. The seasonal high water table occurs at a depth of more than 2.5-5 feet.
Hatboro loam	Class A	*Fluvaquentic Endoaquepts*	This series consists of nearly level, poorly drained soils in floodplain depressions that are frequently flooded. The seasonal high water table occurs at the surface to a depth of 1 foot.
Pfafftown sandy loam	Nonhydric	*Typic Hapludults*	This series consists of well-drained soils on stream terraces with 2-6 percent slopes. The seasonal high water table occurs at a depth of more than 4 feet.

*Class A = hydric soil; Class B = nonhydric soil that may contain inclusions of hydric soils

2.4 Historical Land Use and Development Trends

The Site watershed is characterized primarily by agriculture with forest land in riparian corridors and upper headwater depressions, and low-density residential development scattered along roadways. Impervious surfaces account for less than 5 percent of the watershed land surface (Figure 3A, Appendix A and Table 6). It is anticipated that land uses will remain constant for the foreseeable future. There are currently no pressures from surrounding cities for development.

Table 6. Watershed Land Use
Herman Dairy Restoration Site

Land Use	Acres	Percentage
Forest	197	28
Pasture	454	64
Residential Development	57	8
Total	**708**	**100**

The Site 14-digit Cataloging Unit 03050101120030 is a 37-square mile watershed characterized by 41 percent agriculture, 47 percent forest, and includes 50 permitted animal operations (the most of any Targeted Local Watershed in the upper Catawba). Built up areas around Taylorsville contribute to an overall watershed impervious surface totaling 2.4 percent (NCEEP 2009).

2.5 Protected Species

Species with a Federal classification of Endangered or Threatened are protected under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). The term "Endangered species" is defined as "any species which is in danger of extinction throughout all or a significant portion of its range," and the term "Threatened species" is defined as "any species which is likely to become an Endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C. 1532).

Based on the most recently updated county-by-county database of federally listed species in North Carolina as posted by the United States Fish and Wildlife Service (USFWS) at http://nc-es.fws.gov/es/countyfr.html, three federally protected species are listed for Alexander County. The following table lists the federally protected species and indicates if potential habitat exists within the Site for each.

Table 7. Federally Protected Species for Alexander County
Herman Dairy Restoration Site

Common Name	Scientific Name	Status*	Habitat Present Within Site	Biological Conclusion
Vertebrates				
Bald eagle	*Haliaeetus leucocephalus*	BGPA	No	No Effect
Bog turtle	*Clemmys muhlenbergii*	T (S/A)	No	Not Applicable
Vascular Plants				
Dwarf-flowered heartleaf	*Hexastylis naniflora*	Threatened	No	No Effect

*Endangered = a taxon "in danger of extinction throughout all or a significant portion of its range"; Threatened = a taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range"; Threatened (due to Similarity of Appearance) = a species that is threatened due to similarity of appearance with other rare species and is listed for its protection. These species are not biologically endangered or threatened and are not subject to Section 7 consultation.

Haliaeetus leucocephalus **(bald eagle) BGPA**

Adult bald eagles are identified by their large white head, short white tail, and dark-brown to chocolate- brown body plumage. Immature eagles lack the white head plumage and have brown to black body plumage. In flight bald eagles can be identified by their flat wing soar. Adults average about 3 feet from head to tail, weigh approximately 10-12 pounds, and have a wingspan that can reach up to 7 feet. Fish are the major food source for bald eagles although bald eagles also consume a variety of birds, mammals, and turtles when fish are not readily available.

Eagle nests are generally found in close proximity to water (within 0.5 mile) where the eagle has a clear flight path to the water. They generally nest in the largest living tree with an open view of the surrounding land. Human disturbance may cause an eagle to abandon otherwise suitable habitat.

Biological Conclusion: **NO EFFECT**

Potential habitat for the bald eagle does not occur within or adjacent to the Site. The nearest open water which may serve as habitat for the bald eagle is approximately 6 miles to the south in Lake Hickory. The Site may serve as a fly over corridor for the bald eagle; however, the proposed project will have no effect on the bald eagle.

***Clemmys muhlenbergii* (Bog turtle) Threatened due to Similarity of Appearance**

The bog turtle is a small turtle reaching an adult size of approximately 3 to 4 inches. This otherwise darkly-colored species is readily identifiable by the presence of a bright orange or yellow blotch on the sides of the head and neck (Martof et. al. 1980). The bog turtle has declined drastically within the northern portion of its range due to over-collection and habitat alteration. As a result, the USFWS officially proposed in the January 29, 1997 Federal Register (62 FR 4229) to list bog turtle as threatened within the northern portion of its range, and within the southern portion of its range, which includes North Carolina, the bog turtle is proposed for listing as threatened due to similarity of appearance to the northern population. The proposed listing would allow incidental take of bog turtles in the southern population resulting from otherwise lawful activity. The bog turtle is typically found in bogs, marshes, and wet pastures, usually in association with aquatic or semi-aquatic vegetation and small, shallow streams over soft bottoms (Palmer and Braswell 1995). In North Carolina, bog turtles have a discontinuous distribution in the Mountains and western Piedmont.

Biological Conclusion: **NOT APPLICABLE**

Bog turtle is listed as threatened due to similarity of appearance with another listed species and is listed for its protection. Taxa listed as T(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation.

***Hexastylis naniflora* (Dwarf-flowered heartleaf) Threatened**

The dwarf-flowered heartleaf is a small, spicy-smelling, rhizomatous perennial herb with long-stalked leaves and flowers. Leaves are heart-shaped, evergreen, leathery, and dark green above and paler below; the upper leaf surface is often patterned with pale green reticulate mottles. The leaves grow to about 2.4 inches long and form a dense, spreading rosette. The flowers, which appear in April and May, are solitary, flask-shaped, fleshy and firm, and have three triangular lobes. This species differs from related species by having smaller flowers with calyx tubes that narrow distally rather than broaden (Kral 1983).

Dwarf-flowering heartleaf is found in acidic sandy loam on north-facing wooded slopes of ravines in the Piedmont of North and South Carolina. This species typically occurs in oak-hickory-pine forest where hydrologic conditions range from moist to relatively dry, but also may be present in adjacent pastured woodland. This species typically is found in moist duff at the bases of trees or mountain laurel (Kalmia latifolia) (Kral 1983). In North Carolina, dwarf-flowered heartleaf is known from a few southwestern Piedmont counties (Amoroso and Finnegan 2002).

Biological Conclusion: **NO EFFECT**

This project is not expected to affect mountain dwarf-flowered heartleaf because typical habitat is not present within the Site. No north-facing wooded slopes with oak-hickory forest are located within the project area.

Designated Critical Habitat

No designated critical habitat is documented to occur within Alexander County.

2.6 Cultural Resources

Pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for compliance with Section 106 (36 CFR Part 800) comments were received for the Site from the North Carolina State Historic Preservation Office (NCSHPO) in a letter dated August 31, 2010 from Peter Sandbeck. NCSHPO conducted a "review of the project and are aware of no historic resources which would be affected by the project. Therefore, no comment was made on the project as proposed."

2.7 Potential Constraints

The presence of conditions or characteristics that have the potential to hinder restoration activities within the Site was evaluated. The evaluation focused primarily on the presence of hazardous materials, utilities and restrictive easements, rare/threatened/endangered species or critical habitats, and the potential for hydrologic trespass. Existing information regarding constraints was acquired and reviewed. In addition, any Site conditions that have the potential to restrict the restoration design and implementation were documented during the field investigation.

No constraints that may hinder restoration activities have been identified for this Site.

2.7.1 Property Ownership and Boundary

The property is held by Mr. Ned Herman – Herman Dairy Farms, Inc. A perpetual conservation easement will be prepared that incorporates the results of this study. The conservation easement will be depicted on a recordable map, signed by the owner, and recorded in Alexander County.

2.7.2 Site Access

The Site is accessed from Three Forks Church Road through Herman Dairy Farms. An access easement to the conservation easement will be obtained and recorded in Alexander County.

2.7.3 Utilities

The property is crossed by a utility easement (high tension power lines) in the middle reaches of UT 1 and the upper headwaters of UT 2. The utility easement will not be included in the conservation easement. The utility easement crosses in a perpendicular manner and should not hinder development of the Site. Utilities are not considered a constraint for this project.

2.7.4 FEMA/Hydrologic Trespass

Surface drainage on the Site and surrounding areas are in the process of being analyzed to predict the feasibility of manipulating existing surface drainage patterns without adverse effects to the

Site or adjacent properties. The following presents a summary of hydrologic and hydraulic analyses along with provisions designed to maximize groundwater recharge and wetland restoration while reducing potential for impacts to adjacent properties.

The purpose of the analysis is to predict flood extents for the 1-, 2-, 5-, 10-, 50-, and 100-year storms under existing and proposed conditions after stream and wetland restoration activities have been implemented. The comparative flood elevations are evaluated by simulating peak flood flows for Site features using the WMS (Watershed Modeling System, BOSS International) program and regional regression equations. Once the flows are determined, the river geometry and cross-sections are digitized from a DTM (Digital Terrain Model) surface (prepared by a professional surveyor) using the HEC-GeoRAS component of ArcView. The cross-sections are adjusted as needed based on field-collected data. Once corrections to the geometry are performed, the data is imported into HEC-RAS.

Watersheds and land use estimations were measured from existing DEM (Digital Elevation Model) data and an aerial photograph. Field surveyed cross-sections and water surfaces were obtained along Site features. Valley cross-sections were obtained from both onsite cross-sections and detailed topographic mapping to 1-foot contour intervals using the available DTM. Observations of existing hydraulic characteristics will be incorporated into the model and the computed water surface elevations will be calibrated using engineering judgment.

The HEC-RAS will be completed prior to completion of detailed construction plans for Site restoration activities. A primary objective of the stream and wetland restoration design is maintenance of a no-rise in the 100-year floodplain. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) 3710384000J, effective December 18, 2007, indicates that Site tributaries (UT1, UT2, & UT3) all flow into Muddy Fork. Site tributaries are not located within a detailed flood study; however, a Limited Detailed Flood Study has been performed along Muddy Fork and its floodplain of Muddy Fork. It is assumed that a Conditional Letter of Map Revision (CLOMR) or Letter of Map Revision (LOMR) are not expected to be necessary at this time. However, coordination with FEMA will be conducted, if necessary, prior to initiating Site construction activities.

3.0 PROJECT SITE STREAMS (EXISTING CONDITIONS)

Streams targeted for restoration include three unnamed tributaries to Muddy Fork, which have been dredged, straightened, rerouted, or otherwise impacted within the Site. Current Site conditions have resulted in degraded water quality, a loss of aquatic habitat, reduced nutrient and sediment retention, and unstable channel characteristics (loss of horizontal flow vectors that maintain pools and an increase in erosive forces to channel bed and banks). In addition, the lack of deep-rooted riparian vegetation and continued clearing and dredging of Site steams have exacerbated erosion adjacent to Site channels. Site restoration activities will restore riffle-pool morphology, aid in energy dissipation, increase aquatic habitat, stabilize channel banks, and greatly reduce sediment loss from channel banks.

3.1 Existing Conditions Survey

Site stream dimension, pattern, and profile were measured to characterize existing channel conditions. Locations of existing stream reaches and cross-sections are depicted in Figure 4

(Appendix A) and Figure B1 (Appendix B). Stream geometry measurements under existing conditions are summarized in the Morphological Stream Characteristics Table (Table 8).

3.2 Channel Classification and Morphology

Stream geometry and substrate data have been evaluated to classify existing stream conditions based on a classification utilizing fluvial geomorphic principles (Rosgen 1996). This classification stratifies streams into comparable groups based on pattern, dimension, profile, and substrate characteristics. Primary components of the classification include degree of entrenchment, width-depth ratio, sinuosity, channel slope, and stream substrate composition.

Existing Site reaches are classified as unstable C-type (moderately entrenched, high to moderate width-depth ratio) and F-type (entrenched, high width-depth ratio) streams. Unnamed tributary 1 is also characterized by a D-type (multiple stem) channel due to the excavation of a ditch that parallels the main stream channel. Each stream type is modified by a number 1 through 6 (e. g., E5), denoting a stream type which supports a substrate dominated by 1) bedrock, 2) boulders, 3) cobble, 4) gravel, 5) sand, or 6) silt/clay. Existing Site reaches are characterized by sand and silt/clay substrate as the result of channel rerouting and evolution.

3.3 Channel Evolution

Bed and bank erosion typically leads to channel downcutting and evolution from a stable E-type channel into a G-type (gully) channel. Continued erosion eventually results in lateral extension of the G-type channel into an F-type (widened gully) channel. The F-type channel will continue to widen laterally until the channel is wide enough to support a stable C-type or E-type channel at a lower elevation so that the original floodplain is no longer subject to regular flooding.

3.4 Valley Classification

The Site is located within a valley characterized as Valley Type VIII. This type of valley is identified by the presence of multiple river terraces positioned laterally along broad valleys with gentle, down-valley elevation relief. Alluvial terraces and floodplains are the predominant depositional landforms, which produce a high sediment supply. Typical streams include C- and E-type streams with slightly entrenched, meandering channels with a riffle-pool sequence.

3.5 Discharge

This hydrophysiographic region is characterized by moderate rainfall with precipitation averaging approximately 42-55 inches per year (USDA 1995). Drainage basin sizes within the Site range from 0.1-square mile for UT 1 and UT 2 to 1.0-square mile for UT 1 at its confluence with Muddy Fork.

Discharge estimates for the Site utilize an assumed definition of “bankfull” and the return interval associated with that bankfull discharge. For this study, the bankfull channel is defined as the channel dimensions designed to support the “channel forming” or “dominant” discharge (Gordon et al. 1992). Based on Piedmont regional curves (Harman et al. 1999), the bankfull discharge for a 1.1 square mile watershed is expected to average 95.4 cubic feet per second, which is expected to occur approximately every 1.3 to 1.5 years (Rosgen 1996, Leopold 1994).

Table 8. Morphological Stream Characteristics
Herman Dairy Restoration Site

Variables	REFERENCE - UT* CATAWBA RIVER	REFERENCE - 1	Existing UT 1	PROPOSED	Existing UT 2	PROPOSED	Existing UT 3	PROPOSED
Stream Type	E 4/5	E 4/5	Cd 5	Ec 4/5	Fc 5/6	Ec 4/5	Fc 5/6	Ec 4/5
Drainage Area (mi^2)	1.60	0.45	1.01	1.01	0.04	0.04	0.06	0.06
Bankfull Discharge (cfs)	46.3	47.2	83.7	83.7	8.2	8.2	11.0	11.0
Dimension Variables			**Dimension Variables**		**Dimension Variables**		**Dimension Variables**	
Bankfull Cross-Sectional Area (A_{bkf})	10.9	11.8	20.2	20.2	2.3	2.3	3.0	3.0
Existing Cross-Sectional Area ($A_{existing}$)	10.9	11.8	43.5 - 106.2	20.2	49.9 - 163.2	2.3	44.1 - 73.3	3.0
Bankfull Width (W_{bkf})	Mean: 10.3	Mean: 9.5	Mean: 17.7	Mean: 16.8	Mean: 9.1	Mean: 5.7	Mean: 6.9	Mean: 6.5
	Range: 9.2-11.5	Range: 9.4 - 9.6	Range: 15.6 - 19.0	Range: 15.6 - 18.0	Range: 6.5 - 15.2	Range: 5.3 - 6.1	Range: 6.4 - 9.2	Range: 6.0 - 6.9
Bankfull Mean Depth (D_{bkf})	Mean: 1.1	Mean: 1.3	Mean: 1.2	Mean: 1.2	Mean: 0.3	Mean: 0.4	Mean: 0.4	Mean: 0.5
	Range: 1.1-1.3	Range: 1.2 - 1.3	Range: 1.1 - 1.3	Range: 1.1 - 1.3	Range: 0.2 - 0.4	Range: 0.3 - 0.5	Range: 0.3 - 0.5	Range: 0.4 - 0.6
Bankfull Maximum Depth (D_{max})	Mean: 1.7	Mean: 1.6	Mean: 2.0	Mean: 1.6	Mean: 0.5	Mean: 0.5	Mean: 0.7	Mean: 0.7
	Range: 1.5-1.8	Range: 1.5 - 1.6	Range: 1.9 -2.3	Range: 1.4 - 1.8	Range: 0.4 - 0.8	Range: 0.4 - 0.6	Range: 0.6 - 0.9	Range: 0.6 - 0.8
Pool Width (W_{pool})	Mean: 11.2	Mean: 12.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 20.2	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 6.8	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 7.8
	Range: 9.8-12.6	Range: 11.9 - 13.0		Range: 16.8 - 23.5		Range: 5.7 - 8.0		Range: 6.5 - 9.1
Maximum Pool Depth (D_{pool})	Mean: 1.9	Mean: 1.8		Mean: 2.0		Mean: 0.7		Mean: 0.9
	Range: 1.9-2.0	Range: 1.2 - 2.3		Range: 1.6 - 2.6		Range: 0.5 - 0.9		Range: 0.7 - 1.1
Width of Floodprone Area (W_{fpa})	Mean: 50	Mean: 24	Mean: 150	Mean: 150	Mean: 15	Mean: 150	Mean: 12	Mean: 150
	Range: 25-150	Range: 22 - 25	Range: 26 - 150	Range:	Range: 14 - 19	Range:	Range: 12.0 - 13	Range:
Dimension Ratios			**Dimension Ratios**		**Dimension Ratios**		**Dimension Ratios**	
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 4.9	Mean: 2.5	Mean: 7.9	Mean: 8.9	Mean: 1.6	Mean: 26.3	Mean: 1.7	Mean: 23.1
	Range: 2.7-14.6	Range: 2.3 - 2.7	Range: 1.6 - 9.6	Range: 8.3 - 9.6	Range: 1.3 - 2.2	Range: 24.5 - 38.3	Range: 1.4 - 1.9	Range: 21.7 - 25.0
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 10.0	Mean: 7.6	Mean: 15.5	Mean: 14.0	Mean: 30.3	Mean: 14.0	Mean: 17.3	Mean: 14.0
	Range: 8.0-13.0	Range: 7.2 - 8.0	Range: 12.0 - 17.3	Range: 12.0 - 16.0	Range: 16.3 - 76.0	Range: 12.0 - 16.0	Range: 12.8 - 30.7	Range: 12.0 - 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.5	Mean: 1.2	Mean: 1.7	Mean: 1.3	Mean: 2.0	Mean: 1.3	Mean: 2.0	Mean: 1.3
	Range: 1.4-1.6	Range: 1.2 - 1.3	Range: 1.6 - 1.8	Range: 1.2 - 1.5	Range: 1.7 - 2.0	Range: 1.2 - 1.5	Range: 1.4 - 2.3	Range: 1.2 - 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.0	Mean: 1.0	Mean: 1.9	Mean: 1.0	Mean: 6.8	Mean: 1.0	Mean: 6.2	Mean: 1.0
	Range:	Range:	Range: 1.8 - 3.1	Range: 1.0 - 1.3	Range: 5.0 - 12.2	Range: 1.0 - 1.3	Range: 4.2 - 6.7	Range: 1.0 - 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 1.7	Mean: 1.4	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7
	Range: 1.7-1.8	Range: 0.9 - 1.9		Range: 1.3 - 2.2		Range: 1.3 - 2.2		Range: 1.3 - 2.2
Pool Width / Bankfull Width (W_{pool}/W_{bkf})	Mean: 1.1	Mean: 1.3		Mean: 1.2		Mean: 1.2		Mean: 1.2
	Range: 1.0-1.2	Range: 1.3 - 1.4		Range: 1.0 - 1.4		Range: 1.0 - 1.4		Range: 1.0 - 1.4
Pool Area / Bankfull Cross Sectional Area	Mean: 1.1	Mean: 1.3		Mean: 1.4		Mean: 1.4		Mean: 1.4
	Range: 1.1-1.2	Range: 1.2 - 1.5		Range: 1.1 - 1.6		Range: 1.1 - 1.6		Range: 1.1 - 1.6

* UT to Catawba River includes measurments from a Reference Site measured in 2000.

Table 8. Morphological Stream Characteristics (continued)
Herman Dairy Restoration Site

Variables	REFERENCE - UT* CATAWBA RIVER	REFERENCE - 1	Existing UT 1	PROPOSED	Existing UT 2	PROPOSED	Existing UT 3	PROPOSED
Pattern Variables			**Pattern Variables**		**Pattern Variables**		**Pattern Variables**	
Pool to Pool Spacing (L_{p-p})	Med: 39.0	Med: 60.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 67.2	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 22.8	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 26.0
	Range: 22-62	Range: 29 - 103		Range: 50.4 - 134.4		Range: 17.1 - 45.6		Range: 19.5 - 52.0
Meander Length (L_m)	Med: 45.0	Med: 80.5		Med: 142.8		Med: 48.5		Med: 55.3
	Range: 25-70	Range: 65 - 128		Range: 100.8 - 201.6		Range: 34.2 - 68.4		Range: 39.0 - 78.0
Belt Width (W_{belt})	Med: 35.0	Med: 45.0		Med: 67.2		Med: 22.8		Med: 26.0
	Range: 30-40	Range: 35 - 58		Range: 50.4 - 100.8		Range: 17.1 - 34.2		Range: 19.5 - 39.0
Radius of Curvature (R_c)	Med: 18.0	Med: 16.0		Med: 50.4		Med: 17.1		Med: 19.5
	Range: 12.5-25	Range: 10 - 32		Range: 33.6 - 168.0		Range: 11.4 - 57.0		Range: 13.0 - 65.0
Sinuosity (Sin)	1.40	1.40	1.07	1.20	1.04	1.20	1.01	1.20
Pattern Ratios			**Pattern Ratios**		**Pattern Ratios**		**Pattern Ratios**	
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 3.8	Med: 6.3	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0
	Range: 2.1-6.0	Range: 3.1 - 10.8		Range: 3.0 - 8.0		Range: 3.0 - 8.0		Range: 3.0 - 8.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 4.4	Med: 8.5		Med: 8.5		Med: 8.5		Med: 8.5
	Range: 2.4-6.8	Range: 6.8 - 13.5		Range: 6.0 - 12.0		Range: 6.0 - 12.0		Range: 6.0 - 12.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 3.4	Med: 4.7		Med: 4.0		Med: 4.0		Med: 4.0
	Range: 2.9-3.9	Range: 3.7 - 6.1		Range: 3.0 - 6.0		Range: 3.0 - 6.0		Range: 3.0 - 6.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 1.7	Med: 1.7		Med: 3.0		Med: 3.0		Med: 3.0
	Range: 1.2-2.4	Range: 1.1 - 3.4		Range: 2.0 - 10.0		Range: 2.0 - 10.0		Range: 2.0 - 10.0
Profile Variables			**Profile Variables**		**Profile Variables**		**Profile Variables**	
Average Water Surface Slope (S_{ave})	0.0028	0.0127	0.0062	0.0055	0.0085**	0.0043	0.0040**	0.0011
Valley Slope (S_{valley})	0.0040	0.0091	0.0066	0.0066	0.0052	0.0052	0.0013	0.0013
Riffle Slope (S_{riffle})	Mean: 0.0034	Mean: 0.0248	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0138	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0108	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0028
	Range: .003-0036	Range: 0.0034 - 0.0431		Range: 0.011-0.0165		Range: 0.0086-0.0129		Range: 0.0022-0.0033
Pool Slope (S_{pool})	Mean: 0.0022	Mean: 0.0004		Mean: 0.0011		Mean: 0.0009		Mean: 0.0020
	Range: .0017-.0028	Range: 0 - 0.0048		Range: 0-0.0022		Range: 0-0.0017		Range: 0-0.004
Run Slope (S_{run})	Mean:	Mean: 0.0022		Mean: 0.0022		Mean: 0.0017		Mean: 0.0040
	Range:	Range: 0 - 0.0193		Range: 0-0.0044		Range: 0-0.0034		Range: 0-0.0009
Glide Slope (S_{glide})	Mean:	Mean: 0.0018		Mean: 0.0017		Mean: 0.0013		Mean: 0.0003
	Range:	Range: 0 - 0.0190		Range: 0-0.0044		Range: 0-0.0034		Range: 0-0.0009
Profile Ratios			**Profile Ratios**		**Profile Ratios**		**Profile Ratios**	
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.1	Mean: 1.90	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 2.50	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 2.50	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 2.50
	Range: 1.1-1.3	Range: 0.3 - 3.4		Range: 2.0 - 3.0		Range: 2.0 - 3.0		Range: 2.0 - 3.0
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 0.8	Mean: 0.00		Mean: 0.20		Mean: 0.20		Mean: 0.20
	Range: 0.6-1.0	Range: 0 - 0.4		Range: 0 - 0.4		Range: 0 - 0.4		Range: 0 - 0.4
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean:	Mean: 0.20		Mean: 0.40		Mean: 0.40		Mean: 0.40
	Range:	Range: 0 - 1.5		Range: 0 - 0.8		Range: 0 - 0.8		Range: 0 - 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean:	Mean: 0.10		Mean: 0.30		Mean: 0.30		Mean: 0.30
	Range:	Range: 0 - 1.5		Range: 0 - 0.8		Range: 0 - 0.8		Range: 0 - 0.8

* UT to Catawba River includes measurments from a Reference Site measured in 2000.
** Water surface slopes are steeper than valley slopes for these UTs under existing conditions as the result of a large headcut located within each reach.

3.6 Channel Stability Assessment

3.6.1 Stream Power

Stability of a stream refers to its ability to adjust itself to inflowing water and sediment load. One form of instability occurs when a stream is unable to transport its sediment load, leading to aggradation, or deposition of sediment onto the stream bed. Conversely, when the ability of the stream to transport sediment exceeds the availability of sediments entering a reach, and/or stability thresholds for materials forming the channel boundary are exceeded, erosion or degradation occurs.

Stream power is the measure of a stream's capacity to move sediment over time. Stream power can be used to evaluate the longitudinal profile, channel pattern, bed form, and sediment transport of streams. Stream power may be measured over a stream reach (total stream power) or per unit of channel bed area. The total stream power equation is defined as:

$$\Omega = \rho g Q s$$

where Ω = total stream power (ft-lb/s-ft), ρ = density of water (lb/ft3), g = gravitational acceleration (ft/s2), Q = discharge (ft3/sec), and s = energy slope (ft/ft). The specific weight of water (γ = 62.4 lb/ft3) is equal to the product of water density and gravitational acceleration, ρg. A general evaluation of power for a particular reach can be calculated using bankfull discharge and water surface slope for the reach. As slopes become steeper and/or velocities increase, stream power increases and more energy is available for reworking channel materials. Straightening and clearing channels increases slope and velocity and thus stream power. Alterations to the stream channel may conversely decrease stream power. In particular, over-widening of a channel will dissipate energy of flow over a larger area. This process will decrease stream power, allowing sediment to fall out of the water column, possibly leading to aggradation of the stream bed.

The relationship between a channel and its floodplain is also important in determining stream power. Streams that remain within their banks at high flows tend to have higher stream power and relatively coarser bed materials. In comparison, streams that flood over their banks onto adjacent floodplains have lower stream power, transport finer sediments, and are more stable. Stream power assessments can be useful in evaluating sediment discharge within a stream and the deposition or erosion of sediments from the stream bed.

3.6.2 Shear Stress

Shear stress, expressed as force per unit area, is a measure of the frictional force that flowing water exerts on a streambed. Shear stress and sediment entrainment are affected by sediment supply (size and amount), energy distribution within the channel, and frictional resistance of the stream bed and bank on water within the channel. These variables ultimately determine the ability of a stream to efficiently transport bedload and suspended sediment.

For flow that is steady and uniform, the average boundary shear stress exerted by water on the bed is defined as follows:

$$\tau = \gamma Rs$$

where τ = shear stress (lb/ft2), γ = specific weight of water, R = hydraulic radius (ft), and s = the energy slope (ft/ft). Shear stress calculated in this way is a spatial average and does not necessarily provide a good estimate of bed shear at any particular point. Adjustments to account for local variability and instantaneous values higher than the mean value can be applied based on channel form and irregularity. For a straight channel, the maximum shear stress can be assumed from the following equation:

$$\tau max = 1.5\tau$$

for sinuous channels, the maximum shear stress can be determined as a function of plan form characteristics:

$$\tau max = 2.65\tau(Rc /Wbkf)-0.5$$

where Rc = radius of curvature (ft) and Wbkf = bankfull width (ft).

Shear stress represents a difficult variable to predict due to variability of channel slope, dimension, and pattern. Typically, as valley slope decreases channel depth and sinuosity increase to maintain adequate shear stress values for bedload transport. Channels that have higher shear stress values than required for bedload transport will scour bed and bank materials, resulting in channel degradation. Channels with lower shear stress values than needed for bedload transport will deposit sediment, resulting in channel aggradation.

The actual amount of work accomplished by a stream per unit of bed area depends on the available power divided by the resistance offered by the channel sediments, plan form, and vegetation. The stream power equation can thus be written as follows:

$$\omega = \rho gQs = \tau v$$

where ω = stream power per unit of bed area (N/ft-sec, Joules/sec/ft2), τ = shear stress, and v = average velocity (ft/sec). Similarly,

$$\omega = \Omega/Wbkf$$

where Wbkf = width of stream at bankfull (ft).

3.6.3 Stream Power and Shear Stress Methods and Results

Channel degradation or aggradation occurs when hydraulic forces exceed or do not approach the resisting forces in the channel. The amount of degradation or aggradation is a function of relative magnitude of these forces over time. The interaction of flow within the boundary of open channels is only imperfectly understood. Adequate analytical expressions describing this interaction have yet to be developed for conditions in natural channels. Thus, means of characterizing these processes rely heavily upon empirical formulas.

Traditional approaches for characterizing stability can be placed in one of two categories: 1) maximum permissible velocity and 2) tractive force, or stream power and shear stress. The former is advantageous in that velocity can be measured directly. Shear stress and stream power cannot be measured directly and must be computed from various flow parameters. However, stream power and shear stress are generally better measures of fluid force on the channel boundary than velocity.

Using these equations, stream power and shear stress were estimated for 1) existing dredged and straightened reaches, 2) the reference reaches, and 3) proposed Site conditions. Important input values and output results (including stream power, shear stress, and per unit shear power and shear stress) are presented in Table 9. Average stream velocity and discharge values were calculated for the existing Site stream reaches, the reference reach, and proposed conditions.

Reference Reach 1 values for stream power and shear stress are similar to proposed values but are slightly higher. Reference Reach 1 is characterized by a fully forested riparian fringe and is therefore able to resist stream power and shear stress of these magnitudes. However, the proposed channels will be devoid of deep-rooted vegetation; therefore, proposed targets for stream power and shear stress values should be slightly less than predicted for the reference reach.

Stream power and shear stress values are lower for the existing, dredged and straightened UT1 than for proposed channels. Under existing conditions UT1 acts like a braided channel since stream flow has been split between two separate ditched channels dug along either side of the floodplain. Therefore, existing values are expected to be lower due to aggradation of the channels, which are acting more similar to a multi-channel system. Proposed conditions for UT1 include slightly higher values than existing in order to maintain stream power and shear stress so that the channel neither aggrades nor degrades; results of the analysis indicate that proposed UT 1 is expected to maintain sediment transport functions of a stable stream system.

Stream power and shear stress values are higher for the existing, dredged and straightened UT2 and UT3 than for proposed channels. Existing reaches are degrading as evidenced by bank erosion, channel incision, large head-cuts, and bank-height ratios ranging from 1.8 to 12.2. Degradation has resulted from a combination of water surface slopes that have been steepened, channel straightening, and dredging. Stream power and shear stress values for the proposed channels are lower than for existing channels to effectively transport sediment through the Site without eroding and downcutting, resulting in stable channel characteristics. Results of the analysis indicate that proposed UT2 is expected to maintain stream power as a function of width values. Some areas within the UT3 design channel may be expected to form low-slope, braided, stream/swamp complexes similar to swamps in the area. These stream/swamp complexes would not be considered unstable; however, footage of stream channel restoration in these reaches will be recalculated from distance along the thalweg (1.2 sinuosity) to distance along the valley (1.0 sinuosity).

Table 9. Stream Power (Ω) and Shear Stress (τ) Values
Herman Dairy Restoration Site

	Discharge (ft^2/s)	Water Surface Slope (ft/ft)	Total Stream Power (Ω)	Total Stream Power/Bankfull Width (Ω/W)	Hydraulic Radius	Shear Stress (τ)	Velocity (v)	τ v	τ_{max}
Existing Conditions									
UT1	83.7	0.0062	32.38	1.83	3.73	1.44	1.12	1.61	2.17
UT2	8.2	0.0085	4.35	0.48	11.03	5.85	0.08	0.45	8.78
UT3	11	0.0040	2.75	0.40	7.66	1.91	0.19	0.36	2.87
Reference Reaches									
Reference Reach 1	47.2	0.0178	52.43	5.52	0.98	1.08	4.00	4.33	4.33
Proposed Conditions									
UT1	83.7	0.0055	28.73	1.71	1.05	0.36	4.14	1.50	2.37
UT2	8.2	0.0043	2.20	0.39	0.35	0.09	3.57	0.34	0.25
UT3	11	0.0011	0.76	0.12	0.40	0.03	3.67	0.10	-0.28

3.7 Bankfull Verification

Discharge estimates for the Site utilize an assumed definition of "bankfull" and the return interval associated with that bankfull discharge. For this study, the bankfull channel is defined as the channel dimensions designed to support the "channel forming" or "dominant" discharge (Gordon et al. 1992). Current research also estimates the bankfull discharge would be expected to occur approximately every 1.3 to 1.5 years (Rosgen 1996, Leopold 1994).

The Site is located in the Piedmont Physiographic province; therefore, regional curves for the Piedmont (Harman et al. 1999) were utilized and verified by regional regression equations, Cowan's roughness equation method, and reference stream data.

Based on available Piedmont regional curves, the bankfull discharge for Reference Reach 1 (0.45 square mile watershed) is approximately 50.0 cubic feet per second (Harman et al. 1999). The USGS regional regression equation for the Rural Piedmont region indicates that bankfull discharge for Reference Reach 1 at a 1.3 to 1.5 year return interval for the Blue Ridge/Piedmont region indicates a bankfull discharge for the reference reach of 50-56 cubic feet per second (USGS 2006). Blue Ridge/Piedmont regression calculations of bankfull discharge are similar to estimates based on field indicators and regional curves, as discussed below (plots are included in Appendix C). In addition, a stream roughness coefficient (n) was estimated using a version of Arcement and Schneider's (1989) weighted method for Cowan's (1956) roughness component values and applied to the following equation (Manning 1891) to obtain a bankfull discharge estimate.

$$Qbkf = [1.486/n] * [A*R^{2/3}*S^{1/2}]$$

where, A equals bankfull area, R equals bankfull hydraulic radius, and S equals average water surface slope. The Manning's "n" method indicates that bankfull discharge for the reference reach averages approximately 13.7 cubic feet per second, which is well-below estimates based on Reference Reach 1 field indicators of bankfull and regional curves, as discussed below.

Field indicators of bankfull and riffle cross-sections were utilized to obtain an average bankfull cross-sectional area for Reference Reach 1. The Piedmont regional curves were then utilized to plot the watershed area and discharge for Reference Reach 1 cross-sectional area. Field indicators of bankfull approximate an average discharge of 47.2 cubic feet per second, which is approximately 94 percent of that predicted by the Piedmont regional curves.

Based on the above analysis of methods to determine bankfull discharge, proposed conditions at the Site will be based on an area 94 percent of the size indicated by Piedmont regional curves based on bankfull indicators and stream measurements of Reference Reach 1. Table 10 summarizes all methods analyzed for estimating bankfull discharge.

Table 10. Reference Reach 1 Bankfull Discharge Analysis
Herman Dairy Restoration Site

Method	Watershed Area (square miles)	Return Interval (years)	Discharge (cfs)
Reference Reach			
Piedmont Regional Curves (Harmen et al. 1999)	0.45	1.3 – 1.5	50.0
Blue Ridge/Piedmont Regional Regression Model (USGS 2006)*	0.45	1.3 – 1.5	50-56
Manning's "n" using Cowan's Method (1956)	NA	NA	13.7
Field Indicators of Bankfull	0.45	1.3 – 1.5	47.2

*North Carolina Flood Frequency Software, Revised 2001, Recompiled 2006

3.8 Vegetation

Distribution and composition of plant communities reflect landscape-level variations in topography, soils, hydrology, and past or present land use practices. The Site is composed of agriculture land and scrub-shrub.

Agriculture land is currently dominated by corn (*Zea mays*) planted for harvesting, in addition to opportunistic herbaceous species, and maintains little vegetative diversity. Scrub-shrub areas along unnamed tributaries to Muddy Creek consist of sparse canopy trees consisting of sycamore (*Plantanus occidentalis*), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), white oak (*Quercus alba*), and black willow (*Salix nigra*) along stream banks adjacent to UT1. The remaining scrub-shrub areas are dominated by early successional species such as sweetgum (*Liquidambar styraciflua*), Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), pokeweed (*Phytolacca americana*), goldenrod (*Solidago* spp.), common greenbrier (*Smilax rotundifolia*), and Japanese honeysuckle (*Lonicera japonica*).

4.0 REFERENCE STREAMS

Two reference reaches were identified for the Site. The first reference stream (Reference Reach 1) is located less than 3 miles southwest of the Site on Spring Creek (Figure 5A, Appendix A). Reference Reach 1 was the primary stream used to emulate restoration parameters at the Site. The second reference stream (UT to Catawba River) is located approximately 20 miles southeast of the Site situated at the top of an alluvial fan where the channel enters the Catawba River floodplain. Measurements for the UT to Catawba River reference reach were completed in 2000 and only pattern ratios were used for this project. The streams were measured and classified by stream type (Rosgen 1996).

4.1 Channel Classification

Both reference reaches are characterized as E-type, highly sinuous (1.4) channels with sand and gravel dominated substrates. E-type streams are characterized as slightly entrenched, riffle-pool channels exhibiting high sinuosity (1.3 to greater than 1.5). E-type streams typically exhibit a sequence of riffles and pools associated with a sinuous flow pattern. In North Carolina, E-type streams often occur in narrow to wide valleys with well-developed alluvial floodplains (Valley Type VIII). E-type channels are typically considered stable; however, these streams are sensitive to upstream drainage basin changes and/or channel disturbance, and may rapidly convert to other stream types.

4.2 Discharge

Based on an analysis of bankfull discharge, proposed conditions at the Site will be based on an area 94 percent of the size indicated by Piedmont regional curves (see Section 3.7 Bankfull Verification).

4.3 Channel Morphology

Dimension: Data collected at Reference Reach 1 indicate bankfull cross-sectional areas of 11.8 square feet, which was slightly smaller than predicted by regional curves (12.5 square feet). However, the stream is within a reasonable deviation from predictions by regional curve calculations and adequately verify the use of this reference at the Site. Reference Reach 1 exhibits a bankfull width of 9.5, a bankfull depth of 1.3 feet, a width-to-depth ratio of 7.6, and a bank-height ratio of 1.0 (see Table 8, Table of Morphological Stream Characteristics). Figures 5B-5D (Appendix A) provide drainage area, existing conditions, plan view, and cross-sectional data for Reference Reach 1 and depict the bankfull channel area.

The second reference reach (UT to Catawba River) was not used for dimension purposes. Data collected at this reach indicate bankfull cross-sectional areas of 10.9 square feet, which was significantly smaller than predicted by regional curves (29.5 square feet). This discrepancy is most likely due to the reach's location adjacent to influence from alluvial deposition from the Catawba River. Two implications of such deposition include 1) elevation of the channel bed thereby reducing cross-sectional area and 2) more coarse-grained bed materials resulting in a larger than average hyporheic zone.

Pattern and Profile: In-field measurements of the reference reaches have yielded a sinuosity of 1.4 (thalweg distance/straight-line distance). Onsite valley slopes range from 0.0178 at Reference Reach 1 to 0.0040 at the UT to Catawba River Reference. Valley slopes exhibited by reference channels range from slightly higher (0.0013) to slightly lower (0.0066) than the Site, providing a good range of slopes to compare existing and proposed Site conditions.

Substrate: Reference channels are characterized by substrate dominated by sand and gravel sized particles.

5.0 PROJECT SITE WETLANDS (EXISTING CONDITIONS)

5.1 Existing Jurisdictional Wetlands

Jurisdictional wetlands/hydric soils within the Site were delineated in the field following guidelines set forth in the *Corps of Engineers Wetlands Delineation Manual* and subsequent regional supplements, and located using GPS technology with reported submeter accuracy during October 2010 (Environmental Laboratory 1987). Study area wetlands are considered palustrine systems, as defined by Cowardin et al. (1979). Existing jurisdictional wetlands are depicted as black cross-hatching on Figure 4 in Appendix A. A tear sheet confirming the delineation was received from USACE representative Amanda Jones on January 26, 2011; a copy of the tear sheet is included in Appendix D.

Wetlands are defined by the presence of three criteria: hydrophytic vegetation, hydric soils, and evidence of wetland hydrology during the growing season (Environmental Laboratory 1987). Open water systems and wetlands receive similar treatment and consideration with respect to Section 404 review.

5.2 Hydrological Characterization

It should be noted that construction activities will restore groundwater hydrology to approximately 7.2 acres of drained riparian hydric soils and 1.2 acres of drained nonriparian hydric soils, in addition to, enhance 2.2 acres of cleared riparian wetlands and enhance 0.1 acre of cleared nonriparian wetlands. Areas of the Site targeted for riparian wetlands will receive hydrological inputs from periodic overbank flooding of restored tributaries, groundwater migration into the wetlands, upland/stormwater runoff, and, to a lesser extent, direct precipitation. Areas targeted for nonriparian wetlands will receive hydrological inputs from groundwater seepage, upland/stormwater runoff, and direct precipitation.

5.3 Soil Characterization

5.3.1 Taxonomic Classification

Detailed soil mapping conducted by licensed soil scientists indicate that 10.6 acres of the Site are currently underlain by hydric soils of the Hatboro Series. Typical hydric soil profiles locations are depicted on Figure 4 (Appendix A) and are described below. Information pertaining the jurisdictional determination is included in Appendix D.

5.3.2 Profile Description

<u>Profile 1</u>

0-8 inches: 10YR 4/3 clay loam

8-10 inches: 10YR 5/3 clay loam with common/fine/distinct mottles 5YR 5/8

10-13+ inches: 10YR 5/2 sandy clay loam with common/fine /distinct mottles 7.5YR 5/6

Profile 2
0-6 inches 10YR 4/3 clay loam
6-8 inches 10YR 5/3 clay loam with few/fine/faint mottles 7.5YR 5/8
8-12+ inches 10YR 6/2 clay loam with common/fine/distinct mottles 7.5YR 5/8

Profile 3
0-4 inches: 10YR 5/4 clay loam
4-12 inches: 10YR 5/2 clay loam with many/medium/distinct mottles 7.5YR 5/6
12-14+ inches: 10YR 6/1 clay loam with common/medium/prominent mottles 7.5YR 5/8

Profile 4
0-4 inches: 10YR 5/4 clay loam
4-10 inches: 2.5Y 5/2 clay loam with many/fine/prominent mottles 7.5YR 5/6
10-14+ inches: 2.5Y 6/2 clay loam with many/medium/distinct mottles 7.5YR 5/6

Profile 5
0-6 inches: 10YR 5/3 clay loam with many/medium/distinct mottles 7.5YR 5/6
6-12 inches: 10YR 5/2 clay loam with many/medium/distinct mottles 7.5YR 5/8
12-14+ inches: 10YR 6/2 clay loam with many/medium/prominent mottles 7.5YR 5/8 few/fine/faint mottles 7.5YR 5/6

5.4 Plant Community Characterization

Areas proposed for wetland restoration and enhancement are primarily vegetated by agricultural row crops and opportunistic herbaceous species with very little vegetative diversity.

6.0 Reference Forest Ecosystem

A Reference Forest Ecosystem (RFE) is a forested area on which to model restoration efforts at the Site in relation to soils and vegetation. RFEs should be ecologically stable climax communities and should be a representative model of the Site forested ecosystem as it likely existed prior to human disturbances. Data describing plant community composition and structure should be collected at the RFEs and subsequently applied as reference data in an attempt to emulate a natural climax community.

The RFE for this project is adjacent to Reference Reach 1 located less than 3 miles southwest of the Site on Spring Creek. The RFE supports plant community and landform characteristics that restoration efforts will attempt to emulate. Tree and shrub species identified within the reference forest and outlined in Table 11 will be used, in addition to other relevant species in appropriate Schafale and Weakley (1990) community descriptions.

Table 11. Reference Forest Ecosystem

Piedmont/Low Mountain Alluvial Forest	
Canopy Species	**Understory Species**
American beech (*Fagus grandifolia*)	ironwood (*Carpinus caroliniana*)
white oak (*Quercus alba*)	sourwood (*Oxydendrum arboreum*)
red oak (*Quercus rubra*)	flowering dogwood (*Cornus florida*)
tulip poplar (*Liriodendron tulipifera*)	white pine (*Pinus strobus*)
American sycamore (*Platanus occidentalis*)	tulip poplar (*Liriodendron tulipifera*)
sourwood (*Oxydendrum arboreum*)	arrow-wood (*Viburnum dentatum*)
red maple (*Acer rubrum*)	American holly (*Ilex opaca*)
river birch (*Betula nigra*)	common greenbrier (*Smilax rotundifolia*)
	giant cane (*Arundinaria gigantea*)
	Christmas fern (*Polystichum acrostichoides*)
	cinnamon fern (*Osmunda cinnamomea*)

7.0 PROJECT SITE RESTORATION PLAN

7.1 Restoration Project Goals and Objectives

The primary goals of this stream and wetland restoration project focus on improving water quality, enhancing flood attenuation, and restoring wildlife habitat and will be accomplished by the following.

1. Removing nonpoint sources of pollution associated with agricultural production including a) cessation of broadcasting sludge, fertilizer, pesticides, and other agricultural materials into and adjacent to Site streams/wetlands and b) restoration of a forested riparian buffer adjacent to streams and wetlands to treat surface runoff.
2. Reducing sedimentation within onsite and downstream receiving waters through a) reduction of bank erosion, vegetation maintenance, and plowing to Site streams and wetlands and b) restoration of a forested riparian buffer adjacent to Site streams and wetlands.
3. Reestablishing stream stability and the capacity to transport watershed flows and sediment loads by restoring stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
4. Promoting floodwater attenuation by a) reconnecting bankfull stream flows to the abandoned floodplain, b) restoring secondary, entrenched tributaries thereby reducing floodwater velocities within smaller catchment basins, c) restoring depressional floodplain wetlands to increase the floodwater storage capacity within the Site, and d) revegetating Site floodplains to increase frictional resistance on floodwaters crossing Site floodplains.
5. Improving aquatic habitat by enhancing stream bed variability and the use of in-stream structures.

6. Providing a terrestrial wildlife corridor and refuge in an area extensively developed for agricultural production.
7. Restoring and reestablishing natural community structure, habitat diversity, and functional continuity.
8. Enhancing and protecting the Site's full potential of stream and wetland functions and values in perpetuity.

These goals will be achieved by the following.

- Restoring approximately 4686 linear feet of stream channel through construction of stable channel at the historic floodplain elevation.
- Restoring approximately 110 linear feet of braided stream channel by redirecting diffuse flow across riparian wetlands.
- Enhancing (Level I) approximately 468 linear feet of stream channel through cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
- Restoring approximately 7.2 acres of riparian wetland by removing spoil castings, restoring stream inverts to historic elevations to rehydrate stream-side wetlands, filling ditches and abandoned channels, eliminating land use practices, and planting with native forest vegetation.
- Enhancing approximately 2.2 acres of riparian wetland by filling ditches/abandoned channels and supplemental planting.
- Restoring approximately 1.2 acres of nonriparian wetland by removing spoil castings, filling abandoned ditches to rehydrate slope wetlands, eliminating land use practices, and planting with native forest vegetation.
- Enhancing approximately 0.1 acres of riparian wetland through supplemental plantings.
- Revegetating floodplains and slopes adjacent to restored streams and wetlands.
- Protecting the Site in perpetuity with a conservation easement.

7.2 Stream Design

Onsite streams targeted for restoration have endured significant disturbance from land use activities such as land clearing, livestock grazing, straightening and rerouting of channels, and other anthropogenic maintenance. Site streams will be restored to emulate historic conditions at the Site utilizing parameters from a nearby, relatively undisturbed reference stream (Reference Reach 1) (see Section 4.0 Reference Streams).

7.2.1 Designed Channel Classification

The proposed channel has been designed to emulate parameters of the relatively undisturbed reference stream (Reference Reach 1) located less than 3 miles southwest of the Site. Reference Reach 1 is classified as an E 4/5-type channel; Site restoration reaches have been proposed as Ec 4/5-type and braided channels (see Table 8 Morphological Stream Characteristics). Proposed channels are expected to be characterized by sand and gravel substrate similar to reference streams, which emulate historic Site conditions.

7.2.2 Target Wetland Communties/Buffer Communities

Onsite wetland and buffer areas targeted for restoration and enhancement have endured significant disturbance from land use activities such as land clearing, livestock grazing, and other anthropogenic maintenance. These areas will be planted with native forest species typical of wetland and buffer communities in the region such as those found within the reference forest (see Section 6.0 Reference Forest Ecosystem). Emphasis will focus on developing a diverse plant assemblage.

7.3 Stream Restoration

Stream restoration efforts are designed to restore a stable, meandering stream on new location that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions (Figure 6, Appendix A). Geometric attributes for the existing, degraded channels and the proposed, stable channels are listed in Table of Morphological Stream Characteristics (Table 8).

Based on preliminary analysis and field investigations, restoration activities will follow stream guidance as presented in *Information Regarding Stream Restoration with Emphasis on the Coastal Plain – Draft* (USACE and NCDWQ 2007). Primary activities designed to restore the channels include 1) belt-width preparation and grading, 2) channel excavation, 3) installation of channel plugs, 4) backfilling of the abandoned channel, and 5) vegetative planting.

Belt-width Preparation and Grading

Care will be taken to avoid the removal of existing, deeply rooted vegetation within the belt-width corridor, which may provide design channel stability. Material excavated during grading will be stockpiled immediately adjacent to channel segments to be abandoned and backfilled. These segments will be backfilled after stream diversion is completed.

Spoil material may be placed to stabilize temporary access roads and to minimize compaction of the underlying floodplain. However, all spoil will be removed from floodplain surfaces upon completion of construction activities.

After preparation of the corridor, the design channel and updated profile survey will be developed and the location of each meander wavelength plotted and staked along the profile. Pool locations and relative frequency configurations may be modified in the field based on local variations in the floodplain profile.

Channel Excavation

The channels will be constructed within the range of values depicted in the Table of Morphological Stream Characteristics (Table 8). Bed material will be imported to the Site and utilized within stream riffles to provide substrate similar to historic conditions at the Site and nearby reference streams.

The stream banks and local belt-width area of constructed channels will be immediately planted with shrub and herbaceous vegetation. Deposition of shrub and woody debris into and/or overhanging the constructed channel is encouraged.

Particular attention will be directed toward providing vegetative cover and root growth along the outer bends of each stream meander. Live willow stake revetments, available root mats, and/or biodegradable, erosion-control matting may be embedded into the break-in-slope to promote more rapid development of an overhanging bank. Willow stakes will be purchased and/or collected onsite and inserted through the root/erosion mat into the underlying soil.

Channel Plugs

Impermeable plugs will be installed along abandoned channel segments. The plugs will consist of low-permeability materials or hardened structures designed to be of sufficient strength to withstand the erosive energy of surface flow events across the Site. Dense clays may be imported from off-site or existing material, compacted within the channel, may be suitable for plug construction. The plug will be of sufficient width and depth to form an imbedded overlap in the existing banks and channel bed.

Channel Backfilling

After impermeable plugs are installed, the abandoned channel will be backfilled. Backfilling will be performed primarily by pushing stockpiled materials into the channel. The channel will be filled using material from off-site and compacted in the vicinity of the backfilled channel. Vegetation debris (root mats, top soils, shrubs, woody debris, etc.) will be redistributed across the backfill area upon completion.

Braided Channel Development

Minimal channel excavation is proposed at the upper extents of UT3, which is proposed to be constructed as a braided, D-type stream in a low-gradient valley, without a defined stream channel (USACE et al. 2007). It is anticipated that this stream type will develop without intervention. Use of heavy equipment and disruption of existing vegetation and soils will therefore be minimized.

In-Stream Structures

Stream restoration under natural stream design techniques normally involves the use of in-stream structures for bank stabilization, grade control, and habitat improvement. Primary activities designed to achieve these objectives may include the installation of a limited number of cross-vanes, log vanes, and two outfall drop structures (Figures 6-7, Appendix A).

Cross-vane Weirs

Cross-vane weirs may be installed in the channel (Figure 7, Appendix A). The purpose of the vane is to 1) sustain bank stability, 2) direct high velocity flows during bankfull events toward the center of the channel, 3) maintain average pool depth throughout the reach, 4) preserve water surface elevations and reconnect the adjacent floodplain to flooding dynamics from the stream, and 5) modify energy distributions through increases in channel roughness and local energy slopes during peak flows.

Cross-vane weirs will be constructed of boulders approximately 24 inches in minimum width. Cross-vane weir construction will be initiated by imbedding footer rocks into the stream bed for stability to prevent undercutting of the structure. Header rocks will then be placed atop the footer rocks at the design elevation. Footer and header rocks create an arm that slopes from the center of the channel upward at approximately 7 to 10 degrees, tying in at the bankfull floodplain elevation. The cross-vane arms at both banks will be tied into the bank with a sill to eliminate the possibility of water diverting around the structure. Once the header and footer stones are in place, filter fabric will be buried into a trench excavated around the upstream side of the vane arms. The filter fabric is then draped over the header rocks to force water over the vane. The upstream side of the structure can then be backfilled with suitable material to the elevation of the header stones.

Log Vanes

The primary purpose of the log vanes is to direct high velocity flows during bankfull events towards the center of the channel (Figure 7, Appendix A). Log vanes will be constructed utilizing large tree trunks harvested from the Site or imported from offsite. The tree stem harvested for a log cross-vane arm must be long enough to be imbedded into the stream channel and extend several feet into the floodplain. Logs will create an arm that slopes from the center of the channel upward at approximately 5 to 7 degrees, tying in at the bankfull floodplain elevation. Logs will extend from each stream bank at an angle of 20 to 30 degrees. A trench will be dug into the stream channel that is deep enough for the head of the log to be at or below the channel invert. The trench is then extended into the floodplain and the log is set into the trench such that the log arm is below the floodplain elevation. If the log is not of sufficient size to completely block stream flow (gaps occur between the log and channel bed), then a footer log will be installed beneath the header log. Support pilings will then be situated at the base of the log and at the head of the log to hold the log in place. Once these vanes are in place, filter fabric is toed into a trench on the upstream side of the vane and draped over the structure to force water over the vane. The upstream side of the structure is then backfilled with suitable material.

Drop Structure

Drop structures are proposed at the outfall of UT1 and UT3 at Muddy Fork to lower Site hydrology to its preconstruction elevation (Figures 6 and 7, Appendix A). To avoid hydrologic trespass, the drop structures may be installed approximately 150 feet from the downstream Site outfalls. The structures should be constructed to resist erosive forces associated with hydraulic drops proposed at the Site. A TerraCell drop structure, or other similar structure may be installed. TerraCell is a light weight, flexible mat made of high density polyethylene strips. The strips are bonded together to form a honeycomb configuration. The honeycomb mat is fixed in place and filled with gravel or sand. Material in the TerraCell structure may be planted with grasses and shrubs for additional erosion protection. The TerraCell structure will form a nickpoint that approximates geologic controls in stream beds.

7.4 Stream Enhancement (Level II)

Stream enhancement (level II) is proposed for the upper reaches of UT1 and UT1A (Figure 6, Appendix A). Stream enhancement will entail the cessation of current land management practices, removal of spoil material along the stream banks, invasive species control, and planting riparian buffers with native forest vegetation. Riparian buffers will extend a minimum of 50 feet from the top of stream banks to facilitate stream recovery and prevent further degradation of the stream.

7.5 Sediment Transport Analysis

Stream stability assessment including calculations of stream power and shear stress to compare 1) existing dredged and straightened reaches, 2) Reference Reach 1, and 3) proposed Site conditions are discussed in Section 3.6 (Channel Stability Assessment).

7.6 HEC RAS Analysis

The HEC-RAS analysis will be completed prior to completion of detailed construction plans for Site restoration activities. This analysis is discussed in more detail in Section 2.7.3 (FEMA/Hydrological Trespass).

7.7 Hydrological Modifications (Wetland Restoration and Enhancement)

Alternatives for wetland restoration are designed to restore a fully functioning wetland system, which will provide surface water storage, nutrient cycling, removal of imported elements and compounds, and will create a variety and abundance of wildlife habitat. Portions of the Site underlain by hydric soils have been impacted by channel incision, vegetative clearing, ditching, and earth movement associated with agricultural practices. Wetland restoration options should focus on the removal of fill materials, restoration of vegetative communities, the reestablishment of soil structure and microtopographic variations, redirecting normal surface hydrology back to Site floodplains, and filling ditches. These activities will result in the restoration of 7.2 acres of riparian wetland, enhancement of 2.2 acres of riparian wetland, restoration of 1.2 acres of nonriparian slope wetland, and enhancement of 0.1 acre of nonriparian wetland (Figure 6, Appendix A). Restored and enhanced NCWAM wetland types will consist of 2.2 acres of Bottomland Hardwood Forest, 7.2 acres of Headwater Forest, and 1.3 acres of Seep wetlands as depitcted on Figure 8 (Appendix A).

<u>Reestablishment of Historic Groundwater Elevations</u>

Hydric soils adjacent to the incised channels appear to have been drained due to lowering of the groundwater table and a lateral drainage effect from existing stream reaches. Reestablishment of channel inverts is expected to rehydrate soils adjacent to Site streams. Restoring Site stream reaches are expected to rehydrate hydric soils, resulting in the restoration of jurisdictional hydrology to riparian wetlands.

<u>Excavation and Grading of Elevated Spoil and Sediment Embankments</u>

Some areas adjacent to existing channels have experienced both natural and unnatural sediment deposition. Spoil piles were likely cast adjacent to the channel during dredging, straightening, and rerouting of Site streams, and ditching of the adjacent floodplain. Major flood events may have deposited additional sediment adjacent to stream banks from onsite eroding banks and upstream agricultural fields. The removal of these spoil materials represents a critical element of Site wetland restoration. Spoil piles are relatively small and limited to banks of existing streams and ditches. The spoil will be removed to the level of the historic floodplain and used to fill in the abandoned channels/ditches. In the event that additional material is needed to fill abandoned channels/ditches, small areas may be excavated within the floodplain to a depth no greater than 1 foot below the historic floodplain elevation.

Hydrophytic Vegetation

Site wetland areas targeted for restoration and enhancement have endured significant disturbance from land use activities such as land clearing, livestock grazing, and other anthropogenic maintenance. Wetland areas will be revegetated with native vegetation typical of wetland communities in the region. Emphasis will focus on developing a diverse plant assemblage. Section 7.9 (Natural Plant Community Restoration) provides detailed information concerning community species associations.

Reconstructing Stream Corridors

The stream restoration plan involves the reconstruction of Site streams through the floodplain. Existing channels will be backfilled so that the water table may be restored to historic conditions.

7.8 Soil Restoration

Soil grading will occur during stream restoration activities. Topsoils may be stockpiled during construction activities and will be spread on the soil surface once critical subgrade has been established. The replaced topsoil will serve as a viable growing medium for community restoration to provide nutrients and aid in the survival of planted species.

7.9 Natural Plant Community Restoration

Restoration of floodplain forest and stream-side habitat allows for development and expansion of characteristic species across the landscape. Ecotonal changes between community types contribute to diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife.

Reference Forest Ecosystem (RFE) data, onsite observations, and community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) were used to develop the primary plant community associations that will be promoted during community restoration activities.

Stream-side trees and shrubs include species with high value for sediment stabilization, rapid growth rate, and the ability to withstand hydraulic forces associated with bankfull flow and overbank flood events. Stream-side trees and shrubs will be planted within 15 feet of the channel throughout the meander belt-width. Shrub elements will be planted along the reconstructed stream banks, concentrated along outer bends. Piedmont/Low Mountain Alluvial Forest is targeted for the remainder of the Site (Figure 9, Appendix A). The following planting plan is the blueprint for community restoration.

7.9.1 Planting Plan

The purpose of a planting plan is to reestablish vegetative community patterns across the landscape. The plan consists of 1) acquisition of available plant species, 2) implementation of proposed Site preparation, and 3) planting of selected species.

Species selected for planting will be dependent upon availability of local seedling sources. Advance notification to nurseries (1 year) will facilitate availability of various noncommercial elements.

Bare-root seedlings of tree species will be planted within specified map areas at a density of approximately 680 stems per acre on 8-foot centers. Shrub species in the stream-side assemblage will be planted at a density of 2720 stems per acre on 4-foot centers. Table 12 depicts the total number of stems and species distribution within each vegetation association. Planting will be performed between December 1 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season. A total of 27,947 diagnostic tree and shrub seedlings may be planted during restoration.

Table 12. Planting Plan

Vegetation Association	Piedmont/Low Mountain Alluvial Forest*		Stream-side Assemblage**		TOTAL
Area (acres)	**28.3**		**3.2**		**31.5**
Species	**# planted***	**% of total**	**# planted****	**% of total**	**# planted**
Cherrybark oak (*Quercus pagoda*)	1924	10	--	--	1924
American elm (*Ulmus americana*)	1924	10	--	--	1924
Hackberry (*Celtis laevigata*)	1924	10	--	--	1924
Green ash (*Fraxinus pennsylvanica*)	962	5	--	--	962
Shagbark hickory (*Carya ovata*)	1924	10	--	--	1924
Bitternut hickory (*Carya cordiformis*)	2887	15	--	--	2887
Sycamore (*Platanus occidentalis*)	1924	10	--	--	1924
River birch (*Betula nigra*)	2887	15	--	--	2887
Ironwood (*Carpinus caroliniana*)	1924	10	--	--	1924
Silky dogwood (*Cornus amomum*)	962	5	1741	20	2703
Tag alder (*Alnus serrulata*)	--	--	3482	40	3482
Black willow (*Salix nigra*)	--	--	3482	40	3482
TOTAL	**19,242**	**100**	**8705**	**100**	**27,947**

* Planted at a density of 680 stems/acre.
** Planted at a density of 2720 stems/acre.

7.9.2 Nuisance Species Management

Chinese privet (*Ligustrum sinense*), located within all scrub-shrub and riparian areas of the Site, will be controlled mechanically and/or chemically, as part of this project. No other nuisance species controls are proposed at this time. Inspections for beaver and other potential nuisance species will occur throughout the course of the monitoring period. Appropriate actions may be taken to ameliorate any negative impacts regarding vegetation development and/or water management on an as-needed basis. The presences of nuisance species will be monitored over the course of the monitoring period. Appropriate actions will be taken to ameliorate any negative impacts regarding vegetation development and/or water management on an as-needed basis.

8.0 PERFORMANCE CRITERIA

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

8.1 Streams

Restored stream reaches are proposed to be monitored for geometric activity for five years. Annual fall monitoring will include development of channel cross-sections on riffles and pools and a water surface profile of the channel. The data will be presented in graphic and tabular format. Data to be presented will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, 5) width-to-depth ratio, 6) water surface slope, and 7) sinuosity. The stream will subsequently be classified according to stream geometry and substrate (Rosgen 1996). Significant changes in channel morphology will be tracked and reported by comparing data in each successive monitoring year.

Changes in the biotic community are anticipated from a shift in habitat opportunities as tributaries are restored. In-stream, biological monitoring is proposed to track the changes during the monitoring period. The benthic macroinvertebrate community will be sampled using NCDWQ protocols found in the *Standard Operating Procedures for Benthic Macroinvertebrates* (NCDWQ 2006) and *Benthic Macroinvertebrate Protocols for Compensatory Stream Restoration Projects* (NCDWQ 2001). Biological sampling of benthic macroinvertebrates will be used to collect preconstruction baseline data for comparison with postconstruction restored conditions.

Benthic macroinvertebrate monitoring locations will be established within proposed restoration reaches and one reference monitoring location upstream of the enhancement reaches within a relatively stable reach. It is anticipated that postrestoration collections may move slightly from the prerestoration conditions in order to take advantage of developing habitat niches (i.e. riffles, vegetative cover, woody debris in channel, overhanging banks) that cannot be predicted prior to restoration. Benthic macroinvertebrate samples will be collected from individual reaches using the Qual-4 collection method. Sampling techniques of the Qual-4 collection method consist of kick nets, sweep nets, leaf packs, and visual searches. Preproject biological sampling are anticipated to occur in June 2011; post restoration monitoring will occur during the same time frame of each monitoring year.

Identification of collected organisms will be performed by personnel with NCDWQ or by a NCDWQ certified laboratory. Other data collected will include D50 values/NCDWQ habitat assessment forms.

8.1.1 Stream Success Criteria

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

The channel configuration will be measured on 3000 linear feet of stream and 20 cross-sections on an annual basis in order to track changes in channel geometry, profile, or substrate. These data will be utilized to determine the success in restoring stream channel stability. Specifically, the width-to-depth ratio and bank-height ratios should be indicative of a stable or moderately unstable channel with minimal changes in cross-sectional area, channel width, and/or bank erosion along the monitoring reach. In addition, channel abandonment and/or shoot cutoffs must not occur and sinuosity values must remain relatively constant. Visual assessment of in-stream structures will be conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure.

8.1.2 Stream Contingency

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

Structure Failure

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

Headcut Migration Through the Site

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

Bank Erosion

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

8.2 Wetlands

Three groundwater monitoring gauges will be installed within the Site wetland restoration areas and one additional gauge will be installed in a reference wetland to monitor groundwater hydrology. Hydrological sampling will continue for five years throughout the growing season at intervals necessary to satisfy the hydrology success criteria within each design unit (USEPA 1990).

8.2.1 Wetland Success Criteria

According to the *Soil Survey of Alexander County*, the growing season for Alexander County as recorded in Hickory, North Carolina during the period from 1951-1984 is from March 20-November 9 (USDA 1995). However, for purposes of this project gauge hydrologic success will be determined using data from February 1-November 9 to more accurately represent the period of biological activity.

Target hydrological characteristics include saturation or inundation for 8 percent of the monitored period (February 1-November 9), during average climatic conditions. During years with atypical climatic conditions, groundwater gauges in reference wetlands may dictate threshold hydrology success criteria (75 percent of reference). These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed.

8.2.2 Wetland Contingency

Hydrological contingency will require consultation with hydrologists and regulatory agencies if wetland hydrology enhancement is not achieved. Floodplain surface modifications, including construction of ephemeral pools, represent a likely mechanism to increase the floodplain area in support of jurisdictional wetlands. Recommendations for contingency to establish wetland hydrology will be implemented and monitored until Hydrology Success Criteria are achieved.

8.3 Vegetation

Restoration monitoring procedures for vegetation will monitor plant survival and species diversity. After planting has been completed in winter or early spring, an initial evaluation will be performed to verify planting methods and to determine initial species composition and density. Supplemental planting and additional modifications will be implemented, if necessary. A photographic record of plant growth should be included in each annual monitoring report.

During the first year, vegetation will receive a cursory, visual evaluation on a periodic basis to ascertain the degree of overtopping of planted elements by nuisance species. Subsequently, quantitative sampling of vegetation will be performed as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) in September of the first monitoring year and annually between June 1 and September 30 for the remainder of the monitoring period until vegetation success criteria are achieved.

During quantitative vegetation sampling in early fall of the first year, 10 sample plots (10 meters by 10 meters) will be randomly placed within the Site; however, best professional judgment may be necessary to establish vegetative monitoring plots upon completion of construction activities. In each sample plot, vegetation parameters to be monitored include species composition and species density.

8.3.1 Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon the density and growth of "Characteristic Tree Species." Characteristic Tree Species include planted species, species identified through visual inventory of an approved reference (relatively undisturbed) forest community, and species outlined in Schafale and Weakley (1990).

An average density of 320 stems per acre of Characteristic Tree Species must be surviving in the first three monitoring years. Subsequently, 290 Characteristic Tree Species per acre must be surviving in year 4, 260 Characteristic Tree Species per acre in year 5, and 210 Characteristic Tree Species per acre in year 7.

No single volunteer species (most notably red maple, loblolly pine, and sweet gum) will comprise more than 20 percent of the total composition at years 3, 5, or 7. If this occurs, remedial procedures/protocols outlined in the contingency plan will be implemented. During years 3, 5, and 7, no single volunteer species, comprising over 20 percent of the total composition, may be more than twice the height of the planted trees. If this occurs, remedial procedures outlined in the contingency plan will be implemented.

If, within the first 3 years, any species exhibits greater than 50 percent mortality, the species will either be replanted or an acceptable replacement species will be planted in its place as specified in the contingency plan.

8.3.2 Vegetation Contingency

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

8.4 Scheduling and Reporting

The first year monitoring report will be submitted at the end of December after Site implementation. Monitoring will continue for five years for streams and wetlands, and seven year for vegetation or until agreed upon success criteria are achieved, with a report submitted by the end of December for each monitoring year (years 1-5 and year 7).

9.0 REFERENCES

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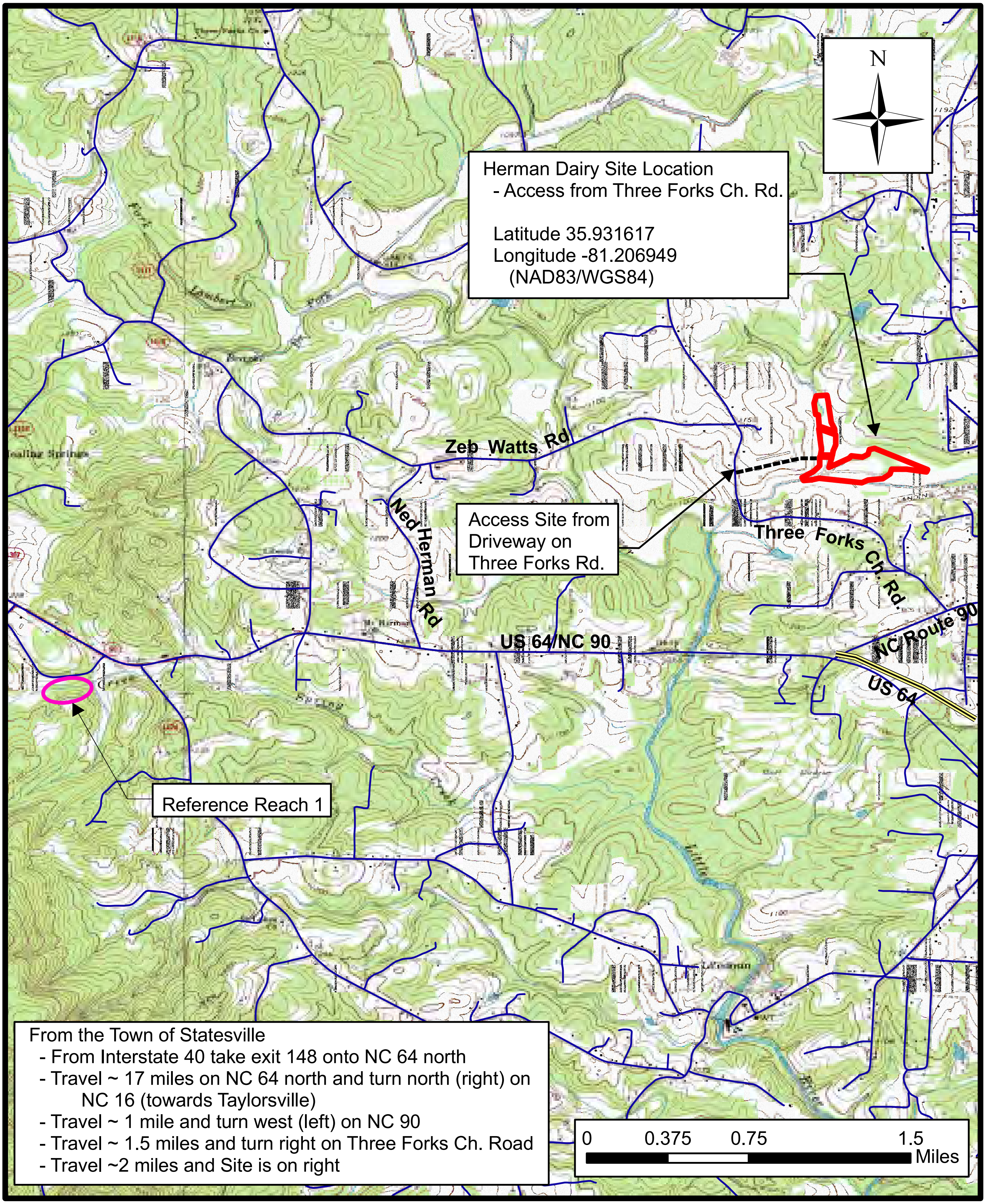
APPENDIX A
FIGURES



Axiom Environmental
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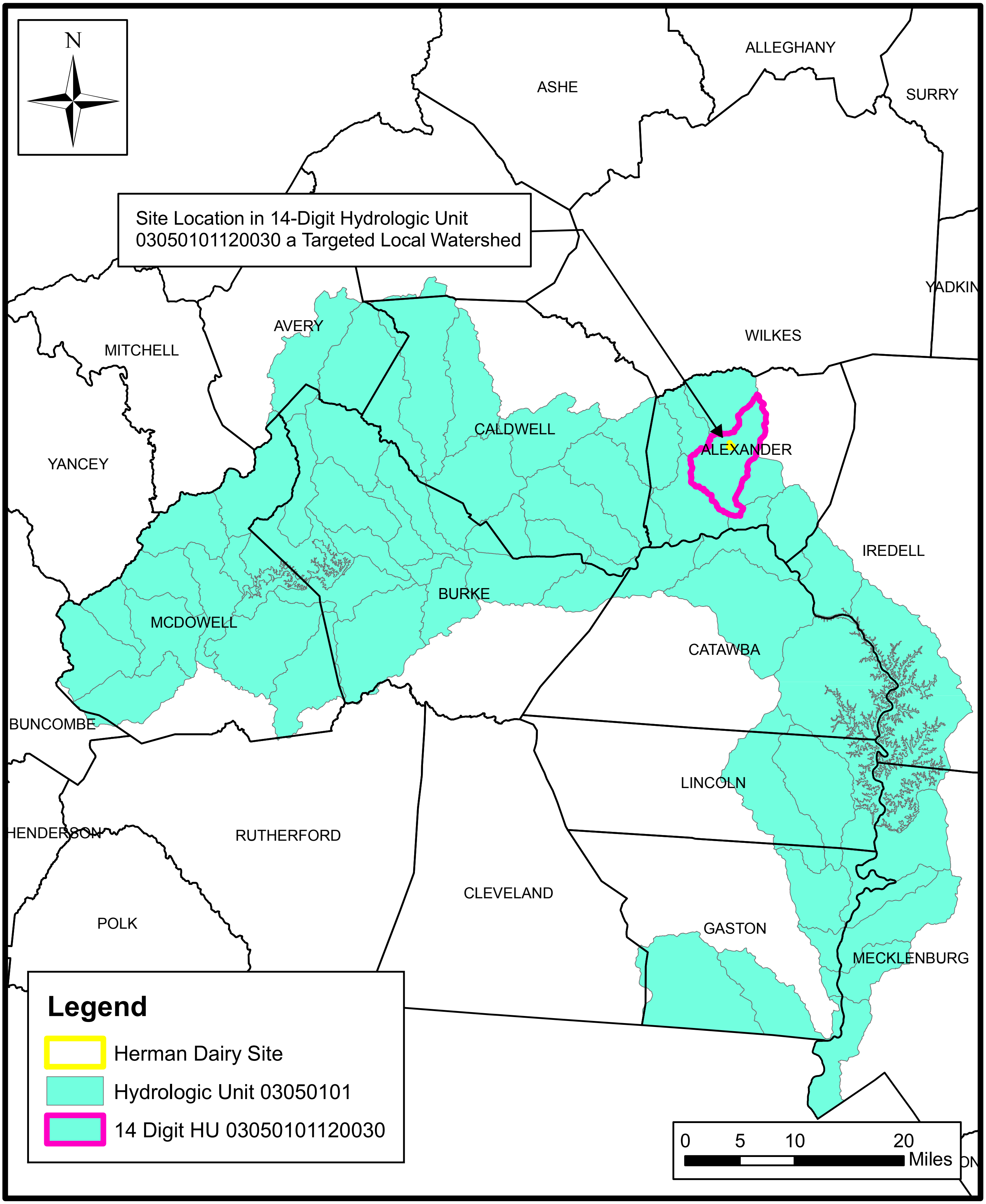
Axiom Environmental, Inc.

HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
SITE LOCATION
Alexander County, North Carolina

Dwn. By: WGL	FIGURE 1
Date: Dec 2010	
Project: 10-016	



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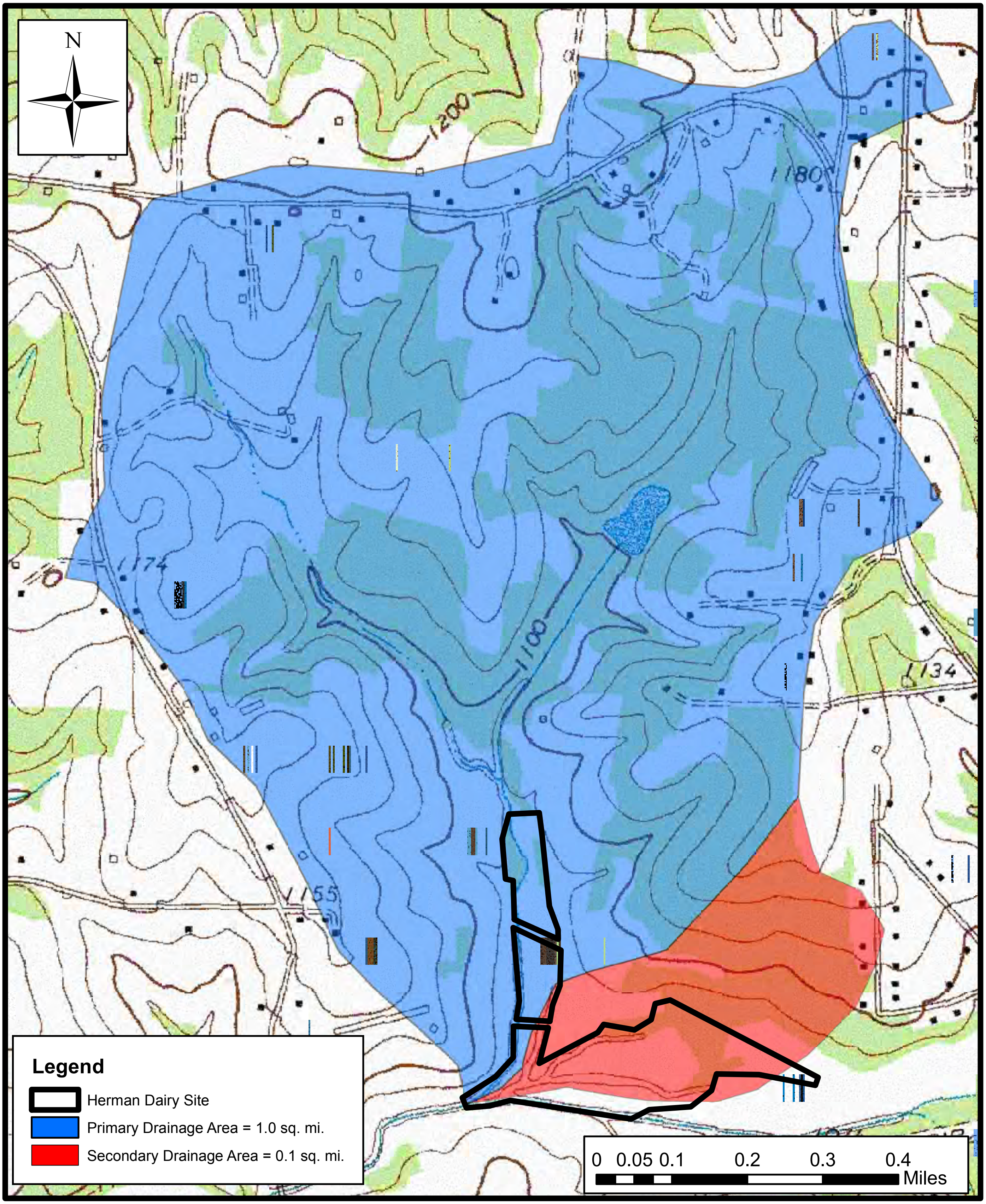
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
HYDROLOGIC UNIT MAP
Alexander County, North Carolina

Dwn. By: WGL
Date: Oct 2010
Project: 10-016

FIGURE 2



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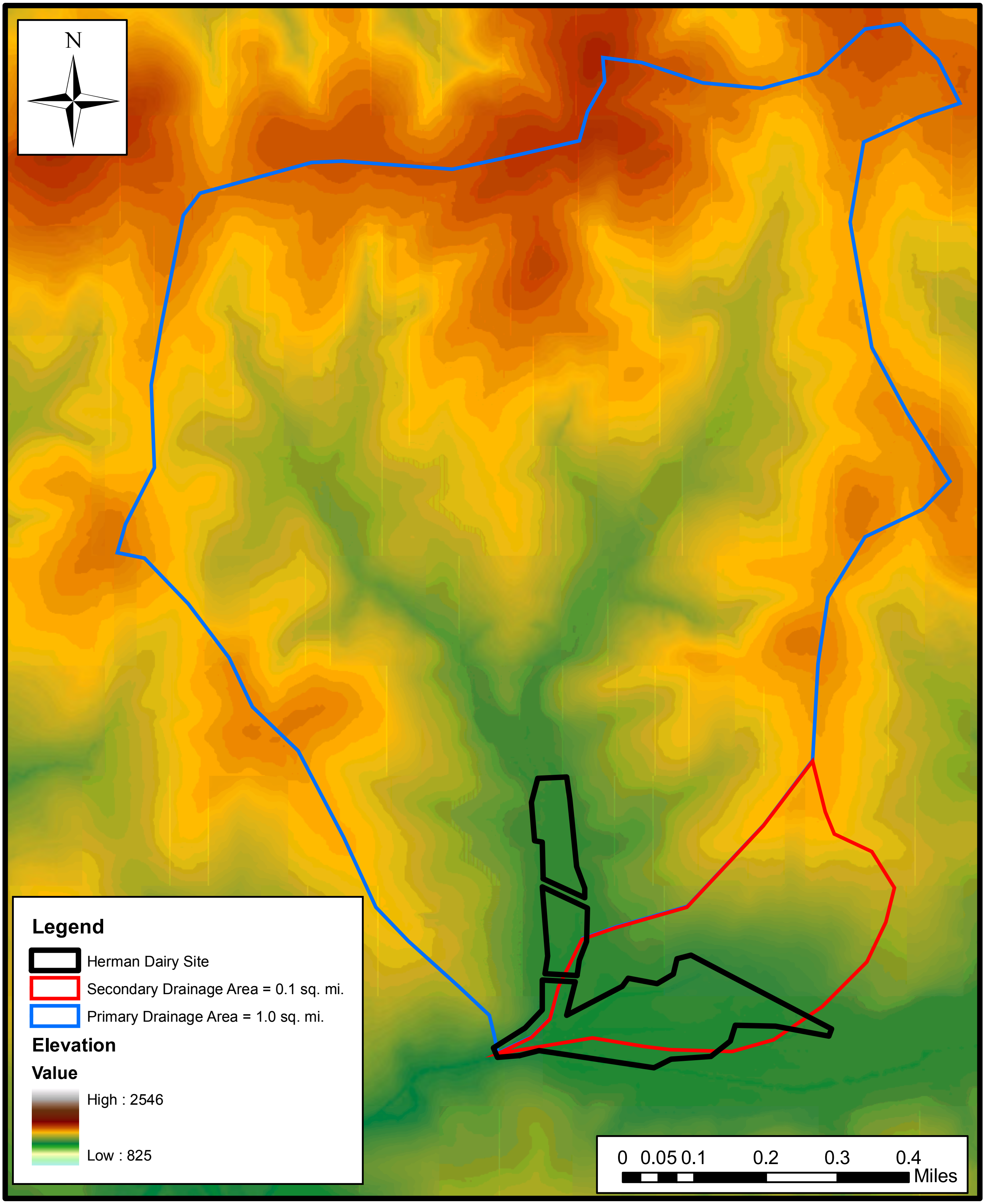
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
TOPOGRAPHY AND DRAINAGE AREA
Alexander County, North Carolina

Dwn. By: WGL	FIGURE
Date: Jan 2011	3A
Project: 10-016	



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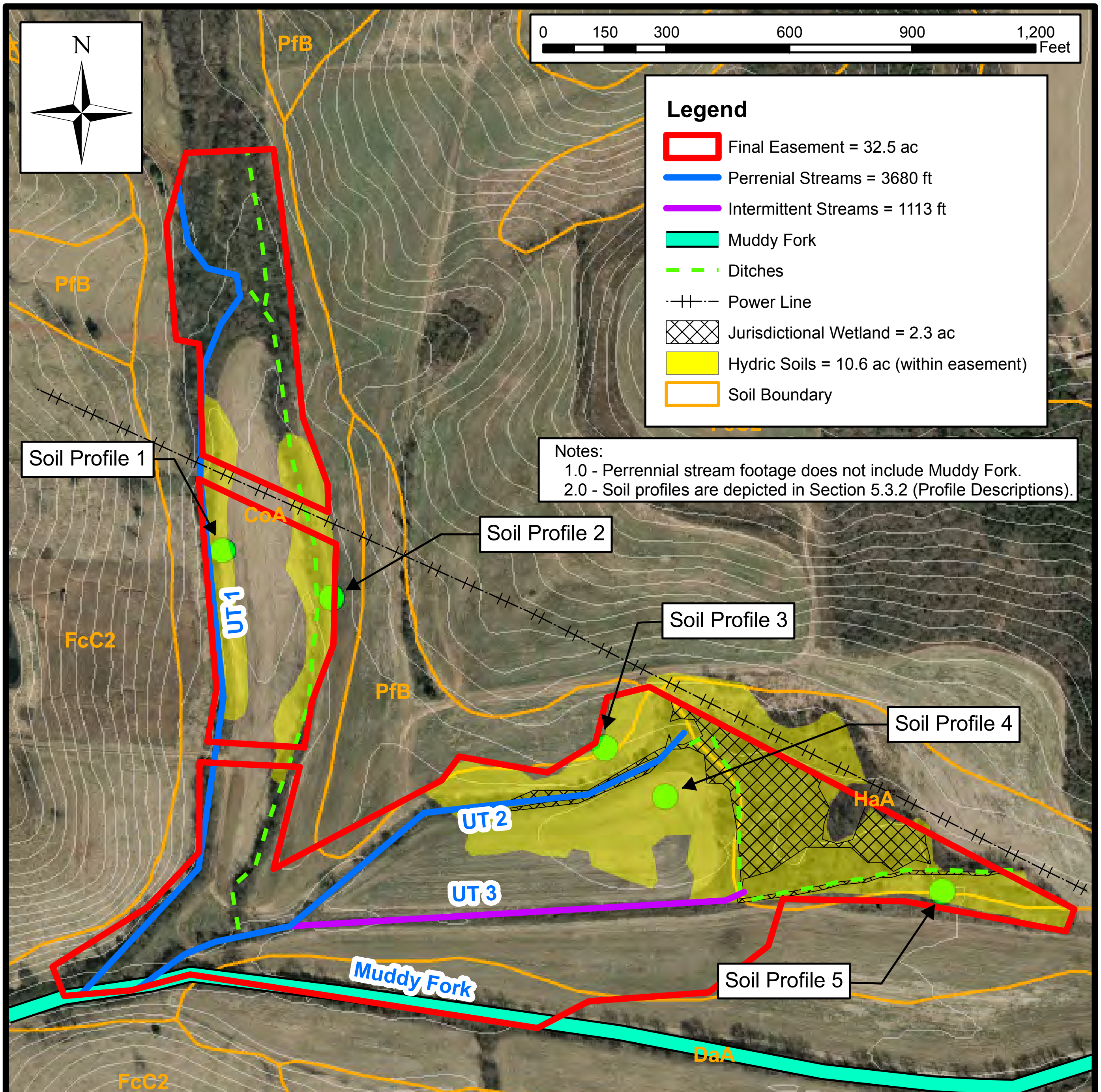
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
TOPOGRAPHY AND DRAINAGE AREA
Alexander County, North Carolina

Dwn. By: WGL	FIGURE
Date: Jan 2011	3B
Project: 10-016	



Symbol	Hydric Status	Soil Name	Soil Taxonomy
CoA	Class B	Codorus Loam, 0-2% Slopes	*Fluvaquentic Dystrudepts*
DaA	Class B and Nonhydric	Dan River and Comus Soils, 0-4% Slopes	*Oxyaquic Dystrudepts and Fluventic Dystrudepts*
HaA	Class A	Hatboro Loam, 0-2% Slopes	*Fluvaquentic Endoaquepts*
PfB	Nonhydric	Pfafftown Sandy Loam, 2-6% Slope	*Typic Hapludults*

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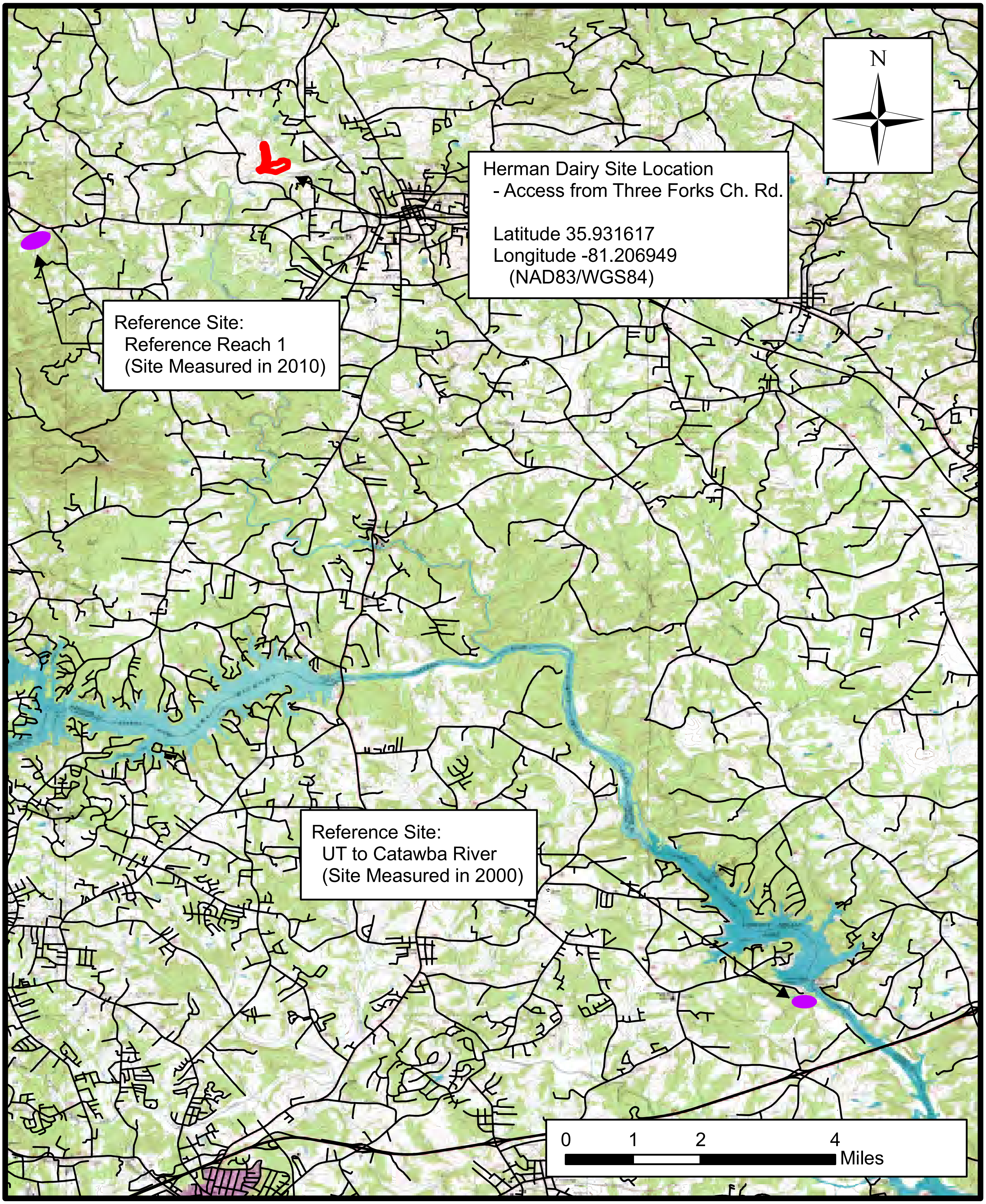
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
EXISTING CONDITIONS
Alexander County, North Carolina

Dwn. By: WGL
Date: Jan 2011
Project: 10-016

FIGURE 4



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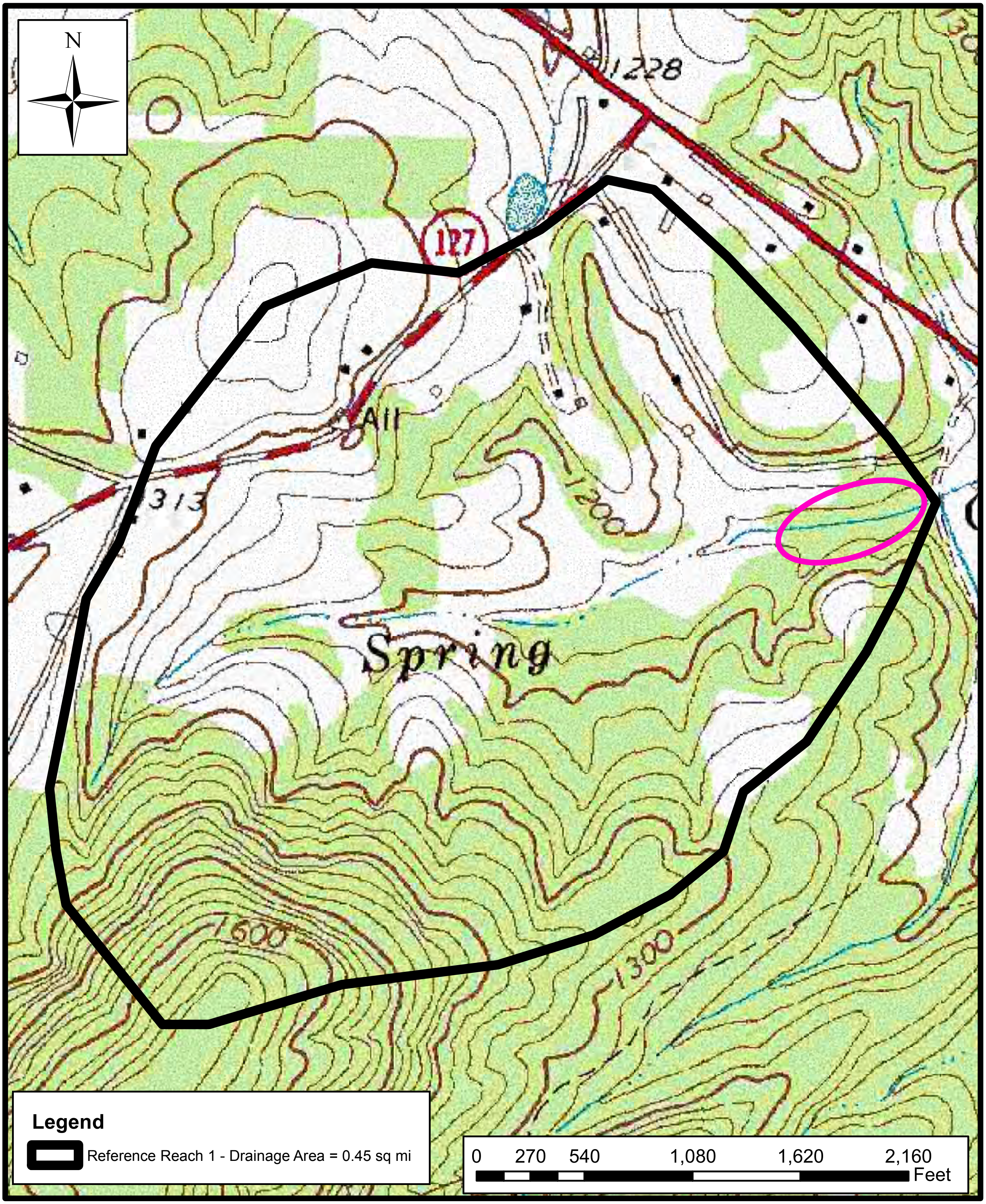
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
REFERENCE SITE VICINITY MAP
Alexander County, North Carolina

Dwn. By: WGL	FIGURE 5A
Date: Jan 2011	
Project: 10-016	



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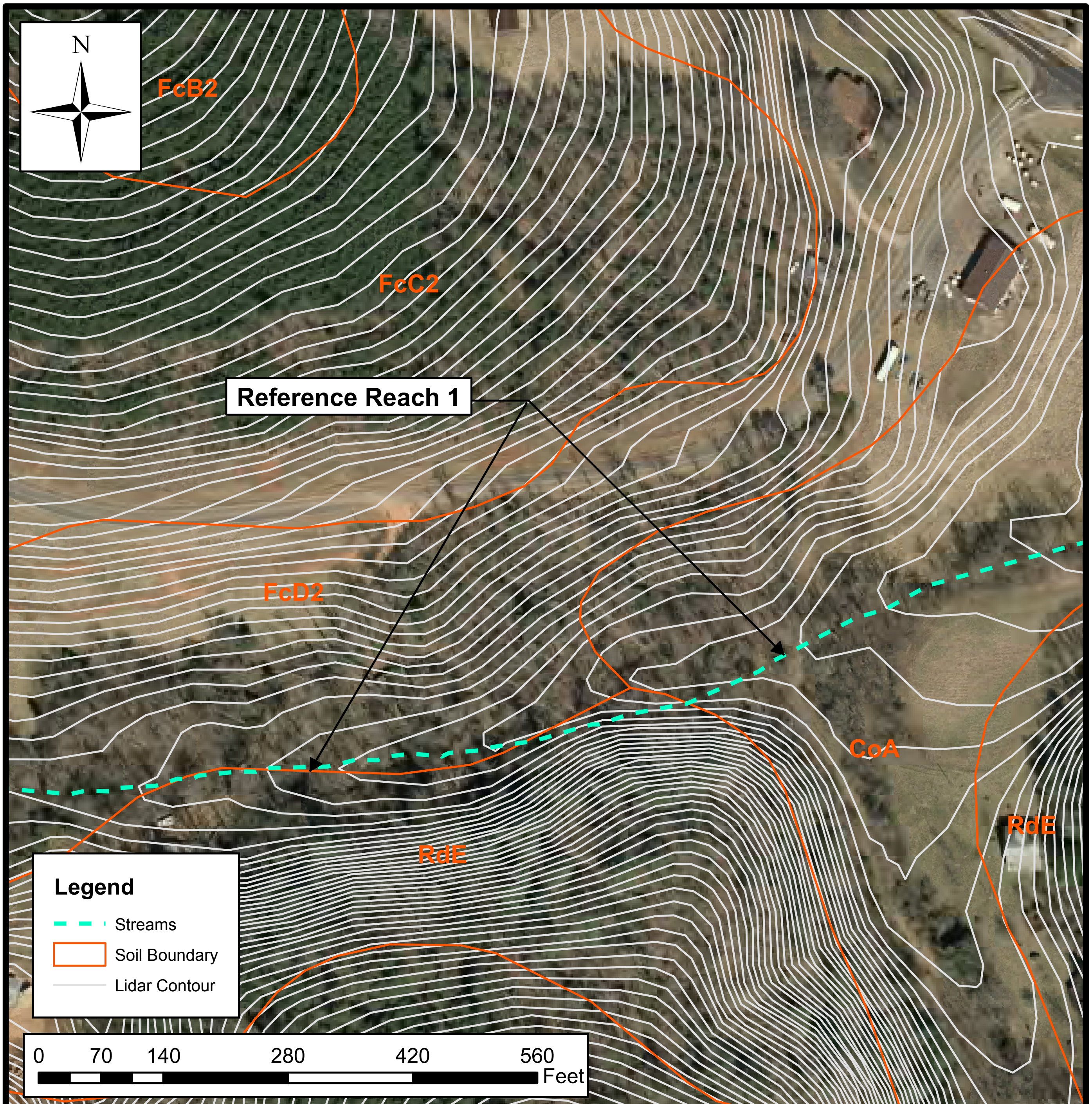
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
REFERENCE SITE 1 - WATERSHED
Alexander County, North Carolina

Dwn. By: WGL	FIGURE
Date: Jan 2011	5B
Project: 10-016	



Herman Dairy Reference - 1 Soils

Symbol	Hydric Status	Soil Name	Soil Taxonomy
CoA	Class B	Codorus Loam, 0-2% Slopes	*Fluvaquentic Dystrudepts*
FcD2	Nonhydric	Fairview Sandy Loam, 15-25% Slopes	*Typic Kanhapludults*
RdE	Nonhydric	Rhodhiss Sandy Loam, 25-45% Slopes	*Typic hapludults*

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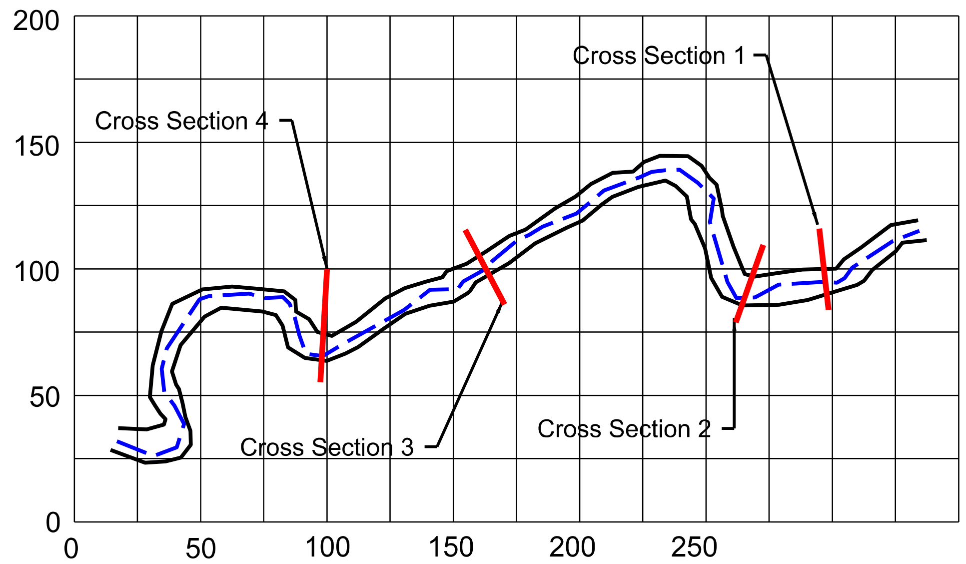
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
REFERENCE SITE 1 - EXISTING CONDITIONS
Alexander County, North Carolina

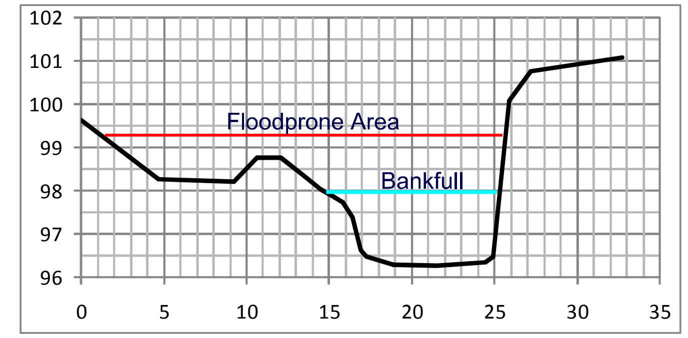
Dwn. By: WGL
Date: Jan 2011
Project: 10-016

FIGURE 5C

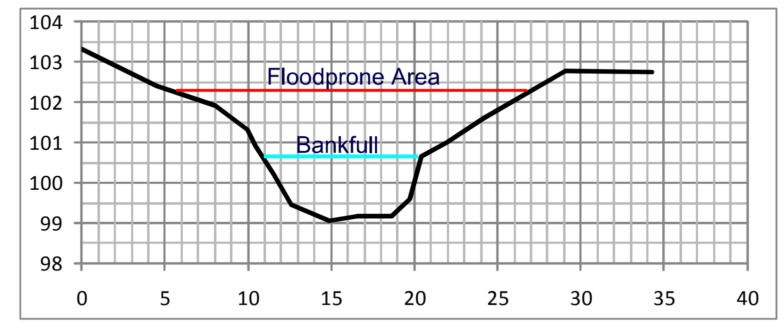


Reference Pattern
Lp-p = 60 (29 - 103) ft
Lm = 80.5 (65 - 128) ft
Wbelt = 45 (35 - 58) ft
Rc = 16 (10 - 32) ft
Lp-p/Wbkf = 6.3 (3.1 - 10.8)
Lm/Wbkf = 8.5 (6.8 - 13.5)
Wbelt/Wbkf = 4.7 (3.7 - 6.1)
Rc/Wbkf = 1.7 (1.1 - 3.4)
SIN = 1.40

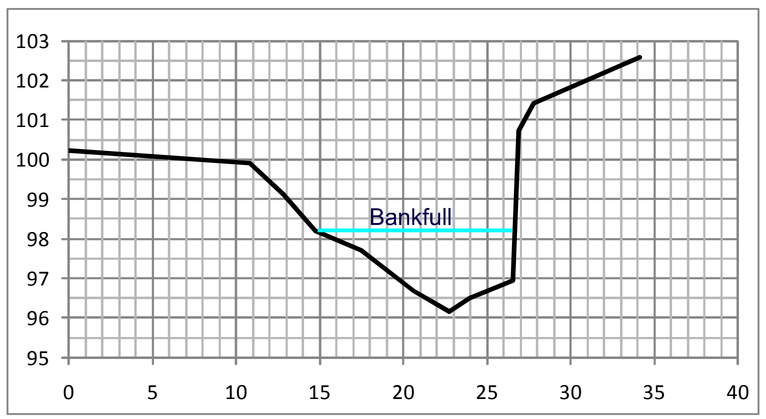
Pattern Legend
- Top of Bank
- Thalweg
- Cross Section



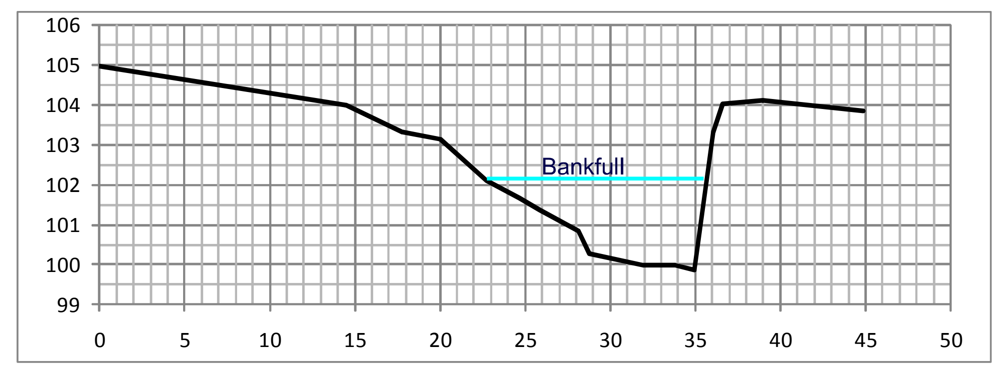
Cross Section 1 - Riffle
Abkf = 11.9 ft
Dave = 1.3 ft
Wbkf = 9.4 ft
Dmax = 1.5 ft
Bank Height = 1.5 ft
Bank Height Ratio = 1.0
W/D = 7.4
FPA = 25
ENT = 2.7
Stream Type = E



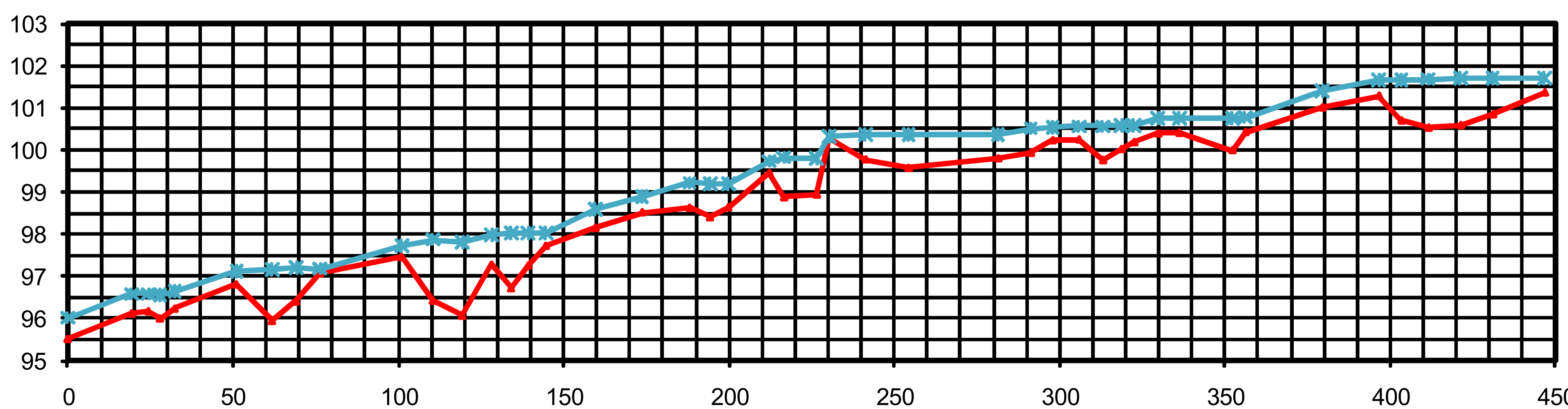
Cross Section 3 - Riffle
Abkf = 11.8 ft
Dave = 1.2 ft
Wbkf = 9.6 ft
Dmax = 1.6 ft
Bank Height = 1.6 ft
Bank Height Ratio = 1.0
W/D = 7.9
FPA = 22
ENT = 2.3
Stream Type = E



Cross Section 2 - Pool
Abkf = 13.8 ft
Wbkf = 11.9 ft
Dmax = 2.1 ft



Cross Section 4 - Pool
Abkf = 18.1 ft
Wbkf = 13.0 ft
Dmax = 2.3 ft



Profile (Reference Reach 1)
Save = 0.0127 rise/run
Svalley = 0.0178 rise/run
Sriffle = 0.0248 (0.0034 - 0.0431) rise/run
Spool = 0.0004 (0 - 0.0048) rise/run
Srun = 0.0022 (0 - 0.0193) rise/run
Sglide = 0.0018 (0 - 0.0190) rise/run

Axiom Environmental, Inc.

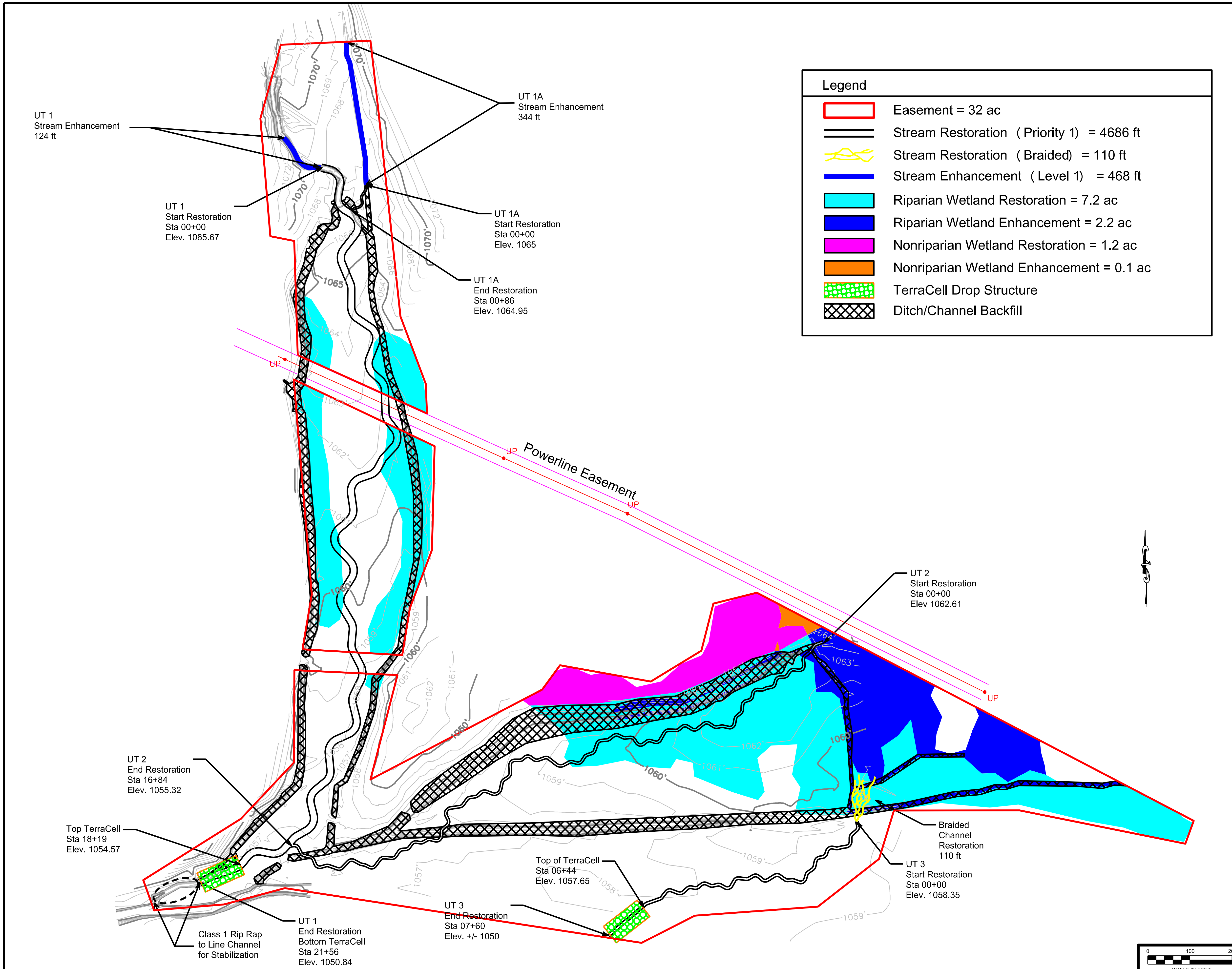
RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation

NOTES/REVISIONS

Project:
Herman Dairy Mitigation Site
Alexander County North Carolina

Title:
Reference Reach 1 Dimension, Pattern, and Profile

Scale: NA
Date: November 2010
Project No.: 10-016
FIGURE NO. 5D



Axiom Environmental, Inc.

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation

NOTES/REVISIONS

Project:

Herman Dairy Mitigation Site

Alexander County North Carolina

Title:

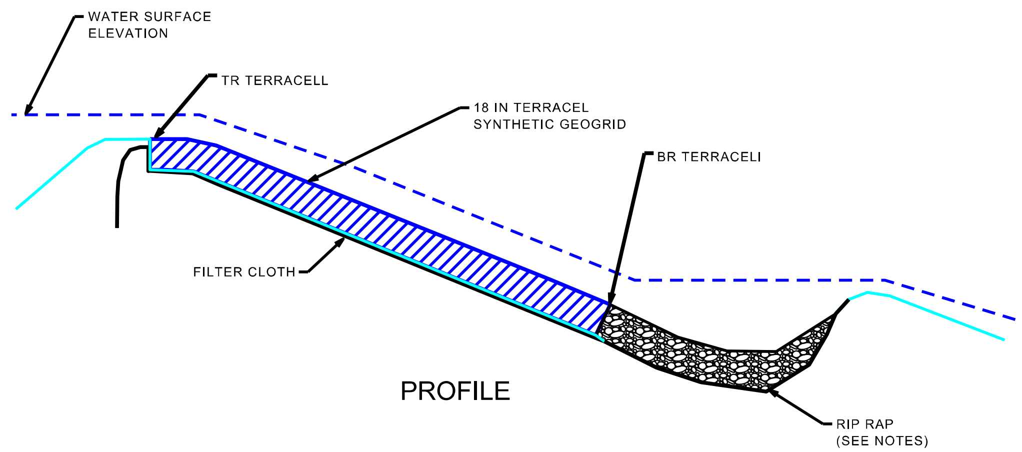
Restoration Plan

Scale: 1" = 225'

Date: November 2010

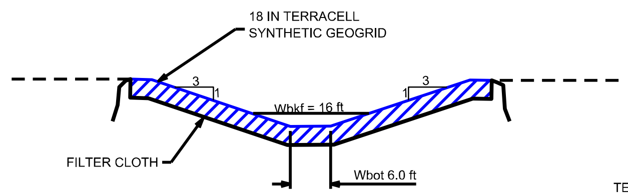
Project No.: 10-016

FIGURE NO. 6



PROFILE

TERRACELL STRUCTURE NOTES:
1. CONTRACTOR WILL INSTALL 18 INCH TERRACELL SYNTHETIC GEOGRID AS PER THE MANUFACTURES SPECIFICATIONS.
2. AT BOTTOM RIFFLE DOWNSTREAM FROM TERRACELL STRUCTURE THE POOL WILL BE ARMORED WITH EROSION CONTROL FABRIC AND CLASS 1 RIP RAP OR OTHER SUITABLE MATERIAL.

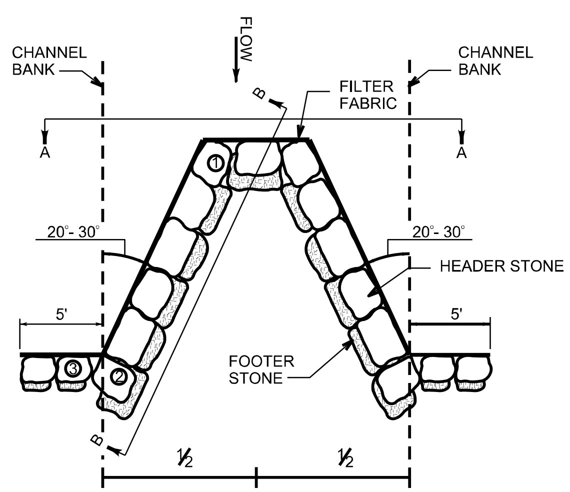


CROSS-SECTION

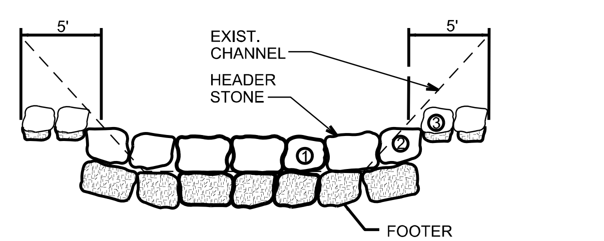
TERRACELL STRUCTURE NOTES:
1. CONTRACTOR WILL INSTALL 18 INCH TERRACELL SYNTHETIC GEOGRID AS PER THE MANUFACTURES SPECIFICATIONS.
2. ONCE THE SYNTHETIC GEOGRID HAS BEEN INSTALLED, GEOCELLS WILL BE BACKFILLED WITH GRAVEL AND TOPSOIL AND PLANTED WITH EROSION CONTROLL GRASSES AND WILLOW STAKES (*SALIX NIGRA*).

REACH	ARM LENGTH (FT.)	CHANNEL DEPTH (FT.)
Tributary 1	12.0	1.4 - 1.8
Tributaries 2 and 3	5.0	0.4 - 0.8

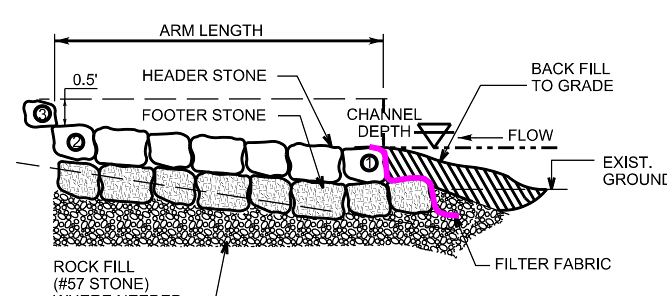
NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 32" ALONG THE SHORTEST DIMENSION.



PLAN VIEW

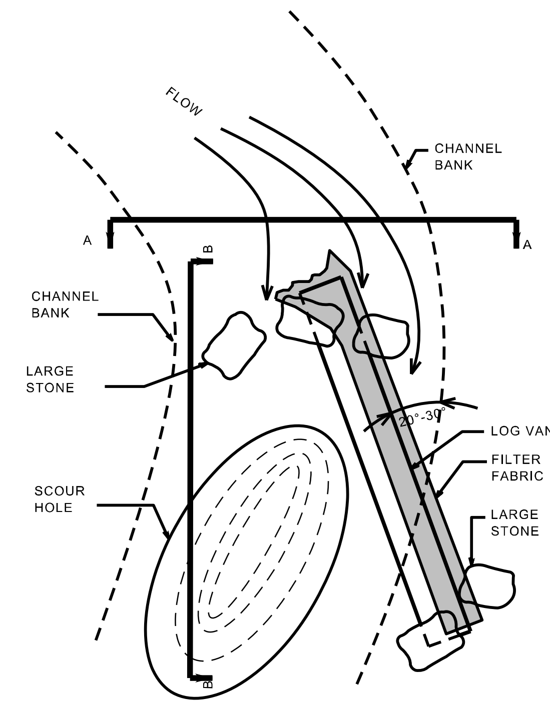


ELEVATION A-A



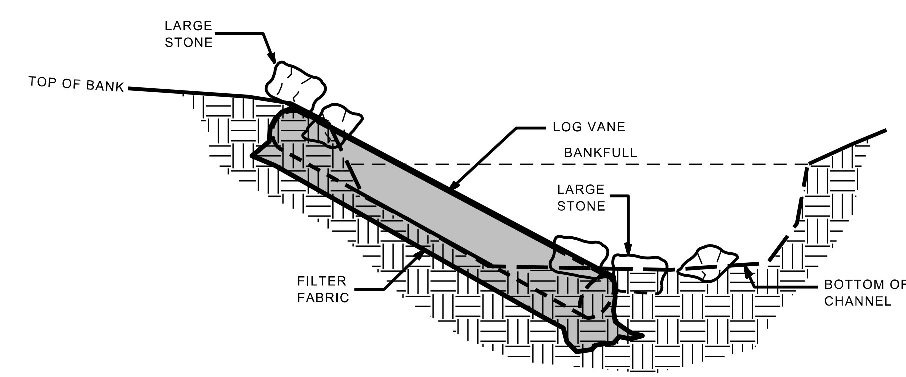
PROFILE B-B

TYPICAL CROSS-VANE

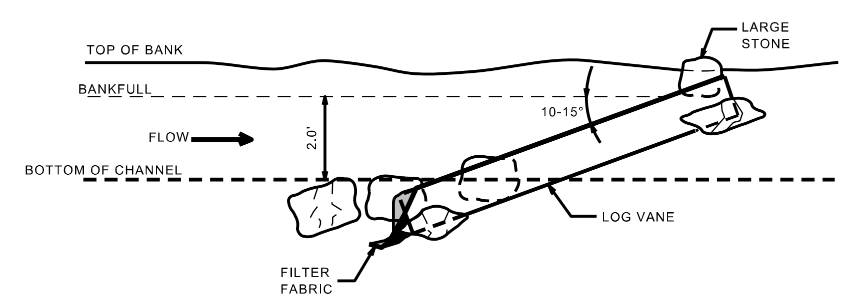


NOTE:
FILTER FABRIC TOED IN AND DRAPED ON UPSTREAM SIDE OF LOG VANE PRIOR TO BACKFILL.

PLAN VIEW
SCALE: N.T.S.



CROSS-SECTION A-A
SCALE: N.T.S.



PROFILE B-B
SCALE: N.T.S.

NOTE:
FILTER FABRIC TOED IN AND DRAPED ON UPSTREAM SIDE OF LOG VANE PRIOR TO BACKFILL.

TYPICAL LOG VANE

Axiom Environmental, Inc.

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation

NOTES/REVISIONS

Project:

Herman Dairy Mitigation Site

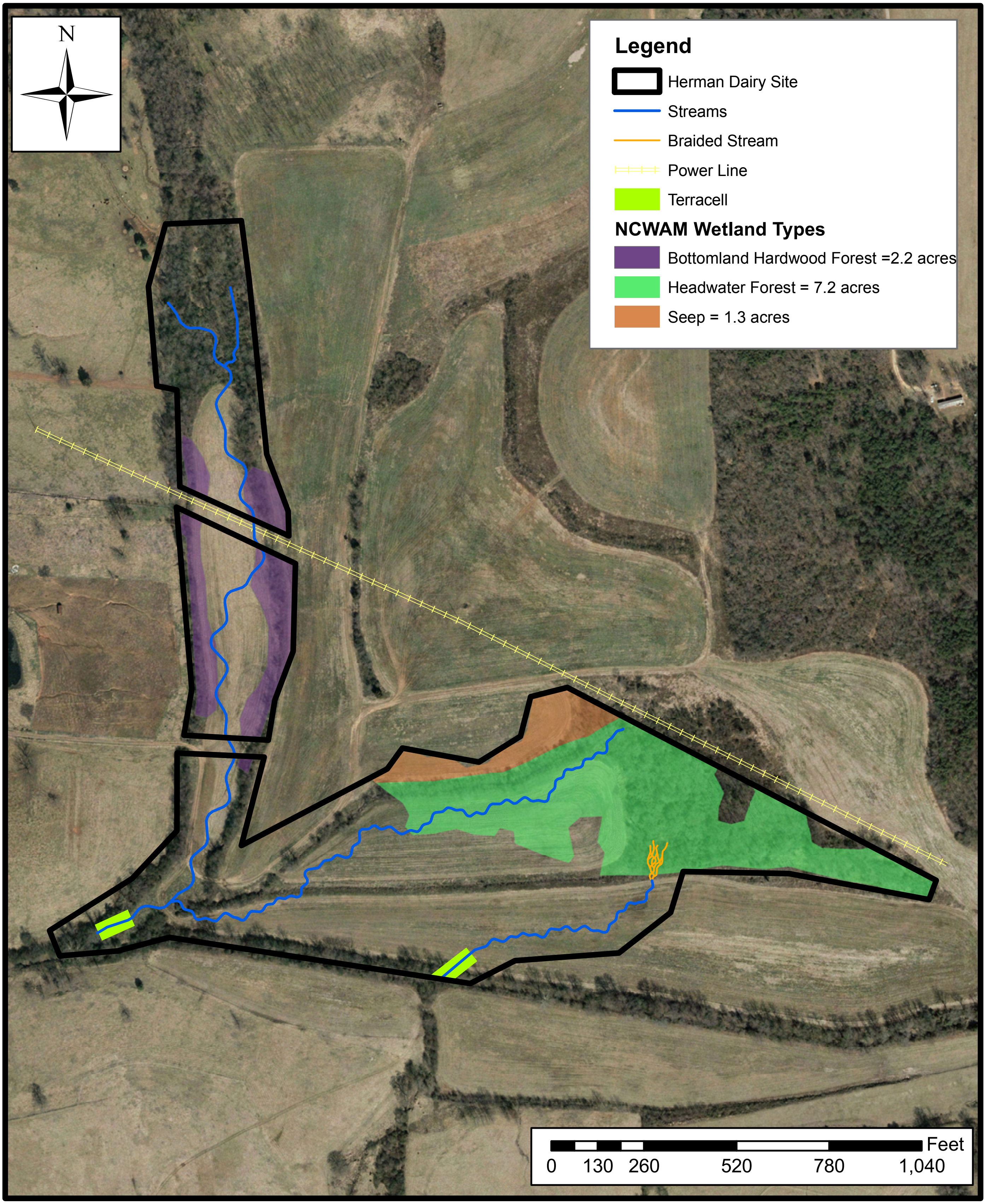
Alexander County North Carolina

Title:

TYPICAL STRUCTURE DETAILS

Scale: NO SCALE
Date: November 2010
Project No.: 10-016

FIGURE NO.
7



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Axiom Environmental, Inc.

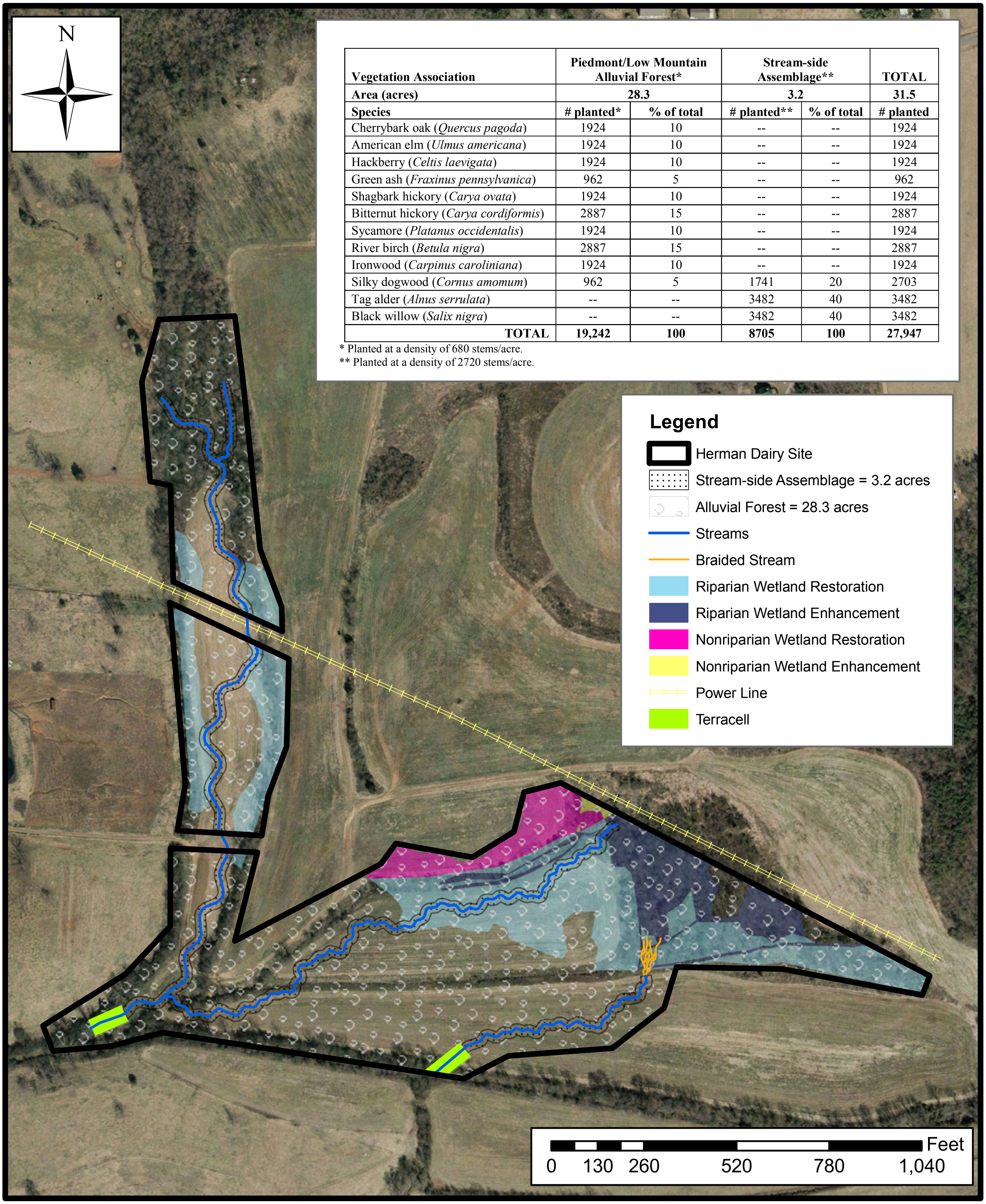
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
PROPOSED NCWAM WETLAND TYPES
Alexander County, North Carolina

Dwn. By: CLF
Date: Jan 2011
Project: 10-016

FIGURE 8

Vegetation Association	Piedmont/Low Mountain Alluvial Forest*		Stream-side Assemblage**		TOTAL
Area (acres)	**28.3**		**3.2**		**31.5**
Species	**# planted***	**% of total**	**# planted****	**% of total**	**# planted**
Cherrybark oak (*Quercus pagoda*)	1924	10	--	--	1924
American elm (*Ulmus americana*)	1924	10	--	--	1924
Hackberry (*Celtis laevigata*)	1924	10	--	--	1924
Green ash (*Fraxinus pennsylvanica*)	962	5	--	--	962
Shagbark hickory (*Carya ovata*)	1924	10	--	--	1924
Bitternut hickory (*Carya cordiformis*)	2887	15	--	--	2887
Sycamore (*Platanus occidentalis*)	1924	10	--	--	1924
River birch (*Betula nigra*)	2887	15	--	--	2887
Ironwood (*Carpinus caroliniana*)	1924	10	--	--	1924
Silky dogwood (*Cornus amomum*)	962	5	1741	20	2703
Tag alder (*Alnus serrulata*)	--	--	3482	40	3482
Black willow (*Salix nigra*)	--	--	3482	40	3482
TOTAL	**19,242**	**100**	**8705**	**100**	**27,947**

* Planted at a density of 680 stems/acre.
** Planted at a density of 2720 stems/acre.



Axiom Environmental
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693
Axiom Environmental, Inc.

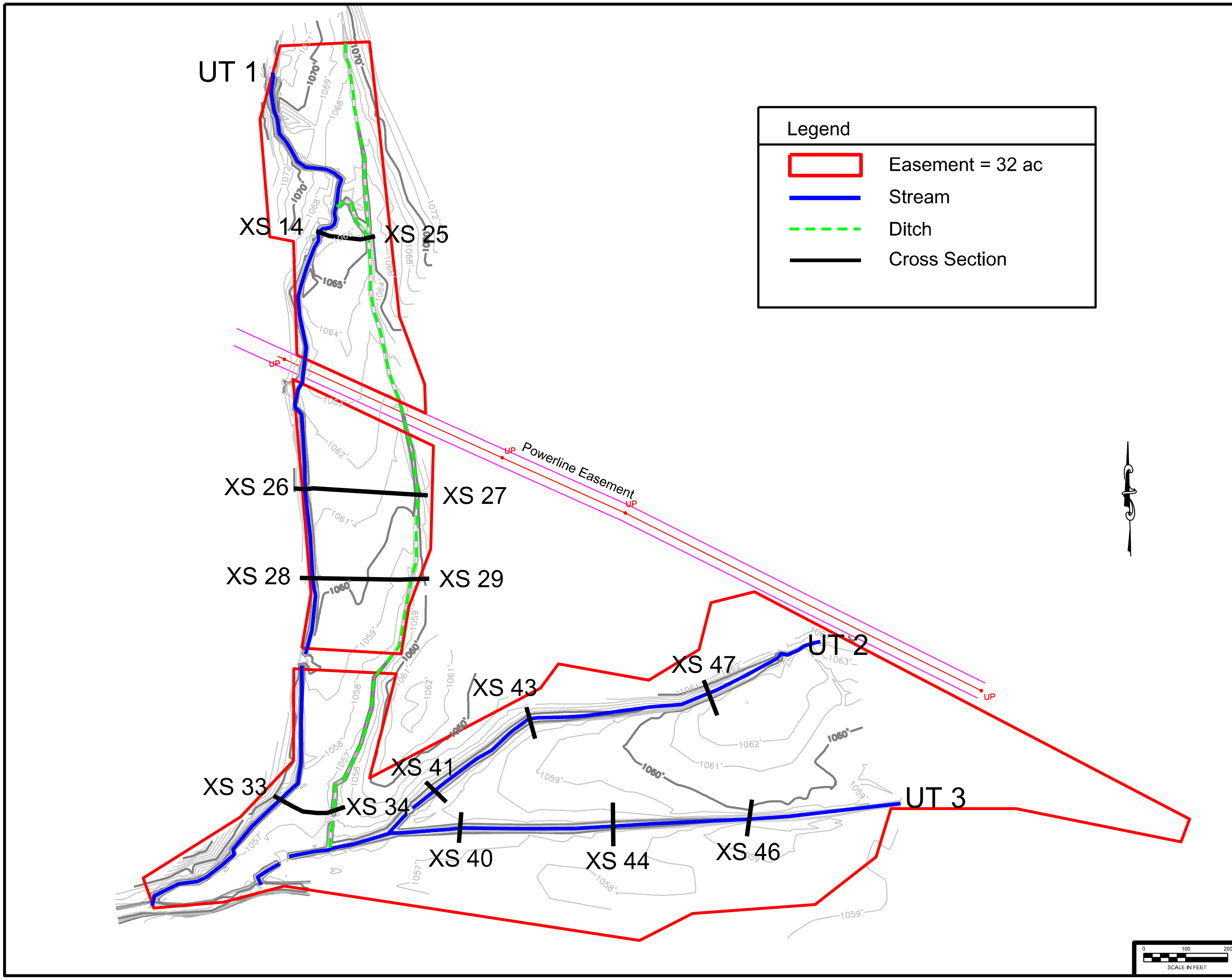
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
PLANTING PLAN
Alexander County, North Carolina

Dwn. By: CLF
Date: Jan 2011
Project: 10-016

FIGURE 9

Appendix B
Existing Stream Data

Figure B1. Existing Stream Cross-section Locations
Existing Stream Data



Axiom Environmental, Inc.

NOTES/REVISIONS

Project:

Herman Dairy Mitigation Site

Alexander County North Carolina

Title:

Cross Section Location

Scale: 1" = 345'

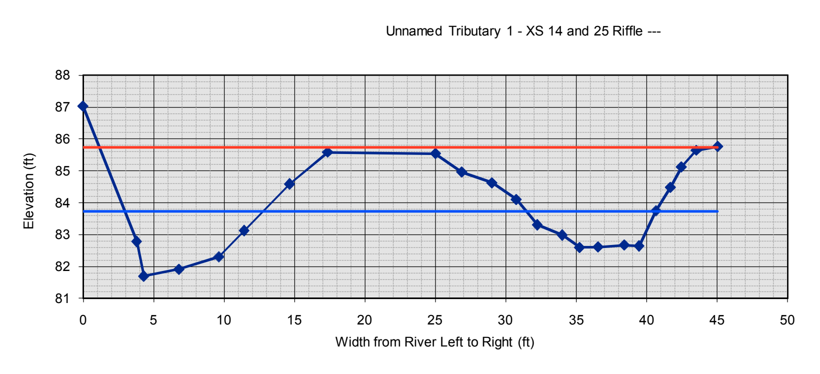
Date: November 2010

Project No.: 10-016

FIGURE NO.

B1

Cross Section



section:	Unnamed Tributary 1 - XS 14 and 25
	Riffle --- ---
description:	Unnamed Tributary 1 - XS 14 and 25
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	12.97788	87.02212
	☐	3.814005	17.21424	82.78576
	☐	4.305891	18.30009	81.69991
	☐	6.806662	18.0869	81.9131
	☐	9.63469	17.69708	82.30292
	☐	11.43833	16.87127	83.12873
	☐	14.66467	15.41151	84.58849
	☐	17.36	14.41943	85.58057
	☐	25	14.46115	85.53885
	☐	26.87394	15.03773	84.96227
	☐	29.01861	15.37589	84.62412
	☐	30.74491	15.89643	84.10357
	☐	32.24287	16.69503	83.30497
	☐	34.00678	17.01595	82.98405
	☐	35.24822	17.4028	82.5972
	☐	36.55005	17.38882	82.61118
	☐	38.3996	17.32925	82.67075
	☐	39.45585	17.3542	82.6458
	☐	40.66803	16.25361	83.74639
	☐	41.68345	15.51561	84.48439
	☐	42.46713	14.8802	85.1198
	☐	43.52121	14.35412	85.64588
	☐	45.03189	14.23966	85.76034
	☐			
	☐			
	☐			
	☐			
	☐			

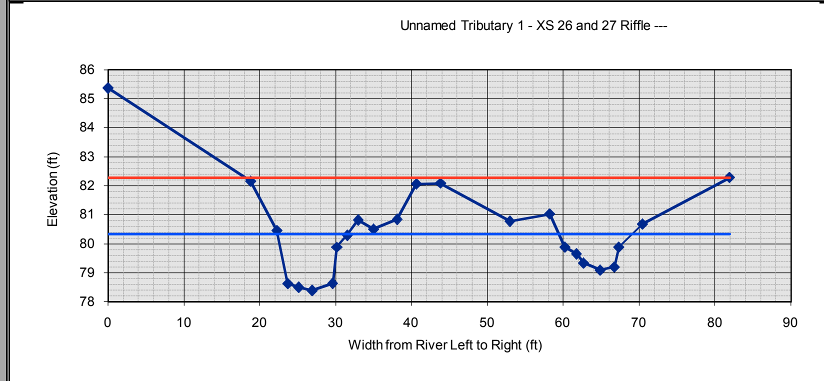
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
16.28	14.4	150.0		
83.72	85.6			

dimensions			
20.2	x-section area	1.1	d mean
18.9	width	21.0	wet P
2.0	d max	1.0	hyd radi
3.9	bank ht	17.8	w/d ratio
150.0	W flood prone area	7.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Unnamed Tributary 1 - XS 26 and 27
	Riffle --- ---
description:	Unnamed Tributary 1 - XS 26 and 27
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	14.63831	85.36169
	☐	18.77084	17.84076	82.15924
	☐	22.25488	19.53953	80.46047
	☐	23.68119	21.36044	78.63956
	☐	25.11541	21.49143	78.50857
	☐	26.8862	21.60167	78.39833
	☐	29.61613	21.35493	78.64508
	☐	30.15198	20.10704	79.89296
	☐	31.52746	19.7057	80.2943
	☐	32.95727	19.17926	80.82074
	☐	34.98181	19.48919	80.51081
	☐	38.10295	19.15432	80.84568
	☐	40.64645	17.9396	82.0604
	☐	43.83	17.91761	82.08239
	☐	53	19.21782	80.78219
	☐	58.24293	18.9713	81.02871
	☐	60.22106	20.10573	79.89427
	☐	61.78384	20.34506	79.65494
	☐	62.67498	20.65641	79.34359
	☐	64.88621	20.90074	79.09926
	☐	66.76622	20.79813	79.20187
	☐	67.33577	20.10864	79.89136
	☐	70.46569	19.31457	80.68543
	☐	81.91452	17.71312	82.28688
	☐			
	☐			
	☐			
	☐			

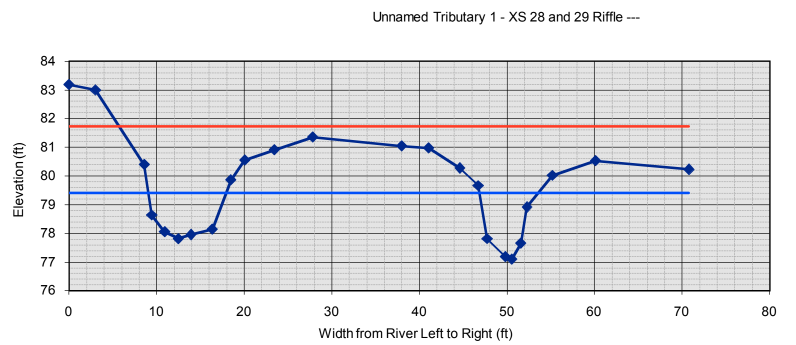
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
19.66	17.94	150.0		
80.34	82.06			

dimensions			
20.2	x-section area	1.1	d mean
19.0	width	21.3	wet P
1.9	d max	1.0	hyd radi
3.7	bank ht	17.8	w/d ratio
150.0	W flood prone area	7.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Unnamed Tributary 1 - XS 28 and 29
	Riffle --- ---
description:	Unnamed Tributary 1 - XS 28 and 29
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	16.82307	83.17693
	☐	3.017515	17.00939	82.99061
	☐	8.582564	19.60277	80.39723
	☐	9.435794	21.36286	78.63714
	☐	10.91523	21.9478	78.0522
	☐	12.48462	22.18456	77.81544
	☐	13.94305	22.0429	77.9571
	☐	16.3656	21.85535	78.14465
	☐	18.4682	20.13642	79.86358
	☐	20.06356	19.45237	80.54763
	☐	23.46094	19.08643	80.91357
	☐	27.83	18.64568	81.35432
	☐	38	18.95414	81.04586
	☐	41.07024	19.02454	80.97546
	☐	44.61664	19.72835	80.27165
	☐	46.70864	20.33329	79.66671
	☐	47.74231	22.19213	77.80787
	☐	49.82391	22.81145	77.18855
	☐	50.56745	22.89471	77.10529
	☐	51.585	22.34374	77.65626
	☐	52.28194	21.08321	78.91679
	☐	55.19339	19.97696	80.02304
	☐	60.10116	19.47066	80.52934
	☐	70.76941	19.7732	80.2268
	☐			
	☐			
	☐			
	☐			

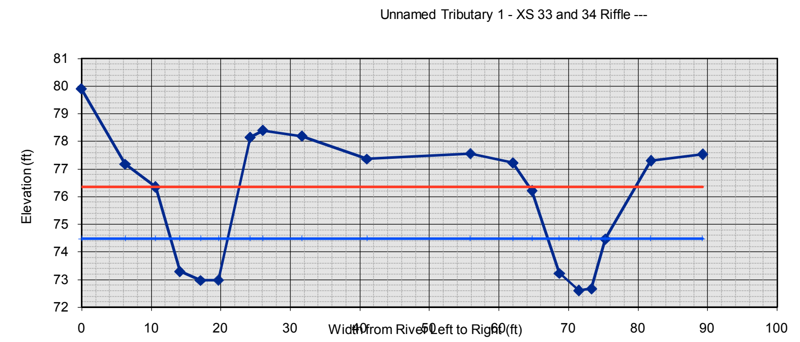
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
20.58	18.65	150.0		
79.42	81.35			

dimensions			
20.2	x-section area	1.3	d mean
15.6	width	18.7	wet P
2.3	d max	1.1	hyd radi
4.2	bank ht	12.1	w/d ratio
150.0	W flood prone area	9.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Unnamed Tributary 1 - XS 33 and 34
	Riffle --- ---
description:	Unnamed Tributary 1 - XS 33 and 34
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	20.10277	79.89723
	☐	6.254071	22.81851	77.18149
	☐	10.63986	23.64366	76.35634
	☐	14.1327	26.70352	73.29648
	☐	17.10137	27.02118	72.97882
	☐	19.68273	27.01259	72.98741
	☐	24.24154	21.85246	78.14754
	☐	26.04776	21.60374	78.39626
	☐	31.69	21.80958	78.19042
	☐	41	22.63474	77.36526
	☐	55.88951	22.43642	77.56358
	☐	61.98711	22.77546	77.22455
	☐	64.76137	23.77883	76.22117
	☐	68.66313	26.77566	73.22434
	☐	71.46948	27.38473	72.61527
	☐	73.27027	27.32632	72.67368
	☐	75.27729	25.52976	74.47024
	☐	81.82253	22.69282	77.30718
	☐	89.25434	22.46363	77.53637
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

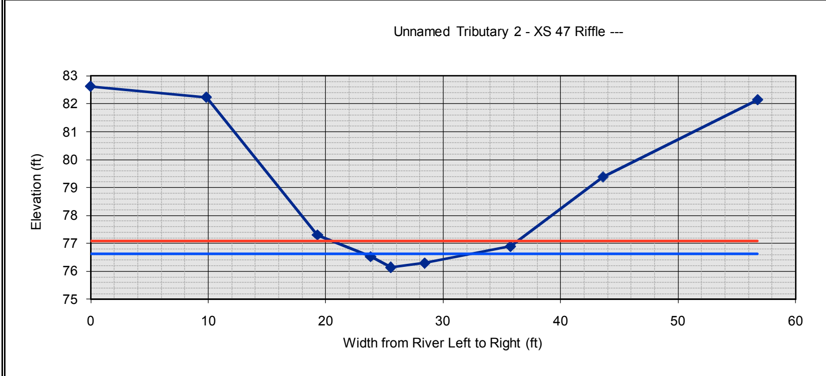
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
25.52	21.6	26.0		
74.48	78.4			

dimensions			
20.2	x-section area	1.2	d mean
16.5	width	18.8	wet P
1.9	d max	1.1	hyd radi
5.8	bank ht	13.5	w/d ratio
26.0	W flood prone area	1.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: Unnamed Tributary 2 - XS 47

Riffle

---

description: Unnamed Tributary 2 - XS 47

height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	17.38375	82.61625
	☐	9.848171	17.76987	82.23013
	☐	19.30558	22.69608	77.30392
	☐	23.8271	23.47533	76.52467
	☐	25.56073	23.85124	76.14876
	☐	28.43128	23.70378	76.29622
	☐	35.73312	23.09903	76.90098
	☐	43.62294	20.61727	79.38273
	☐	56.76386	17.85826	82.14174

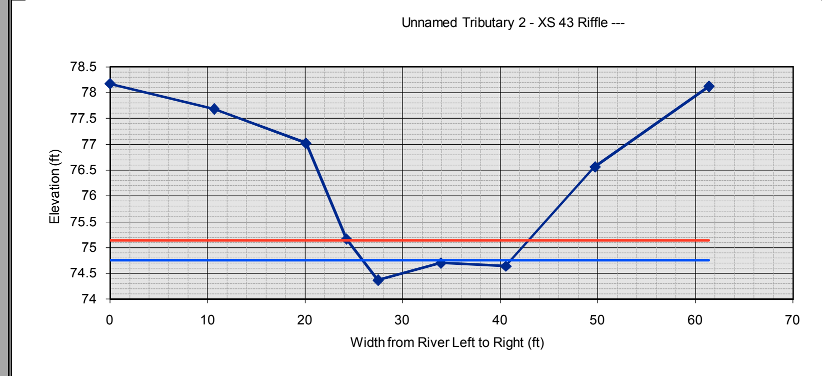
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
23.38	17.77	15.0		
76.62	82.23			

dimensions			
2.3	x-section area	0.3	d mean
9.1	width	9.1	wet P
0.5	d max	0.3	hyd radi
6.1	bank ht	35.9	w/d ratio
15.0	W flood prone area	1.7	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: Unnamed Tributary 2 - XS 43

Riffle

---

description: Unnamed Tributary 2 - XS 43

height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	21.82883	78.17117
	☐	10.67773	22.315	77.685
	☐	20.07407	22.97781	77.02219
	☐	24.21549	24.82853	75.17148
	☐	27.48371	25.62548	74.37452
	☐	33.91667	25.29564	74.70436
	☐	40.56632	25.359	74.641
	☐	49.71958	23.43232	76.56768
	☐	61.36995	21.87863	78.12137

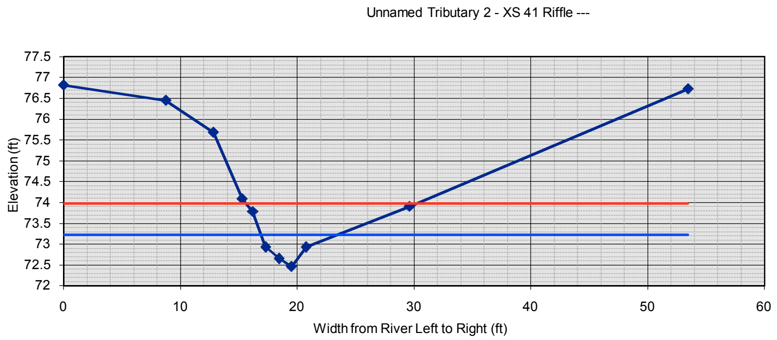
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
25.24	22.9	19.0		
74.76	77.1			

dimensions			
2.3	x-section area	0.2	d mean
15.2	width	15.3	wet P
0.4	d max	0.2	hyd radi
2.7	bank ht	99.2	w/d ratio
19.0	W flood prone area	1.2	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: Unnamed Tributary 2 - XS 41
Riffle

---
description: Unnamed Tributary 2 - XS 41
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	23.19102	76.80898
	☐	8.746085	23.55159	76.44841
	☐	12.82672	24.31621	75.68379
	☐	15.28327	25.91794	74.08206
	☐	16.17563	26.21669	73.78331
	☐	17.29477	27.07347	72.92653
	☐	18.44028	27.34774	72.65226
	☐	19.51305	27.53477	72.46523
	☐	20.75569	27.0717	72.9283
	☐	29.61427	26.09826	73.90174
	☐	53.46496	23.27324	76.72676

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
26.78	23.55	14.0		
73.22	76.45			

dimensions

2.3	x-section area	0.4	d mean
6.5	width	6.7	wet P
0.8	d max	0.3	hyd radi
4.0	bank ht	18.4	w/d ratio
14.0	W flood prone area	2.2	ent ratio

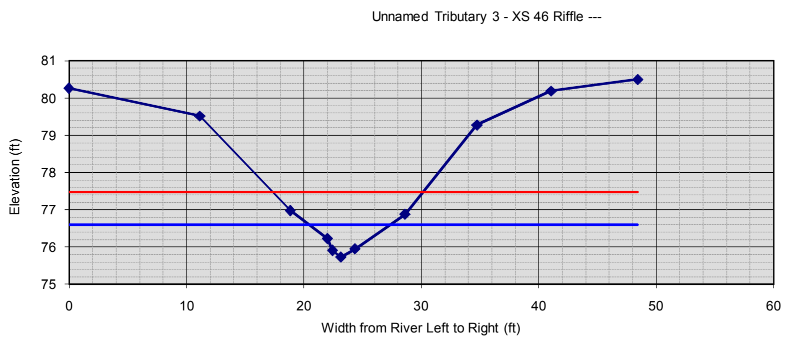
hydraulics

0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material

0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Unnamed Tributary 3 - XS 46
	Riffle --- ---
description:	Unnamed Tributary 3 - XS 46
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	19.73006	80.26994
	☐	11.13323	20.47685	79.52315
	☐	18.84082	23.0263	76.9737
	☐	21.99294	23.77685	76.22315
	☐	22.41821	24.09503	75.90497
	☐	23.12804	24.27093	75.72907
	☐	24.3401	24.05719	75.94281
	☐	28.60395	23.12233	76.87767
	☐	34.72797	20.72228	79.27772
	☐	41.03759	19.80172	80.19828
	☐	48.40458	19.50036	80.49964

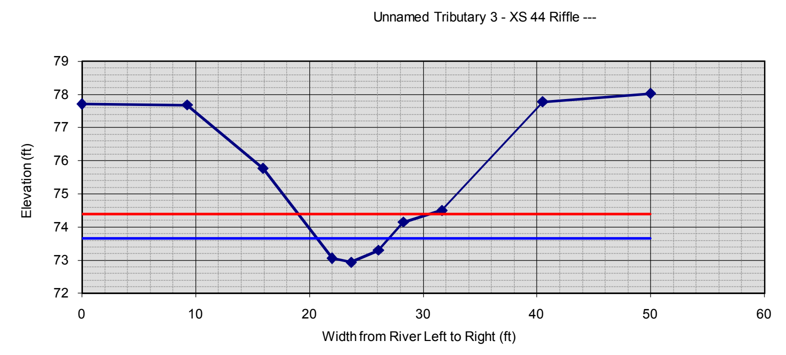
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
23.4	20.48	12.0		
76.6	79.52			

dimensions			
3.0	x-section area	0.4	d mean
6.9	width	7.2	wet P
0.9	d max	0.4	hyd radi
3.8	bank ht	16.0	w/d ratio
12.0	W flood prone area	1.7	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Unnamed Tributary 3 - XS 44
	Riffle --- ---
description:	Unnamed Tributary 3 - XS 44
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	22.29003	77.70998
	☐	9.239196	22.31831	77.68169
	☐	15.91316	24.23614	75.76386
	☐	21.98747	26.94326	73.05674
	☐	23.6649	27.06285	72.93715
	☐	26.0458	26.70378	73.29622
	☐	28.24951	25.85855	74.14145
	☐	31.64313	25.50106	74.49894
	☐	40.49228	22.22071	77.77929
	☐	49.9585	21.9774	78.0226

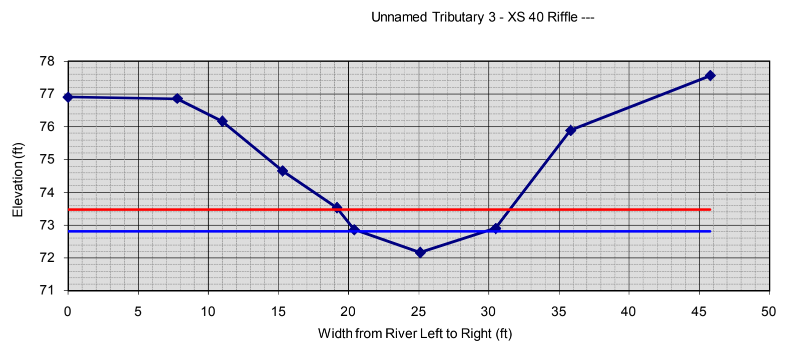
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
26.34	22.32	12.0		
73.66	77.68			

dimensions			
3.0	x-section area	0.5	d mean
6.4	width	6.6	wet P
0.7	d max	0.5	hyd radi
4.7	bank ht	13.5	w/d ratio
12.0	W flood prone area	1.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Unnamed Tributary 3 - XS 40**

Riffle

---

description: **Unnamed Tributary 3 - XS 40**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	23.09384	76.90616
	☐	7.77047	23.13876	76.86124
	☐	10.98171	23.83139	76.16861
	☐	15.28853	25.34312	74.65688
	☐	19.15598	26.45756	73.54245
	☐	20.393	27.13397	72.86603
	☐	25.09451	27.82755	72.17245
	☐	30.48772	27.09914	72.90086
	☐	35.83141	24.10766	75.89234
	☐	45.77845	22.44144	77.55857
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
27.18	24.1	13.0		
72.82	75.9			

dimensions			
3.0	x-section area	0.3	d mean
9.2	width	9.3	wet P
0.6	d max	0.3	hyd radi
3.7	bank ht	28.4	w/d ratio
13.0	W flood prone area	1.4	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

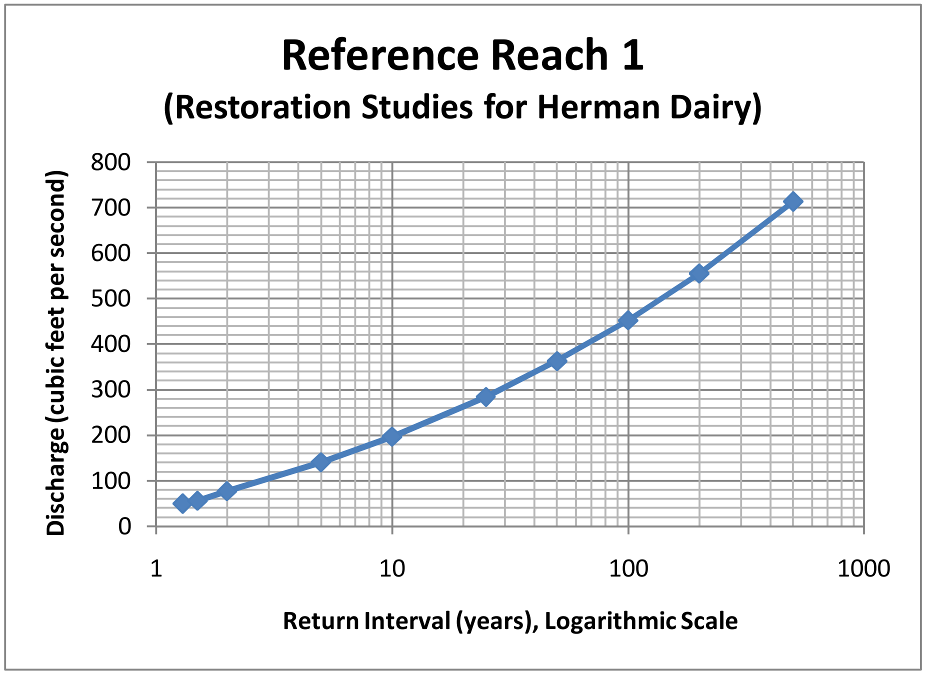
Appendix C
Flood Frequency Analysis Data

Regional Regression Equation
Herman Dairy Restoration Studies
Reference Reach 1
(Drainage Area = 0.45 square mile)

Region: Blue Ridge/Piedmont

Return Interval (years)	Discharge (cfs)
1.3	**50**
1.5	**56**
2	77.1
5	140.99
10	196.8
25	284.4
50	362.6
100	452.5
200	555.2
500	713.3

Bold indicates interpolated data.



Appendix D
Jurisdicitonal Determination Info

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: Tasha McCormick, Project Manager USACE, Asheville Regulatory Field Office 151 Patton Ave RM 208 Asheville, NC 28806 828-271-7980	If you only have questions regarding the appeal process you may also contact: Jason Steele Administrative Appeals Review Officer 60 Forsyth Street, SW (Room 9M10) Atlanta, GA 30303-8801 404-562-5137

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: Tasha McCormick, Project Manager, Asheville Regulatory Field Office, 151 Patton Avenue, Room 208, Asheville, NC 28801.

10-016

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **2010-01918** County: **Alexander** U.S.G.S. Quad: **Taylorsville**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: **Ned Herman**
Address: **311 Ned Herman Road**
Taylorsville, NC 28681

Telephone No.: **828-312-5310**

Agent: **Axiom Environmental/Matthew D. Thomas**
20 Enterprise Street, Suite 7
Raleigh, NC 27607
919-306-2027

Property description:
Size (acres) **50 acres +-**
Nearest Waterway **Muddy Fork**
Nearest Town **Taylorsville**
River Basin **Catawba**
Coordinates Approximately **35.931617°N, -81.206949° W**

Location description **The site is located off of Three Forks Church Road (SR 1313), Taylorsville, Alexander County, NC. The site contains unnamed tributaries to Muddy Fork and adjacent wetlands.**

Indicate Which of the Following Apply:

A. Preliminary Determination

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

B. Approved Determination

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

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

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

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

_ The waters have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on _____. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ There are no waters of the U.S., to include wetlands, present on the above described property which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

Action Id. 2010-01918

This delineation/determination has been conducted to identify the limits of COE's Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

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

C. Basis For Determination

The site contains wetlands as determined by the USACE 1987 Wetland Delineation Manual and contains stream channels located on the property that exhibit indicators of ordinary high water marks. The stream channels on the property are unnamed tributaries to Muddy Fork which flows into the Little River which ultimately flows into the Catawba River. The Catawba joins the Santee-Cooper River in South Carolina before entering the Atlantic Ocean. Is a Section 10 water at the Mountain Island Lake Dam on Lake Wylie in Mecklenburg County.

D. Remarks

Site visit conducted on November 18, 2010 by Amanda Jones.

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: Tasha McCormick, Project Manager
151 Patton Avenue, Room 208
Asheville, North Carolina 28801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete; that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by March 27, 2011.

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: Tasha McCormick TM

Issue Date: **January 26, 2011** Expiration Date: **January 26, 2016**

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete the Customer Satisfaction Survey located at our website at http://regulatory.usacesurvey.com/ to complete the survey online.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL			
Applicant: Ned Herman		File Number: 2010-01918	Date: January 26, 2011
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.

Axiom Environmental, Inc.

Axiom Environmental, Inc.

20 Enterprise Street, Suite 7, Raleigh, North Carolina 27607 919-306-2027

December 13, 2010

Ms. Amanda Jones
US Army Corps of Engineers
Asheville Regulatory Field Office
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006

RE: Section 404 Jurisdictional Area Delineation **10-016**
Herman Dairy Farm (Ned Herman Property)
Alexander County, NC

Dear Ms. Jones,

Axiom Environmental would like to request written verification of jurisdictional areas located on several parcels of land in central Alexander County, North Carolina. The area of interest consists of Property Numbers 0008217, 0064946, and 0066298 owned by Herman Diary Farm (c/o Ned Herman) (Site) of Taylorsville, North Carolina. During the previous site visit, held on November 18, we agreed up a wetland boundary that was subsequently delineated. Flags were placed along the wetland boundary and the positions were surveyed. All jurisdictional areas were delineated in accordance with the methodology established by the Corps of Engineers Wetland Delineation Manual (Technical Report Y-8-1) and U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook.

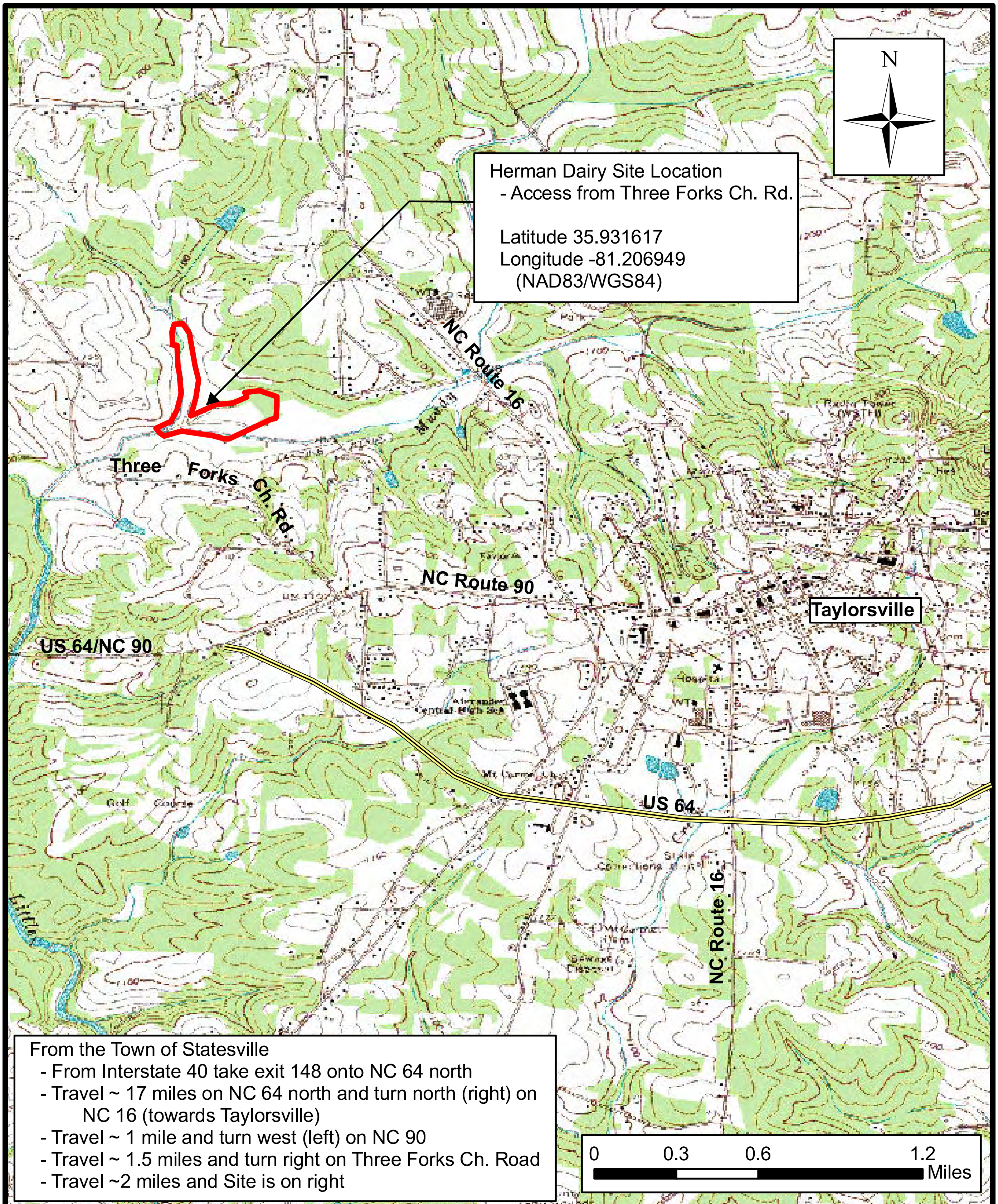
This package includes USACE Stream Quality Assessment Worksheets, USACE Routine Wetland Determination Forms, and NCWAM Assessment Forms. Also included are figures showing the location of the Site, Natural Resources Conservation Service mapped hydric soils, topography of the Site, jurisdictional features, and LIDAR.

If you would like to schedule an additional site visit, need any additional information regarding Herman Dairy Farm, or have any comments please feel free to contact me at (919) 306-2027.

Best,

Matthew D. Thomas

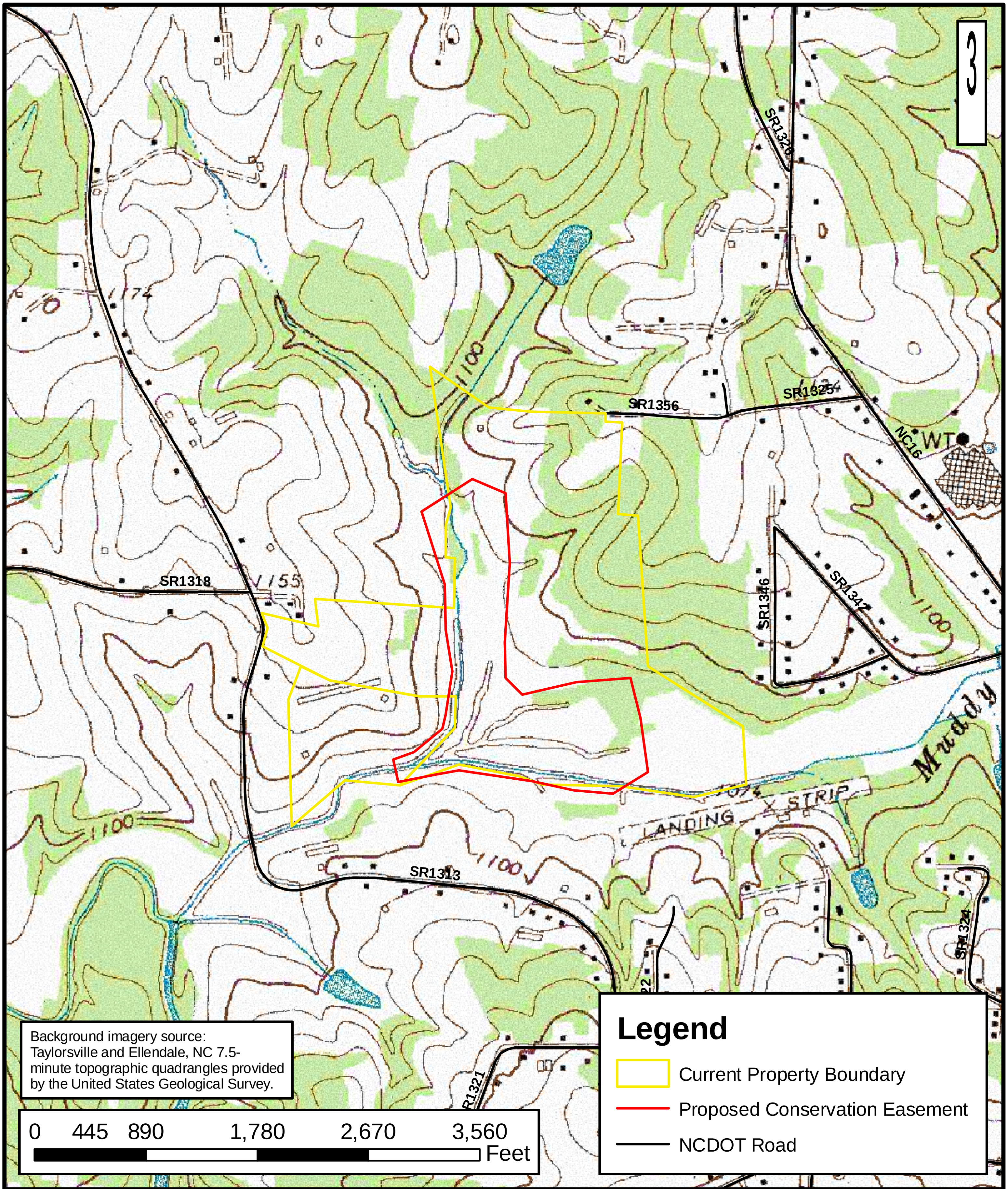
Enc.
Cc: Worth Creech, Restoration Systems, LLC.



Axiom Environmental
20 Enterprise St. #7
Raleigh, NC 27607
(919) 215-1693

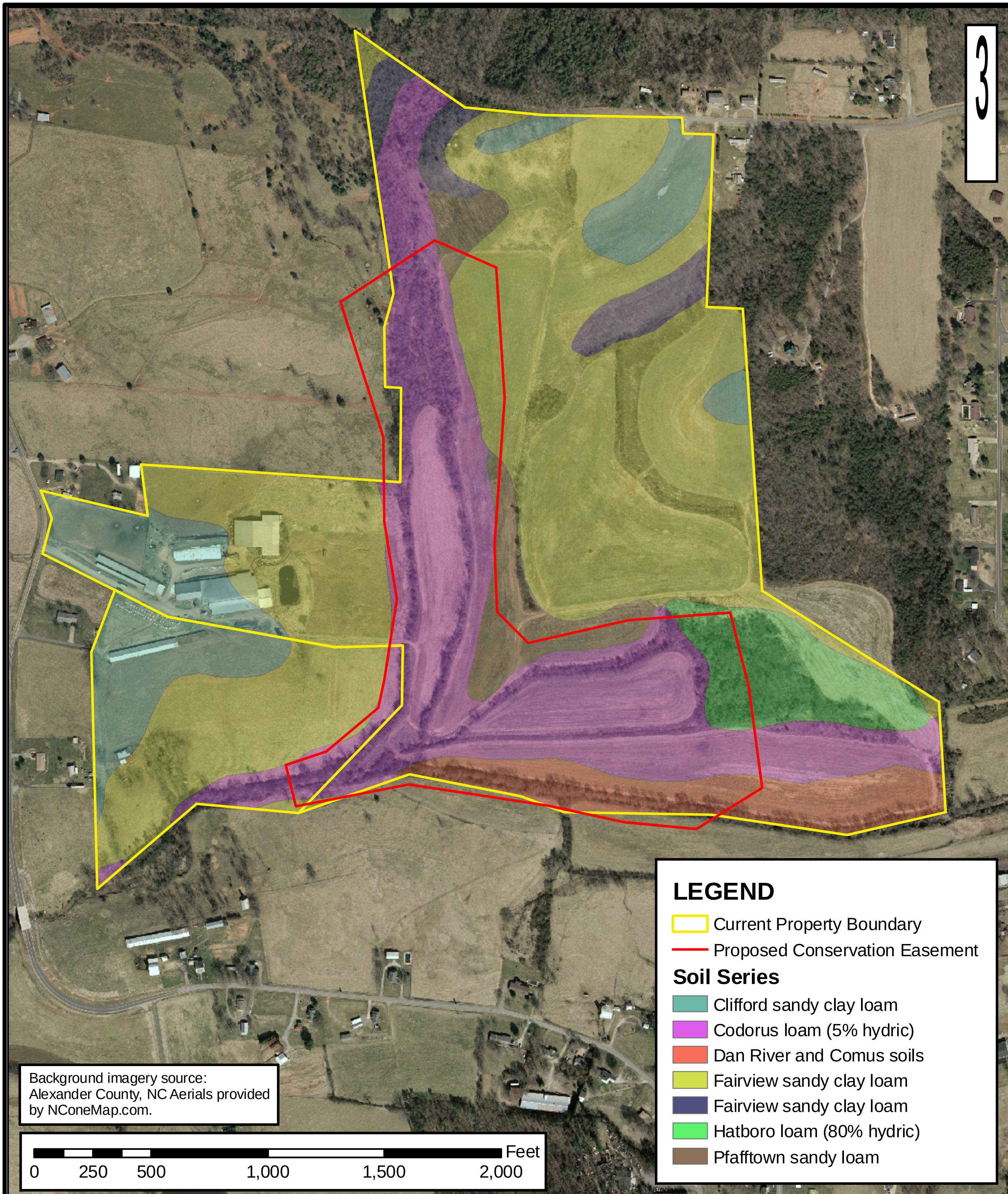
HERMAN DAIRY
STREAM AND WETLAND RESTORATION SITE
SITE LOCATION
Alexander County, North Carolina

Dwn. By: WGL	FIGURE 1
Date: Feb 2010	
Project: 09-002	

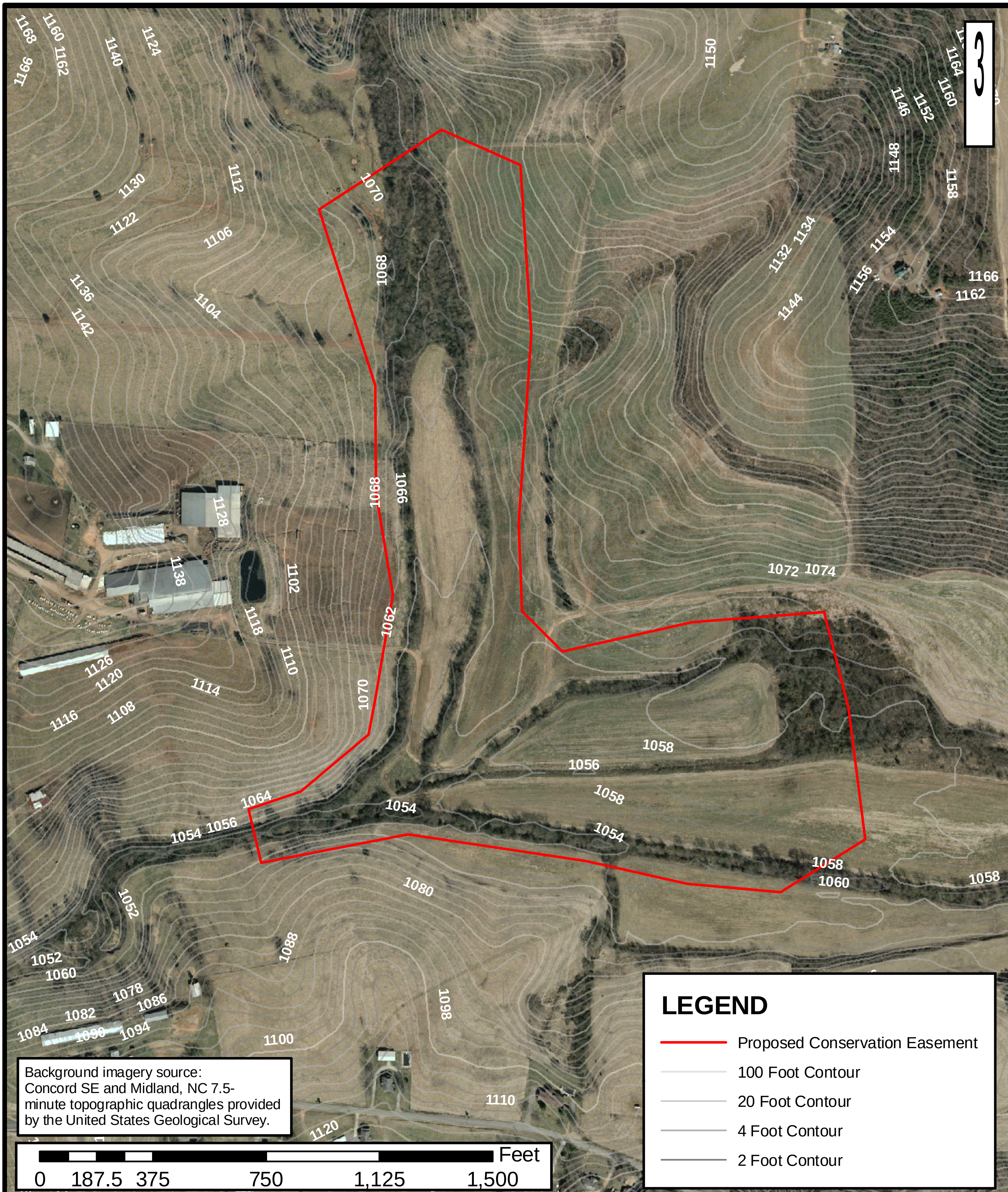


Axiom Environmental, Inc.	Prepared for: RS RESTORATION SYSTEMS LLC	Project: **HERMAN DAIRY FARM** Alexander County, NC	Title: **TOPOGRAPHIC MAP**	Drawn by: MDT Date: OCT 2010 Scale: 1:12000 Project No.: 10-016

FIGURE 2



Axiom Environmental, Inc.	Prepared for: RS Restoration Systems LLC	Project: **HERMAN DAIRY FARM** Alexander County, NC	Title: **NRCS SOIL SURVEY**	Drawn by: MDT Date: OCT 2010 Scale: 1:6500 Project No.: 10-016	FIGURE 3



Axiom Environmental, Inc.

Prepared for: RS RESTORATION SYSTEMS LLC

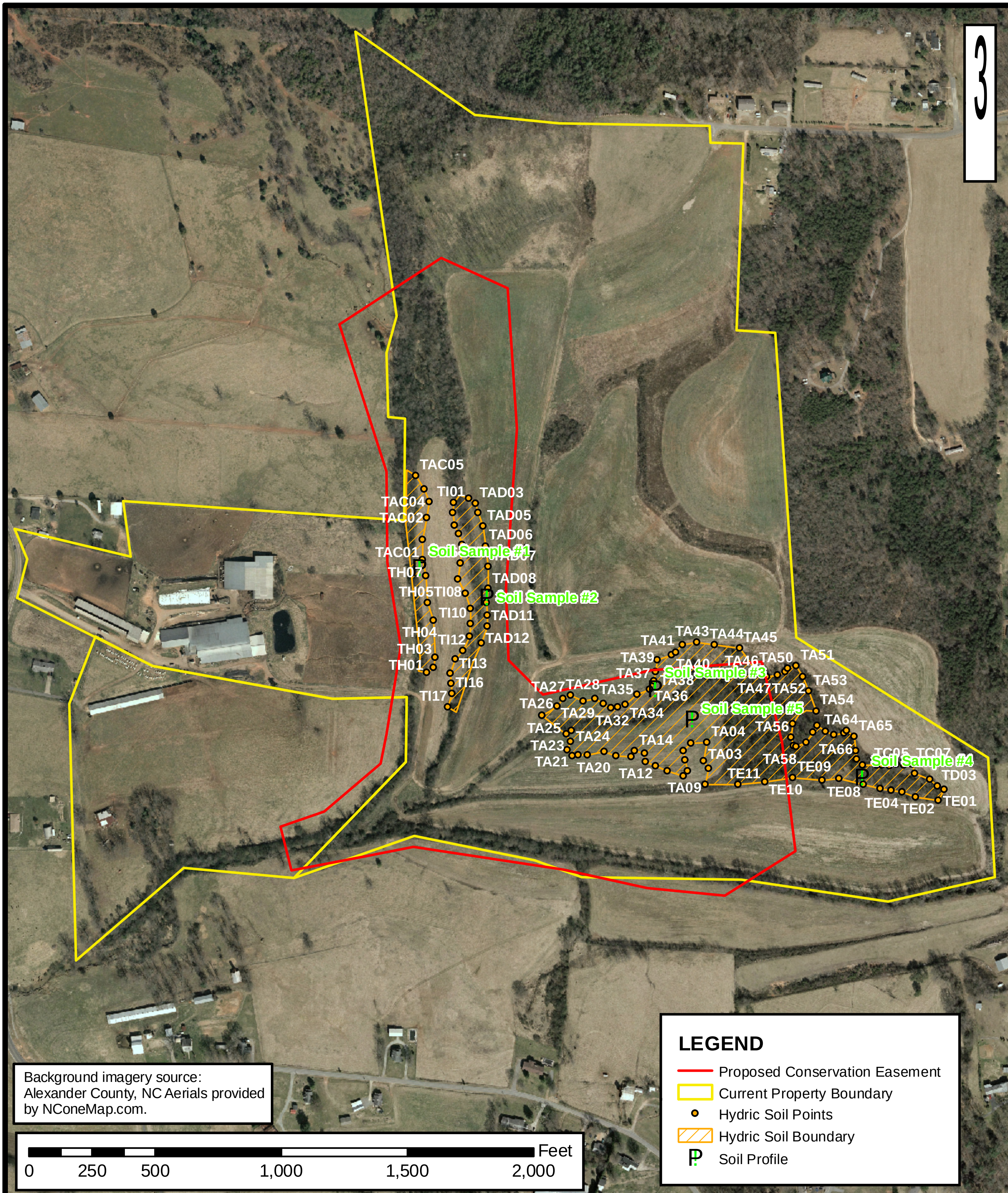
Project: **HERMAN DAIRY FARM**

Alexander County, NC

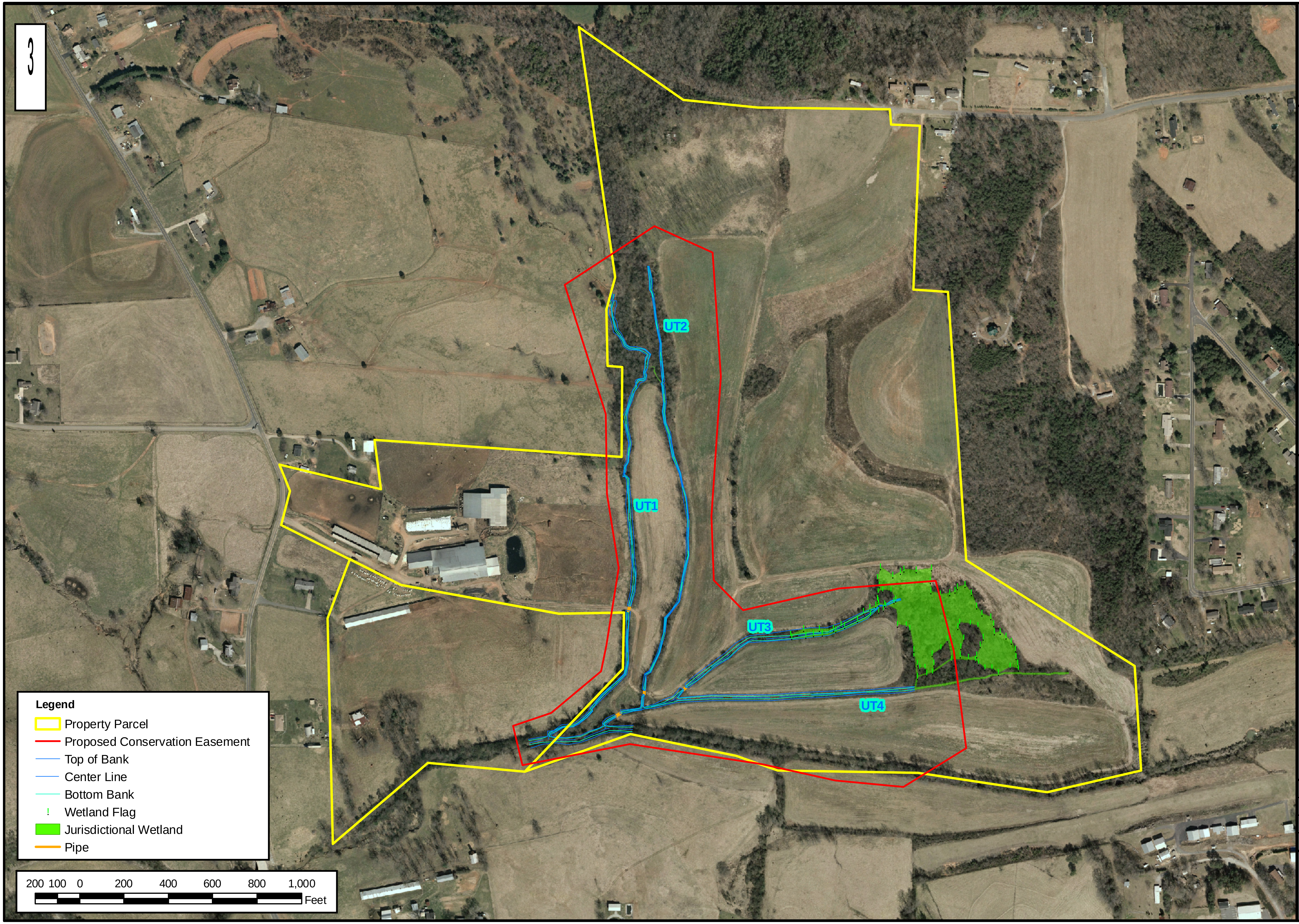
Title: **CONTOUR MAP**

Drawn by:	MDT
Date:	OCT 2010
Scale:	1:4000
Project No.:	10-016

FIGURE 4



Axiom Environmental, Inc.	Prepared for: RESTORATION SYSTEMS LLC	Project: **HERMAN DAIRY FARM** Alexander County, NC	Title: **HYDRIC SOILS**	Drawn by: MDT	FIGURE 5
				Date: OCT 2010	
				Scale: 1:6000	
				Project No.: 10-016	



Axiom Environmental, Inc.

Prepared for:

RS RESTORATION SYSTEMS | LLC

Project:

HERMAN DAIRY FARM

Alexander County, NC

Title:

JURISDICTIONAL FEATURES

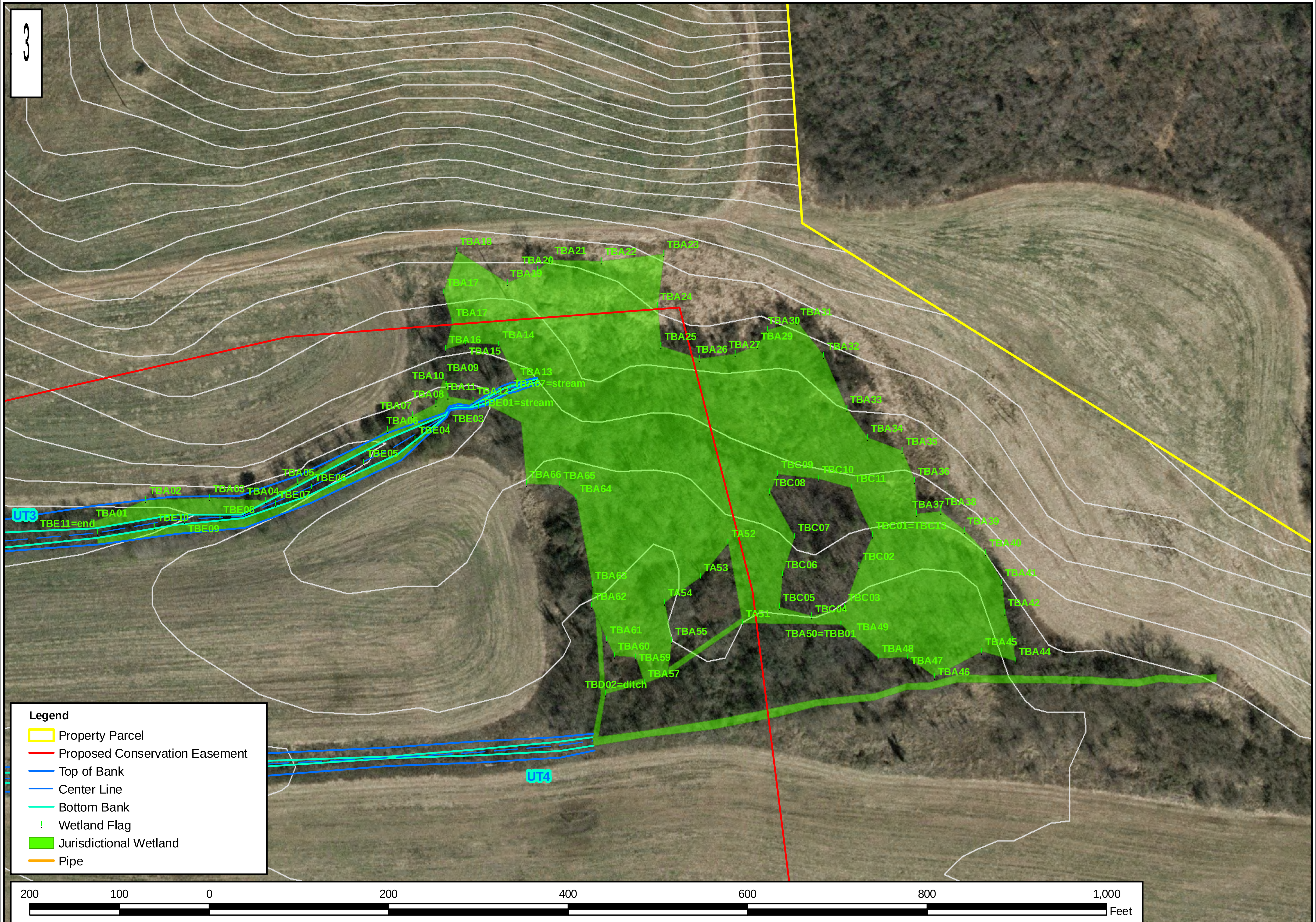
Notes:

1. Background imagery source: Alexander County aerial photographyprovided by the NC OneMap program online, supported by the NC Geographic Information Coordination Council).
2. 4-foot elevation contours are generated from Light Distance and Ranging (LiDAR) data (2007) from the NC Floodplain Mapping Program and are provided by the NCDOT.

Drawn by:	MDT
Date:	DEC 2010
Scale:	1:4800
Project No.:	10-016

FIGURE

6



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

HERMAN DAIRY FARM

Alexander County, NC

Title:

JURISDICTIONAL FEATURES

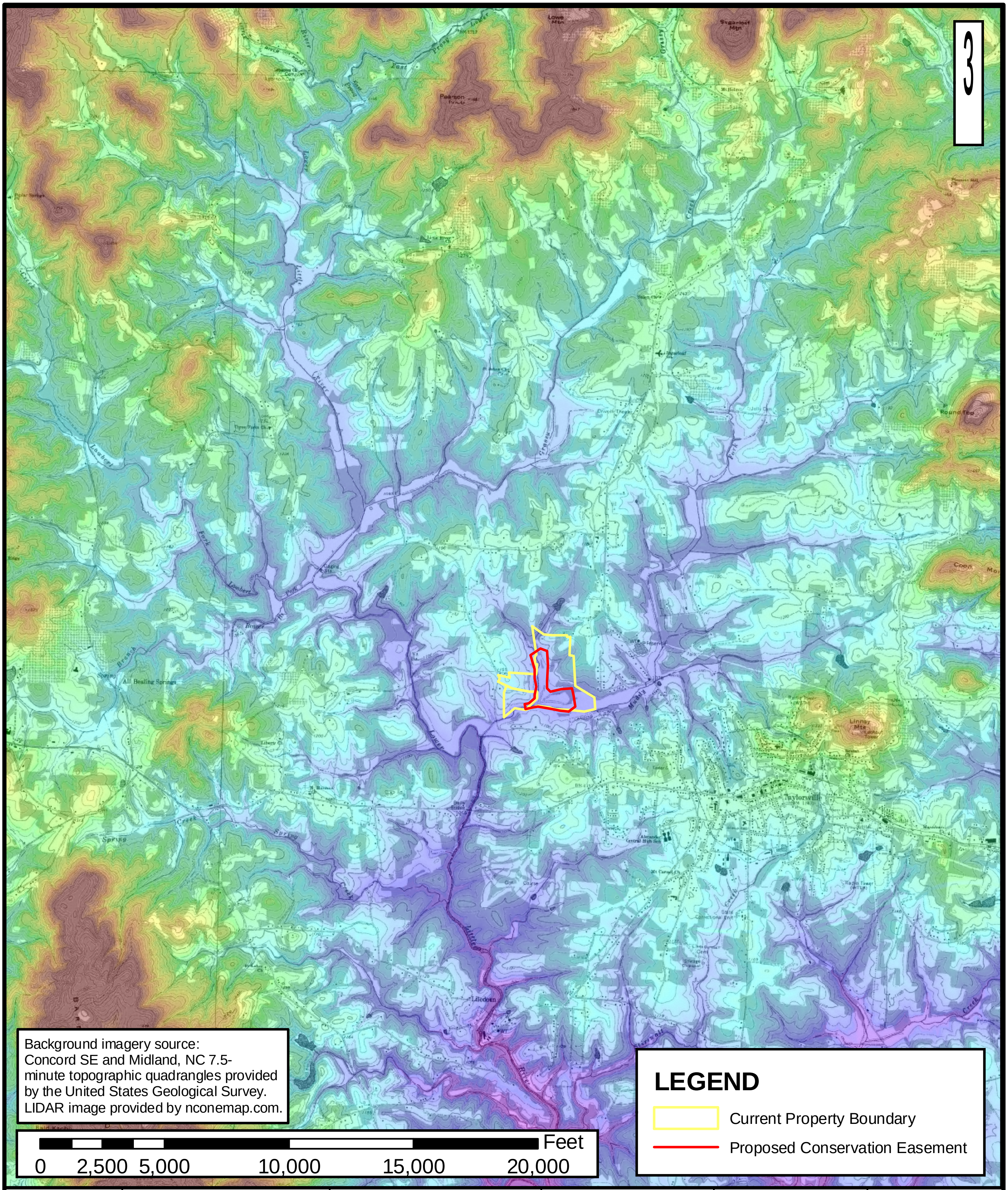
Notes:

1. Background imagery source: Alexander County aerial photographyprovided by the NC OneMap program online, supported by the NC Geographic Information Coordination Council).
2. 4-foot elevation contours are generated from Light Distance and Ranging (LiDAR) data (2007) from the NC Floodplain Mapping Program and are provided by the NCDOT.

Drawn by:	MDT
Date:	DEC 2010
Scale:	1:1200
Project No.:	10-016

FIGURE

6A



Axiom Environmental, Inc.	Prepared for: RS RESTORATION SYSTEMS LLC	Project: **HERMAN DAIRY FARM** Alexander County, NC	Title: **LIDAR MAP**	Drawn by: MDT Date: OCT 2010 Scale: 1:60000 Project No.: 10-016	FIGURE 7

USACE AID#______________________ DWQ #______________________ Site # UT1

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: Restoration Systems

2. Evaluator's name: Axiom – M. Thomas

3. Date of evaluation: 9/28/10

4. Time of evaluation: 12 pm

5. Name of stream: UT to Muddy Fork

6. River basin: Catawba

7. Approximate drainage area: 670 ac

8. Stream order: 2nd

9. Length of reach evaluated: 100'

10. County: Alexander

11. Site coordinates (if known): 35.9315, -81.2067

12. Subdivision name (if any): ______________________

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location): on

14. Proposed channel work (if any): stream restoration

15. Recent weather conditions: avg temps, below avg ppt

16. Site conditions at time of visit: sunny, 50°F

17. Identify any special waterway classifications known: Section 10 Tidal Waters Essential Fisheries Habitat Trout Waters Outstanding Resource Waters Nutrient Sensitive Waters Water Supply Watershed ________(I-IV)

18. Is there a pond or lake located upstream of the evaluation point? ***YES*** NO If yes, estimate the water surface area: 2 ac

19. Does channel appear on USGS quad map? ***YES*** NO

20. Does channel appear on USDA Soil Survey? ***YES*** NO

21. Estimated watershed land use: 10% Residential % Commercial % Industrial 45% Agricultural 30% Forested 15% Cleared / Logged % Other (______________________)

22. Bankfull width: 8'

23. Bank height (from bed to top of bank): 4'

24. Channel slope down center of stream: Flat (0 to 2%) ***Gentle (2 to 4%)*** Moderate (4 to 10%) Steep (>10%)

25. Channel sinuosity: Straight ***Occasional bends*** Frequent meander Very sinuous Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 37 **Comments:** ______________________

Evaluator's Signature______________________ **Date** 11/19/10

This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change – version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	4
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	3
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	1
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	2
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	3
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	1
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	0
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	0
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	1
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	1
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	2
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	1
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	1
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	2
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	2
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	2
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	2
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	2
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	1
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	3
		Total Points Possible	100	100	100	
		TOTAL SCORE (also enter on first page)				37

* These characteristics are not assessed in coastal streams.

USACE AID#_________ DWQ #_________ Site # UT2

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: Restoration Systems

2. Evaluator's name: Axiom Environmental/M. Thomas

3. Date of evaluation: 11/19/10

4. Time of evaluation: 4 pm

5. Name of stream: UT2

6. River basin: Catawba

7. Approximate drainage area: 40 ac

8. Stream order: 1st

9. Length of reach evaluated: 100'

10. County: Alexander

11. Site coordinates (if known): 35.935436, -81.206600

12. Subdivision name (if any):_________

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):

14. Proposed channel work (if any): Stream restoration

15. Recent weather conditions: below average ppt, average temps

16. Site conditions at time of visit: sunny, 50°F

17. Identify any special waterway classifications known: Section 10 Tidal Waters Essential Fisheries Habitat Trout Waters Outstanding Resource Waters Nutrient Sensitive Waters Water Supply Watershed ________(I-IV)

18. Is there a pond or lake located upstream of the evaluation point? YES **NO** If yes, estimate the water surface area:_________

19. Does channel appear on USGS quad map? YES **NO**

20. Does channel appear on USDA Soil Survey? **YES** NO

21. Estimated watershed land use: 5% Residential % Commercial % Industrial 40% Agricultural 30% Forested 25% Cleared / Logged % Other (__________)

22. Bankfull width: 3'

23. Bank height (from bed to top of bank): 2'

24. Channel slope down center of stream: Flat (0 to 2%) ***Gentle (2 to 4%)*** Moderate (4 to 10%) Steep (>10%)

25. Channel sinuosity: ***Straight*** Occasional bends Frequent meander Very sinuous Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 40 **Comments:**__________

Evaluator's Signature__________ **Date** 11/19/10

This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change – version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	3
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	1
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	3
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	2
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	2
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	3
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	1
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	1
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	0
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	1
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	1
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	2
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	3
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	3
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	2
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	1
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	2
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	4
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	1
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	1
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	3
		Total Points Possible	100	100	100	
		TOTAL SCORE (also enter on first page)				40

* These characteristics are not assessed in coastal streams.

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

Project/Site:	Herman Dairy Farm			**Date:**	09/23/10
Applicant/Owner:	Restoration Systems			**County:**	Alexander
Investigator:	Axiom – M. Thomas			**State:**	North Carolina
Do Normal Circumstances Exist on the Site?		***Yes***	No	**Community ID:**	Headwater Wetland, Seep
Is the site significantly disturbed (Atypical)?		***Yes***	No	**Transect ID:**	Upland
Is the area a potential problem area?		Yes	***No***	**Plot ID:**	TG05 up

VEGETATION

Dominant Plant Species	*Stratum*	*Indicator*	*Dominant Plant Species*	*Stratum*	*Indicator*
1. *Platanus occidentalis*	C	FACW+	9.		
2. *Liquidambar styraciflua*	C	FAC+	10.		
3. *Ligustrum sinense*	Sh	FAC	11.		
4. *Rosa multiflora*	Sh	UPL	12.		
5. *Phytolacca americana*	Sh	FACU+	13.		
6. *Solidago* sp.	H	--	14.		
7. *Smilax rotundifolia*	Sh	FAC	15.		
8. *Lonicera japonica*	V	FAC-	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 71%

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks)	*Primary Wetland Hydrology Indicators:*
___ Stream, Lake or Tide Gauge	___ Inundated
___ Aerial Photographs	___ Saturated in Upper 12 Inches
___ Other	___ Water Marks
X No Recorded Data Available	___ Drift Lines
	___ Sediment Deposits
	___ Drainage Patterns in Wetlands
	Secondary Indicators: (2 or more required):
Field Observations:	___ Oxidized Root Channels in Upper 12 Inches
Depth of Surface Water: -- (in.)	___ Water-Stained Leaves
Depth to Free Water in Pit: >12 (in.)	___ Local Soil Survey Data
Depth to Saturated Soil: >12 (in.)	___ FAC-Neutral Test
	___ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Codous loam

Taxonomy (Subgroup): Fluvaquentic Dystrudepts

Drainage Class: MWD and SWPD

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 - 3	A	10YR 4/2			Clay loam
3 – 11	B	10YR 5/2			Clay loam
			7.5 YR 5/6	Many/Faint	
12 – 13+	C	10YR 6/1			Clay loam
			7.5YR 5/6	Many/Faint	

Hydric Soil Indicators:

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

Remarks:

WETLAND DETERMINATION

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

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Herman Dairy Farm City/County: Taylorsville /Alexander Sampling Date: 9/23/10

Applicant/Owner: Restoration Systems, LLC State: NC Sampling Point: T605

Investigator(s): Axiom - M. Thomas Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): concave Slope (%): 2

Subregion (LRR or MLRA): 136 Lat: 35.931617 Long: -81.206949 Datum: WGS 84

Soil Map Unit Name: Codorus loam NWI classification: PFO1B

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ✓ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ___	Is the Sampled Area within a Wetland?	Yes ___ No ✓
Hydric Soil Present? Yes ✓ No ___		
Wetland Hydrology Present? Yes ___ No ✓		

Remarks:
portions of area have been ditched, other portions has vegetation cleared for utility easement.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): [illegible]

Water Table Present? Yes ___ No ✓ Depth (inches): >12"

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): >12"

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: TG05

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	20	Yes	FACW
2. Liquidambar styraciflua	20	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	40 = Total Cover		
Sapling/Shrub Stratum (Plot size: 30')			
1. Ligustrum sinense	20	Yes	FAC
2. Rosa multiflora	10	Yes	UPL
3. Phytolacca americana	10	Yes	FACU
4. Smilax rotundifolia	10	Yes	FAC
5.			
6.			
7.			
8.			
9.			
10.			
	50 = Total Cover		
Herb Stratum (Plot size: 30')			
1. Solidago sp.	15	Yes	--
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1. Lonicera japonica	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	5 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 71 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: TGØ5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
Ø-4"	10YR 4/2						CL	
5"-8"	10YR 5/2		7.5 YR 5/6	5	RM	M	CL	
8"-14+	10YR 6/1						Sa CL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ✓ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ No ___

Remarks:

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

Project/Site:	Herman Dairy Farm		**Date:**	09/23/10	
Applicant/Owner:	Restoration Systems		**County:**	Alexander	
Investigator:	Axiom – M. Thomas		**State:**	North Carolina	
Do Normal Circumstances Exist on the Site?	***Yes***	No	**Community ID:**	Headwater Wetland, Seep	
Is the site significantly disturbed (Atypical)?	***Yes***	No	**Transect ID:**	Wetland	
Is the area a potential problem area?	Yes	***No***	**Plot ID:**	TG05 wet	

VEGETATION

	Dominant Plant Species	*Stratum*	*Indicator*		*Dominant Plant Species*	*Stratum*	*Indicator*
1.	*Liquidambar styraciflua*	C	FAC+	9.			
2.	*Acer rubrum*	C	FAC	10.			
3.	*Nyssa sylvatica*	SC, Sh	FAC	11.			
4.	*Lonicera japonica*	V	FAC-	12.			
5.	*Ligustrum sinense*	Sh	FAC	13.			
6.	*Microstegium vimineum*	H	FAC+	14.			
7.	*Impatiens capensis*	H	FACW	15.			
8.	*Lobelia cardinalis*	H	FACW+	16.			

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

Remarks:

HYDROLOGY

			Primary Wetland Hydrology Indicators:
	Recorded Data (Describe in Remarks)		Inundated
	Stream, Lake or Tide Gauge	X	Saturated in Upper 12 Inches
	Aerial Photographs		Water Marks
	Other		Drift Lines
X	No Recorded Data Available		Sediment Deposits
		X	Drainage Patterns in Wetlands
			Secondary Indicators: (2 or more required):
			Oxidized Root Channels in Upper 12 Inches
		X	Water-Stained Leaves
			Local Soil Survey Data
		X	FAC-Neutral Test
			Other (Explain in Remarks)

Field Observations:

Depth of Surface Water: -- (in.)

Depth to Free Water in Pit: 4 (in.)

Depth to Saturated Soil: 3 (in.)

Remarks:

SOILS

Map Unit Name (Series and Phase): Codous loam

Taxonomy (Subgroup): Fluvaquentic Dystrudepts

Drainage Class: MWD and SWPD

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 - 4	A	10YR 4/2			Clay loam
5 – 8	B	10YR 5/2			Clay loam
			7.5 YR 5/6	Few/Faint	
8 – 14+	C	10YR 6/1			Sandy clay loam

Hydric Soil Indicators:

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

Remarks:

WETLAND DETERMINATION

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

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Herman Dairy Farm City/County: Taylorsville/Alexander Sampling Date: 9/23/10

Applicant/Owner: Restoration Systems, LLC State: NC Sampling Point: T6Ø5

Investigator(s): Axiom- M. Thomas Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 2

Subregion (LRR or MLRA): 136 Lat: 35.93417 Long: -81.206949 Datum: WGS 84

Soil Map Unit Name: Codorus loam NWI classification: PFØ1B

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ___ Hydric Soil Present? Yes ✓ No ___ Wetland Hydrology Present? Yes ✓ No ___	**Is the Sampled Area within a Wetland?** Yes ✓ No ___

Remarks: portions of wetland has been ditched, other portions has vegetation cleared for power easement.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ✓ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): —

Water Table Present? Yes ✓ No ___ Depth (inches): 4"

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 3"

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: TG05

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	30	Yes	FAC
2. Acer rubrum	20	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	50 = Total Cover		
Sapling/Shrub Stratum (Plot size: 30')			
1. Nyssa sylvatica	20	Yes	FAC
2. Ligustrum sinense	40	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	60 = Total Cover		
Herb Stratum (Plot size: 30')			
1. Microstegium vimineum	40	Yes	FAC
2. Impatiens capensis	15	Yes	FACW
3. Lobelia cardinalis	5	No	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1. Lonicera japonica	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	5 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 8 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: TG-Ø5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
Ø-4	10YR 4/2						CL	
4-8	10YR 5/2		7.5YR 5/6	5	RM	M	CL	
8-14+	10YR 6/1						SCL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

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:North Carolina County/parish/borough: Alexander City: Taylorsville
Center coordinates of site (lat/long in degree decimal format): Lat. 35.931617° **N**, Long. -81.206949° **E**.
Universal Transverse Mercator:
Name of nearest waterbody: Muddy Fork
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Catawba River
Name of watershed or Hydrologic Unit Code (HUC): 03050101

☒ 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: 4350 linear feet: 2 - 8 width (ft) and/or acres.
      Wetlands: .01 acres.

   c. **Limits (boundaries) of jurisdiction** based on: **Established by OHWM.**
      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: 90 **acres**
Drainage area: 90 **acres**
Average annual rainfall: 48.83 inches
Average annual snowfall: 9.8 inches

(ii) Physical Characteristics:
(a) Relationship with TNW:
☐ Tributary flows directly into TNW.
☒ Tributary flows through **10 (or more)** tributaries before entering TNW.

Project waters are **30 (or more)** river miles from TNW.
Project waters are **1 (or less)** river miles from RPW.
Project waters are **5-10** 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]: Ut to Muddy Creek to Muddy Creek to Little River to Catawba River.
Tributary stream order, if known: 1st .

---

[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.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☐ Natural
☐ Artificial (man-made). Explain: .
☒ Manipulated (man-altered). Explain: channelized.

Tributary properties with respect to top of bank (estimate):
Average width: 4 - 8 feet
Average depth: 1 - 2 feet
Average side slopes: **3:1** .

Primary tributary substrate composition (check all that apply):

☒ Silts ☒ Sands ☐ Concrete
☒ Cobbles ☐ Gravel ☐ Muck
☐ Bedrock ☐ Vegetation. Type/% cover:
☐ Other. Explain: .

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: somewhat stable.
Presence of run/riffle/pool complexes. Explain: .
Tributary geometry: **Relatively straight**
Tributary gradient (approximate average slope): 2 %

(c) Flow:

Tributary provides for: **Seasonal flow**
Estimate average number of flow events in review area/year: **20 (or greater)**
Describe flow regime: flow in wet season, sporadic flow in summer..
Other information on duration and volume: .

Surface flow is: **Discrete and confined.** Characteristics: .

Subsurface flow: **Unknown**. 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: water has oily film.
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: .
- ☐ 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: acres
Wetland type. Explain: .
Wetland quality. Explain: .
Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:
Flow is: **Pick List**. Explain: .

Surface flow is**: Pick List**
Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .
☐ 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 **Pick List** river miles from TNW.
Project waters are **Pick List** aerial (straight) miles from TNW.
Flow is from: **Pick List.**
Estimate approximate location of wetland as within the **Pick List** 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: .
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: **Pick List**
Approximately ( ) 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)

Summarize overall biological, chemical and physical functions being performed: .

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: .

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: stream scores high on USACE Stream Assessment Workshet and higher on NCDWQ Stream Worksheet.
   ☒ 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: low scores on the USACE Stream Assesment Worksheet and NCDWQ Stream Form.

Provide estimates for jurisdictional waters in the review area (check all that apply):
☒ Tributary waters: **4350** linear feet **2 -8** 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: **.01** 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: 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.
☐ 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: .

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[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.*

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 solely 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 sole 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.

SECTION IV: DATA SOURCES.

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: Figure 6.
☒ 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: Taylorsville and Ellendale, NC 7.5 minute topo quads.
☒ USDA Natural Resources Conservation Service Soil Survey. Citation: Soil Data Mart.
☐ National wetlands inventory map(s). Cite name: .
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps: .
☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
☒ Photographs: ☐ Aerial (Name & Date): .
or ☒ Other (Name & Date): September 28, 2010.
☐ Previous determination(s). File no. and date of response letter: .
☐ Applicable/supporting case law: .
☐ Applicable/supporting scientific literature: .
☒ Other information (please specify): UT 1 and UT 2 on Figure 6.

B. ADDITIONAL COMMENTS TO SUPPORT JD: .

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:North Carolina County/parish/borough: Alexander City: Taylorsville
Center coordinates of site (lat/long in degree decimal format): Lat. 35.931617° **N**, Long. -81.206949° **E**.
Universal Transverse Mercator:
Name of nearest waterbody: Muddy Fork
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Catawba River
Name of watershed or Hydrologic Unit Code (HUC): 03050101

☒ 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: 2693 linear feet: 4 - 8 width (ft) and/or acres.
      Wetlands: 1.47 acres.

   c. **Limits (boundaries) of jurisdiction** based on: **Established by OHWM.**
      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: 735 **acres**
Drainage area: 735 **acres**
Average annual rainfall: 50.69 inches
Average annual snowfall: 10.0 inches

(ii) Physical Characteristics:
(a) Relationship with TNW:
☐ Tributary flows directly into TNW.
☒ Tributary flows through **10 (or more)** tributaries before entering TNW.

Project waters are **25-30** river miles from TNW.
Project waters are **1 (or less)** river miles from RPW.
Project waters are **5-10** 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]: Muddy Fork to Little River to Catawba River.
Tributary stream order, if known: 4^{th} .

[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.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☒ Natural
☐ Artificial (man-made). Explain: .
☒ Manipulated (man-altered). Explain: stream has been previously channelized.

Tributary properties with respect to top of bank (estimate):
Average width: 4 feet
Average depth: 4 feet
Average side slopes: **3:1** .

Primary tributary substrate composition (check all that apply):
☒ Silts ☒ Sands ☐ Concrete
☒ Cobbles ☒ Gravel ☐ Muck
☐ Bedrock ☐ Vegetation. Type/% cover:
☐ Other. Explain: .

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: highly eroding.
Presence of run/riffle/pool complexes. Explain: .
Tributary geometry: **Relatively straight**
Tributary gradient (approximate average slope): 2 %

(c) Flow:
Tributary provides for: **Seasonal flow**
Estimate average number of flow events in review area/year: **6-10**
Describe flow regime: .
Other information on duration and volume: .

Surface flow is: **Discrete and confined.** Characteristics: .

Subsurface flow: **Unknown**. 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 ☐ the presence of litter and debris
☐ changes in the character of soil ☐ destruction of terrestrial vegetation
☐ shelving ☒ the presence of wrack line
☐ vegetation matted down, bent, or absent ☒ sediment sorting
☒ leaf litter disturbed or washed away ☒ scour
☒ sediment deposition ☐ multiple observed or predicted flow events
☒ water staining ☐ abrupt change in plant community
☐ other (list):
☐ 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: ☐ Mean High Water Mark indicated by:
☐ oil or scum line along shore objects ☐ survey to available datum;
☐ fine shell or debris deposits (foreshore) ☐ physical markings;
☐ physical markings/characteristics ☐ vegetation lines/changes in vegetation types.
☐ tidal gauges
☐ other (list):

(iii) Chemical Characteristics:
Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain: water color is turbid.
Identify specific pollutants, if known: sediment.

[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: .
☐ 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: acres
  Wetland type. Explain: .
  Wetland quality. Explain: .
Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:
Flow is: **Pick List**. Explain: .

Surface flow is**: Pick List**
  Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .
  ☐ 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 **Pick List** river miles from TNW.
Project waters are **Pick List** aerial (straight) miles from TNW.
Flow is from: **Pick List.**
Estimate approximate location of wetland as within the **Pick List** 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: .
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: **Pick List**
Approximately ( ) 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)

Summarize overall biological, chemical and physical functions being performed: .

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: .

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: low scores on the USACE Stream Assesment Worksheet and NCDWQ Stream Form.

Provide estimates for jurisdictional waters in the review area (check all that apply):
☒ Tributary waters: **2693** linear feet **4 -8** 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: **1.47** 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: 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.
☐ 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: .

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[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.*

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 solely 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 sole 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.

SECTION IV: DATA SOURCES.

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: Figure 6.
☒ 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: Taylorsville and Ellendale, NC 7.5 minute topo quads.
☒ USDA Natural Resources Conservation Service Soil Survey. Citation: Soil Data Mart.
☐ National wetlands inventory map(s). Cite name: .
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps: .
☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
☒ Photographs: ☐ Aerial (Name & Date): .
or ☒ Other (Name & Date): September 28, 2010.
☐ Previous determination(s). File no. and date of response letter: .
☐ Applicable/supporting case law: .
☐ Applicable/supporting scientific literature: .
☒ Other information (please specify): UT3 & UT4 on Figure 6.

B. ADDITIONAL COMMENTS TO SUPPORT JD: .

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 3.0
Rating Calculator Version 3.0

Wetland Site Name	Herman Dairy Farm	Date	9/28/10
Wetland Type	Headwater Forest	Assessor Name/Organization	M. Thomas/Axiom

Presence of stressor affecting assessment area (Y/N)	YES
Notes on Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**HIGH**
	Sub-Surface Storage and Retention	Condition	**LOW**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**HIGH**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**MEDIUM**
	Landscape Patch Structure	Condition	**HIGH**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**HIGH**
	Condition/Opportunity	**HIGH**
	Opportunity Presence? (Y/N)	**YES**
Habitat	Conditon	**HIGH**

Overall Wetland Rating **HIGH**

Soil Sample #1

0 – 8”	brown	10YR 4/3	CL
8” – 10”	brown	10YR 5/3	CL
	yellowish red	5YR 5/8 (common/fine/distinct)	
10” – 13”+	grayish brown	10YR 5/2	SCL
	strong brown	7.5YR 5/6 (common/Fine/distinct)	

Soil Profile #2

0 – 6”	brown	10YR 4/3	CL
6” – 8”	brown	10YR 5/3	CL
	strong brown	7.5YR 5/8 (few/fine/faint)	
8” – 12”+	light brownish gray	10YR 6/2	CL
	strong brown	7.5YR 5/8 (common/fine/distinct)	

Soil Profile #3

0 – 4”	yellowish brown	10YR 5/4	CL
4” – 12”	grayish brown	10YR 5/2	CL
	strong brown	7.5YR 5/6 (many/medium/distinct)	
12” – 14”+	gray	10YR 6/1	CL
	strong brown	7.5YR 5/8 (common/medium/prominent)	

Soil Profile #4

0 – 4”	yellowish brown	10YR 5/4	CL
4” – 10”	grayish brown	2.5Y 5/2	CL
	light olive brown	7.5YR 5/6 (many/fine/prominent)	
10” – 14”+	light brownish gray	2.5Y 6/2	CL
	strong brown	7.5YR 5/6 (many/medium/distinct)	

Soil Profile #5

0 – 6”	brown	10YR 5/3	CL
	strong brown	7.5 YR 5/6 (many/medium/distinct)	
6” – 12”	grayish brown	10YR 5/2	CL
	strong brown	7.5YR 5/8 (many/medium/distinct)	
12” – 14”+	light brownish gray	10YR 6/2	CL
	strong brown	7.5YR 5/8 (many/medium/distinct)	
	strong brown	7.5YR 5/6 (few/fine/faint)	

AGENT AUTHORIZATION FORM

PROPERTY LEGAL DESCRIPTION:

PARCEL ID: 0508217

STREET ADDRESS: 311 Ned Herman Rd
Taylorsville, NC 28681

TELEPHONE: 828-312-5310

Please print:

Property Owner: NED HERMAN

Please sign:

Property Owner: Kent Herman

The undersigned, registered property owners of the above noted property, do hereby authorize

Matthew Thomas of Axiom Environmental Inc

to act on my behalf and take all actions necessary for the processing, issuance and acceptance of this permit or certification and any and all standard and special conditions attached.