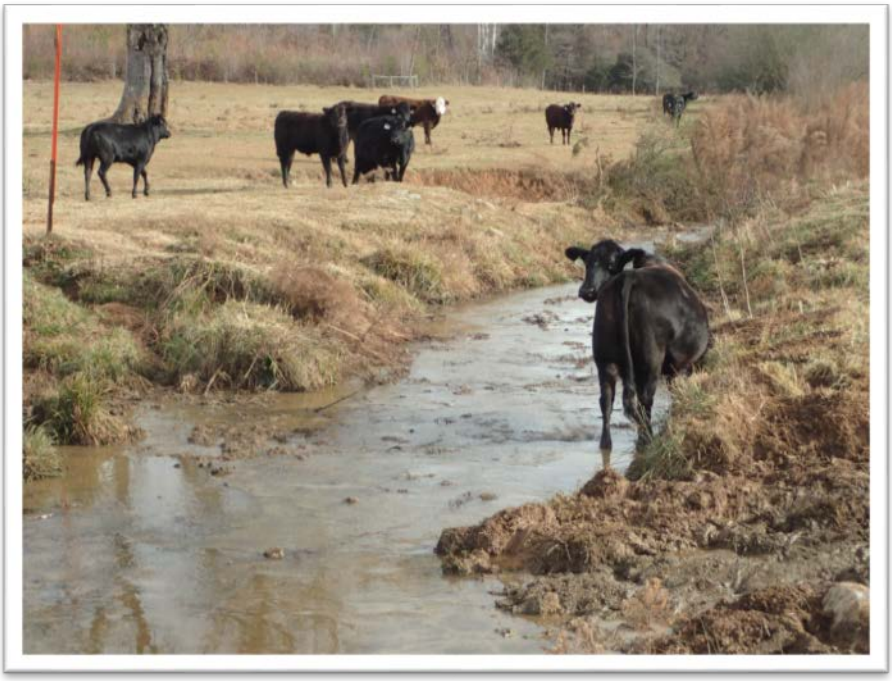
FINAL MITIGATION PLAN

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, North Carolina

DMS Project ID No. 95017
Full Delivery Contract No. 7526
USACE Action ID No. SAW-2018-01166
RFP No. 16-007330

Cape Fear River Basin
Cataloging Unit 03030002



Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NORTH CAROLINA 27699-1652

January 2020

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January 2020

"This mitigation plan has been written in conformance with the requirements of the following:

- 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).
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010

These documents govern NCDMS operations and procedures for the delivery of compensatory mitigation."

This document was assembled using the June 2017 *DMS Stream and Wetland Mitigation Plan Template and Guidance* and the October 24, 2016 NC Interagency Review Team *Wilmington District Stream and Wetland Compensatory Mitigation Update*.

DWR Comments, Mac Haupt and Erin Davis:

1. DMS Question 18.c. – Given the discussions that occurred during the most recent site visit, July 8, 2019, regarding the interpretation of the "center of wetted perimeter", DWR will need to confer with other members of the IRT for the purposes of drafting clarifying language before this issue can be resolved. *It is our understanding (see USACE comment # 1) that center of design channel will be used for all Restoration reach length calculations.*
2. Page 3, Table 1
   a. Based on the design sheets, each tributary footage extends to the Cane Creek "centerline". This appears to result in double counting mitigation credits for the functional uplift associated with the Cane Creek restoration. DWR recommends the tributary footage end at the Cane Creek proposed bankfull line intercept.
   As requested, centerlines have been terminated at the channel bankfull on Figures 6A and 6B, as well as Table 1.
   b. UT2 EII - Since there is no bed/bank work and only supplemental planting within the forested buffer, DWR believes 5:1 is a more appropriate enhancement ratio for the UT2 lower reach.
   During our initial walkthrough, the IRT agreed to Enhancement Level II for the lower reach of UT 2 (downstream of the gas line). This reach was proposed for removal of livestock, invasive species control, and supplemental planting, which meets the criteria for a 2.5:1 credit ratio. We respectfully request the use of the standard credit ratio, as this second IRT visit was not intended to overturn decisions of the previous IRT visit.
3. Page 14, Section 3.5.2 – Only one soil profile was included to document mapping of 4.377 acres of drained hydric soil; Appendix D sample point GH04 is located within an existing wetland area. DWR would like to see additional soil boring data to support the proposed wetland restoration mapping extent.
   Two additional soil boring logs have been added to the appendix and are depicted on Figure 4.
4. Page 24 – Figure D-6 was referenced but is not included in Appendix D. Also, NHP correspondence was referenced but was not included in Appendix C (which appears to be the wrong appendix). Please include these items in the Final Mitigation Plan.
   These were added in Appendix K of the final Mitigation Plan.
5. Page 26, Section 8.2.1 – Cane Creek is identified as Priority 1 restoration. Please confirm whether there will be a section of Priority 2 restoration at the western end. If so, please note and include an approximate length.
   A Short Section of Priority 2 restoration may occur at the upper (western) end of the project; however, the channel is largely being constructed within the existing channel (to be backfilled) and will not result in cut to the floodplain. Priority 1 restoration is initiated in full by station 319. Text has been added to this section.
6. Page 28, Section 8.2.3 - Based on DWR field notes from June 27, 2018, a justification for Enhancement I for the UT2 upper reach was requested. An entrenchment ratio and cross sectional area were provided in the draft plan as justification. However, based on site observations the lower portion of this reach (Station 4+17 to approximately 2+00) did not appear highly incised and had good bedform. Cattle impacts to banks were noted. DWR supports an Enhancement II approach with bank work and 1-2 in-stream structures at a 2:1 ratio. Based on site observations upstream of Station 2+00 Enhancement I is acceptable, including raising the streambed and adding in-stream structures. Also, based on field observations UT2A appears to be a stable tributary with good bedform and connection to the surrounding wetland. DWR believes Preservation is a more appropriate approach for UT2A.
   Figure 6A as well as the discussion of UT 2 and 2A have been altered to include Stream Enhancement Level I on the upper 200 feet of UT 2, with the remainder of UT 2 (upstream of the gas line) being Enhancement Level II at a 2:1 credit ratio. In addition, UT 2A has been changed to preservation at a

10:1 credit ratio.

7. Page 31, Section 8.6.1 – DWR recommends adding at least one additional FACW species to the seed mix. The current seed mix includes 1 FACW, 3 FAC and 1 FACU species; and the warm season grasses can take multiple growing seasons to fully establish.

   The seeding section of the document has been updated to read "In addition to planting seedlings, herbaceous seed mix will be planted on the Site. Upland areas will receive a diverse mix of pollinator friendly native and naturalized species including both forbs and grasses. Streamside zones and wetlands, including the Marsh Treatment Wetland Areas, will receive a similarly designed mix with an additional component of FACW species (including Elymus virginicus, Juncus effusus, and Carex spp.)."

8. Page 32, Table 14 – DWR recommends reducing the proposed percentage of green ash (*Fraxinus pennsylvanica*) to be planted since emerald ash borer (*Agrilus planipennis*) has been detected in Alamance county and has the potential to impact long-term tree density and canopy cover (https://ncforestservice.gov/forest_health/pdf/Map_EAB_NCTracking.pdf). Additionally, the planting plan does not include dominant tree species listed by Schafale (2012) for the Dry-Mesic Oak-Hickory Forest community such as white oak (*Quercus alba*). DWR would like an additional species characteristic of the target community included in the planting plan.

   Table 14 was updated to reduce the number of green ash and to add multiple suitable species such as white oak and red oak to the Dry-Mesic Oak hickory Forest community.

9. Page 34, Table 16 – DWR's position is that March 1st be the earliest start of the growing season for Alamance County. Since soil temperature must be used to determine the start of the growing season a justification must be included in the final plan. DWR will require an onsite temperature probe data and bud burst documentation included in each monitoring report.

   The data collected/reported is as follows for wetland restoration "Soil temperature and bud burst will be documented at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period".

10. Page 35, Table 17
    a. DWR would prefer the use of pressure transducers rather than crest gauges.
       Pressure transducers are used as crest gauges and the table has been updated.
    b. Since the wetland restoration areas are mapped Wehadkee, DWR requires the wetland hydrology success criteria be changed to a minimum 12 percent of the growing season.
       This was updated.

11. Page 35, Section 9.2 – To avoid confusion, DWR would prefer discussion of contingencies be incorporated into the Adaptive Management Section 10.

    Section 9.2 text was moved to Section 10.

12. Appendix A Figures
    a. Figure 6 is listed in the Table of Contents but was not included in Appendix A.
       Figures 6 has been removed from the Table of contents.
    b. Figure 6A – A portion of wetland GHI located west of the gas line break should be shown as enhancement (currently all shown as restoration).
       Wetland GHI has been updated.
    c. Figure 6B includes callouts for "ditch to be backfilled in wetland enhancement areas". This activity was also noted on page 30. However, no wetland ditch filling callouts are on Sheets 4-6 and only a stream plug detail was included.
       Areas that are hatched for Restoration will be graded to match the floodplain. This includes fill of ditches.
    d. Figures 6B and 9 - Please add north arrows.
       North arrow was added to Figure 6B. The north arrow on Figure 9 has been moved to a portion of the figure that has a lighter background to make it more visible.
    e. Figure 8B – Please add "Drop Structure" title to the top detail.

"Drop Structure" has been added to Figure 8B.

f. Figure 9 has the marsh treatment area in the legend but not shown on the map.
The marsh treatment area layer has been turned on for Figure 9.

g. Figure 10B has the gas line in the legend but not shown on the map.
The gas line has been removed from the monitoring plan legend.

h. Figures were provided for the Cedarock reference reach. Why weren't similar figures provided for Causey Farm?
As explained in the document "The Causey Farm reference was measured in 2004 as a reference reach for the Causey Farm stream mitigation project, which was a successful project through five years of monitoring with no issues." Therefore, these figures were not developed for the project.

13. Appendix E - Letters from SHPO, NRCS and USFWS were referenced. Please include this correspondence.

These letters are included as part of the Categorical Exclusion document in Appendix E.

14. Sheet 2A & Figure 8A – DWR is concerned that the proposed log vanes could see undermining without a footer log. DWR would prefer log vanes to be designed with a footer log.

A footer log has been added to Figure 8A

15. Sheet 03A – Can existing and proposed fencing please be clearly indicated on this sheet.

The plans have been update to show existing and proposed fencing.

16. Sheet 4 – Please confirm the bold dashed line denotes floodplain grading extent (and add callout). The easement line appears to bisect Cane Creek and UT3, please update.

The bold dashed line shown on the plan/profile sheets are the limits of construction, not floodplain. The easement bisecting Cane Creek and UT3 has been removed.

17. Sheet 5 – Please confirm whether the double dashed line crossing Cane Creek is a piped culvert existing or proposed.

The lines depicted are an existing path. It will be obsolete post construction.

18. Sheet 12 – Gates are shown at the easement crossing, but no existing or proposed fencing is shown connected to the gates, please update.

Updated

Kim Browning, USACE:

1. Design Sheets: Regarding the discussion at the July 8, 2019 field visit regarding stream crediting, the USACE Mitigation Credit Calculation Memo released October 5, 2017, states "When existing stream length measurements are conducted for the purposes of determining credit during mitigation plan development (e.g., measuring existing enhancement or preservation reaches), the center of the wetted perimeter (using base flow conditions) should be used….For restoration reaches or any other approach where the stream will be built in a new location, credit amounts should be based on the center of the designed channel as shown in the plan sheet."
    a. Based on this guidance, the centerline of the wetted perimeter should be used to calculate stream credit length in the enhancement and preservation reaches, not based on the thalweg as currently shown on the plan maps.
    b. The restoration reaches should be based on the center of the newly designed channel, not on the thalweg as currently shown on the plan maps.
    c. Where there is a confluence, only one stream should be measured where the two channels join, rather than measuring both channels.

    Stream lengths and credit calculations should be revised based on the above. (This should address DWR's comment #1 above.)

All figures and tables in the detailed restoration plan have been changed to calculate length by

centerline for restoration. Enhancement level II and preservation lengths are calculated using wetted perimeter. In addition, at stream confluences, the smaller tributaries are terminated at the bankfull line of the larger tributary to eliminate double calculation of stream length.

2. Table 1: The proposed length of Cane Creek and UT4 do not match the amounts on the cover sheet of the Construction Plans.

Table 1 is used for credit calculations and will not match construction plans. This results in the model developed to construct the stream channels (depicted on construction plans) being based on our original wetted perimeter calculations and the detailed plan (credit calculations) being based on centerline of the channel.

3. UT4- Please confirm that this reach is intermittent. If so, please include a flow gauge in the upper third of this reach.

During the USACE walkthrough of the Site for a JD verification, UT 4 was determined to have a perennial flow regime. In addition, no questions of flow regime were raised during the IRT walkthrough, and no request to install a gauge to monitor flow was brought forth. Therefore, we respectfully request to not add a flow gauge for this tributary.

4. It would be helpful to depict photo points/digital image stations on Figures 10A and 10B.

Photo Stations are located at each cross section and vegetation plot. Labels on the legend for Figures 10A and 10B have been changed to read "Cross Section/Photo Station" and "Vegetation Plot/Photo Station".

5. Please include Categorical Exclusion documents in the appendix.

The Categorical Exclusion document is included as Appendix E.

6. Page 25: When Marsh Treatment Areas are planned within the easement, please describe any maintenance required, if applicable.

Maintenance will not be necessary; the treatment areas will fill with sediment and organic matter and are expected to naturalize over time.

7. The lower reach of UT2 was not deeply incised, had good bedform, and had an existing buffer. The only apparent issue was cattle impacts. EII is more appropriate for this reach.

Enhancement level II was proposed for the lower reaches of UT 2.

8. Section 8.3: Wetland restoration—It would be beneficial to add some coarse woody debris to the depressional areas and throughout the wetland for habitat, and to help store sediment, increase water storage/infiltration, and absorb water energy during overbank events.

The following was added to Section 8.3 "Coarse woody debris will be added to depressional areas within the wetlands to provide habitat, store sediment, increase water storage/filtration, and to absorb energy during overbank events."

9. It's great to see that macroinvertebrate monitoring years 3, 5, 7 is planned, and listed in Tables 15 and 16. Is the 2% additional credit being sought? If so, please adjust asset tables and show the monitoring stations on Figures 10A and 10B.

Preconstruction benthic macroinvertebrates have been collected at the Site. Monitoring locations for future benthic macroinvertebrate sampling has been shown on Figures 10A and 10B. Benthic macroinvertebrate sampling is not included in success criteria; however, we request the additional 2% credit and have updated the credit table as such.

10. Table 17: Continuous surface flow for at least 30-consecutive days is only applicable to intermittent streams, and gauge data should document this.

The "intermittent reach of UT3" was added to this.

11. At least one veg plot should be located within the wetland enhancement area.

2 vegetation plots were moved to encompass a portion of the wetland enhancement areas. Currently 5 of the 12 plots are at least partially including wetland enhancement areas.

12. Figure 10A and 10B—The wetland enhancement and wetland restoration labels are switched (Blue areas should be E and green areas should be R).

The labels have been switched on Figures 10A and 10B

TABLE OF CONTENTS

TABLES

APPENDICES

1.0 PROJECT INTRODUCTION

The Phantom Mill Stream & Wetland Mitigation Site (hereafter referred to as the "Site") encompasses 16.1 acres of disturbed forest and livestock pasture along Cane Creek and unnamed tributaries to Cane Creek (warm water streams in the Jordan Lake watershed). The Site is located approximately 1 mile north of Pleasant Hill and 2 miles west of Snow Camp in southwest Alamance County (Figures 1 and 2, Appendix A).

1.1 Directions to Site

Directions to the Site from Raleigh, North Carolina.

- Take US-64 West out of Raleigh and travel 25 miles,
- Take exit 381 and turn right onto NC-87 N; travel 24 miles,
- Turn left onto E Greensboro Chapel Hill Road; travel 10.2 miles,
- Turn right onto Charlie Euliss Road; travel to the end of the road.
    - Site Latitude, Longitude
      35.8924ºN, 79.4754ºW (WGS84)

1.2 USGS Hydrologic Unit Code and NCDWR River Basin Designation

The Site is located within the Cape Fear River Basin in 14-digit United States Geological Survey (USGS) Cataloging Unit and **Targeted Local Watershed 03030002050050** of the South Atlantic/Gulf Region (North Carolina Division of Water Resources [NCDWR] subbasin number 03-06-04) [Figures 1 and 2, Appendix A]). Topographic features of the Site include Cane Creek, which has been assigned Stream Index Numbers 16-28, and a Best Usage Classification of **WS-V, NSW** (NCDWR 2013). Site tributaries are not listed on the final 2016 NC 303(d) list (NCDWR 2018).

1.3 Physiography and Land Use

The Site is located in the Carolina Slate Belt Ecoregion of the Piedmont Physiographic Province within Alamance County, North Carolina. Regional physiography is characterized by dissected irregular plains, some hills, linear ridges, isolated monadnocks, and low to moderate gradient streams with mostly boulder and cobble substrates (Griffith et al. 2002). Onsite elevations range from a high of 630 feet National Geodetic Vertical Datum (NGVD) at the upper reach of UT3 to a low of approximately 590 feet NGVD at the Site outfall (USGS Snow Camp, North Carolina 7.5-minute topographic quadrangle) (Figures 1 and 3, Appendix A).

The Site provides water quality functions to an approximately 4.4-square mile (2795-acre) watershed at the outfall; Site tributary watershed sizes range from 0.08-0.13 square miles (50-83 acres) (Figure 3, Appendix A). The watershed is dominated by pasture, agricultural land, forest, and sparse residential property. Impervious surfaces account for less than 5 percent of the upstream watershed land surface.

Land use at the Site is characterized by disturbed forest and livestock pasture. Riparian zones are primarily composed of herbaceous vegetation that is sparse and disturbed due to livestock grazing, bush hogging, and regular land-management activities.

1.4 Project Components and Structure

The Site encompasses 16.1 acres of disturbed forest and livestock pasture along the warm waters of Cane Creek and unnamed tributaries to Cane Creek. In its current state, the Site includes 4404 linear feet of degraded stream channel (based on the approved PJD), 0.923 acre of degraded wetland, and 4.377 acres of drained hydric soil (Figure 4, Appendix A).

Proposed Site restoration activities include the construction of meandering, E/C-type stream channel resulting in 2984 linear feet of Priority I stream restoration, 335 linear feet of stream enhancement (Level I), 666 linear feet of stream enhancement (Level II), 669 linear feet of stream preservation, 3.727 acres of riparian wetland restoration, and 0.828 acre of riparian wetland enhancement (Table 1) (Figures 6A-6B, Appendix A).

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 1-4.

Table 1. Project Components and Mitigation Credits
Phantom Mill Restoration Site

Reach ID	Stream Stationing/ Wetland Type	Existing Footage/ Acreage	Mitigation Plan Footage/ Acreage	Mitigation Level	Mitigation Ratio	Mitigation Credits	Comment
Cane Creek-R	0+00-19+87	1807	1987-70= 1917	Restoration (Priority I)	1:1	1917.000	70 lf is located outside of the easement and therefore is not generating credit
Cane Creek-P	19+87-24+71	484	484	Preservation	10:1	48.400	
UT 1	00+00-01+98	NA	198	No Credit	NA	0	Feature is non-jurisdictional
UT 2A-P	00+00-00+34	34	34	Preservation	10:1	3.400	
UT 2-EI	00+00-02+14	214	214	Enhancement (Level I)	1.5:1	142.667	
UT 2-EII	02+14-04+17	203	203	Enhancement (Level II)	2.0:1	101.500	
UT 2-EII	04+78-08+29	351	351	Enhancement (Level II)	2.5:1	140.400	
UT 2-P	08+29-09+80	151	151	Preservation	10:1	15.100	
UT 3-EI	00+00-01+83	183	183-62= 121	Enhancement (Level I)	1.5:1	80.667	62 lf is located outside of the easement and therefore is not generating credit
UT 3-R	01+83-09+89	851	806	Restoration	1:1	806.000	
UT 4-EII	00+00-01+12	112	112	Enhancement (Level II)	2.5:1	44.800	
UT 4-R	01+12-03+73	110	261	Restoration	1:1	261.000	
Wetland R	Riparian Riverine	--	3.727	Restoration	1:1	3.727	Wetland Restoration
Wetlands E	Riparian Riverine	0.923	0.828	Enhancement	2:1	0.4147	Wetland Enhancement

Length & Area Summations by Mitigation Category		
Restoration Level	**Stream (linear footage)**	**Riparian Wetland (acreage)**
Restoration	2984	3.727
Enhancement (Level I)	335	--
Enhancement (Level II)	666	--
Preservation	669	--
Enhancement	--	0.828

Overall Assets Summary	
Asset Category	**Overall Credits**
Stream	**3560.933**
2% Benthic Credit	**71.219**
Total Stream Credit	**3632.152**
Riparian Riverine Wetland	**4.141**

Table 2. Project Activity and Reporting History
Phantom Mill Restoration Site

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal (RFP No. 16-007330)	February 2018	February 2018
Institution Date (NCDMS Contract No. 7526)	--	4/19/18
Mitigation Plan	August 7, 2019	January 2020
Construction Plans	--	January 2020

Table 3. Project Contacts Table
Phantom Mill Restoration Site

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

Table 4. Project Attribute Table
Phantom Mill Restoration Site

Project Information	
Project Name	Phantom Mill Restoration Site
Project County	Alamance County, North Carolina
Project Area (acres)	16.1
Project Coordinates (latitude & latitude)	35.8924ºN, 79.4754ºW
Planted Area (acres)	12.5
Project Watershed Summary Information	
Physiographic Province	Piedmont
Project River Basin	Cape Fear
USGS HUC for Project (14-digit)	03030002050050
NCDWR Sub-basin for Project	03-06-04
Project Drainage Area (acres)	2795
Percentage of Project Drainage Area that is Impervious	<5%
CGIA Land Use Classification	Managed Herbaceous Cover & Hardwood Swamps

Section 4. Project Attribute Table
Phantom Mill Restoration Site (continued)

Reach Summary Information				
Parameters	**Cane Creek**	**UT2**	**UT 3**	**UT4**
Length of reach (linear feet)	2333	967	1037	225
Valley Classification & Confinement	Alluvial, confined – moderately confined			
Drainage Area (acres)	2795	67	83	50
NCDWR Stream ID Score	--	34.5	32	34.5
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial/ Intermittent	Perennial
NCDWR Water Quality Classification	WS-V, NSW			
Existing Morphological Description (Rosgen 1996)	Eg5	Cg 3/4	F4	Eg4
Proposed Stream Classification (Rosgen 1996)	C/E 3/4	C/E 3/4	Cb 3/4	C/E 3/4
Existing Evolutionary Stage (Simon and Hupp 1986)	II/III	II/III	III/IV	II/III
Underlying Mapped Soils	Chewacla loam, Cullen clay loam, Riverview loam			
Drainage Class	Somewhat poorly drained, well-drained, well-drained, respectively			
Hydric Soil Status	Nonhydric (may contain hydric inclusions), nonhydric, nonhydric, respectively			
Valley Slope	0.0035	0.0225	0.0320	0.0237
FEMA Classification	Lower reaches AE floodway	NA	NA	NA
Native Vegetation Community	Piedmont Alluvial Forest/Dry-Mesic Oak-Hickory Forest			
Watershed Land Use/Land Cover (Site)	43% forest,55% agricultural land, <2% low density residential/impervious surface			
Watershed Land Use/Land Cover (Cedarock Reference Channel)	65% forest, 30% agricultural land, <5% low density residential/impervious surface			
Percent Composition of Exotic Invasive Vegetation	<5%			

Table 4. Project Attribute Table
Phantom Mill Restoration Site (continued)

Wetland Summary Information			
Parameters	**Wetlands**		
Wetland acreage	4.377 acre drained & 0.923 acre degraded		
Wetland Type	Riparian riverine		
Mapped Soil Series	Worsham and Wehadkee		
Drainage Class	Poorly drained		
Hydric Soil Status	Hydric		
Source of Hydrology	Groundwater, stream overbank		
Hydrologic Impairment	Incised streams, compacted soils, livestock, ditches		
Native Vegetation Community	Piedmont/Low Mountain Alluvial Forest		
% Composition of Exotic Invasive Vegetation	<5%		
Restoration Method	Hydrologic, vegetative, livestock		
Enhancement Method	Vegetative, livestock		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States-Section 401	Yes	Yes	JD Package (App D)
Waters of the United States-Section 404	Yes	Yes	JD Package (App D)
Endangered Species Act	Yes	Yes	CE Document (App E)
Historic Preservation Act	Yes	Yes	CE Document (App E)
Coastal Zone Management Act	No	--	NA
FEMA Floodplain Compliance	Yes	No	In Process (App F)
Essential Fisheries Habitat	No	--	NA

2.0 WATERSHED APPROACH AND SITE SELECTION

Primary considerations for Site selection included the potential for improvement of water quality within a region of North Carolina under heavy development and livestock/agricultural pressure. More specifically, considerations included: desired aquatic resource functions; hydrologic conditions; soil characteristics; aquatic habitat diversity; habitat connectivity; compatibility with adjacent land uses; reasonably foreseeable effects the mitigation project will have on ecologically important aquatic and terrestrial resources; and potential development trends and land use changes. Site specific characteristics are summarized below, in addition to development trends and land use changes within the watershed.

Currently, the proposed Site is characterized by disturbed forest and livestock pasture. A summary of existing Site characteristics in favor of proposed stream and wetland activities include the following.

- Streams and wetlands are accessible to livestock
- Stream banks are trampled by livestock
- Streams and wetlands have been cleared of forest vegetation
- Site receives nonpoint source inputs including agricultural chemicals and livestock waste
- Wetland soils have been compacted by livestock and agricultural equipment
- Wetland hydrology has been removed by stream channel entrenchment
- Streams are classified as nutrient sensitive waters

In addition to the opportunity for ecological improvements at the Site, the use of the particular mitigation activities and methods proposed in the Design Approach & Mitigation Work Plan (Section 8.0) are expected to produce naturalized stream and wetland resources that will be ecologically self-sustaining, requiring minimal long-term management (Long-term Management Plan [Section 11.0]).

Development Trends and Land Use Changes in Cape Fear 03030002 (Cape Fear 02)

Between the 2000 and 2010 censuses, the Cape Fear 02 population increased approximately 17 percent. The general trend of population growth appears to be continuing according to recent population estimates, which indicate Guilford, Orange, Chatham, and Durham counties are all growing at faster annual rates than North Carolina's 1.02 percent (USCB 2013). These data suggest land development activities will increase in frequency, as will aquatic ecosystem impacts related to such development. Therefore, there is an immediate and prolonged need for compensatory stream mitigation in the watershed. Of further benefit, aquatic ecosystem restoration projects are capable of reducing nutrient loading in sensitive downstream receiving waters such as Jordan Lake.

According to the *Cape Fear River Basinwide Water Quality Plan* (NCDWQ 2005), all land uses and discharges of wastewater and stormwater in the Cape Fear 02 subbasin 03-06-04 potentially contribute nutrients to B. Everett Jordan Lake. B. Everett Jordan Lake provides low-flow augmentation, flood control, recreation, fish and wildlife habitat, and water supply. The lake is impaired for aquatic life due to excessive levels of chlorophyll *a* in violation of current standards in all segments of the reservoir. In addition, the Site has a supplemental water quality classification of Nutrient Sensitive Waters, which designates areas with water quality problems associated with excessive plant growth resulting from nutrient enrichment. The proposed mitigation activities will reduce sediment and nutrient levels, and improve water quality within the Site and downstream watersheds.

Project goals are based on the *Cape Fear River Basin Restoration Priorities* (RBRP) report (NCEEP 2009) and on-site data collection of channel morphology and function observed during field investigations. The Site is located within **Targeted Local Watershed (TLW) 03030002050050** (Figure 2, Appendix A). The RBRP report documents benthic ratings vary between "Fair" and "Good-Fair" possibly due to cattle, dairy, and poultry operations. The project is not located in a Regional or Local Watershed Planning Area; however, RBRP goals are addressed by project activities as follows with Site specific information following the RBRP goals in parenthesis.

1. Reduce and control sediment inputs (sediment model [Section 3.2] – reduction of 31.1 tons/year after mitigation is complete);
2. Reduce and manage nutrient inputs (nutrient model [Section 3.3] - livestock removal from streams will result in a direct reduction of 821.7 pounds of nitrogen, 68.1 pounds of phosphorus per year, and 4.7 x 10^{11} colonies of fecal coliform; eliminate fertilizer application; and install one marsh treatment area);
3. Protect and augment designated natural heritage areas (protect portions of the Dry-Mesic Basic Oak Hickory Forest (Piedmont Subtype) Natural Community and the Kimesville Road Basic Forest Natural Area that area partially located within the Site and augment these areas, which extend north of the Site).

Site specific mitigation goals and objectives have been developed through the use of North Carolina Stream Assessment Method (NC SAM) and North Carolina Wetland Assessment Method (NC WAM) and are discussed further in Section 6.0 (Functional Uplift and Project Goals/Objectives).

3.0 BASELINE AND EXISTING CONDITIONS

3.1 Soils and Land Form

Soils that occur within the Site, according to the *Web Soil Survey* (USDA 2017) are described in Table 5.

Table 5. Web Soil Survey Soils Mapped within the Site

Map Unit Symbol	Map Unit Name (Classification)	Hydric Status	Description
CaC3	Cecil clay loam (*Typic Kanhapludults*)	Non-hydric	This series consists of severely eroded, well-drained soils on hillslopes on ridges. This soil is saprolite derived from granite and gneiss and/or schist. Slopes range from 6-10 percent. Depth to the water table and the restrictive layer is more than 80 inches.
DaD3	Davidson clay (*Rhodic Kandiudults*)	Non-hydric	This series consists of severely eroded, well-drained soils on hillslope on ridges formed from residuum weathered from diorite and/or gabbro and/or diabase and/or gneiss. Slopes range from 10-15 percent. Depth to the water table and the restrictive layer is more than 80 inches.
DcC	Durham coarse sandy loam (*Typic Hapludults*)	Non-hydric	This series consists of well-drained soils on interfluves formed from residuum weathered from diorite and/or gabbro and/or diabase and/or gneiss. Slopes range from 6-10 percent. Depth to the water table and the restrictive layer is more than 80 inches.
HaC3	Helena clay loam (*Aquic Hapludults*)	Non-hydric	This series consists of well-drained soils on hillslopes on ridges formed from saprolite derived from granite and gneiss and/or schist. Slopes range from 6-10 percent. Depth to the water table and the restrictive layer is more than 80 inches.
LaD3, LbB, LbB2, LbC2, LbD2	Lloyd clay loam and loam (*Rhodic Kanhapludults*)	Non-hydric	This series can be eroded to severely eroded, and consists of well-drained soils on interfluves and hillslopes on ridges. This series developed from residuum weather from gneiss residuum weathered from schist. Slopes range from 2-15 percent. Depth to the water table is more than 80 inches. Depth to the restrictive layer is more than 80 inches within loamy soils and 40-60 inches to paralithic bedrock in loamy clay.
Lc	Local alluvial land	Hydric	This series consists of nearly level, poorly drained soils on floodplains. This series developed from loamy alluvium derived from igneous and metamorphic rock. Slopes range from 0-2 percent. Depth to the water table is about 0-12 inches. Depth to the restrictive layer is more than 80 inches.
Me	Moderately gullied land (Cecil, Appling, and Lloyd materials)	Non-hydric	This series consists of severely eroded, well-drained soils on hillslopes on ridges. This series developed from residuum weathered from metamorphic rock and/or residuum weathered from mica schist. Slopes range from 6-15 percent. Depth to the water table and the restrictive layer is more than 80 inches.
Wa	Wehadkee sandy loam and fine sandy loam (*Fluvaquentic Endoaquepts*)	Hydric	This series consists of nearly level, poorly drained soils in depressions on floodplains. This series developed from loamy alluvium derived from igneous and metamorphic rock. Slopes range from 0-2 percent. Depth to the water table is about 0-12 inches. Depth to the restrictive layer is more than 80 inches.
WcD	Wilkes stony soils (*Typic Hapludalfs*)	Non-hydric	This series consists of well-drained soils on hillslopes on ridges. This series developed from residuum weathered from diorite and/or gabbro and/or diabase and/or gneiss. Slopes range from 10-15 percent. Depth to the water table is more than 80 inches. Depth to the restrictive layer is 10-20 inches to paralithic bedrock.
Wd	Worsham sandy loam (*Typic Endoaquults*)	Hydric	This series consists of poorly drained soils in depressions at footslopes. This series developed from alluvium and/or colluvium over saprolite derived from granite and gneiss. Slopes range from 2-6 percent. Depth to the water table is about 0-12 inches. Depth to the restrictive layer is more than 80 inches.

3.2 Sediment Model

Sediment load modeling was performed using methodologies outlined in *A Practical Method of Computing Streambank Erosion Rate* (Rosgen 2009) along with *Estimating Sediment Loads using the Bank Assessment of Non-point Sources Consequences of Sediment* (Rosgen 2011). These models provide a quantitative prediction of streambank erosions by calculating Bank Erosion Hazard Index (BEHI) and Near-Bank Stress (NBS) along each Site reach. The resulting BEHI and NBS values are then compared to streambank erodibility graphs prepared for North Carolina by the NC Stream Restoration Institute and NC Sea Grant.

Streambank characteristics involve measurements of bank height, angles, materials, presence of layers, rooting depth, rooting density, and percent of the bank protected by rocks, logs, roots, or vegetation. Site reaches have been measured for each BEHI and NBS characteristic and predicted lateral erosion rate, height, and length to calculate a cubic volume of sediment contributed by the reach each year. Data forms for the analysis are available upon request and the data output is presented in Appendix B. Results of the model are presented in the following table.

Table 6. BEHI and NBS Modeling Summary

Stream Reach	Proposed Mitigation Treatment	Predicted Sediment Contribution (tons/year)
Cane Creek	Restoration and Preservation	24.2
UT 2	Enhancement (I), Enhancement (II), and Preservation	1.3
UT 3	Restoration and Enhancement (I)	5.4
UT 4	Restoration and Enhancement (II)	0.2
	Total Sediment Contribution (tons/year)	**31.1**

Based on this analysis, mitigation of Site streams will reduce streambank erosion and subsequent pollution of receiving waters.

3.3 Nutrient Model

Nutrient modeling was conducted using a method developed by NCDMS (NCDMS 2016) to determine nutrient and fecal coliform reductions from exclusion of livestock from the buffer.

The equation for nutrient reduction due to cattle exclusion for this model includes the following:

TN reduction (lbs/yr) = 51.04 (lbs/ac/yr) x Area (ac)
TP reduction (lbs/yr) = 4.23 (lbs/ac/yr) x Area (ac)

Where:
TN – total nitrogen;
TP – total phosphorus; and
Area – total area of restored riparian buffers inside of livestock exclusion fences.

Equations for fecal coliform reduction for this model include the following.

Fecal coliform reduction (col) = 2.2×10^{11} (col/AU/day) x AU x 0.085

Where:
Col - quantities of Fecal Coliform bacteria
AU - animal unit (1000 lbs of livestock)

Results of the NCDMS analysis indicate approximately 821.7 lbs/yr of nitrogen, 68.1 lbs/yr of phosphorus, and 4.68×10^{11} col of fecal coliform/day will be reduced due to exclusion of livestock from the easement area.

3.4 Project Site Streams

Streams targeted for restoration include Cane Creek and unnamed tributaries to Cane Creek, which have been cleared, dredged of cobble substrate, straightened, trampled by livestock, eroded vertically and laterally, and receive extensive sediment and nutrient inputs from livestock. Approximately 85 percent of the existing stream channel has been degraded contributing to sediment export from the Site resulting from mechanical processes from livestock hoof shear. In addition, streamside wetlands have been cleared and drained by channel downcutting and land uses. 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). 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.

3.4.1 Existing Conditions Survey

Site stream dimension, pattern, and profile were measured to characterize existing channel conditions. Locations of existing stream reaches and cross-section locations are depicted in Figure 4 (Appendix A). Stream geometry measurements under existing conditions are summarized in Table 7 (Essential Morphology Parameters) and presented in detail in Table B1 (Appendix B).

Table 7. Essential Morphology Parameters

Parameter	Existing				Reference		Proposed			
	Cane Creek	UT2	UT3	UT4	Cedarock Park	Causey Farm	Cane Creek	UT2	UT3	UT4
Valley Width (ft)	200	50	25	50	50-100	150-200	200	50	25	50
Contributing Drainage Area (sq. mi.)	4.16	0.10	0.13	0.08	0.21	0.63	4.16	0.10	0.13	0.08
Channel/Reach Classification	Eg5	Cg ¾	F4	Eg4	Eb4	E5	C/E ¾	C/E ¾	Cb ¾	C/E ¾
Design Discharge Width (ft)	18.6-43.5	7.8-17.2	3.6-10.6	5.0-7.4	8.1	11.0	27.1	7.8	4.1	7.0
Design Discharge Depth (ft)	1.2-2.8	0.2-0.6	0.1-0.3	0.5-0.7	0.8	1.4	1.9	0.6	0.3	0.5
Design Discharge Area (ft^2)	52.3	4.3	1.6	3.5	8.0	14.7	52.3	4.3	1.6	3.5
Design Discharge Velocity (ft/s)	4.4	3.8	11.8	3.7	3.6	4.1	4.4	3.8	11.8	3.7
Design Discharge Discharge (cfs)	232.1	16.2	18.9	13.1	28.8	60.6	232.1	16.2	18.9	13.1
Water Surface Slope	0.0033	0.0188	0.0317	0.0228	0.0258	0.0053	0.0030	0.0188	0.0305	0.0206
Sinuosity	1.06	1.20	1.01	1.04	1.20	1.46	1.15	1.20	1.05	1.15
Width/Depth Ratio	6.6-36.3	13.0-86.0	12.0-106.0	7.1-14.8	10.1	9.0	14.0	14.0	14.0	14
Bank Height Ratio	1.1-2.0	0.9-3.1	1.7-10.0	1.1-3.2	1.0	1.4	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.6-5.4	1.2-12.8	1.0-2.2	1.1-20.0	2.1	12	2.6	6.4	12.2	7.1
Substrate	Sand	Gravel/cobble	Gravel	Gravel	Gravel	Sand	Gravel/cobble	Gravel/cobble	Gravel/cobble	Gravel/cobble

3.4.2 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). Existing Site reaches are classified as unstable Cg-, Eg-, and F-type streams with variable sinuosity. Existing Site reaches are characterized by variable substrate ranging from sand to gravel, with occasional cobble as the result of channel impacts including livestock trampling, channel straightening, and riparian vegetation removal.

3.4.3 Channel Evolution

Site streams targeted for restoration have been channelized and are continually trampled by livestock resulting primarily in channels classified as channelized (Class II), degraded (Class III), and degraded and widened (Class IV) channels throughout the Site (Simon and Hupp 1986).

3.4.4 Valley Classification

UT2-UT4 are characterized by small stream, headwater, moderately confined to confined, alluvial valleys with approximately 25- to 50-foot floodplain valley widths. Cane Creek is characterized by a large watershed (4.4 square miles) and an unconfined alluvial valley approximately 200 feet in width. Valley slopes of restoration reaches are typical for the Piedmont region and range from 0.0035 on Cane Creek and 0.0188-0.0320 on UT2-UT4. Typical streams in this region include C- and E-type streams with slightly entrenched, meandering channels with a riffle-pool sequence. However, steeper slopes such as UT3 may trend towards B-type, bedrock confined, step-pool streams.

3.4.5 Discharge

This hydrophysiographic region is characterized by moderate rainfall with precipitation averaging approximately 40-50 inches per year (USDA 1960). Drainage basin sizes range from 0.08- to 0.13-square mile on UT2-UT4, and 4.4 square miles for Cane Creek.

The Site's discharge is dominated by a combination of upstream basin catchment, groundwater flow, and precipitation. Based on indicators of bankfull at reference reaches and on-Site, the designed channel will equal approximately 93 percent of the channel size indicated by Piedmont regional curves (Harman et al. 1999); this is discussed in Section 5.2 (Bankfull Verification). Based on bankfull studies, the bankfull discharge ranges from 13.1-18.9 cubic feet per second for UT2-UT4, and is 232.1 cubic feet per second for Cane Creek.

3.5 Project Site 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 (Environmental Laboratory 1987). A jurisdictional wetland delineation was completed and verbally approved by United States Army Corps of Engineers (USACE) representative David Bailey during a field meeting on August 21, 2018. Written confirmation of the determination has been included in Appendix D. Existing jurisdictional wetlands are depicted in light blue and drained hydric soils are depicted in black cross hatch on Figure 4 (Appendix A).

3.5.1 Hydrological Characterization

Construction activities are expected to restore approximately 3.727 acre of drained riparian hydric soils and enhance 0.828 acre of cleared riparian wetlands. Areas of the Site targeted for riparian wetlands will receive hydrological inputs from periodic overbank flooding of restored tributaries, groundwater migration into wetlands, upland/stormwater runoff, and, to a lesser extent, direct precipitation. Hydrological impairment in drained soils has resulted from lateral draw-down of the water table adjacent to existing, incised stream channels.

3.5.2 Soil Characterization

Detailed soil mapping conducted by a North Carolina Licensed Soil Scientist (NCLSS) in May 2018 indicate that the Site is currently underlain by hydric soils of the Wehadkee and Worsham series (Figure 4, Appendix A). Wetlands have been disturbed by livestock grazing and cleared of vegetation within pastureland. These hydric soils have been effectively drained by stream channel incision or relocation of stream channels to the floodplain margins.

Onsite hydric soils are grey to gley in color and are compacted and pockmarked by livestock trampling. Livestock trampling, grazing, and clearing has resulted in an herbaceous vegetative community. Groundwater springs and surface runoff contribute hydrology to these areas, although the dominant hydrological influence is the lateral draw-down of the water table adjacent to incised stream channels or streams relocated to the floodplain margins. A detailed soil profile conducted by a NCLSS is described in the following table. Additional soil profile descriptions are located in Appendix B and are depicted on Figure 4 (Appendix A).

Table 8. Profile Description

Depth (inches)	Color	Texture
0 - 3	10 YR 5/3 10 YR 5/6 mottles 5%	Silty clay loam
3 - 5	10 YR 5/3 10 YR 5/6 mottles 20%	Silty clay
5-12+	10 YR 6/2 10 YR 5/6 mottles 10%	Silty clay

3.5.3 Plant Community Characterization

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

4.0 REFERENCE STUDIES

4.1 REFERENCE STREAMS

Two reference reaches were identified for the Site. The first reference stream (Cedarock) is located approximately 7 miles north-northeast of the Site in Cedarock Park on an unnamed tributary to Rock Creek (Figure 5A, Appendix A). The second reference stream (Causey Farm) is located approximately 8 miles west-northwest of the Site, immediately north of Causey Airport on unnamed tributaries to Stinking Quarter Creek. The Causey Farm reference was measured in 2004 as a reference reach for the Causey Farm stream mitigation project, which was a successful project through five years of monitoring with no issues. The streams were measured and classified by

stream type (Rosgen 1996). Stream data is available for the Causey Farm reference; however, no figures were available for inclusion with this document.

4.1.1 Channel Classification

The reference reaches are both characterized as E-type streams; Cedarock is a moderately sinuous (1.2) channel dominated by gravel substrate and Causey Farm had slightly higher sinuousity channel, due to a lower valley slope, with a sand-dominated substrate.

4.1.2 Discharge

Field indicators of bankfull approximate an average discharge of 31.3 and 59.8 cfs, respectively for the Cedar Fork and Causey Farm reference reaches, which is 108 and 94 percent of that predicted by the regional curves.

4.1.3 Channel Morphology

Dimension: Data collected at Cedarock and Causey Farm indicate bankfull cross-sectional areas of 8.0 and 14.7 square feet, respectively. Cedarock was slightly larger than predicted by regional curves (7.5 square feet) and Causey Farm was slightly smaller than predicted by regional curves (15.7 square feet). Cedarock and Causey exhibit a bankfull width of 8.1 and 11.0, a bankfull depth of 0.8 and 1.4 feet, and width-to-depth ratios of 10.1 and 9.0, respectively (see Table B1, Morphological Stream Characteristics). Figure 5C (Appendix A) provides plan view and cross-sectional data for the Cedarock reference reach. The reference reaches exhibit a bank-height ratio of 1.0 and 1.4, respectively. The Causey Farm reference reach was slightly incised; however, defined bankfull indicators were present, which assisted with determining the appropriate cross-sectional area.

Pattern and Profile: In-field measurements of the reference reaches have yielded an average sinuosity of 1.2 at Cedarock and 1.45 at Causey Farm (thalweg distance/straight-line distance). Onsite valley slopes of Site restoration reaches range from 0.0185-0.0241. Valley slopes exhibited by reference channels range from slightly higher (0.0310 at Cedarock) than the Site to slightly lower (0.0077 at Causey Farm), providing a good range of slopes to compare existing and proposed Site conditions. Although slightly incised, the Causey Farm reference reach had a suitable pattern with no shoot cutoffs, eroding outer bends, or excessively tight radius of curvatures, in addition to appropriate pool-to-pool spacing and meander wavelengths.

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

4.2 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 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 located 4 miles east of the Site at the Abbey Lamm Stream and Wetland Mitigation Site. 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 9 will be used, in addition to other relevant species in appropriate Schafale and Weakley (1990) and Schafale (2012) community descriptions.

Table 9. Reference Forest Ecosystem

Piedmont/Low Mountain Alluvial Forest	
red maple (*Acer rubrum*)	black gum (*Nyssa sylvatica*))
tag alder (*Alnus serrulata*)	black cherry (*Prunus serotina*)
ironwood (*Carpinus caroliniana*)	white oak (*Quercus alba*)
pignut hickory (*Carya glabra*)	swamp chestnut oak (*Quercus michauxii*)
green ash (*Fraxinus pennsylvanica*)	water oak (*Quercus nigra*)
eastern red cedar (*Juniperus virginiana*)	cherrybark oak (*Quercus pagoda*)
tulip poplar (*Liriodendron tulipifera*)	willow oak (*Quercus phellos*)
sweetgum (*Liquidambar styraciflua*)	slippery elm (*Ulmus rubra*)

5.0 CHANNEL ASSESSMENTS

5.1 Channel Stability Assessment

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.

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 10. Average stream velocity and bankfull discharge values were calculated for the existing Site stream reaches, the reference reach, and proposed conditions.

In order to maintain sediment transport functions of a stable stream system, the proposed channel should exhibit stream power and shear stress values so the channel is neither aggrading nor degrading. Results of the analysis indicate the proposed channel reaches are expected to maintain stream power as a function of width values of approximately 1.60-7.65 and shear stress values of approximately 0.32-0.57 (Table 10).

Table 10. Stream Power (Ω) and Shear Stress (τ) Values

	Bankfull Discharge (ft^3/s)	Water surface Slope (ft/ft)	Total Stream Power (Ω)	Ω/W	Hydraulic Radius	Shear Stress (τ)	Velocity (v)	τ v	τ_{max}
Existing Conditions									
Cane Creek	232.1	0.0033	47.79	**2.08**	3.97	**0.82**	2.12	1.73	1.23
UT2	16.2	0.0188	19.00	**1.73**	1.52	**1.78**	0.91	1.61	2.67
UT3	18.9	0.0317	37.39	**4.73**	2.30	**4.55**	0.99	4.50	6.83
UT4	13.1	0.0228	18.64	**2.91**	1.25	**1.78**	1.38	2.45	2.67
Reference Conditions									
Cedarock	28.8	0.0258	46.37	**5.72**	0.82	**1.33**	3.60	4.78	6.67
Causey Farm	60.6	0.0053	20.04	**1.82**	1.07	**0.35**	4.12	1.45	2.10
Proposed Conditions									
Cane Creek	232.1	0.003	43.45	**1.60**	1.69	**0.32**	4.44	1.41	0.48
UT2	16.2	0.0188	19.00	**2.44**	0.48	**0.56**	3.77	2.11	0.84
UT3	18.9	0.0305	35.97	**7.65**	0.30	**0.57**	11.81	6.79	0.86
UT4	13.1	0.0206	16.84	**2.41**	0.44	**0.56**	3.74	2.10	0.84

Cedarock reference reach values for stream power and shear stress are higher due to steeper valley and water surface slopes resulting in higher stream power and shear stress values. Causey Farm reference reach values for stream power and shear stress are slightly lower due to flatter valley and water surface slopes resulting in slightly lower stream power and shear stress values.

Existing, Site streams are characterized by a wide range of water surface slopes and varying degrees of degradation. In general, stream power values of existing streams are slightly elevated for Cane Creek and UT4, and lower for UT2-UT3 as compared to proposed values. Shear stress values of existing streams are significantly elevated as compared to proposed and reference reach values. Proposed stream power and shear stress values appear adequate to mobilize and transport sediment through the Site, without aggradation or erosion on proposed stream banks.

5.2 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).

Based on available Piedmont regional curves, the predicted bankfull discharge for the reference reaches averages approximately 28.8 and 63.8 cubic feet per second (cfs) for Cedarock and Causey Farm, respectively (Harmen et al. 1999). The USGS regional regression equation for the Piedmont region indicates that bankfull discharge for the reference reaches at a 1.3-1.5 year return interval average approximately 27-32 and 53-65 cfs, respectively (USGS 2006).

Field indicators of bankfull, primarily topographic breaks identified on the banks, and riffle cross-sections were utilized to obtain an average bankfull cross-sectional area for the reference reaches. The Piedmont regional curves were then utilized to plot the watershed area and discharge for the reference reach cross-sectional area. Field indicators of bankfull approximate an average discharge of 31.3 and 59.8 cfs, respectively for the reference reaches, which is 108 and 94 percent of that predicted by the regional curves; which is verified by the range approximated by the USGS regional regression equation.

Based on the above analysis of methods to determine bankfull discharge, proposed conditions at the Site will be based on reference reaches and indicators of bankfull on a cross-section located in an undisturbed reach located at the Abbey Lamm Mitigation Site (located less than 4 miles east of the Site and currently in its fourth year of successful monitoring). Indicators of bankfull were used at the Abbey Lamm Mitigation Site to compare the bankfull cross-sectional area to that predicted by the curves; however, a detailed reference reach analysis was not appropriate. The designed onsite channel restoration area will equal approximately 93 percent of the channel size indicated by Piedmont regional curves. Table 11 summarizes all methods analyzed for estimating bankfull discharge.

Table 11. Reference Reach Bankfull Discharge Analysis

Method	Watershed Area (square miles)	Return Interval (years)	Discharge (cfs)
Cedarock Reference Reach			
Piedmont Regional Curves (Harman et al. 1999)	0.2	1.3-1.5	28.8
Piedmont Regional Regression Model (USGS 2004)	0.2	1.3-1.5	27-32
Field Indicators of Bankfull	0.2	1.3-1.5	31.3
Causey Farm Reference Reach			
Piedmont Regional Curves (Harman et al. 1999)	0.6	1.3-1.5	63.8
Piedmont Regional Regression Model (USGS 2004)	0.6	1.3-1.5	53-65
Field Indicators of Bankfull	0.6	1.3-1.5	59.8

6.0 FUNCTIONAL UPLIFT AND PROJECT GOALS/OBJECTIVES

Project goals are based on the *Cape Fear River Basin Restoration Priorities* (RBRP) report (NCEEP 2009) and on-site data collection of channel morphology and function observed during field investigations. The RBRP report documents benthic ratings vary between "Fair" and "Good-Fair" possibly due to cattle, dairy, and poultry operations. The project is not located in a Regional or Local Watershed Planning Area; however, RBRP goals are addressed by project activities as follows with Site specific information following the RBRP goals in parenthesis.

1. Reduce and control sediment inputs (sediment model [Section 3.2] – reduction of 31.1 tons/year after mitigation is complete);
2. Reduce and manage nutrient inputs (nutrient model [Section 3.3] - livestock removal from streams will result in a direct reduction of 821.7 pounds of nitrogen, 68.1 pounds of phosphorus per year, and 4.7 x 10^{11} colonies of fecal coliform; eliminate fertilizer application; and install one marsh treatment area);
3. Protect and augment designated natural heritage areas (protect portions of the Dry-Mesic Basic Oak Hickory Forest (Piedmont Subtype) Natural Community and the Kimesville Road Basic Forest Natural Area that area partially located within the Site and augment these areas, which extend north of the Site).

Site specific mitigation goals and objectives have been developed through the use of North Carolina Stream Assessment Method (NC SAM) and North Carolina Wetland Assessment Method (NC WAM) analyses of existing and reference stream systems at the Site (NC SFAT 2015 and NC WFAT 2010). These methodologies rate functional metrics for streams and wetlands as high, medium, or low based on field data collected on forms and transferred into a rating calculator. Using Boolean logic, the rating calculator assigns a high, medium, or low value for each metric and overall function. Site functional assessment data forms are available upon request and model output is included in Appendix B.

Tables 12A and 12B summarize NC SAM and NC WAM metrics targeted for functional uplift and the corresponding mitigation activities proposed to provide functional uplift. Metrics targeted to meet the Site's goals and objectives are depicted in bold.

Table 12A. Phantom Mill NC SAM Summary

NC SAM Function Class Rating Summary	Cane Cr	UT 2	UT 3	UT 4
(1) HYDROLOGY	**LOW**	HIGH	**LOW**	MEDIUM
(2) Baseflow	HIGH	HIGH	MEDIUM	HIGH
(2) Flood Flow	**LOW**	HIGH	**LOW**	MEDIUM
(3) Streamside Area Attenuation	**LOW**	HIGH	**LOW**	MEDIUM
(4) Floodplain Access	MEDIUM	MEDIUM	MEDIUM	MEDIUM
(4) Wooded Riparian Buffer	**LOW**	HIGH	**LOW**	MEDIUM
(4) Microtopography	**LOW**	HIGH	**LOW**	HIGH
(3) Stream Stability	**LOW**	MEDIUM	**LOW**	MEDIUM
(4) Channel Stability	**LOW**	HIGH	HIGH	HIGH
(4) Sediment Transport	**LOW**	**LOW**	**LOW**	MEDIUM
(4) Stream Geomorphology	**LOW**	MEDIUM	**LOW**	**LOW**
(1) WATER QUALITY	**LOW**	MEDIUM	**LOW**	HIGH
(2) Baseflow	HIGH	HIGH	MEDIUM	HIGH
(2) Stream-side Area Vegetation	**LOW**	HIGH	**LOW**	HIGH
(3) Upland Pollutant Filtration	**LOW**	HIGH	**LOW**	HIGH
(3) Thermoregulation	**LOW**	HIGH	**LOW**	HIGH
(2) Indicators of Stressors	**YES**	**YES**	**YES**	NO
(2) Aquatic Life Tolerance	**LOW**	HIGH	**LOW**	**Omitted**
(1) HABITAT	**LOW**	**LOW**	**LOW**	MEDIUM
(2) In-stream Habitat	**LOW**	**LOW**	**LOW**	**LOW**
(3) Baseflow	HIGH	HIGH	MEDIUM	HIGH
(3) Substrate	MEDIUM	MEDIUM	MEDIUM	MEDIUM
(3) Stream Stability	**LOW**	HIGH	MEDIUM	MEDIUM
(3) In-Stream Habitat	**LOW**	**LOW**	**LOW**	**LOW**
(2) Stream-side Habitat	**LOW**	HIGH	**LOW**	HIGH
(3) Stream-side Habitat	**LOW**	HIGH	**LOW**	HIGH
(3) Thermoregulation	**LOW**	HIGH	**LOW**	HIGH
OVERALL	**LOW**	MEDIUM	**LOW**	MEDIUM

Based on NC SAM output, all three primary stream functional metrics (Hydrology, Water Quality, and Habitat), as well as 19 sub-metrics are under-performing as exhibited by a LOW to MEDIUM metric rating. These same metrics measured in a relatively undisturbed Enhancement Level II reach exhibit MEDIUM TO HIGH metric ratings (see Figure 4, Appendix A for UT locations). LOW performing metrics are to be targeted for functional uplift through mitigation activities, goals and objectives, as well as, monitoring and success criteria.

Table 12B. Phantom Mill NC WAM Summary

NC WAM Sub-function Rating Summary	K1
Wetland Type	Bottomland Hardwood Forest
(1) HYDROLOGY	HIGH
(2) Surface Storage & Retention	MEDIUM
(2) Sub-surface Storage and Retention	HIGH
(1) WATER QUALITY	MEDIUM
(2) Pathogen change	HIGH
(2) Particulate Change	**LOW**
(2) Soluble change	MEDIUM
(2) Physical Change	MEDIUM
(1) HABITAT	**LOW**
(2) Physical Structure	**LOW**
(2) Landscape Patch Structure	**LOW**
(**2) Vegetative Composition**	**LOW**
OVERALL	MEDIUM

An NC WAM form was filled out in the floodplain of Cane Creek. Typically, NC WAM forms are not filled out in wetland restoration areas. However, the primary functional uplift to wetlands will occur in this area. Therefore, the NC WAM form was filled out using best professional judgement concerning several sub-functions.

Table 12C outlines stream and wetland functions targeted for functional uplift, goals that are tied to the specific functions, and objectives to be completed to achieve the proposed goals.

Table 12C. Stream/Wetland Targeted Functions, Goals, and Objectives

Targeted Functions	Goals	Objectives
(1) HYDROLOGY		
(2) Flood Flow (Floodplain Access) (3) Streamside Area Attenuation (4) Wooded Riparian Buffer (4) Microtopography	• Attenuate flood flow across the Site. • Minimize downstream flooding to the maximum extent possible. • Connect streams to functioning wetland systems.	• Construct new channel at historic floodplain elevation to restore overbank flows and restore jurisdictional wetlands • Plant woody riparian buffer • Remove livestock • Deep rip floodplain soils to reduce compaction and increase soil surface roughness • Protect riparian buffers with a perpetual conservation easement
(3) Stream Stability (4) Channel Stability (4) Sediment Transport (4) Stream Geomorphology	• Increase stream stability within the Site so that channels are neither aggrading nor degrading.	• Construct channels with proper pattern, dimension, and longitudinal profile • Remove livestock • Construct stable channels with cobble/gravel substrate • Plant woody riparian buffer
(1) WATER QUALITY		
(2) Streamside Area Vegetation (3) Upland Pollutant Filtration (3) Thermoregulation (2) Indicators of Stressors (2) Aquatic Life Tolerance Wetland Particulate Change	• Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	• Remove livestock and reduce agricultural land/inputs • Install marsh treatment areas • Plant woody riparian buffer • Restore/enhance jurisdictional wetlands adjacent to Site streams • Provide surface roughness through deep ripping/plowing • Restore overbank flooding by establishing proper channel dynamics
(1) HABITAT		
(2) In-stream Habitat (3) Substrate (3) Stream Stability (3) In-Stream Habitat (2) Stream-side Habitat (3) Stream-side Habitat (3) Thermoregulation Wetland Physical Structure Wetland Landscape Patch Structure	• Improve instream and stream-side habitat.	• Construct stable channels with cobble/gravel substrate • Plant woody riparian buffer to provide organic matter and shade • Construct new channel at historic floodplain elevation to restore overbank flows and plant woody riparian buffer • Protect riparian buffers with a perpetual conservation easement • Restore/enhance jurisdictional wetlands adjacent to Site streams

7.0 SITE DESIGN AND IMPLEMENTATION CONSTRAINTS

The presence of conditions or characteristics that have the potential to hinder restoration activities on 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 Site 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 known Site constraints, that may hinder proposed mitigation activities, were identified during field surveys. Potential constraints reviewed include the following.

7.1 Threatened & Endangered Species

One federally protected species is listed as occurring in Alamance County (USFWS 2018); the following table summarizes potential habitat and a preliminary biological conclusion.

Table 13. Threatened and Endangered Species

Species-Status	Habitat	Potential Habitat at Site	Biological Conclusion
Cape Fear shiner (*Notropis mekistocholas*) Endangered	The Cape Fear shiner is known only from the Cape Fear River watershed. In general, habitat occurs in streams with clean gravel, cobble, or boulder substrates. It is most often observed inhabiting slow pools, riffles, and slow runs associated with water willow (*Justicia americana*) beds, which it uses for cover. Juveniles can be found inhabiting slackwater, among large rock outcrops and in flooded side channels and pools. Spawning occurs May through June, when water temperatures reach 66 degrees Fahrenheit.	No	No Effect

7.2 Cultural Resources

The term "cultural resources" refers to prehistoric or historic archaeological sites, structures, or artifact deposits over 50 years old. "Significant" cultural resources are those that are eligible or potentially eligible for inclusion in the National Register of Historic Places. Evaluations of site significance are made with reference to the eligibility criteria of the National Register (36 CFR 60) and in consultation with the North Carolina State Historic Preservation Office (SHPO).

Field visits were conducted at the Site in late 2016/early 2017 to ascertain the presence of structures or other features that may be eligible for inclusion on the National Register of Historic Places. No structures were identified within proposed easement boundaries. Coordination with SHPO occurred during the planning process (Task 1 Categorical Exclusion) and no significant cultural resources have been documented within, or adjacent to the easement boundaries.

7.3 North Carolina Natural Heritage Elements

A query of the North Carolina Natural Heritage Program (NCNHP) database indicates there are records of natural areas, or conservation/managed areas within the proposed project boundary. Within the project boundary the following occurrences are documented.

Natural Community – Dry-Mesic Basic Oak Hickory Forest (Piedmont Subtype)
Natura Area – Kimesville Road Basic Forest

Within a one-mile radius of the project boundary NCNHP lists several element occurrences, which are summarized in the NCNHP correspondence in Appendix K. In addition, several North Carolina Division of Mitigation Services (NCDMS) conservation easements are located within close proximity of the Site including the following (Figure D-8, Appendix K).

Wells Creek (9160 ft to the Northeast)
Wells Creek #2 (12,270 ft to the Northeast)
Upper UT to Cane Creek (Pickard) – (8440 ft to the South)

7.4 FEMA

Inspection of the FEMA Flood Insurance Rate Map 3710874800J, Panel 8748, effective September 6, 2006, indicates that the lower reaches of Cane Creek are located within a Zone AE flood area. Therefore, a HEC-RAS analysis will be completed on the existing and proposed conditions of Cane Creek and its tributaries that enter the Cane Creek floodplain to assess hydraulic performance. As per North Carolina Floodplain Mapping requirements, a Conditional Letter of Map Revision (CLOMR) may need to be prepared for the site.

7.5 Utilities

A gas line crosses the easement at several locations. The gas line will be utilize for landowner crossings of the easement. Utility lines are not expected to hinder proposed mitigation activities.

7.6 Air Transport Facilities

One air transport facility, Hinshaw Greenacres Airport, is located 2.5 miles southwest of the Site.

8.0 DESIGN APPROACH AND MITIGATION WORK PLAN

8.1 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, ditching within the floodplain, and other anthropogenic maintenance. Site streams will be restored to emulate historic conditions at the Site utilizing parameters from nearby, relatively undisturbed reference streams (see Section 4.1 Reference Streams).

Primary activities designed to restore Site streams include 1) stream restoration, 2) stream enhancement (Level I), 3) stream enhancement (Level II), 4) stream preservation, 5) wetland restoration, 6) wetland enhancement, 7) construction of a marsh treatment area, and 8) vegetation planting (Figures 6A-6B, Appendix A).

8.1.1 Stream Restoration

Stream restoration efforts are designed to restore a stable stream that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions. Restoration at the Site will be Priority I restoration; therefore, bankfull elevations will be raised to meet the adjacent

valley floodplain elevation. As with most Priority 1 stream restoration projects, a small portion of the stream in the upstream section of the Site may require Priority 2 stream restoration methods until the channel is elevated to the existing floodplain. At this Site, Cane Creek will have approximately 200 feet of Priority 2 stream restoration at its upper extent.

Stream restoration is expected to entail 1) channel excavation, 2) spoil stockpiling, 3) channel stabilization, 4) channel diversion, and 5) channel backfill.

In-stream Structures

The use of in-stream structures for grade control and habitat is essential for successful stream restoration (Figure 8A, Appendix A). In-stream structures may be placed in the channel to elevate local water surface profiles in the channel, potentially flattening the water energy slope or gradient and directing stream energy into the center of the channel and away from banks. The structures will consist of log cross-vanes or log j-hook vanes; however, at the discretion of the Engineer, rock cross-vanes or rock j-hook vanes may be substituted if dictated by field conditions. In addition, cross-vanes may be placed in relatively straight reaches to provide secondary (perpendicular) flow cells during bankfull events.

Piped and Forded Channel Crossings

Landowner constraints will necessitate the installation of 2 piped crossings and 1 forded channel crossing within breaks in the easement to allow access to portions of the property isolated by stream restoration activities. The piped crossings may be constructed of properly sized pipes and hydraulically stable rip-rap or suitable rock. Crossings will be large enough to handle the weight of anticipated vehicular traffic. Approach grades to the crossing will be at an approximate 10:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material, which is free of fines.

The channel ford is proposed for a crossing of the larger Cane Creek. The ford is expected to consist of a shallow depression in the stream banks where vehicular and livestock crossings can be made. The ford will be constructed of hydraulically stable rip-rap or suitable rock. Approach grades to the ford will be at a minimum 15:1 slope (Figure 8C, Appendix A). The bed elevation of the ford will equal the floodplain elevation above and below the ford to reduce the risk of headcutting.

Marsh Treatment Area

One shallow wetland marsh treatment area will be excavated in the floodplain to intercept surface waters draining through agricultural areas prior to discharging into UT1. Marsh treatment areas are intended to improve the mitigation project and are not generating mitigation credit. The proposed marsh treatment area location is depicted on Figures 6A-B (Appendix A) and will consist of shallow depressions that will provide treatment and attenuation of initial stormwater pulses (Figure 8B, Appendix A). The outfall will be constructed of hydraulically stable rip-rap or other suitable material that will protect against headcut migration into the constructed depression. It is expected that the treatment area will fill with sediment and organic matter over time.

Drop Structure

Drop structures are proposed on Cane Creek the transition from restoration to preservation and at the lower reaches of UT 3 at its confluence with Cane Creek. The drop structure may be constructed out of large cobble depending upon anticipated scour from the restored stream channels. The structures should be constructed to resist erosive forces associated with hydraulic drops proposed at the Site.

8.1.2 Stream Enhancement (Level I)

Stream enhancement (level I) activities include the installation of in-stream structures, providing proper channel dimension and appropriate floodplain width, reducing shear on eroding banks, removing livestock and fencing streams, and planting with native woody vegetation.

8.1.3 Stream Enhancement (Level II)

Stream enhancement (level II) activities include stabilizing streambanks (where necessary), removing livestock and fencing streams, and supplemental planting with riparian forest vegetation.

8.1.4 Stream Preservation

Stream preservation will occur in reaches characterized by channels with mature riparian vegetation, good channel bed substrate, and little bank erosion. The reaches are not accessible by livestock and are included into the project to protect the upstream and downstream ends of the project from future impacts.

8.2 Individual Reach Discussions

Mitigation strategies proposed for each reach are presented below.

8.2.1 Cane Creek

Cane Creek enters the Site from the upstream property and extends for 2333 linear feet in its current location. The majority (80 %) of the reach has been dredged and straightened in support of livestock grazing production and is surrounded by pasture characterized by planted herbaceous vegetation. In addition to channel straightening, the adjacent floodplain has been ditched to drain wetlands and expedite the flow of hydrology off the floodplain. Livestock have full access to the stream channel resulting in eroded channel banks in areas where vegetation has not colonized. A gas line crosses the upper reaches of the stream that supports a forded crossing to access the northern portions of the property. The lower reach of Cane Creek is characterized by mature vegetation and is fenced from livestock.

In its current state, Cane Creek is classified as a Cg-type channel with entrenchment ratios ranging from 1.6 to 5.4 (averaging 4.3). Although entrenchment ratios exhibit some connection to the floodplain, the majority of the channel is incised, as evidenced by bank-height-ratios ranging from 1.1 to 2.0. Incision varies across the reach, with deep incision occurring in areas where livestock have wallowed out the channel banks. Dredging and straightening of the channel have resulted in low sinuosity (1.06) and a loss of riffle pool morphology.

Cane Creek is proposed for two mitigation treatments; 1) stream restoration and 2) stream preservation.

Stream Restoration

Stream restoration is proposed for the majority of Cane Creek where the channel has been straightened and is heavily impacted by livestock. A Short Section of Priority 2 restoration may occur at the upper (western) end of the project; however, the channel is largely being constructed within the existing channel (to be backfilled) and will not result in cut to the floodplain. Priority 1 restoration is initiate by station 319 and will occur for the remainder of the Site. Priority 1 restoration is proposed to reconnect the channel to degraded/drained wetlands or hydric soils. Channel construction is expected to entail filling ditches/drainage features, upgrading a forded channel crossing, excavating a channel that connects stream overbank events with adjacent wetlands, installation of grade control and habitat structures, and connecting the channel with downstream preservation reaches.

Stream Preservation

The lower reaches of the Cane Creek are proposed for stream preservation. These areas are stable and livestock do not access the channels, or stream buffer. Preservation reaches will have invasive species treatment, fence upgrades to ensure livestock exclusion, and placement of a conservation easement.

8.2.2 UT1

UT 1 is currently not considered a jurisdictional stream; however, drainage from the upstream watershed is proposed to be diverted from the current ditched feature into a drained hydric soil pocket. A piped crossing is proposed to be installed outside of the conservation easement, with the pipe discharging into a constructed channel that approximates a natural stream channel. The drainage channel will be directed into a marsh treatment area to treat surface waters of pollutants and sediment before discharging into the Site floodplain. The constructed channel will incrementally shallow in depth, until the channel discharges as sheet-flow onto floodplain wetland restoration areas. No stream credit is currently being proposed for this drainage feature.

8.2.3 UT2

UT 2 enters the Site from the upstream property and extends for 967 linear feet in its current location. A small feeder tributary (UT 2A) joins the stream, extending from a spring immediately upstream from the conservation easement boundary. UT 2 is characterized by disturbed forest vegetation that is heavily impacted by timber harvest and livestock activity, particularly in the cool, shaded floodplain bottom. Livestock impacts appear to be heaviest in the upper reaches (upstream from the gas line crossing). Below the gas line crossing, livestock access the floodplain; however, the stream remains intact with suitable pattern and dimension. The downstream third of the reach is fenced from livestock and is characterized by undisturbed forest.

In its current state, UT 2 is classified as a Cg-type channel; however, the channel exhibits varying conditions throughout its reach. The upper reaches (above the gas line) exhibit severe incision with entrenchment ratios averaging 1.4 (ranging from 1.2 to 1.6) and bank-height-ratios averaging 1.8. The channel is severely oversized, exhibiting existing channel cross sectional areas more than three times the bankfull cross sectional area. As the channel descends below the gas line, the channel shallows with entrenchment ratios elevating to an average of 7.8. The reach is still incised with bank-height-ratios ranging up to 1.5; however, a lack of erosion and channel pattern indicate

the channel is relatively stable. Both reaches appear to exhibit natural sinuosity (approximately 1.2); therefore, the incised and oversized upper reach (approximately 200 ft) is proposed for enhancement (level I) and the middle reach is proposed for enhancement (level II).

UT 2 is proposed for three mitigation treatments; 1) stream enhancement (level I), 2) stream enhancement (level II), and 3) stream preservation.

Stream Enhancement (Level I)
Stream enhancement (level I) is proposed for the upper reaches (approximately 200 ft) of UT 2 where channel pattern appears to exhibit suitable sinuosity and pool-to-pool spacing; however, the channel is relatively incised, impacted by livestock, and is characterized by low radius of curvature values in several bends. Mitigation in these areas will focus on elevating the stream bed, providing the proper channel dimension, and reducing shear on tight meander bends. Structures will be strategically placed to reduce pressure on channel banks and focus scour into the center of the channel. This reach will ultimately reconnect the channel to the floodplain and adjacent wetlands, and bring the channel to a suitable elevation.

Stream Enhancement (Level II)
The middle reaches of UT 2 are proposed for stream enhancement (level II) through the removal of livestock, supplemental planting with native hardwood species, and placement of a permanent conservation easement.

Stream Preservation
UT 2A and the undisturbed/lower reaches of UT 2 are proposed for stream preservation. These areas are stable and livestock do not access the channels, or buffer. Preservation reaches will have invasive species treatment, fence upgrades to ensure livestock exclusion, and placement of a conservation easement.

8.2.4 UT3

UT 3 enters the Site from the upstream property and extends for 1037 linear feet in its current location. The channel drains into the easement from a pond located upstream of the conservation easement. The pond attenuates stormwater pulses, thereby reducing the bankfull cross section area of the channel. In an effort to predict the proposed design cross sectional area of UT 3, cross sections were measured in a relatively undisturbed wooded location upstream of the conservation easement. The cross sectional area derived from the wooded reach was utilized for design channel dimension. In addition to affecting cross sectional area, the pond may also hinder proposed overbank flooding events after the project has been constructed.

The entire on-site reach of UT 3 has been ditched, straightened, and cleared of vegetation and is currently utilized as pasture. The upper reach of UT 3 is characterized by intermittent stream flow; a gas line crosses the upstream reach of UT 3. Upon crossing the gas line the channel immediately becomes perennial and is classified as an F-type channel with entrenchment ratios averaging 1.4 and bank-height-ratios averaging 5.0. Dredging and straightening of the channel have resulted in low sinuosity (1.01) and a loss of riffle pool morphology. Although sinuosity in this reach is low, the channel is contained within a narrow, steeply sloped valley and is expected to be constructed

with characteristics of a step-pool (B-type) channel that is characterized by relatively low sinuosity (proposed sinuosity 1.05).

UT 3 is proposed for two mitigation treatments; 1) stream enhancement (level I) and 2) stream restoration.

Stream Enhancement (Level I)
Stream enhancement (level I) is proposed for the upper, intermittent reach of UT 3 that is not expected to receive extensive stormwater pulses. The channel is relatively incised and impacted by livestock. A main component of this reach is constructing a channel with proper dimension; thereby elevating the channel bed for downstream restoration reaches.

Stream Restoration
Stream restoration is proposed for the majority of UT 3 and is expected to include stabilization of hydraulic drops in the channel, a combination of raising the channel bed and lowering the adjacent floodplain, installation of structures (log cross vanes and log vanes), planting with native hardwood forest, and fencing livestock from the stream. The narrow, relatively steep valley necessitate a low sinuosity stream channel which will ultimately be constructed as a Cb-type channel, with shorter pool-to-pool spacing and more frequent structures, particularly in the upper reaches of the stream.

8.2.5 UT4

UT 4 enters the Site from the upstream property and extends for 225 linear feet in its current location. The channel is wooded on the left bank and partially wooded on the right bank (pasture encroaches within the 50 foot buffer). The upper reaches of the channel are slightly impacted by erosion; however, the channel appears relatively stable. As the channel descends towards Cane Creek, the channel begins to erode and is characterized by shoot cutoffs. Ultimately, the channel goes subterranean with the floodplain collapsing on the channel.

In its current state, UT 4 is classified as a Cg-type channel with an entrenchment ratio averaging 1.8 and a bank-height-ratio averaging 1.8. Both entrenchment ratio and bank-height ratio show incision as the channel nears Cane Creek. The channel exhibits low sinuosity (1.04) possibly due to straightening in the past, but may also result from the smaller channel discharging into the larger Cane Creek. Although the channel is wooded on both sides, channel erosion is evident throughout the reach.

UT 4 is proposed for two mitigation treatments; 1) stream enhancement (level II) and 2) stream restoration.

Stream Enhancement (Level II)
Stream enhancement (level II) in the upper reach of UT 4 is expected to include additional activities beyond the typical removal of livestock and planting. Activities will include the installation of grade control/habitat structures to stabilize hydraulic drops in the channel, reduce erosive forces of flood waters, and prepare the channel for stream restoration in the lower reaches. Although the channel is not directly accessed by livestock, IRT member agreed to this approach for the upper reaches of UT 4.

Stream Restoration

Stream restoration is proposed for the lower reaches of UT 4 where channel banks are eroding and the stream is scouring multiple channels or burrowing under floodplain materials. Stream restoration is expected to entail restoration in place until the channel reaches the abandoned/backfilled Cane Creek channel where Priority 1 restoration will connect to the new location Cane Creek channel.

8.3 Wetland Restoration

Wetland restoration activities 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 drainage ditch excavation, vegetative clearing, agriculture plowing, herbicide application, and other land disturbances associated with land use management. Wetland restoration will focus on the restoration of vegetative communities, filling drainage ditches, the reestablishment of soil structure and microtopographic variations, and redirecting normal surface hydrology from streams back into the Site floodplains. Coarse woody debris will be added to depressional areas within the wetlands to provide habitat, store sediment, increase water storage/filtration, and to absorb energy during overbank events. In addition, the construction of (or provisions for) surface water storage depressions (ephemeral pools) will also add an important component to groundwater restoration activities. These activities will result in the restoration of 3.727 acres of jurisdictional riparian riverine wetlands.

Restoration of Historic Groundwater Elevations

Hydric soils appear to have been drained due to lowering of the groundwater tables and a lateral drainage effect from stream channel incision and straightening. Reconstructing streams at a natural depth, increasing stream sinuosity, and directing surface flow from adjacent properties across the ground surface is expected to rehydrate hydric soils within the Site, resulting in the restoration of jurisdictional hydrology to riparian wetlands.

Hydrophytic Vegetation

Site wetland areas have endured significant disturbance from land use activities such as land clearing, livestock trampling, herbicide application, and other anthropogenic maintenance. Wetland areas will be revegetated with native forest vegetation typical of wetland communities in the region. Emphasis will focus on developing a diverse plant assemblage.

8.4 Wetland Enhancement

Wetland enhancement will focus on the removal of livestock and restoration of vegetative communities resulting in the enhancement of 0.828 acre of riparian riverine wetland.

8.5 Soil Restoration

Soil grading will occur during stream restoration activities. Topsoils will 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.

8.6 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.

8.6.1 Planting Plan

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 top of bank throughout the meander belt-width. Shrub elements will be planted along the reconstructed stream banks, concentrated along outer bends. Piedmont Alluvial Forest is the target community for Site floodplains and Dry-Mesic Oak-Hickory Forest is the target community for upland side-slopes.

Bare-root seedlings within the Piedmont Alluvial and Dry-Mesic Oak-Hickory Forests will be planted at a density of approximately 680 stems per acre on 8-foot centers. Shrub species in the stream-side assemblage and Marsh Wetland Treatment Areas will be planted at a density of 2720 stems per acre on 4-foot centers.

Table 14 depicts the total number of stems and species distribution within each vegetation association (Figure 9, Appendix A). 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.

In addition to planting seedlings, herbaceous seed mix will be planted on the Site. Upland areas will receive a diverse mix of pollinator friendly native and naturalized species including both forbs and grasses. Streamside zones and wetlands, including the Marsh Treatment Wetland Areas, will receive a similarly designed mix with an additional component of FACW species (including *Elymus virginicus, Juncus effusus, and Carex* spp.).

Table 14. Planting Plan

Vegetation Association	Piedmont/Low Mountain Alluvial Forest*		Dry-Mesic Oak-Hickory Forest*		Marsh Treatment Wetland**		Stream-side Assemblage**		TOTAL
Area (acres)	**7.7**		**2.0**		**0.01**		**2.8**		**12.5**
Species	**# planted***	**% of total**	**# planted***	**% of total**	**# planted****	**% of total**	**# planted****	**% of total**	**# planted**
Tag alder (*Alnus serrulata*)	--	--	--	--	25	17	375	5	400
River birch (*Betula nigra*)	600	11	--	--	--	--	800	11	1400
Ironwood (*Carpinus caroliniana*)	--	--	300	21	--	--	--	--	300
Sugarberry (*Celtis laevigata*)	500	10	--	--	--	--	500	7	1000
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	25	17	--	--	25
Red bud (*Cercis canadensis*)	--	--	100	7	--	--	--	--	100
Sweet pepperbush (*Clethra alnifolia*)	--	--	--	--	25	17	--	--	25
Silky dogwood (*Cornus amomum*)	500	10	--	--	25	17	1475	20	2000
Persimmon (*Diospyros virginiana*)	--	--	200	14	--	--	--	--	200
White ash (*Fraxinus americana*)	--	--	100	7	--	--	--	--	100
Green ash (*Fraxinus pennsylvanica*)	300	6	--	--	--	--	700	9	1000
Tulip poplar (*Liriodendron tulipifera*)	500	10	100	7	--	--	--	--	600
Sycamore (*Platanus occidentalis*)	1100	21	--	--	--	--	1500	20	2600
Black gum (*Nyssa sylvatica*)	100	2	200	14	--	--	--	--	300
White oak (*Quercus alba*)	250	5	250	17	--	--	--	--	500
Water oak (*Quercus nigra*)	700	13	100	7	--	--	700	9	1500
Red oak (*Quercus rubra*)	--	--	100	7	--	--	--	--	100
Willow oak (*Quercus phellos*)	700	13	--	--	--	--	700	9	1400
Black willow (*Salix nigra*)	--	--	--	--	--	--	750	10	750
Elderberry (*Sambucus canadensis*)	--	--	--	--	25	17	--	--	25
Possumhaw (*Viburnum nudum*)	--	--	--	--	25	17	--	--	25
TOTAL	**5250**	**100**	**1450**	**100**	**150**	**100**	**7500**	**100**	**14,350**

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

8.6.2 Nuisance Species Management

Invasive plant species will be observed and treated mechanically and/or chemically, as part of this project. No other nuisance species treatments 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.

9.0 MONITORING AND SUCCESS CRITERIA

Monitoring will be conducted by Axiom Environmental, Inc based on the schedule in Table 15. A summary of monitoring is outlined in Table 16 (Figures 10A – 10D, Appendix A). Annual monitoring reports will be submitted to the NCDMS by Restoration Systems no later than December 31 of each monitoring year data is collected.

Table 15. Monitoring Schedule

Resource	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Streams	■	■	■		■		■
Wetlands	■	■	■	■	■	■	■
Vegetation	■	■	■		■		■
Macroinvertebrates			■		■		■
Visual Assessment	■	■	■	■	■	■	■
Report Submittal	■	■	■	■	■	■	■

Table 16. Monitoring Summary

Stream Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 16 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern will be depicted on a plan view figure with a written assessment and photograph of the area included in the report.
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Stream Hydrology	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through monitoring period	1 surface water gauges on UT 3	Surface water data for each monitoring period
Bankfull Events	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through monitoring period	1 surface water gauges on UT 3	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through monitoring period	2 crest gauges (pressure transducers) on Cane Creek	Visual evidence, photo documentation, and/or rain data.
Benthic Macroinvertebrates	"Qual 4" method described in *Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates, Version 5.0* (NCDWR 2016)	Pre-construction, Years 3, 5, and 7 during the "index period" referenced in *Small Streams Biocriteria Development* (NCDWQ 2009)	The number of stations and exact locations will be determined at the time pre-construction benthics are collected	Results* will be presented on a site-by-site basis and will include a list of taxa collected, an enumeration of *Ephemeroptera, Plecoptera,* and *Tricopetera* taxa as well as Biotic Index values.
Wetland Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Wetland Restoration	Groundwater gauges	As-built, Years 1, 2, 3, 4, 5, 6, and 7 throughout the year with the growing season defined as March 1-October 22	7 gauges spread throughout restored wetlands	Soil temperature and bud burst will be documented at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period
Vegetation Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Vegetation establishment and vigor	Permanent vegetation plots 0.0247 acre (100 square meters) in size; *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	12 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre
	Annual random vegetation plots, 0.0247 acre (100 square meters) in size	As-built, Years 1, 2, 3, 5, and 7	3 plots randomly selected each year	Species and height

*Benthic Macroinvertebrate sampling data will not be tied to success criteria; however, the data may be used as a tool to observe positive gains to in-stream habitat.

9.1 Success Criteria

Monitoring and success criteria for stream restoration should relate to project goals and objectives identified from on-site NC SAM data collection. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving success criteria. The following summarizes Site success criteria.

Table 17. Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Continuous surface flow must be documented each year for at least 30 consecutive days on the intermittent reach of UT3. • Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section during the monitoring period. • Entrenchment ratio (ER) must be no less than 2.2 at any measured riffle cross-section during the monitoring period. • BHR and ER at any measure riffle cross-section should not change by more than 10% from baseline condition during the monitoring period. • The stream project shall remain stable and all other performance standards shall be met through four separate bankfull events, occurring in separate years, during the monitoring years 1-7.
Wetland Hydrology
• Saturation or inundation within the upper 12 inches of the soil surface for, at a minimum, 12 percent of the growing season, during average climatic conditions
Vegetation
• Within planted portions of the site, a minimum of 320 stems per acre must be present at year 3; a minimum of 260 stems per acre must be present at year 4; and a minimum of 210 stems per acre must be present at year 7. • Trees must average 7 feet in height at year 5, and 10 feet in height at year 7 in each plot. • Planted and volunteer stems are counted, provided they are included in the approved planting list for the site; natural recruits not on the planting list may be considered by the IRT on a case-by-case basis.

Note: Cross section measurements will be calculated using area fit methodology to determine BHR and ER.

9.2 Compatibility with Project Goals

The following table outlines the compatibility of Site performance criteria described above to Site goals and objectives that will be utilized to evaluate if Site goals and objectives are achieved.

Table 18. Compatibility of Performance Criteria to Project Goals and Objectives

Goals	Objectives	Success Criteria
(1) HYDROLOGY		
• Attenuate flood flow across the Site. • Minimize downstream flooding to the maximum extent possible. • Connect streams to functioning wetland systems.	• Construct new channel at historic floodplain elevation to restore overbank flows and restore jurisdictional wetlands • Plant woody riparian buffer • Remove livestock • Deep rip floodplain soils to reduce compaction and increase soil surface roughness • Protect riparian buffers with a perpetual conservation easement	• BHR not to exceed 1.2 • Document four overbank events in separate monitoring years • Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded
• Increase stream stability within the Site so that channels are neither aggrading nor degrading.	• Construct channels with proper pattern, dimension, and longitudinal profile • Remove livestock from the Site • Construct stable channels with cobble/gravel substrate • Plant woody riparian buffer	• Cross-section measurements indicate a stable channel with cobble/gravel substrate • Visual documentation of stable channels and structures • BHR not to exceed 1.2 • ER of 2.2 or greater • < 10% change in BHR and ER in any given year • Livestock excluded from the easement • Attain Vegetation Success Criteria
(1) WATER QUALITY		
• Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	• Remove livestock and reduce agricultural land/inputs • Install marsh treatment areas • Plant woody riparian buffer • Restore/enhance jurisdictional wetlands adjacent to Site streams • Provide surface roughness through deep ripping/plowing • Restore overbank flooding by establishing proper channel dynamics	• Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria
(1) HABITAT		
• Improve instream and stream-side habitat.	• Construct stable channels with cobble/gravel substrate • Plant woody riparian buffer to provide organic matter and shade • Construct new channel at historic floodplain elevation to restore overbank flows and plant woody riparian buffer • Protect riparian buffers with a perpetual conservation easement • Restore/enhance jurisdictional wetlands adjacent to Site streams	• Cross-section measurement indicate a stable channel with cobble/gravel substrate • Visual documentation of stable channels and in-stream structures. • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded

10.0 ADAPTIVE MANAGEMENT PLAN

In the event the mitigation Site or a specific component of the mitigation Site fails to achieve the necessary performance standards as specified in the mitigation plan, the sponsor shall notify the members of the IRT and work with the IRT to develop contingency plans and remedial actions.

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

10.1 Stream Contingency

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 a 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 incision, lateral instability, and/or elevated width-to-depth ratios locally or systemically, 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 to reduce shear stress to stable values.

10.2 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.

10.3 Vegetation Contingency

If vegetation success criteria are not achieved, 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.

11.0 LONG-TERM MANAGEMENT PLAN

The Site will be transferred to the NCDEQ Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the Site to ensure that restrictions required in the conservation easement are upheld. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statute GS 113A-232(d)(3). Interest gained by the endowment fund may be used for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

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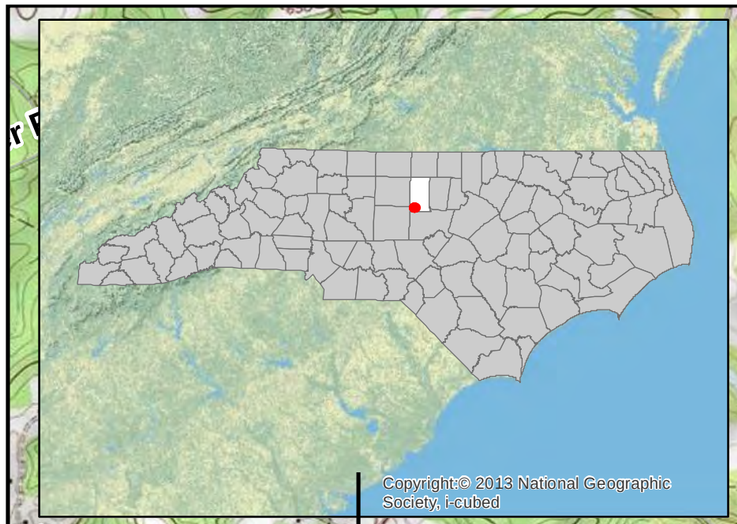
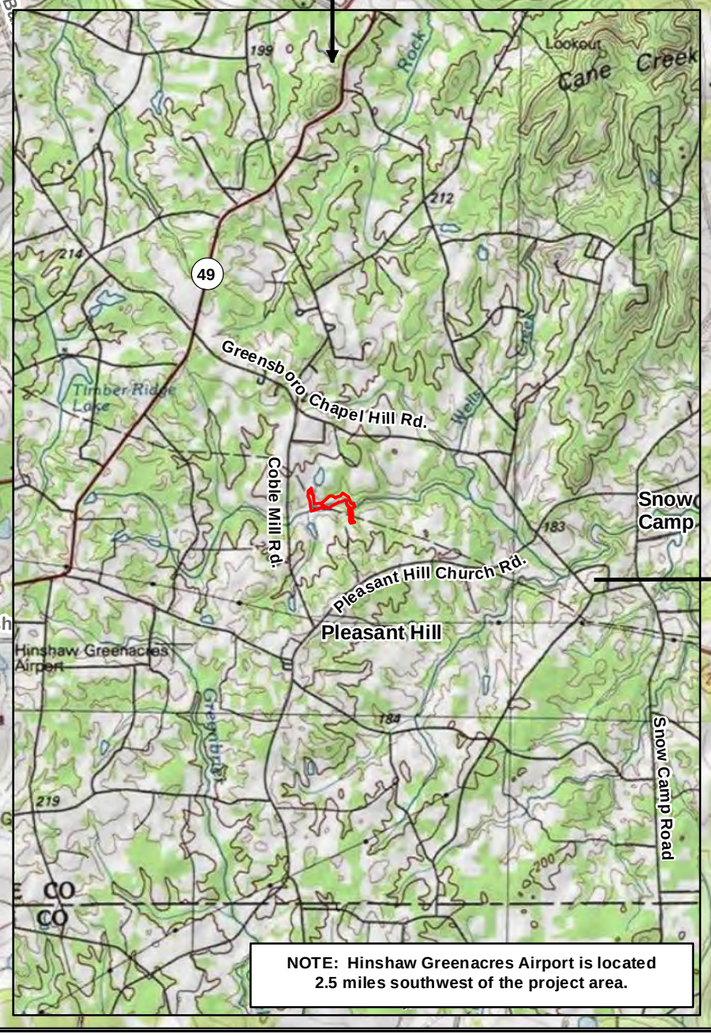
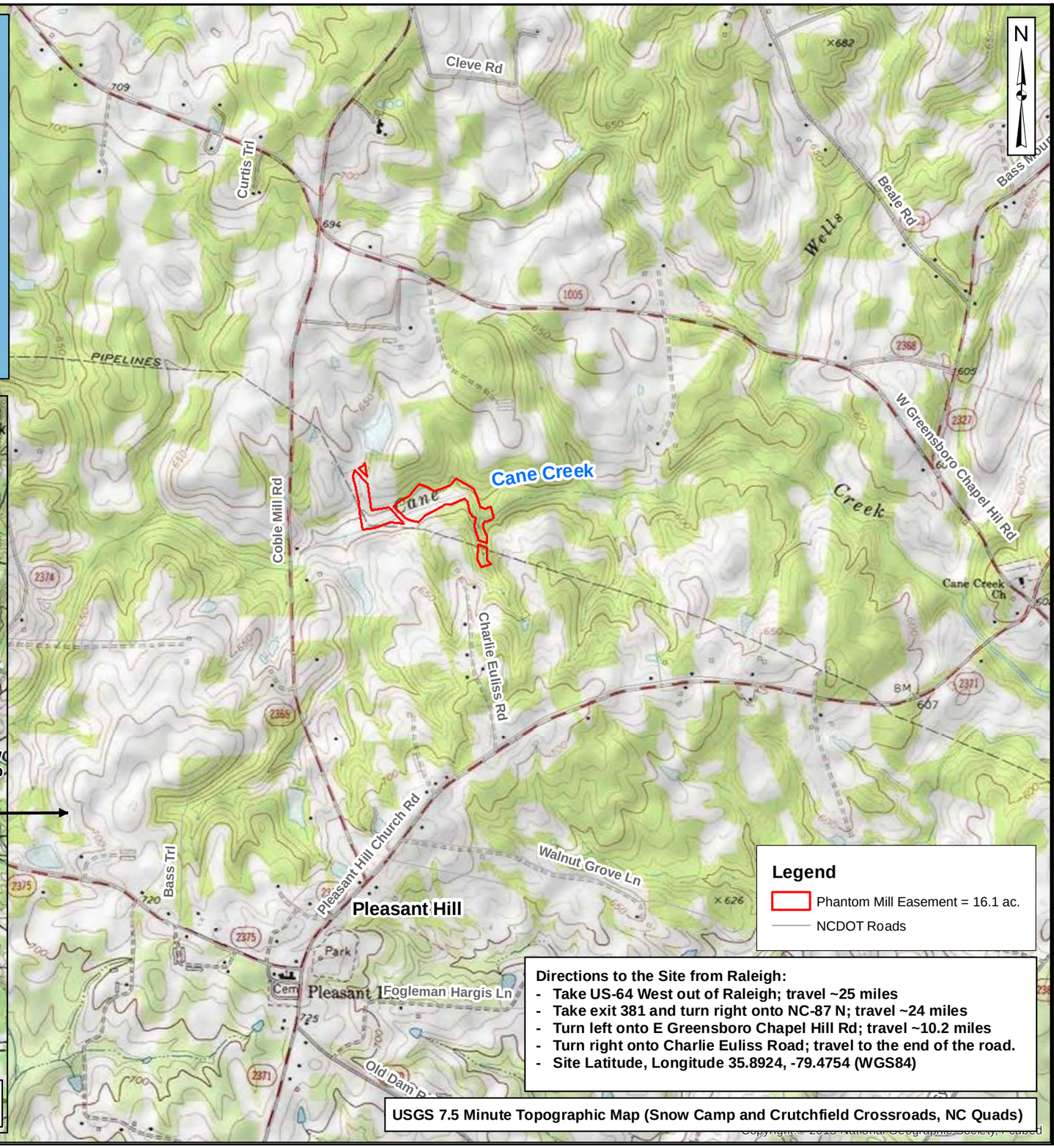




NOTE: Hinshaw Greenacres Airport is located 2.5 miles southwest of the project area.



Legend

- Phantom Mill Easement = 16.1 ac.
- NCDOT Roads

Directions to the Site from Raleigh:

- Take US-64 West out of Raleigh; travel ~25 miles
- Take exit 381 and turn right onto NC-87 N; travel ~24 miles
- Turn left onto E Greensboro Chapel Hill Rd; travel ~10.2 miles
- Turn right onto Charlie Euliss Road; travel to the end of the road.
- Site Latitude, Longitude 35.8924, -79.4754 (WGS84)

USGS 7.5 Minute Topographic Map (Snow Camp and Crutchfield Crossroads, NC Quads)

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

SITE LOCATION

Drawn by: CLF/KRJ

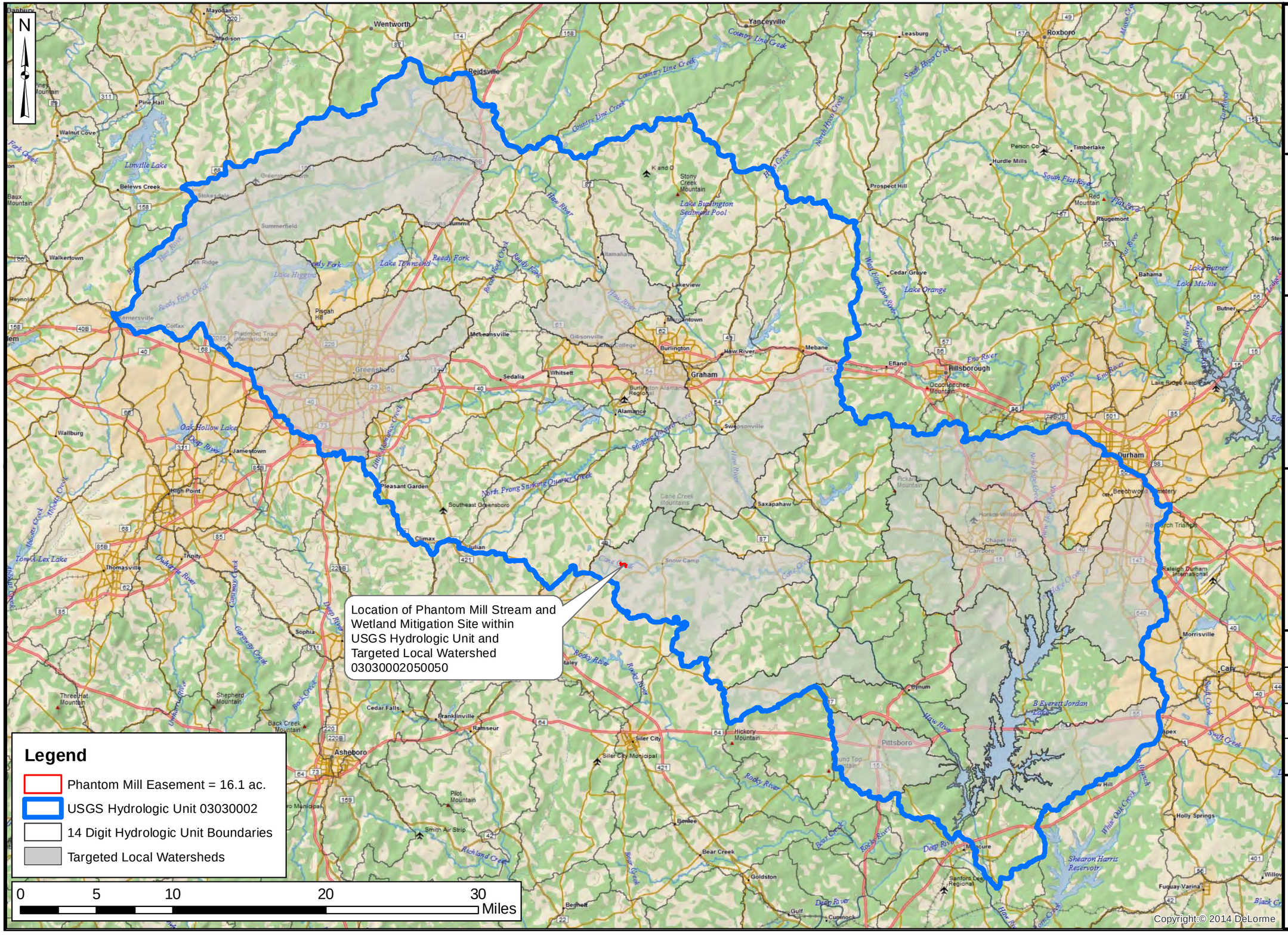
Date: JUL 2018

Scale: 1:20,000

Project No.: 18-012

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

HYDROLOGIC UNIT MAP

Drawn by: CLF/KRJ

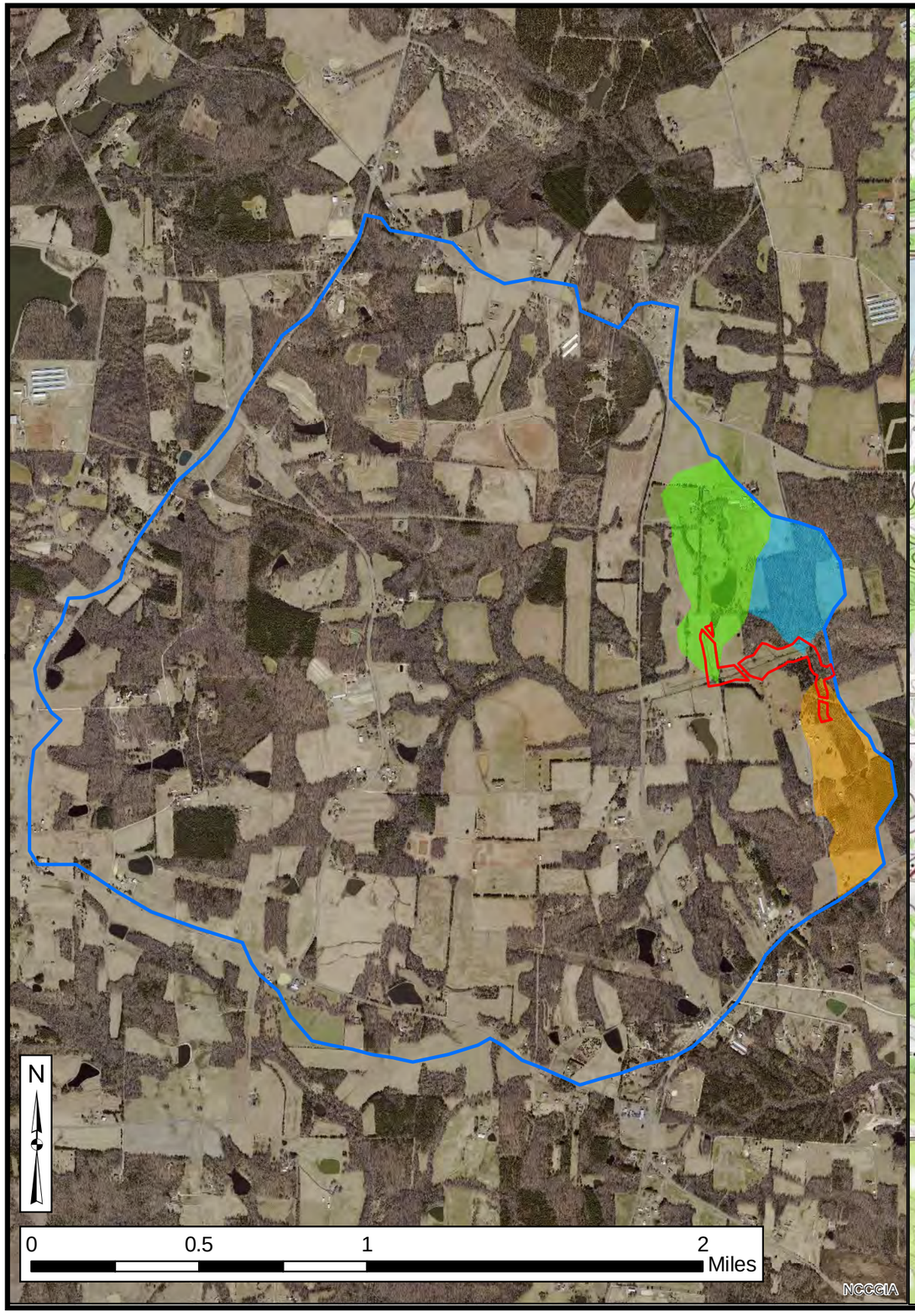
Date: JUL 2018

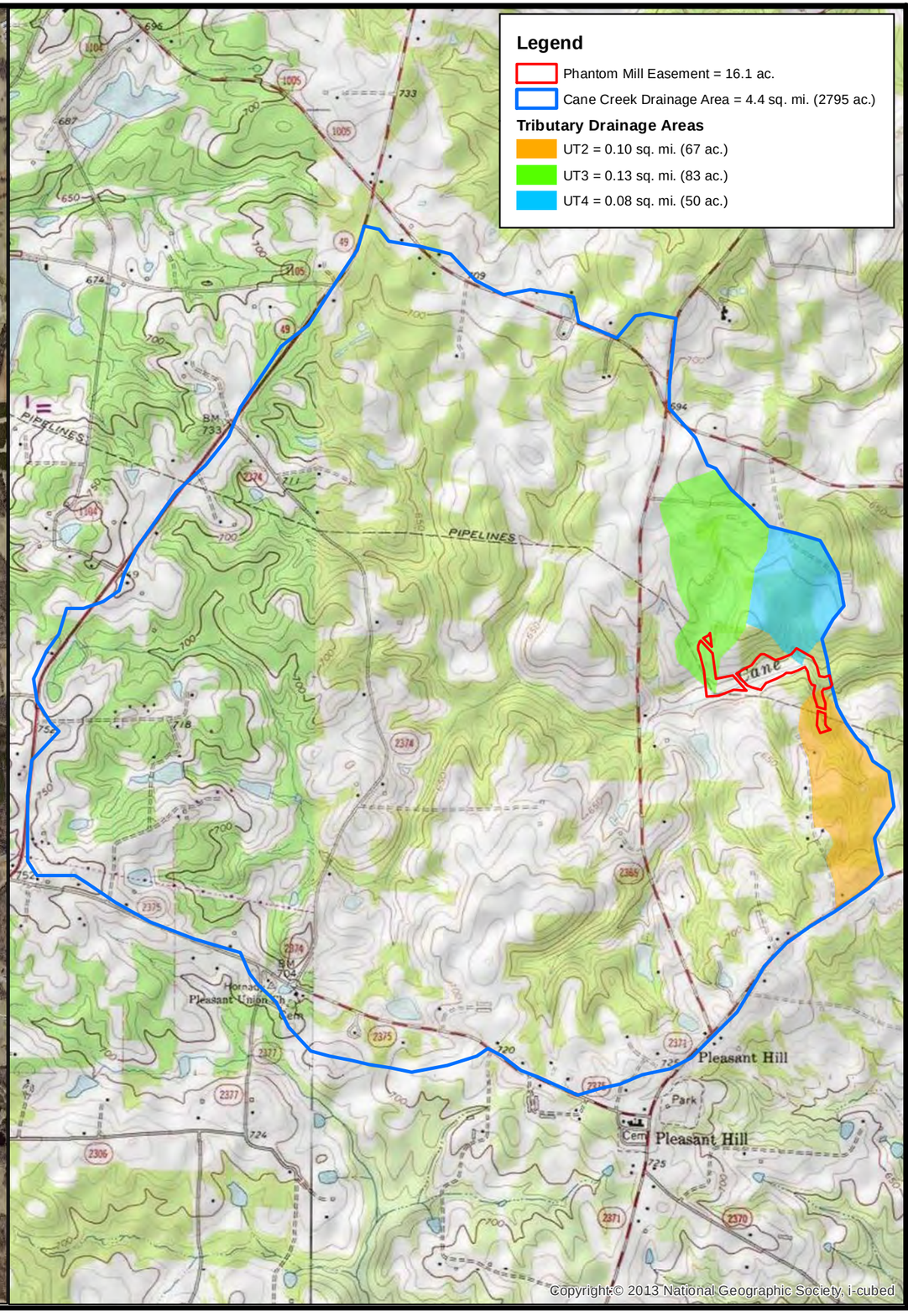
Scale: 1:375,000

Project No.: 18-012

FIGURE

2





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by: CLF/KRJ

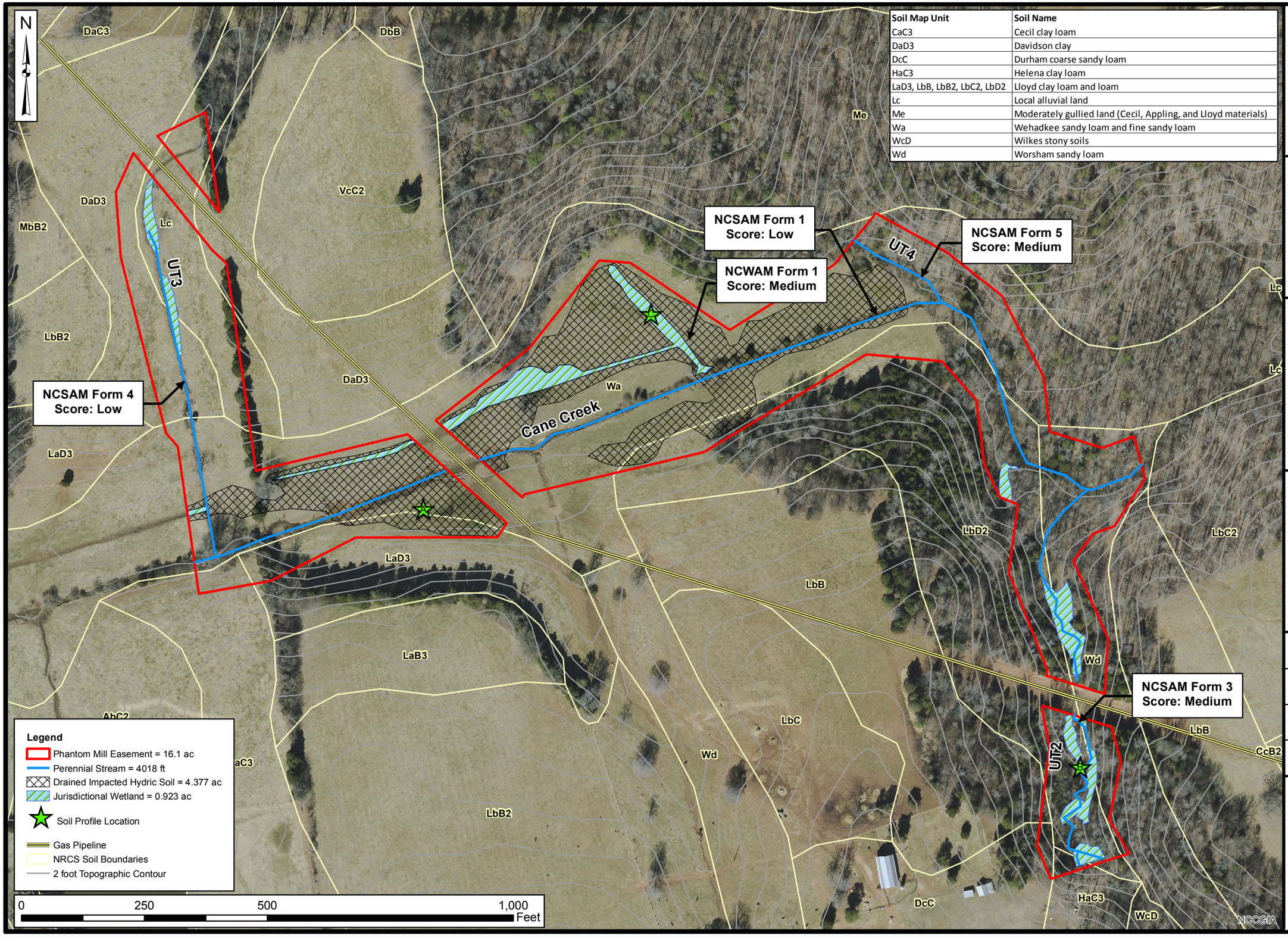
Date: JUL 2018

Scale: 1:24,000

Project No.: 18-012

FIGURE

3



Soil Map Unit	Soil Name
CaC3	Cecil clay loam
DaD3	Davidson clay
DcC	Durham coarse sandy loam
HaC3	Helena clay loam
LaD3, LbB, LbB2, LbC2, LbD2	Lloyd clay loam and loam
Lc	Local alluvial land
Me	Moderately gullied land (Cecil, Appling, and Lloyd materials)
Wa	Wehadkee sandy loam and fine sandy loam
WcD	Wilkes stony soils
Wd	Worsham sandy loam

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL MITIGATION SITE

Alamance County, NC

Title:

EXISTING CONDITIONS AND SOILS

Drawn by: KRJ

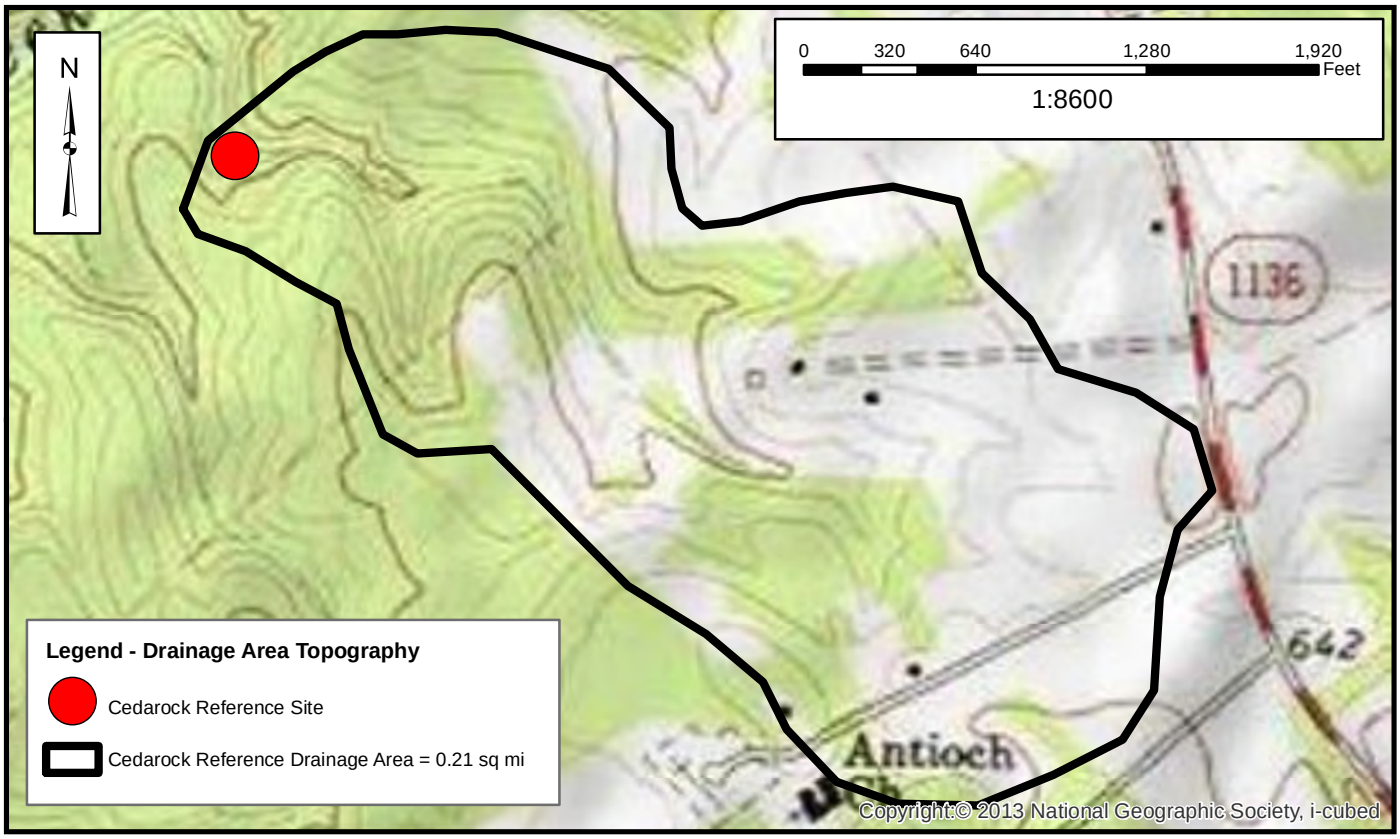
Date: MAY 2019

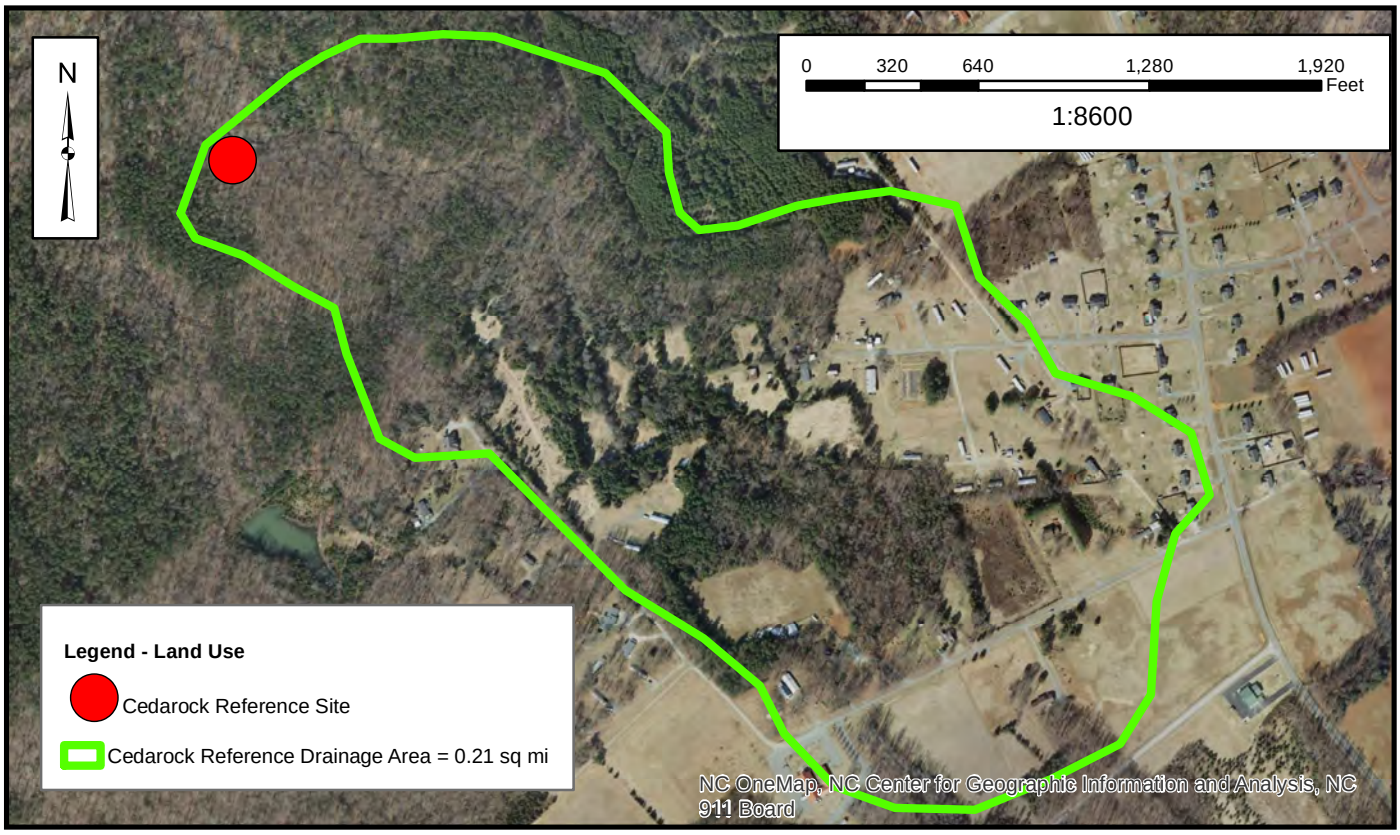
Scale: 1:2200

Project No.: 18-012

FIGURE

4



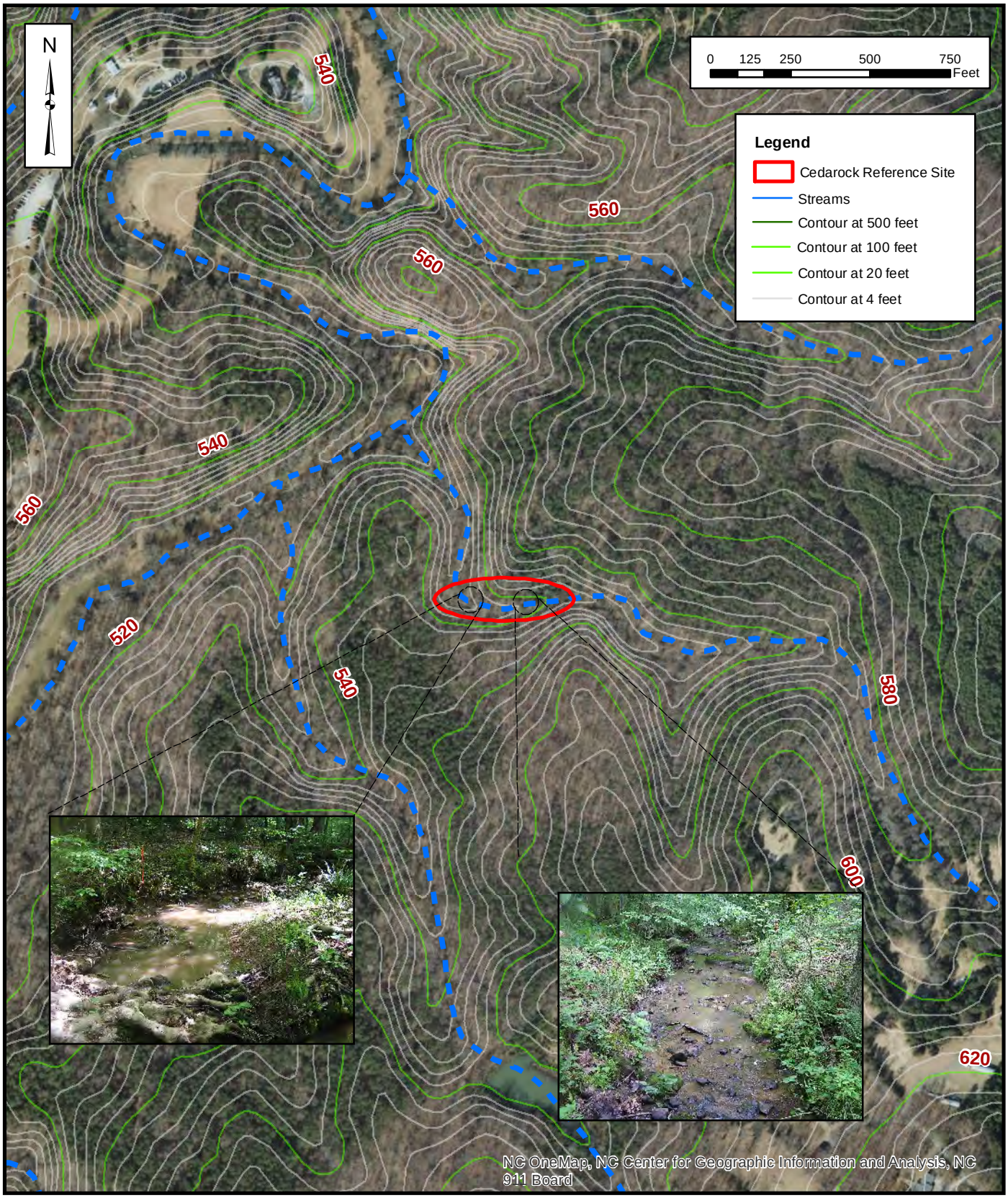


Axiom Environmental, Inc.
Axiom Environmental
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693

CEDAROCK REFERENCE DRAINAGE AREA
PHANTOM MILL MITIGATION SITE
Alamance County, North Carolina

Dwn. by: WGL
Date: Oct 2018
Project: 18-012

FIGURE
5A



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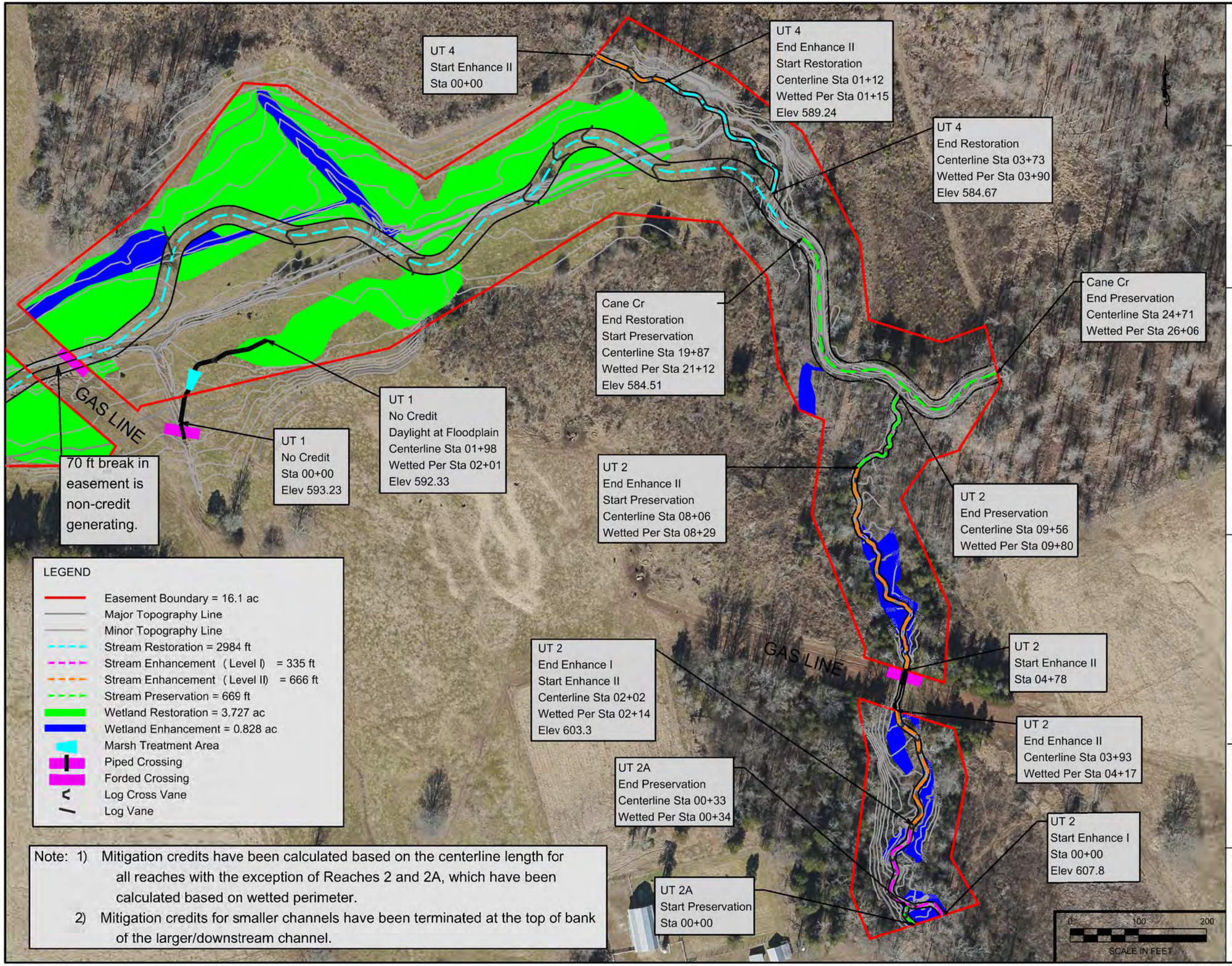
Raleigh, NC 27603
(919) 215-1693

EXISTING CONDITIONS CEDAROCK REFERENCE REACH
PHANTOM MILL MITIGATION SITE
Alamance County, North Carolina

Dwn. by.	WGL
Date:	Oct 2018
Project:	18-012

FIGURE
5B



Note: 1) Mitigation credits have been calculated based on the centerline length for all reaches with the exception of Reaches 2 and 2A, which have been calculated based on wetted perimeter.

2) Mitigation credits for smaller channels have been terminated at the top of bank of the larger/downstream channel.

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

Alamance County North Carolina

Title:

RESTORATION PLAN

Scale: AS SHOWN

Date: Jan 2019

Project No.: 18-012

FIGURE NO.

6A

Note: All ditches and drainage swales will be backfilled completely.

UT 3
Start Enhance I
Sta 00+00
Elev 617.52

UT 3
End Enhance I
Start Restoration
Centerline Sta 01+83
Wetted Per Sta 01+86
Elev 614.15

GAS LINE

62 ft break
in easement
is non-credit
generating.

Ditch to be backfilled.

Ditch to be backfilled.

UT 3
End Restoration
Centerline Sta 09+89
Wetted Per Sta 10+31
Elev 591.39

GAS LINE

Reroute Ditch

UT 1
No Credit
Daylight onto
floodplain wetlands
Centerline Sta 01+98
Wetted Per Sta 02+01
Elev 592.33

70 ft break
in easement
is non-credit
generating.

UT 1
No Credit
Sta 00+00
Elev 593.23

Cane Cr
Start Restoration
Sta 00+00
Elev 591.59

LEGEND

- Easement Boundary = 16.1 ac
- Major Topography Line
- Minor Topography Line
- Stream Restoration = 2984 ft
- Stream Enhancement (Level I) = 335 ft
- Stream Enhancement (Level II) = 666 ft
- Stream Preservation = 669 ft
- Wetland Restoration = 3.727 ac
- Wetland Enhancement = 0.828 ac
- Marsh Treatment Area
- Piped Crossing
- Forded Crossing
- Log Cross Vane
- Log Vane

Note: 1) Mitigation credits have been calculated based on the centerline length for all reaches with the exception of Reaches 2 and 2A, which have been calculated based on wetted perimeter.
2) Mitigation credits for smaller channels have been terminated at the top of bank of the larger/downstream channel.

0 100 200
SCALE IN FEET

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill
Mitigation Site

Alamance County
North Carolina

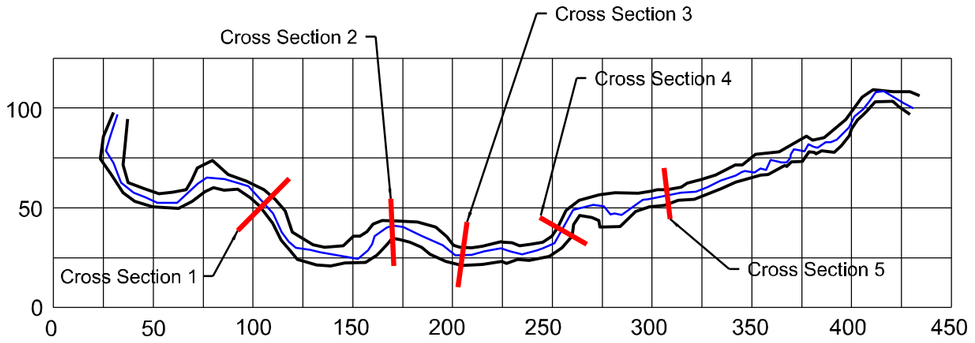
Title:

RESTORATION
PLAN

Scale: AS SHOWN
Date: Jan 2019
Project No.: 18-012

FIGURE NO.

6B

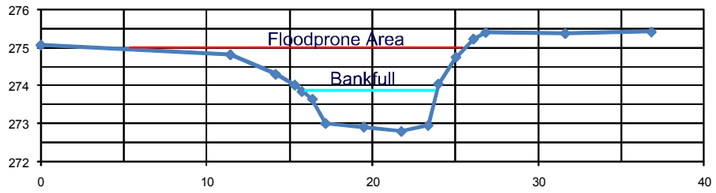


Reference Pattern

Lp-p = 37 (25 - 68) ft
Lm = 68 (44 - 116) ft
Wbelt = 23 (20 - 38) ft
Rc = 16 (11 - 27) ft
Lp-p/Wbkf = 4.6 (3.1 - 8.4)
Lm/Wbkf = 8.4 (5.5 - 14.3)
Wbelt/Wbkf = 2.8 (2.4 - 4.7)
Rc/Wbkf = 2.0 (1.4 - 3.3)
SIN = 1.20

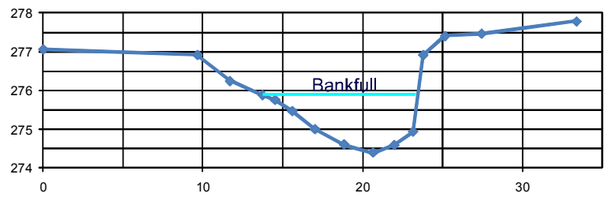
Pattern Legend

- Top of Bank
- Thalweg
- Cross Section



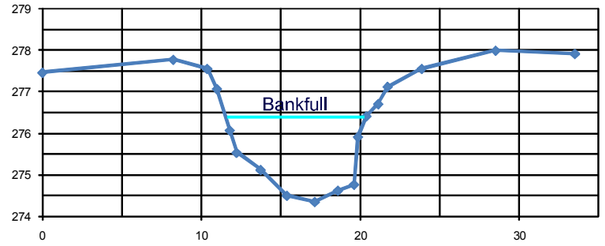
Cross Section 1 - Riffle

Abkf = 6.6 ft
Dave = 0.8 ft
Wbkf = 8.1 ft
Dmax = 1.1 ft
Bank Height = 2.0 ft
Bank Height Ratio = 1.8
W/D = 10.0
FPA = 18
ENT = 2.2
Stream Type = E



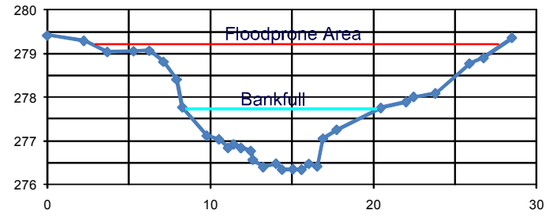
Cross Section 2 - Pool

Abkf = 9.0 ft
Wbkf = 9.7 ft
Dmax = 1.5 ft



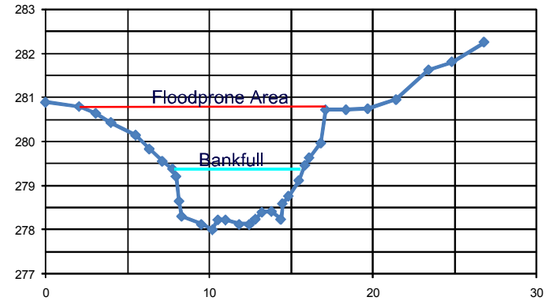
Cross Section 3 - Pool

Abkf = 13.1 ft
Wbkf = 8.9 ft
Dmax = 2.1 ft



Cross Section 4 - Riffle

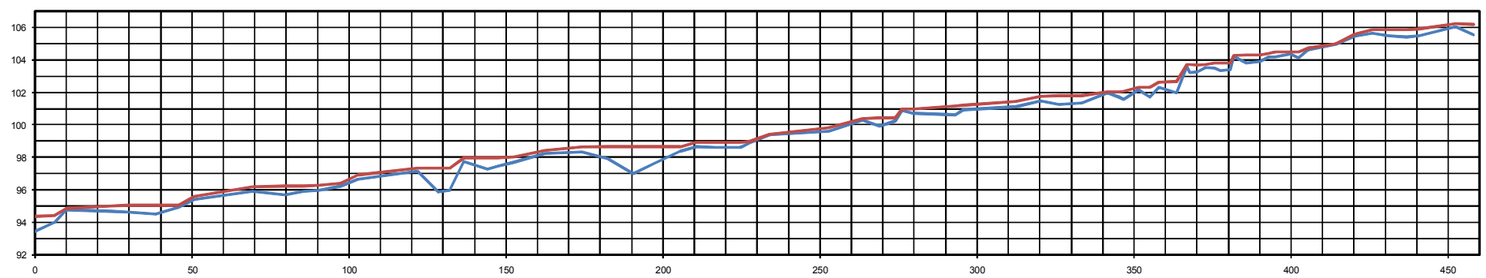
Abkf = 9.6 ft
Dave = 0.8 ft
Wbkf = 12.1 ft
Dmax = 1.4 ft
Bank Height = 1.4 ft
Bank Height Ratio = 1.0
W/D = 15.2
FPA = 25
ENT = 2.1
Stream Type = Eb



Cross Section 5 - Riffle

Abkf = 8.0 ft
Dave = 1.0 ft
Wbkf = 8.0 ft
Dmax = 1.4 ft
Bank Height = 1.4 ft
Bank Height Ratio = 1.0
W/D = 8.0
FPA = 15
ENT = 1.9
Stream Type = Eb

Cedarock Reference Reach



Profile (Reference Reach)

Save = 0.0258 rise/run
Svalley = 0.0310 rise/run
Sriffle = 0.0316 (0 - 0.0576) rise/run
Spool = 0.0007 (0 - 0.018) rise/run
Srun = 0.0353 (0 - 0.3565) rise/run
Sglide = 0.0029 (0 - 0.0431) rise/run

- Water Surface
- Channel Bed

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill
Stream and Wetland
Mitigation Site

Alamance County
North Carolina

Title:

Cedarock Reference Reach
Dimension, Pattern,
and Profile

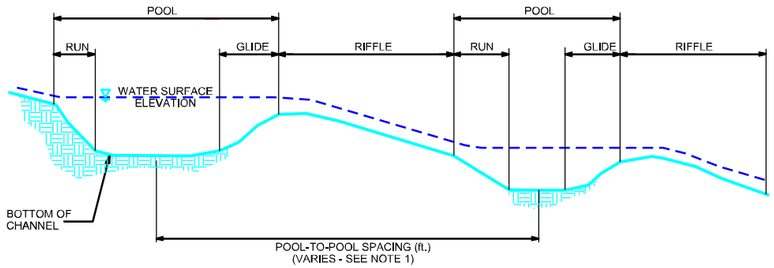
Scale: NA

Date: August 2017

Project No.: 17-009

FIGURE NO.

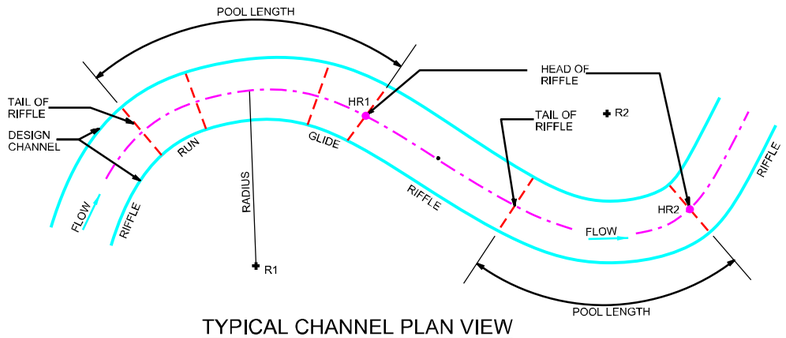
5C



TYPICAL CHANNEL PROFILE

NOTES:

1. POOL-TO-POOL SPACING IS MEASURED FROM CENTER OF POOL BEND TO CENTER OF POOL BEND.

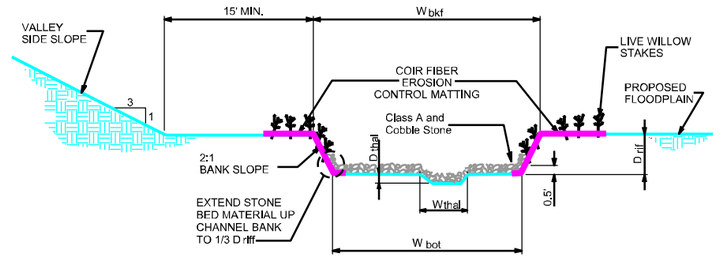


TYPICAL CHANNEL PLAN VIEW

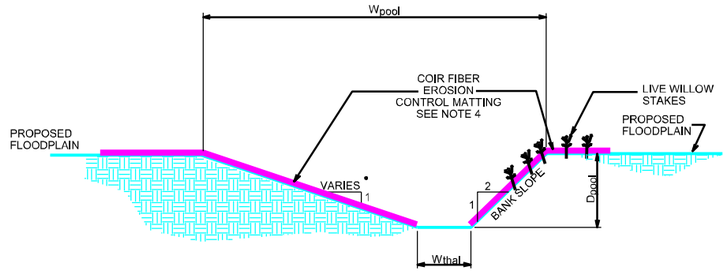
CHANNEL PLAN VIEW NOTES:

1. THE CONTRACTOR SHALL LAYOUT THE CHANNEL ALIGNMENT BY LOCATING THE RADII AND SCRIBING THE CENTER LINE FOR EACH POOL BEND. THE CONNECTING TANGENT SECTIONS SHALL COMPLETE THE LAYOUT OF THE CHANNEL.

2. FIELD ADJUSTMENTS OF THE ALIGNMENT MAY BE REQUIRED TO SAVE TREES OR AVOID OBSTACLES. THE STAKE-OUT SHALL BE APPROVED BY THE CONSTRUCTION MANAGER BEFORE CONSTRUCTION OF THE CHANNEL.



TYPICAL RIFFLE CROSS-SECTION



• MAX. 1:1 SLOPE

TYPICAL POOL CROSS-SECTION

CHANNEL CONSTRUCTION NOTES:

1. MATERIAL EXCAVATED FROM CHANNEL AND FLOODPLAIN SHALL BE USED TO BACKFILL EXISTING CHANNEL.

2. BANK PROTECTION SHALL CONSIST OF NATURAL COIR FIBER MATTING.

3. THE CONTRACTOR SHALL SUPPLY BED MATERIAL FOR THE ENTIRE BED LENGTH OF EACH RIFFLE SECTION. THE BED MATERIAL SHALL CONSIST OF A MIX OF CLASS A AND SMALLER STONE.

CROSS-SECTION DIMENSIONS							
REACH	Wbkf (ft.)	Wbot (ft.)	Driff (ft.)	Dthal (ft.)	Dpool (ft.)	Wpool (ft.)	Wthal (ft.)
UT 2	7.8	4.6	0.7	0.1	1.1	8.5	1.9
UT 3	4.7	2.7	0.4	0.1	0.6	5.2	1.0
UT 4	7.0	4.2	0.6	0.1	1.0	7.7	1.7
Cane Creek	27.1	16.3	2.6	0.1	3.7	29.8	7.6

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

Alamance County North Carolina

Title:

PROPOSED DIMENSION, PATTERN, AND PROFILE

Scale: NA

Date: Oct 2018

Project No.: 18-012

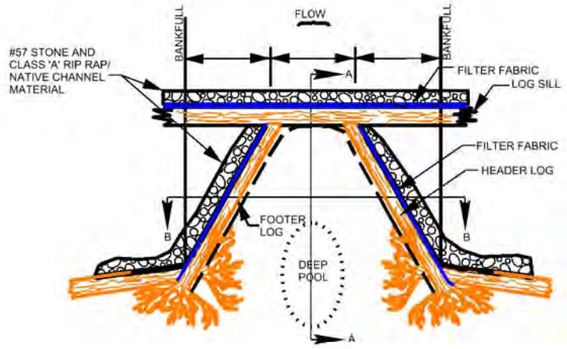
FIGURE NO.

7

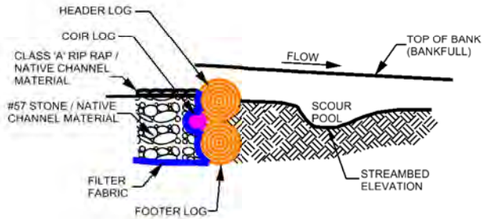
LOG CROSS VANE

SCALE:NTS

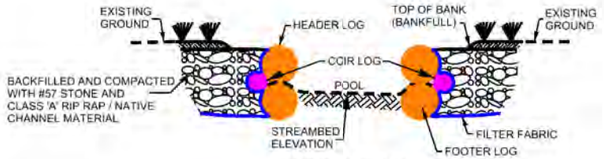
PLAN VIEW



NOTES:
1. HEADER AND FOOTER LOGS SHALL BE A MINIMUM OF 18" DIAMETER AND SHALL BE A HARDWOOD SPECIES. (FOOTER LOG MAY BE SUBSTITUTED WITH PINE)
2. A DOUBLE FOOTER LOG MAY BE REQUIRED IN SAND BED STREAMS.
3. ALL STONES ARE TO BE STRUCTURE STONES.
4. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE STRUCTURE TO PREVENT WASHOUT OF SEDIMENT THROUGH LOG GAPS. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.
5. PERPENDICULAR ROOTWAD LOGS ARE REQUIRED IF THE LOG VANE ARM DOES NOT HAVE A ROOTBALL TO TIE INTO THE BANK.



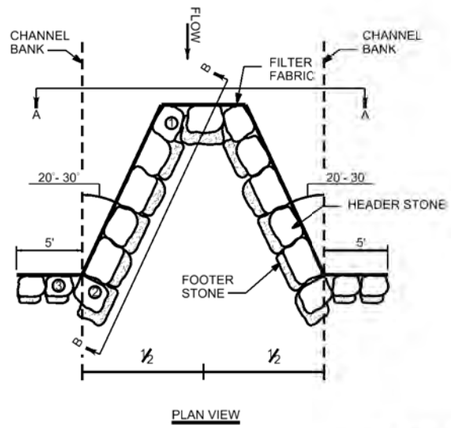
SECTION A-A



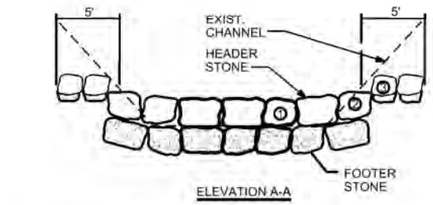
SECTION B-B

REACH	ARM LENGTH (FT.)	CHANNEL DEPTH (FT.)
UT 2, 3, 4	6	0.5 - 0.8
Cane Creek	21	2.7

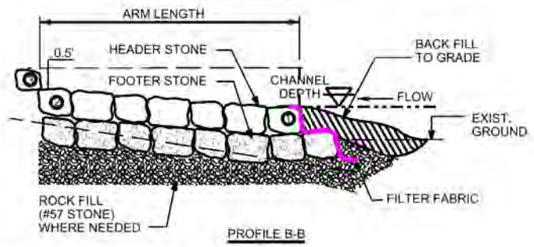
NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 24" ALONG THE SHORTEST DIMENSION.



PLAN VIEW

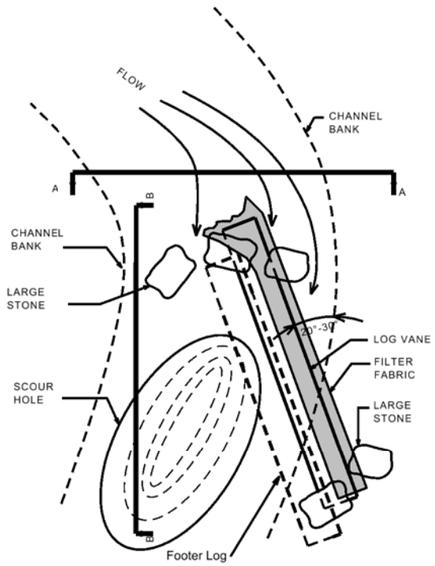


ELEVATION A-A



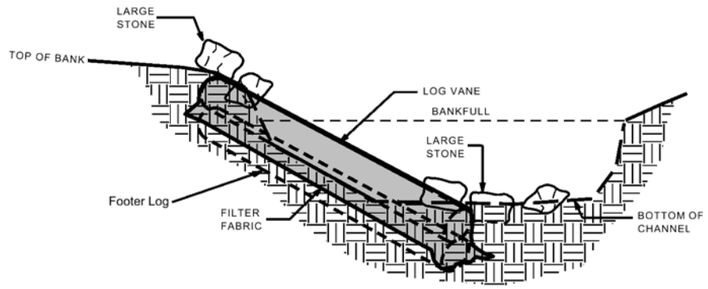
PROFILE B-B

TYPICAL CROSS-VANE

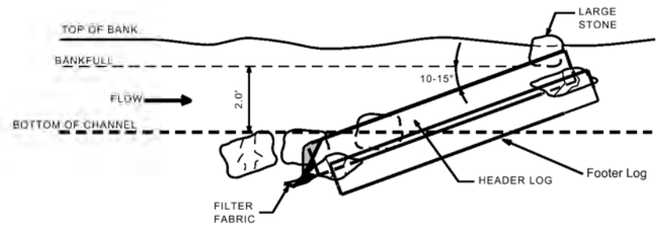


NOTE:
FILTER FABRIC TOED IN AND DRAPED ON UPSTREAM SIDE OF LOG VANE PRIOR TO BACKFILL.

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

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

Alamance County North Carolina

Title:

TYPICAL STRUCTURE DETAILS

Scale: NO SCALE

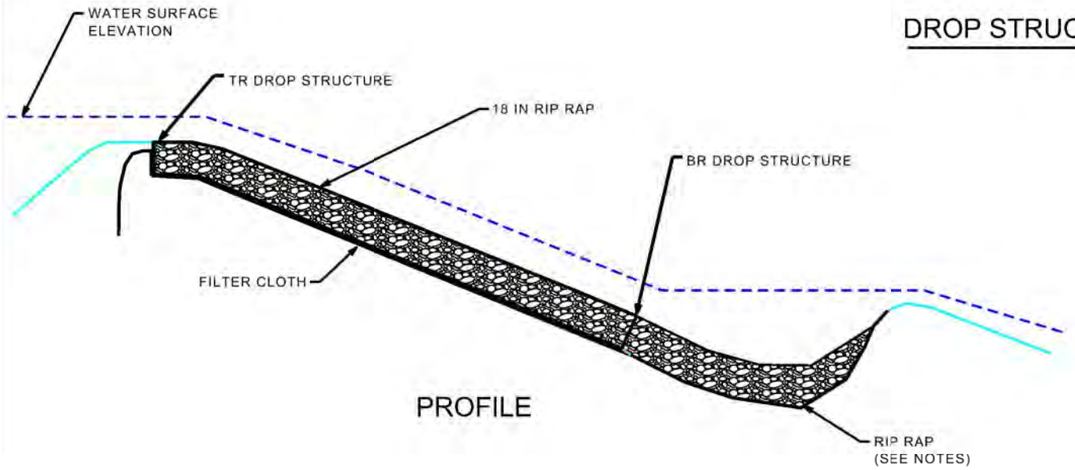
Date: Jan 2019

Project No.: 18-012

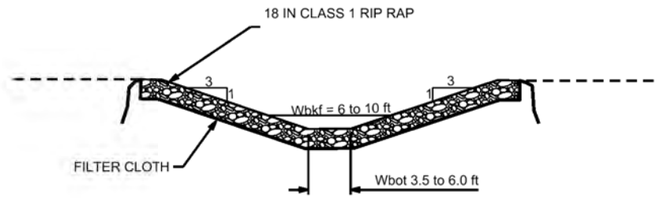
FIGURE NO.

8A

DROP STRUCTURE

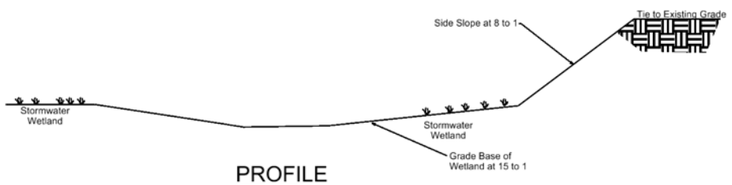


PROFILE

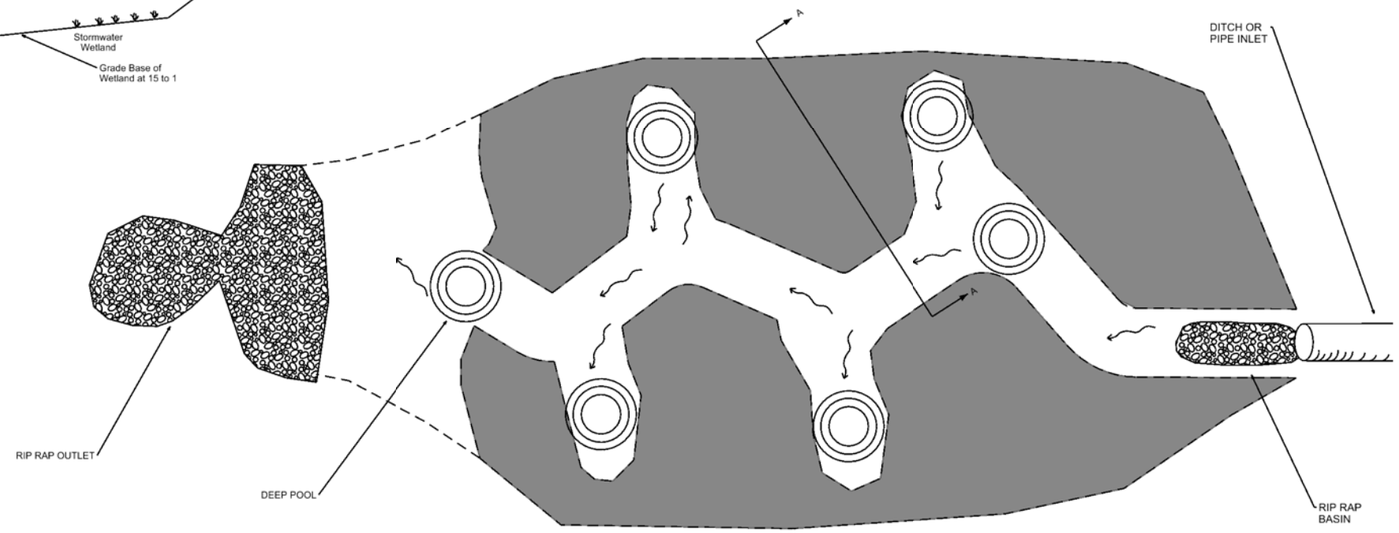


CROSS-SECTION

STRUCTURE NOTES:
1. CONTRACTOR WILL INSTALL EROSION CONTROL FABRIC AND 18-INCH DEPTH OF CLASS 1 RIP RAP OR OTHER SUITABLE MATTERIAL.



PROFILE
SECTION A-A



MARSH TREATMENT AREA

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

Alamance County North Carolina

Title:

TYPICAL STRUCTURE DETAILS

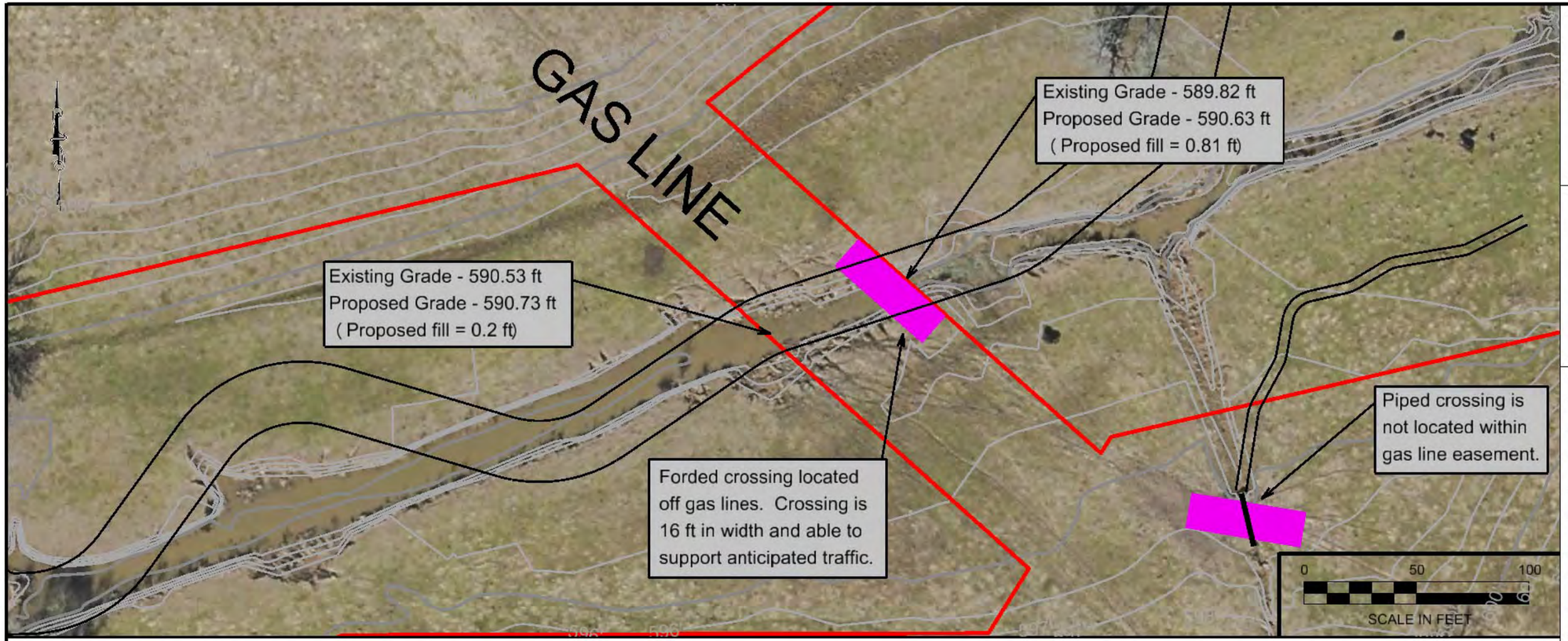
Scale: NO SCALE

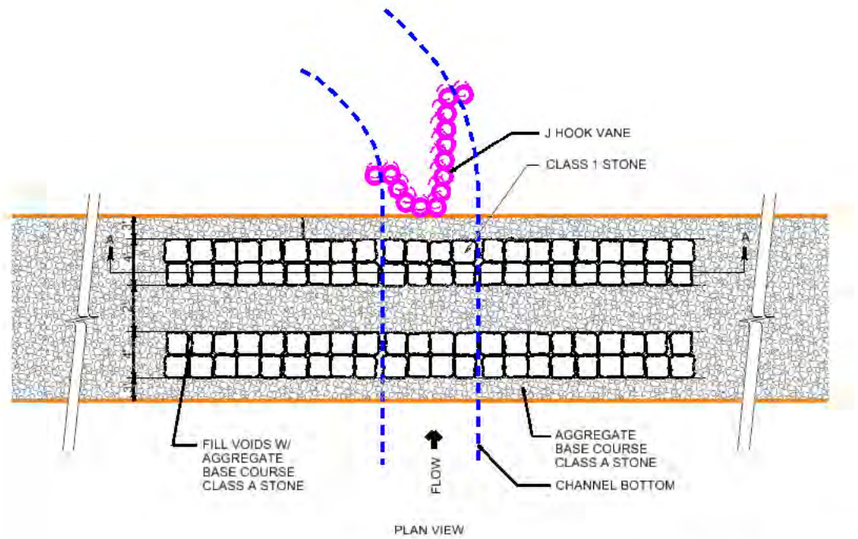
Date: Jan 2019

Project No.: 18-012

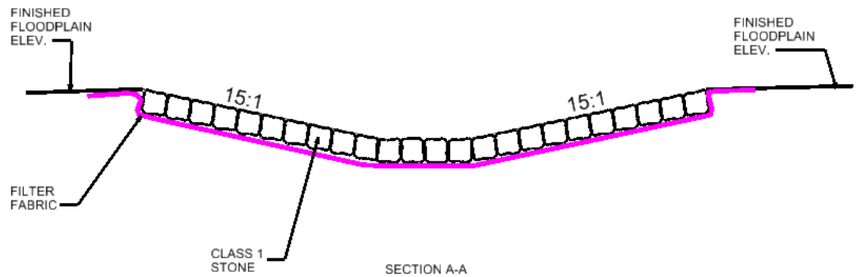
FIGURE NO.

8B





PERMANENT CHANNEL FORD DETAIL



NOTES:

1. KEEP FORD CROSS FALL WITHIN 1-2% OF STREAM GRADIENT.
2. FILL VOIDS BETWEEN CLASS 1 STONE WITH AGGREGATE BASE COURSE CLASS A TO CREATE DRIVEABLE SURFACE.

PERMANENT CHANNEL FORD DETAIL

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

Alamance County North Carolina

Title:

TYPICAL DETAILS

Scale:	FIGURE NO.
AS SHOWN	8C
Date: Jan 2019	
Project No.: 18-012	

Vegetation Association	Piedmont/Low Mountain Alluvial Forest*		Dry-Mesic Oak-Hickory Forest*		Marsh Treatment Wetland**		Stream-side Assemblage**		TOTAL
Area (acres)	7.7		2		0.01		2.8		12.5
Species	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted**	% of total	# planted
Tag alder (*Alnus serrulata*)	0	0%	0	0%	25	17%	375	5%	400
River birch (*Betula nigra*)	600	11%	0	0%	0	0%	800	11%	1400
Ironwood (*Carpinus caroliniana*)	0	0%	300	21%	0	0%	0	0%	300
Sugarberry (*Celtis laevigata*)	500	10%	0	0%	0	0%	500	7%	1000
Buttonbush (*Cephalanthus occidentalis*)	0	0%	0	0%	25	17%	0	0%	25
Red bud (*Cercis canadensis*)	0	0%	100	7%	0	0%	0	0%	100
Sweet pepperbush (*Clethra alnifolia*)	0	0%	0	0%	25	17%	0	0%	25
Silky dogwood (*Cornus amomum*)	500	10%	0	0%	25	17%	1475	20%	2000
Persimmon (*Diospyros virginiana*)	0	0%	200	14%	0	0%	0	0%	200
White ash (*Fraxinus americana*)	0	0%	100	7%	0	0%	0	0%	100
Green ash (*Fraxinus pennsylvanica*)	300	6%	0	0%	0	0%	700	9%	1000
Tulip poplar (*Liriodendron tulipifera*)	500	10%	100	7%	0	0%	0	0%	600
Sycamore (*Platanus occidentalis*)	1100	21%	0	0%	0	0%	1500	20%	2600
Black gum (*Nyssa sylvatica*)	100	2%	200	14%	0	0%	0	0%	300
White Oak (*Quercus alba*)	250	5%	250	17%	0	0%	0	0%	500
Water oak (*Quercus nigra*)	700	13%	100	7%	0	0%	700	9%	1500
Red Oak (*Quercus rubra*)	0	0%	100	7%	0	0%	0	0%	100
Willow oak (*Quercus phellos*)	700	13%	0	0%	0	0%	700	9%	1400
Black willow (*Salix nigra*)	0	0%	0	0%	0	0%	750	10%	750
Elderberry (*Sambucus canadensis*)	0	0%	0	0%	25	17%	0	0%	25
Possumhaw (*Viburnum nudum*)	0	0%	0	0%	25	17%	0	0%	25
TOTAL	5250	100%	1450	100%	150	100%	7500	100%	14,350

LEGEND

- Easement Boundary = 16.1 ac
- Major Topography Line
- Minor Topography Line
- Stream-side Assemblage = 2.8 ac
- Piedmont/Mountian Alluvial Forest = 7.7 ac
- Dry-Mesic Oak Hickory Forest = 2.0 ac
- Marsh Treatment Area = 0.01 ac

0 200 400

SCALE IN FEET

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

Alamance County North Carolina

Title:

PLANTING PLAN

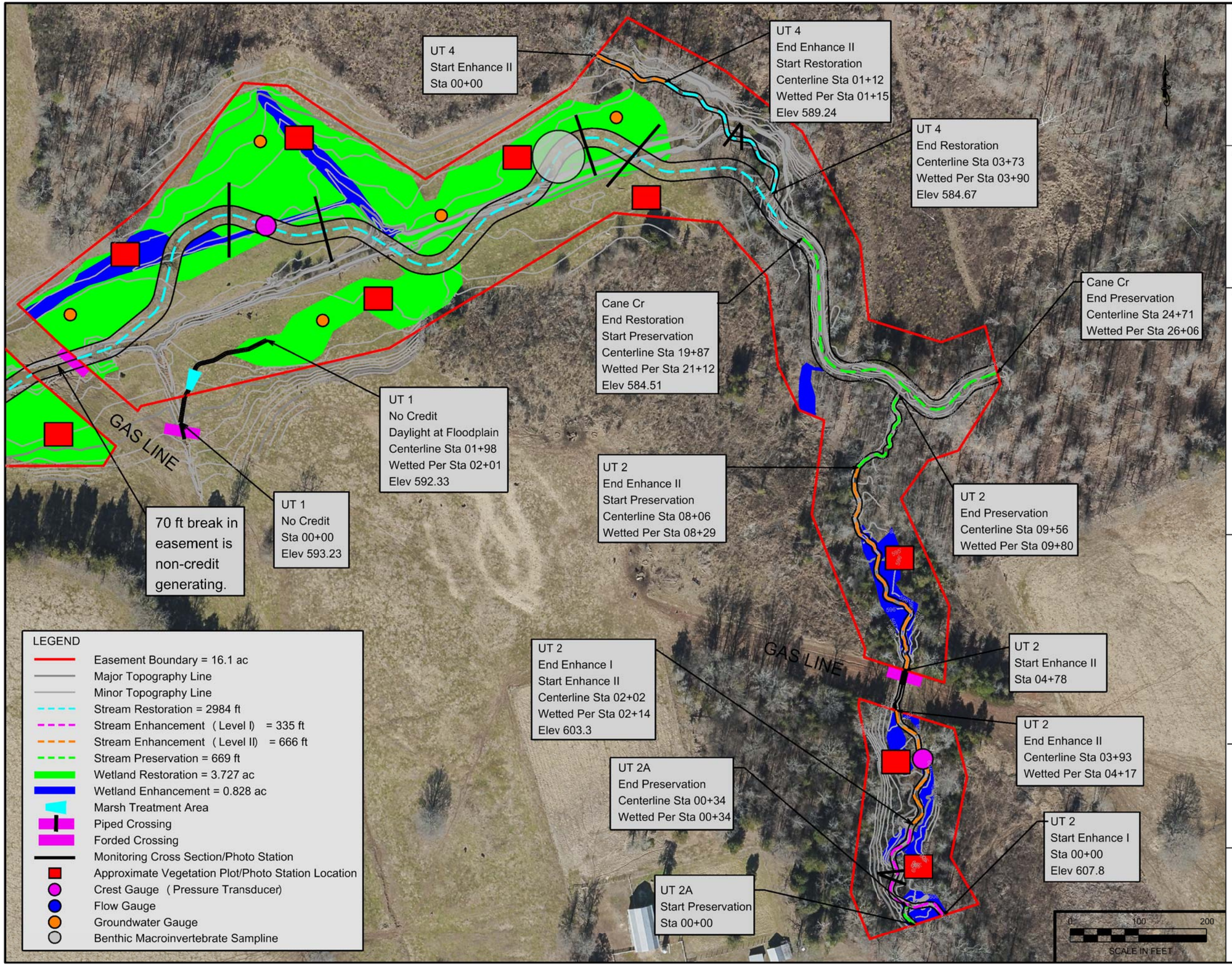
Scale: AS SHOWN

Date: Jan 2019

Project No.: 18-012

FIGURE NO.

9



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

Alamance County North Carolina

Title:

MONITORING PLAN

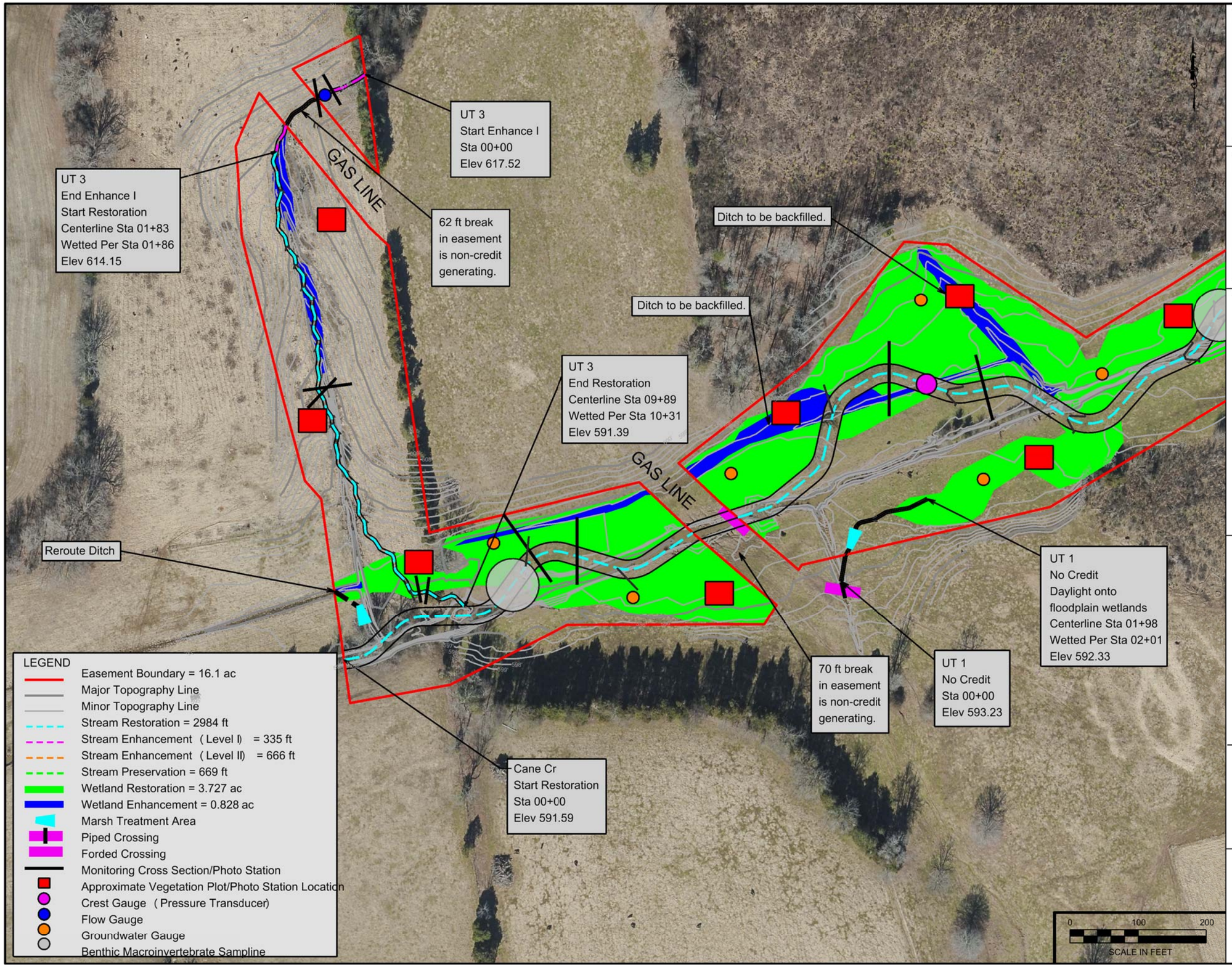
Scale: AS SHOWN

Date: Jan 2019

Project No.: 18-012

FIGURE NO.

10A



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

Alamance County North Carolina

Title:

MONITORING PLAN

Scale: AS SHOWN

Date: Jan 2019

Project No.: 18-012

FIGURE NO.

10B

Appendix B
Existing Stream & Wetland Data

Table B1. Phantom Mill Morphological Stream Characteristics
Existing Stream Cross-section Data
NC SAM Forms
NC WAM Forms
NCDWQ Stream Forms
BEHI/NBS Data
Soil Boring Log

Table B1. Phantom Mill Morphological Stream Characteristics

Variables	REFERENCE - CEDAROCK PARK	REFERENCE - CAUSEY* FARM	Existing UT 4	PROPOSED UT 4
Stream Type	Eb 4	E 5	Eg 4	E/C 3/4
Drainage Area (mi^2)	0.21	0.63	0.08	0.08
Bankfull Discharge (cfs)	28.8	60.6	13.1	13.1
Dimension Variables				
Bankfull Cross-Sectional Area (A_{bkf})	8.0	14.7	3.5	3.5
Existing Cross-Sectional Area at TOB ($A_{existing}$)	8.0	14.7	3.5 - 15.4	3.5
Bankfull Width (W_{bkf})	Mean: 8.1 Range: 8.0 - 12.1	Mean: 11.0 Range: 10.7 - 11.3	Mean: 6.4 Range: 5.0 to 7.4	Mean: 7.0 Range: 6.5 to 7.5
Bankfull Mean Depth (D_{bkf})	Mean: 0.8 Range: 0.8 - 1.0	Mean: 1.4 Range: 1.3 - 1.4	Mean: 0.6 Range: 0.5 to 0.7	Mean: 0.5 Range: 0.5 to 0.5
Bankfull Maximum Depth (D_{max})	Mean: 1.4 Range: 1.1 - 1.4	Mean: 2.0 Range: 1.9 - 2.0	Mean: 0.9 Range: 0.6 to 1.0	Mean: 0.7 Range: 0.6 to 0.8
Pool Width (W_{pool})	Mean: 9.3 Range: 8.9 - 9.7	Mean: 10.5 Range:	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 7.7 Range: 7.0 to 9.8
Maximum Pool Depth (D_{pool})	Mean: 1.8 Range: 1.5 - 2.1	Mean: 2.7 Range:		Mean: 1.0 Range: 0.7 to 1.1
Width of Floodprone Area (W_{fpa})	Mean: 18 Range: 15 - 25	Mean: 131 Range: 122 - 140	Mean: 10 Range: 8.0 to 100.0	Mean: 50 Range: 30.0 to 90.0
Dimension Ratios				
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 2.1 Range: 1.9 - 2.2	Mean: 12 Range: 11 - 13	Mean: 1.8 Range: 1.1 to 20.0	Mean: 7.1 Range: 4.3 to 12.9
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 10.1 Range: 8.0 - 15.1	Mean: 9 Range: 8 - 9	Mean: 10.7 Range: 7.1 to 14.8	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.4 Range: 1.4 - 1.8	Mean: 1.4 Range: 1.4 - 1.5	Mean: 1.4 Range: 1.2 to 2.0	Mean: 1.4 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.0 Range: 1.0 - 1.8	Mean: 1.4 Range:	Mean: 1.8 Range: 1.1 to 3.2	Mean: 1.0 Range: 1.0 to 1.2
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 1.9 Range: 0 - 2.1	Mean: 2 Range:	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.9 Range: 1.3 to 2.1
Pool Width / Bankfull Width (W_{pool}/W_{bkf})	Mean: 1.1 Range: 0 - 1.2	Mean: 1 Range:		Mean: 1.1 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area	Mean: 1.4 Range: 0 - 1.6	Mean: 1.4 Range:		Mean: 1.4 Range: 1.1 to 1.6

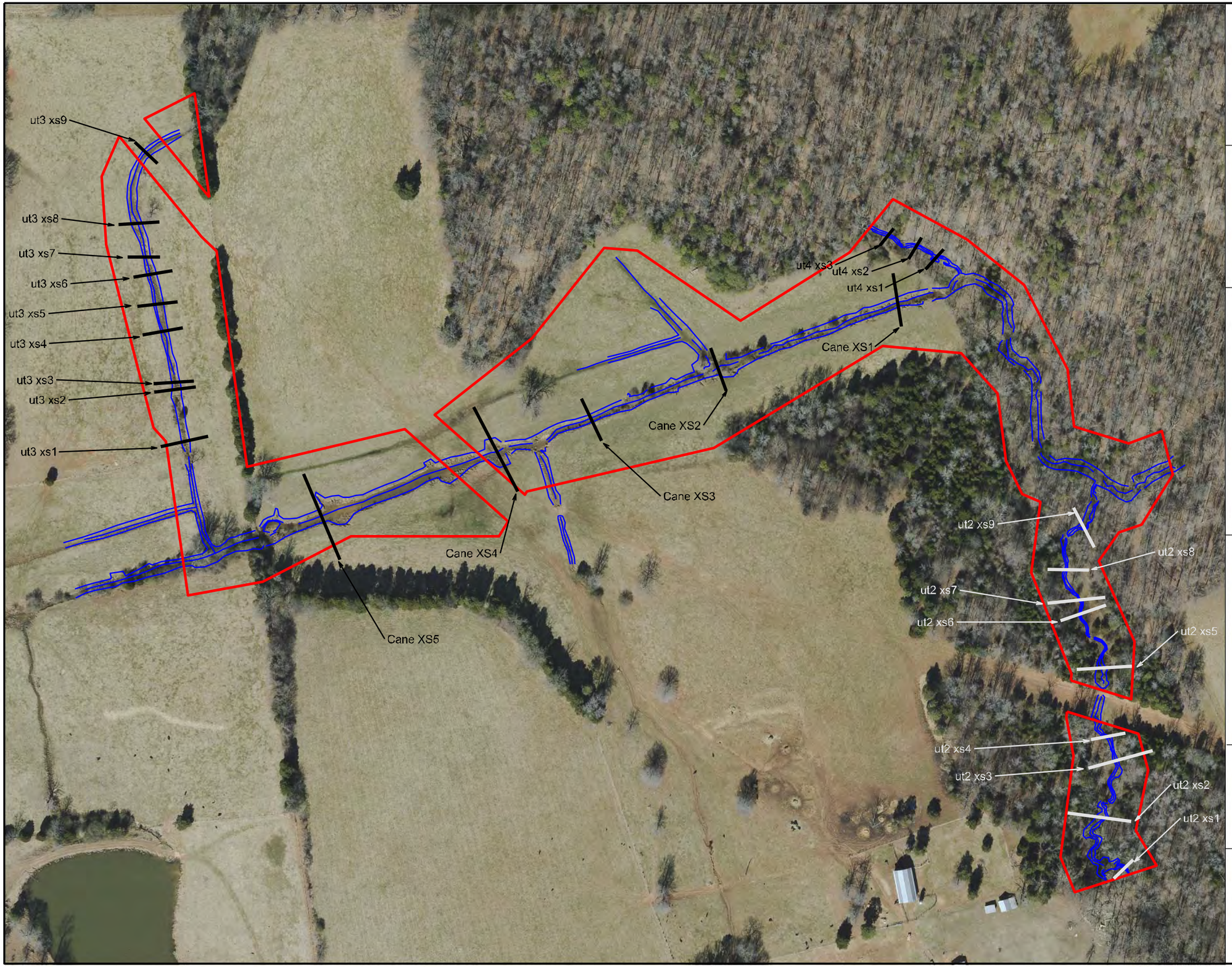
Variables	REFERENCE - CEDAROCK PARK	REFERENCE - CAUSEY* FARM	Existing UT 4	PROPOSED UT 4
Pattern Variables				
Pool to Pool Spacing (L_{p-p})	Med: 37.2 Range: 25 - 69	Med: 44.3 Range: 22 - 81	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 28.0 Range: 21.0 to 56.0
Meander Length (L_m)	Med: 68.4 Range: 44 - 116	Med: 62.9 Range: 10 - 91		Med: 59.5 Range: 42.0 to 84.0
Belt Width (W_{belt})	Med: 22.8 Range: 20 - 38	Med: 29.8 Range: 17 - 36		Med: 28.0 Range: 21.0 to 42.0
Radius of Curvature (R_c)	Med: 16.5 Range: 11 - 27	Med: 30.6 Range: 9 - 113		Med: 21.0 Range: 14.0 to 70.0
Sinuosity (Sin)	1.20	1.46	1.04	1.15
Pattern Ratios				
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 4.6 Range: 3.1 - 8.4	Med: 4 Range: 2.0 - 7.4	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 8.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 8.4 Range: 5.5 - 14.3	Med: 5.7 Range: 0.9 - 8.3		Med: 8.5 Range: 6.0 to 12.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 2.8 Range: 2.4 - 4.7	Med: 2.7 Range: 1.5 - 3.5		Med: 4.0 Range: 3.0 to 6.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 2.0 Range: 1.4 - 3.3	Med: 2.8 Range: 0.8 - 10.3		Med: 3.0 Range: 2.0 to 10.0
Profile Variables				
Average Water Surface Slope (S_{ave})	0.0258	0.0053	0.0228	0.0206
Valley Slope (S_{valley})	0.0310	0.0077	0.0237	0.0237
Riffle Slope (S_{riffle})	Mean: 0.0316 Range: 0.01 - 0.0576	Mean: 0.0098 Range: 0.002 - 0.01198	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0309 Range: 0.0247 to 0.0330
Pool Slope (S_{pool})	Mean: 0.0007 Range: 0 - 0.018	Mean: 0.0006 Range: 0 - 0.004		Mean: 0.0021 Range: 0.0000 to 0.0144
Run Slope (S_{run})	Mean: 0.0353 Range: 0 - 0.3565	Mean: Range:		Mean: 0.0082 Range: 0.0000 to 0.0165
Glide Slope (S_{glide})	Mean: 0.0029 Range: 0 - 0.0431	Mean: Range:		Mean: 0.0023 Range: 0.0000 to 0.0165
Profile Ratios				
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.2 Range: 0.39 - 2.23	Mean: 1.6 Range: 0 - 3.7	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.5 Range: 1.2 to 1.6
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 0.0 Range: 0 - 0.70	Mean: 0.1 Range: 0 - 0.8		Mean: 0.10 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 1.37 Range: 0 - 13.82	Mean: Range:		Mean: 0.40 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.11 Range: 0 - 1.67	Mean: Range:		Mean: 0.11 Range: 0.0 to 0.8

* Causey Farm Reference includes measurments from a Reference Site measured in 2004.

Table B1. Phantom Mill Morphological Stream Characteristics

Variables	Existing Cane Creek	PROPOSED Cane Creek	Existing UT 2	PROPOSED UT 2	Existing UT 3	PROPOSED UT 3
Stream Type	Eg 5	E/C 3/4	Cg 3/4	E/C 3/4	F 4	Cb 3/4
Drainage Area (mi^2)	4.16	4.16	0.10	0.10	0.13	0.13
Bankfull Discharge (cfs)	232.1	232.1	16.2	16.2	18.9	18.9
Dimension Variables						
Bankfull Cross-Sectional Area (A_{bkf})	52.3	52.3	4.3	4.3	1.6	1.6
Existing Cross-Sectional Area at TOB ($A_{existing}$)	65.7 - 153.1	52.3	3.5 - 32.2	4.3	3.6 - 34.6	1.6
Bankfull Width (W_{bkf})	Mean: 23.0 18.6 to 43.5	Mean: 27.1 Range: 25.1 to 28.9	Mean: 11.0 7.8 to 17.2	Mean: 7.8 Range: 7.2 to 8.3	Mean: 7.9 4.1 to 11.7	Mean: 4.7 Range: 4.4 to 5.1
Bankfull Mean Depth (D_{bkf})	Mean: 2.3 Range: 1.2 to 2.8	Mean: 1.9 Range: 1.8 to 2.1	Mean: 0.4 Range: 0.2 to 0.6	Mean: 0.6 Range: 0.5 to 0.6	Mean: 0.2 Range: 0.1 to 0.3	Mean: 0.3 Range: 0.3 to 0.4
Bankfull Maximum Depth (D_{max})	Mean: 3.3 Range: 2.0 to 4.4	Mean: 2.7 Range: 2.3 to 2.9	Mean: 0.8 Range: 0.4 to 1.2	Mean: 0.8 Range: 0.7 to 0.8	Mean: 0.4 Range: 0.2 to 0.7	Mean: 0.5 Range: 0.4 to 0.5
Pool Width (W_{pool})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 29.8 Range: 27.1 to 37.9	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 8.5 Range: 7.8 to 10.9	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 5.2 Range: 4.7 to 6.6
Maximum Pool Depth (D_{pool})		Mean: 3.7 Range: 2.5 to 4.1		Mean: 1.1 Range: 0.7 to 1.2		Mean: 0.6 Range: 0.4 to 0.7
Width of Floodprone Area (W_{fpa})	Mean: 100 Range: 50.0 to 100.0	Mean: 70 Range: 100.0 to 150.0	Mean: 50 Range: 20.0 to 100.0	Mean: 50 Range: 30.0 to 90.0	Mean: 12 Range: 8.0 to 25.0	Mean: 50 Range: 30.0 to 90.0
Dimension Ratios						
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 4.3 Range: 1.6 to 5.4	Mean: 2.6 Range: 3.7 to 5.5	Mean: 3.6 Range: 1.2 to 12.8	Mean: 6.4 Range: 3.9 to 11.6	Mean: 1.4 Range: 1.1 to 4.8	Mean: 10.6 Range: 6.3 to 19.0
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 10.0 Range: 6.6 to 36.3	Mean: 14.0 Range: 12.0 to 16.0	Mean: 27.5 Range: 13.0 to 86.0	Mean: 14.0 Range: 12.0 to 16.0	Mean: 39.5 Range: 10.3 to 117.0	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf}/ D_{bkf} Ratio	Mean: 1.6 Range: 1.4 to 1.7	Mean: 1.4 Range: 1.2 to 1.5	Mean: 2.0 Range: 1.7 to 3.0	Mean: 1.4 Range: 1.2 to 1.5	Mean: 1.8 Range: 1.0 to 3.0	Mean: 1.4 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.4 Range: 1.1 to 2.0	Mean: 1.0 Range: 1.0 to 1.2	Mean: 1.5 Range: 0.9 to 3.1	Mean: 1.0 Range: 1.0 to 1.2	Mean: 5.0 Range: 1.3 to 10.0	Mean: 1.0 Range: 1.0 to 1.2
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.9 Range: 1.3 to 2.1	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.9 Range: 1.3 to 2.1	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.9 Range: 1.3 to 2.1
Pool Width / Bankfull Width (W_{pool}/W_{bkf})		Mean: 1.1 Range: 1.0 to 1.4		Mean: 1.1 Range: 1.0 to 1.4		Mean: 1.1 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area		Mean: 1.4 Range: 1.1 to 1.6		Mean: 1.4 Range: 1.1 to 1.6		Mean: 1.4 Range: 1.1 to 1.6

Variables	Existing Cane Creek	PROPOSED Cane Creek	Existing UT 2	PROPOSED UT 2	Existing UT 3	PROPOSED UT 3
Pattern Variables						
Pool to Pool Spacing (L_{p-p})	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 108.2 Range: 81.2 to 216.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 31.0 Range: 23.3 to 62.1	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 18.9 Range: 14.2 to 37.9
Meander Length (L_m)		Med: 230.0 Range: 162.4 to 324.7		Med: 66.0 Range: 46.6 to 93.1		Med: 40.2 Range: 28.4 to 56.8
Belt Width (W_{belt})		Med: 108.2 Range: 81.2 to 162.4		Med: 31.0 Range: 23.3 to 46.6		Med: 18.9 Range: 14.2 to 28.4
Radius of Curvature (R_c)		Med: 81.2 Range: 54.1 to 270.6		Med: 23.3 Range: 15.5 to 77.6		Med: 14.2 Range: 9.5 to 47.3
Sinuosity (Sin)	1.06	1.15	1.20	1.20	1.01	1.05
Pattern Ratios						
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 8.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 8.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 8.0
Meander Length/ Bankfull Width (L_m/W_{bkf})		Med: 8.5 Range: 6.0 to 12.0		Med: 8.5 Range: 6.0 to 12.0		Med: 8.5 Range: 6.0 to 12.0
Meander Width Ratio (W_{belt}/W_{bkf})		Med: 4.0 Range: 3.0 to 6.0		Med: 4.0 Range: 3.0 to 6.0		Med: 4.0 Range: 3.0 to 6.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})		Med: 3.0 Range: 2.0 to 10.0		Med: 3.0 Range: 2.0 to 10.0		Med: 3.0 Range: 2.0 to 10.0
Profile Variables						
Average Water Surface Slope (S_{ave})	0.0033	0.0030	0.0188	0.0188	0.0317	0.0305
Valley Slope (S_{valley})	0.0035	0.0035	0.0225	0.0225	0.0320	0.0320
Riffle Slope (S_{riffle})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0046 Range: 0.0037 to 0.0049	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0281 Range: 0.0225 to 0.0300	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0457 Range: 0.0366 to 0.0488
Pool Slope (S_{pool})		Mean: 0.0003 Range: 0.0000 to 0.0021		Mean: 0.0019 Range: 0.0000 to 0.0131		Mean: 0.0030 Range: 0.0000 to 0.0213
Run Slope (S_{run})		Mean: 0.0012 Range: 0.0000 to 0.0024		Mean: 0.0075 Range: 0.0000 to 0.0150		Mean: 0.0122 Range: 0.0000 to 0.0244
Glide Slope (S_{glide})		Mean: 0.0003 Range: 0.0000 to 0.0024		Mean: 0.0021 Range: 0.0000 to 0.0150		Mean: 0.0034 Range: 0.0000 to 0.0244
0.0118 (0.0089 - 0.0111)						
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.5 Range: 1.2 to 1.6	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.5 Range: 1.2 to 1.6	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.5 Range: 1.2 to 1.6
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})		Mean: 0.10 Range: 0.0 to 0.7		Mean: 0.10 Range: 0.0 to 0.7		Mean: 0.10 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})		Mean: 0.40 Range: 0.0 to 0.8		Mean: 0.40 Range: 0.0 to 0.8		Mean: 0.40 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})		Mean: 0.11 Range: 0.0 to 0.8		Mean: 0.11 Range: 0.0 to 0.8		Mean: 0.11 Range: 0.0 to 0.8



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

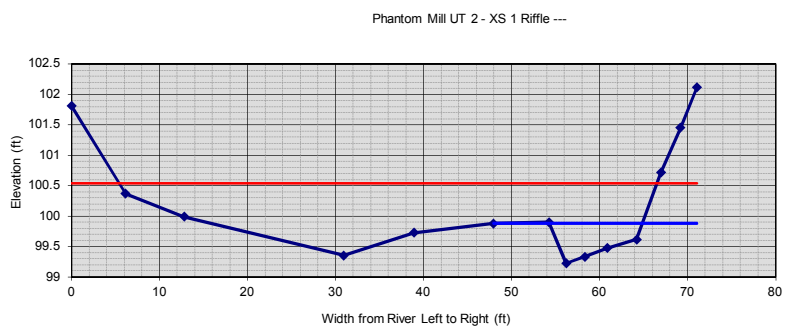
Alamance County North Carolina

Title:

EXISTING CONDITION CROSS SECTION LOCATIONS

Scale:	FIGURE NO.
NA	B1
Date: Oct 2018	
Project No.: 18-012	

Cross Section



section:	Phantom Mill UT 2 - XS 1
	Riffle

	---
description:	Phantom Mill UT 2 - XS 1
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	-1.811033	101.811
	☑	6.135155	-0.369196	100.3692
	☑	12.78931	0.010624	99.98938
	☑	30.91675	0.646708	99.35329
	☑	38.90491	0.276529	99.72347
	☐	47.95489	0.120201	99.8798
	☐	54.22142	0.102339	99.89766
	☐	56.21735	0.776355	99.22365
	☐	58.29191	0.66923	99.33077
	☐	60.83754	0.525475	99.47453
	☐	64.21632	0.383553	99.61645
	☐	66.96396	-0.715086	100.7151
	☐	69.1692	-1.452304	101.4523
	☐	71.0577	-2.113146	102.1131

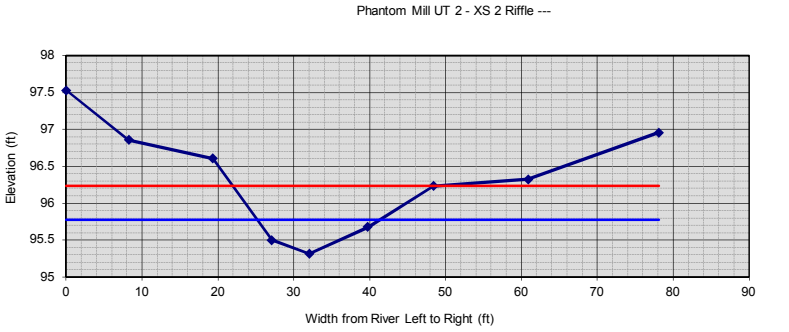
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
0.12	0.1	60.0		
99.88	99.9			

dimensions			
4.3	x-section area	0.4	d mean
10.7	width	10.8	wet P
0.7	d max	0.4	hyd radi
0.7	bank ht	26.4	w/d ratio
60.0	W flood prone area	5.6	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:	Phantom Mill UT 2 - XS 2
	Riffle

	---
description:	Phantom Mill UT 2 - XS 2
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	2.469787	97.53021
	☐	8.259994	3.143572	96.85643
	☐	19.32278	3.394245	96.60576
	☐	27.09663	4.502439	95.49756
	☐	32.03282	4.68471	95.31529
	☐	39.74489	4.324555	95.67545
	☐	48.40147	3.767683	96.23232
	☐	60.85807	3.678192	96.32181
	☐	78.1228	3.042671	96.95733

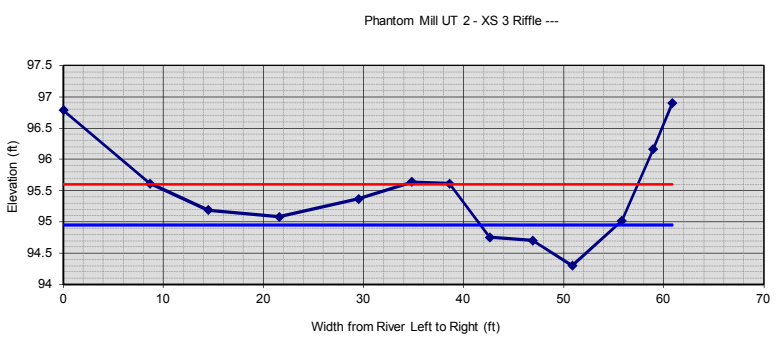
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
4.225	3.77	26.0		
95.775	96.23			

dimensions			
4.3	x-section area	0.3	d mean
16.1	width	16.2	wet P
0.5	d max	0.3	hyd radi
0.9	bank ht	60.3	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: **Phantom Mill UT 2 - XS 3**

Riffle

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description: **Phantom Mill UT 2 - XS 3**

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

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**3.217557**	96.78244
	☐	**8.651966**	**4.386913**	95.61309
	☐	**14.47809**	**4.811604**	95.1884
	☐	**21.56289**	**4.920413**	95.07959
	☐	**29.49326**	**4.630195**	95.36981
	☐	**34.83276**	**4.3606**	95.6394
	☐	**38.57248**	**4.387129**	95.61287
	☐	**42.61373**	**5.246869**	94.75313
	☐	**46.89313**	**5.295393**	94.70461
	☐	**50.85777**	**5.69993**	94.30007
	☐	**55.78016**	**4.987648**	95.01235
	☐	**58.9114**	**3.84079**	96.15921
	☐	**60.84714**	**3.098847**	96.90115
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	☐			

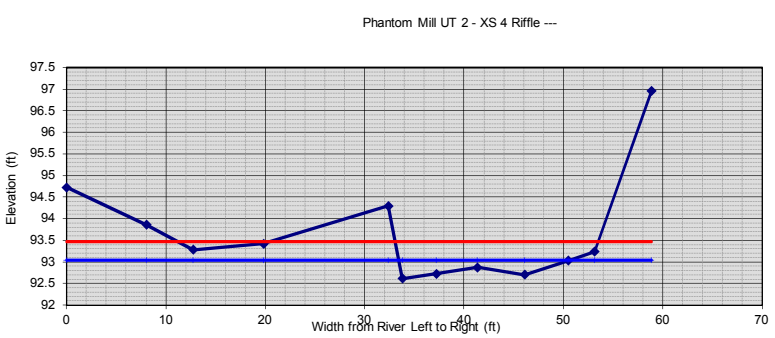
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
5.05	**4.36**	**50.0**		
94.95	95.64			

dimensions			
4.3	x-section area	0.3	d mean
13.7	width	13.7	wet P
0.6	d max	0.3	hyd radi
1.3	bank ht	43.7	w/d ratio
50.0	W flood prone area	3.7	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: **Phantom Mill UT 2 - XS 4**

Riffle

---

description: **Phantom Mill UT 2 - XS 4**

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

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**5.277746**	94.72225
	☐	**8.061445**	**6.140302**	93.8597
	☐	**12.71938**	**6.718965**	93.28104
	☐	**19.82834**	**6.581007**	93.41899
	☐	**32.37358**	**5.707862**	94.29214
	☐	**33.7858**	**7.385964**	92.61404
	☐	**37.20976**	**7.272965**	92.72704
	☐	**41.36232**	**7.123717**	92.87628
	☐	**46.08871**	**7.298933**	92.70107
	☐	**50.49674**	**6.971628**	93.02837
	☐	**53.10182**	**6.764397**	93.2356
	☐	**58.85907**	**3.039409**	96.96059
	☐			
	☐			
	☐			
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	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

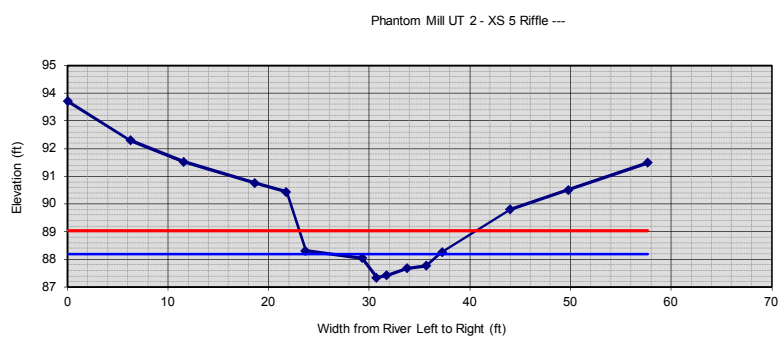
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
6.96	**6.76**	**20.0**		
93.04	93.24			

dimensions			
4.3	x-section area	0.2	d mean
17.2	width	17.4	wet P
0.4	d max	0.2	hyd radi
0.6	bank ht	69.0	w/d ratio
20.0	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:	Phantom Mill UT 2 - XS 5
	Riffle

	---
description:	Phantom Mill UT 2 - XS 5
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	6.293781	93.70622
	☐	6.244931	7.706963	92.29304
	☐	11.52595	8.471912	91.52809
	☐	18.57592	9.2348	90.7652
	☐	21.73155	9.567863	90.43214
	☐	23.65396	11.69688	88.30312
	☐	29.28523	11.96115	88.03885
	☐	30.70361	12.65753	87.34247
	☐	31.72407	12.58498	87.41502
	☐	33.74296	12.32837	87.67163
	☐	35.62962	12.23892	87.76108
	☐	37.22284	11.73602	88.26398
	☐	43.98344	10.20441	89.79559
	☐	49.74792	9.492329	90.50767
	☐	57.64811	8.515894	91.48411
	☐			
	☐			
	☐			
	☐			
	☐			
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	☐			
	☐			
	☐			
	☐			

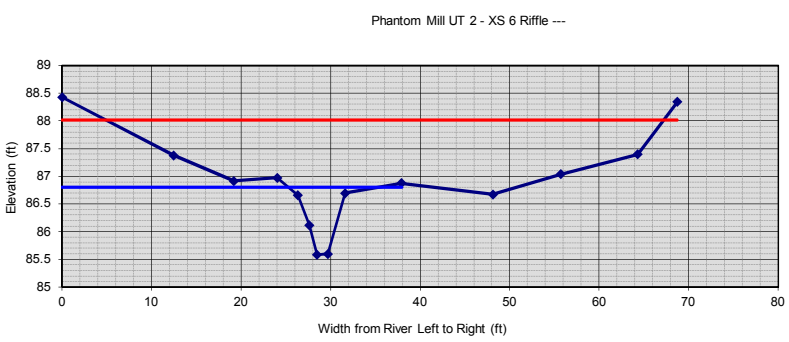
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
11.81	10.2	22.0		
88.19	89.8			

dimensions			
4.3	x-section area	0.4	d mean
10.9	width	11.2	wet P
0.8	d max	0.4	hyd radi
2.5	bank ht	27.9	w/d ratio
22.0	W flood prone area	2.0	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:	Phantom Mill UT 2 - XS 6
	Riffle

	---
description:	Phantom Mill UT 2 - XS 6
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	11.5775	88.4225
	☐	12.43771	12.62227	87.37773
	☐	19.15348	13.08425	86.91575
	☐	24.04079	13.02692	86.97308
	☐	26.34366	13.34244	86.65756
	☐	27.58727	13.88185	86.11815
	☐	28.46123	14.41586	85.58414
	☐	29.65398	14.40432	85.59568
	☐	31.59608	13.3061	86.6939
	☐	37.92244	13.12848	86.87152
	☑	48.09104	13.32677	86.67323
	☑	55.68574	12.96255	87.03745
	☑	64.27182	12.60534	87.39466
	☑	68.70969	11.6595	88.34051
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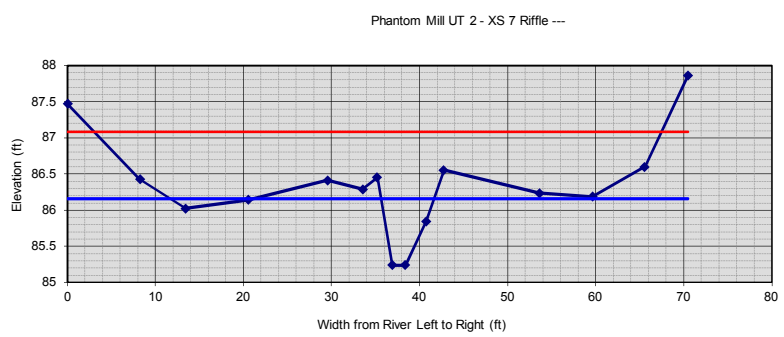
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
13.20	13.3	100.0		
86.8	86.7			

dimensions			
4.3	x-section area	0.4	d mean
10.1	width	10.6	wet P
1.2	d max	0.4	hyd radi
1.1	bank ht	23.4	w/d ratio
100.0	W flood prone area	9.9	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:	Phantom Mill UT 2 - XS 7
	Riffle

	---
description:	Phantom Mill UT 2 - XS 7
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	12.52809	87.47191
	☐	8.264581	13.57259	86.42741
	☐	13.38834	13.97779	86.02221
	☐	20.50771	13.85745	86.14255
	☐	29.52268	13.58892	86.41108
	☐	33.53464	13.71126	86.28874
	☐	35.17474	13.54657	86.45343
	☐	36.87608	14.76003	85.23997
	☐	38.36729	14.76121	85.23879
	☐	40.75344	14.15261	85.84739
	☐	42.73331	13.4476	86.5524
	☐	53.6057	13.76366	86.23634
	☐	59.66259	13.81375	86.18625
	☐	65.55638	13.39947	86.60054
	☐	70.46917	12.14117	87.85883
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FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
13.84	13.55	100.0		
86.16	86.45			

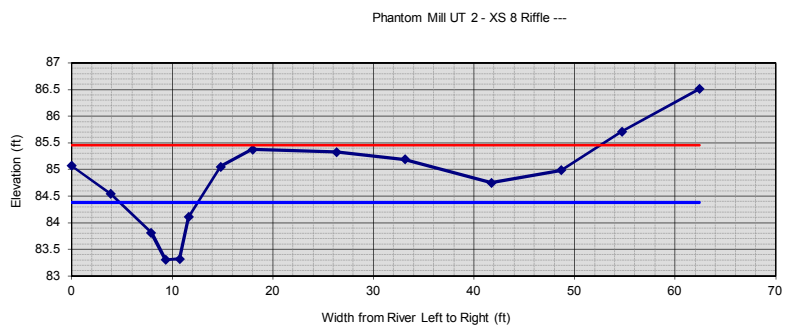
dimensions			
4.3	x-section area	0.3	d mean
15.5	width	15.9	wet P
0.9	d max	0.3	hyd radi
1.2	bank ht	56.4	w/d ratio
100.0	W flood prone area	6.5	ent ratio

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		

For additional cross sections make a copy of the "Dimension" worksheet.
To create a copy "right click" on the dimension tab below.

Cross Section



section:	Phantom Mill UT 2 - XS 8
	Riffle

	---
description:	Phantom Mill UT 2 - XS 8
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	14.93136	85.06864
	☐	3.901434	15.46396	84.53604
	☐	7.89615	16.18991	83.81009
	☐	9.356045	16.69564	83.30437
	☐	10.74473	16.68239	83.31761
	☐	11.618	15.89624	84.10376
	☐	14.81187	14.94846	85.05154
	☐	18.00242	14.62369	85.37631
	☐	26.3189	14.67115	85.32885
	☐	33.15014	14.81182	85.18818
	☐	41.74081	15.24942	84.75058
	☐	48.67877	15.01628	84.98372
	☐	54.70188	14.28801	85.71199
	☐	62.40523	13.48298	86.51702
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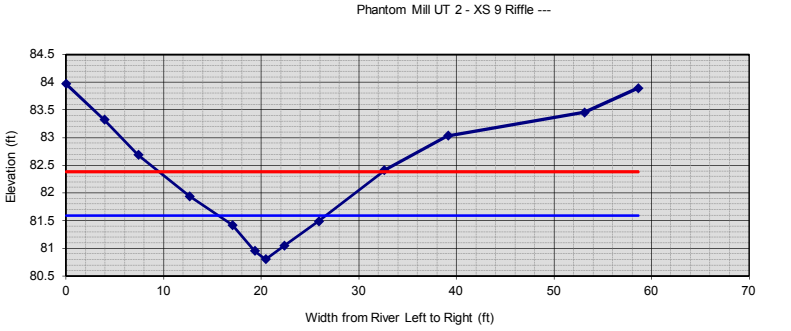
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
15.62	14.95	100.0		
84.38	85.05			

dimensions			
4.3	x-section area	0.6	d mean
7.8	width	8.3	wet P
1.1	d max	0.5	hyd radi
1.7	bank ht	14.1	w/d ratio
100.0	W flood prone area	12.8	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:	Phantom Mill UT 2 - XS 9
	Riffle

	---
description:	Phantom Mill UT 2 - XS 9
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	16.02991	83.97009
	☐	3.922484	16.67587	83.32413
	☐	7.39561	17.31376	82.68624
	☐	12.63172	18.05857	81.94143
	☐	17.02881	18.58192	81.41808
	☐	19.35241	19.04708	80.95292
	☐	20.43476	19.20062	80.79938
	☐	22.38571	18.94828	81.05172
	☐	25.89274	18.50792	81.49208
	☐	32.6346	17.5936	82.4064
	☐	39.13992	16.96745	83.03255
	☐	53.11018	16.5415	83.4585
	☐	58.65384	16.10379	83.89621
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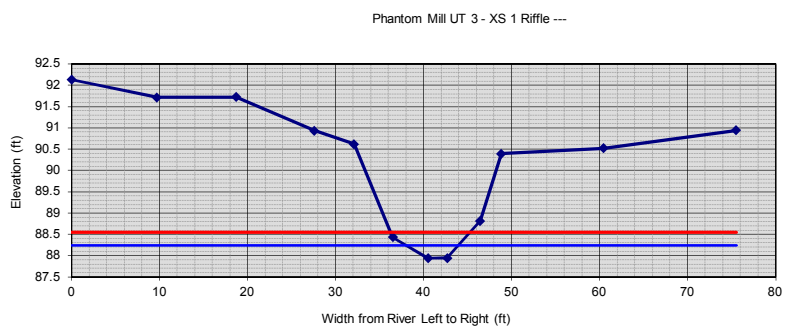
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
18.41	17.31	22.0		
81.59	82.69			

dimensions			
4.3	x-section area	0.4	d mean
11.0	width	11.1	wet P
0.8	d max	0.4	hyd radi
1.9	bank ht	28.4	w/d ratio
22.0	W flood prone area	2.0	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:	Phantom Mill UT 3 - XS 1
	Riffle

	---
description:	Phantom Mill UT 3 - XS 1
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	7.86859	92.13141
	☐	9.685084	8.285187	91.71481
	☐	18.71103	8.278515	91.72149
	☐	27.59718	9.063809	90.93619
	☐	32.09566	9.380943	90.61906
	☐	36.48507	11.5716	88.4284
	☐	40.47603	12.06442	87.93558
	☐	42.68722	12.05704	87.94296
	☐	46.43236	11.18701	88.81299
	☐	48.8097	9.607505	90.3925
	☐	60.40774	9.476062	90.52394
	☐	75.51973	9.060519	90.93948
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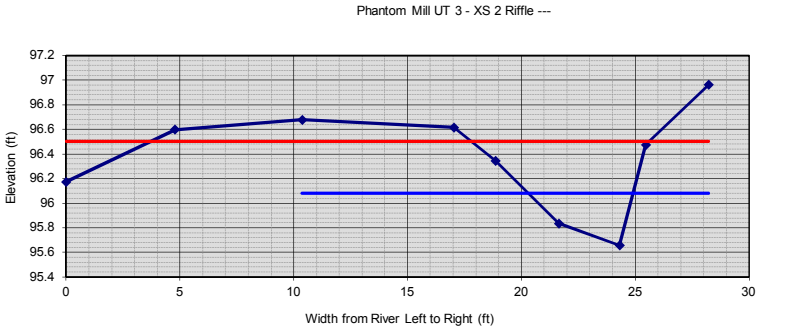
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
11.76	9.61	9.0		
88.24	90.39			

dimensions			
1.2	x-section area	0.2	d mean
6.0	width	6.0	wet P
0.3	d max	0.2	hyd radi
2.5	bank ht	28.8	w/d ratio
9.0	W flood prone area	1.5	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:	Phantom Mill UT 3 - XS 2
	Riffle

	---
description:	Phantom Mill UT 3 - XS 2
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	3.827859	96.17214
	☑	4.778658	3.403673	96.59633
	☐	10.3655	3.320819	96.67918
	☐	17.02528	3.384488	96.61551
	☐	18.85251	3.655956	96.34404
	☐	21.65066	4.164515	95.83549
	☐	24.30858	4.342916	95.65708
	☐	25.46695	3.523664	96.47634
	☐	28.23138	3.035459	96.96454
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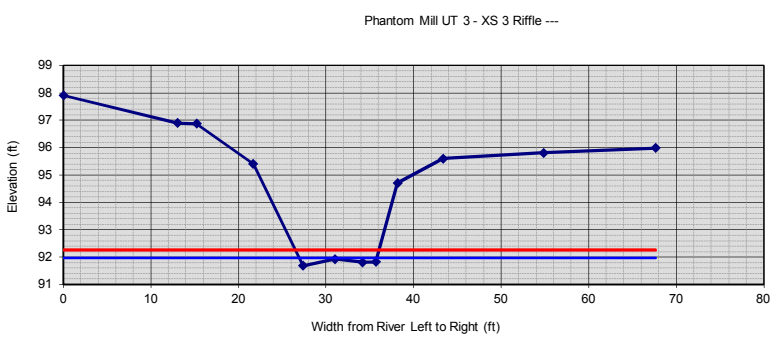
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
3.92	3.52	7.0		
96.08	96.48			

dimensions			
1.2	x-section area	0.3	d mean
4.6	width	4.8	wet P
0.4	d max	0.2	hyd radi
0.8	bank ht	18.0	w/d ratio
7.0	W flood prone area	1.5	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:	Phantom Mill UT 3 - XS 3
	Riffle

	---
description:	Phantom Mill UT 3 - XS 3
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	2.097765	97.90224
	☐	13.07324	3.102351	96.89765
	☐	15.21528	3.123303	96.8767
	☐	21.66522	4.591573	95.40843
	☐	27.35596	8.319891	91.68011
	☐	31.05913	8.069347	91.93065
	☐	34.13296	8.192031	91.80797
	☐	35.70674	8.172861	91.82714
	☐	38.19553	5.292567	94.70743
	☐	43.38275	4.394759	95.60524
	☐	54.82264	4.195809	95.80419
	☐	67.62177	4.01156	95.98844
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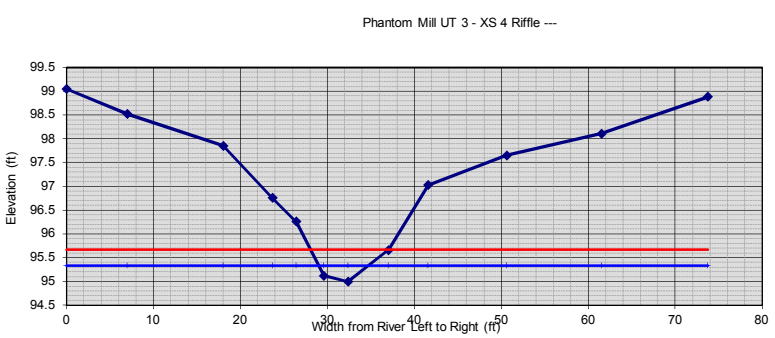
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
8.03	5.29	9.0		
91.97	94.71			

dimensions			
1.2	x-section area	0.1	d mean
8.9	width	9.1	wet P
0.3	d max	0.1	hyd radi
3.0	bank ht	64.5	w/d ratio
9.0	W flood prone area	1.0	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:	Phantom Mill UT 3 - XS 4
	Riffle

	---
description:	Phantom Mill UT 3 - XS 4
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	0.956009	99.04399
	☐	7.017477	1.480836	98.51916
	☐	18.00336	2.145554	97.85445
	☐	23.7115	3.241813	96.75819
	☐	26.38505	3.744053	96.25595
	☐	29.5976	4.881536	95.11846
	☐	32.37663	5.00751	94.99249
	☐	36.98714	4.343545	95.65646
	☐	41.59278	2.975665	97.02434
	☐	50.61449	2.352831	97.64717
	☐	61.52059	1.893316	98.10668
	☐	73.75524	1.119872	98.88013
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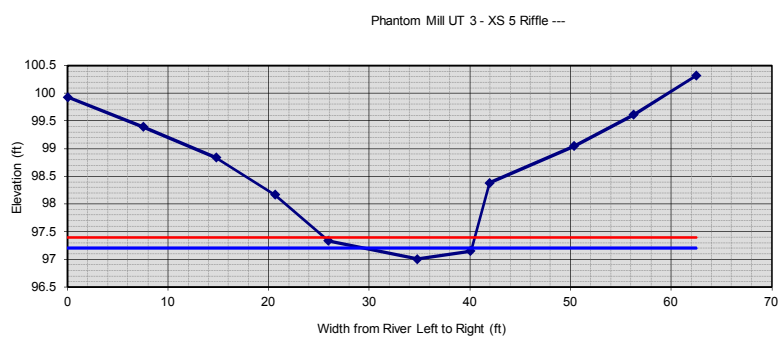
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
4.67	2.98	9.0		
95.33	97.02			

dimensions			
1.2	x-section area	0.2	d mean
5.7	width	5.8	wet P
0.3	d max	0.2	hyd radi
2.0	bank ht	26.8	w/d ratio
9.0	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:	Phantom Mill UT 3 - XS 5
	Riffle

	---
description:	Phantom Mill UT 3 - XS 5
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	0.070254	99.92975
	☐	7.535934	0.608059	99.39194
	☐	14.75761	1.160926	98.83907
	☐	20.64268	1.831061	98.16894
	☐	25.93962	2.666928	97.33307
	☐	34.77462	2.994273	97.00573
	☐	40.06381	2.850075	97.14993
	☐	41.92504	1.6179	98.3821
	☐	50.31229	0.956441	99.04356
	☐	56.23396	0.388357	99.61164
	☐	62.49862	-0.320675	100.3207
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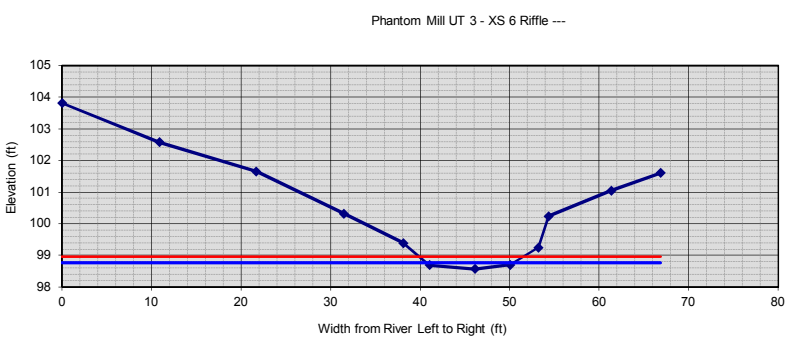
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
2.8	1.83	16.0		
97.2	98.17			

dimensions			
1.2	x-section area	0.1	d mean
10.6	width	10.6	wet P
0.2	d max	0.1	hyd radi
1.2	bank ht	97.2	w/d ratio
16.0	W flood prone area	1.5	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:	Phantom Mill UT 3 - XS 6
	Riffle

	---
description:	Phantom Mill UT 3 - XS 6
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	-3.81134	103.8113
	☐	10.87349	-2.571387	102.5714
	☐	21.65921	-1.656635	101.6566
	☐	31.44534	-0.316773	100.3168
	☐	38.13291	0.607398	99.3926
	☐	41.05225	1.305814	98.69419
	☐	46.12162	1.435636	98.56436
	☐	50.05498	1.300495	98.69951
	☐	53.19538	0.758957	99.24104
	☐	54.35809	-0.237288	100.2373
	☐	61.34587	-1.045139	101.0451
	☐	66.81415	-1.603378	101.6034
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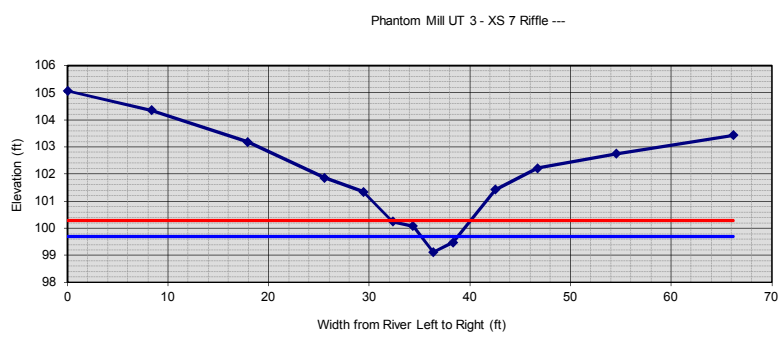
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
1.24	0.61	12.0		
98.76	99.39			

dimensions			
1.2	x-section area	0.1	d mean
9.6	width	9.6	wet P
0.2	d max	0.1	hyd radi
0.8	bank ht	78.2	w/d ratio
12.0	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:	Phantom Mill UT 3 - XS 7
	Riffle

	---
description:	Phantom Mill UT 3 - XS 7
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	-5.064162	105.0642
	☐	8.34158	-4.354744	104.3547
	☐	17.90665	-3.186172	103.1862
	☐	25.54458	-1.861133	101.8611
	☐	29.39587	-1.346353	101.3464
	☐	32.34075	-0.244303	100.2443
	☐	34.33255	-0.08455	100.0846
	☐	36.3247	0.882649	99.11735
	☐	38.28887	0.518209	99.48179
	☐	42.53792	-1.422359	101.4224
	☐	46.71732	-2.217367	102.2174
	☐	54.53172	-2.742968	102.743
	☐	66.17434	-3.431943	103.4319
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FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
0.3	-1.42	8.0		
99.7	101.42			

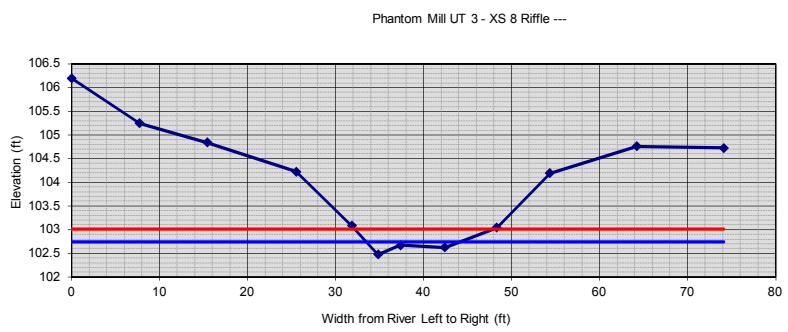
dimensions			
1.2	x-section area	0.3	d mean
3.6	width	3.9	wet P
0.6	d max	0.3	hyd radi
2.3	bank ht	11.2	w/d ratio
8.0	W flood prone area	2.2	ent ratio

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		

For additional cross sections make a copy of the "Dimension" worksheet.
To create a copy "right click" on the dimension tab below.

Cross Section



section:	Phantom Mill UT 3 - XS 8
	Riffle

	---
description:	Phantom Mill UT 3 - XS 8
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	-6.191112	106.1911
	☐	7.718932	-5.246033	105.246
	☐	15.41346	-4.836989	104.837
	☐	25.50134	-4.221575	104.2216
	☐	31.82403	-3.080941	103.0809
	☐	34.80156	-2.469532	102.4695
	☐	37.36026	-2.669046	102.669
	☐	42.43058	-2.619479	102.6195
	☐	48.29427	-3.043273	103.0433
	☐	54.34575	-4.191743	104.1917
	☐	64.18063	-4.75629	104.7563
	☐	74.10857	-4.726187	104.7262
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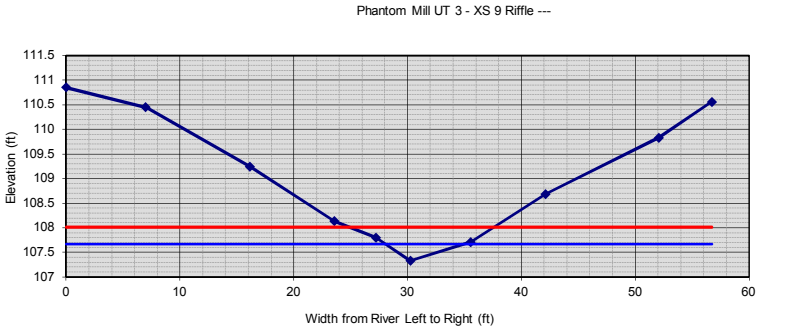
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-2.74	-4.19	16.0		
102.74	104.19			

dimensions			
1.2	x-section area	0.1	d mean
10.6	width	10.7	wet P
0.3	d max	0.1	hyd radi
1.7	bank ht	93.8	w/d ratio
16.0	W flood prone area	1.5	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:	Phantom Mill UT 3 - XS 9
	Riffle

	---
description:	Phantom Mill UT 3 - XS 9
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	-10.8497	110.8497
	☐	6.992027	-10.44974	110.4497
	☐	16.15819	-9.235922	109.2359
	☐	23.58433	-8.132643	108.1326
	☐	27.21037	-7.797847	107.7978
	☐	30.2499	-7.329286	107.3293
	☐	35.55532	-7.712135	107.7121
	☐	42.13957	-8.688877	108.6889
	☐	52.05743	-9.830967	109.831
	☐	56.723	-10.56082	110.5608
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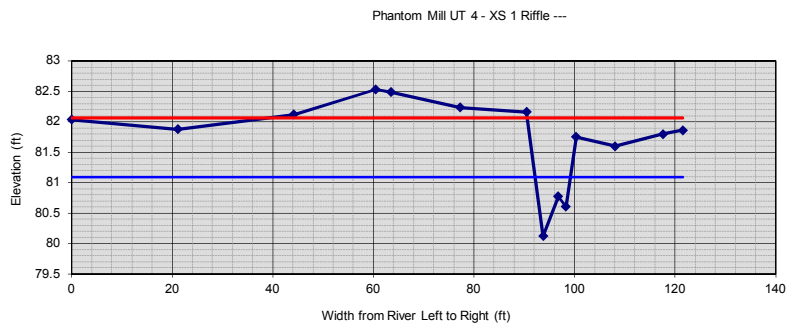
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-7.67	-7.79	12.0		
107.67	107.79			

dimensions			
1.2	x-section area	0.2	d mean
6.9	width	7.0	wet P
0.3	d max	0.2	hyd radi
0.5	bank ht	40.7	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:	Phantom Mill UT 4 - XS 1
	Riffle

	---
description:	Phantom Mill UT 4 - XS 1
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	17.96411	82.03589
	☐	21.09949	18.12086	81.87914
	☐	44.19494	17.88278	82.11722
	☐	60.4864	17.46993	82.53007
	☐	63.53147	17.51107	82.48894
	☐	77.28794	17.76334	82.23666
	☐	90.48713	17.83727	82.16273
	☐	93.75562	19.88147	80.11853
	☐	96.7749	19.22628	80.77372
	☐	98.2682	19.39816	80.60184
	☐	100.3017	18.25109	81.74891
	☐	108.0602	18.40344	81.59656
	☐	117.5538	18.20419	81.79582
	☐	121.4853	18.13699	81.86301
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FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
18.91	18.25	34.0		
81.09	81.75			

dimensions			
3.5	x-section area	0.5	d mean
6.9	width	7.4	wet P
1.0	d max	0.5	hyd radi
1.6	bank ht	13.7	w/d ratio
34.0	W flood prone area	4.9	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:	Phantom Mill UT 4 - XS 2
	Riffle

	---
description:	Phantom Mill UT 4 - XS 2
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	17.11737	82.88263
	☐	3.491141	17.5417	82.4583
	☐	6.544886	17.6248	82.3752
	☐	7.739999	18.64122	81.35879
	☐	9.325043	18.67213	81.32787
	☐	11.06495	17.91848	82.08153
	☐	12.33544	17.22463	82.77538
	☐	16.58344	17.47948	82.52052
	☐	27.0269	17.44944	82.55057
	☐	36.08649	17.62964	82.37036
	☐	41.24042	17.57052	82.42948
	☐	54.05933	17.62514	82.37486
	☑	76.7523	17.72988	82.27012
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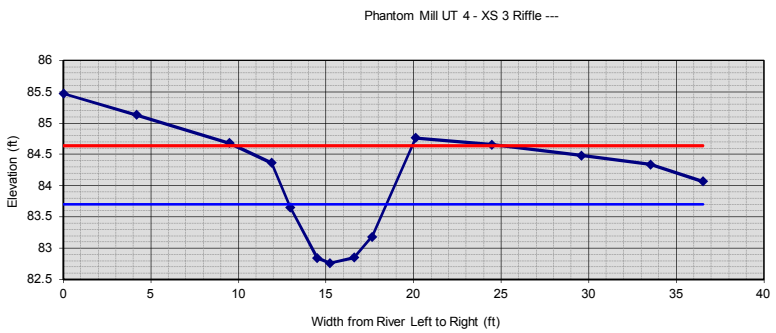
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
17.63	17.62	100.0		
82.37	82.38			

dimensions			
3.5	x-section area	0.7	d mean
5.0	width	5.6	wet P
1.0	d max	0.6	hyd radi
1.1	bank ht	7.3	w/d ratio
100.0	W flood prone area	19.8	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: **Phantom Mill UT 4 - XS 3**

Riffle

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description: **Phantom Mill UT 4 - XS 3**

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

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	14.52655	85.47346
	☐	4.180838	14.86637	85.13363
	☐	9.484878	15.31661	84.68339
	☐	11.87742	15.634	84.366
	☐	12.94906	16.3447	83.6553
	☐	14.48794	17.15398	82.84602
	☐	15.20213	17.23846	82.76154
	☐	16.60315	17.14854	82.85146
	☐	17.62486	16.81671	83.18329
	☐	20.10095	15.23462	84.76538
	☐	24.46188	15.34411	84.65589
	☐	29.58037	15.52095	84.47905
	☐	33.51425	15.66227	84.33774
	☐	36.52415	15.93218	84.06782
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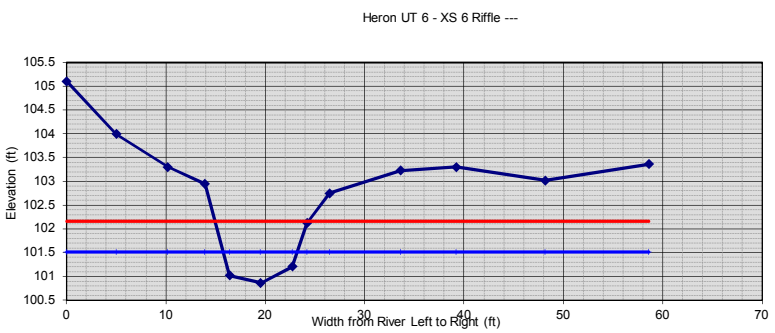
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
16.3	15.63	10.0		
83.7	84.37			

dimensions			
3.5	x-section area	0.6	d mean
5.6	width	6.0	wet P
0.9	d max	0.6	hyd radi
1.6	bank ht	8.8	w/d ratio
10.0	W flood prone area	1.8	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: **Heron UT 6 - XS 6**

Riffle

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description: **Heron UT 6 - XS 6**

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

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	-5.107818	105.1078
	☐	5.010166	-3.995349	103.9953
	☐	10.19764	-3.297722	103.2977
	☐	13.92587	-2.945199	102.9452
	☐	16.40797	-1.019446	101.0194
	☐	19.53875	-0.863434	100.8634
	☐	22.70209	-1.203885	101.2039
	☐	24.20329	-2.119199	102.1192
	☐	26.45447	-2.745982	102.746
	☐	33.58295	-3.22527	103.2253
	☐	39.22602	-3.301976	103.302
	☐	48.18361	-3.019769	103.0198
	☐	58.58147	-3.358079	103.3581
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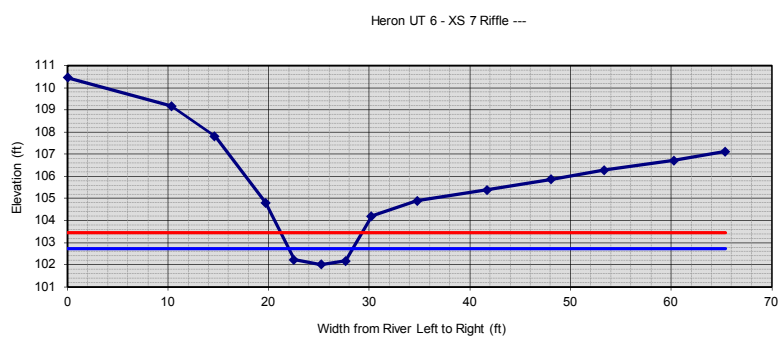
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-1.51	-2.75	8.0		
101.51	102.75			

dimensions			
3.5	x-section area	0.5	d mean
7.4	width	7.7	wet P
0.6	d max	0.5	hyd radi
1.9	bank ht	15.7	w/d ratio
8.0	W flood prone area	1.1	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:	Heron UT 6 - XS 7
	Riffle

	---
description:	Heron UT 6 - XS 7
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	-10.45259	110.4526
	☐	10.307	-9.163992	109.164
	☐	14.60834	-7.807966	107.808
	☐	19.68968	-4.807787	104.8078
	☐	22.50318	-2.234225	102.2342
	☐	25.1908	-2.012344	102.0123
	☐	27.62137	-2.178747	102.1787
	☐	30.19682	-4.200131	104.2001
	☐	34.76816	-4.892201	104.8922
	☐	41.66387	-5.376576	105.3766
	☐	48.01961	-5.855613	105.8556
	☐	53.35921	-6.276139	106.2761
	☐	60.2526	-6.718926	106.7189
	☐	65.37831	-7.122694	107.1227
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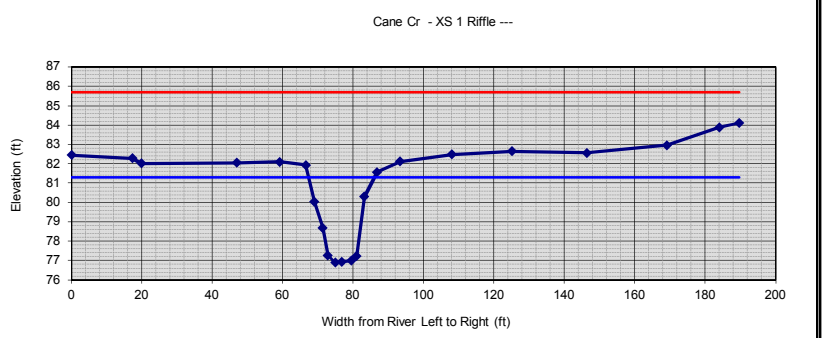
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-2.73	-4.2	8.0		
102.73	104.2			

dimensions			
3.5	x-section area	0.6	d mean
6.4	width	6.8	wet P
0.7	d max	0.5	hyd radi
2.2	bank ht	11.6	w/d ratio
8.0	W flood prone area	1.3	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: **Cane Cr - XS 1**

Riffle

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description: **Cane Cr - XS 1**

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

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**17.55752**	82.44248
	☐	**17.24092**	**17.72232**	82.27768
	☐	**19.89204**	**17.9855**	82.0145
	☐	**46.8435**	**17.95477**	82.04523
	☐	**59.14002**	**17.89916**	82.10085
	☐	**66.53341**	**18.07183**	81.92817
	☐	**68.94507**	**19.96212**	80.03789
	☐	**71.34559**	**21.31169**	78.68831
	☐	**72.79231**	**22.7294**	77.2706
	☐	**74.87398**	**23.11148**	76.88852
	☐	**76.74561**	**23.05571**	76.94429
	☐	**79.43147**	**23.01591**	76.9841
	☐	**80.94416**	**22.76591**	77.23409
	☐	**83.16786**	**19.70798**	80.29202
	☐	**86.74999**	**18.43383**	81.56617
	☐	**93.32139**	**17.89145**	82.10855
	☐	**108.0176**	**17.51848**	82.48152
	☐	**125.0808**	**17.35639**	82.64361
	☐	**146.3736**	**17.43801**	82.56199
	☐	**169.1367**	**17.04336**	82.95664
	☐	**184.0402**	**16.10967**	83.89033
	☐	**189.6414**	**15.89224**	84.10776
	☐			
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	☐			

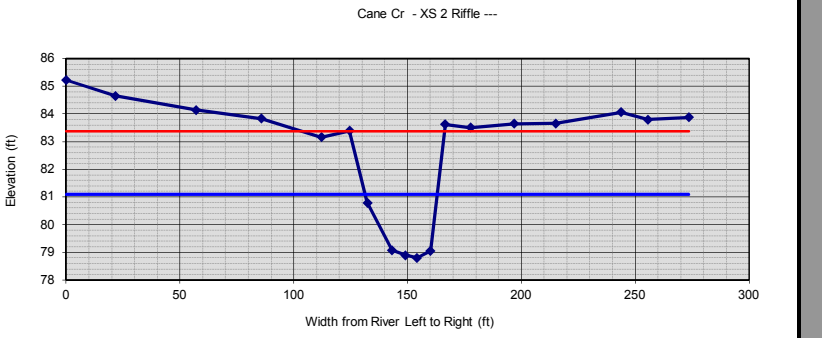
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
18.71	**18.07**	**100.0**		
81.29	81.93			

dimensions			
52.3	x-section area	2.8	d mean
18.6	width	21.8	wet P
4.4	d max	2.4	hyd radi
5.0	bank ht	6.6	w/d ratio
100.0	W flood prone area	5.4	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		

Cross Section



section: **Cane Cr - XS 2**

Riffle

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description: **Cane Cr - XS 2**

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

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**14.78345**	85.21656
	☐	**21.54154**	**15.35396**	84.64604
	☐	**56.97165**	**15.85945**	84.14055
	☐	**85.8326**	**16.16453**	83.83547
	☐	**112.1224**	**16.84399**	83.15601
	☐	**124.4625**	**16.61006**	83.38994
	☐	**132.2835**	**19.21731**	80.78269
	☐	**143.0947**	**20.92754**	79.07246
	☐	**149.1254**	**21.10239**	78.89761
	☐	**154.0596**	**21.19658**	78.80342
	☐	**160.0764**	**20.9439**	79.0561
	☐	**166.568**	**16.37983**	83.62017
	☐	**177.6603**	**16.49776**	83.50224
	☐	**196.6882**	**16.35302**	83.64699
	☐	**215.1795**	**16.33893**	83.66107
	☐	**243.8702**	**15.94223**	84.05777
	☐	**255.5502**	**16.20897**	83.79103
	☐	**273.5783**	**16.12668**	83.87332
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

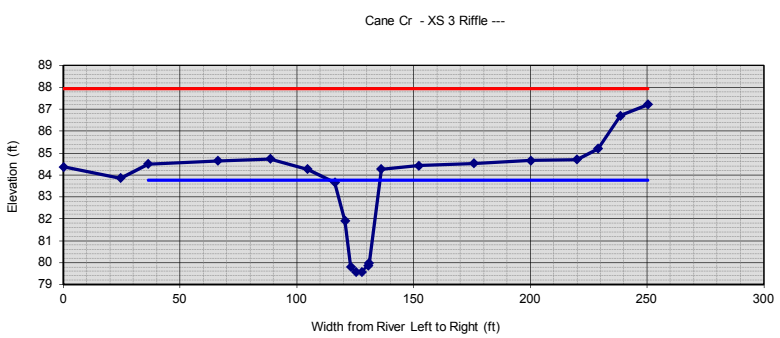
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
18.912	**16.61**	**50.0**		
81.088	83.39			

dimensions			
52.3	x-section area	1.7	d mean
31.6	width	32.4	wet P
2.3	d max	1.6	hyd radi
4.6	bank ht	19.1	w/d ratio
50.0	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: Cane Cr - XS 3
Riffle

---
description: Cane Cr - XS 3
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	15.62401	84.37599
	☑	24.54642	16.14107	83.85893
	☐	36.29047	15.49576	84.50424
	☐	66.16153	15.35541	84.64459
	☐	88.6318	15.26743	84.73257
	☐	104.5282	15.73679	84.26322
	☐	116.2065	16.34656	83.65344
	☐	120.6192	18.09807	81.90193
	☐	123.0781	20.2078	79.79221
	☐	125.3899	20.41736	79.58264
	☐	127.727	20.4259	79.5741
	☐	130.498	20.13134	79.86866
	☐	130.963	20.02357	79.97643
	☐	136.1392	15.73062	84.26938
	☐	152.2988	15.57221	84.42779
	☐	175.7635	15.46654	84.53346
	☐	200.2727	15.33542	84.66458
	☐	219.8545	15.2976	84.7024
	☐	229.0117	14.80257	85.19743
	☐	238.5714	13.2864	86.7136
	☐	250.3852	12.78749	87.21251
	☐			
	☐			
	☐			
	☐			

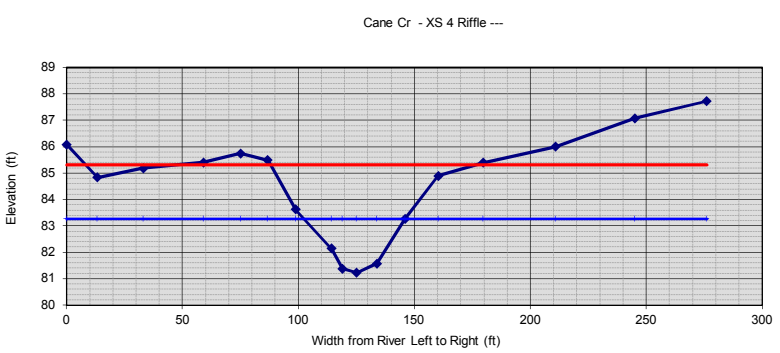
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
16.245	15.73	100.0		
83.755	84.27			

dimensions			
52.3	x-section area	2.5	d mean
21.3	width	23.8	wet P
4.2	d max	2.2	hyd radi
4.7	bank ht	8.6	w/d ratio
100.0	W flood prone area	4.7	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: Cane Cr - XS 4
Riffle

---
description: Cane Cr - XS 4
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	13.91288	86.08712
	☐	13.32872	15.16159	84.83841
	☐	32.989	14.81373	85.18627
	☐	59.05505	14.59576	85.40424
	☐	75.04803	14.25477	85.74523
	☐	86.726	14.50764	85.49236
	☐	98.68405	16.37873	83.62127
	☐	114.2546	17.85455	82.14545
	☐	118.8834	18.61479	81.38521
	☐	125.1111	18.77623	81.22377
	☐	133.8914	18.42256	81.57744
	☐	145.9664	16.72518	83.27482
	☐	160.3655	15.10535	84.89465
	☐	179.6003	14.60332	85.39668
	☐	210.8986	13.99769	86.00232
	☐	245.1682	12.92186	87.07814
	☐	276.0975	12.2727	87.7273
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

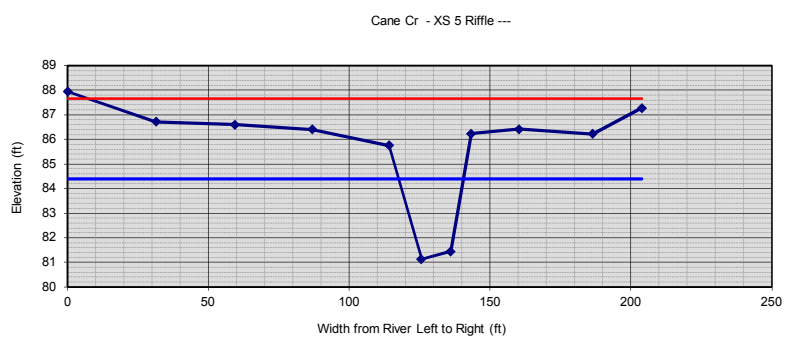
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
16.735	15.01	90.0		
83.265	84.99			

dimensions			
52.3	x-section area	1.2	d mean
43.5	width	43.7	wet P
2.0	d max	1.2	hyd radi
3.8	bank ht	36.1	w/d ratio
90.0	W flood prone area	2.1	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: **Cane Cr - XS 5**

Riffle

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description: **Cane Cr - XS 5**

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

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**12.05058**	87.94942
	☐	**31.34555**	**13.28383**	86.71617
	☐	**59.41993**	**13.40849**	86.59151
	☐	**86.77879**	**13.59677**	86.40324
	☐	**114.1523**	**14.2493**	85.7507
	☐	**125.581**	**18.86648**	81.13352
	☐	**136.0273**	**18.55885**	81.44116
	☐	**143.3225**	**13.76346**	86.23654
	☐	**160.2602**	**13.58736**	86.41264
	☐	**186.4354**	**13.77651**	86.22349
	☐	**203.9266**	**12.72413**	87.27587
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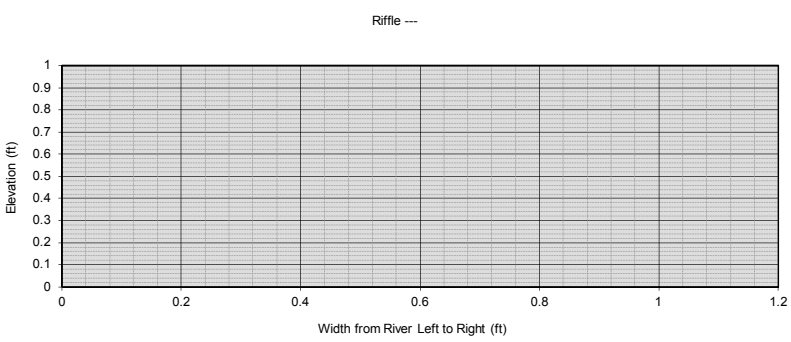
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
15.605	**14.25**	**100.0**		
84.395	85.75			

dimensions			
52.3	x-section area	2.3	d mean
23.0	width	24.5	wet P
3.3	d max	2.1	hyd radi
4.6	bank ht	10.1	w/d ratio
100.0	W flood prone area	4.3	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:

Riffle

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description:

height of instrument (ft):

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐			
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	☐			
	☐			

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
0	---			

dimensions			
0.0	x-section area	0.0	d mean
0.0	width	0.0	wet P
0.0	d max	0.0	hyd radi
0.0	bank ht	0.0	w/d ratio
0.0	W flood prone area	0.0	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		

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill Cane Creek
Stream Category: Pa3
Date of Evaluation: 171222
Assessor Name/Organization: Perkinson - Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill UT-1 | Date of Evaluation: 171222
Stream Category: Pb1 | Assessor Name/Organization: Perkinson - Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**MEDIUM**	**MEDIUM**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**MEDIUM**	**MEDIUM**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Streamside Area Vegetation	**LOW**	**LOW**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**OMITTED**	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**LOW**
(2) In-stream Habitat	**LOW**	**LOW**
(3) Baseflow	**MEDIUM**	**MEDIUM**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**LOW**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone Habitat	NA	NA
Overall	**LOW**	**LOW**

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill UT-2 | Date of Evaluation: 171222
Stream Category: Pa1 | Assessor Name/Organization: Perkinson - Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**HIGH**	
(3) Streamside Area Attenuation	**HIGH**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**HIGH**	
(4) Microtopography	**HIGH**	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**HIGH**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**HIGH**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**HIGH**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**HIGH**	
(3) Thermoregulation	**HIGH**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**MEDIUM**	

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill UT-3 | Date of Evaluation: 171222
Stream Category: Pb1 | Assessor Name/Organization: Perkinson - Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**HIGH**	**HIGH**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Streamside Area Vegetation	**LOW**	**LOW**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**LOW**	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**MEDIUM**
(2) In-stream Habitat	**LOW**	**HIGH**
(3) Baseflow	**MEDIUM**	**MEDIUM**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**HIGH**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone Habitat	NA	NA
Overall	**LOW**	**LOW**

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill UT-4
Date of Evaluation: 172122
Stream Category: Pb1
Assessor Name/Organization: Perkinson/Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**MEDIUM**	**MEDIUM**
(2) Baseflow	**HIGH**	**HIGH**
(2) Flood Flow	**MEDIUM**	**MEDIUM**
(3) Streamside Area Attenuation	**MEDIUM**	**MEDIUM**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**MEDIUM**	**MEDIUM**
(4) Microtopography	NA	NA
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(4) Channel Stability	**HIGH**	**HIGH**
(4) Sediment Transport	**MEDIUM**	**MEDIUM**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**HIGH**	**HIGH**
(2) Baseflow	**HIGH**	**HIGH**
(2) Streamside Area Vegetation	**HIGH**	**HIGH**
(3) Upland Pollutant Filtration	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Indicators of Stressors	**NO**	**NO**
(2) Aquatic Life Tolerance	**OMITTED**	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**MEDIUM**	**HIGH**
(2) In-stream Habitat	**LOW**	**HIGH**
(3) Baseflow	**HIGH**	**HIGH**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**HIGH**
(2) Stream-side Habitat	**HIGH**	**HIGH**
(3) Stream-side Habitat	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone Habitat	NA	NA
Overall	**MEDIUM**	**HIGH**

NC WAM Wetland Rating Sheet

Accompanies User Manual Version 5.0

Wetland Site Name	All Existing Wetlands	Date	1/9/2018
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Jernigan/Axiom

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
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **MEDIUM**

Phantom Mill UT2

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Euliss UT-2	**Latitude:** 35.889892
Evaluator: Jernigan – Axiom	**County:** Alamance	**Longitude:** -79.472613
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 34.5	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	(.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 9)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	(3)
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Mayfly, amphipods, caddisfly observed

Sketch:

Phantom Mill UT1
(Form 1)

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Phantom Mill	**Latitude:** 35.887917
Evaluator: Lewis Axiom	**County:** Alamance	**Longitude:** -79.474709
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 16.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 7)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	(1)	2	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	(0)	1	2	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	(No = 0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4.5)				
12. Presence of Baseflow	(0)	1	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 5)				
18. Fibrous roots in streambed	3	(2)	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Phantom Mill UT1 (Form 2)

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Euliss UT1 DS Headcut	**Latitude:** 35.888120
Evaluator: Jernigan - Ariem	**County:** Alamance	**Longitude:** -79.474720
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	1	(2)	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	1	2	(3)
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Phantom Mill UT 3
Form 3

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Phantom Mill	**Latitude:** 35.894334
Evaluator: Lewis - Axiom	**County:** Alamance	**Longitude:** -79.478732
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 32	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	1	2	(3)
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Phantom Mill UT4

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Eulas UT-4	**Latitude:** 35.893467
Evaluator: Jernigan - Axiom	**County:** Alamance	**Longitude:** -79.474310
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 34.5	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 7.5)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	(0.5)	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: 1 Salamander and 1 amphipod observed

Sketch:

Site		Phanton Mill Steam and Wetland Mitigation Site						
Stream		Cane Creek			Bank Length		3312	
Observers		Perkinson			Date		22-Dec-17	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	187	left	moderate	low	0.01	187	4.92	9.2
2	495	left	moderate	moderate	0.013	308	4.4	17.6
3	940	left	moderate	moderate	0	445	4.4	0.0
4	1144	left	low	low	0.1	204	4.7	95.9
5	1656	left	moderate	low	0.01	512	4.6	23.6
6								
7								
8								
9								0.0
10	187	right	moderate	low	0.1	187	4.92	92.0
11	495	right	moderate	moderate	0.015	308	4.4	20.3
12	940	right	moderate	moderate	0.1	445	4.5	200.3
13	1144	right	low	low	0.014	204	4.8	13.7
14	1656	right	moderate	low	0.013	512	4.5	30.0
15								
16								
17								0.0
18								0.0
19								0.0
20								0.0
21								0.0
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		502.5
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		18.6
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		24.2
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.01

Site		Phantom Mill Steam and Wetland Mitigation Site						
Stream		UT 2			Bank Length		1622	
Observers		Perkinson			Date		22-Dec-17	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	427	left	low	low	0	427	2.9	0.0
2	451	left	moderate	low	0.1	24	1.4	3.4
3	779	left	moderate	low	0.015	328	2	9.8
4	811	left	low	low	0	32	2.2	0.0
5								
6								
7								
8								
9								
10	427	right	low	low	0	427	2.9	0.0
11	451	right	moderate	low	0.1	24	1.4	3.4
12	779	right	moderate	low	0.015	328	2	9.8
13	811	right	low	low	0	32	2.21	0.0
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		26.4
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		1.0
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		1.3
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.00

Site		Phantom Mill Steam and Wetland Mitigation Site						
Stream		UT 3			Bank Length		2338	
Observers		Perkinson			Date		22-Dec-17	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	272	left	moderate	low	0.013	272	2.2	7.8
2	425	left	low	low	0.001	153	2	0.3
3	543	left	low	low	0	118	2	0.0
4	708	left	high	low	0.11	165	1.8	32.7
5	1169	left	low	low	0.001	461	2.2	1.0
6								0.0
7								0.0
8								0.0
9								0.0
10	272	right	moderate	low	0.013	272	2.2	7.8
11	425	right	high	low	0.1	153	2	30.6
12	543	right	moderate	low	0.013	118	0.7	1.1
13	708	right	high	low	0.11	165	1.7	30.9
14	1169	right	low	low	0.001	461	2.3	1.1
15								0.0
16								0.0
17								0.0
18								0.0
19								0.0
20								0.0
21								0.0
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		113.1
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		4.2
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		5.4
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.00

Site		Phantom Mill Steam and Wetland Mitigation Site						
Stream		UT 4			Bank Length		440	
Observers		Perkinson			Date		22-Dec-17	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	40	left	moderate	low	0.02	40	2.3	1.8
2	220	left	low	low	0	180	3	0.0
3								0.0
4								0.0
5								0.0
6								0.0
7								0.0
8								0.0
9								0.0
10	40	right	moderate	low	0.02	40	2.5	2.0
11	220	right	low	low	0	180	3	0.0
12								0.0
13								0.0
14								0.0
15								0.0
16								0.0
17								0.0
18								0.0
19								0.0
20								0.0
21								0.0
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		3.8
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		0.1
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		0.2
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.00

BEHI/NBS Summary

Stream Reach	Erosion Rate (tons/year)
Cane Creek	24.2
UT 2	1.3
UT 3	5.4
UT 4	0.2
Total	**31.1**

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Project/Site: Phantom Mill Stream & Wetland Mitigation Site

County, State: Alamance, NC

Sampling Point/ Coordinates: Hydric Soil - A / 35.891954, -79.477303

Investigator: Lewis

Notes: Location of soil profile is depicted on Figure 4 (Existing Conditions).

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-3	10YR 5/3	95	10YR 5/6	5	silty clay loam
3-5	10YR 5/3	80	10YR 5/6	20	silty clay
5-12+	10YR 6/2	90	10YR 5/6	10	silty clay

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Project/Site: Phantom Mill Stream & Wetland Mitigation Site

County, State: Alamance, NC

Sampling Point/ Coordinates: Hydric Soil - B / 35.890531, -79.472788

Investigator: Lewis

Notes: Location of soil profile is depicted on Figure 4 (Existing Conditions).

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10YR 3/1	85	10YR 5/1	5	silty loam
			10YR 5/6	10	
6-9	10YR 4/1	95	10YR 5/6	5	loamy sand
9+	2.5Y 6/2	95	10YR 5/6	5	loamy sand

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Project/Site: Phantom Mill Stream & Wetland Mitigation Site

County, State: Alamance, NC

Sampling Point/
Coordinates: Hydric Soil - C / 35.893049, -79.475747

Investigator: Lewis

Notes: Location of soil profile is depicted on Figure 4 (Existing Conditions).

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-3	10YR 6/1	90	10YR 5/6	10	silty loam
3-7	10YR 6/1	70	10YR 5/6	15	loam
			Gley 5/1	15	
7+	Gley 6/1	70	10YR 6/1	15	clay loam
			10YR 5/6	15	

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

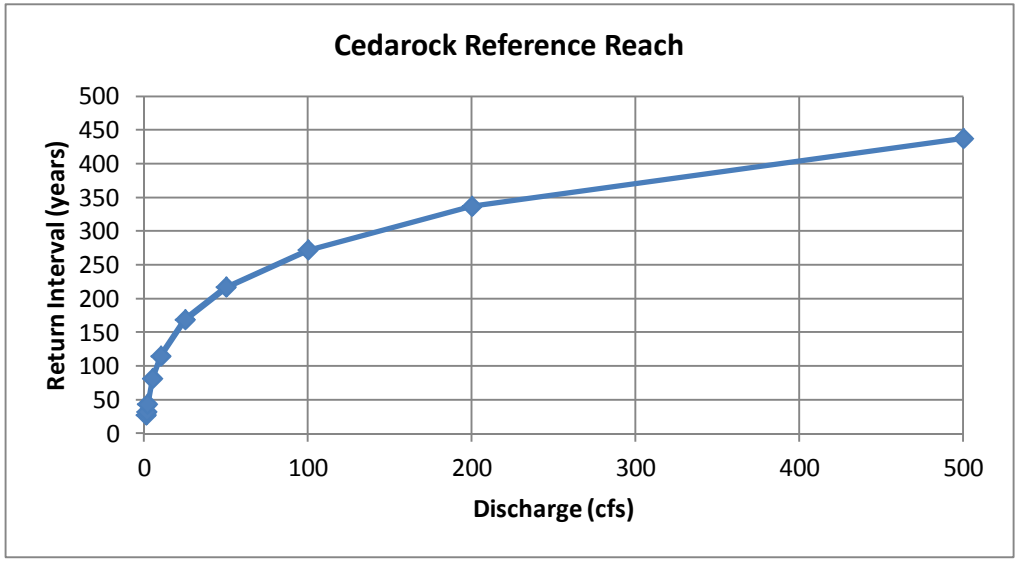
Name/Print: W. Grant Lewis

Appendix C
Flood Frequency Analysis Data

Reference Reaches
Flood Frequency Analaysis-Regional Regression Equation (USGS 2004)

Cedarock Reference Reach

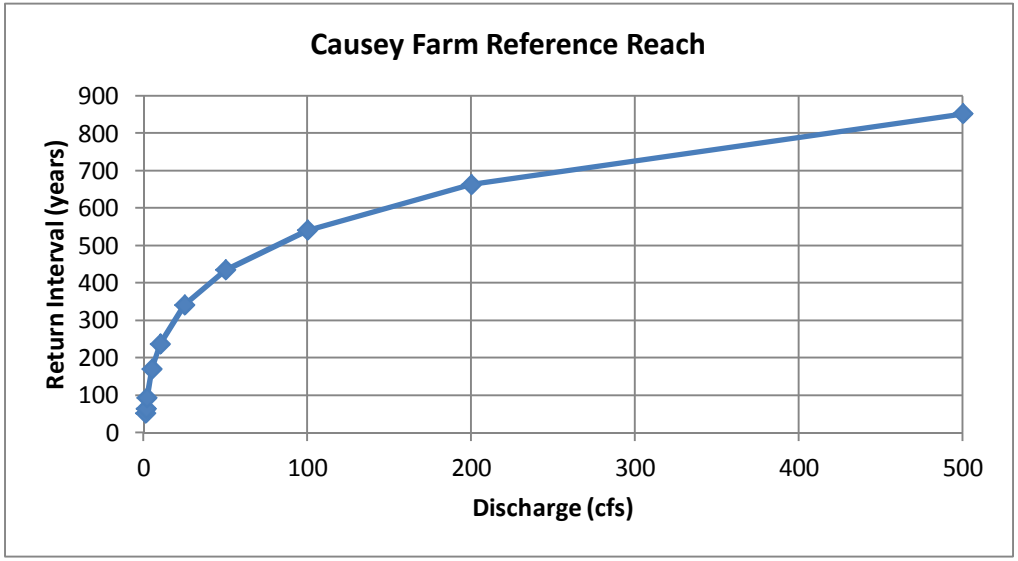
Return Interval (years)	Discharge (cfs)
1.3	**27**
1.5	**32**
2	43.6
5	81.4
10	115
25	169
50	217
100	272
200	337
500	438



Note: Bold values are interpolated.

Causey Farm Reference Reach

Return Interval (years)	Discharge (cfs)
1.3	**53**
1.5	**65**
2	94.3
5	171
10	238
25	342
50	435
100	541
200	663
500	852



Appendix D
Jurisdictional Determination Info

SAW-2018-01166

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2018-01166** County: **Alamance** U.S.G.S. Quad: **NC-Snow Camp**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: **NCDEQ DMS**
Attn: Tim Baumgartner
Address: **1619 Mail Service Center**
Raleigh, NC 27699-1619

Size (acres) **~18** Nearest Town **Snow Camp**
Nearest Waterway **Cane Creek** River Basin **Cape Fear**
USGS HUC **03030002** Coordinates **35.8924 N, -79.4754 W**
Location description: **The project area is located along Cane Creek (South side of Haw River), approximately 0.25 mile east of Coble Mill Road, near Snow Camp, Alamance County, North Carolina. The Project Area is shown as the "Phantom Mill Stream and Wetland Mitigation Site Easement" on the attached Figure 3, titled "Potential Waters of the US."**

Indicate Which of the Following Apply:

A. Preliminary Determination

☒ **There appear to be waters including wetlands, on the above described project area, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). The waters including wetlands, have been delineated, and the delineation has been verified by the Corps to be sufficiently accurate and reliable. The approximate boundaries of these waters are shown on the enclosed delineation map dated August 2018. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.**

☐ There appear to be waters including wetlands, on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). However, since the waters including wetlands, have not been properly delineated, this preliminary jurisdiction determination may not be used in the permit evaluation process. Without a verified wetland delineation, this preliminary determination is merely an effective presumption of CWA/RHA jurisdiction over all of the waters including wetlands, at the project area, which is not sufficiently accurate and reliable to support an enforceable permit decision. We recommend that you have the waters including wetlands, on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

B. Approved Determination

☐ There are Navigable Waters of the United States within the above described project area/property subject to the permit requirements of Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403) and Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐ There are waters including wetlands, on the above described project area/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 recommend you have the waters including wetlands, on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

☐ The waters including wetlands, on your project area/property have been delineated and the delineation has been verified by the Corps. The approximate boundaries of these waters are shown on the enclosed delineation map dated MAP DATE. If you wish to have the delineation surveyed, the Corps can review and verify the survey upon completion. Once verified, this survey will

provide an accurate depiction of all areas subject to CWA and/or RHA 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 including wetlands, have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on SURVEY SIGNED DATE. 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 project area/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.

☐ The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management in Morehead City, NC, at (252) 808-2808 to determine their requirements.

Placement of dredged or fill material within waters of the US, including wetlands, without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **David Bailey at (919) 554-4884 X 30 or David.E.Bailey2@usace.army.mil**.

C. Basis For Determination: See the Preliminary Jurisdictional Determination form dated 5/7/2019.

D. Remarks: None.

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' 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.

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

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 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:

US Army Corps of Engineers
South Atlantic Division
Attn: Jason Steele, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801

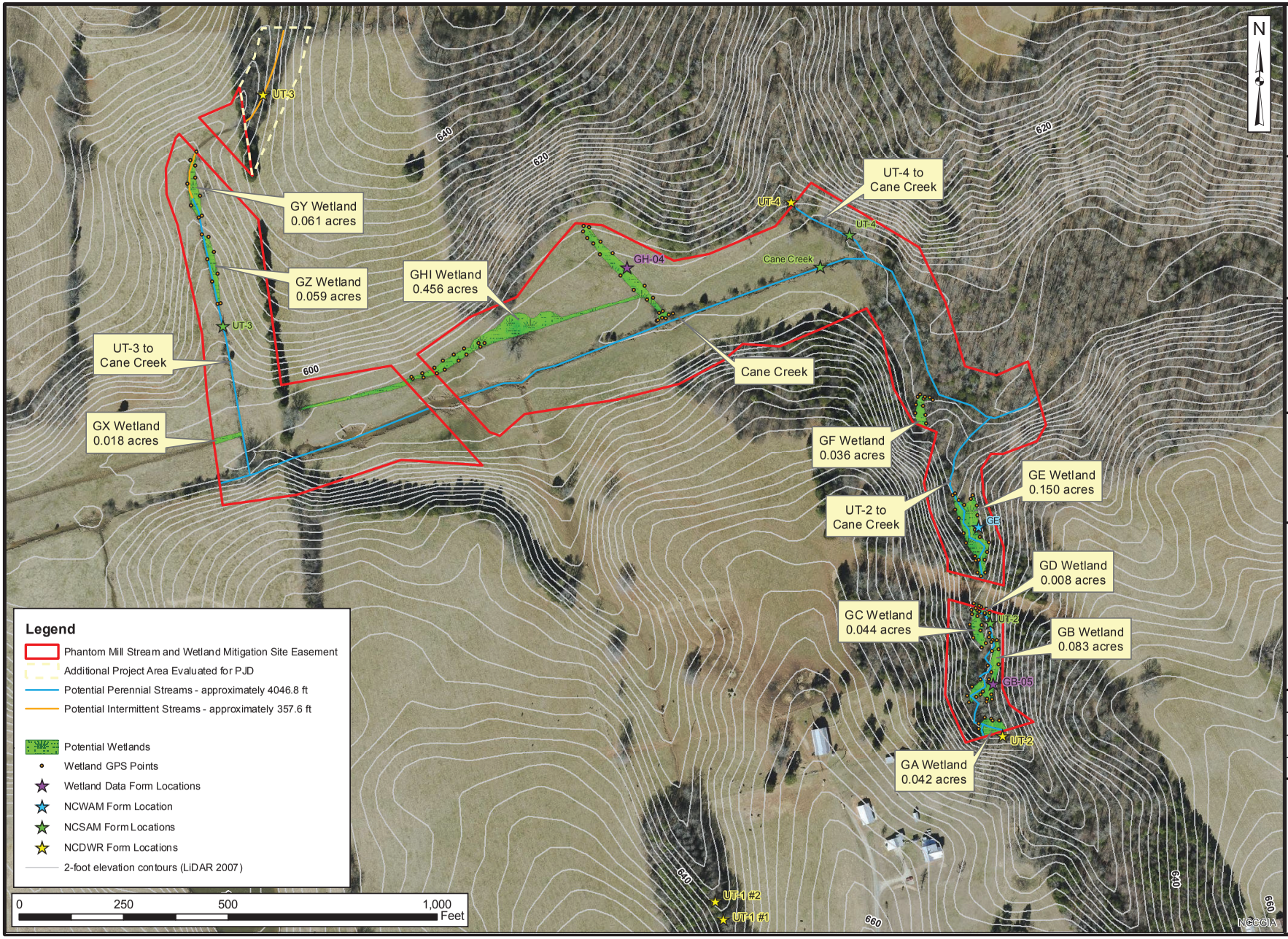
In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **Not applicable**.
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: David E Bailey Digitally signed by BAILEY.DAVID.E.1379283736 Date: 2019.05.07 10:58:41 -04'00'

Date of JD: **5/7/2019** Expiration Date of JD: **Not applicable**

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 our Customer Satisfaction Survey, located online at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Copy furnished:
Sue Homewood, NCDEQ-DWR, 450 W. Hanes Mill Rd, Suite 300, Winston-Salem, NC 27105



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

POTENTIAL WATERS OF THE US

Notes:

1. Background Imagery Source: 2014 aerial photography provided by the NC OneMap program (online, provided by the NC Geographic Information Coordination Council)

Drawn by:	KRJ
Date:	AUG 2018
Scale:	1:2600
Project No.:	18-012

FIGURE

3

SAW-2018-01166

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **NCDEQ DMS (Attn: Tim Baumgartner)**	File Number: **SAW-2018-01166**	Date: **5/7/2019**

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
☐ 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 or http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or the 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 district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

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

SAW-2018-01166

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: **District Engineer, Wilmington Regulatory Division** **attn: David E. Bailey** **Raleigh Regulatory Field Office** **3331 Heritage Trade Drive, Suite 105** **Wake Forest, North Carolina 27587**	If you only have questions regarding the appeal process you may also contact: **Mr. Jason Steele, Administrative Appeal Review Officer** **CESAD-PDO** **U.S. Army Corps of Engineers, South Atlantic Division** **60 Forsyth Street, Room 10M15** **Atlanta, Georgia 30303-8801** **Phone: (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 send this form to:

District Engineer, Wilmington Regulatory Division, **David Bailey, 69 Darlington Avenue, Wilmington, North Carolina 28403**

For Permit denials, Proffered Permits and Approved Jurisdictional Determinations send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Jason Steele, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801
Phone: (404) 562-5137

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: 5/7/2019

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Grant Lewis - Axiom Environmental, Inc, 218 Snow Avenue, Raleigh, NC 27603

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: CESAW-RG-R, SAW-2018-01166

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: NC County/parish/borough: Alamance City: Snow Camp

Center coordinates of site (lat/long in degree decimal format):

Lat.: 35.8924 Long.: -79.4754

Universal Transverse Mercator:

Name of nearest waterbody: Cane Creek

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:

■ Field Determination. Date(s): 8/22/2018

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
See attached					

Site Number/ Feature Name	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resources
Cane Creek	35.89296	-79.474464	R2UB1/2	2222.9 feet	Non-section 10 - Non-wetland
UT 2	35.891597	-79.473033	R3UB1/2	920.0 feet	Non-section 10 - Non-wetland
UT 3	35.893508	-79.478913	R3UB1/2	1036.5 feet	Non-section 10 - Non-Wetland
UT 4	35.893317	-79.474033	R3UB1/2	225.0 feet	Non-section 10 - Non-Wetland
GHI	35.8927	-79.4765	PSS1	0.456 acres	Non-section 10 - Wetland
GF	35.8921	-79.4733	PSS1	0.036 acres	Non-section 10 - Wetland
GE	35.8913	-79.4729	PSS1	0.150 acres	Non-section 10 - Wetland
GD	35.8907	-79.4728	PSS1	0.008 acres	Non-section 10 - Wetland
GC	35.8907	-79.4729	PSS1	0.044 acres	Non-section 10 - Wetland
GB	35.8904	-79.4727	PSS1	0.083 acres	Non-section 10 - Wetland
GA	35.89	-79.4727	PSS1	0.042 acres	Non-section 10 - Wetland
GX	35.8919	-79.4789	PSS1	0.018 acres	Non-section 10 - Wetland
GY	35.8936	-79.4792	PSS1	0.061 acres	Non-section 10 - Wetland
GZ	35.893	-79.479	PSS1	0.059 acres	Non-section 10 - Wetland

1) The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.

2) In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there *"may be"* waters of the U.S. and/or that there *"may be"* navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for PJD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

- [x] Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
  Map: Aerial, soils, and topo maps (Axiom).
- [x] Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - [x] Office concurs with data sheets/delineation report.
  - [ ] Office does not concur with data sheets/delineation report. Rationale: _____.
- [ ] 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.
- [x] U.S. Geological Survey map(s). Cite scale & quad name: 1:24,000 Snow Camp Quad.
- [x] Natural Resources Conservation Service Soil Survey. Citation: Alamance Co. Soil Sruevey.
- [ ] National wetlands inventory map(s). Cite name: _____.
- [ ] State/local wetland inventory map(s): _____.
- [ ] FEMA/FIRM maps: _____.
- [ ] 100-year Floodplain Elevation is: _____.(National Geodetic Vertical Datum of 1929)
- [x] Photographs: [x] Aerial (Name & Date): 2014 NC OneMap.
  or [ ] Other (Name & Date): _____.
- [ ] Previous determination(s). File no. and date of response letter: _____.
- [x] Other information (please specify): LiDAR (NC Floodmaps).

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

_____	_____
Signature and date of Regulatory staff member completing PJD	Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

[1] Districts may establish timeframes for requestor to return signed PJD forms. If the requestor does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Digitally signed by BAILEY.DAVID.E.1379283736
Date: 2019.05.07 10:09:05 -04'00'

Signature and date of
Regulatory Project Manager
(REQUIRED)

W. Grant Lewis

Digitally signed by W. Grant Lewis
DN: cn=W. Grant Lewis, o=Axiom Environmental, Inc., ou, email=glewis@axiomenvironmental.org, c=US
Date: 2018.01.02 09:45:03 -05'00'

Signature and date of
person requesting preliminary JD
(REQUIRED, unless obtaining
the signature is impracticable)

A. PARCEL INFORMATION

Street Address: Charlie Euliss Rd

City, State: Snow Camp, NC

County: Alamance

Parcel Index Number(s) (PIN): 101409

B. REQUESTOR INFORMATION

Name: Grant Lewis - Axiom Environmental, Inc

Mailing Address: 218 Snow Avenue

Raleigh, NC 27603

Telephone Number: (919) 215-1693

Electronic Mail Address: glewis@axiomenvironmental.org

Select one:

- ☐ I am the current property owner.
- ☑ I am an Authorized Agent or Environmental Consultant[1]
- ☐ Interested Buyer or Under Contract to Purchase
- ☐ Other, please explain. _____

_____

C. PROPERTY OWNER INFORMATION[2]

Name: Charles Euliss

Mailing Address: 8148 Charlie Euliss Road

Snow Camp, NC 27349

Telephone Number: (336) 263-2351

Electronic Mail Address: _____

[1] Must provide completed Agent Authorization Form/Letter.

[2] Documentation of ownership also needs to be provided with request (copy of Deed, County GIS/Parcel/Tax Record).

D. PROPERTY ACCESS CERTIFICATION[3,4]

By signing below, I authorize representatives of the Wilmington District, U.S. Army Corps of Engineers (Corps) to enter upon the property herein described for the purpose of conducting on-site investigations, if necessary, and issuing a jurisdictional determination pursuant to Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899. I, the undersigned, am either a duly authorized owner of record of the property identified herein, or acting as the duly authorized agent of the owner of record of the property.

W. Grant Lewis

Print Name

Capacity: ☐ Owner ☑ Authorized Agent[5]

Date

* Please see attached Agent Authorization form

Signature

E. REASON FOR JD REQUEST: (Check as many as applicable)

☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all aquatic resources.

☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all jurisdictional aquatic resources under Corps authority.

☑ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps, and the JD would be used to avoid and minimize impacts to jurisdictional aquatic resources and as an initial step in a future permitting process.

☐ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps; this request is accompanied by my permit application and the JD is to be used in the permitting process.

☐ I intend to construct/develop a project or perform activities in a navigable water of the U.S. which is included on the district Section 10 list and/or is subject to the ebb and flow of the tide.

☐ A Corps JD is required in order obtain my local/state authorization.

☐ I intend to contest jurisdiction over a particular aquatic resource and request the Corps confirm that jurisdiction does/does not exist over the aquatic resource on the parcel.

☐ I believe that the site may be comprised entirely of dry land.

☐ Other:_____

[3] For NCDOT requests following the current NCDOT/USACE protocols, skip to Part E.

[4] If there are multiple parcels owned by different parties, please provide the following for each additional parcel on a continuation sheet.

[5] Must provide agent authorization form/letter signed by owner(s).

F. JURISDICTIONAL DETERMINATION (JD) TYPE (Select One)

☑ I am requesting that the Corps provide a preliminary JD for the property identified herein.

A Preliminary Jurisdictional Determination (PJD) provides an indication that there may be "waters of the United States" or "navigable waters of the United States"on a property. PJDs are sufficient as the basis for permit decisions. For the purposes of permitting, all waters and wetlands on the property will be treated as if they are jurisdictional "waters of the United States". PJDs cannot be appealed (33 C.F.R. 331.2); however, a PJD is "preliminary" in the sense that an approved JD can be requested at any time. PJDs do not expire.

☐ I am requesting that the Corps provide an approved JD for the property identified herein.

An Approved Jurisdictional Determination (AJD) is a determination that jurisdictional "waters of the United States" or "navigable waters of the United States" are either present or absent on a site. An approved JD identifies the limits of waters on a site determined to be jurisdictional under the Clean Water Act and/or Rivers and Harbors Act. Approved JDs are sufficient as the basis for permit decisions. AJDs are appealable (33 C.F.R. 331.2). The results of the AJD will be posted on the Corps website. A landowner, permit applicant, or other "affected party" (33 C.F.R. 331.2) who receives an AJD may rely upon the AJD for five years (subject to certain limited exceptions explained in Regulatory Guidance Letter 05-02).

☐ I am unclear as to which JD I would like to request and require additional information to inform my decision.

G. ALL REQUESTS

☑ Map of Property or Project Area. This Map must clearly depict the boundaries of the review area.

☑ Size of Property or Review Area ~18 acres.

☐ The property boundary (or review area boundary) is clearly physically marked on the site.

H. REQUESTS FROM CONSULTANTS

☑ Project Coordinates (Decimal Degrees): Latitude: 35.8924
Longitude: -79.4754

☑ A legible delineation map depicting the aquatic resources and the property/review area. Delineation maps must be no larger than 11x17 and should contain the following: (Corps signature of submitted survey plats will occur after the submitted delineation map has been reviewed and approved).[6]

- North Arrow
- Graphical Scale
- Boundary of Review Area
- Date
- Location of data points for each Wetland Determination Data Form or tributary assessment reach.

For Approved Jurisdictional Determinations:

- Jurisdictional wetland features should be labeled as Wetland Waters of the US, 404 wetlands, etc. Please include the acreage of these features.
- Jurisdictional non-wetland features (i.e. tidal/navigable waters, tributaries, impoundments) should be labeled as Non-Wetland Waters of the US, stream, tributary, open water, relatively permanent water, pond, etc. Please include the acreage or linear length of each of these features as appropriate.
- Isolated waters, waters that lack a significant nexus to navigable waters, or non-jurisdictional upland features should be identified as Non-Jurisdictional. Please include a justification in the label regarding why the feature is non-jurisdictional (i.e. "Isolated", "No Significant Nexus", or "Upland Feature"). Please include the acreage or linear length of these features as appropriate.

For Preliminary Jurisdictional Determinations:

- Wetland and non-wetland features should not be identified as Jurisdictional, 404, Waters of the United States, or anything that implies jurisdiction. These features can be identified as Potential Waters of the United States, Potential Non-wetland Waters of the United States, wetland, stream, open water, etc. Please include the acreage and linear length of these features as appropriate.

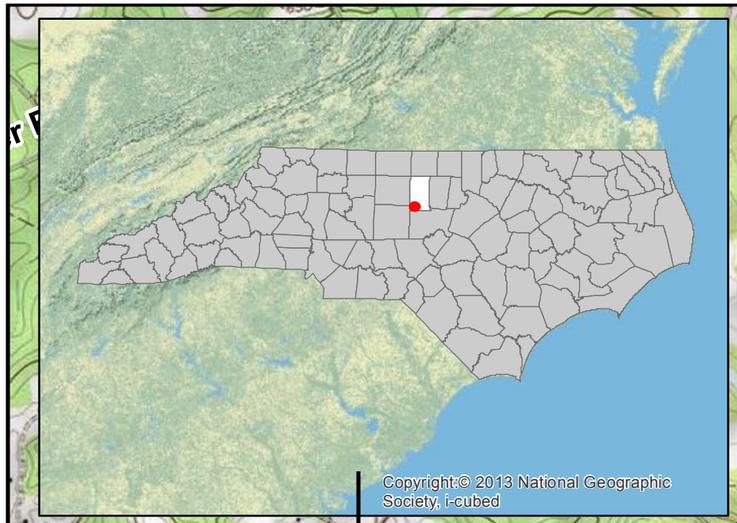
☑ Completed Wetland Determination Data Forms for appropriate region
(at least one wetland and one upland form needs to be completed for each wetland type)

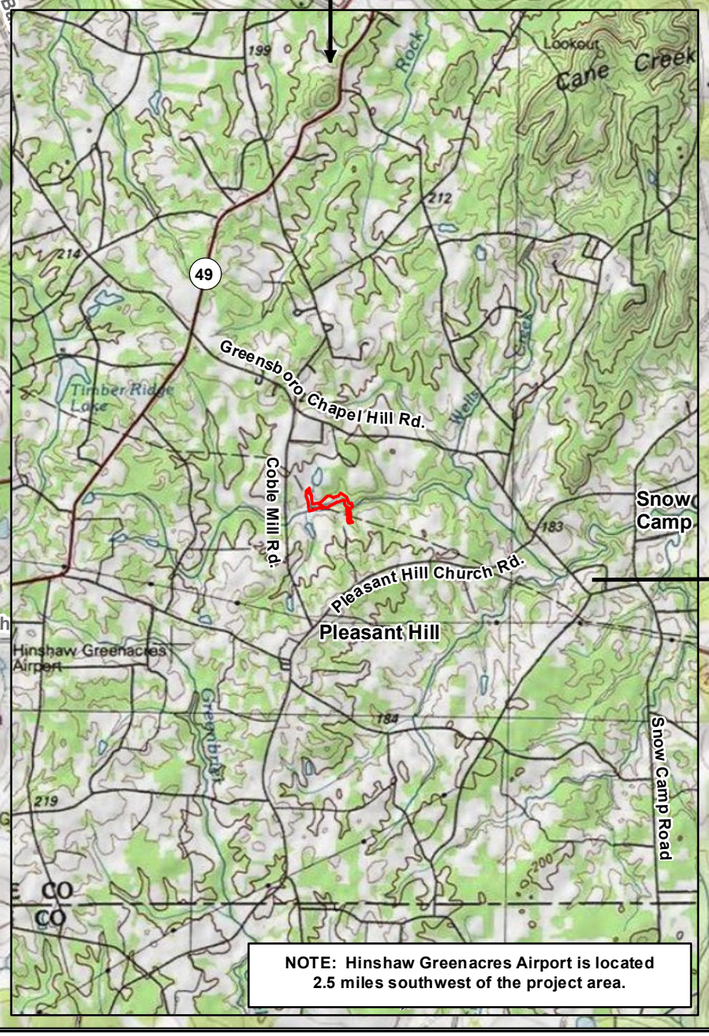
[6] Please refer to the guidance document titled "Survey Standards for Jurisdictional Determinations" to ensure that the supplied map meets the necessary mapping standards. http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Jurisdiction/

- [x] Completed appropriate Jurisdictional Determination form
  - **PJDs,** please complete a Preliminary Jurisdictional Determination Form[7] and include the Aquatic Resource Table
  - **AJDs**, please complete an Approved Jurisdictional Determination Form[8]
- [x] Vicinity Map
- [x] Aerial Photograph
- [x] USGS Topographic Map
- [x] Soil Survey Map
- [x] Other Maps, as appropriate (e.g. National Wetland Inventory Map, Proposed Site Plan, previous delineation maps, LIDAR maps, FEMA floodplain maps)
- [ ] Landscape Photos (if taken)
- [x] NCSAM and/or NCWAM Assessment Forms and Rating Sheets
- [x] NC Division of Water Resources Stream Identification Forms
- [ ] Other Assessment Forms

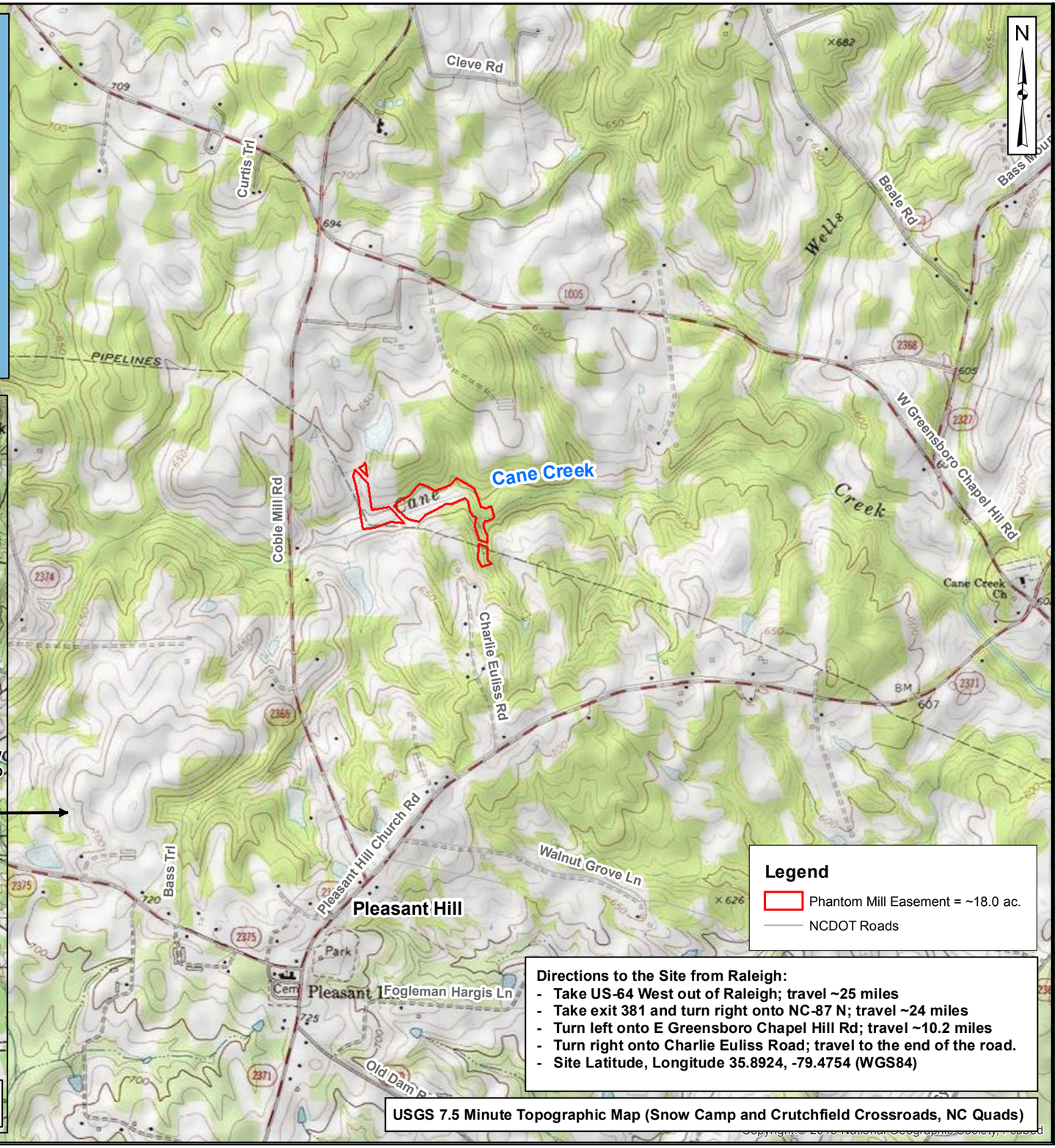
[7] www.saw.usace.army.mil/Portals/59/docs/regulatory/regdocs/JD/RGL_08-02_App_A_Prelim_JD_Form_fillable.pdf
[8] Please see http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Jurisdiction/

Principal Purpose: The information that you provide will be used in evaluating your request to determine whether there are any aquatic resources within the project area subject to federal jurisdiction under the regulatory authorities referenced above.
Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public, and may be made available as part of a public notice as required by federal law. Your name and property location where federal jurisdiction is to be determined will be included in the approved jurisdictional determination (AJD), which will be made available to the public on the District's website and on the Headquarters USACE website.
Disclosure: Submission of requested information is voluntary; however, if information is not provided, the request for an AJD cannot be evaluated nor can an AJD be issued.





NOTE: Hinshaw Greenacres Airport is located 2.5 miles southwest of the project area.



Legend

- Phantom Mill Easement = ~18.0 ac.
- NCDOT Roads

Directions to the Site from Raleigh:

- **Take US-64 West out of Raleigh; travel ~25 miles**
- **Take exit 381 and turn right onto NC-87 N; travel ~24 miles**
- **Turn left onto E Greensboro Chapel Hill Rd; travel ~10.2 miles**
- **Turn right onto Charlie Euliss Road; travel to the end of the road.**
- **Site Latitude, Longitude 35.8924, -79.4754 (WGS84)**

USGS 7.5 Minute Topographic Map (Snow Camp and Crutchfield Crossroads, NC Quads)

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

SITE LOCATION

Drawn by: CLF/KRJ

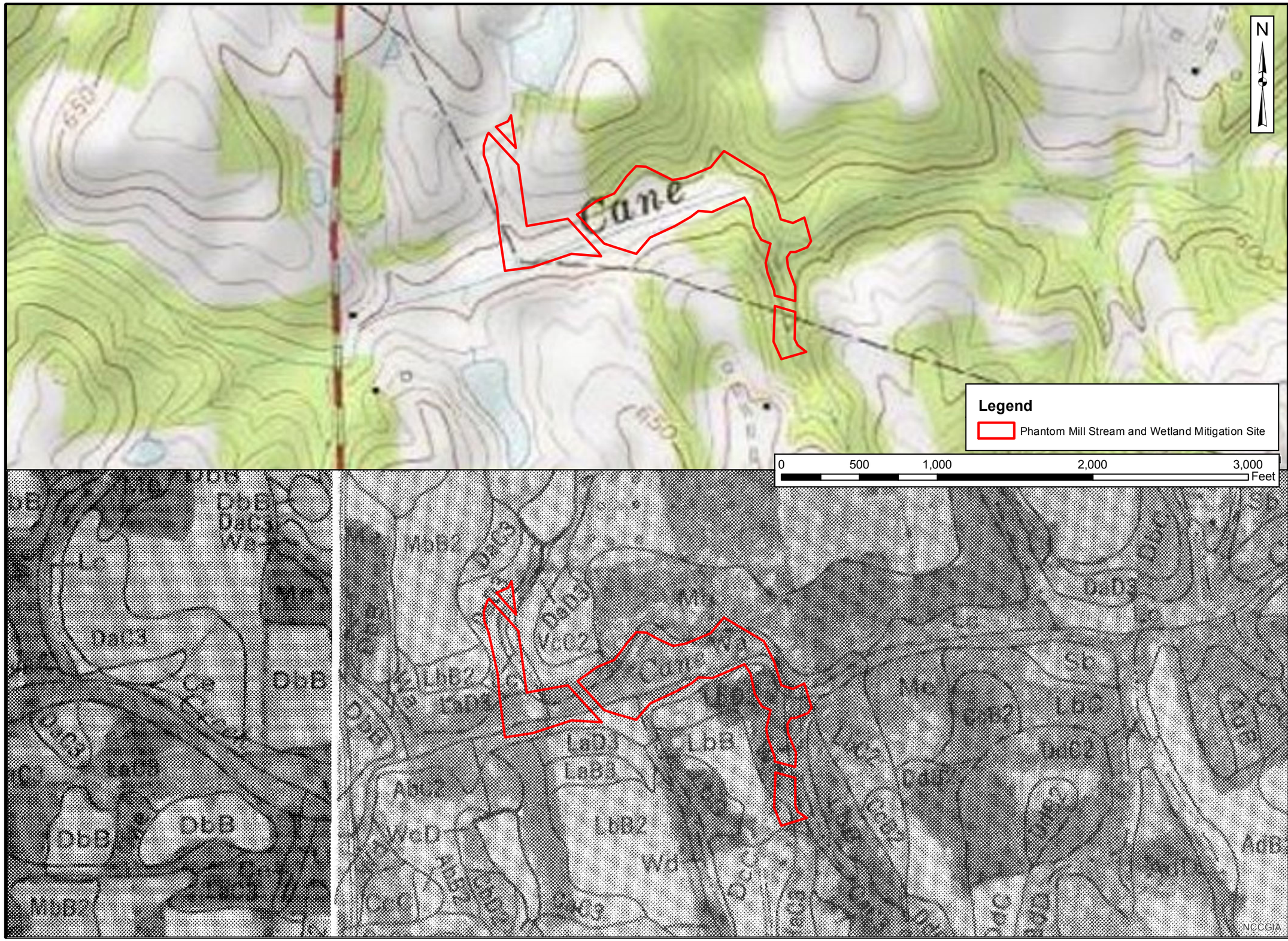
Date: JAN 2018

Scale: 1:20,000

Project No.: 17-001.04

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

PROJECT MAPPING

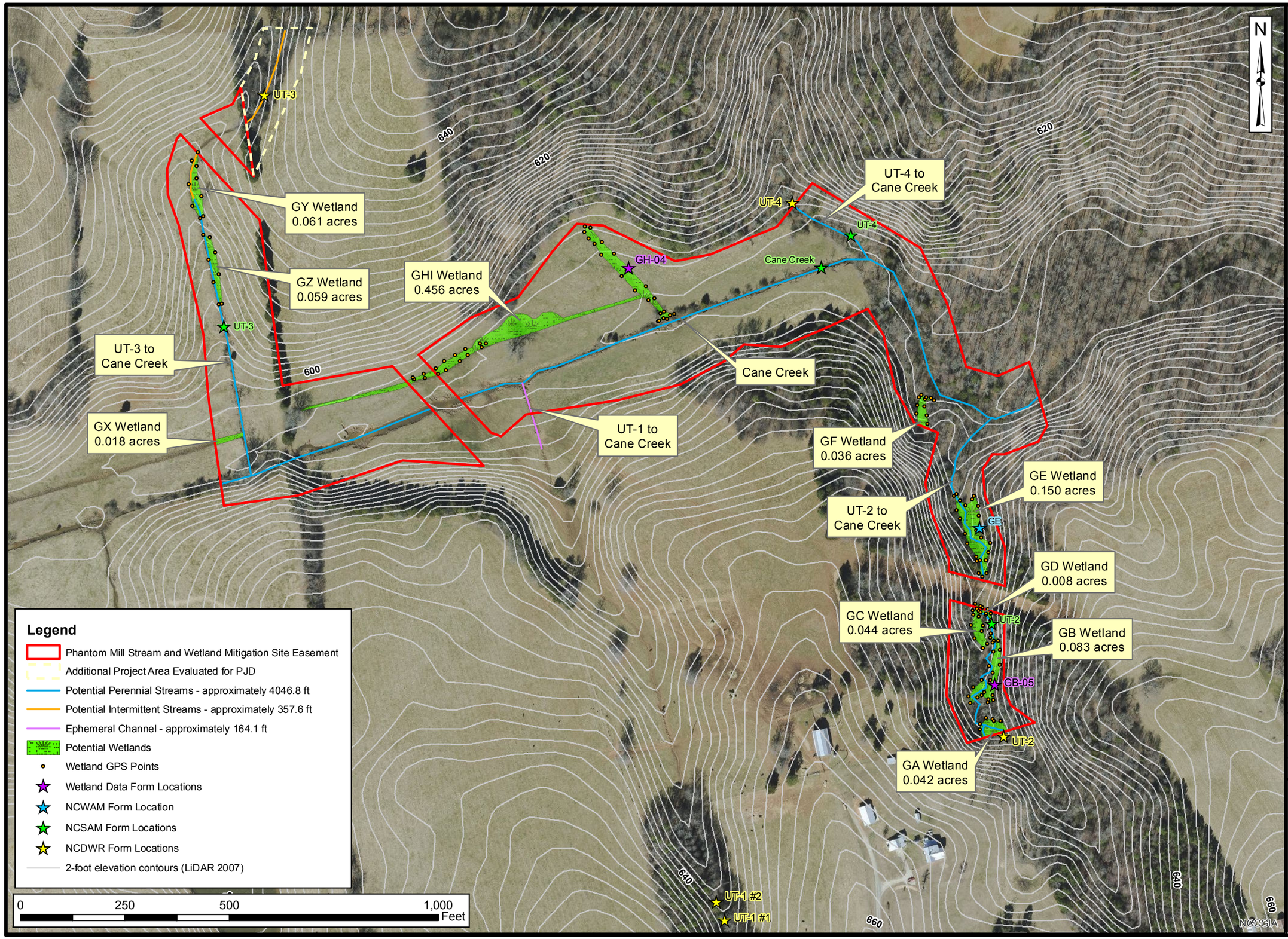
Notes:

1. Background Imagery Sources:
   a. Snow Camp, NC (1972) 7.5 minute topographic quadrangle provided by the U.S. Geological Survey (USGS, top window)
   b. Soil Survey of Alamance County, NC (1960) provided by the National Resource Conservation Service, sheets 29 and 30 (bottom window)

Drawn by:	KRJ
Date:	MAY 2018
Scale:	1:7000
Project No.:	18-012

FIGURE

2



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

JURISDICTIONAL AREAS

Notes:

1. Background Imagery Source: 2014 aerial photography provided by the NC OneMap program (online, provided by the NC Geographic Information Coordination Council)

Drawn by:	KRJ
Date:	AUG 2018
Scale:	1:2600
Project No.:	18-012

FIGURE

3

Site Number/ Feature Name	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resources
Cane Creek	35.89296	-79.474464	R2UB1/2	2222.9 feet	Non-section 10 - Non-wetland
UT 2	35.891597	-79.473033	R3UB1/2	920.0 feet	Non-section 10 - Non-wetland
UT 3	35.893508	-79.478913	R3UB1/2	1036.5 feet	Non-section 10 - Wetland
UT 4	35.893317	-79.474033	R3UB1/2	225.0 feet	Non-section 10 - Wetland
GHI	35.8927	-79.4765	PSS1	0.456 acres	Non-section 10 - Wetland
GF	35.8921	-79.4733	PSS1	0.036 acres	Non-section 10 - Wetland
GE	35.8913	-79.4729	PSS1	0.150 acres	Non-section 10 - Wetland
GD	35.8907	-79.4728	PSS1	0.008 acres	Non-section 10 - Wetland
GC	35.8907	-79.4729	PSS1	0.044 acres	Non-section 10 - Wetland
GB	35.8904	-79.4727	PSS1	0.083 acres	Non-section 10 - Wetland
GA	35.89	-79.4727	PSS1	0.042 acres	Non-section 10 - Wetland
GX	35.8919	-79.4789	PSS1	0.018 acres	Non-section 10 - Wetland
GY	35.8936	-79.4792	PSS1	0.061 acres	Non-section 10 - Wetland
GZ	35.893	-79.479	PSS1	0.059 acres	Non-section 10 - Wetland

LANDOWNER AUTHORIZATION FORM

PROPERTY LEGAL DESCRITION:

Deed Book: 3427 **Page:** 915 **County:** Alamance

Parcel ID Number: 8757991777

Street Address: _____

_____

Property Owner (please print: Charles R. Eulss Irrevocable Trust

The undersigned, registered property owner(s) of the above property, do hereby authorize

Wolf Creek Restoration Systems LLC
(Contractor/Agent/Project Manager)[1] **of (Name of Contractor/Agent Firm/Agency)[2]**

Grant Lewis of Axiom Environmental
(Contractor/Agent/Project Manager)[1] **(Name of Contractor/Agent Firm/Agency)[2]**

to take all actions necessary for the evaluation of the property as a potential stream, wetland and/or riparian buffer mitigation project, including conducting stream and/or wetland determinations and delineations, as well as issuance and acceptance of any required permit(s) or certification(s). I agree to allow regulatory agencies, including the US Army Corps of Engineers, to visit the property as part of these environmental reviews.

Property Owners(s) Address: _____
(if different from above)

_____

Property Owner Telephone Number: 336-263-2351

We hereby certify the above information to be true and accurate to the best of our knowledge.

Charles R Eulss 1-24-18
(Property Owner Authorized Signature) **(Date)**

[1]Name of full delivery staff member (full-deliveries) or DMS project manager (design-bid-build).
[2]Name of company (full-deliveries) or DMS (design-bid-build).

LANDOWNER AUTHORIZATION FORM

PROPERTY LEGAL DESCRITION:

Deed Book: 987 **Page:** 155 **County:** Alamance

Parcel ID Number: 875779804

Street Address: 8110 Cobble Mill Rd
Snow Camp N.C. 27349

Property Owner (please print: Roger E. Owens

The undersigned, registered property owner(s) of the above property, do hereby authorize

Wetland Restoration Systems LLC
(Contractor/Agent/Project Manager)[1] **of (Name of Contractor/Agent Firm/Agency)[2]**

Corantis Lewis of Axiom Environmental
(Contractor/Agent/Project Manager)[1] **(Name of Contractor/Agent Firm/Agency)[2]**

to take all actions necessary for the evaluation of the property as a potential stream, wetland and/or riparian buffer mitigation project, including conducting stream and/or wetland determinations and delineations, as well as issuance and acceptance of any required permit(s) or certification(s). I agree to allow regulatory agencies, including the US Army Corps of Engineers, to visit the property as part of these environmental reviews.

Property Owners(s) Address: _____
(if different from above)

Property Owner Telephone Number: _____

We hereby certify the above information to be true and accurate to the best of our knowledge.

Roger Owens 1-24-2018
(Property Owner Authorized Signature) **(Date)**

[1]Name of full delivery staff member (full-deliveries) or DMS project manager (design-bid-build).
[2]Name of company (full-deliveries) or DMS (design-bid-build).

GB05 Wet

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Phantom Mill City/County: Snow Camp / Alamance Sampling Date: 5/15/18
Applicant/Owner: Restoration Systems State: NC Sampling Point: GB05
Investigator(s): AXE Lewis Section, Township, Range: Patterson
Landform (hillslope, terrace, etc.): FloodPlain Local relief (concave, convex, none): concave Slope (%): 1%
Subregion (LRR or MLRA): P-240 Lat: 35.890531 Long: -79.472788 Datum: NAD 83
Soil Map Unit Name: CnD2-Cullen Clay loam, 10-15% Moderately eroded NWI classification: HN/F
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: Forested cow pasture with heavily disturbed vegetative stratum and soils.

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): 3
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: GB05 Wet

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1. Liquidambar styraciflua	15	y	
2.			
3.			
4.			
5.			
6.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			
Sapling Stratum (Plot size: _____)			
1. Alnus serrulata	5	yes	
2. Ligustrum sinense	2		
3. E red cedar	1		
4.			
5.			
6.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			
Shrub Stratum (Plot size: _____)			
1. Rosa Multiflora	2		
2. Alnus serulata	2		
3. Liquidambar Styraciflua	1		
4. Ligustrum sinense	3		
5.			
6.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			
Herb Stratum (Plot size: _____)			
1. Microstegium	15	Y	
2. Carex sp	5		
3. Arrow Arrum	3		
4. Polygonum sp (Impatiens)	1		
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			
Woody Vine Stratum (Plot size: _____)			
1. Muscadine	5		
2.			
3.			
4.			
5.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (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 Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** _____ **No** _____

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

SOIL

Sampling Point: GB05 wet

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/1	85	10YR 5/1	5	D	M	SL	
			10YR 5/6	10	C	M		
6-9	10YR 4/1	95	10YR 5/6	5	C	M	Loamy Sand	
9+	2.5Y 6/2	95	10YR 5/6	5	C	M	Loamy Sand	

[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)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

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)**
- ___ 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:

GB05 UP

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Phantom Mill City/County: Snow Camp Alamance Sampling Date: 5/15/18
Applicant/Owner: Restoration Systems State: NC Sampling Point: GB05 UP
Investigator(s): AXE Lewis Section, Township, Range: Patterson
Landform (hillslope, terrace, etc.): hillside Local relief (concave, convex, none): Convex Slope (%): 6
Subregion (LRR or MLRA): P-240 Lat: 35.890531 Long: -79.472788 Datum: NAD84
Soil Map Unit Name: CnD2-Cullen Clay Loam, 10-15%, moderately eroded NWI classification: N/A
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:
Slope is in a wooded pasture with disturbance to vegetative layers

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): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: GB05 up

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1. Liquidambar Styraciflua	10		
2. Liriodendron tulipifera	5		
3. Carya tomentosa	5		
4.			
5.			
6.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			
Sapling Stratum (Plot size: _____)			
1. AM Holly	5		
2. E Red cedar	2		
3. Liriodendron tulipifera	2		
4. Celtis laevigata	5		
5. Acer rubrum	2		
6.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			
Shrub Stratum (Plot size: _____)			
1. Acer rubrum	5		
2. rosa Multiflora	3		
3. Ligustrum Sinensis	2		
4.			
5.			
6.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			
Herb Stratum (Plot size: _____)			
1. Crowns Brand (Iron weed)	10		
2. Micro stegium	10		
3. Violet	5		
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			
Woody Vine Stratum (Plot size: _____)			
1. PI	2		
2. Muscadine	2		
3. Smilax laurifolia	2		
4.			
5.			
= Total Cover			
50% of total cover: _____ 20% of total cover: _____			

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (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 Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No _____

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

SOIL

Sampling Point: GB05 up

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 5/4	100					sandy loam	
3-7	10YR 5/6	100					SL	
7+	7.5Y 5/8	100					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)
- ___ 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)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

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)**
- ___ 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:

GH4 UP

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Phantom Mill City/County: Snow Camp/Alamance Sampling Date: 5/15/18.
Applicant/Owner: Restoration Systems State: NC Sampling Point: GH4 UP
Investigator(s): AXE Lewis Section, Township, Range: Patterson
Landform (hillslope, terrace, etc.): Flood Plain Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR or MLRA): P-240 Lat: 35.893049 Long: -79.475747 Datum: WGS84
Soil Map Unit Name: ChA-Chewacla loam 0-2%, frequently flooded NWI classification: N/A
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:
Active Pasture in a Floodplain that has been ditched and tiled.

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): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✓	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: GH4 UP

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size:)			
1. clover	60		
2. Butter cup	20		
3. Poa Annua	5		
4. Fescue	10		
5. Solanum	2		
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (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 Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** _____ **No** _____

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

Pasture land

SOIL

Sampling Point: GH4 UP

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/3	100					silt loam	
2-10	10YR 5/3	80	10YR 6/1	10	D	RM	sandy loam	
			10YR 5/6	10	C	PL		
10+	10YR 5/6	90	10YR 6/1	5	D	RM	sandy clay loam	
			10YR 4/6	5	C	PL		

[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)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

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)**
- ___ 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:

GH4 Wet

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Phantom Mill City/County: Snow Camp / Alamance Sampling Date: 5/15/18
Applicant/Owner: Restoration Systems State: NC Sampling Point: GH4 Wet
Investigator(s): AXE Lewis Section, Township, Range: Patterson
Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR or MLRA): P-240 Lat: 35.893049 Long: -79.475747 Datum: WGS 84
Soil Map Unit Name: ChA - Chewacla loam, 0-2%, frequently flooded NWI classification: HWF
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:
Active pasture used for livestock graging. The field has been ditched with tile installed.

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): 0.5
Water Table Present? Yes ✓ No ____ Depth (inches): 0
Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: GH4 Wet

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: NA)			
1.			
2.			
3. NA			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Sapling Stratum (Plot size: NA)			
1.			
2.			
3. NA			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Shrub Stratum (Plot size: NA)			
1.			
2.			
3. NA			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Herb Stratum (Plot size: ____)			
1. Carex sp	25		
2. Cyperus cyperinus	20		
3. Juncus effusus	10		
4. Clover	3		
5. Buttercup	2		
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Woody Vine Stratum (Plot size: NA)			
1.			
2.			
3. NA			
4.			
5.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (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 Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ____ **No** ____

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

Active Livestock Pasture. Only Herbs present

SOIL

Sampling Point: GH4 Wet

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 6/1	90	10YR 5/6	10	C	PL	silt loam	
3-7	10YR 6/1	70	10YR 5/6	15	C	PL	loam	
			Gley 5/1	15	D	RM		
7+	Gley 6/1	70	10YR 6/1	15	C	RM	clay loam	
			10YR 5/6	15	C	PL		

[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)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

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)**
- ___ 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:

NC WAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Phantom Mill	Date of Evaluation	05-15-2018
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Wetland GE
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	A.Keith/Axiom
Level III Ecoregion	Piedmont	Nearest Named Water Body	Cane Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030002
County	Alamance	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.891251, -79.472822

Evidence of stressors affecting the assessment area (may not be within the assessment area)

Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☒ Yes ☐ No

Regulatory Considerations - Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.

☐ Anadromous fish
☒ Federally protected species or State endangered or threatened species
☒ NCDWR riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

☐ Blackwater
☒ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ☐ Yes ☒ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☒A	☐A	Not severely altered
☐B	☒B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☐A	☒A	Water storage capacity and duration are not altered.
☒B	☐B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☐C	☐C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ☐A Sandy soil
- ☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ☐C Loamy or clayey soils not exhibiting redoximorphic features
- ☐D Loamy or clayey gleyed soil
- ☐E Histosol or histic epipedon

4b.
- ☒A Soil ribbon < 1 inch
- ☐B Soil ribbon ≥ 1 inch

4c.
- ☒A No peat or muck presence
- ☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☐A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☒B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☐C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric (skip for non-riparian wetlands)

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☐B	☐B	☐B	Confined animal operations (or other local, concentrated source of pollutants
☒C	☒C	☒C	≥ 20% coverage of pasture
☐D	☐D	☐D	≥ 20% coverage of agricultural land (regularly plowed land)
☒E	☒E	☒E	≥ 20% coverage of maintained grass/herb
☒F	☒F	☒F	≥ 20% coverage of clear-cut land
☐G	☐G	☐G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed or hydrologic alterations that prevent drainage and/or overbank flow from affecting the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? (Wetland buffer need only be present on one side of the .water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ☐A ≥ 50 feet
- ☒B From 30 to < 50 feet
- ☐C From 15 to < 30 feet
- ☐D From 5 to < 15 feet
- ☐E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☒Yes ☐No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☐A	☐A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☐C	☒C	From 50 to < 80 feet
☐D	☐D	From 40 to < 50 feet
☐E	☐E	From 30 to < 40 feet
☐F	☐F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)

Answer for assessment area dominant landform.

☒A Evidence of short-duration inundation (< 7 consecutive days)
☐B Evidence of saturation, without evidence of inundation
☐C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
☐A	☐A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☐I	☐I	☐I	From 0.1 to < 0.5 acre
☒J	☒J	☒J	From 0.01 to < 0.1 acre
☐K	☐K	☐K	< 0.01 acre or assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☐A	☐A	≥ 500 acres
☐B	☐B	From 100 to < 500 acres
☐C	☒C	From 50 to < 100 acres
☒D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☐F	☐F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directions? If the assessment area is clear cut, select option "C."

☐A 0
☐B 1 to 4
☒C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☒B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☐C Vegetation severely altered from reference in composition, or expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species), or exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☐A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	☐A	☐A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☒B	Canopy present, but opened more than natural gaps
	☒C	☐C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☒B	☒B	Moderate density mid-story/sapling layer
	☐C	☐C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☐B	☒B	Moderate density shrub layer
	☒C	☐C	Shrub layer sparse or absent
Herb	☒A	☒A	Dense herb layer
	☐B	☐B	Moderate density herb layer
	☐C	☐C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

☐A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☒B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☒B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☐C Majority of canopy trees are < 6 inches DBH or no trees.

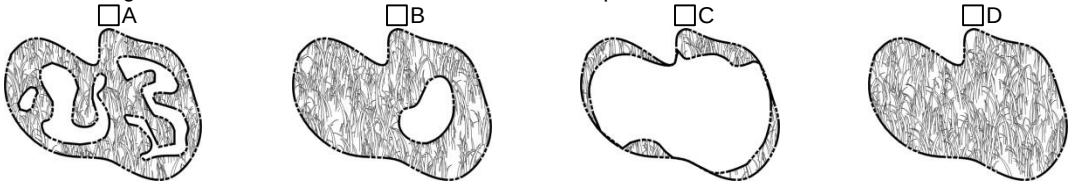
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

Include both natural debris and man-placed natural debris.
☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

☐A ☐B ☐C ☐D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.
☐A Overbank and overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☒C Overland flow is severely altered in the assessment area.
☐D Both overbank and overland flow are severely altered in the assessment area.

Notes
Wetland bound by active cattle pasture.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetland GE	Date of Assessment	05-15-2018
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	A.Keith/Axiom

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	
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
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-surface Storage and Retention	Condition	**MEDIUM**
Water Quality	Pathogen Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence (Y/N)	**NO**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence (Y/N)	**NO**
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence (Y/N)	**NO**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence (Y/N)	**NO**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
Habitat	Physical Structure	Condition	**MEDIUM**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics	Rating
Hydrology	Condition	**LOW**
Water Quality	Condition	**MEDIUM**
	Condition/Opportunity	**MEDIUM**
	Opportunity Presence (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM Wetland Rating Sheet

Accompanies User Manual Version 5.0

Wetland Site Name	All Existing Wetlands	Date	1/9/2018
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Jernigan/Axiom

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
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **MEDIUM**

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill Cane Creek
Stream Category: Pa3
Date of Evaluation: 171222
Assessor Name/Organization: Perkinson - Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill UT-1 | Date of Evaluation: 171222
Stream Category: Pb1 | Assessor Name/Organization: Perkinson - Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**MEDIUM**	**MEDIUM**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**MEDIUM**	**MEDIUM**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Streamside Area Vegetation	**LOW**	**LOW**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**OMITTED**	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**LOW**
(2) In-stream Habitat	**LOW**	**LOW**
(3) Baseflow	**MEDIUM**	**MEDIUM**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**LOW**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone Habitat	NA	NA
Overall	**LOW**	**LOW**

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill UT-2 | Date of Evaluation: 171222
Stream Category: Pa1 | Assessor Name/Organization: Perkinson - Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**HIGH**	
(3) Streamside Area Attenuation	**HIGH**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**HIGH**	
(4) Microtopography	**HIGH**	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**HIGH**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**HIGH**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**HIGH**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**HIGH**	
(3) Thermoregulation	**HIGH**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**MEDIUM**	

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill UT-3 | Date of Evaluation: 171222
Stream Category: Pb1 | Assessor Name/Organization: Perkinson - Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**HIGH**	**HIGH**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Streamside Area Vegetation	**LOW**	**LOW**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**LOW**	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**MEDIUM**
(2) In-stream Habitat	**LOW**	**HIGH**
(3) Baseflow	**MEDIUM**	**MEDIUM**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**HIGH**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone Habitat	NA	NA
Overall	**LOW**	**LOW**

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Phantom Mill UT-4
Date of Evaluation: 172122
Stream Category: Pb1
Assessor Name/Organization: Perkinson/Axiom

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**MEDIUM**	**MEDIUM**
(2) Baseflow	**HIGH**	**HIGH**
(2) Flood Flow	**MEDIUM**	**MEDIUM**
(3) Streamside Area Attenuation	**MEDIUM**	**MEDIUM**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**MEDIUM**	**MEDIUM**
(4) Microtopography	NA	NA
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(4) Channel Stability	**HIGH**	**HIGH**
(4) Sediment Transport	**MEDIUM**	**MEDIUM**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**HIGH**	**HIGH**
(2) Baseflow	**HIGH**	**HIGH**
(2) Streamside Area Vegetation	**HIGH**	**HIGH**
(3) Upland Pollutant Filtration	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Indicators of Stressors	**NO**	**NO**
(2) Aquatic Life Tolerance	**OMITTED**	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**MEDIUM**	**HIGH**
(2) In-stream Habitat	**LOW**	**HIGH**
(3) Baseflow	**HIGH**	**HIGH**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**HIGH**
(2) Stream-side Habitat	**HIGH**	**HIGH**
(3) Stream-side Habitat	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone Habitat	NA	NA
Overall	**MEDIUM**	**HIGH**

Phantom Mill UT1
(Form 1)

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Phantom Mill	**Latitude:** 35.887917
Evaluator: Lewis Axiom	**County:** Alamance	**Longitude:** -79.474709
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 16.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 7)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	(1)	2	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	(0)	1	2	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	(No = 0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4.5)				
12. Presence of Baseflow	(0)	1	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 5)				
18. Fibrous roots in streambed	3	(2)	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Phantom Mill UT1 (Form 2)

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Euliss UT1 DS Headcut	**Latitude:** 35.888120
Evaluator: Jernigan - Ariem	**County:** Alamance	**Longitude:** -79.474720
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	1	(2)	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	1	2	(3)
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Phantom Mill UT2

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Euliss UT-2	**Latitude:** 35.889892
Evaluator: Jernigan – Axiom	**County:** Alamance	**Longitude:** -79.472613
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 34.5	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	(.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 9)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	(3)
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Mayfly, amphipods, caddisfly observed

Sketch:

Phantom Mill UT 3
Form 3

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Phantom Mill	**Latitude:** 35.894334
Evaluator: Lewis - Axiom	**County:** Alamance	**Longitude:** -79.478732
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 32	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	1	2	(3)
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Phantom Mill UT4

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: 3/16/17	**Project/Site:** Eulas UT-4	**Latitude:** 35.893467
Evaluator: Jernigan - Axiom	**County:** Alamance	**Longitude:** -79.474310
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 34.5	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 7.5)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	(0.5)	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: 1 Salamander and 1 amphipod observed

Sketch:

Appendix E
Categorical Exclusion Document

Phantom Mill Stream and Wetland Mitigation Site

Alamance County, North Carolina

DMS Project No. 100057

Categorical Exclusion/ERTR

Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

1652 Mail Service Center

Raleigh, NC 27699-1652

June 2018

TASK 1 b.) Categorical Exclusion Summary:

Part 1: General Project Information

(Attached) Part 2: All Projects

Regulation/Questions

Coastal Zone Management Act

Not applicable – project is not located within a CAMA county.

CERCLA

No issue within project boundaries – please see the attached Executive Summary from a Limited Phase 1 Site Assessment performed by Environmental Data Resources, Inc. (EDR) on June 12th, 2018.

National Historic Preservation Act (Section 106)

No Issue – please see attached letter from Ramona M. Bartos- State of the Historic Preservation Office.

Uniform Act

Please see the attached letter, sent to the landowner June 12th, 2018.

Part 3: Ground-Disturbing Activates Regulation/Questions

American Indian Religious Freedom Act (AIRFA)

Not applicable – project is not located in a county claimed as "territory" by the Eastern Band of Cherokee Indians.

Antiquities Act (AA)

Not applicable – project is not located on Federal land.

Archaeological Resources Protection Act (ARPA)

Not applicable – project is not located on federal or Indian lands.

Endangered Species Act (ESA)

Project activities were determined to pose "No Effect" to Endangered or Threatened Species. The proposed project will occur in existing agricultural fields. There is not Potential Habitat at Site for any of the T&E species and no endangered species were observed during field surveys. Record searches from the Natural Heritage Program indicate that federally protected species have not been documented within a mile of the Site boundaries.

Executive Order 13007 (Indian Sacred Sites)

Not applicable – project is not located in a county claimed as "territory" by the Eastern Band of Cherokee Indians.

Farmland Protection Policy Act (FPPA)

Please find the attached Form AD-1006 and letter from Milton Cortes of the NRCS.

Fish and Wildlife Coordination Act (FWCA)

Please find the attached response from the Fish and Wildlife Service

Land & Water Conservation Fund Act (Section 6(f))

Not applicable

Magnuson-Stevens Fishery Conservation and management Act (Essential Fish Habitat)

Not applicable – project is not located within an estuarine system

Migratory Bird Treaty Act (MBTA)

USFWS has no recommendation with the project relative to the MBTA

Wilderness Act

Not applicable – the project is not located within a Wilderness area.

Appendix A

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Phantom Mill Stream and Wetland Mitigation Site
County Name:	Alamance
EEP Number:	ID #: 100057 Contract #: 7526
Project Sponsor:	Restoration Systems, LLC
Project Contact Name:	JD Hamby
Project Contact Address:	1101 Haynes Street, Suite 211, Raleigh, NC 27604
Project Contact E-mail:	jhamby@restorationsystems.com
EEP Project Manager:	Jeff Schaffer jeff.schaffer@ncdenr.gov

Project Description

The Site is located within Targeted Local Watershed (TLW) 03030002050050. The Site is proposed to include 3874 feet of stream restoration, 147 feet of stream enhancement (level I), 210 feet of stream enhancement (level II), 550 feet of stream preservation, 2.22 acres of reestablished riparian riverine wetlands, and 0.45 acre of enhanced riparian riverine wetland. Site alterations include removing livestock, restoring streams, and planting native, woody vegetation.

For Official Use Only

Reviewed By:

7/19/18
Date

EEP Project Manager

Conditional Approved By:

Date

For Division Administrator
FHWA

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

Final Approval By:

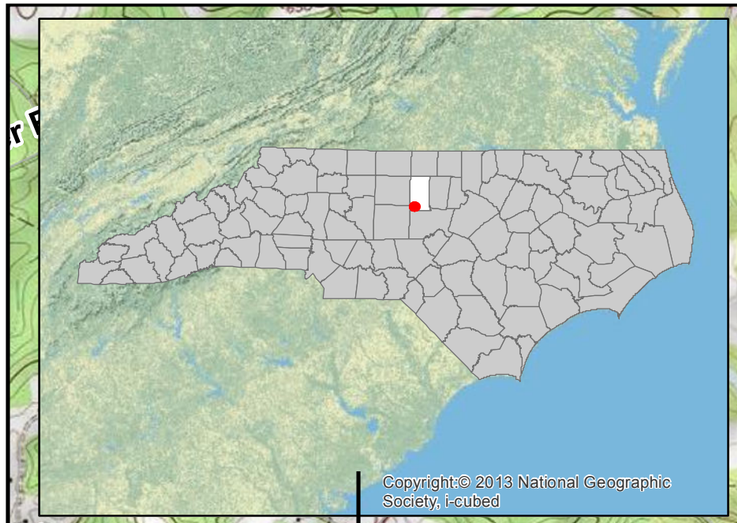
7-18-18
Date

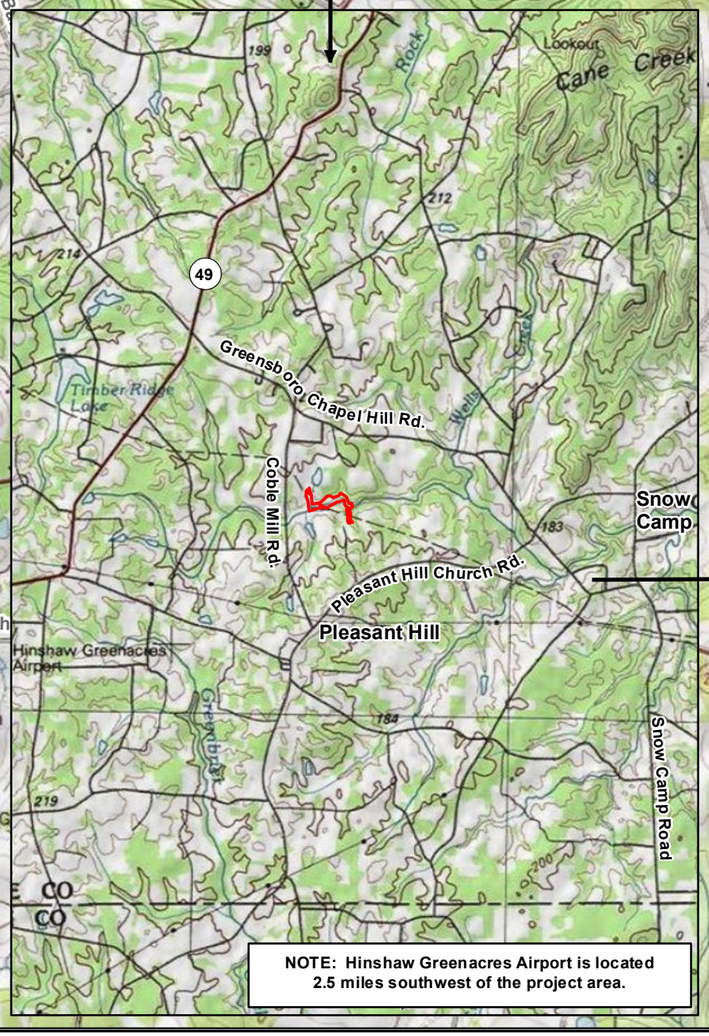
For Division Administrator
FHWA

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☑ Yes ☐ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☑ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☑ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☑ No ☑ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☑ Yes ☑ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☑ No ☑ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☑ Yes ☑ No ☐ N/A
6. Is there an approved hazardous mitigation plan?	☑ Yes ☑ No ☑ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☑ Yes ☐ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☐ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☐ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☐ Yes ☑ No
2. Does the project require the acquisition of real estate?	☐ Yes ☐ No ☑ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☑ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☑ Yes ☐ No ☐ N/A

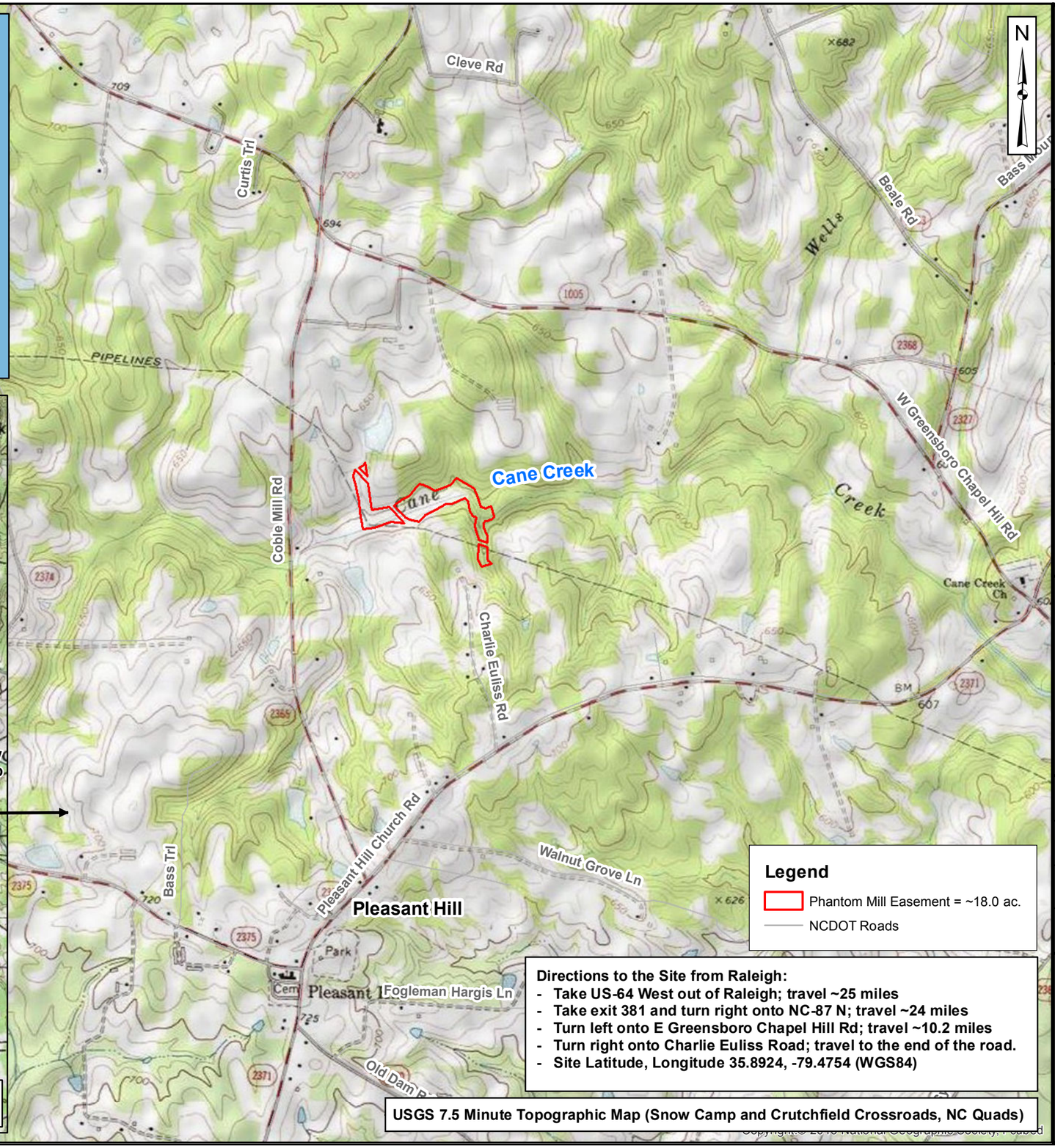
Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☐ Yes ☑ No
2. Is the site of religious importance to American Indians?	☐ Yes ☐ No ☑ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☐ No ☑ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☑ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☑ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☑ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☑ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☐ Yes ☐ No ☑ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☐ No ☑ N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☐ No ☑ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☐ Yes ☐ No ☑ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☐ No ☑ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☑ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☑ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☑ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☑ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☑ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☑ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☑ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☑ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☑ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☑ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☑ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☑ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☑ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☑ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☑ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☑ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☑ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☑ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☑ N/A





NOTE: Hinshaw Greenacres Airport is located 2.5 miles southwest of the project area.



Legend

- Phantom Mill Easement = ~18.0 ac.
- NCDOT Roads

Directions to the Site from Raleigh:

- **Take US-64 West out of Raleigh; travel ~25 miles**
- **Take exit 381 and turn right onto NC-87 N; travel ~24 miles**
- **Turn left onto E Greensboro Chapel Hill Rd; travel ~10.2 miles**
- **Turn right onto Charlie Euliss Road; travel to the end of the road.**
- **Site Latitude, Longitude 35.8924, -79.4754 (WGS84)**

USGS 7.5 Minute Topographic Map (Snow Camp and Crutchfield Crossroads, NC Quads)

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

SITE LOCATION

Drawn by: CLF/KRJ

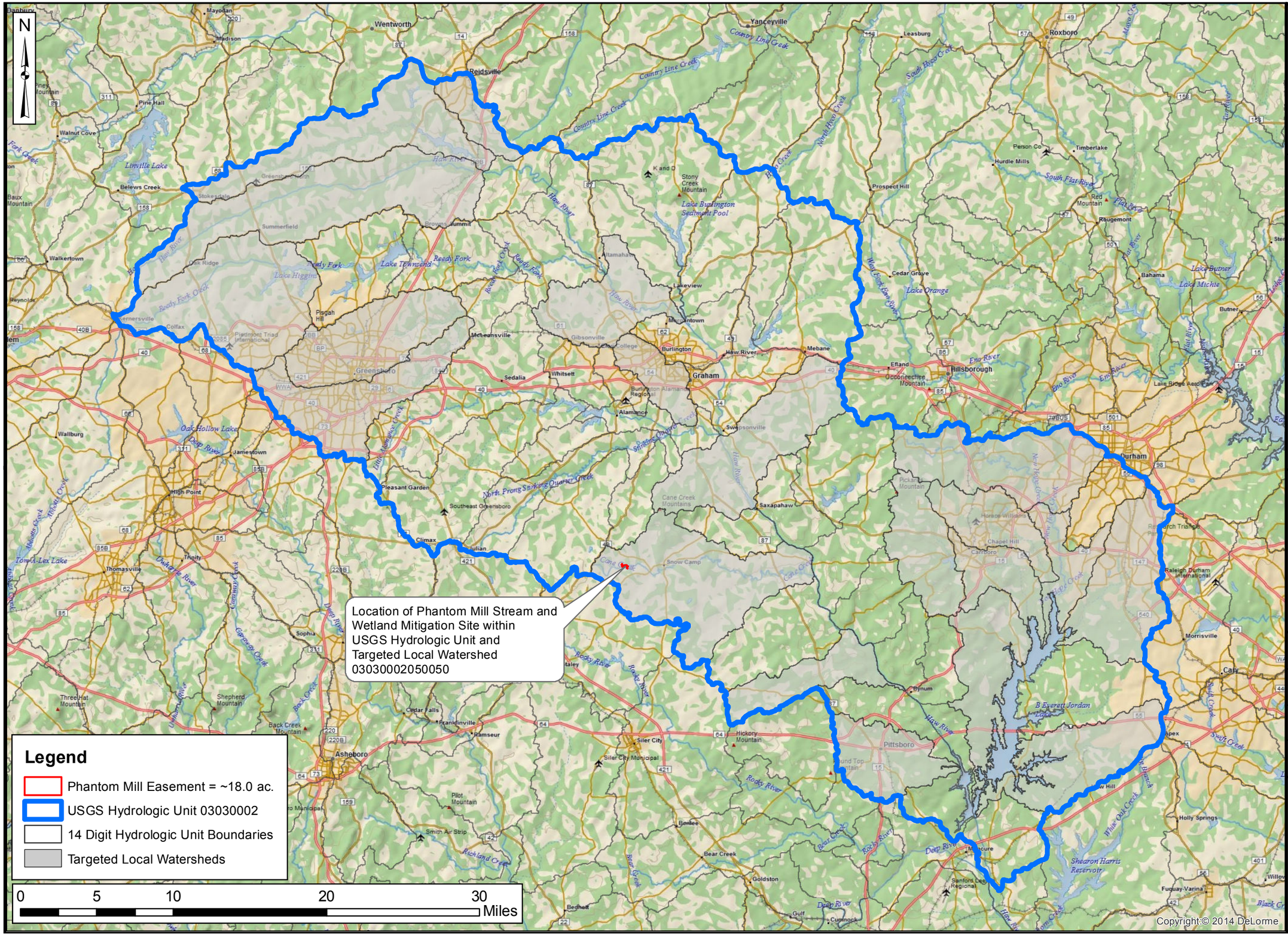
Date: JAN 2018

Scale: 1:20,000

Project No.: 17-001.04

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

HYDROLOGIC UNIT MAP

Drawn by: CLF/KRJ

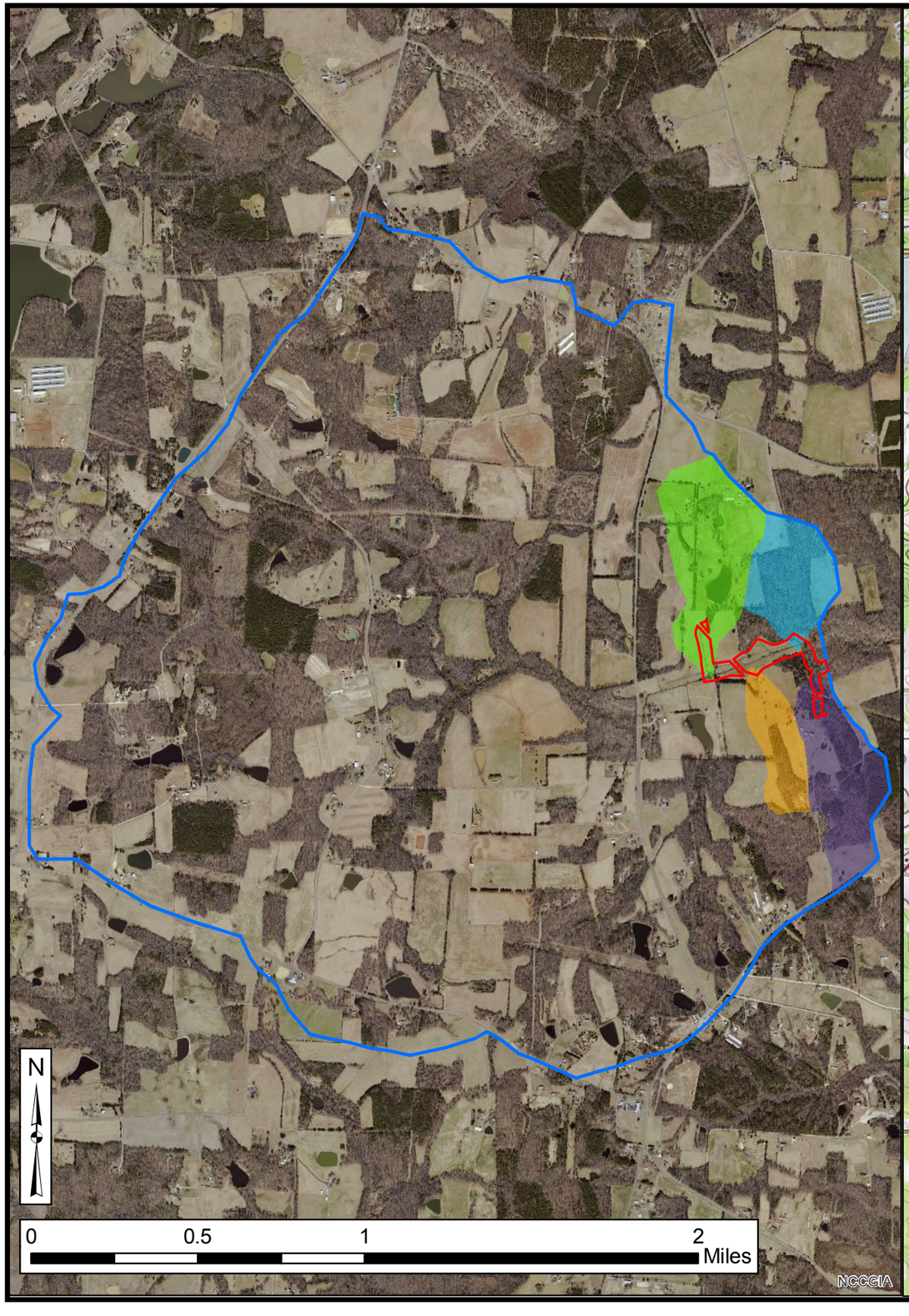
Date: JAN 2018

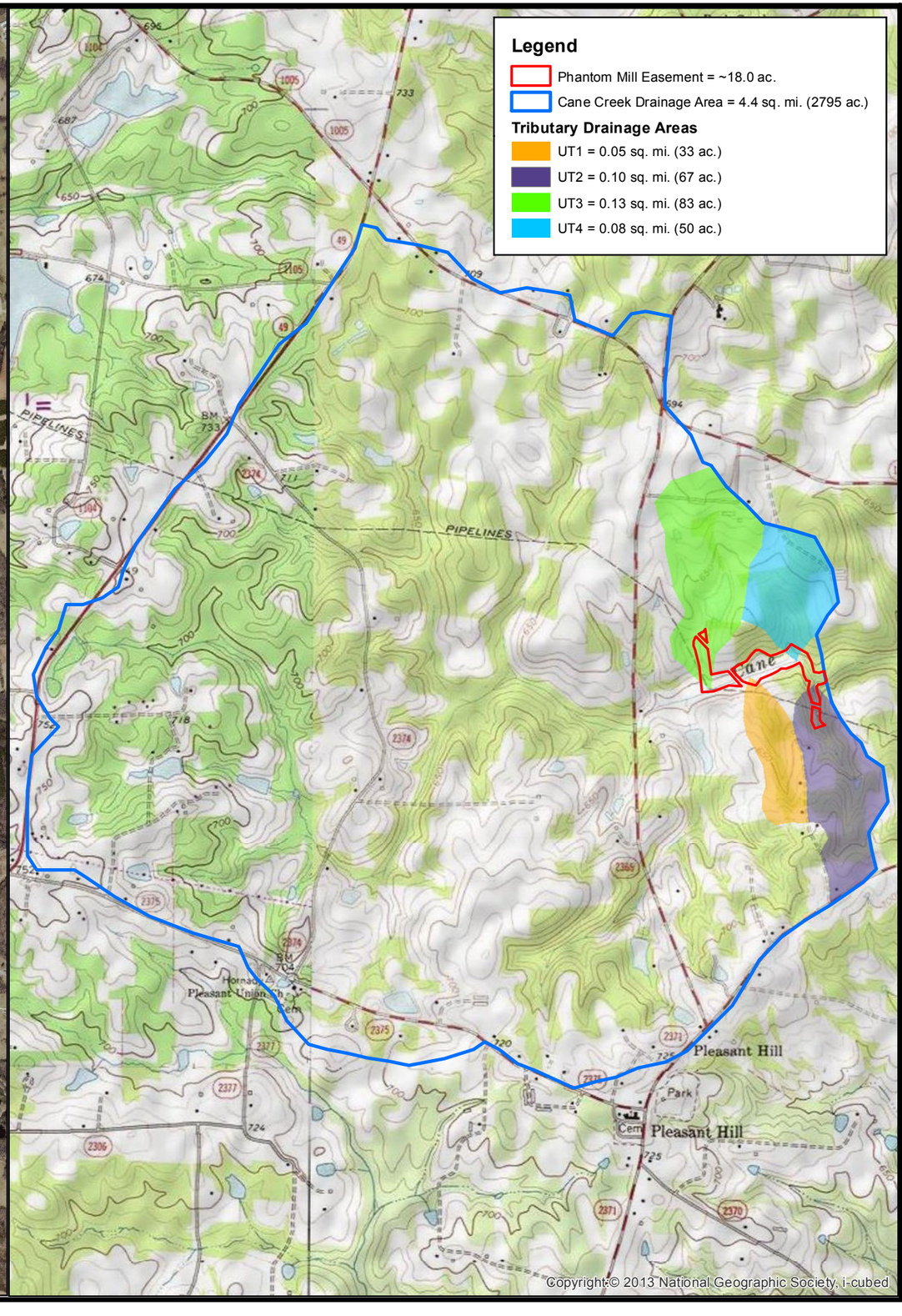
Scale: 1:375,000

Project No.: 17-001.04

FIGURE

2





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by: CLF/KRJ

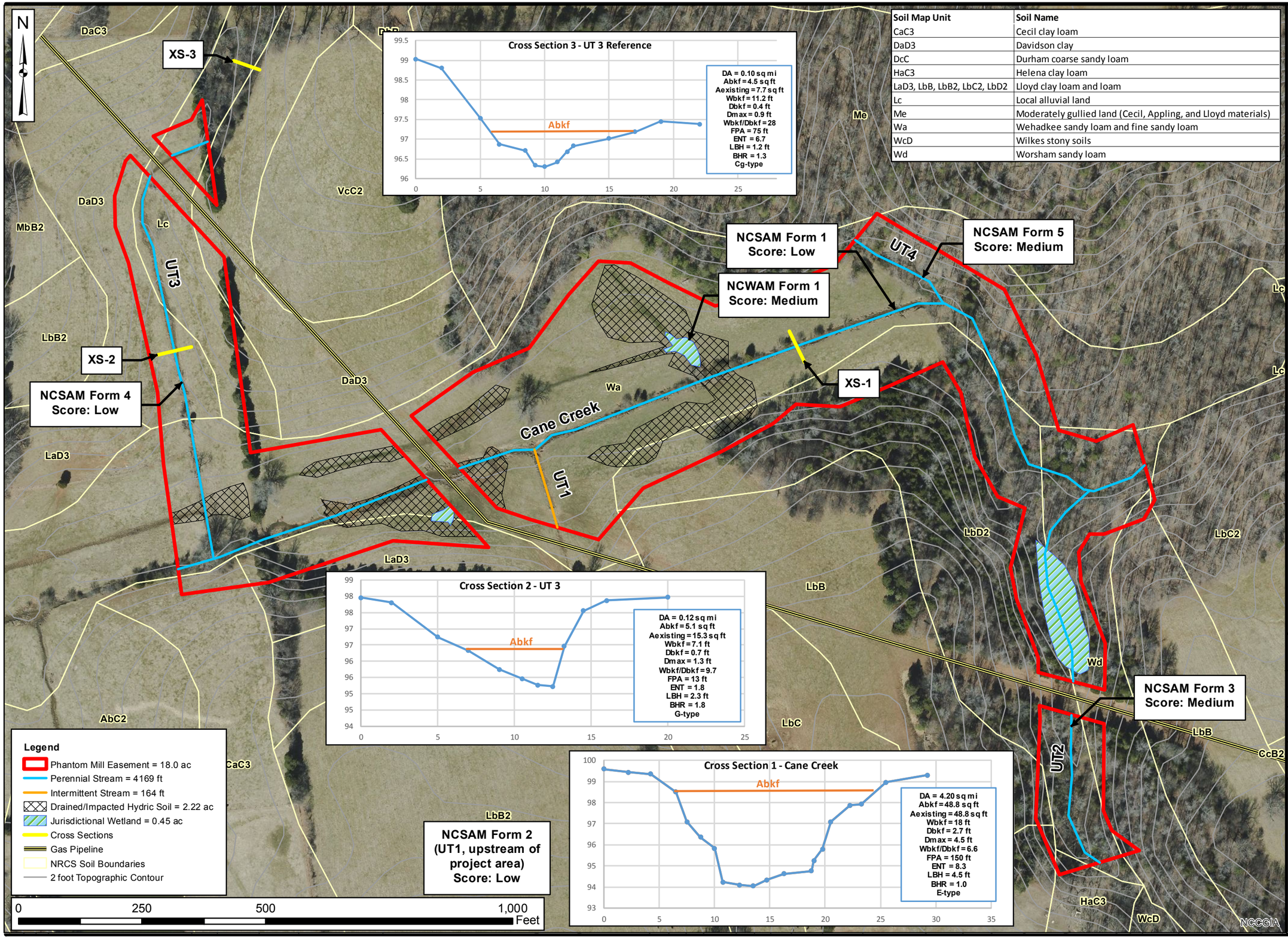
Date: JAN 2018

Scale: 1:24,000

Project No.: 17-001.04

FIGURE

3



Soil Map Unit	Soil Name
CaC3	Cecil clay loam
DaD3	Davidson clay
DcC	Durham coarse sandy loam
HaC3	Helena clay loam
LaD3, LbB, LbB2, LbC2, LbD2	Lloyd clay loam and loam
Lc	Local alluvial land
Me	Moderately gullied land (Cecil, Appling, and Lloyd materials)
Wa	Wehadkee sandy loam and fine sandy loam
WcD	Wilkes stony soils
Wd	Worsham sandy loam

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL MITIGATION SITE

Alamance County, NC

Title:

EXISTING CONDITIONS AND SOILS

Drawn by: KRJ

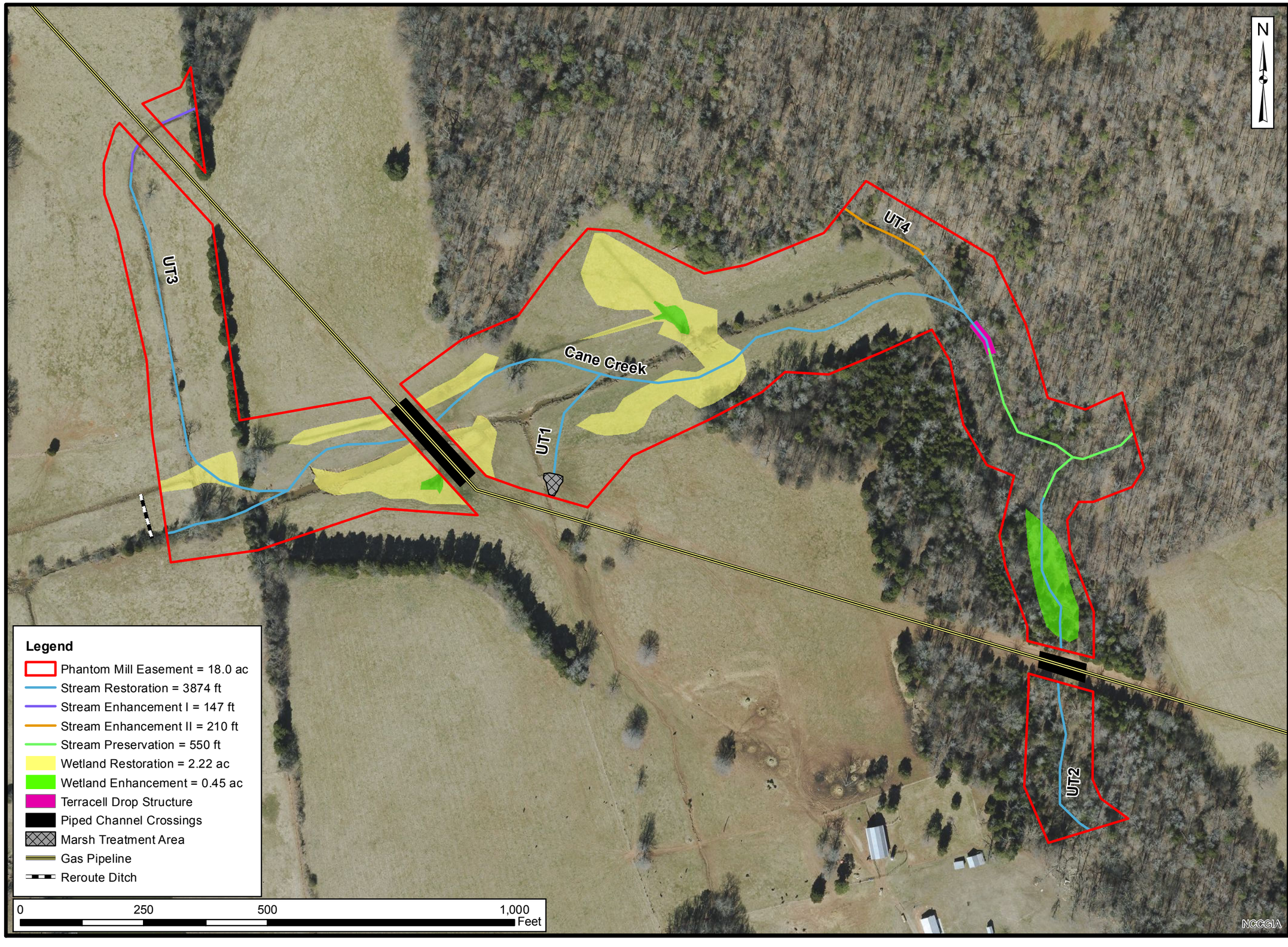
Date: JAN 2018

Scale: 1:2200

Project No.: 17-001.04

FIGURE

4



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL MITIGATION SITE

Alamance County, NC

Title:

PROPOSED CONDITIONS

Drawn by: KRJ

Date: JAN 2018

Scale: 1:2200

Project No.: 17-001.04

FIGURE

5

June 12th, 2018

MR. ROGER E. OWENS
8110 COBLE MILL RD
SNOW CAMP, NC 490

Dear Mr. Owens:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Alamance County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

JD Hamby
Project Manager

June 12th, 2018

MR. CHARLIE EULISS
8148 CHARLIE EULISS RD.
SNOW CAMP, NC 490

Dear Mr. Euliss:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Alamance County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

JD Hamby
Project Manager

May 18th, 2018

Shannon Deaton,
Habitat Conservation Program Manager
North Carolina Wildlife Resources Commission
1701 Mail Service Center
Raleigh, NC 27699-1701

Re: Phantom Mill Stream & Wetland Mitigation Site, Alamance County, NC

Dear Ms. Deaton:

The purpose of this letter is to request concurrence from the North Carolina Wildlife Recourse Commission concerning a stream restoration project located in Alamance County for the N.C. Division of Mitigation Services. The project will restore unnamed tributaries as well as sections of Cane Creek and adjacent drained riparian wetlands in existing row crop fields and forested areas. Please review and comment on any possible issues that might emerge with respect to the Fish and Wildlife Coordination Act from the potential stream restoration project. Attached is a USGS base map with the projects 9 acre footprint identified.

Phantom Mill Stream & Wetland Mitigation Site has been identified for the purpose of providing in-kind mitigation for unavoidable impacts to streams wetlands within watersheds of the Cape Fear River Basin 03030002.

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

Yours truly,

Restoration Systems, LLC

JD Hamby
Project Manager
jhamby@restorationsytems.com
919-755-9490

Attachments: Location and USGS Map

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

22 June 2018

Mr. JD Hamby
Restoration Systems LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604

Subject: Request for Project Review and Comments
Phantom Mill Stream & Wetland Mitigation Site
Alamance County, North Carolina

Dear Mr. Hamby,

Biologists with the North Carolina Wildlife Resource Commission (NCWRC) received your letter on 30 May 2018 requesting review and comment on any possible concerns regarding the Phantom Mill Stream & Wetland Mitigation Site. Biologists with NCWRC have reviewed the provided documents. Comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) and North Carolina General Statutes (G.S. 113-131 et seq.).

The Phantom Mill Stream & Mitigation Site is located at the terminus of Charlie Euliss Road near Pleasant Hill, Alamance County, North Carolina. The project occurs on approximately 9 acres of row crop fields and forested areas. The project will provide in-kind mitigation for unavoidable impacts to streams and wetlands within the Cape Fear River Basin (HUC 03030002). The project will restore portions of Cane Creek and its unnamed tributaries, as well as adjacent wetlands that are currently drained for agricultural use. Cane Creek is classified as a Water Supply V and Nutrient Sensitive Water by the N.C. Division of Water Resources (NCDWR).

We have records for the state significantly rare Carolina ladle crayfish (*Cambarus davidi*) within Well Creek, upstream of its confluence with Cane Creek. The Carolina ladle crayfish is an endemic species found in the Neuse and Cape Fear drainages. As such, NCWRC may want to survey the site for this species prior to construction. Adjacent to the site lies the Kimesville Road Basic Forest Natural Heritage Natural Area, in which occurs a Dry-Mesic Basic Oak-Hickory Forest Natural Community. The lack of records from the site does not imply or confirm the absence of federal or state-listed species or state Species of Greatest Conservation Need listed in the 2015 State Wildlife Action Plan (http://www.ncwildlife.org/plan). Therefore, we recommend surveying for the presence of suitable habitat for federal and state-protected species prior to the onset of the project.

Mailing Address: Habitat Conservation • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

Based upon the information provided to NCWRC, it is unlikely that stream and wetland mitigation will adversely affect any federal or state-listed species. However, we recommend leaving snags and mature trees or if necessary, remove tees outside the maternity roosting season for bats (May 15 – August 15). We recommend that riparian buffers are as wide as possible, given site constraints and landowner needs. NCWRC generally recommends a woody buffer of 100 feet on perennial streams to maximize the benefits of buffers, including bank stability, stream shading, treatment of overland runoff, and wildlife habitat.

Stream restoration projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will help protect water quality, improve aquatic and terrestrial habitats, and provide a travel corridor for wildlife species. Provided measures are taken to minimize erosion and sedimentation from construction/restoration activities, we do not anticipate the project to result in significant adverse impacts to aquatic and terrestrial wildlife resources.

Thank you for the opportunity to provide comments. If I can be of additional assistance, please call (919) 707-0364 or email olivia.munzer@ncwildlife.org.

Sincerely,

Olivia Munzer
Western Piedmont Habitat Conservation Coordinator
Habitat Conservation Program

ec: Brena Jones, NCWRC

May 18th, 2018

Renee Gledhill-Earley,
Environmental Review Coordinator
North Carolina State Historic Preservation Office
109 East Jones Street
Raleigh, NC 27699-4617
Sent electronically to Environmental.Review@ncdcr.gov

Re: Phantom Mill Stream & Wetland Mitigation Site, Alamance County, NC

Dear Renee,

The purpose of this letter is to request written concurrence from the State Historic Preservation Office (SHPO) for the Shaw's Run Stream & Wetland Mitigation Site in Alamance County, a Full-Delivery project for the N.C. Davison of Mitigation Services. Please review and comment on any possible issues that might emerge with respect to SHPO from a potential stream restoration project depicted on the attached mapping.

Project Name:	Phantom Mill Stream & Wetland Mitigation Site
Project Location:	8110 Coble Mill Rd. Snow Camp, NC
Project Contact:	JD Hamby, Restoration Systems LLC, 1101 Haynes St. Suite 211, Raleigh, NC 27604

Project Description: The project has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. Permits from the NC DWR and USACE will be obtained to restore waters of the US. Soil and erosion control permits will also be obtained. The project encompasses 9 acres of drained hydric soils, and cleared riparian buffer area currently used for row crop production. Approximately 4781 linear feet of stream and 2.67 acres of riparian wetland will be restored or enhanced.

The term "cultural resources" refers to prehistoric or historic archaeological sites, structures, or artifact deposits over 50 years old. "Significant" cultural resources are those that are eligible or potentially eligible for inclusion in the National Register of Historic Places. Evaluations of site significance are made with reference to the eligibility criteria of the National Register (36 CFR 60) and in consultation with the North Carolina State Historic Preservation Office (SHPO).

Field visits were conducted in January 2017 to conduct evaluations for presence of structures or features that may be eligible for the National Register of Historic Places. No structures were identified within the Site boundaries that may be eligible for the National Register. In addition to field reviews for historically relevant structures, a records search was conducted at the SHPO office to determine if documented occurrences of historic structures or artifacts occur within, or adjacent to the Site. The SHPO records

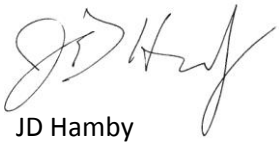
identify no features within the Site boundaries and 5 features within a 1.0 mile radius of the Site, listed here:

- AM0457 | Ward Mill (DOE: 2013)
- AM0458 | Ward Mill House (DOE: 2013)
- AM0342 | Isley-Pike House
- AM0095 | Stanley Coble House
- AM1659 | W.H. Hornaday Farm

Typical SHPO coordination will occur prior to construction activities to determine if any significant cultural resources are present; however, no constraints are expected at this time. We thank you in advance for your timely response and cooperation. Please feel free to contact me with any questions that you may have concerning the extent of site disturbance associated with this project.

Yours truly,

RESTORATION SYSTEMS, LLC



JD Hamby
Project Manager
jhamby@restorationsytems.com
919-755-9490

Attachments – USGS Map, Existing Conditions

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

July 3, 2018

JD Hamby
Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, NC 27604

Re: Phantom Mill Stream & Mitigation Site, 8110 Coble Mill Road, Snow Camp, Alamance County, ER 18-1208

Dear Mr. Hamby:

Thank you for your email of June 1, 2018, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

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

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

Sincerely,

Renee Gledhill-Earley

for Ramona M. Bartos

May 18th, 2018

Milton Cortes
USDA Natural Resources Conservation Service
4407 Bland Road
Suite 117
Raleigh, NC 27609

Re: Phantom Mill Stream & Wetland Mitigation Site, Alamance County, NC

Restoration Systems, LLC (RS), of Raleigh, NC has been awarded a contract by DMS to provide 4111 Stream Mitigation Units and 2.45 Wetland Mitigation Units at the Phantom Mill Stream & Wetland Mitigation Site, Alamance County, North Carolina.

One of the earliest tasks to be performed by RS is completion of an environmental screening and preparation/submittal of a Categorical Exclusion (CE) document. This document is specifically required by the Federal Highway Administration (FHWA) to ensure compliance with various federal environmental laws and regulations. DMS must demonstrate that its projects comply with federal mandates as a precondition to FHWA reimbursement of compensatory mitigation costs borne by the North Carolina Department of Transportation to offset its projects' unavoidable impacts to streams and wetlands.

In order for the project to proceed, RS is obligated to coordinate with the NRCS to complete Form AD-1006 in compliance with the Farmland Protection Policy Act on behalf of the FHWA. The purpose of this letter is to request your assistance in completion of the Form.

Project Location & Description

The Site is located 1 mile north of Pleasant Hill and 2 miles west of Snow Camp (Figures 1 and 2, Appendix A). Site land use consists of disturbed forest and livestock pasture. Site hydrology drains through Cane Creek and unnamed tributaries to Cane Creek. The proposed conservation easement area contains approximately 18.0 acres.

The Site is located in the Carolina Slate Belt portion of the Piedmont ecoregion of North Carolina. Regional physiography is characterized by dissected, irregular plains with moderate to steep slopes and low to moderate gradient streams over boulder and cobble-dominated substrate (Griffith et al. 2002). Onsite elevations range from a high of 540 feet National Geodetic Vertical Datum (NGVD) at the upper reach of UT1 to a low of approximately 490 feet NGVD at the Site outfall (USGS Snow Camp, North Carolina 7.5-minute topographic quadrangle) (Figure 3, Appendix A).

The Site provides water quality functions to an approximately 4.4-square mile (2795-acre) watershed at the outfall; Site tributary watershed sizes range from 0.05-0.13 square miles (33-83 acres) (Figure 3, Appendix A). The watershed is dominated by pasture, agricultural land, forest, and sparse residential property. Impervious surfaces account for less than 5 percent of the upstream watershed land surface.

Land use at the Site is characterized by disturbed forest and livestock pasture. Riparian zones are primarily composed of herbaceous vegetation that is sparse and disturbed due to livestock grazing, bush hogging, and regular land-management activities.

Restoration Means & Methods

Stream restoration efforts are designed to restore a stable stream that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions. Restoration at the Site will be Priority I restoration; therefore, bankfull elevations will be raised to meet the adjacent valley floodplain elevation.

Stream restoration is expected to entail 1) channel excavation, 2) spoil stockpiling, 3) channel stabilization, 4) channel diversion, and 5) channel backfill.

Stream enhancement (level I) will occur on the upper reaches of UT3. This reach is characterized by a channel contained within a relatively confined valley with little adjacent floodplain available. Stream dimension will be restored in these reaches, fencing will be erected to exclude livestock, and planting riparian buffers with native forest vegetation will occur where needed and will extend a minimum of 50 feet from the top of stream banks to facilitate stream recovery and prevent further degradation of the stream. Stream enhancement (level II) will occur on the upper reaches of UT4. These reaches are characterized by channels with riparian vegetation, good channel bed substrate, and little bank erosion. The reaches are accessible by livestock and will have fence erected to exclude livestock. Planting riparian buffers with native forest vegetation will occur where needed and will extend a minimum of 50 feet from the top of stream banks to facilitate stream recovery and prevent further degradation of the stream.

Alternatives for wetland reestablishment 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 drainage ditch excavation, vegetative clearing, agriculture plowing, herbicide application, and other land disturbances associated with land use management. Wetland reestablishment options should focus on the restoration of vegetative communities, filling drainage ditches, the reestablishment of soil structure and microtopographic variations, and redirecting normal surface hydrology from streams back into the Site floodplains. In addition, the construction of (or provisions for) surface water storage depressions (ephemeral pools) will also add an important component to groundwater restoration activities. These activities will result in the reestablishment or enhancement of 2.22 acres of jurisdictional riparian riverine wetlands. Wetland enhancement will focus on the removal of livestock and restoration of vegetative communities resulting in the enhancement of 0.45 acre of riparian wetland.

Restoration of floodplain forest 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.

Revegetating floodplains will provide overall system stability, shade, and wildlife habitat. In addition, viable riparian communities will improve system biogeochemical function by filtering pollutants from overland and shallow subsurface flows and providing organic materials to adjacent stream channels.

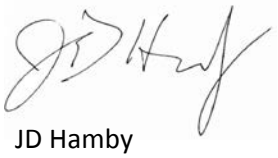
Variations in vegetative planting will occur based on topography and hydraulic condition of soils. Vegetative species composition will be based on RFEs, site-specific features, and community descriptions from Classification of the Natural Communities of North Carolina (Schafale and Weakley 1990). Community associations to be utilized include: 1) Piedmont/Low Mountain Alluvial Forest, 2) Dry-Mesic Oak-Hickory Forest and 3) Streamside Assemblage.

Bare-root seedlings within the Piedmont Alluvial Forest and Dry-Mesic Oak-Hickory Forest will be planted at a density of approximately 680 stems per acre on 8-foot centers, and in the stream-side assemblage at a density of approximately 2720 stems per acre on 4-foot centers. Planting will be performed between November 15 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season.

Should you have any questions or if any additional information is needed to complete the Form, please feel free to contact me at the office 919.334.9111. Your valuable time and cooperation are much appreciated.

Yours truly,

RESTORATION SYSTEMS, LLC



JD Hamby
Project Manager
jhamby@restorationsytems.com
919-334-9111

Attachments- Location and Condition Maps
AD-1006 Form

John Hamby

From: Cortes, Milton - NRCS, Raleigh, NC <Milton.Cortes@nc.usda.gov>
Sent: Sunday, June 24, 2018 3:09 PM
To: John Hamby
Subject: RE: Request Farmland Impact Evaluation-Stream and Wetland Mitigation Sites
Attachments: Arabia Bay Wetland Restoration Site_AD1006.pdf; Phantom Mill_AD1006.pdf; Shaws Run_AD1006.pdf; Slingshot Restoration Site_AD1006.pdf

Importance: High

Follow Up Flag: Follow up
Flag Status: Completed

John:

Please find attached the Farmland Conversion Impact Rating forms, AD1026, for:

Arabia Bay Wetland Rest Hoke Co.
Phantom Mill Stream & Wet Rest Alamance Co.
Shaw's Run Stream & Wet Rest Columbus Co.
Slingshot Stream & Wet Rest Rockingham Co.

Please let us know if we can be of further assistance.

Cordially:

Milton Cortes

Acting State Soil Scientist
Natural Resources Conservation Service
4407 Bland Rd, Suite 117
Raleigh, NC 27609
Phone: 919-873-2171
milton.cortes@nc.usda.gov

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 5/31/18
Name Of Project Phantom Mill Stream & Wetland Restoration Site	Federal Agency Involved Federal Highway Administration
Proposed Land Use Stream and Wetland Restoration	County And State Alamance, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS 5/18/18

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes ☑	No ☐	Acres Irrigated none	Average Farm Size 114 acres
Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 240,623	% 86	Amount Of Farmland As Defined in FPPA Acres: 179,301	% 64
Name Of Land Evaluation System Used Alamance Co. NC LESA	Name Of Local Site Assessment System N/A		Date Land Evaluation Returned By NRCS 6/24/18	

PART III *(To be completed by Federal Agency)*	Alternative Site Rating Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	18.1			
B. Total Acres To Be Converted Indirectly	0.0			
C. Total Acres In Site	18.1	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	11.5			
B. Total Acres Statewide And Local Important Farmland	6.6			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.0101			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	36.2			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	72	0	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	15			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	15			
4. Protection Provided By State And Local Government	20	0			
5. Distance From Urban Builtup Area	15	10			
6. Distance To Urban Support Services	15	4			
7. Size Of Present Farm Unit Compared To Average	10	1			
8. Creation Of Nonfarmable Farmland	10	0			
9. Availability Of Farm Support Services	5	4			
10. On-Farm Investments	20	10			
11. Effects Of Conversion On Farm Support Services	10	0			
12. Compatibility With Existing Agricultural Use	10	1			
TOTAL SITE ASSESSMENT POINTS	160	70	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	72	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	70	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	142	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)

This form was electronically produced by National Production Services Staff

Clear Form

Form AD-1006 (10-83)

Phantom MIll Alamance County, North Carolina

Regulatory review

The IPaC regulatory review process helps evaluate the potential impacts of your project on resources managed by the U.S. Fish and Wildlife Service. It walks through regulations covering each protected resource, and offers suggestions and assistance in designing your project.

Endangered species

Endangered species are protected under the Endangered Species Act [1].

THERE ARE NO ENDANGERED SPECIES EXPECTED TO OCCUR AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act [2] and the Bald and Golden Eagle Protection Act [3].

3 migratory birds of conservation concern are expected to occur or may be affected by activities in this location.

Contact the local U.S. Fish and Wildlife Service field office

There is currently no regulatory review process in IPaC for migratory birds. Please contact the local U.S. Fish and Wildlife Service field office to evaluate effects and authorize take.

Facilities

U.S. Fish and Wildlife Service facilities are protected under the National Wildlife Refuge System Administration Act [4] and the National Fish Hatchery System [5].

THERE ARE NO U.S. FISH AND WILDLIFE SERVICE REFUGES OR FISH HATCHERIES AT THIS LOCATION.

Wetlands

Wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act [6], or other State/Federal statutes.

THERE ARE NO KNOWN WETLANDS AT THIS LOCATION.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Phone: (919) 856-4520 Fax: (919) 856-4556

In Reply Refer To:
Consultation Code: 04EN2000-2018-SLI-0764
Event Code: 04EN2000-2018-E-01669
Project Name: Phantom MIll

May 18, 2018

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The species list generated pursuant to the information you provided identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or

evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

Not all Threatened and Endangered Species that occur in North Carolina are subject to section 7 consultation with the U.S Fish and Wildlife Service. Atlantic and shortnose sturgeon, sea turtles,when in the water, and certain marine mammals are under purview of the National Marine Fisheries Service. If your project occurs in marine, estuarine, or coastal river systems you should also contact the National Marine Fisheries Service, http://www.nmfs.noaa.gov/

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office. If you have any questions or comments, please contact John Ellis of this office at john_ellis@fws.gov.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
(919) 856-4520

Project Summary

Consultation Code: 04EN2000-2018-SLI-0764

Event Code: 04EN2000-2018-E-01669

Project Name: Phantom MIll

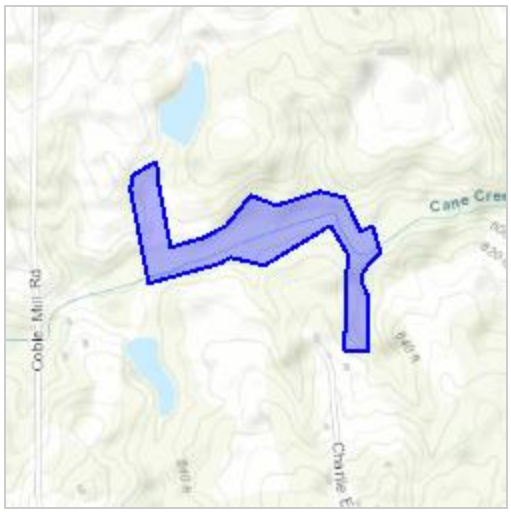
Project Type: STREAM / WATERBODY / CANALS / LEVEES / DIKES

Project Description: This proposal describes the Phantom Mill Stream & Wetland Mitigation Site (Site) and is designed specifically to assist in fulfilling North Carolina Department of Environment and Natural Resources (NCDENR) Division of Mitigation Services (NCDMS) mitigation goals. The Site is located within 14-digit Cataloging Unit and Targeted Local Watershed 03030002050050, 1 mile north of Pleasant Hill and 2 miles west of Snow Camp (Figures 1 and 2, Appendix A). The Site is not located within a Regional Watershed or Local Watershed Planning area. The Site is situated along warm water streams of Cane Creek and unnamed tributaries to Cane Creek.

The Phantom Mill Stream & Wetland Mitigation Site is proposed to include 3874 linear feet of stream restoration, 147 linear feet of stream enhancement (level I), 210 linear feet of stream enhancement (level II), 550 linear feet of stream preservation, 2.22 acres of reestablished riparian riverine wetlands, and 0.45 acre of enhanced riparian riverine wetland. Site alterations include removing livestock, restoring streams, and planting native, woody vegetation within the entire 18.0-acre Site easement. Mitigation outlined in this report will result in net gains in hydrology, water quality, and habitat functions, and are designed to provide 4111 Stream Mitigation Units and 2.45 Riparian Riverine Wetland Mitigation Units.
Construction and planting will occur outside of the growing season during winter months.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/35.891931393075616N79.47799622271137W



Counties: Alamance, NC

Endangered Species Act Species

There is a total of 0 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Phantom Mill
8110 Coble Mill Road
Snow Camp, NC 27349

Inquiry Number: 5328451.11s
June 11, 2018

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

8110 COBLE MILL ROAD
SNOW CAMP, NC 27349

COORDINATES

Latitude (North):	35.8923440 - 35° 53' 32.43''
Longitude (West):	79.4763280 - 79° 28' 34.78''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	637519.7
UTM Y (Meters):	3972880.0
Elevation:	612 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5945593 SNOW CAMP, NC
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140827
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
8110 COBLE MILL ROAD
SNOW CAMP, NC 27349

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION

NO MAPPED SITES FOUND

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ---------- National Priority List
Proposed NPL ---------- Proposed National Priority List Sites
NPL LIENS ---------- Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ---------- National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY ---------- Federal Facility Site Information listing
SEMS ---------- Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE ---------- Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS ---------- Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ---------- RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ---------- RCRA - Large Quantity Generators
RCRA-SQG ---------- RCRA - Small Quantity Generators
RCRA-CESQG ---------- RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS ---------- Land Use Control Information System
US ENG CONTROLS ---------- Engineering Controls Sites List

US INST CONTROL ..... Sites with Institutional Controls

Federal ERNS list

ERNS ..... Emergency Response Notification System

State- and tribal - equivalent NPL

NC HSDS ..... Hazardous Substance Disposal Site

State- and tribal - equivalent CERCLIS

SHWS ..... Inactive Hazardous Sites Inventory

State and tribal landfill and/or solid waste disposal site lists

SWF/LF ..... List of Solid Waste Facilities
OLI ..... Old Landfill Inventory

State and tribal leaking storage tank lists

LUST ..... Regional UST Database
LAST ..... Leaking Aboveground Storage Tanks
INDIAN LUST ..... Leaking Underground Storage Tanks on Indian Land
LUST TRUST ..... State Trust Fund Database

State and tribal registered storage tank lists

FEMA UST ..... Underground Storage Tank Listing
UST ..... Petroleum Underground Storage Tank Database
AST ..... AST Database
INDIAN UST ..... Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

INST CONTROL ..... No Further Action Sites With Land Use Restrictions Monitoring

State and tribal voluntary cleanup sites

VCP ..... Responsible Party Voluntary Action Sites
INDIAN VCP ..... Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS ..... Brownfields Projects Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ..... A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

HIST LF ..... Solid Waste Facility Listing

SWRCY Recycling Center Listing
INDIAN ODI Report on the Status of Open Dumps on Indian Lands
DEBRIS REGION 9 Torres Martinez Reservation Illegal Dump Site Locations
ODI Open Dump Inventory
IHS OPEN DUMPS Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL Delisted National Clandestine Laboratory Register
US CDL National Clandestine Laboratory Register

Local Land Records

LIENS 2 CERCLA Lien Information

Records of Emergency Release Reports

HMIRS Hazardous Materials Information Reporting System
SPILLS Spills Incident Listing
IMD Incident Management Database
SPILLS 90 SPILLS 90 data from FirstSearch
SPILLS 80 SPILLS 80 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR RCRA - Non Generators / No Longer Regulated
FUDS Formerly Used Defense Sites
DOD Department of Defense Sites
SCRD DRYCLEANERS State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR Financial Assurance Information
EPA WATCH LIST EPA WATCH LIST
2020 COR ACTION 2020 Corrective Action Program List
TSCA Toxic Substances Control Act
TRIS Toxic Chemical Release Inventory System
SSTS Section 7 Tracking Systems
ROD Records Of Decision
RMP Risk Management Plans
RAATS RCRA Administrative Action Tracking System
PRP Potentially Responsible Parties
PADS PCB Activity Database System
ICIS Integrated Compliance Information System
FTTS FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS Material Licensing Tracking System
COAL ASH DOE Steam-Electric Plant Operation Data
COAL ASH EPA Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER PCB Transformer Registration Database
RADINFO Radiation Information Database
HIST FTTS FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS Incident and Accident Data
CONSENT Superfund (CERCLA) Consent Decrees
INDIAN RESERV Indian Reservations
FUSRAP Formerly Utilized Sites Remedial Action Program
UMTRA Uranium Mill Tailings Sites
LEAD SMELTERS Lead Smelter Sites

US AIRS ---- Aerometric Information Retrieval System Facility Subsystem
US MINES ---- Mines Master Index File
ABANDONED MINES ---- Abandoned Mines
FINDS ---- Facility Index System/Facility Registry System
ECHO ---- Enforcement & Compliance History Information
DOCKET HWC ---- Hazardous Waste Compliance Docket Listing
UXO ---- Unexploded Ordnance Sites
FUELS PROGRAM ---- EPA Fuels Program Registered Listing
AIRS ---- Air Quality Permit Listing
ASBESTOS ---- ASBESTOS
COAL ASH ---- Coal Ash Disposal Sites
DRYCLEANERS ---- Drycleaning Sites
Financial Assurance ---- Financial Assurance Information Listing
NPDES ---- NPDES Facility Location Listing
UIC ---- Underground Injection Wells Listing
AOP ---- Animal Operation Permits Listing

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP ---- EDR Proprietary Manufactured Gas Plants
EDR Hist Auto ---- EDR Exclusive Historical Auto Stations
EDR Hist Cleaner ---- EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS ---- Recovered Government Archive State Hazardous Waste Facilities List
RGA LF ---- Recovered Government Archive Solid Waste Facilities List
RGA LUST ---- Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

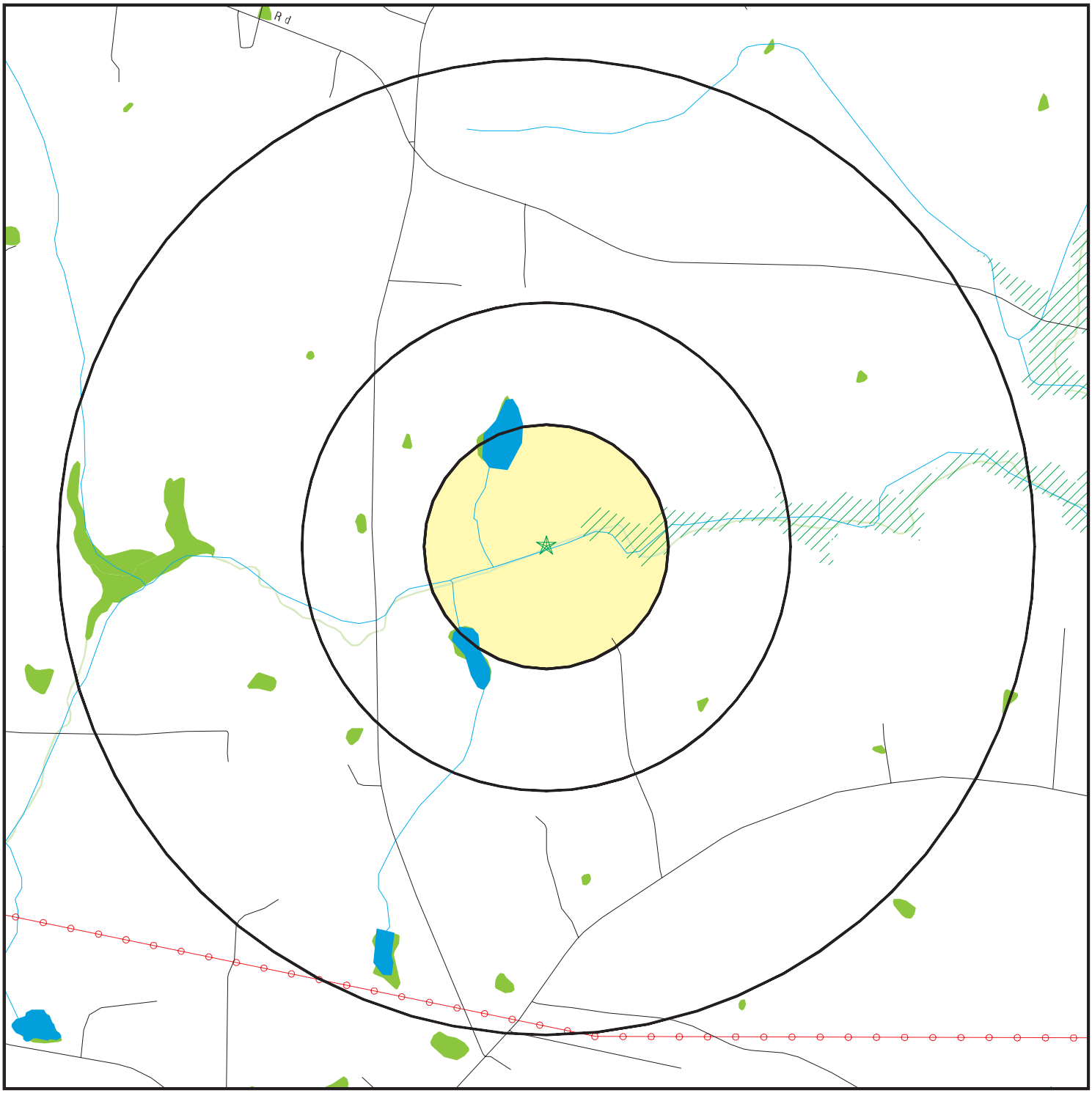
Surrounding sites were not identified.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 5328451.11S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Phantom Mill ADDRESS: 8110 Coble Mill Road Snow Camp NC 27349 LAT/LONG: 35.892344 / 79.476328	CLIENT: Restoration Systems, LLC CONTACT: JD Hamby INQUIRY #: 5328451.11s DATE: June 11, 2018 4:31 pm

Appendix F
FEMA Coordination

Axiom Environmental, Inc.

Axiom Environmental, Inc.

218 Snow Avenue, Raleigh, North Carolina 27603 919-215-1693

September 27, 2018

Libby Hodges
Alamance County Local Floodplain Administrator
4218 Mail Service Center
Raleigh, NC 27699-4218

Re: Phantom Mill Stream and Wetland mitigation project Alamance County **18-012**
FEMA Floodplain Requirements Checklist

Dear Ms. Hodges:

The purpose of this letter is to request concurrence from the Alamance County concerning a stream and wetland restoration site located in Alamance County. The Site encompasses approximately 16 acres of agricultural land used for livestock grazing and hay production. Existing Site streams have been cleared, dredged of cobble substrate, trampled by livestock, eroded vertically and laterally, and receive extensive sediment and nutrient inputs from livestock. Proposed activities at the Site include the restoration of perennial and intermittent stream channels, enhancement of perennial stream channel, and restoration of riparian wetlands. Work proposed on the main channel of Cane Creek includes moving the channel to a relict and abandoned reach of channel, and planting with forest vegetation on cleared sections.

Stream reaches are depicted on the attached figures and lengths/priority are as follows:

Reach	**Length**	**Priority**
Cane Creek	2503	Priority 1 Restoration and Preservation
UT 1	201	Priority 1 Restoration
UT 2 and 2A	967	Priority 1 Restoration, Enhancement, and Preservation
UT 3	1063	Priority 1 Restoration and Enhancement
UT 4	405	Priority 1 Restoration and Enhancement

FEMA mapping was reviewed to determine if the project is located in a FEMA study area (DFIRM panel numbers 8748 and 8746). Based on existing floodplain mapping, the site is located in Special Flood Hazard Area and the project may require a "Conditional Letter of Map Revision" (CLOMR), and a subsequent "Letter of Map Revision" (LOMR).

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

Yours truly,

AXIOM ENVIRONMENTAL

W Grant Lewis

W. Grant Lewis
Senior Project Manager

Attachments

- Figure 1 Project Location
- Figure 2 Topography and Drainage Area
- Figure 3A and 3B Restoration Plan
- EEP Floodplain Requirements Checklist

Cc Raymond Holz
Kristie Corson

EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. State NFIP Engineer), NC Floodplain Mapping Unit (attn. State NFIP Coordinator) and NC Ecosystem Enhancement Program.

Project Location

Name of project:	Phantom Mill Stream and Wetland Restoration Site
Name if stream or feature:	Cane Creek
County:	Alamance
Name of river basin:	Cape Fear
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Alamance
DFIRM panel number for entire site:	8748 and 8746
Consultant name:	Axiom Environmental, Inc.
Phone number:	919-215-1693
Address:	218 Snow Avenue Raleigh, NC 27603

Design Information

Provide a general description of project (one paragraph). Include project limits on a reference orthophotograph at a scale of 1" = 500". (See Attached)

Summarize stream reaches or wetland areas according to their restoration priority. (See Attached)

Example

Reach	Length	Priority
Example: Reach A	*1000*	*One (Restoration)*
Example: Reach B	*2000*	*Three (Enhancement)*

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

(•) Yes ( ) No

If project is located in a SFHA, check how it was determined:

☐ Redelineation

☐ Detailed Study

☑ Limited Detail Study

☐ Approximate Study

☐ Don't know

List flood zone designation:

Check if applies:

☑ AE Zone

- (•) Floodway
- ( ) Non-Encroachment
- ( ) None

☐ A Zone

- ( ) Local Setbacks Required
- ( ) No Local Setbacks Required

If local setbacks are required, list how many feet:

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

( ) Yes (•) No

Land Acquisition (Check)

☐ State owned (fee simple)

☐ Conservation easment (Design Bid Build)

☑ Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)

Is community/county participating in the NFIP program?

◉ Yes ○ No

Note: if community is not participating, then all requirements should be addressed to NFIP (attn: State NFIP Engineer, (919) 715-8000

Name of Local Floodplain Administrator: Katherine Liles
Phone Number: 336-570-4052

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☐ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision

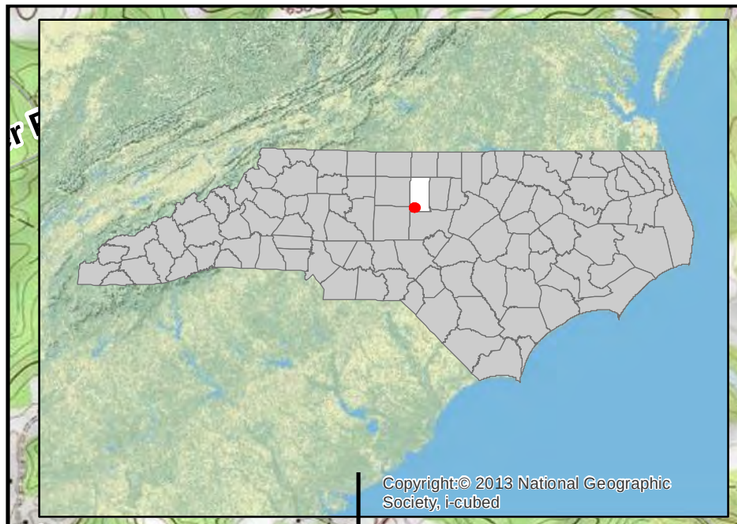
☐ Other Requirements

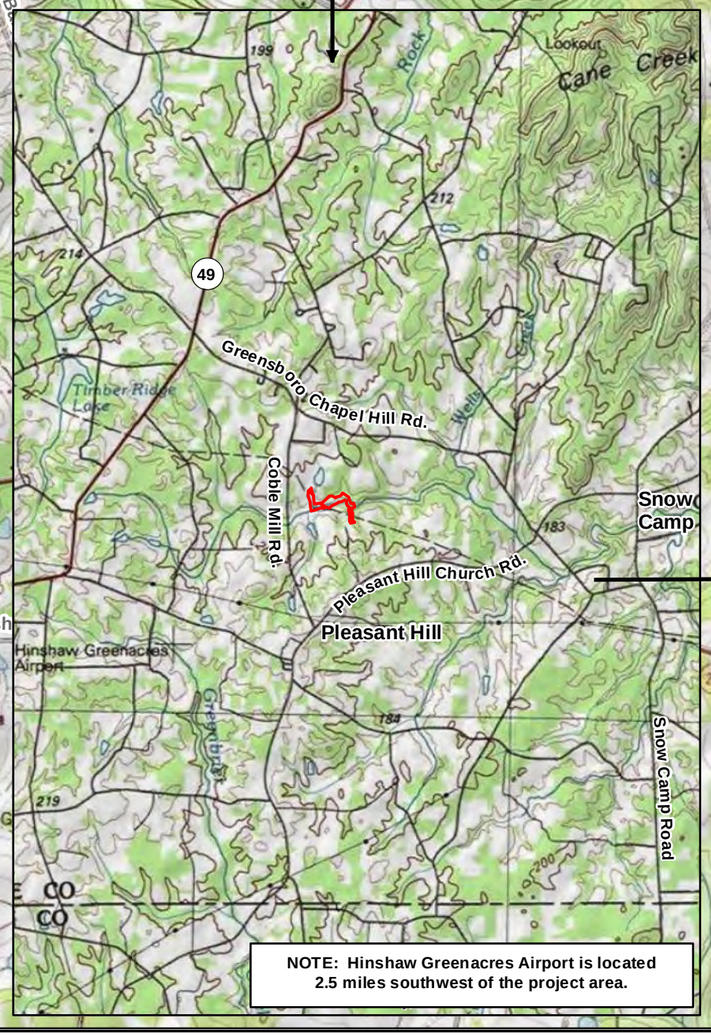
List other requirements:

Comments:

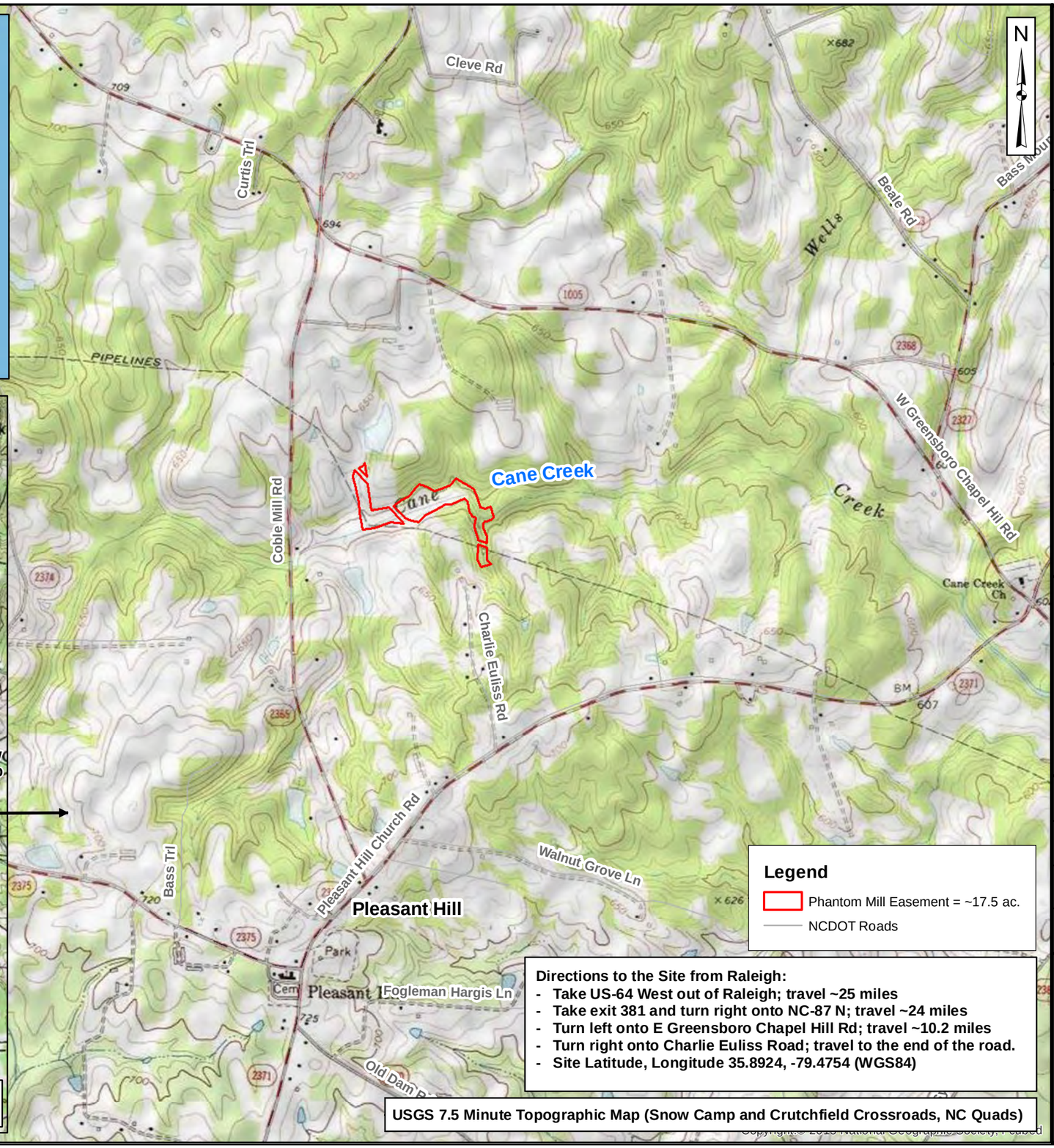
Name: W. Grant Lewis Signature: W Grant Lewis

Title: President Date: 8/27/18





NOTE: Hinshaw Greenacres Airport is located 2.5 miles southwest of the project area.



Legend

- Phantom Mill Easement = ~17.5 ac.
- NCDOT Roads

Directions to the Site from Raleigh:

- **Take US-64 West out of Raleigh; travel ~25 miles**
- **Take exit 381 and turn right onto NC-87 N; travel ~24 miles**
- **Turn left onto E Greensboro Chapel Hill Rd; travel ~10.2 miles**
- **Turn right onto Charlie Euliss Road; travel to the end of the road.**
- **Site Latitude, Longitude 35.8924, -79.4754 (WGS84)**

USGS 7.5 Minute Topographic Map (Snow Camp and Crutchfield Crossroads, NC Quads)

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

SITE LOCATION

Drawn by: CLF/KRJ

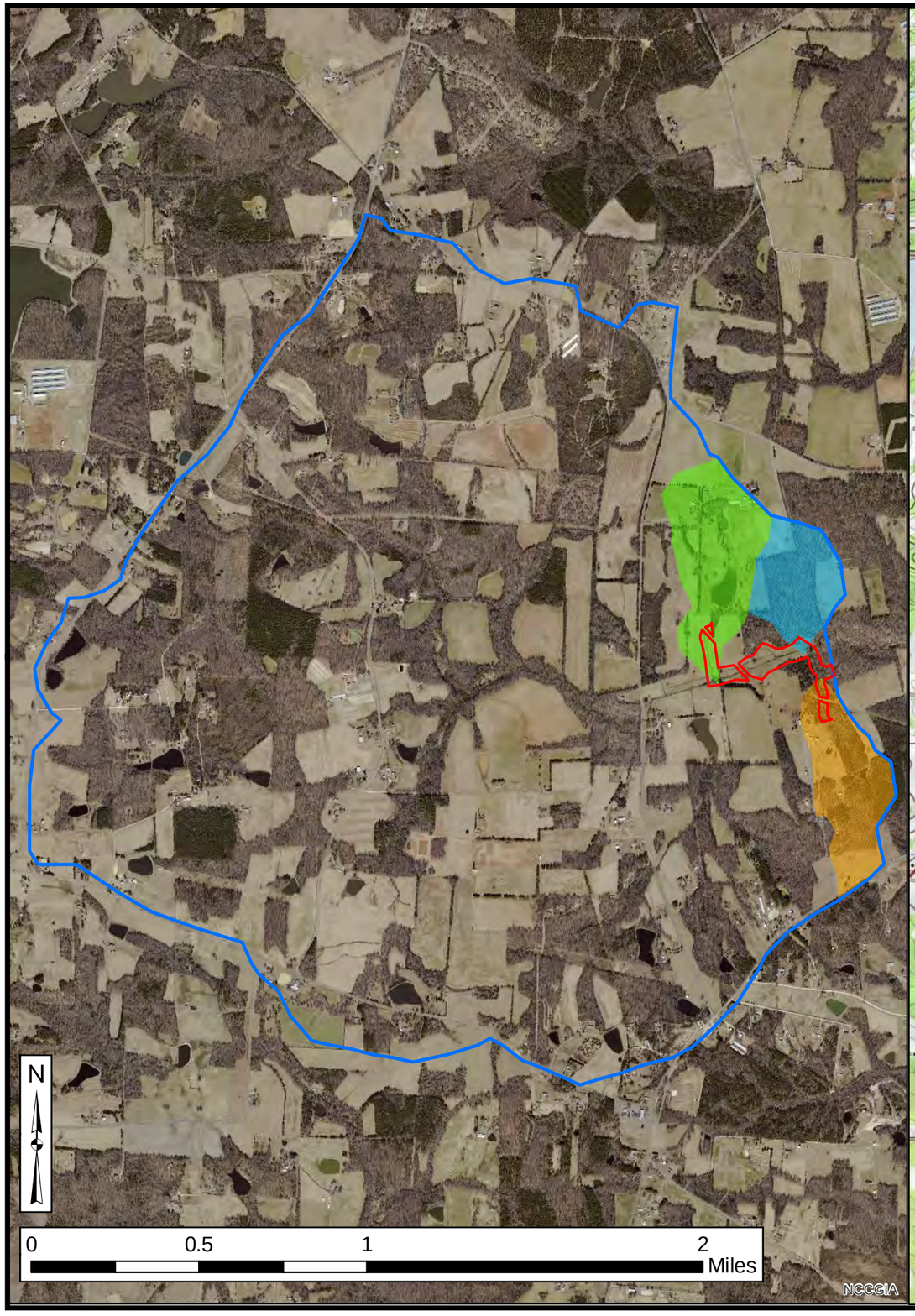
Date: JUL 2018

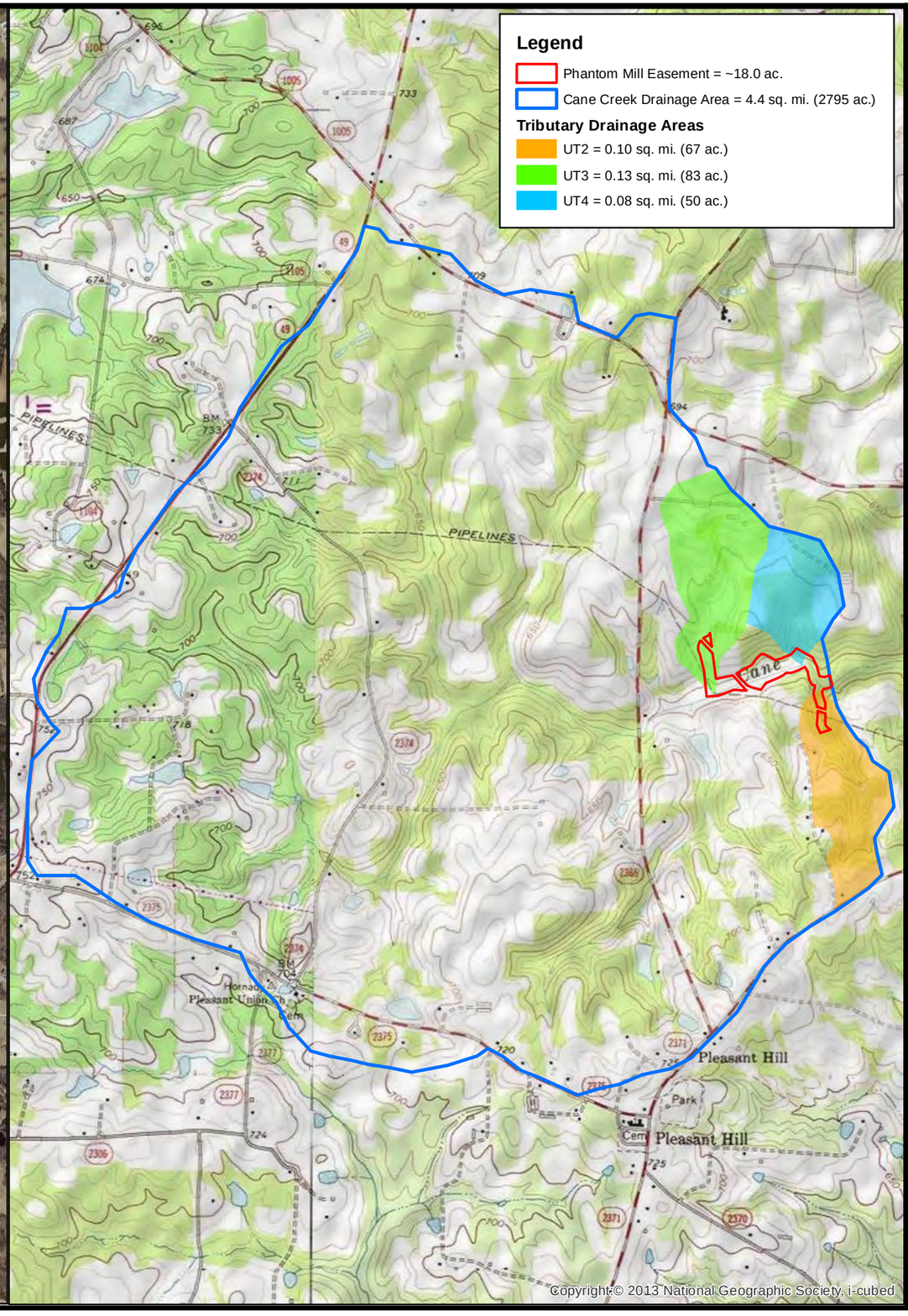
Scale: 1:20,000

Project No.: 18-012

FIGURE

1





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by: CLF/KRJ

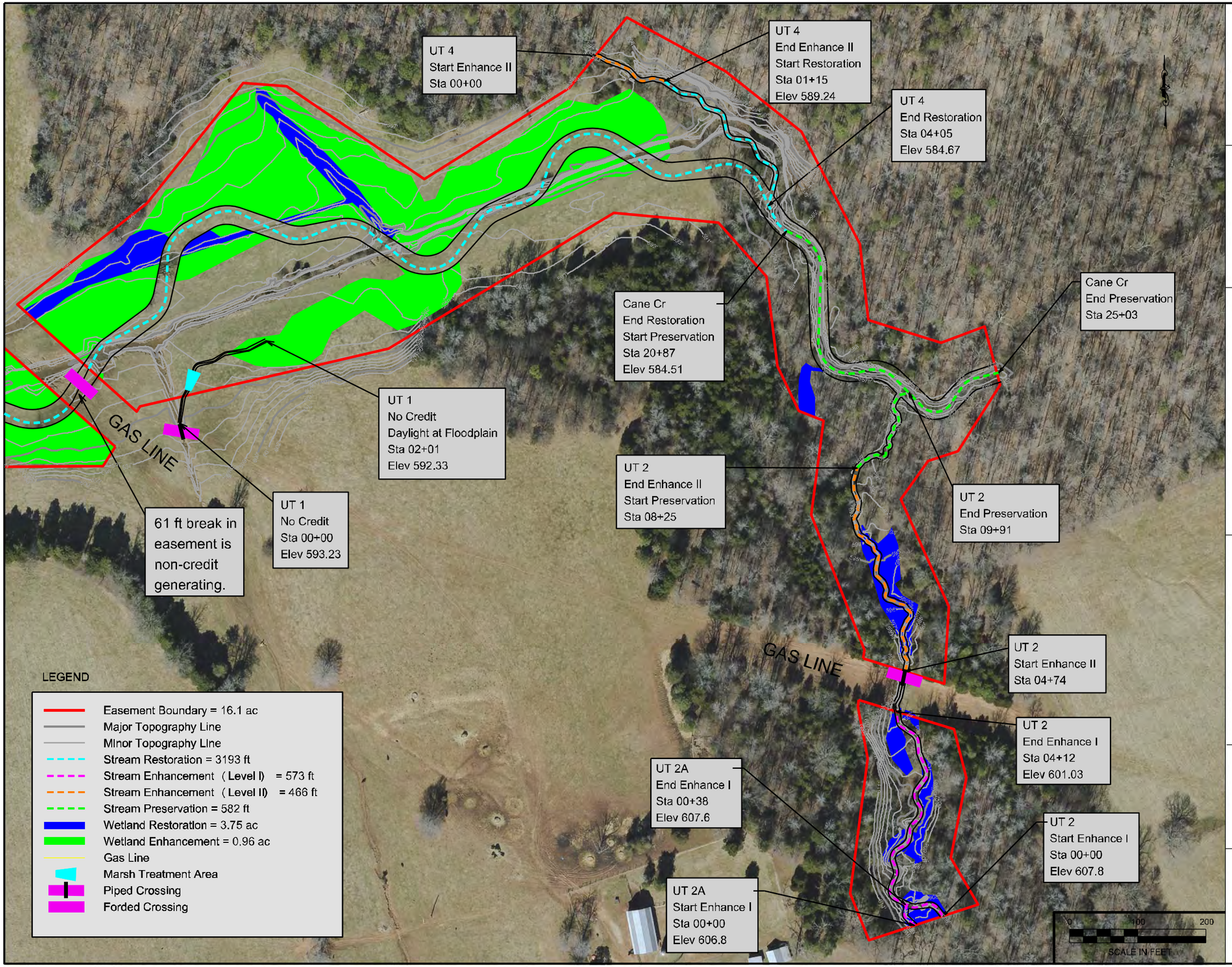
Date: JUL 2018

Scale: 1:24,000

Project No.: 18-012

FIGURE

2



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill Mitigation Site

Alamance County North Carolina

Title:

RESTORATION PLAN

Scale: AS SHOWN

Date: Oct 2018

Project No.: 18-012

FIGURE NO.

6A

Note: All ditches and drainage swales will be backfilled completely.

UT 3
End Enhance I
Start Restoration
Sta 01+86
Elev 614.15

UT 3
Start Enhance I
Sta 00+00
Elev 617.52

63 ft break
in easement
is non-credit
generating.

GAS LINE

Ditch to be backfilled.

Ditch to be backfilled.

UT 3
End Restoration
Sta 10+63
Elev 591.39

GAS LINE

Rerout Ditch

UT 1
No Credit
Daylight onto
floodplain wetlands
Sta 02+01
Elev 592.33

61 ft break
in easement
is non-credit
generating.

UT 1
No Credit
Sta 00+00
Elev 593.23

Cane Cr
Start Restoration
Sta 00+00
Elev 591.59

LEGEND

- Easement Boundary = 16.1 ac
- Major Topography Line
- Minor Topography Line
- Stream Restoration = 3193 ft
- Stream Enhancement (Level I) = 573 ft
- Stream Enhancement (Level II) = 466 ft
- Stream Preservation = 582 ft
- Wetland Restoration = 3.75 ac
- Wetland Enhancement = 0.96 ac
- Gas Line
- Marsh Treatment Area
- Piped Crossing
- Forded Crossing

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Phantom Mill
Mitigation Site

Alamance County
North Carolina

Title:

RESTORATION
PLAN

Scale: AS SHOWN

Date: Oct 2018

Project No.: 18-012

FIGURE NO.

6B

Appendix G
Financial Assurances

FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the Division of Mitigation Service's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the US Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

Appendix H
Site Protection Instrument

As of the Date of this Certification, On the Real Property described in this Deed, there are No Delinquent Taxes Owed which are (1) ad valorem County Taxes, (2) ad valorem Municipal Taxes collected by Alamance County or (3) any other taxes collected by Alamance County.
Date: 10-18-2018
Deputy/Tax Collector: [signature]

BK 3820 PG 0707

FILED
ALAMANCE COUNTY, NC
HUGH WEBSTER
REGISTER OF DEEDS

FILED	Oct 18, 2018
AT	12:09:48 pm
BOOK	03820
START PAGE	0707
END PAGE	0719
INSTRUMENT #	17465
EXCISE TAX	$508.00

LD

Parcel ID: 101409

TS: $508.00

STATE OF NORTH CAROLINA

DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT

ALAMANCE COUNTY

SPO File Number: 01-BF and 01-BG
DMS Project Number: 100057

Prepared by: Office of the Attorney General
Property Control Section
Return to: NC Department of Administration
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this 18th day of October, 2018, by Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement Dated April 22, 2015, ("**Grantor**"), whose mailing address is 8148 Charlie Euliss Road, Snow Camp, NC 27349, to The State of North Carolina ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the

13/26

protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between Restoration Systems, LLC, a North Carolina limited liability company, 1101 Haynes Street, Suite 211, Raleigh, NC 27604-1499, and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number 7526.

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Department of Environment and Natural Resources and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Understanding, (MOU) duly executed by all parties on November 4, 1998. This MOU recognized that the Wetlands Restoration Program was to provide effective compensatory mitigation for authorized impacts to wetlands, streams and other aquatic resources by restoring, enhancing and preserving the wetland and riparian areas of the State; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Division of Mitigation Services (formerly Ecosystem Enhancement Program) is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the Department of Environment and Natural Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resources Commission, the North Carolina Division of Water Quality, the North Carolina Division of Coastal Management, and the National Marine Fisheries Service entered into an agreement to continue the In-Lieu Fee operations of the North Carolina Department of Natural Resources' Division of Mitigation Services (formerly Ecosystem Enhancement Program) with an effective date of 28 July, 2010, which supersedes and replaces the previously effective MOA and MOU referenced above; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, the Division of Mitigation Services in the Department of Environmental Quality, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Patterson Township, Alamance County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 89.96 acres (and originally containing approximately 118 acres before certain out conveyances identified in the deed described herein below) and being conveyed to the Grantor by deed as recorded in **Deed Book 3427 at Page 915** of the Alamance County Registry, North Carolina, with the Property being identified as "Parcel 101409" in said deed; and

WHEREAS, Grantor is willing to grant a Conservation Easement and Right of Access over the herein described areas of the Property, thereby restricting and limiting the use of the areas of the Property subject to the Conservation Easement to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept said Easement and Access Rights. The Conservation Easement shall be for the protection and benefit of the waters of Cane Creek.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access.

The Conservation Easement Area consists of the following:

BEING ALL OF Conservation Easement Area 1 containing a total of 1.05 acres, more or less, Conservation Easement Area 2 containing a total of 9.72 acres, more or less, and Conservation Easement Area 3 containing a total of 1.92 acres, more or less, as shown on the plat of survey titled "Conservation Easement Survey for The State of North Carolina, Division of Mitigation Services, DMS Project ID No. 100057, SPO File Numbers 01-BF and 01-BG of the Phantom Mill Stream & Wetland Mitigation Site over and across a Portion of the Lands Currently Owned by Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement dated April 22, 2015 Per D.B. 3427, Pg. 915 and also owned by Roger E. Owens Per D.B. 987, Pg. 155," dated October 9, 2018, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in the Alamance County, North Carolina Register of Deeds at Plat Book 79, Pages 322-323.

See attached "**Exhibit A**", Legal Description of area of the Property hereinafter referred to as the "Conservation Easement Area"

The purposes of this Conservation Easement are to maintain, restore, enhance, construct, create and preserve wetland and/or riparian resources in the Conservation Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Conservation Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Conservation Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Conservation Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. Any rights not expressly reserved hereunder by the Grantor, including the rights to all mitigation credits, including, but not limited to, stream, wetland, and riparian buffer mitigation units, derived from each site within the area of the Conservation Easement, are conveyed to and belong to the Grantee. Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Conservation Easement Area for the purposes thereof.

B. Motorized Vehicle Use. Motorized vehicle use in the Conservation Easement Area is prohibited except within a Crossing Area(s) or Road or Trail as shown on the recorded survey plat.

C. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Conservation Easement Area not inconsistent with this Conservation Easement, and the right of access to the Conservation Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

D. **Damage to Vegetation.** Except within Crossing Area(s) as shown on the recorded survey plat and as related to the removal of non-native plants, diseased or damaged trees, or vegetation that destabilizes or renders unsafe the Conservation Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited.

E. Industrial, Residential and Commercial Uses. All industrial, residential and commercial uses are prohibited in the Conservation Easement Area.

F. Agricultural Use. All agricultural uses are prohibited within the Conservation Easement Area including any use for cropland, waste lagoons, or pastureland.

G. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Conservation Easement Area.

H. **Roads and Trails.** There shall be no construction or maintenance of new roads, trails, walkways, or paving in the Conservation Easement.

All existing roads, trails and crossings within the Conservation Easement Area shall be shown on the recorded survey plat.

I. Signs. No signs shall be permitted in the Conservation Easement Area except interpretive signs describing restoration activities and the conservation values of the Conservation Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Conservation Easement Area.

J. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or any other material in the Conservation Easement Area is prohibited.

K. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, drilling, hydraulic fracturing; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

L. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Conservation Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides in the Conservation Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Conservation Easement Area may temporarily be withdrawn for good cause shown as needed for the survival of livestock on the Property.

M. Subdivision and Conveyance. Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

N. Development Rights. All development rights are permanently removed from the Conservation Easement Area and are non-transferrable.

O. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Conservation Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation Easement, and the Grantor obtains advance written approval from the Division of Mitigation Services, 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. Right of Access, Construction, and Inspection. The Grantee, its employees and agents, successors and assigns, receive a perpetual Right of Access to the Conservation Easement Area over the Property at reasonable times to undertake any activities on the property to restore, construct, manage, maintain, enhance, protect, and monitor the stream, wetland and any other riparian resources in the Conservation Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

C. Signs. The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities within the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

D. Fences. Conservation Easements are purchased to protect the investments by the State (Grantee) in natural resources. Livestock within conservations easements damages the investment and can result in reductions in natural resource value and mitigation credits which would cause financial harm to the State. Therefore, Landowners (Grantor) with livestock are required to restrict livestock access to the Conservation Easement area. Repeated failure to do so may result in the State (Grantee) repairing or installing livestock exclusion devices (fences) within the conservation area for the purpose of restricting livestock access. In such cases, the landowner (Grantor) must provide access to the State (Grantee) to make repairs.

E. Crossing Area(s). The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the

Grantee shall, except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by such breach. If the breach and damage remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by bringing appropriate legal proceedings including an action to recover damages, as well as injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Conservation Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief, if the breach is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement, and the Grantor and Grantee acknowledge that the damage would be irreparable and remedies at law inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Conservation Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor is complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Conservation Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life or damage to the Property resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring expenses, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown herein or to other addresses as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees that any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed is subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

F. This Conservation Easement and Right of Access may be amended, but only in writing signed by all parties hereto, or their successors or assigns, if such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the State Property Office and the U.S. Army Corps of Engineers in writing sixty (60) days prior to the initiation of any transfer of all or any part of the Property or of any request to void or modify this Conservation Easement. Such notifications and modification requests shall be addressed to:

Division of Mitigation Services Program Manager
NC State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

and

General Counsel
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the

transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Conservation Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Conservation Easement Area, and the right of quiet enjoyment of the Conservation Easement Area,

TO HAVE AND TO HOLD, the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes,

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same is free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

Charles R Euliss (SEAL)
Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement dated April 22, 2015

NORTH CAROLINA
COUNTY OF Alamance

I, John Duncan Hamby, a Notary Public in and for the County and State aforesaid, do hereby certify that Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement dated April 22, 2015, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 18 day of October, 2018.

Notary Public

My commission expires:

11-15-21

JOHN DUNCAN HAMBY NOTARY PUBLIC WAKE COUNTY, NC My Commission Expires 11-15-2021

EXHIBIT A

CONSERVATION EASEMENT
OF THE PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

CONSERVATION EASEMENT AREA 1

BEING ALL OF Conservation Easement Area 1 of the Phantom Mill Stream and Wetland Mitigation Site lying and being situated in Patterson Township, Alamance County, North Carolina, and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 1 and being the Northwestern most corner of the Conservation Easement Area 1 and being located South 67°57'34" East 826.57 feet from an iron stake with a blue cap inscribed: "K2 DESIGN CONTROL POINT" (Point No. 97) with N.C. Grid Coordinates N=779,818.2705', E=1,859,118.7835' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 1), South 72°38'16" East 146.11' to an iron stake; thence South 14°50'50" East 73.06' to an iron stake; thence South 11°20'03" West 120.02' to an iron stake; thence South 30°32'17" East 79.16' to an iron stake; thence South 71°55'33" West 167.72' to an iron stake; thence North 22°10'25" West 73.96' to an iron stake; thence North 07°25'27" East 199.00' to an iron stake; thence North 10°51'12" West 76.62' to an iron stake; thence North 06°30'13" East 11.12' to an iron stake, which is the Point of Beginning (Point No. 1), having an area of 1.05 acres, more or less, as shown on plat of survey titled "Conservation Easement Survey for The State of North Carolina, Division of Mitigation Services, DMS Project ID No. 100057, SPO File Numbers 01-BF and 01-BG of the Phantom Mill Stream & Wetland Mitigation Site over and across a Portion of the Lands Currently Owned by Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement dated April 22, 2015 Per D.B. 3427, Pg. 915 and also owned by Roger E. Owens Per D.B. 987, Pg. 155," dated October 9, 2018, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded at Plat Book 79, Pages 322-323, Alamance County Register of Deeds.

CONSERVATION EASEMENT AREA 2

BEING ALL OF Conservation Easement Area 2 of the Phantom Mill Stream and Wetland Mitigation Site lying and being situated in Patterson Township, Alamance County, North Carolina, and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 10 and being the Southeastern most corner of the Conservation Easement Area 2 and being located South 72°11'02" East 936.20 feet from an iron stake with a blue cap inscribed: "K2 DESIGN CONTROL POINT" (Point No. 97) with N.C. Grid Coordinates N=779,818.2705', E=1,859,118.7835' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 10), North 72°38'16" West 123.87' to an iron stake; thence North 06°30'13" East 12.74' to an iron stake; thence North 21°35'32" West 212.25' to an iron stake; thence North 07°28'50" East 139.28' to an iron stake; thence North 67°45'28" West 39.13' to an iron stake; thence North 25°46'16" West 72.16' to an iron stake; thence North 07°06'00" West 133.02' to an iron stake; thence North 41°46'01" West 105.71' to an iron stake; thence North 84°48'12" West 154.03' to an iron stake; thence South 58°55'33" West 385.10' to an iron stake; thence South 76°52'47" West 374.32' to an iron stake; thence South 31°59'41" West 8.52' to an iron stake; thence North 49°19'25" West 150.03' to an iron stake; thence North 46°38'30" West 85.38' to an iron stake; thence North 52°03'04" East 242.00' to an iron stake; thence North 38°35'27" East 225.45' to an iron stake; thence South 86°08'04" East 64.38' to an iron stake; thence South 55°53'21" East 243.68' to an iron stake; thence North 57°55'05" East 250.30' to an iron stake; thence North 39°11'42" East 134.20' to an iron stake; thence South 61°19'19" East 164.57' to an iron stake; thence South 51°38'04" East 142.40' to an iron stake; thence South 27°16'33" East 185.70' to an iron stake; thence South 06°24'23" East 111.80' to an iron stake; thence South 72°53'13" East 111.80' to an iron stake; thence North 69°48'33" East 68.30' to an iron stake; thence South 14°40'16" East 88.26' to an iron stake; thence South 32°21'25" West 115.02' to an iron stake; thence South 71°16'21" West 46.56' to an iron stake; thence South 35°23'25" West 68.45' to an iron stake; thence South 24°11'12" East 171.91' to an iron stake; thence South 03°33'12" West 113.37' to an iron stake, which is the Point of Beginning (Point No. 10), having an area of 9.72 acres, more or less, as shown on plat of survey titled "Conservation Easement Survey for The State of North Carolina, Division of Mitigation Services, DMS Project ID No. 100057, SPO File Numbers 01-BF and 01-BG of the Phantom Mill Stream & Wetland Mitigation Site over and across a Portion of the Lands Currently Owned by Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement dated April 22, 2015 Per D.B. 3427, Pg. 915 and also owned by Roger E. Owens Per D.B. 987, Pg. 155," dated October 9, 2018, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded at Plat Book 79, Pages 322-323, Alamance County Register of Deeds.

CONSERVATION EASEMENT AREA 3

BEING ALL OF Conservation Easement Area 3 of the Phantom Mill Stream and Wetland Mitigation Site lying and being situated in Patterson Township, Alamance County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 42 and being the Northern most corner of the Conservation Easement Area 3 and being located North 65°24'05" West 578.40 feet from an iron stake with a blue cap inscribed: "K2 DESIGN CONTROL POINT" (Point No. 97) with N.C. Grid Coordinates N=779,818.2705', E=1,859,118.7835' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 42), thence South 46°38'30" East 109.68' to an iron stake; thence South 49°19'25" East 160.60' to an iron stake; thence South 31°59'41" West 34.00' to an iron stake; thence South 89°50'09" West 288.64' to an iron stake; thence South 63°02'11" West 193.58' to an iron stake; thence North 10°21'00" West 9.13' to a mag nail set in a

post; thence North 08°28'37" West 54.68' to an iron stake; thence North 12°43'07" West 5.31' to an iron stake; thence North 06°48'00" West 70.47' to a mag nail set in a post; thence North 07°21'11" West 86.07' to an iron stake; thence North 76°30'51" East 316.60' to an iron stake, which is the Point of Beginning (Point No. 42), having an area of 1.92 acres, more or less, as shown on plat of survey titled "Conservation Easement Survey for The State of North Carolina, Division of Mitigation Services, DMS Project ID No. 100057, SPO File Numbers 01-BF and 01-BG of the Phantom Mill Stream & Wetland Mitigation Site over and across a Portion of the Lands Currently Owned by Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement dated April 22, 2015 Per D.B. 3427, Pg. 915 and also owned by Roger E. Owens Per D.B. 987, Pg. 155," dated October 9, 2018, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded at Plat Book 79, Pages 322-323, Alamance County Register of Deeds.

ALL TOGETHER WITH that certain new twenty (20) foot-wide non-exclusive access easement labeled as Access Easement 1 and those certain new sixty (60) foot-wide non-exclusive access easements labeled as Access Easement 2, and Access Easement 3, all for ingress, egress, and regress and all as shown on the foregoing described plat of survey recorded in Plat Book 79, Pages 322-323, Alamance County Register of Deeds.

As of the Date of this Certification, On the real Property described in this Deed, there are No Delinquent Taxes Owed which are (1) ad valorem County Taxes, (2) ad valorem Municipal Taxes collected by Alamance County or (3) any other taxes collected by Alamance County.
Date: 10-18-2018
Deputy/Tax Collector: YM

BK 3820 PG 0720

FILED
ALAMANCE COUNTY, NC
HUGH WEBSTER
REGISTER OF DEEDS

FILED	Oct 18, 2018
AT	12:09:53 pm
BOOK	03820
START PAGE	0720
END PAGE	0731
INSTRUMENT #	17466
EXCISE TAX	$270.00

LD

Parcel ID: 101372

RS: $270.00

STATE OF NORTH CAROLINA

DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT

ALAMANCE COUNTY

SPO File Number: 01-BF and 01-BG
DMS Project Number: 100057

Prepared by: Office of the Attorney General
Property Control Section
Return to: NC Department of Administration
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this 18th day of October, 2018, by Roger E. Owens ("**Grantor**"), whose mailing address is 8110 Coble Mill Road, Snow Camp, NC 27349, to The State of North Carolina ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the

12/26

protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between Restoration Systems, LLC, a North Carolina limited liability company, 1101 Haynes Street, Suite 211, Raleigh, NC 27604-1499, and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number 7526.

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Department of Environment and Natural Resources and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Understanding, (MOU) duly executed by all parties on November 4, 1998. This MOU recognized that the Wetlands Restoration Program was to provide effective compensatory mitigation for authorized impacts to wetlands, streams and other aquatic resources by restoring, enhancing and preserving the wetland and riparian areas of the State; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Division of Mitigation Services (formerly Ecosystem Enhancement Program) is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the Department of Environment and Natural Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resources Commission, the North Carolina Division of Water Quality, the North Carolina Division of Coastal Management, and the National Marine Fisheries Service entered into an agreement to continue the In-Lieu Fee operations of the North Carolina Department of Natural Resources' Division of Mitigation Services (formerly Ecosystem Enhancement Program) with an effective date of 28 July, 2010, which supersedes and replaces the previously effective MOA and MOU referenced above; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, the Division of Mitigation Services in the Department of Environmental Quality, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Patterson Township, Alamance County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 54.25 acres and being conveyed to the Grantor by deed as recorded in **Deed Book 987 at Page 155** of the Alamance County Registry, North Carolina, with said Property being identified as "Tract #1" in said deed; and

WHEREAS, Grantor is willing to grant a Conservation Easement and Right of Access over the herein described areas of the Property, thereby restricting and limiting the use of the areas of the Property subject to the Conservation Easement to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept said Easement and Access Rights. The Conservation Easement shall be for the protection and benefit of the waters of Cane Creek.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access.

The Conservation Easement Area consists of the following:

BEING ALL OF Conservation Easement Area 4 containing a total of 3.21 acres, more or less, and Conservation Easement Area 5 containing a total of 0.25 acres, more or less, as shown on the plat of survey titled "Conservation Easement Survey for The State of North Carolina, Division of Mitigation Services, DMS Project ID No. 100057, SPO File Numbers 01-BF and 01-BG of the Phantom Mill Stream & Wetland Mitigation Site over and across a Portion of the Lands Currently Owned by Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement dated April 22, 2015 Per D.B. 3427, Pg. 915 and also owned by Roger E. Owens Per D.B. 987, Pg. 155," dated October 9, 2018, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in the Alamance County, North Carolina Register of Deeds at Plat Book 79, Pages 322-323.

See attached "**Exhibit A**", Legal Description of area of the Property hereinafter referred to as the "Conservation Easement Area"

The purposes of this Conservation Easement are to maintain, restore, enhance, construct, create and preserve wetland and/or riparian resources in the Conservation Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Conservation Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the

use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Conservation Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Conservation Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. Any rights not expressly reserved hereunder by the Grantor, including the rights to all mitigation credits, including, but not limited to, stream, wetland, and riparian buffer mitigation units, derived from each site within the area of the Conservation Easement, are conveyed to and belong to the Grantee. Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Conservation Easement Area for the purposes thereof.

B. Motorized Vehicle Use. Motorized vehicle use in the Conservation Easement Area is prohibited except within a Crossing Area(s) or Road or Trail as shown on the recorded survey plat.

C. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Conservation Easement Area not inconsistent with this Conservation Easement, and the right of access to the Conservation Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

D. **Damage to Vegetation.** Except within Crossing Area(s) as shown on the recorded survey plat and as related to the removal of non-native plants, diseased or damaged trees, or vegetation that destabilizes or renders unsafe the Conservation Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited.

E. Industrial, Residential and Commercial Uses. All industrial, residential and commercial uses are prohibited in the Conservation Easement Area.

F. Agricultural Use. All agricultural uses are prohibited within the Conservation Easement Area including any use for cropland, waste lagoons, or pastureland.

G. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Conservation Easement Area.

H. **Roads and Trails.** There shall be no construction or maintenance of new roads, trails, walkways, or paving in the Conservation Easement.

All existing roads, trails and crossings within the Conservation Easement Area shall be shown on the recorded survey plat.

I. Signs. No signs shall be permitted in the Conservation Easement Area except interpretive signs describing restoration activities and the conservation values of the Conservation Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Conservation Easement Area.

J. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or any other material in the Conservation Easement Area is prohibited.

K. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, drilling, hydraulic fracturing; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

L. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Conservation Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides in the Conservation Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Conservation Easement Area may temporarily be withdrawn for good cause shown as needed for the survival of livestock on the Property.

M. Subdivision and Conveyance. Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

N. Development Rights. All development rights are permanently removed from the Conservation Easement Area and are non-transferrable.

O. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Conservation Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation

Easement, and the Grantor obtains advance written approval from the Division of Mitigation Services, 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. Right of Access, Construction, and Inspection. The Grantee, its employees and agents, successors and assigns, receive a perpetual Right of Access to the Conservation Easement Area over the Property at reasonable times to undertake any activities on the property to restore, construct, manage, maintain, enhance, protect, and monitor the stream, wetland and any other riparian resources in the Conservation Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

C. Signs. The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities within the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

D. Fences. Conservation Easements are purchased to protect the investments by the State (Grantee) in natural resources. Livestock within conservations easements damages the investment and can result in reductions in natural resource value and mitigation credits which would cause financial harm to the State. Therefore, Landowners (Grantor) with livestock are required to restrict livestock access to the Conservation Easement area. Repeated failure to do so may result in the State (Grantee) repairing or installing livestock exclusion devices (fences) within the conservation area for the purpose of restricting livestock access. In such cases, the landowner (Grantor) must provide access to the State (Grantee) to make repairs.

E. Crossing Area(s). The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the Grantee shall, except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by

such breach. If the breach and damage remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by bringing appropriate legal proceedings including an action to recover damages, as well as injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Conservation Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief, if the breach is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement, and the Grantor and Grantee acknowledge that the damage would be irreparable and remedies at law inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Conservation Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor is complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Conservation Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life or damage to the Property resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring expenses, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the

ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown herein or to other addresses as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees that any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed is subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

F. This Conservation Easement and Right of Access may be amended, but only in writing signed by all parties hereto, or their successors or assigns, if such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the State Property Office and the U.S. Army Corps of Engineers in writing sixty (60) days prior to the initiation of any transfer of all or any part of the Property or of any request to void or modify this Conservation Easement. Such notifications and modification requests shall be addressed to:

Division of Mitigation Services Program Manager
NC State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

and

General Counsel
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Conservation Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Conservation Easement Area, and the right of quiet enjoyment of the Conservation Easement Area,

TO HAVE AND TO HOLD, the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes,

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same is free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

Roger E. Owens (SEAL)
Roger E. Owens

NORTH CAROLINA
COUNTY OF Alamance

I, John Duncan Hamby, a Notary Public in and for the County and State aforesaid, do hereby certify that Roger E. Owens, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 18th day of October, 2018.

Notary Public

My commission expires:

11-15-21

JOHN DUNCAN HAMBY NOTARY PUBLIC WAKE COUNTY, NC My Commission Expires 11-15-2021

EXHIBIT A

CONSERVATION EASEMENT
OF THE PHANTOM MILL STREAM AND WETLAND MITIGATION SITE

CONSERVATION EASEMENT AREA 4

BEING ALL OF Conservation Easement Area 4 of the Phantom Mill Stream and Wetland Mitigation Site lying and being situated in Patterson Township, Alamance County, North Carolina, and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 47 and being the Southeastern most corner of the Conservation Easement Area 4 and being located South 85°58'03" West 805.54 feet from an iron stake with a blue cap inscribed: "K2 DESIGN CONTROL POINT" (Point No. 97) with N.C. Grid Coordinates N=779,818.2705', E=1,859,118.7835' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 47), thence South 79°39'39" West 148.78' to an iron stake; thence North 08°03'48" West 6.92' to an iron stake; thence North 08°03'48" West 295.46' to an iron stake; thence North 41°35'32" West 36.03' to an iron stake; thence North 14°56'11" West 130.54' to an iron stake; thence North 14°13'45" West 238.73' to an iron stake; thence North 03°58'20" West 116.49' to an iron stake; thence North 05°49'43" West 16.82' to an iron stake; thence North 24°07'11" East 86.07' to an iron stake; thence South 39°13'10" East 253.51' to an iron stake; thence South 46°38'30" East 40.50' to an iron stake; thence South 08°12'12" East 7.56' to an iron stake; thence South 07°52'02" East 179.60' to an iron stake; thence South 08°16'31" East 131.56' to a mag nail set in post; thence South 08°14'34" East 93.86' to an iron stake; thence South 07°21'11" East 12.51' to an iron stake; thence South 07°21'11" East 86.07' to a mag nail set in post; thence South 06°48'00" East 70.47' to an iron stake; thence South 12°43'07" East 5.31' to an iron stake thence South 08°28'37" East 54.68' to a mag nail set in post; thence South 10°21'00" East 9.13' to an iron stake, which is the Point of Beginning (Point No. 47), having an area of 3.21 acres, more or less, as shown on plat of survey titled "Conservation Easement Survey for The State of North Carolina, Division of Mitigation Services, DMS Project ID No. 100057, SPO File Numbers 01-BF and 01-BG of the Phantom Mill Stream & Wetland Mitigation Site over and across a Portion of the Lands Currently Owned by Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement dated April 22, 2015 Per D.B. 3427, Pg. 915 and also owned by Roger E. Owens Per D.B. 987, Pg. 155," dated October 9, 2018, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded at Plat Book 79, Pages 322-323, Alamance County Register of Deeds.

CONSERVATION EASEMENT AREA 5

BEING ALL OF Conservation Easement Area 5 of the Phantom Mill Stream and Wetland Mitigation Site lying and being situated in Patterson Township, Alamance County, North

Carolina, and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 70 and being the Eastern most corner of the Conservation Easement Area 5 and being located North 52°40'32" West 1141.96 feet from an iron stake with a blue cap inscribed: "K2 DESIGN CONTROL POINT" (Point No. 97) with N.C. Grid Coordinates N=779,818.2705', E=1,859,118.7835' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 70), thence North 39°13'10" West 199.20' to an iron stake; thence North 63°43'52" East 109.25' to an iron stake; thence South 08°18'40" East 123.19' to a mag nail set in post; thence South 07°10'49" East 81.42' to an iron stake, which is the Point of Beginning (Point No. 70), having an area of 0.25 acres, more or less, as shown on plat of survey titled "Conservation Easement Survey for The State of North Carolina, Division of Mitigation Services, DMS Project ID No. 100057, SPO File Numbers 01-BF and 01-BG of the Phantom Mill Stream & Wetland Mitigation Site over and across a Portion of the Lands Currently Owned by Charles R. Euliss, Trustee of the Charles R. Euliss Irrevocable Trust Agreement dated April 22, 2015 Per D.B. 3427, Pg. 915 and also owned by Roger E. Owens Per D.B. 987, Pg. 155," dated October 9, 2018, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded at Plat Book 79, Pages 322-323, Alamance County Register of Deeds.

ALL TOGETHER WITH that certain new sixty (60) foot-wide non-exclusive access easement labeled as Access Easement 4, for ingress, egress, and regress as shown on the foregoing described plat of survey recorded in Plat Book 79, Pages 322-323, Alamance County Register of Deeds.

Appendix I
Credit Release Schedule

The schedules below list the updated credit release schedules for stream and wetland mitigation projects developed by bank and ILF sites in North Carolina:

Credit Release Schedule and Milestones for Wetlands					
Credit Release Milestone	**Release Activity**	**Banks**		**ILF/NCDMS**	
		Interim Release	**Total Released**	**Interim Release**	**Total Released**
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that interim performance standards have been met	10%	50%	10%	50%
5	Year 3 monitoring report demonstrates that interim performance standards have been met	15%	65%	15%	65%
6*	Year 4 monitoring report demonstrates that interim performance standards have been met	5%	70%	5%	70%
7	Year 5 monitoring report demonstrates that interim performance standards have been met	15%	85%	15%	85%
8*	Year 6 monitoring report demonstrates that interim performance standards have been met	5%	90%	5%	90%
9	Year 7 monitoring report demonstrates that performance standards have been met	10%	100%	10%	100%

*Please note that vegetation plot data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

Credit Release Schedule and Milestones for Streams					
Credit Release Milestone	**Release Activity**	**Banks**		**ILF/NCDMS**	
		Interim Release	**Total Released**	**Interim Release**	**Total Released**
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%	10%	60%
6*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)	5%	65% (75%**)
7	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)	10%	75% (85%**)
8*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)	5%	80% (90%**)
9	Year 7 monitoring report demonstrates that channels are stable, performance standards have been met	10%	90% (100%**)	10%	90% (100%**)

*Please note that vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

**10% reserve of credits to be held back until the bankfull event performance standard has been met.

Appendix J
Maintenance Plan

Maintenance Plan

The Site shall be monitored on a regular basis and a physical inspection of the site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

Component/Feature	**Maintenance through project close-out**
Stream	Routine channel maintenance and repair activities may include securing of loose coir matting and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Beaver	Beaver and associated dams are to be removed as they colonize and until the project is closed.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree- blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.
Road Crossing	Road crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Terracell Drop Structure	Routine maintenance and repair activities may include removal of debris and supplemental installation of live stakes and other target vegetation along the channel. Undermining of the structure may require repair or replacement.

Appendix K
Natural Heritage Program Elements

Natural Heritage Program Report

Figure D-8. Map of Adjacent and Proximal Planning Elements

North Carolina Department of Natural and Cultural Resources
Natural Heritage Program

Governor Roy Cooper | Secretary Susi H. Hamilton

NCNHDE-4972

December 27, 2017

Phillip Perkinson
Axiom Environmental Inc.
218 Snow Avenue
Raleigh, NC 27612
RE: Phantom Mill; 15-005.09

Dear Phillip Perkinson:

The North Carolina Natural Heritage Program (NCNHP) appreciates the opportunity to provide information about natural heritage resources for the project referenced above.

A query of the NCNHP database indicates that there are records for rare species, important natural communities, natural areas, or conservation/managed areas within the proposed project boundary. These results are presented in the attached 'Documented Occurrences' tables and map.

The attached 'Potential Occurrences' table summarizes rare species and natural communities that have been documented within a one-mile radius of the property boundary. The proximity of these records suggests that these natural heritage elements may potentially be present in the project area if suitable habitat exists and is included for reference. Tables of natural areas and conservation/managed area within a one-mile radius of the project area, if any, are also included in this report.

Please note that natural heritage element data are maintained for the purposes of conservation planning, project review, and scientific research, and are not intended for use as the primary criteria for regulatory decisions. Information provided by the NCNHP database may not be published without prior written notification to the NCNHP, and the NCNHP must be credited as an information source in these publications. Maps of NCNHP data may not be redistributed without permission.

Also please note that the NC Natural Heritage Program may follow this letter with additional correspondence if a Dedicated Nature Preserve (DNP), Registered Heritage Area (RHA), Clean Water Management Trust Fund (CWMTF) easement, or an occurrence of a Federally-listed species is documented near the project area.

If you have questions regarding the information provided in this letter or need additional assistance, please contact Rodney A. Butler at rodney.butler@ncdcr.gov or 919.707.8603.

Sincerely,
NC Natural Heritage Program

MAILING ADDRESS:
1651 Mail Service Center
Raleigh, NC 27699-1651

Telephone: (919) 707-8107
www.ncnhp.org

LOCATION:
121 West Jones Street
Raleigh, NC 27603

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Intersecting the Project Area
Phantom Mill
Project No. 15-005.09
December 27, 2017
NCNHDE-4972

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Rank	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	3980	Dry-Mesic Basic Oak--Hickory Forest (Piedmont Subtype)	---	2010	C	2-High	---	---	G3G4	S3

Natural Areas Documented Within Project Area

Site Name	Representational Rating	Collective Rating
Kimesville Road Basic Forest	R5 (General)	C5 (General)

No Managed Areas Documented within the Project Area

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/content/help. Data query generated on December 27, 2017; source: NCNHP, Q4 October 2017. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Within a One-mile Radius of the Project Area
Phantom Mill
Project No. 15-005.09
December 27, 2017
NCNHDE-4972

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Rank	Accuracy	Federal Status	State Status	Global Rank	State Rank
Butterfly	34484	Neonympha helicta	Helicta Satyr	1980-Pre	H	5-Very Low	---	Significantly Rare	G3G4	S1?
Natural Community	3980	Dry-Mesic Basic Oak--Hickory Forest (Piedmont Subtype)	---	2010	C	2-High	---	---	G3G4	S3

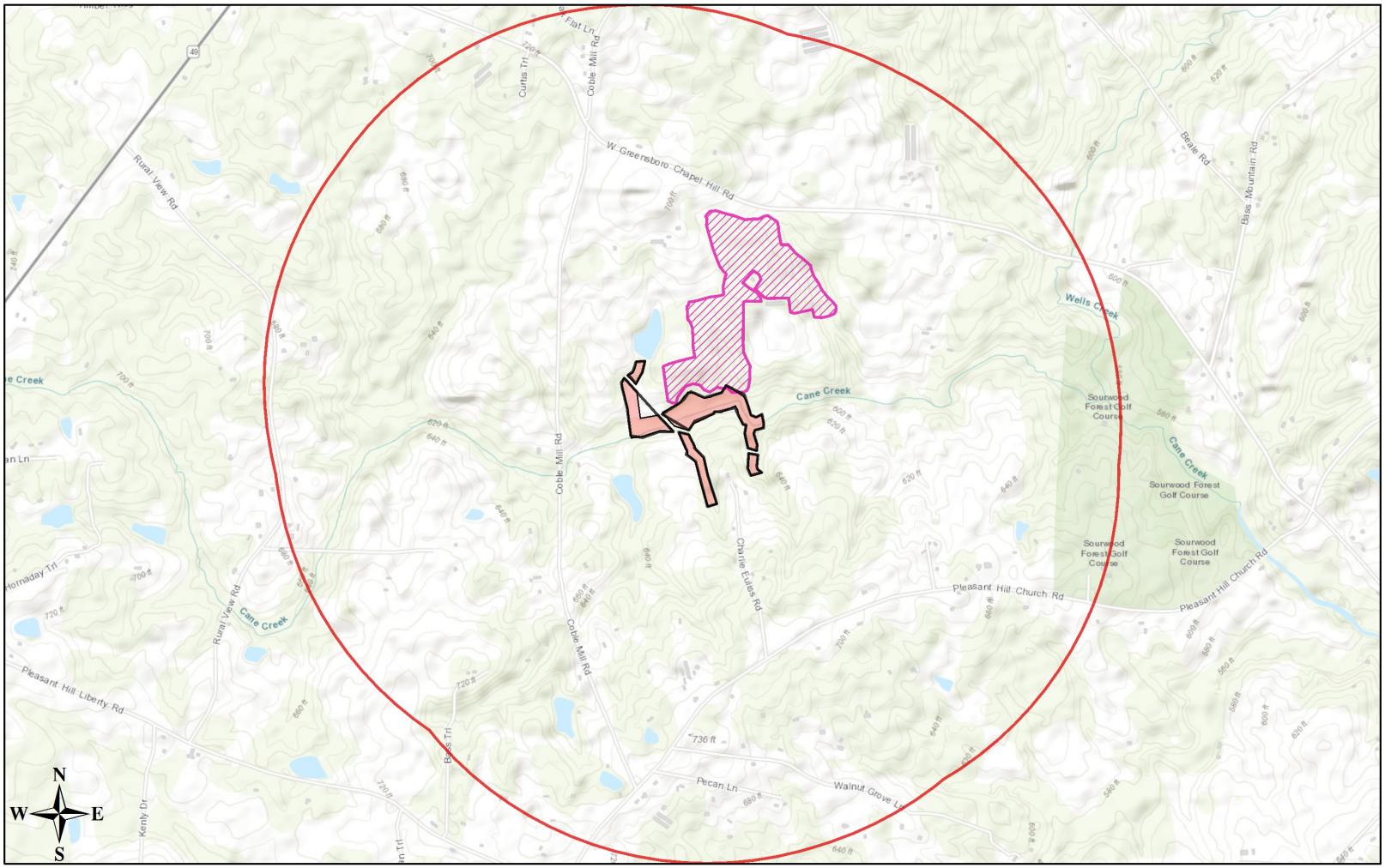
Natural Areas Documented Within a One-mile Radius of the Project Area

Site Name	Representational Rating	Collective Rating
Kimesville Road Basic Forest	R5 (General)	C5 (General)

No Managed Areas are Documented Within a One-mile Radius of the Project Area

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/content/help. Data query generated on December 27, 2017; source: NCNHP, Q4 October 2017. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

NCNHDE-4972: Phantom Mill



December 27, 2017

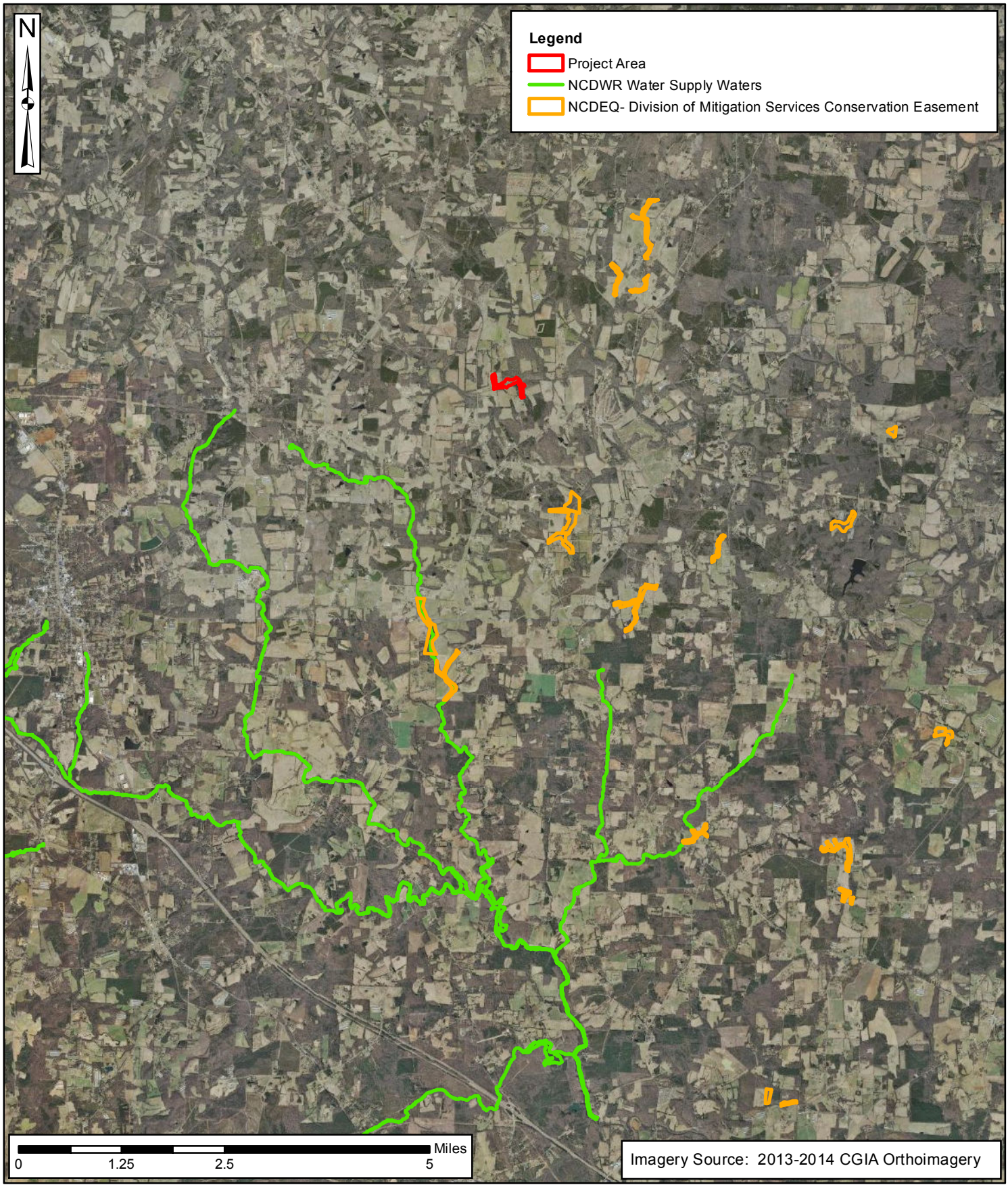
- Project Boundary
- Buffered Project Boundary
- NHP Natural Area (NHNA)

1:24,414

0 0.2 0.4 0.8 mi

0 0.325 0.65 1.3 km

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



Prepared by: Axiom Environmental, Inc.	Prepared for: Restoration Systems, LLC	Project: PHANTOM MILL STREAM AND WETLAND MITIGATION SITE Alamance County, NC	Title: MAP OF ADJACENT AND PROXIMAL PLANNING ELEMENTS	Dwn. by: KRJ Date: Jan. 2018 Project: 17-001.04	FIGURE D-8

Construction Plans

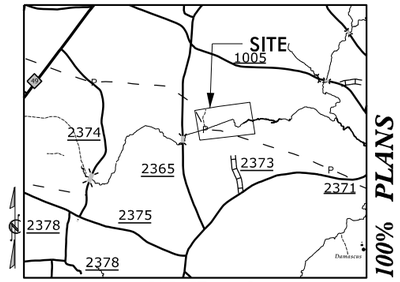
09/08/50

NC DEPARTMENT OF ENVIRONMENTAL QUALITY,
DIVISION OF MITIGATION SERVICES

CONSTRUCTION PLANS
PHANTOM MILL SITE

LOCATION: ALAMANCE COUNTY, NORTH CAROLINA

TYPE OF WORK: STREAM RESTORATION AND ENHANCEMENT (CLEARING, GRUBBING, GRADING, EROSION CONTROL AND PLANTING)



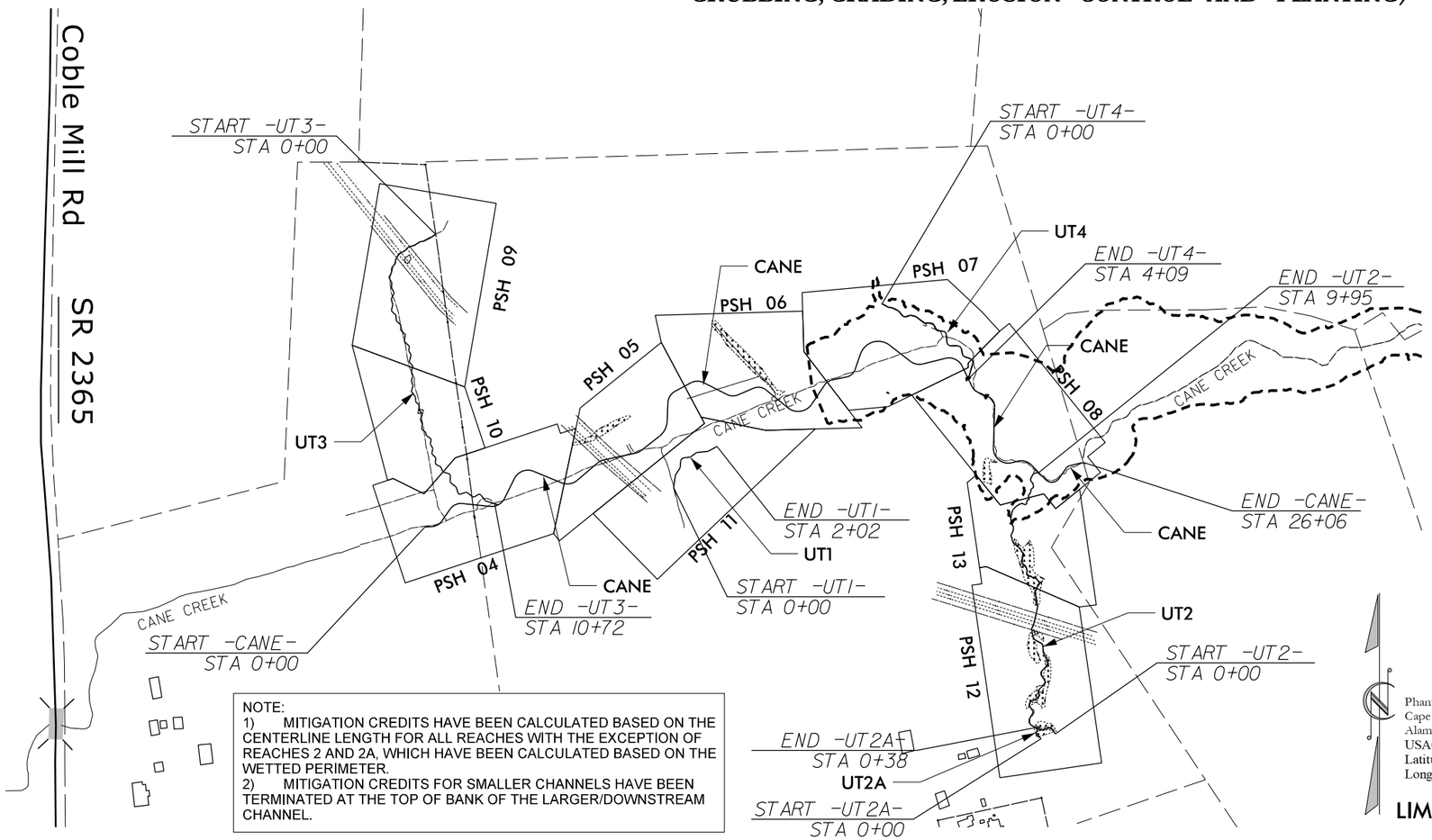
VICINITY MAP
Not to Scale

100% PLANS

INDEX OF SHEETS

SHEET NUMBER	SHEET
01	Title Sheet
01A	Symbology
02	Typicals
02A THRU 02E	Details
03	Control Points and Location Map
03A	Easement
04 THRU 13	Plan and Profile Sheets
E-02 THRU E-02A	Erosion Control Notes
E-03 THRU E-03E	Erosion Control Details
E-03F	Haul Road Locations
E-04 THRU E-13	Erosion Control Plan Sheets

NOTE: CANE CREEK IS LOCATED IN A FEMA LIMITED DETAILED STUDY AREA. PROJECT TO BE CONSTRUCTED ACCORDING TO APPROVED CONSTRUCTION DOCUMENTS. ANY DEVIATIONS FROM THE PLANS WILL REQUIRE APPROVAL FROM THE ENGINEER AND FLOODPLAIN ADMINISTRATOR



NOTE:
1) MITIGATION CREDITS HAVE BEEN CALCULATED BASED ON THE CENTERLINE LENGTH FOR ALL REACHES WITH THE EXCEPTION OF REACHES 2 AND 2A, WHICH HAVE BEEN CALCULATED BASED ON THE WETTED PERIMETER.
2) MITIGATION CREDITS FOR SMALLER CHANNELS HAVE BEEN TERMINATED AT THE TOP OF BANK OF THE LARGER/DOWNSTREAM CHANNEL.

Phantom Mill Stream and Wetland Mitigation Site #100057
Cape Fear 03030002
Alamance County
USACE AID#: SAW-2018-01166
Latitude: 35.8924
Longitude: -79.4754 (WGS84)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

LIMITS OF CONSTRUCTION: 11.1 ACRES

CONTRACT: PHANTOM MILL SITE

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

10 5 0 10 5
PROFILE (VERTICAL)

PROPOSED LENGTH OF CAIN = 2609 LF	PROPOSED LENGTH OF UT2A = 38 LF
PROPOSED LENGTH OF UT1 = 202 LF	PROPOSED LENGTH OF UT3 = 1072 LF
PROPOSED LENGTH OF UT2 = 995 LF	PROPOSED LENGTH OF UT4 = 409 LF
TOTAL STREAM LENGTH = 5325 LF	

RESTORATION LEVEL	STREAM (linear footage)	RIPARIAN WETLAND (acreage)	NONRIPARIAN WETLAND (acreage)
RESTORATION	2984	3.727	0.000
ENHANCEMENT I	335	0.828	0.000
ENHANCEMENT II	666	0.000	0.000
PRESERVATION	669	0.000	0.000
TOTALS	4654	4.555	0.000
MITIGATION UNITS	3632 SMUs	4.141 RIPARIAN WMUs	NONRIPARIAN WMUs

Axiom Environmental
218 Snow Ave
Raleigh, NC 27603
GRANT LEWIS
PROJECT DESIGNER

Restoration Systems
1101 Haynes St.
Suite 211
Raleigh, NC 27604
WORTH CREECH
SITE CONSTRUCTION MANAGER

Prepared in the Office of:
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905 JONES FRANKLIN ROAD
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TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

JOSHUA G. DALTON, P.E.
PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

DocuSigned by: Joshua G Dalton 1082AD8C1499403...

1/17/2020
DATE:

1/17/2020
Phantom_Hyd_psh_01.dgn
jharvey

CONVENTIONAL PLAN SHEET SYMBOLS

Note: Not to Scale **S.U.E. = Subsurface Utility Engineering*

SHEET NAME	SHEET NUMBER
SYMBOLOGY	01A
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin (EIP)
- Computed Property Corner
- Property Monument (ECM)
- Parcel/Sequence Number (123)
- Existing Fence Line
- Proposed Fence
- Proposed Fence Gate
- Proposed Barbed Wire Fence
- Existing Wetland Boundary (WLB)
- Proposed Wetland Boundary (WLB)
- Existing Endangered Animal Boundary (EAB)
- Existing Endangered Plant Boundary (EPB)
- Existing Historic Property Boundary (HPB)

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign (S)
- Well (W)
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream (JS)
- Buffer Zone 1 (BZ 1)
- Buffer Zone 2 (BZ 2)
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch (FLOW)

RIGHT OF WAY & PROJECT CONTROL:

- Secondary Horiz and Vert Control Point
- Primary Horiz Control Point
- Primary Horiz and Vert Control Point

- Exist Permanent Easment Pin and Cap
- New Permanent Easement Pin and Cap
- Vertical Benchmark
- Existing Right of Way Marker
- Existing Right of Way Line
- New Right of Way Line (RW)
- New Right of Way Line with Pin and Cap (RW)
- New Right of Way Line with Concrete or Granite R/W Marker (RW)
- New Control of Access Line with Concrete C/A Marker (C/A)
- Existing Control of Access (C/A)
- New Control of Access (C/A)
- Existing Easement Line (E)
- New Conservation Easement (E)
- New Temporary Drainage Easement (TDE)
- New Permanent Drainage Easement (PDE)
- New Permanent Drainage / Utility Easement (DUE)
- New Permanent Utility Easement (PUE)
- New Temporary Utility Easement (TUE)
- New Aerial Utility Easement (AUE)

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut (C)
- Proposed Slope Stakes Fill (F)
- Proposed Curb Ramp (CR)
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard (Vineyard)

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert (CONC)
- Bridge Wing Wall, Head Wall and End Wall (CONC WW)

MINOR:

- Head and End Wall (CONC HW)
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB (CB)
- Paved Ditch Gutter
- Storm Sewer Manhole (S)
- Storm Sewer (S)

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole (P)
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole
- H-Frame Pole
- U/G Power Line LOS B (S.U.E.*) (P)
- U/G Power Line LOS C (S.U.E.*) (P)
- U/G Power Line LOS D (S.U.E.*) (P)

TELEPHONE:

- Existing Telephone Pole

WATER:

- Water Manhole (W)
- Water Meter
- Water Valve
- Water Hydrant
- U/G Water Line LOS B (S.U.E*) (W)
- U/G Water Line LOS C (S.U.E*) (W)
- U/G Water Line LOS D (S.U.E*) (W)
- Above Ground Water Line (A/G Water)

GAS:

- Gas Valve
- Gas Meter
- U/G Gas Line LOS B (S.U.E.*) (G)
- U/G Gas Line LOS C (S.U.E.*) (G)
- U/G Gas Line LOS D (S.U.E.*) (G)
- Above Ground Gas Line (A/G Gas)

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line (SS)
- Above Ground Sanitary Sewer (A/G Sanitary Sewer)

- SS Forced Main Line LOS B (S.U.E.*) (FSS)
- SS Forced Main Line LOS C (S.U.E.*) (FSS)
- SS Forced Main Line LOS D (S.U.E.*) (FSS)

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box (S)
- Utility Unknown U/G Line LOS B (S.U.E.*) (?UTL)
- U/G Tank; Water, Gas, Oil
- Underground Storage Tank, Approx. Loc. (UST)
- A/G Tank; Water, Gas, Oil
- Geoenvironmental Boring
- U/G Test Hole LOS A (S.U.E.*)
- Abandoned According to Utility Records (AATUR)
- End of Information (E.O.I.)
- Riffle Rip Rap
- Log Vane
- Log Cross Vane
- Step Pool Structure
- Stream Plug
- Floodplain Interceptor

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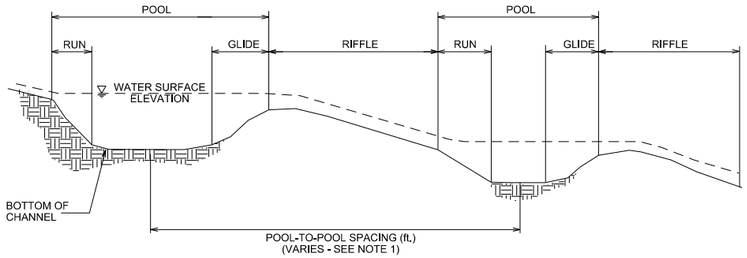
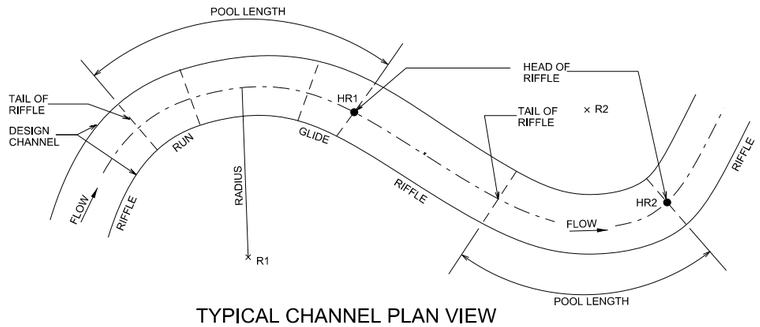


TYPICAL CHANNEL PROFILE

NOTES:

1. POOL-TO-POOL SPACING IS MEASURED FROM CENTER OF POOL BEND TO CENTER OF POOL BEND.

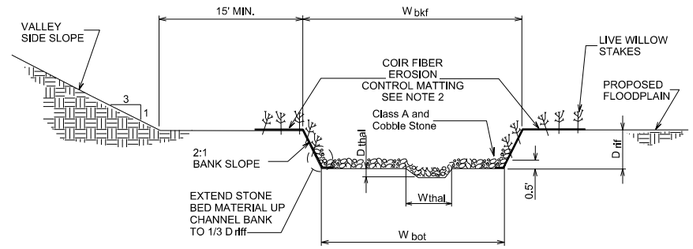


TYPICAL CHANNEL PLAN VIEW

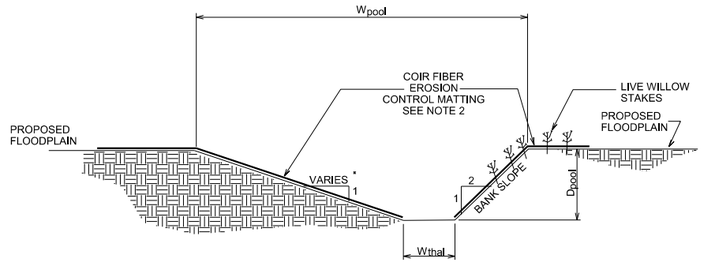
CHANNEL PLAN VIEW NOTES:

1. THE CONTRACTOR SHALL LAYOUT THE CHANNEL ALIGNMENT BY LOCATING THE RADII AND SCRIBING THE CENTER LINE FOR EACH POOL BEND. THE CONNECTING TANGENT SECTIONS SHALL COMPLETE THE LAYOUT OF THE CHANNEL.

2. FIELD ADJUSTMENTS OF THE ALIGNMENT MAY BE REQUIRED TO SAVE TREES OR AVOID OBSTACLES. THE STAKE-OUT SHALL BE APPROVED BY THE CONSTRUCTION MANAGER BEFORE CONSTRUCTION OF THE CHANNEL.



TYPICAL RIFFLE CROSS-SECTION



* MAX. 1:1 SLOPE

TYPICAL POOL CROSS-SECTION

CHANNEL CONSTRUCTION NOTES:

1. MATERIAL EXCAVATED FROM CHANNEL AND FLOODPLAIN SHALL BE USED TO BACKFILL EXISTING CHANNEL.

2. BANK PROTECTION SHALL CONSIST OF NATURAL COIR FIBER MATTING AND PLACED TO THE TOP OF BANK. (SEE DETAIL COIR FIBER MATTING, SHEET E-3D)

3. THE CONTRACTOR SHALL SUPPLY BED MATERIAL FOR THE ENTIRE BED LENGTH OF EACH RIFFLE SECTION. THE BED MATERIAL SHALL CONSIST OF A MIX OF CLASS A AND SMALLER STONE.

ADDITIONAL NOTES:

** TOP AND BOTTOM CASCADE: TIE TO EXISTING BEDROCK IN FIELD TO BUILD CASCADE. NO POOL WILL BE CONSTRUCTED IN THIS LOCATION. IF BEDROCK IS NOT PRESENT FOR ENTIRE LENGTH OF PROPOSED CASCADE, CONSULT DESIGNER OR ENGINEER FOR FIELD ADJUSTMENT.

*** ARMOR RIFFLE: PROVIDE CLASS B RIP RAP PROTECTION ON ENTIRE LENGTH OF RIFFLE APPROXIMATELY ONE STONE LAYER (5"-12") DEEP.

CROSS-SECTION DIMENSIONS

REACH	Wbkf (ft.)	Wbot (ft.)	Driff (ft.)	Dthal (ft.)	Dpool (ft.)	Wpool (ft.)	Wthal (ft.)
UT 2	7.8	4.6	0.7	0.1	1.1	8.5	1.9
UT 1, UT 3	4.7	2.7	0.4	0.1	0.6	5.2	1.0
UT 4	7.0	4.2	0.6	0.1	1.0	7.7	1.7
Cane Creek	27.1	16.3	2.6	0.1	3.7	29.8	7.6

SHEET NAME	SHEET NUMBER
TYPICALS	2
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

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ENG FIRM LICENSE NO. C-890

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

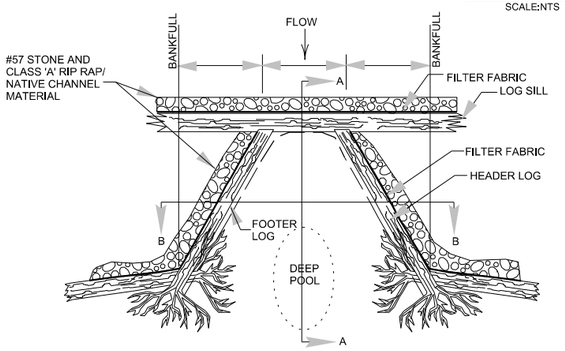
DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

1/17/2020

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

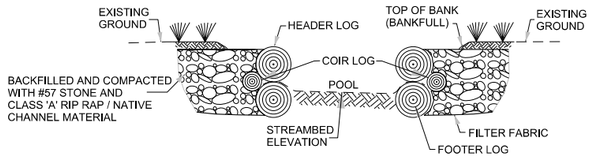
PLAN VIEW



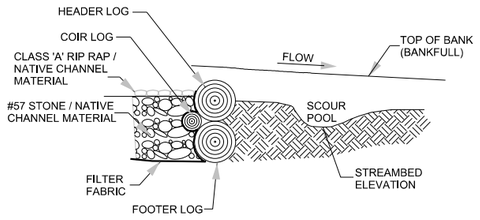
LOG CROSS VANE

SCALE:NTS

NOTES:
1. HEADER AND FOOTER LOGS SHALL BE A MINIMUM OF 18" DIAMETER AND SHALL BE A HARDWOOD SPECIES. (FOOTER LOG MAY BE SUBSTITUTED WITH PINE)
2. A DOUBLE FOOTER LOG MAY BE REQUIRED IN SAND BED STREAMS.
3. ALL STONES ARE TO BE STRUCTURE STONES.
4. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE STRUCTURE TO PREVENT WASHOUT OF SEDIMENT THROUGH LOG GAPS. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.
5. PERPENDICULAR ROOTWAD LOGS ARE REQUIRED IF THE LOG VANE ARM DOES NOT HAVE A ROOTBALL TO TIE INTO THE BANK.



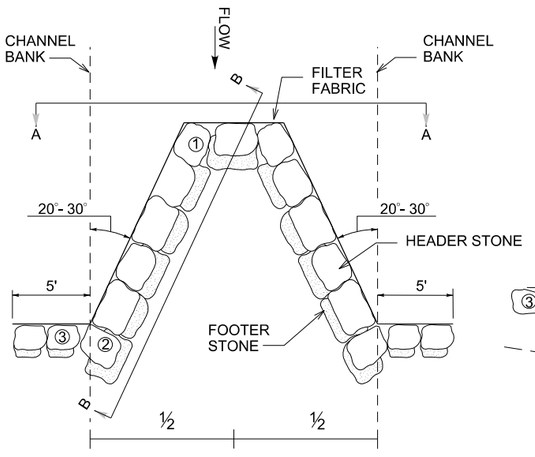
SECTION B-B



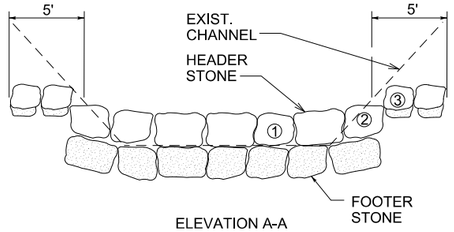
SECTION A-A

REACH	ARM LENGTH (FT.)	CHANNEL DEPTH (FT.)
UT 1, 2, 3, 4	6	0.5 - 0.8
Cane Creek	21	2.7

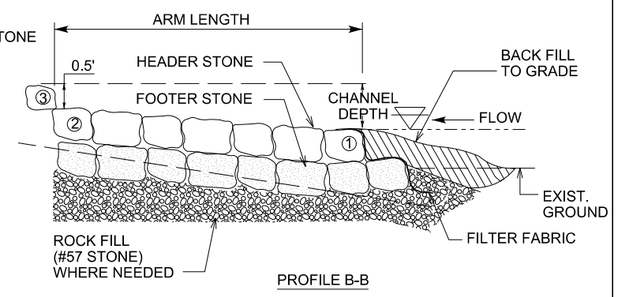
NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 24" ALONG THE SHORTEST DIMENSION.



PLAN VIEW



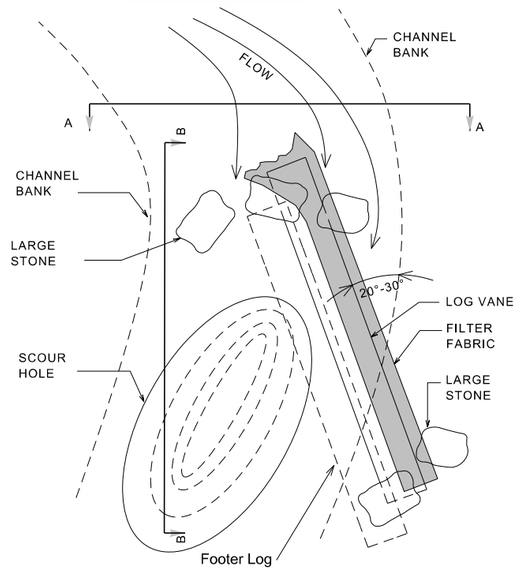
ELEVATION A-A



PROFILE B-B

TYPICAL CROSS-VANE

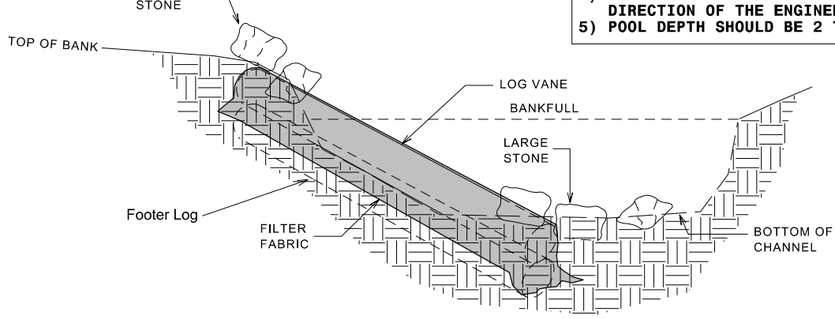
TYPICAL LOG VANE



PLAN VIEW

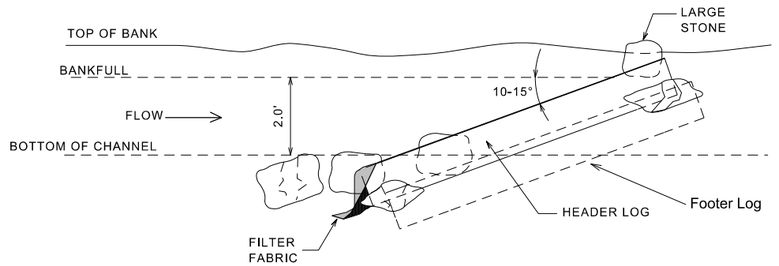
SCALE: N.T.S.

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



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.

NOTES:
1) DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO BANKFULL.
2) DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER BOULDERS.
3) CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
4) COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5) POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.

SHEET NAME	SHEET NUMBER
TYPICALS	2A
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

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NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

1/17/2020

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

1/17/2020
Phantom Hyd_psh_02A.dgn
harvey

SHEET NAME	SHEET NUMBER
TYPICALS	2B
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

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DATE:

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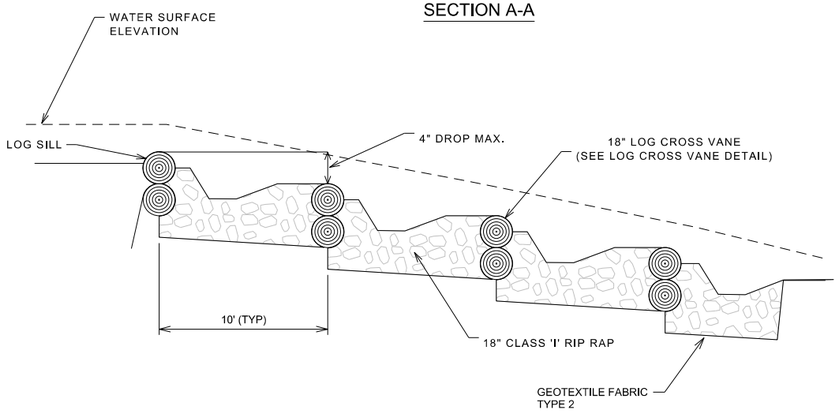
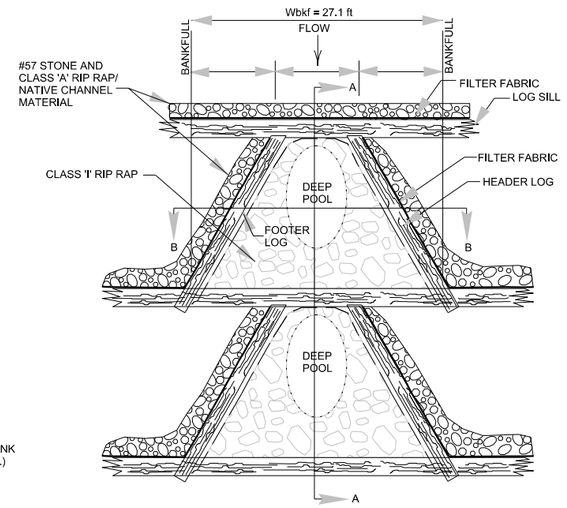
STEP POOL STRUCTURE -CANE-

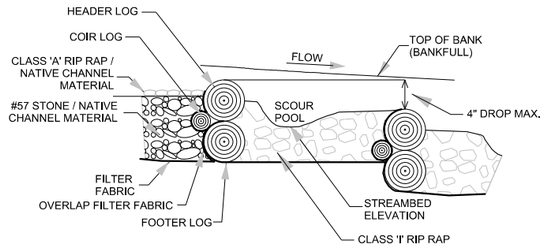
SECTION A-A



PLAN VIEW

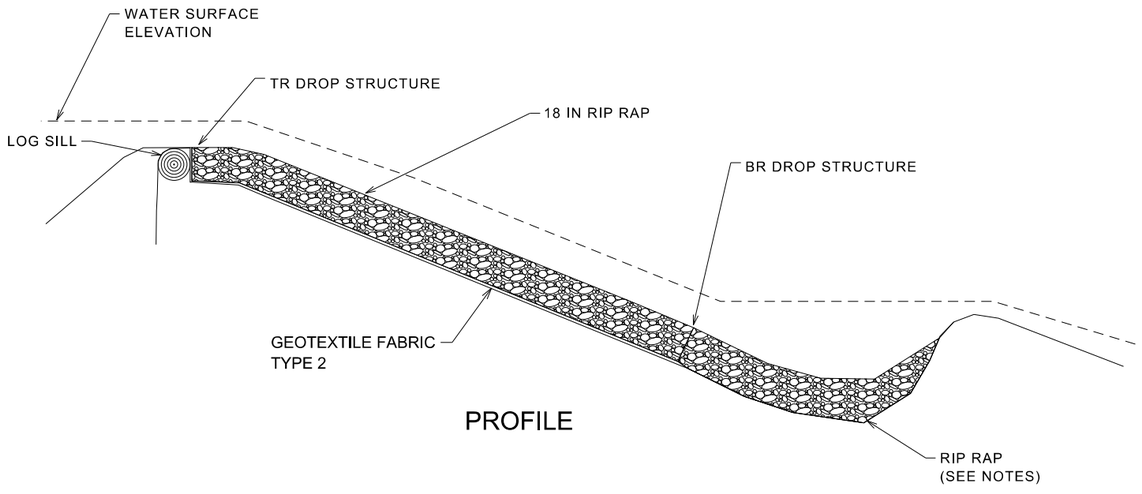


STEP POOL ENLARGEMENT

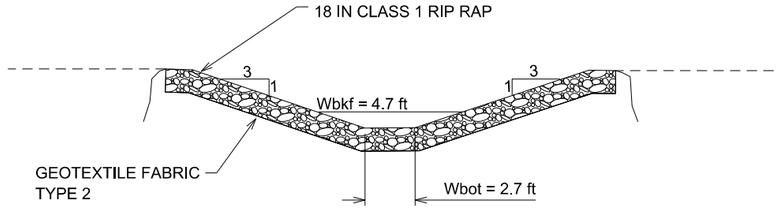


STRUCTURE NOTES:
1. FILL CLASS '1' RIP RAP VOIDS WITH CLASS 'A' RIP RAP/ #57 STONE/ NATIVE CHANNEL MATERIAL MIXTURE.

DROP STRUCTURE -UT3-



PROFILE



-UT3- CROSS-SECTION

STRUCTURE NOTES:
1. CONTRACTOR WILL INSTALL TYPE 2 GEOTEXTILE FABRIC AND 18-INCH DEPTH OF CLASS 1 RIP RAP OR OTHER SUITABLE MATTERIAL.

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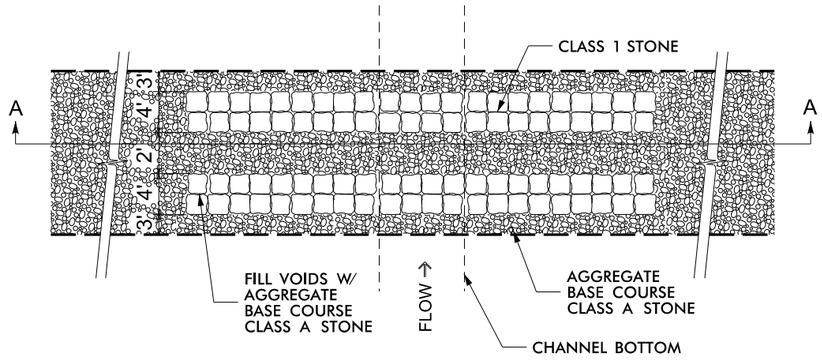
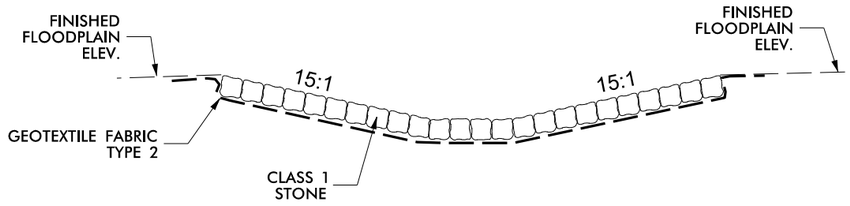
PERMANENT CHANNEL FORD DETAIL

SCALE: N.T.S.



PLAN VIEW



SECTION A-A

NOTES:
1) KEEP FORD CROSS FALL WITHIN 1–2% OF STREAM GRADIENT.
2) FILL VOIDS BETWEEN CLASS 1 STONE WITH AGGREGATE BASE COURSE CLASS A TO CREATE DRIVEABLE SURFACE.

SHEET NAME	SHEET NUMBER
TYPICALS	2C
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
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ENG FIRM LICENSE NO. C-890

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

DocuSigned by:
Joshua G Dalton
1089AD8C1499463...

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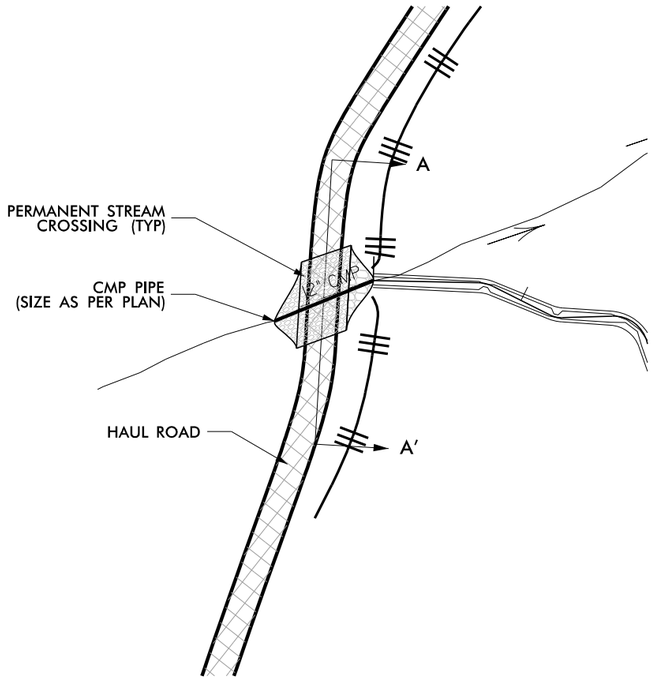
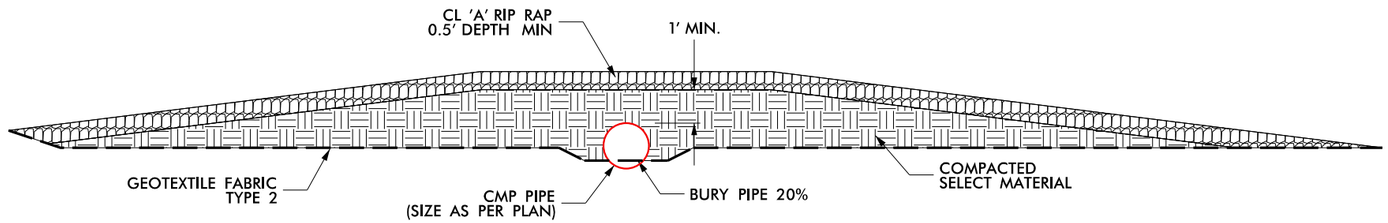
PERMANENT CROSSING

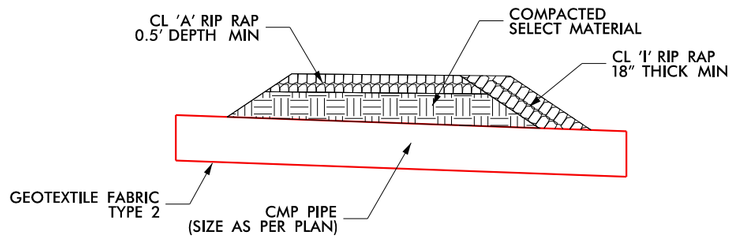
SCALE: N.T.S.



NOTES:
1) INSTALL PERMANENT CROSSING WHILE CONSTRUCTION LOCATION WITHIN STREAM HAS BEEN DEWATERED.
2) IF UNABLE TO INSTALL WHILE LOCATION IS DRY, PLACE MATTING ON EXPOSED SOILS.



SECTION A-A'



SECTION B-B'

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SHEET NAME		SHEET NUMBER
TYPICALS		2D
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ALAMANCE	DATE: 2019

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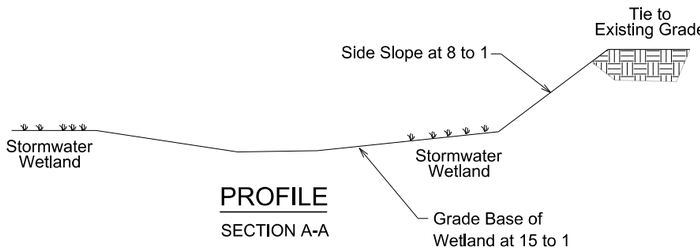
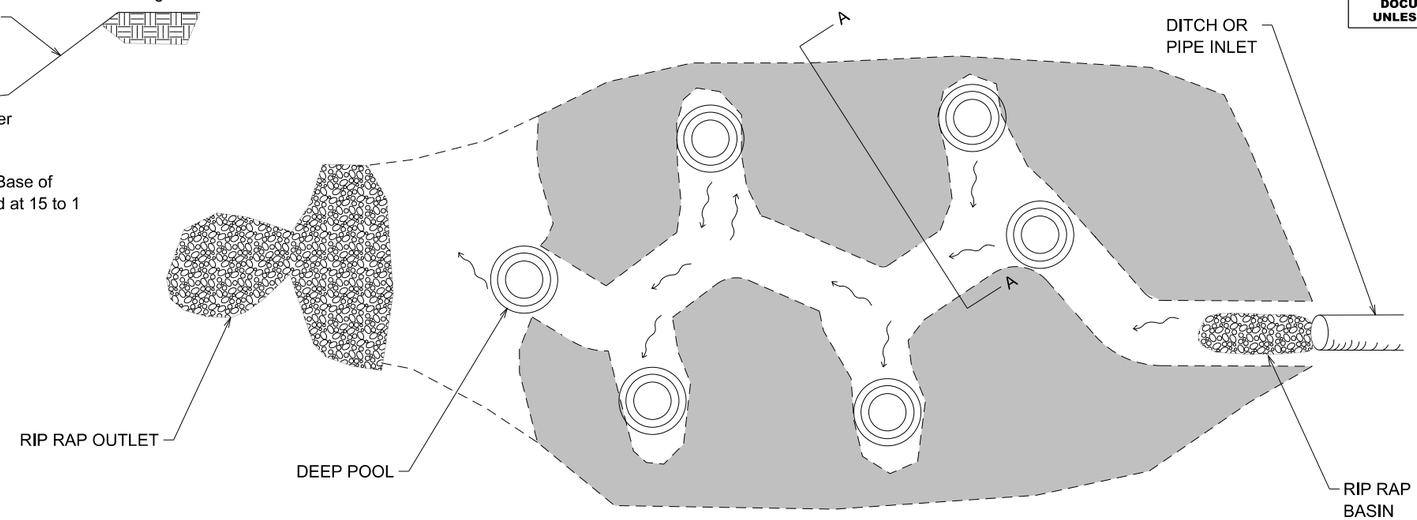
MARSH TREATMENT AREA



PROFILE
SECTION A-A



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SHEET NAME	SHEET NUMBER
TYPICALS	2E
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

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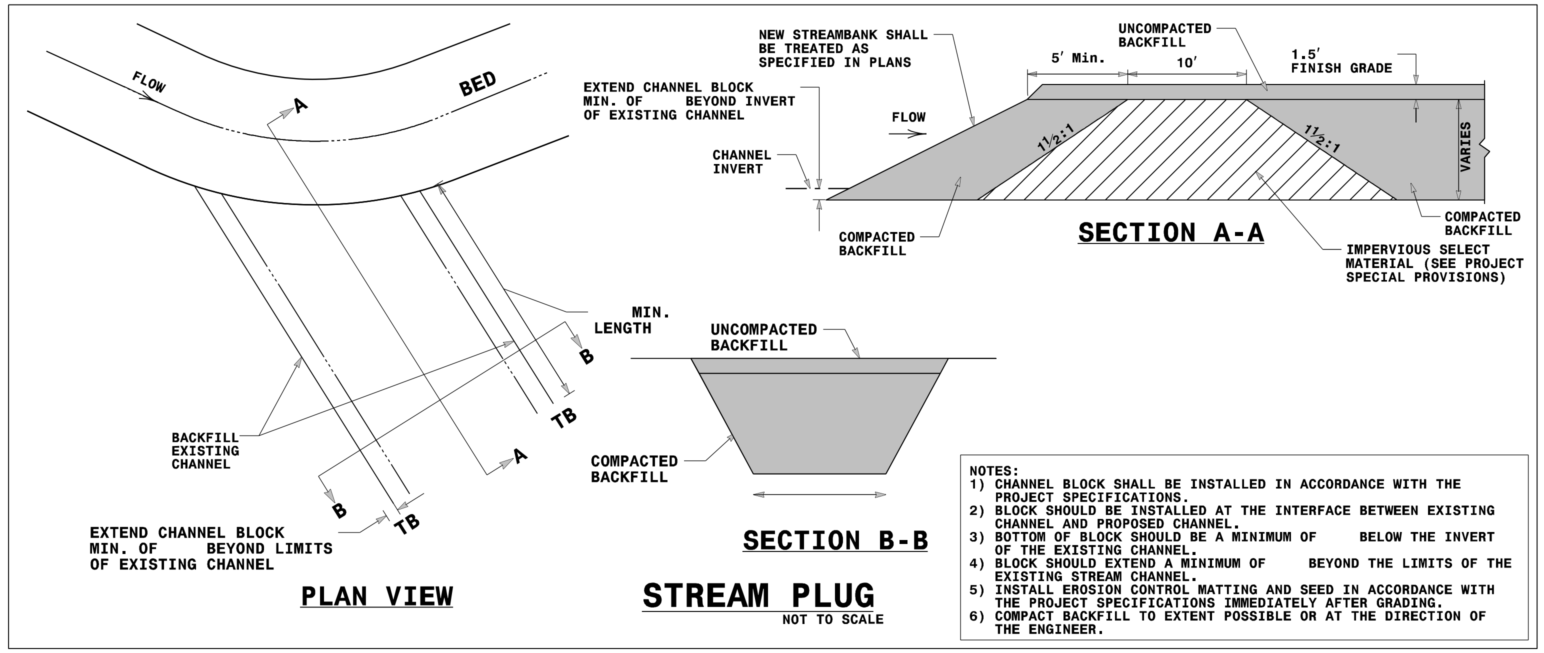
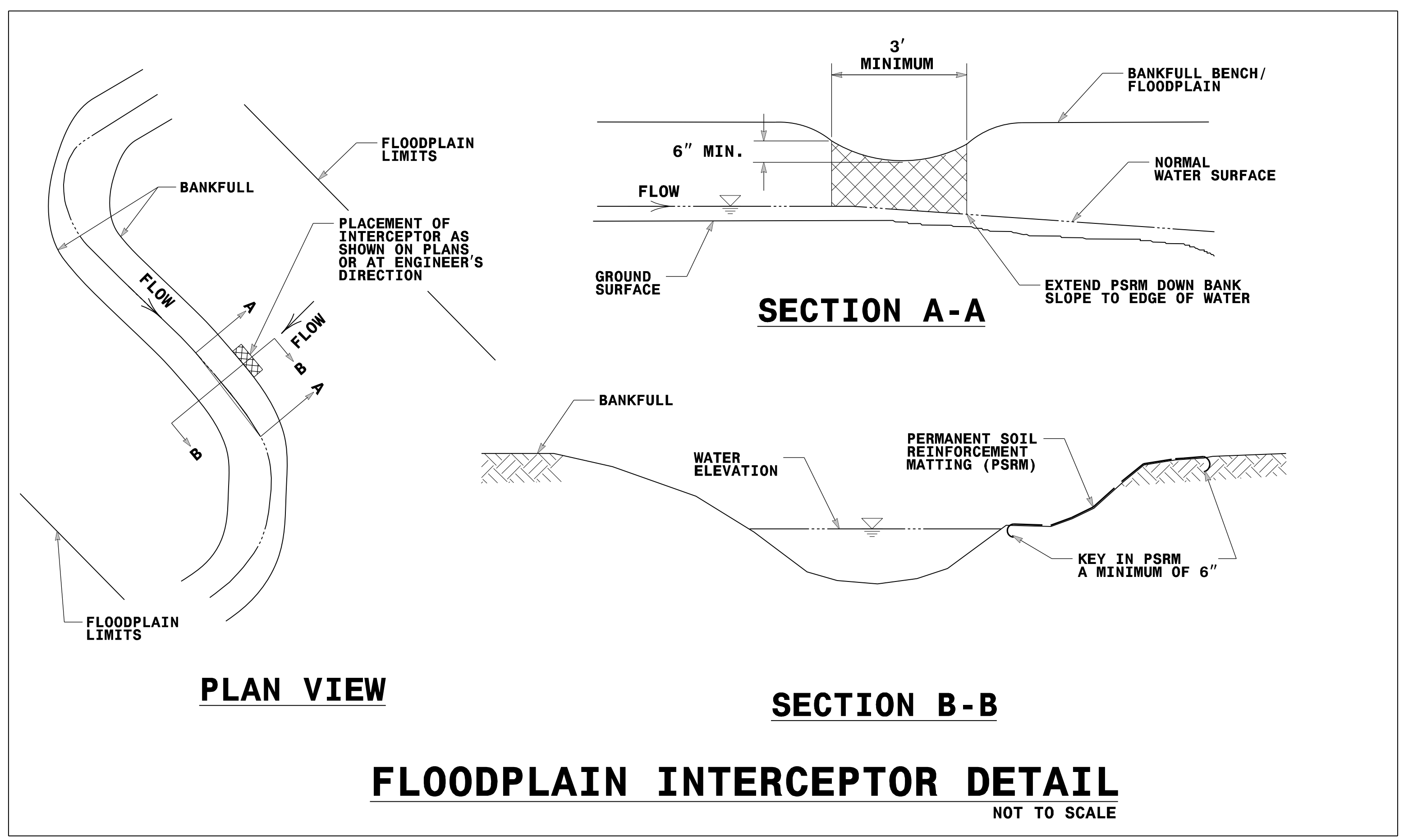

FLOW
BED
A
B
TB
MIN. LENGTH
BACKFILL EXISTING CHANNEL
EXTEND CHANNEL BLOCK MIN. OF BEYOND LIMITS OF EXISTING CHANNEL
PLAN VIEW
NEW STREAMBANK SHALL BE TREATED AS SPECIFIED IN PLANS
EXTEND CHANNEL BLOCK MIN. OF BEYOND INVERT OF EXISTING CHANNEL
CHANNEL INVERT
UNCOMPACTED BACKFILL
5' Min.
10'
1.5' FINISH GRADE
1½:1
VARIES
COMPACTED BACKFILL
IMPERVIOUS SELECT MATERIAL (SEE PROJECT SPECIAL PROVISIONS)
SECTION A-A
SECTION B-B
STREAM PLUG
NOT TO SCALE
NOTES:
1) CHANNEL BLOCK SHALL BE INSTALLED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
2) BLOCK SHOULD BE INSTALLED AT THE INTERFACE BETWEEN EXISTING CHANNEL AND PROPOSED CHANNEL.
3) BOTTOM OF BLOCK SHOULD BE A MINIMUM OF BELOW THE INVERT OF THE EXISTING CHANNEL.
4) BLOCK SHOULD EXTEND A MINIMUM OF BEYOND THE LIMITS OF THE EXISTING STREAM CHANNEL.
5) INSTALL EROSION CONTROL MATTING AND SEED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS IMMEDIATELY AFTER GRADING.
6) COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.


FLOODPLAIN LIMITS
BANKFULL
PLACEMENT OF INTERCEPTOR AS SHOWN ON PLANS OR AT ENGINEER'S DIRECTION
FLOW
A
B
PLAN VIEW
3' MINIMUM
BANKFULL BENCH/ FLOODPLAIN
6" MIN.
NORMAL WATER SURFACE
GROUND SURFACE
EXTEND PSRM DOWN BANK SLOPE TO EDGE OF WATER
SECTION A-A
WATER ELEVATION
PERMANENT SOIL REINFORCEMENT MATTING (PSRM)
KEY IN PSRM A MINIMUM OF 6"
SECTION B-B
FLOODPLAIN INTERCEPTOR DETAIL
NOT TO SCALE

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jharvey

SHEET NAME		SHEET NUMBER
CONTROL POINTS		03
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

SUNGATE DESIGN GROUP, P.A.
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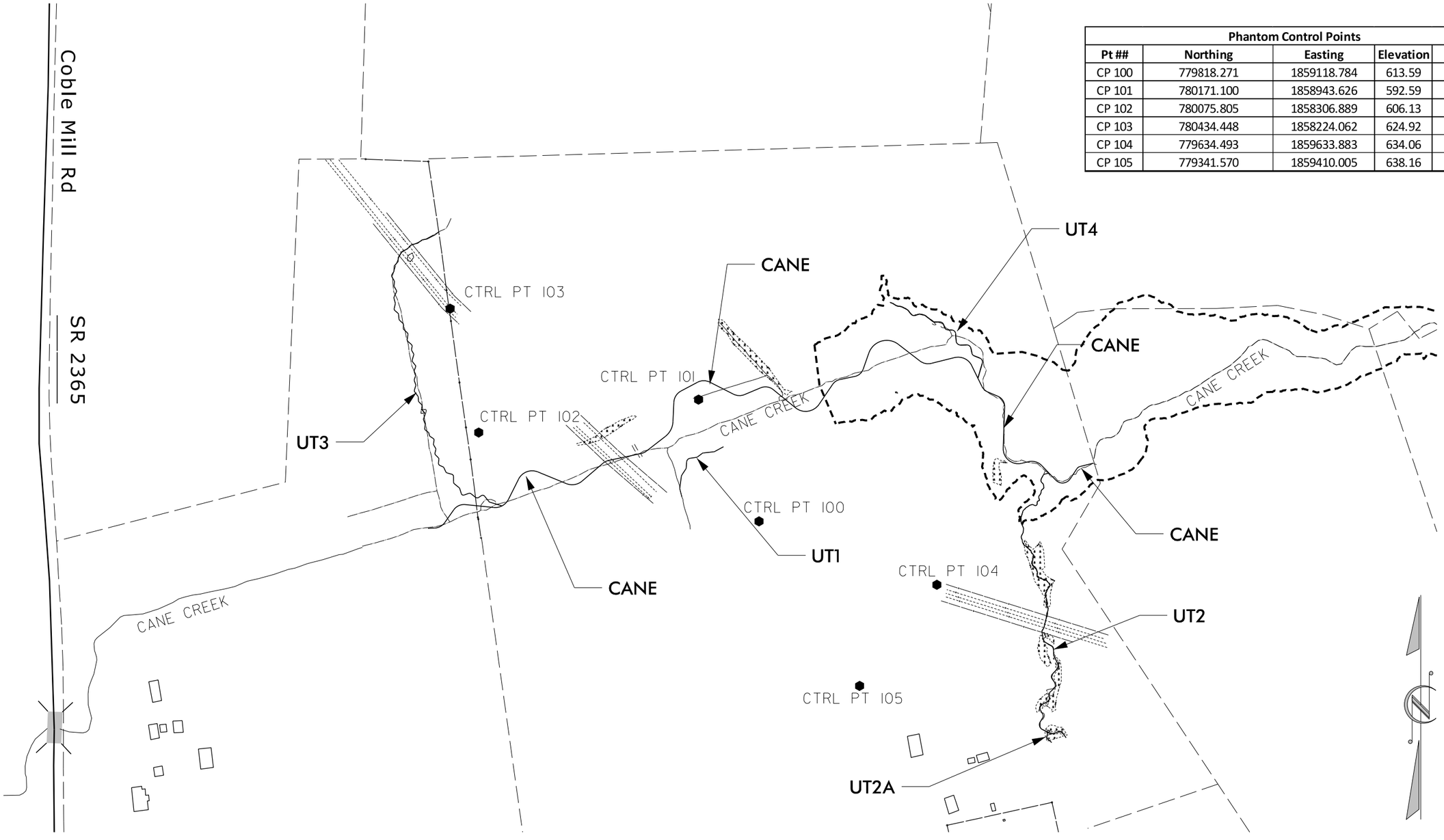
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

SURVEY INFORMATION PROPERTY/ EASEMENT PROVIDED BY:
K2 DESIGN GROUP, P.A.
5688 U.S. HIGHWAY 70 EAST
GOLDSBORO, NC 27534

Phantom Control Points

Pt ##	Northing	Easting	Elevation	Type
CP 100	779818.271	1859118.784	613.59	ISS CAP
CP 101	780171.100	1858943.626	592.59	ISS CAP
CP 102	780075.805	1858306.889	606.13	ISS CAP
CP 103	780434.448	1858224.062	624.92	ISS CAP
CP 104	779634.493	1859633.883	634.06	ISS CAP
CP 105	779341.570	1859410.005	638.16	ISS CAP



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SHEET NAME		SHEET NUMBER
EASEMENT		03A
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ALAMANCE	DATE: 2019

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RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

EXISTING FENCING
PROPOSED FENCING
PROPOSED EASEMENT

Coble Mill Rd

SR 2365

UT4

CANE

CANE

CANE CREEK

UT3

CANE

UT1

CANE

CANE CREEK

UT2

UT2A

CANE CREEK

1/17/2020
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SHEET NAME	SHEET NUMBER
STRUCTURES	4

PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

Axiom Environmental, Inc.

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1/17/2020

DATE:

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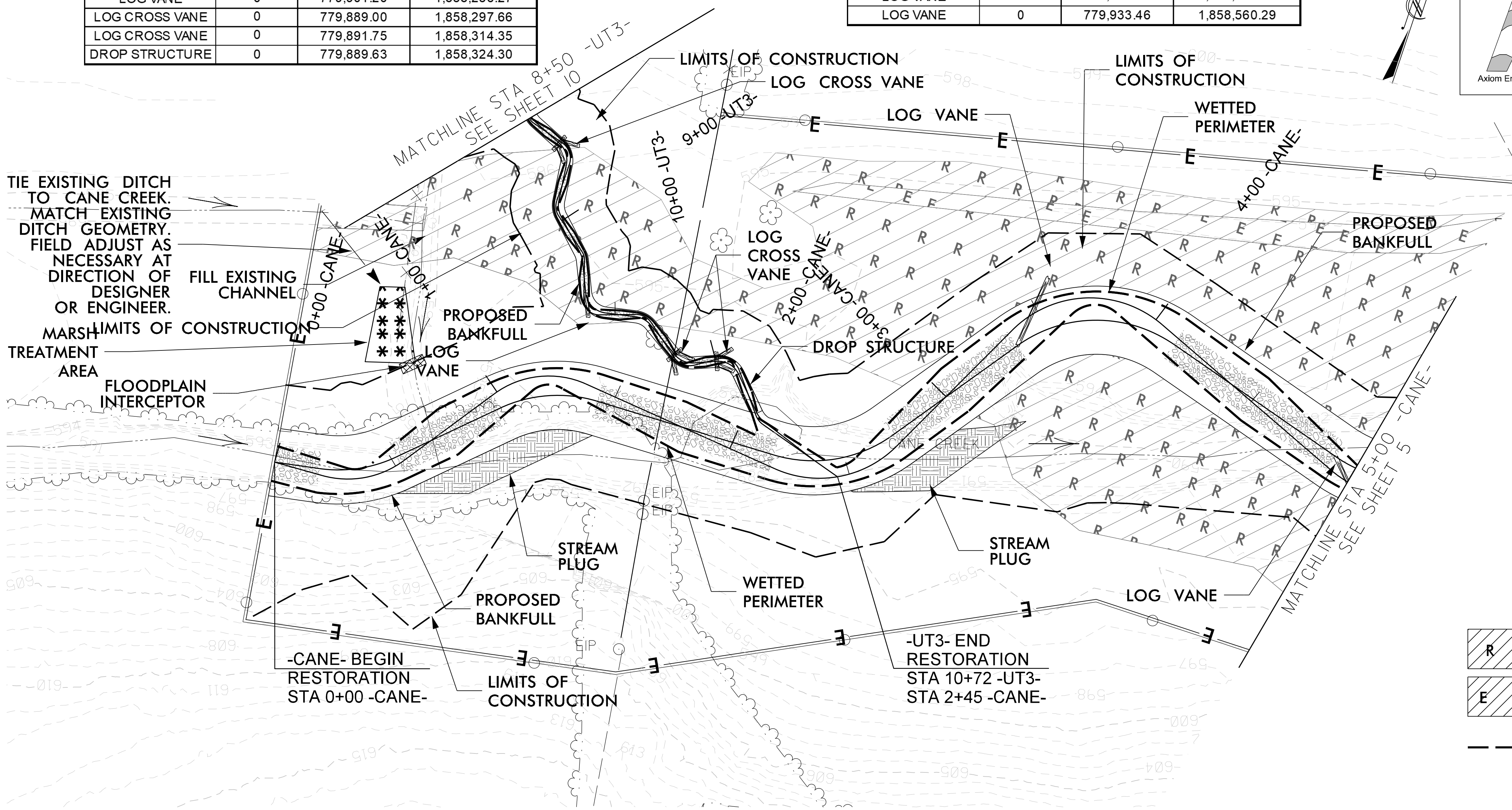
-UT3- STRUCTURE LOCATIONS

STR. TYPE	OFFSET	NORTHING	EASTING
LOG CROSS VANE	0	779,954.41	1,858,227.51
LOG VANE	0	779,901.20	1,858,256.27
LOG CROSS VANE	0	779,889.00	1,858,297.66
LOG CROSS VANE	0	779,891.75	1,858,314.35
DROP STRUCTURE	0	779,889.63	1,858,324.30

-CANE- STRUCTURE LOCATIONS

STR. TYPE	OFFSET	NORTHING	EASTING
LOG VANE	0	779,935.44	1,858,426.06
LOG VANE	0	779,933.46	1,858,560.29

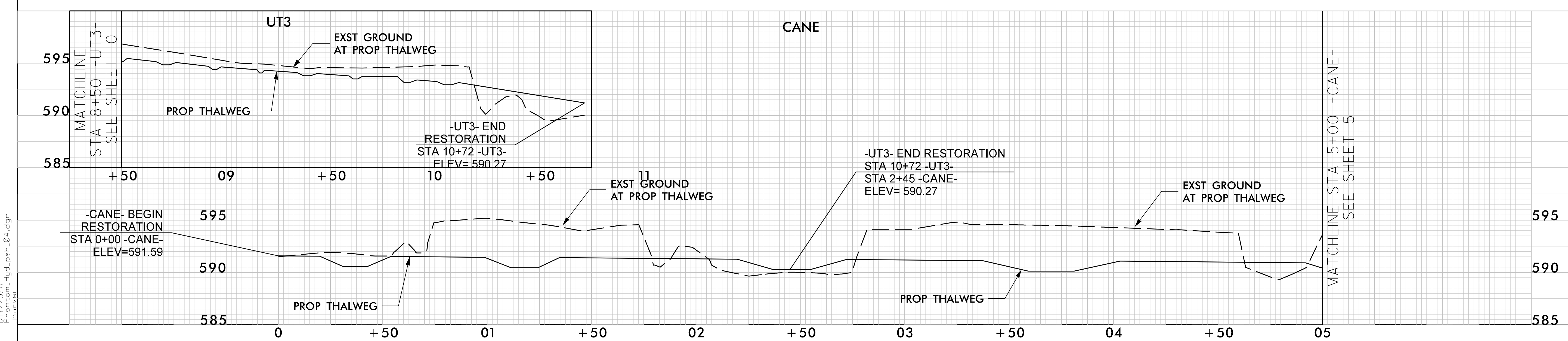


TOPOGRAPHY BASED ON SURVEY PERMFORMED BY K2 SURVEYING ON 8–2018. TOPOGRAPHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR

DENOTES RESTORED WETLANDS

DENOTES ENHANCEMENT IN WETLAND

DENOTES WETTED PERIMETER



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Phantom_Hyd_psh_04.dgn
jharvey

SHEET NAME	SHEET NUMBER
STRUCTURES	5
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
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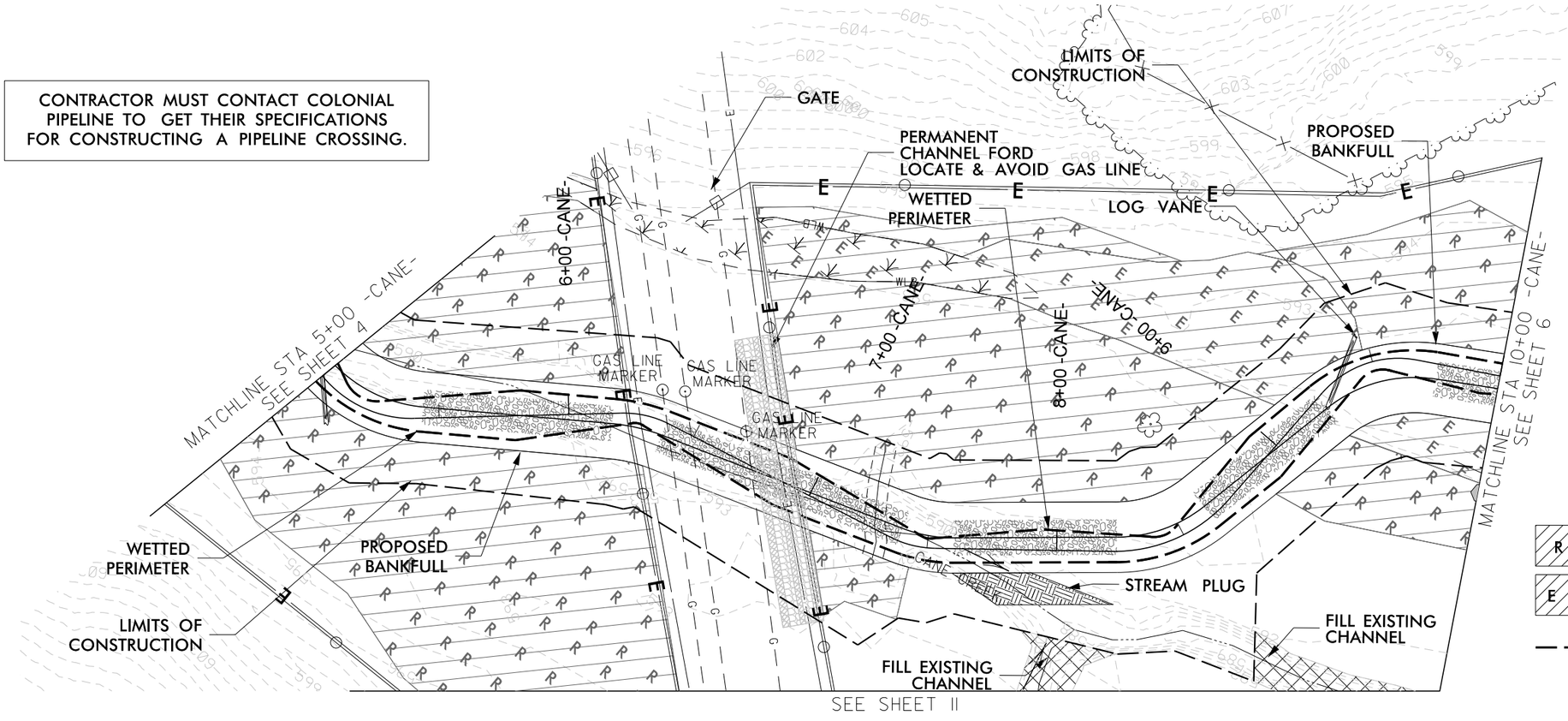
-CANE- STRUCTURE LOCATIONS			
STR. TYPE	OFFSET	NORTHING	EASTING
LOG VANE	0	780,159.46	1,858,876.99

CONTRACTOR MUST CONTACT COLONIAL PIPELINE TO GET THEIR SPECIFICATIONS FOR CONSTRUCTING A PIPELINE CROSSING.



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DATE:

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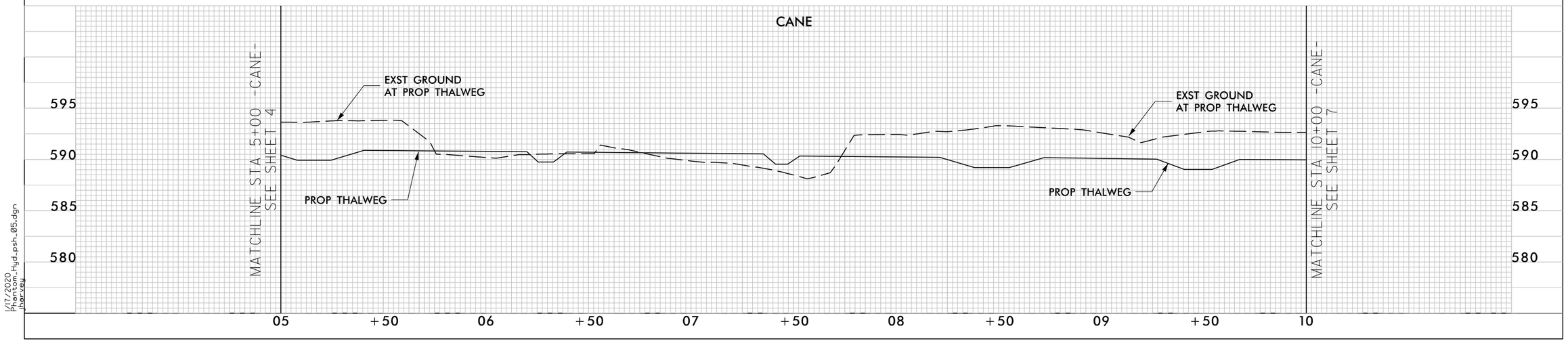
TOPOGRAPHY BASED ON SURVEY PERMFORMED BY K2 SURVEYING ON 8-2018. TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR

R R DENOTES RESTORED WETLANDS

E E DENOTES ENHANCEMENT IN WETLAND

DENOTES WETTED PERIMETER



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jharvey

SHEET NAME	SHEET NUMBER
STRUCTURES	6
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
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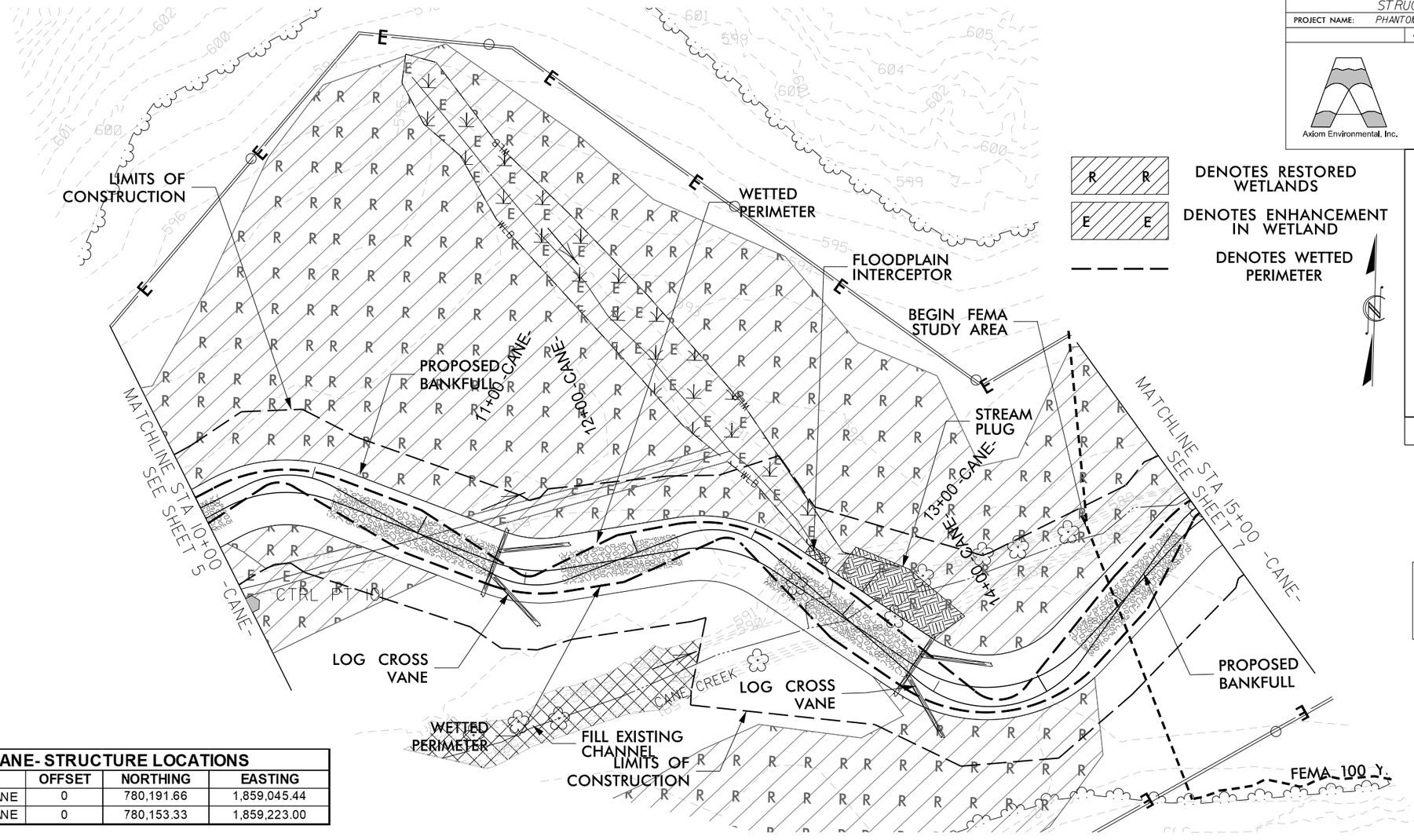
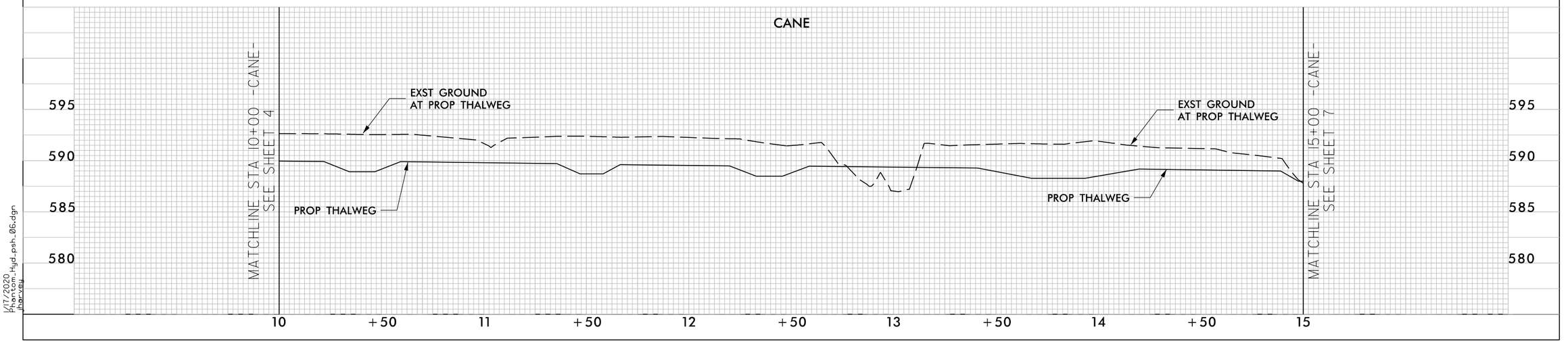


-CANE- STRUCTURE LOCATIONS			
STR. TYPE	OFFSET	NORTHING	EASTING
LOG CROSS VANE	0	780,191.66	1,859,045.44
LOG CROSS VANE	0	780,153.33	1,859,223.00



DocuSigned by:
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TOPOGRAPHY BASED ON SURVEY PERMFORMED BY K2 SURVEYING ON 8-2018. TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR

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SHEET NAME	SHEET NUMBER
STRUCTURES	7
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

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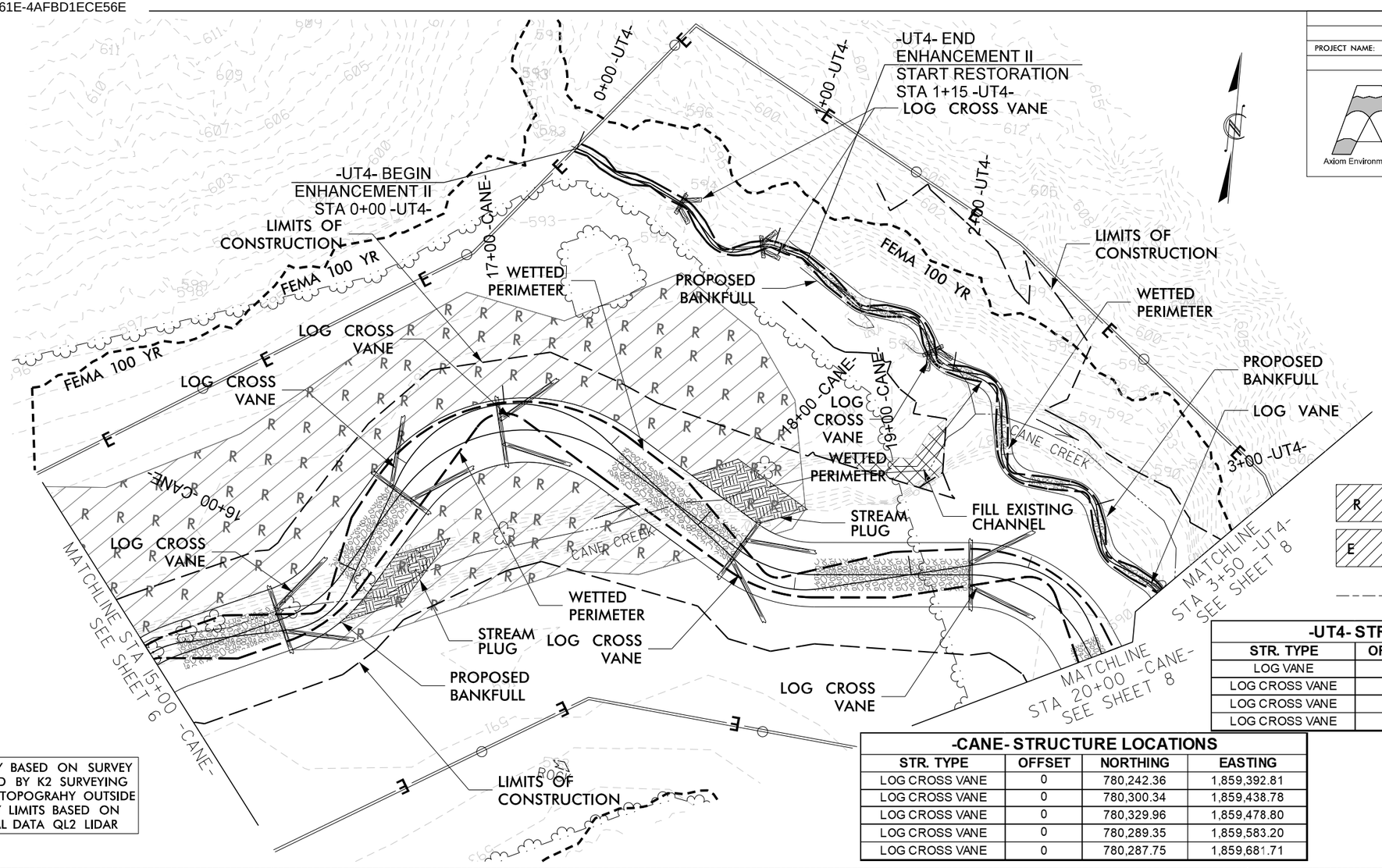


DENOTES RESTORED WETLANDS

DENOTES ENHANCEMENT IN WETLAND

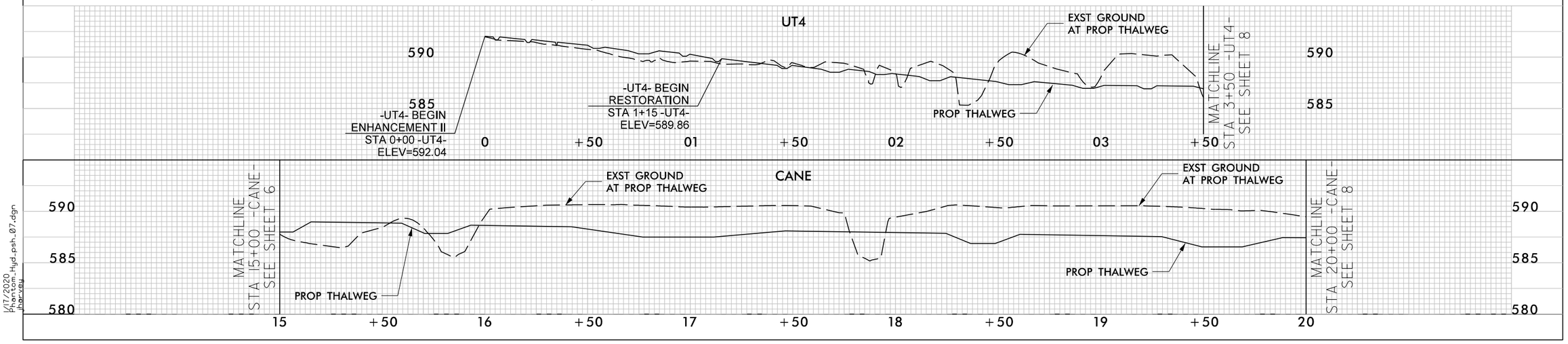
DENOTES WETTED PERIMETER

-UT4- STRUCTURE LOCATIONS

STR. TYPE	OFFSET	NORTHING	EASTING
LOG VANE	0	780,291.04	1,859,756.66
LOG CROSS VANE	0	780,432.82	1,859,545.50
LOG CROSS VANE	0	780,417.86	1,859,581.38
LOG CROSS VANE	0	780,380.69	1,859,657.18

-CANE- STRUCTURE LOCATIONS

STR. TYPE	OFFSET	NORTHING	EASTING
LOG CROSS VANE	0	780,242.36	1,859,392.81
LOG CROSS VANE	0	780,300.34	1,859,438.78
LOG CROSS VANE	0	780,329.96	1,859,478.80
LOG CROSS VANE	0	780,289.35	1,859,583.20
LOG CROSS VANE	0	780,287.75	1,859,681.71



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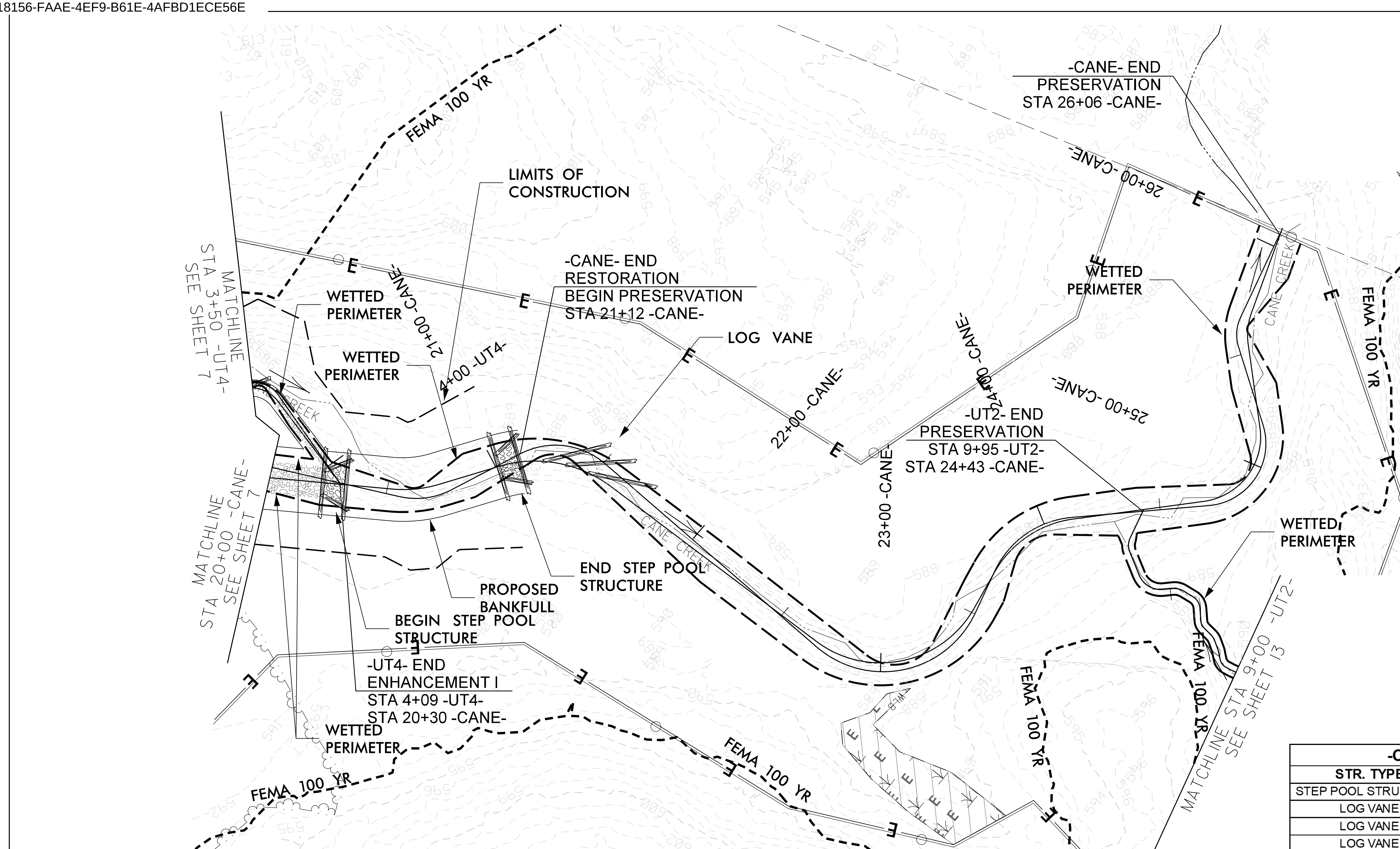

SHEET NAME	SHEET NUMBER
STRUCTURES	8

PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE
COUNTY: ALAMANCE DATE: 2019

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RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
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1089AD8C14994C3...

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DATE:

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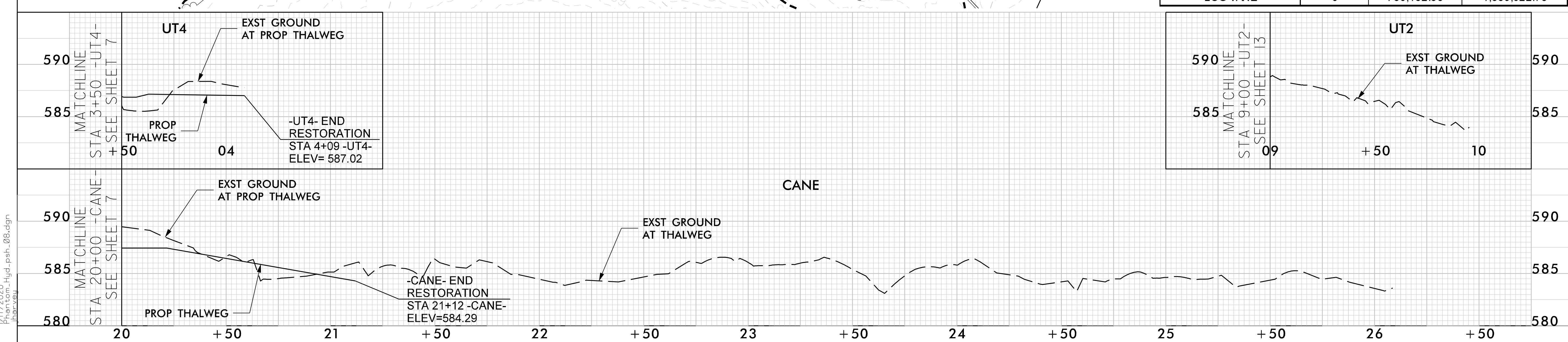
TOPOGRAPHY BASED ON SURVEY PERMFORMED BY K2 SURVEYING ON 8-2018. TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR

R R — DENOTES RESTORED WETLANDS

E E — DENOTES ENHANCEMENT IN WETLAND

— — — DENOTES WETTED PERIMETER

-CANE- STRUCTURE LOCATIONS			
STR. TYPE	OFFSET	NORTHING	EASTING
STEP POOL STRUCTURE	0	780,238.51	1,859,748.34
LOG VANE	0	780,170.96	1,859,814.50
LOG VANE	0	780,162.29	1,859,819.46
LOG VANE	0	780,152.86	1,859,822.75



1/17/2020 Phantom_Hyd_psh_08.dgn jharvey

TOPOGRAPHY BASED ON SURVEY PERMFORMED BY K2 SURVEYING ON 8–2018. TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR

CONTRACTOR MUST CONTACT COLONIAL PIPELINE TO GET THEIR SPECIFICATIONS FOR CONSTRUCTING A PIPELINE CROSSING.

SHEET NAME	SHEET NUMBER
STRUCTURES	9

PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

Axiom Environmental, Inc.

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

1/17/2020
DATE:

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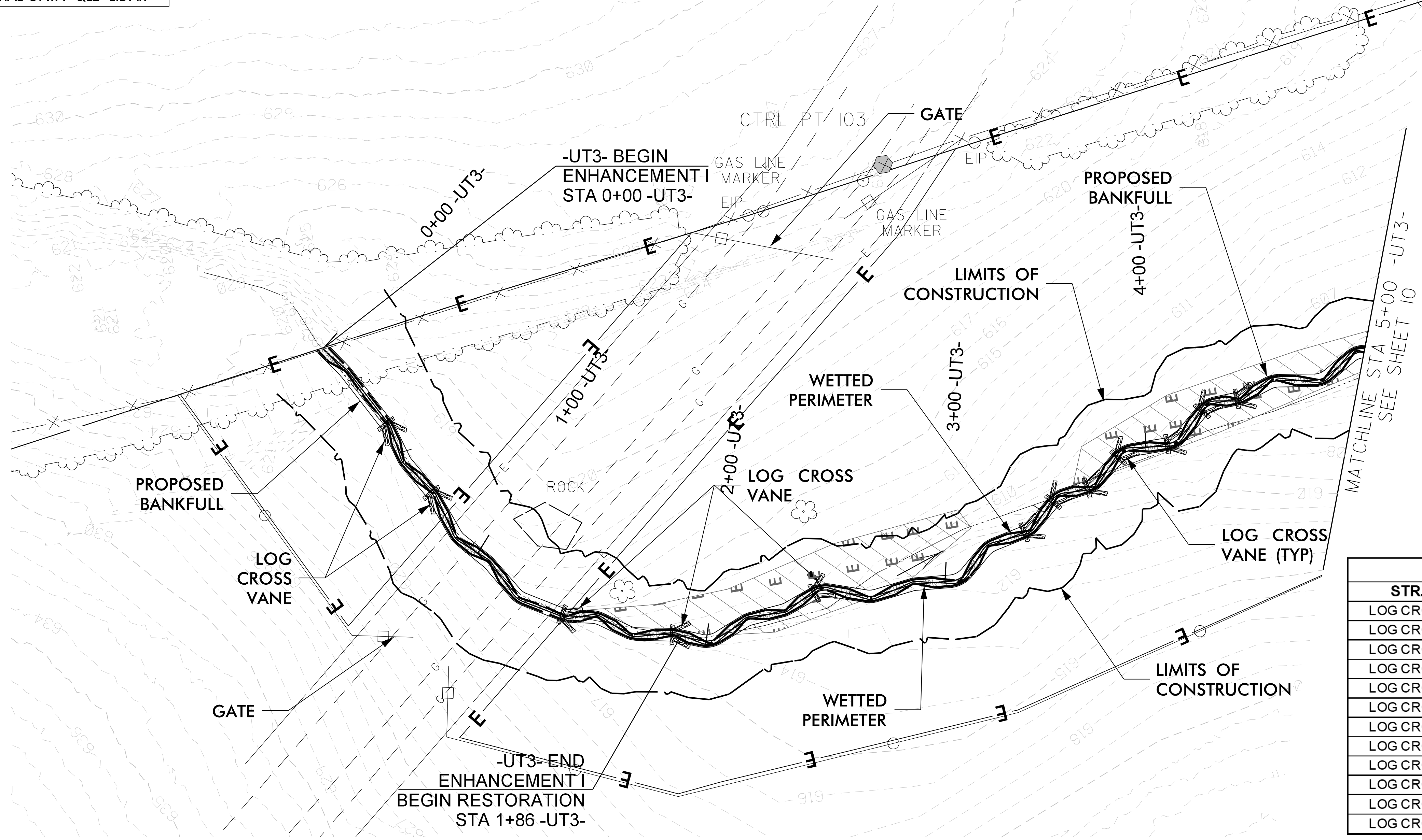


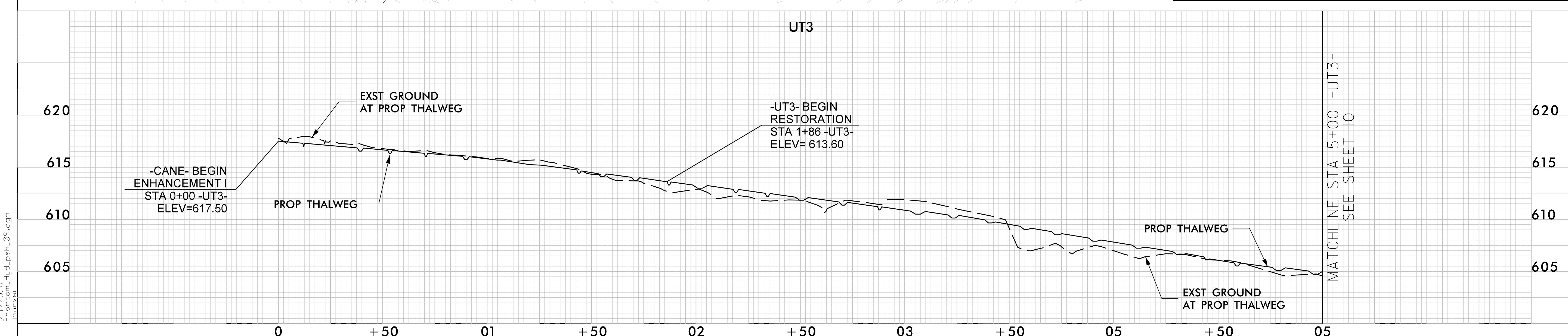
R R DENOTES RESTORED WETLANDS

E E DENOTES ENHANCEMENT IN WETLAND

DENOTES WETTED PERIMETER

-UT3- STRUCTURE LOCATIONS

STR. TYPE	OFFSET	NORTHING	EASTING
LOG CROSS VANE	0	780,637.82	1,858,158.27
LOG CROSS VANE	0	780,625.19	1,858,129.51
LOG CROSS VANE	0	780,583.89	1,858,075.38
LOG CROSS VANE	0	780,543.84	1,858,060.70
LOG CROSS VANE	0	780,487.72	1,858,067.22
LOG CROSS VANE	0	780,404.92	1,858,076.67
LOG CROSS VANE	0	780,392.05	1,858,086.18
LOG CROSS VANE	0	780,378.46	1,858,089.45
LOG CROSS VANE	0	780,364.76	1,858,098.76
LOG CROSS VANE	0	780,345.56	1,858,100.66
LOG CROSS VANE	0	780,330.28	1,858,110.71
LOG CROSS VANE	0	780,316.46	1,858,113.25



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SHEET NAME	SHEET NUMBER
STRUCTURES	10
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

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ENG FIRM LICENSE NO. C-890

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DATE:

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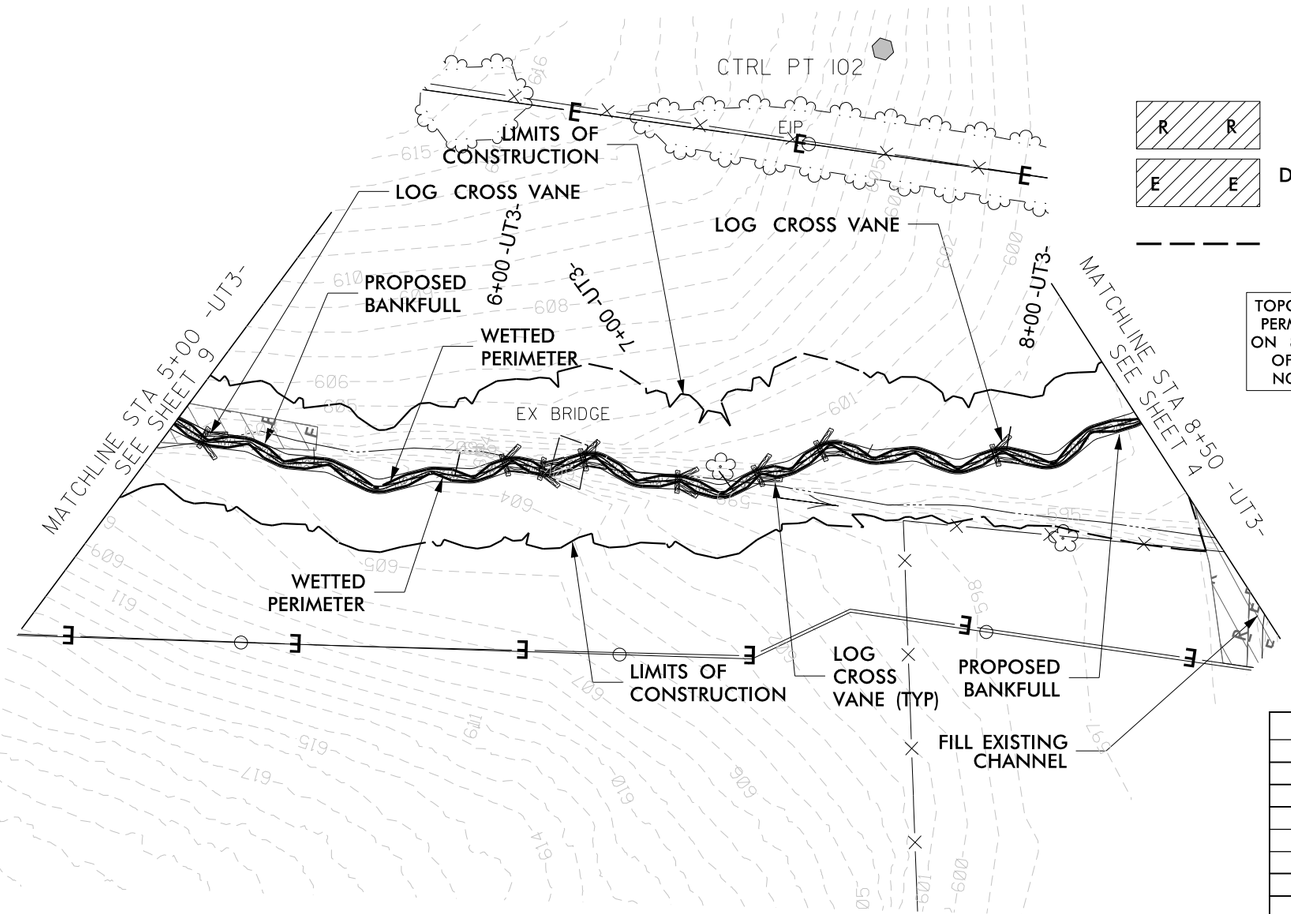


R R DENOTES RESTORED WETLANDS

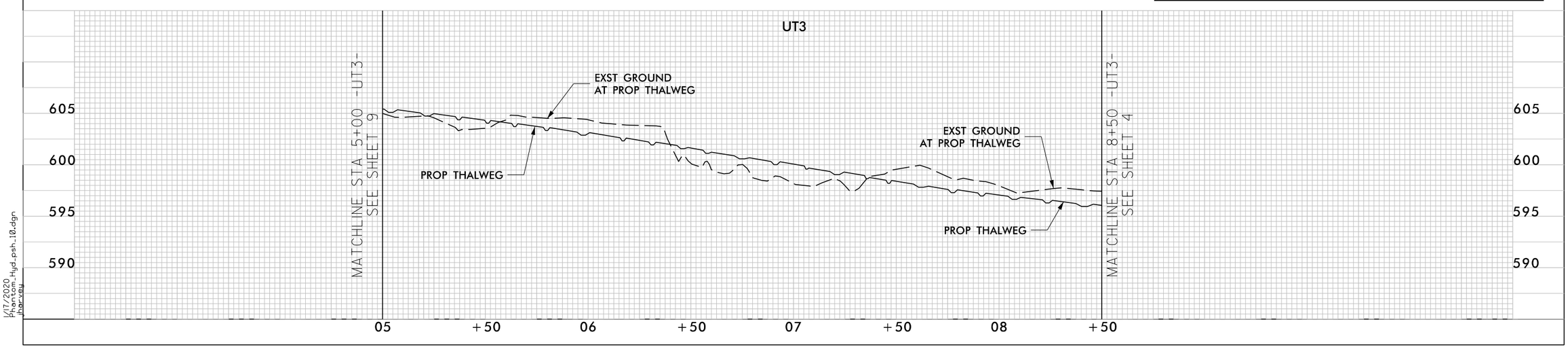
E E DENOTES ENHANCEMENT IN WETLAND

DENOTES WETTED PERIMETER

TOPOGRAPHY BASED ON SURVEY PERMFORMED BY K2 SURVEYING ON 8–2018. TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR

-UT3- STRUCTURE LOCATIONS

STR. TYPE	OFFSET	NORTHING	EASTING
LOG CROSS VANE	0	780,255.03	1,858,120.93
LOG CROSS VANE	0	780,156.97	1,858,140.11
LOG CROSS VANE	0	780,144.98	1,858,142.38
LOG CROSS VANE	0	780,132.66	1,858,149.03
LOG CROSS VANE	0	780,100.82	1,858,150.79
LOG CROSS VANE	0	780,075.82	1,858,160.13
LOG CROSS VANE	0	780,058.19	1,858,173.84
LOG CROSS VANE	0	780,002.52	1,858,188.67



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SHEET NAME	SHEET NUMBER
STRUCTURES	11
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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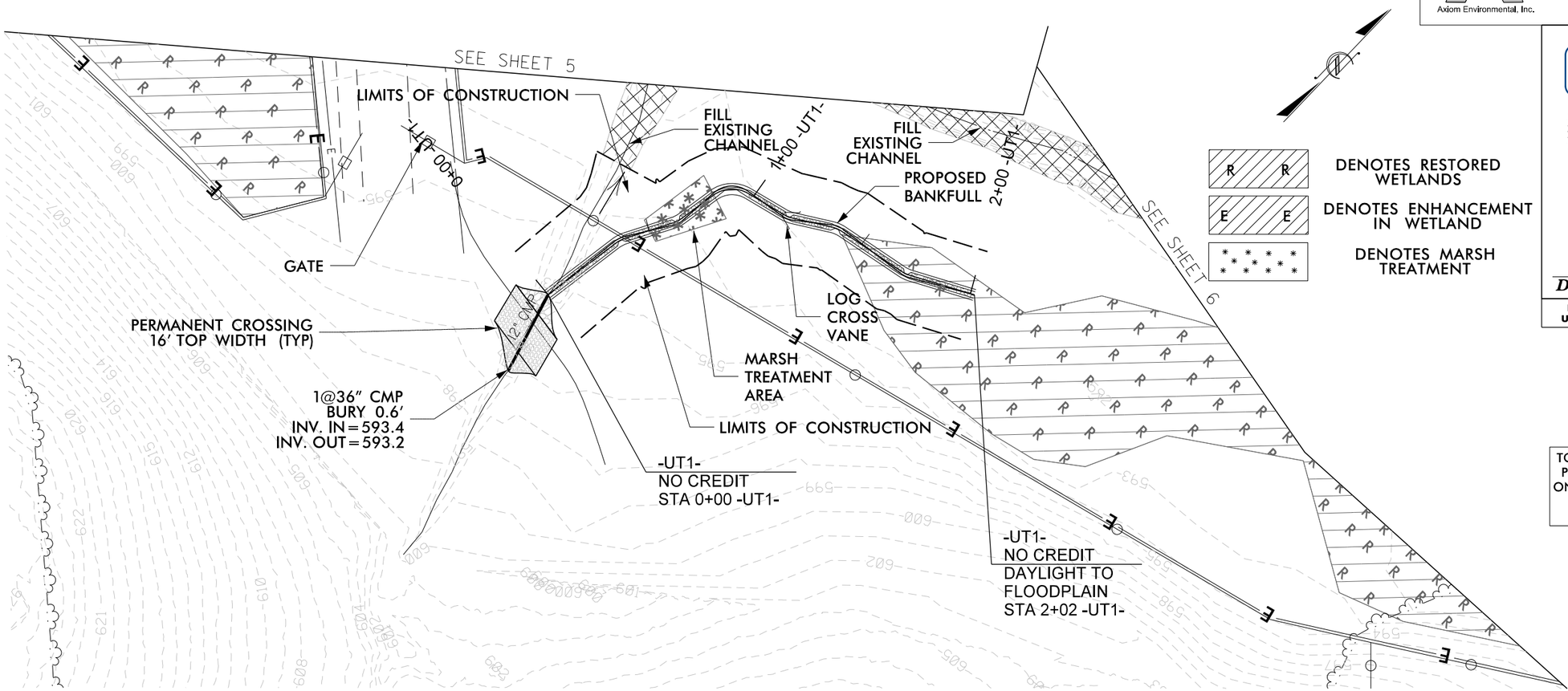
-UT1- STRUCTURE LOCATIONS

STR. TYPE	OFFSET	NORTHING	EASTING
LOG CROSS VANE	0	780,004.28	1,858,936.30



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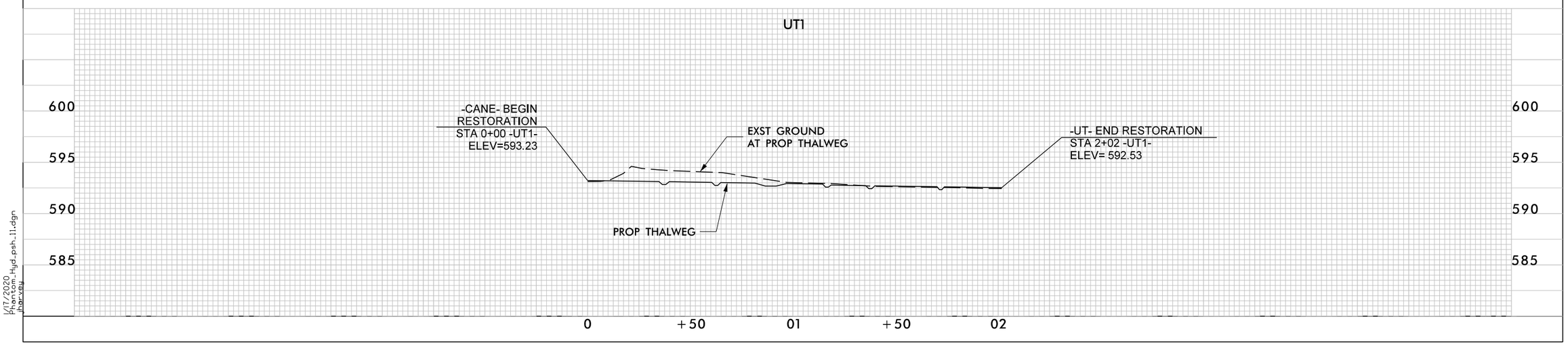

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SHEET NAME	SHEET NUMBER
STRUCTURES	12
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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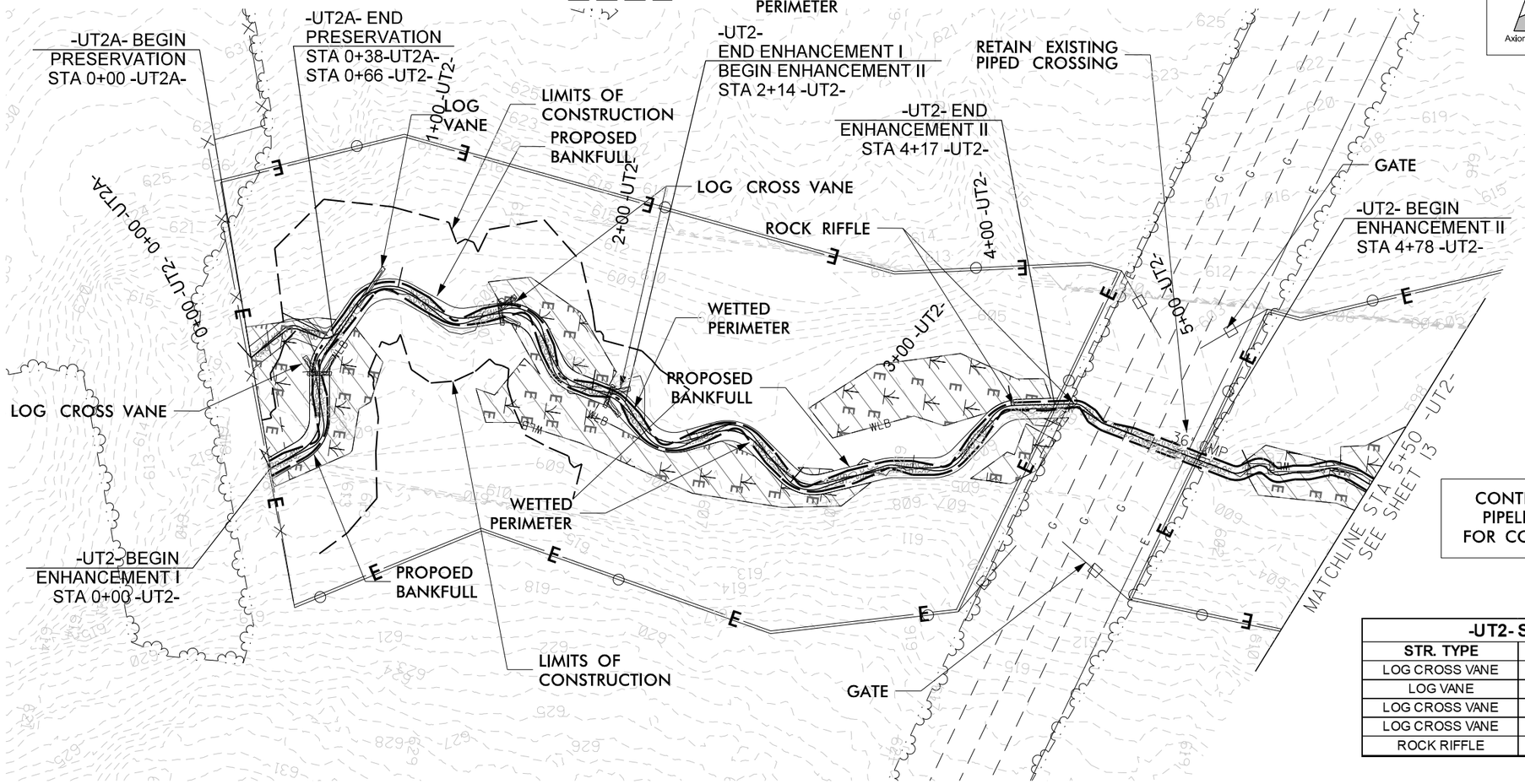
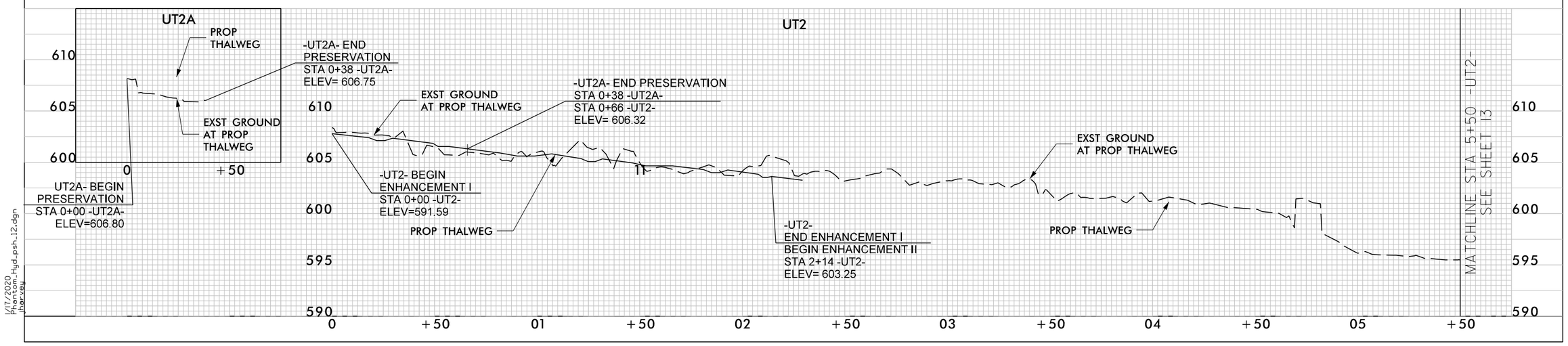


CONTRACTOR MUST CONTACT COLONIAL PIPELINE TO GET THEIR SPECIFICATIONS FOR CONSTRUCTING A PIPELINE CROSSING.

-UT2- STRUCTURE LOCATIONS

STR. TYPE	OFFSET	NORTHING	EASTING
LOG CROSS VANE	0	779,204.87	1,859,968.73
LOG VANE	0	779,215.97	1,859,940.21
LOG CROSS VANE	0	779,271.65	1,859,935.22
LOG CROSS VANE	0	779,318.13	1,859,961.29
ROCK RIFFLE	0	779,477.83	1,859,943.39



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SHEET NAME	SHEET NUMBER
STRUCTURES	13
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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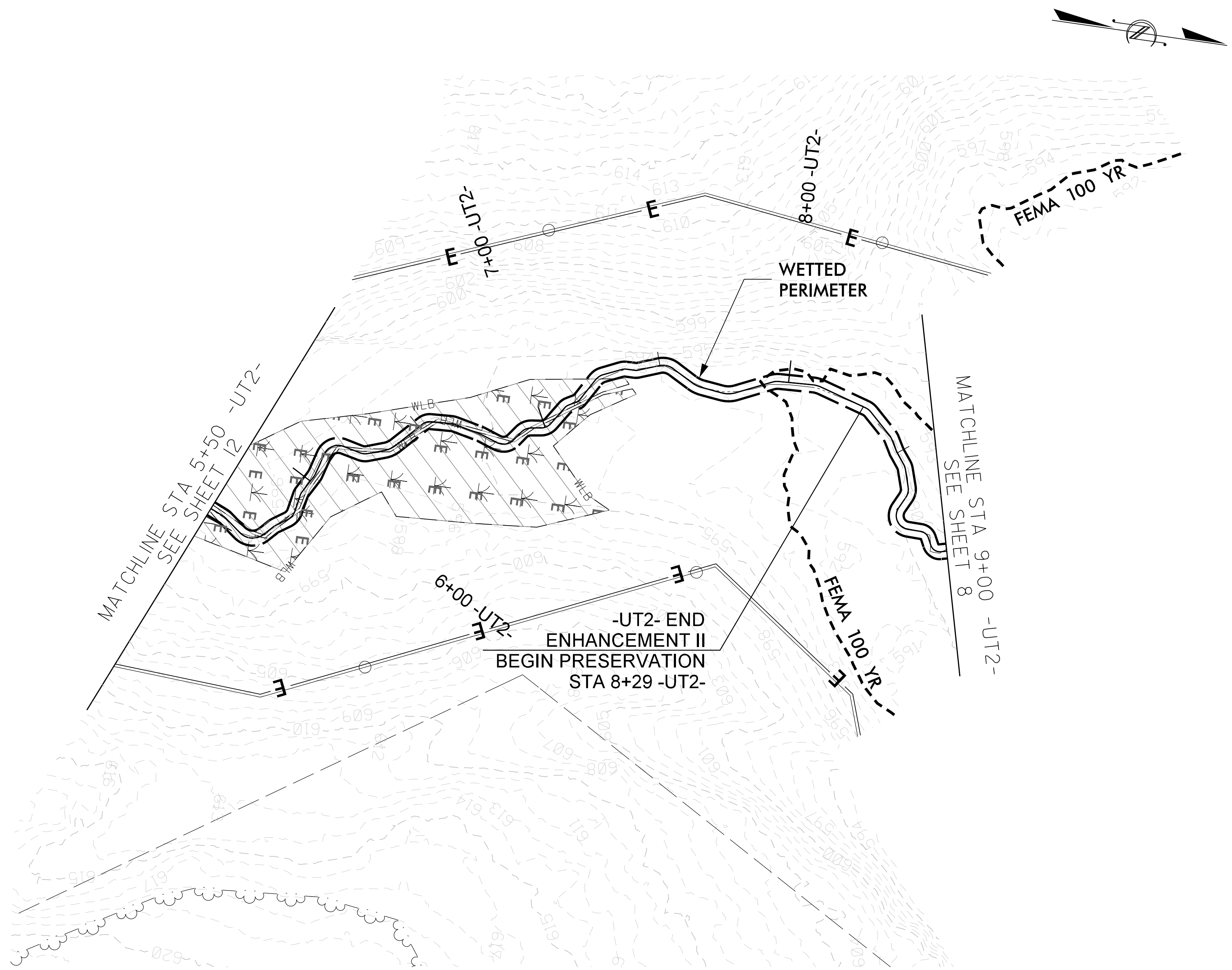

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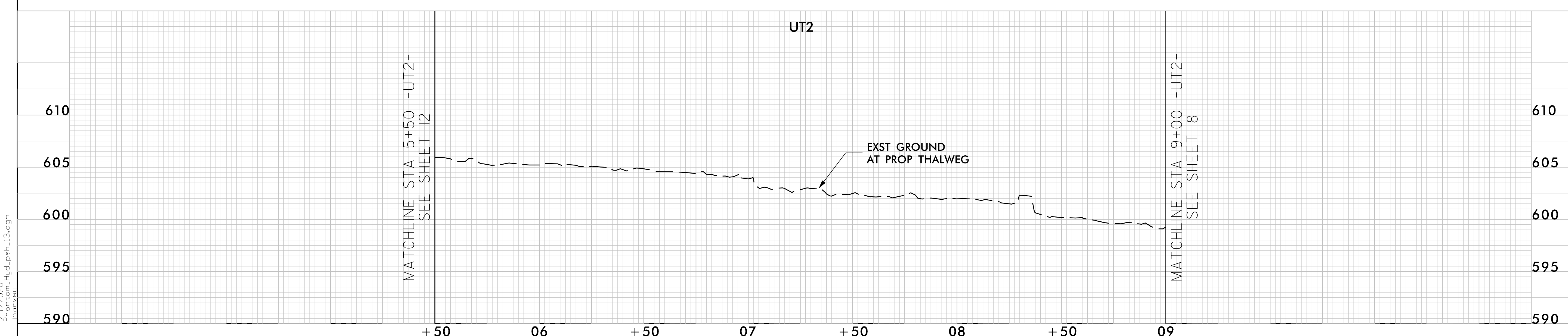

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EROSION CONTROL NOTES

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CONSTRUCTION SEQUENCE

Construction Notes:

1. Staging areas, stockpile areas, construction entrances and access roads will be identified and located according to the Erosion Control Plans and landowner agreements. Variances will be allowed assuming both the Contractor and Designer verbally agree.

2. A construction entrance (as shown on sheet E03F) from Secondary Road 2373 (Charlie Euliss Road) will be installed for access to the CANE, UT1, UT2, UT2A, UT3, and UT4 as shown on the Erosion Control Plans.

3. The Contractor will install silt fencing, as noted on the Erosion Control Plans, at applicable staging and stockpile areas.

4. The proposed stream alignment and structure locations will be staked for each reach (CANE, UT1, UT2, UT2A, UT3, and UT4). Staking will be restricted to riffle elevations only in order to establish and maintain grade for the entire system. Pools will be excavated once structures are installed.

5. The Contractor will begin stockpiling materials in a designated staging area. General details associated with all sections include:

   a. Sediment bags will be used to filter the groundwater and placed within areas of newly excavated channel that are offline from the existing flow. These bags will be utilized as the contractor or designer deem necessary.
   b. Temporary and permanent seed mixes, including applicable mulching, will be applied to the streambanks and disturbed areas at the end of each working day as definable sections are completed. Erosion control matting will be installed on top of the seed and straw in accordance with the Erosion Control Construction Sequence.
   c. Excavated material that is stockpiled will follow erosion and sediment control guidelines as they relate to material storage and stockpiling.
   d. All remaining disturbed areas are to be seeded and covered according to the Erosion Control Construction Sequence.
   e. Riprap aprons will be constructed to impede any erosion of the channel and streambanks by the water diverted from the pump-around procedure.

7. Boulders and materials used for stream structures will be delivered through the primary construction entrance and stockpiled in the appropriate area.

8. This project will require pumping water around the channels during construction. Work will generally proceed from upstream to downstream.

9. Adjust haul roads and associated silt fence as necessary when permanent stream crossings are installed.

Construction Sequence

1. The Contractor will excavate the proposed channel and modify portions of the existing channel based on riffle elevations in sections no greater than 300’ in length at a time (except where longer sections are necessary to maintain constructability) in an upstream to downstream fashion. Impervious dikes will be installed upstream and downstream of the current work section before work on the section is initiated unless noted otherwise (see Table 1.-Working Sections below for suggested work section stations and progression). Water will be diverted around the current work section through the use of a pump and temporary flexible hose. The current work section will be dewatered using an additional pump and a sediment bag. Work sections that involve the construction of a confluence of two reaches may require the use of two pump-around operations. Structures will be installed according to the details presented in the Construction Plans. Excavate only a portion of the channel that can be completed and stabilized within the same day. All excavated material will be placed in an appropriate stockpile area. Pools will be established once structures and channel alignments have been completed locally. Permanent stream crossings will be installed while the working section containing the crossing has been dewatered.

   Grading of some portions of the proposed floodplain may need to be delayed until after work in subsequent sections has been completed, especially near confluences. Haul roads and temporary silt fence may also need to be removed before the proposed floodplain can be completed and/or unused existing channel can be filled.

Table 1. - Working Sections

Order of Progression	Reach	Begin Station	End Station	Notes
1	UT3	0+00	3+00	
2	UT3	3+00	6+00	
3	UT3	6+00	9+00	
4	UT3	9+00	10+72	Confluence with CANE
5	CANE	0+00	1+75	
6	CANE	1+75	3+00	Confluence with UT3
7	CANE	3+00	6+00	
8	CANE	6+00	9+00	Construct channel ford
9	UT1	0+00	2+02	Construct stream crossing Outlet to floodplain
10	CANE	9+00	13+00	
11	CANE	13+00	15+80	
12	CANE	15+80	17+90	
13	CANE	17+90	20+30	
14	UT4	1+15	4+09	
15	CANE	20+30	21+12	
16	UT2	0+00	3+00	Confluence with UT2A
17	UT2A	0+00	0+38	
18	UT2	3+00	4+17	

EROSION CONTROL NOTES

CONSTRUCTION SEQUENCE (CONTINUED)

2. Ponds shall be dewatered prior to dam removal using the following methods:

   -For ponds with an outlet structure, open the outlet structure to dewater the pond at a rate that does not cause excessive erosion downstream of the dam.

   -For ponds without an outlet structure or that require supplemental drawdown, use a pump and temporary flexible hose to dewater the pond into the downstream channel. A rip rap dissipation pad shall be used at the outlet of the temporary flexible hose. Dewater at a rate that does not cause excessive erosion downstream of the discharge point.

3. At the end of each working day, the Contractor will be responsible for the application of seed and straw, as applicable, to newly established streambanks and disturbed areas. Erosion control matting will be installed on top of the seed and straw in accordance with the Erosion Control Construction Sequence.

Post-Construction
After all channel work has been completed:

1. All remaining disturbed areas are to be seeded and mulched in accordance with the Erosion Control Construction Sequence.

2. Live staking can begin on all completed sections of channel (CANE, UT1, UT2, UT2A, UT3, and UT4) in accordance with the Planting Plans.

3. Once channel construction and seeding has been complete, bare-rooted seedlings will be installed.

EROSION CONTROL CONSTRUCTION SEQUENCE

1) Obtain grading permit.
2) Install temporary construction entrance, silt fencing, access roads, and other measures shown on the approved erosion and sedimentation control plan.
3) Install rain gage on site. Contractor shall provide a log book at the project site and shall read and record rain amounts at the same time each day.
4) Contact local Soil Erosion Authority or State for on-site inspection by Environmental Inspector and obtain certificate of compliance.
5) Begin clearing - maintain devices as necessary.
6) Begin channel construction - stockpile waste material in designated spoil areas and surround with silt fencing.
7) Temporary or permanent ground cover stabilization shall occur within 7 calendar days from the last land-disturbing activity, with the following exceptions in which temporary or permanent ground cover shall be provided within 14 calendar days from the last land-disturbing activity:

   - Slopes between 2:1 and 3:1, with a slope length of 10 feet or less
   - Slopes 3:1 or flatter, with a slope length of 50 feet or less
   - Slopes 4:1 or flatter

8) All graded stream banks must be seeded, mulched, and matted at the end of each day. For this reason, daily disturbance is limited to the length of stream that can be completed within daily work hours.
9) Once a newly constructed channel section is stabilized, impervious dikes and pump around stations may be removed, and water may be reintroduced to the channel.
10) When construction is complete and all areas are stabilized completely, call for inspection by Environmental Inspector.
11) If site is approved, remove silt fencing, access roads, etc. and seed out any resulting bare areas.
12) When vegetation has been established, call for final site inspection by Environmental Inspector.

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1/17/2020
DATE:

SHEET NAME	SHEET NUMBER
EROSION CONTROL	E2A
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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SEEDING SCHEDULE

TEMPORARY HERBACEOUS SEED

Common Name	Scientific Name	Application Rate	Application Dates
Grain Rye [A]	*Secale cereale*	130 lbs. per acre (3 lbs. per 1,000 ft^2)	Year-round
Orchard Grass [B]	*Dactylis glomerata*	15 lbs per acre (0.35 lbs. per 1,000 ft^2)	September - March
Brown Top Millet [B]	*Panicum ramosum*	40 lbs. per acre (1.0 lbs. per 1,000 ft^2)	May – September
German Millet [B]	*Setaria italica*	25 lbs. per acre (0.5 lbs. per 1,000 ft^2)	May – September

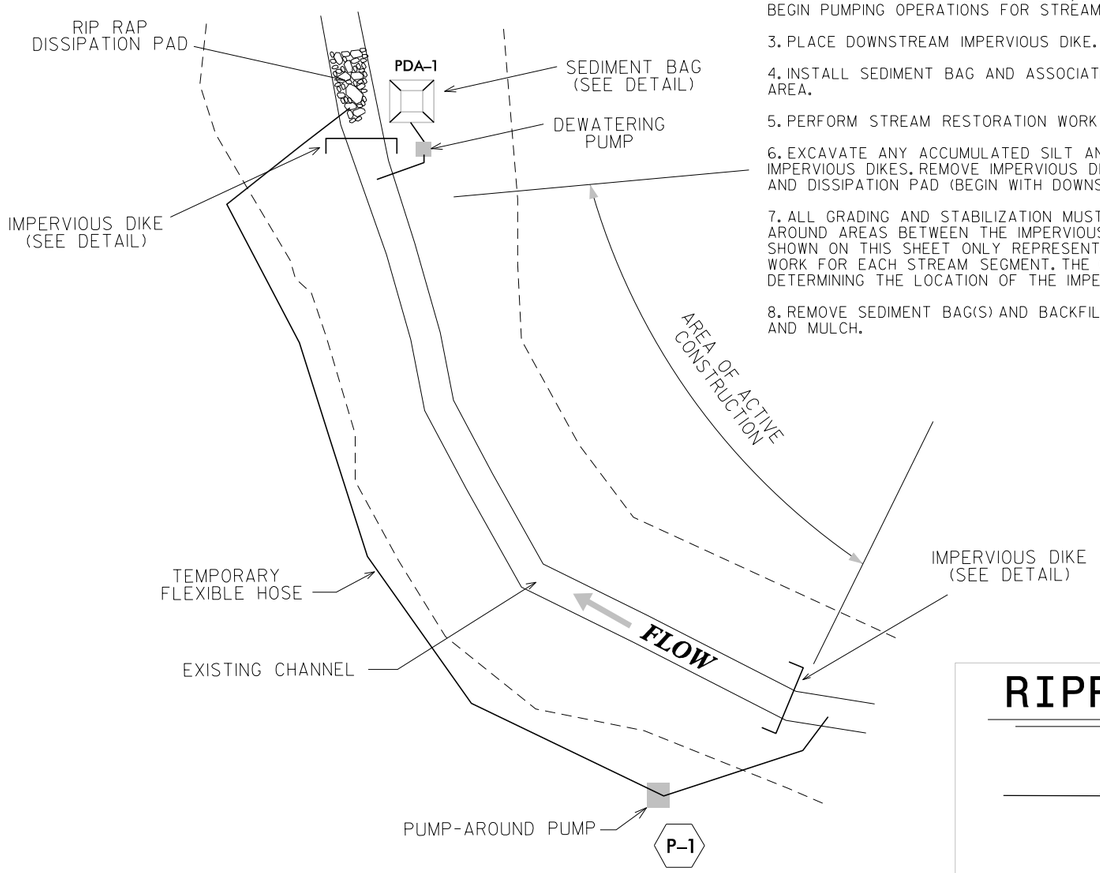
[A] Primarily utilized on disturbed or stockpiled areas.
[B] Primarily utilized near stream channels and streambanks.

SOIL AMENDMENTS
In lieu of a soil test:

Fertilizer	10 – 10 -10 1000 lb./acre

Mulch

Small grain mulch must be applied at a rate of 2 tons/acre to all seeded areas.



CONSTRUCTION SEQUENCE FOR TYPICAL PUMP-AROUND:

1. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.

2. PLACE UPSTREAM IMPERVIOUS DIKE, DOWNSTREAM RIP RAP DISSIPATION PAD, AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.

3. PLACE DOWNSTREAM IMPERVIOUS DIKE.

4. INSTALL SEDIMENT BAG AND ASSOCIATED PUMP. DEWATER THE ENTRAPPED AREA.

5. PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLANS.

6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERVIOUS DIKES. REMOVE IMPERVIOUS DIKES, PUMPS, TEMPORARY FLEXIBLE HOSE, AND DISSIPATION PAD (BEGIN WITH DOWNSTREAM IMPERVIOUS DIKE FIRST).

7. ALL GRADING AND STABILIZATION MUST BE COMPLETED WITHIN THE PUMP AROUND AREAS BETWEEN THE IMPERVIOUS DIKES. THE IMPERVIOUS LOCATIONS AS SHOWN ON THIS SHEET ONLY REPRESENT THE UPPER AND LOWER EXTENT OF WORK FOR EACH STREAM SEGMENT. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF THE IMPERVIOUS DIKES.

8. REMOVE SEDIMENT BAG(S) AND BACKFILL. STABILIZE DISTURBED AREA WITH SEED AND MULCH.

NOTES:

1. ALL EXCAVATION SHALL BE PERFORMED IN ONLY DRY OR ISOLATED SECTIONS OF CHANNEL

2. IMPERVIOUS DIKES ARE TO BE USED TO ISOLATE WORK FROM STREAM FLOW WHEN NECESSARY

3. ALL GRADED STREAM BANKS SHALL BE SEEDED, MULCHED, AND MATTED AT THE END OF EACH WORKING DAY. ALL OTHER GRADED AREAS SHALL BE SEEDED IN ACCORDANCE WITH THE CONSTRUCTION DOCUMENTS.

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

5. PUMPS AND HOSES SHALL BE OF A SUFFICIENT SIZE AND NUMBER TO DEWATER THE WORK AREA.

6. RIP RAP DISSIPATION PAD TO BE INSTALLED DOWNSTREAM OF LOWER IMPERVIOUS DIKE

TYPICAL PUMP-AROUND OPERATION

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SHEET NAME		SHEET NUMBER
EROSION CONTROL TYPICAL		E3
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ALAMANCE	DATE: 2019

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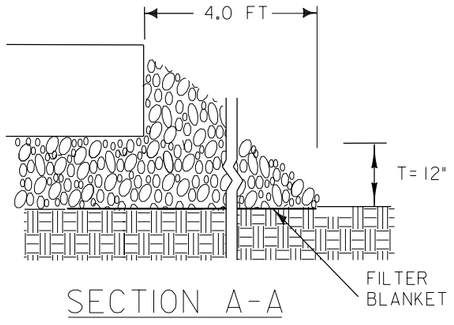
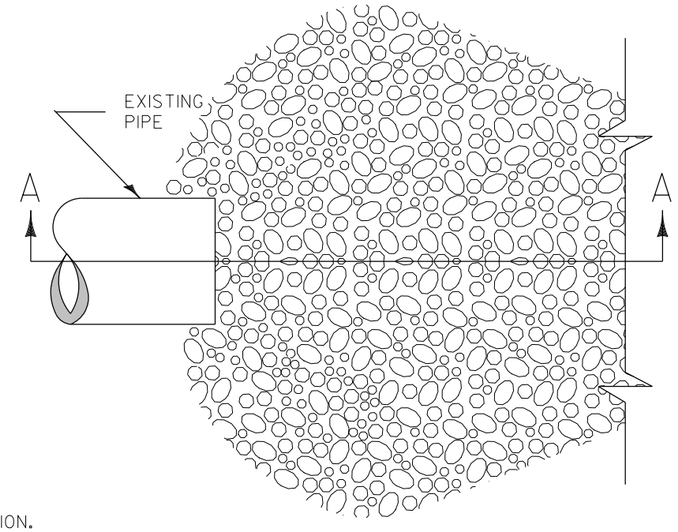
RIPRAP DISSIPATION PAD



SECTION A-A

PLAN VIEW



NOTES:

1. La IS THE LENGTH OF THE RIPRAP APRON.
2. T = THICKNESS
3. IN A WELL-DEFINED CHANNEL EXTEND THE APRON UP THE CHANNEL BANKS TO THE TOP OF THE BANK.
4. A FILTER BLANKET OR FILTER FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION.

RIP RAP DISIPATION PAD SPECIFICATIONS

ASSUMED HOSE SIZE (IN)	PERMANENT (Y/N)	LENGTH La (FT)	WIDTH Wo (FT)	STONE SIZE d50 (IN)	STONE CLASS	THICKNESS (IN)
4"	N	4.0	1.0	3	A	12

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SHEET NAME	SHEET NUMBER
EROSION CONTROL TYPICAL	E3A
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
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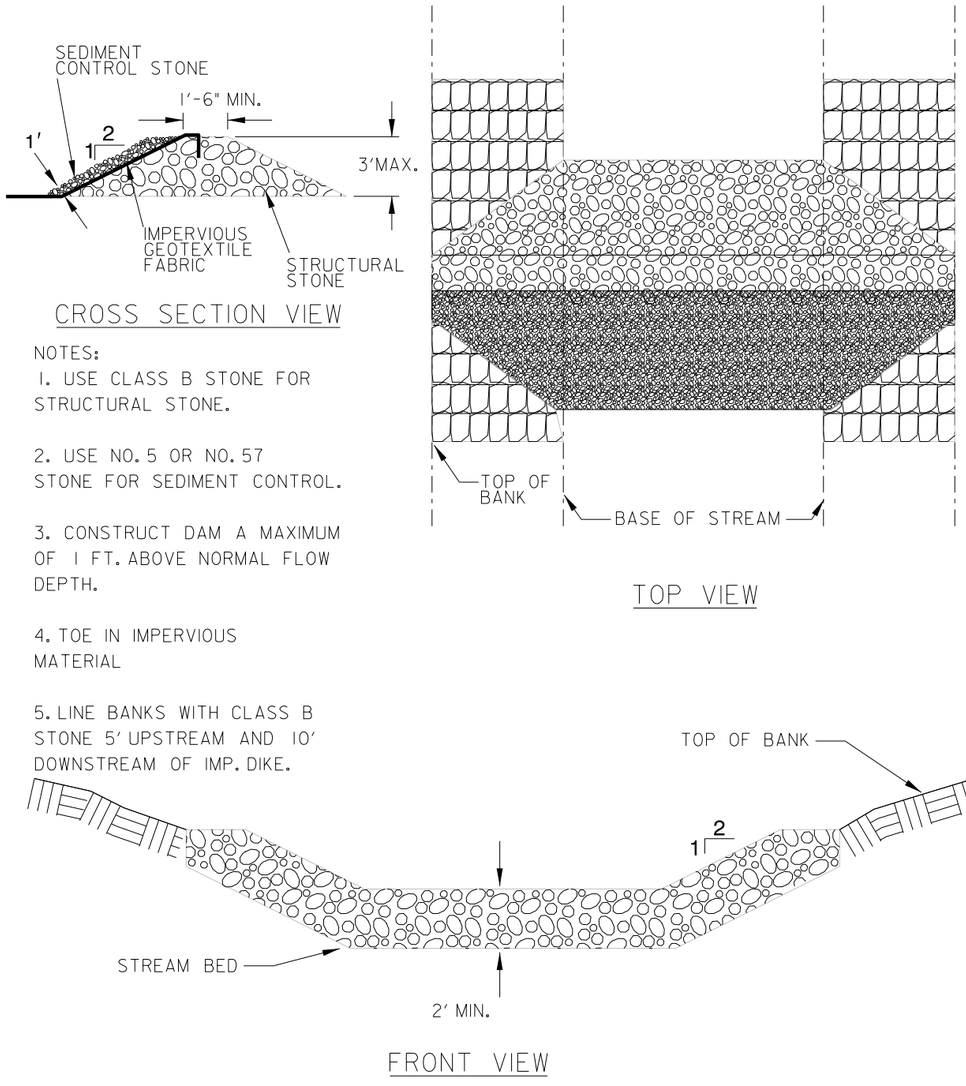
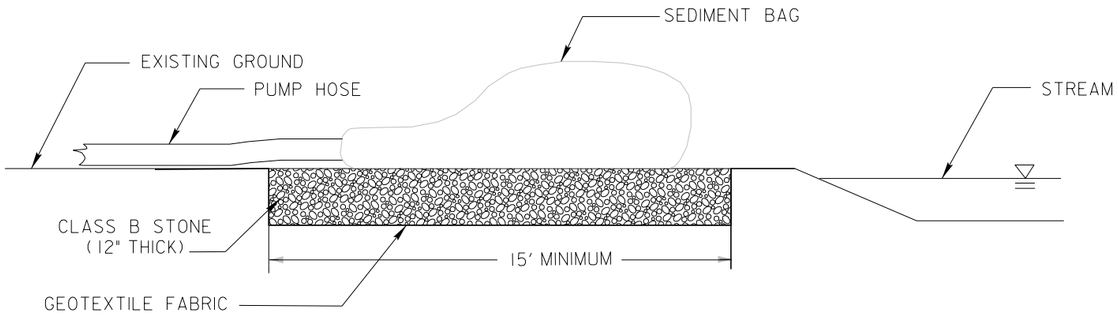
IMPERVIOUS DIKE



SEDIMENT BAG



INSTALLATION:

1. INSTALL SEDIMENT BAG ON A SLOPE SO INCOMING WATER FLOWS DOWNHILL THROUGH BAG WITHOUT CREATING MORE EROSION. TO INCREASE THE EFFICIENCY OF FILTRATION, PLACE THE BAG ON A GRAVEL BED IN ORDER TO MAXIMIZE WATER FLOW THROUGH THE SURFACE AREA OF THE BAG.

2. BAG IS FULL WHEN IT NO LONGER CAN EFFICIENTLY FILTER SEDIMENT OR ALLOW WATER TO PASS AT A REASONABLE RATE. FLOW RATES WILL VARY DEPENDING ON THE SIZE OF SEDIMENT BAG, THE TYPE AND AMOUNT OF SEDIMENT DISCHARGED INTO THE BAG, THE TYPE OF GROUND, ROCK OR OTHER SUBSTANCE UNDER THE BAG AND THE DEGREE OF THE SLOPE ON WHICH THE BAG LIES. UNDER MOST CIRCUMSTANCES THE SEDIMENT BAG WILL ACCOMMODATE FLOW RATES OF 1100 GALLONS PER MINUTE. USE OF EXCESSIVE FLOW RATES OR OVERFILLING WITH SEDIMENT WILL CAUSE THE BAG TO RUPTURE OR FAILURE OF THE HOSE ATTACHMENT STRAPS.

3. DISPOSE OF SEDIMENT BAG AS DIRECTED BY THE SITE DESIGNER. IF ALLOWED, BAG MAY BE CUT OPEN AND THE CONTENTS SEEDED AFTER REMOVING VISIBLE FABRIC.

4. REFER TO DETAIL REGARDING GEOTEXTILE FABRIC ATTRIBUTES.

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SHEET NAME	SHEET NUMBER
EROSION CONTROL TYPICAL	E3B

PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

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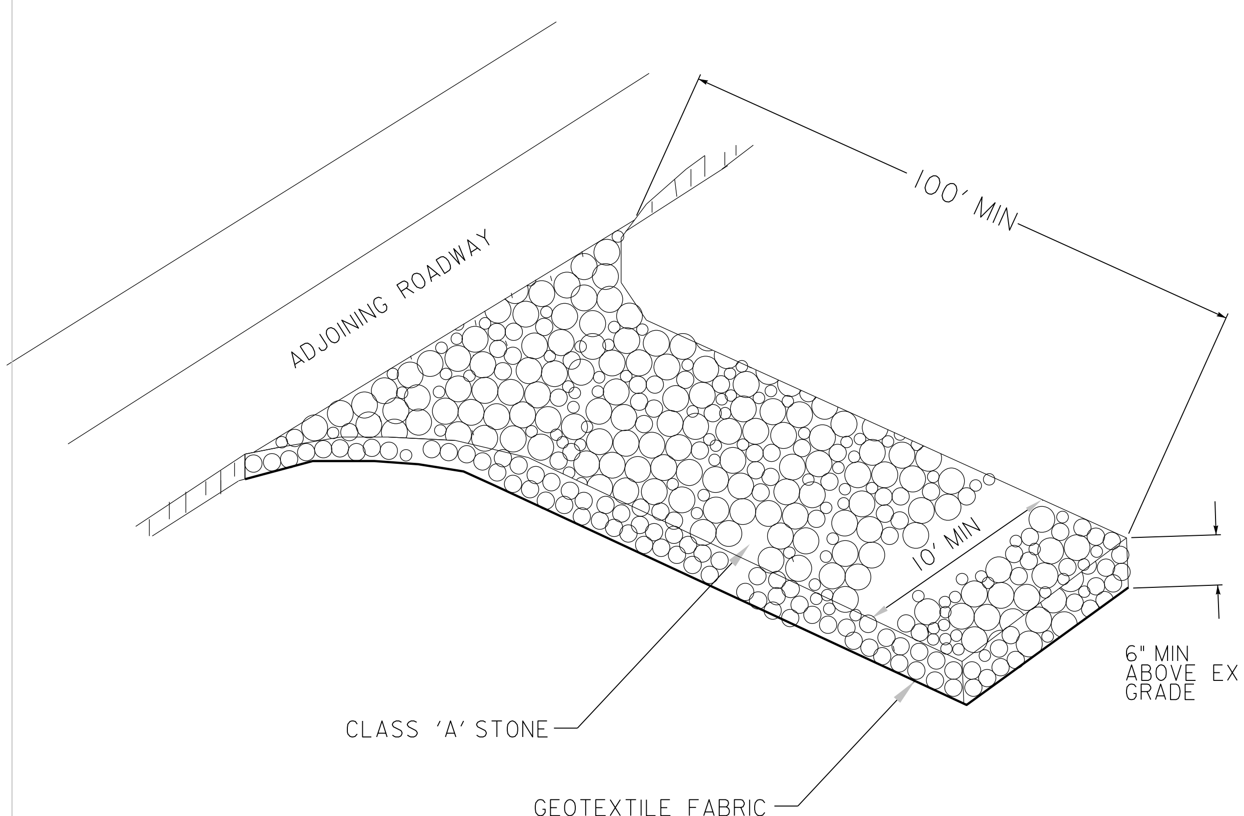
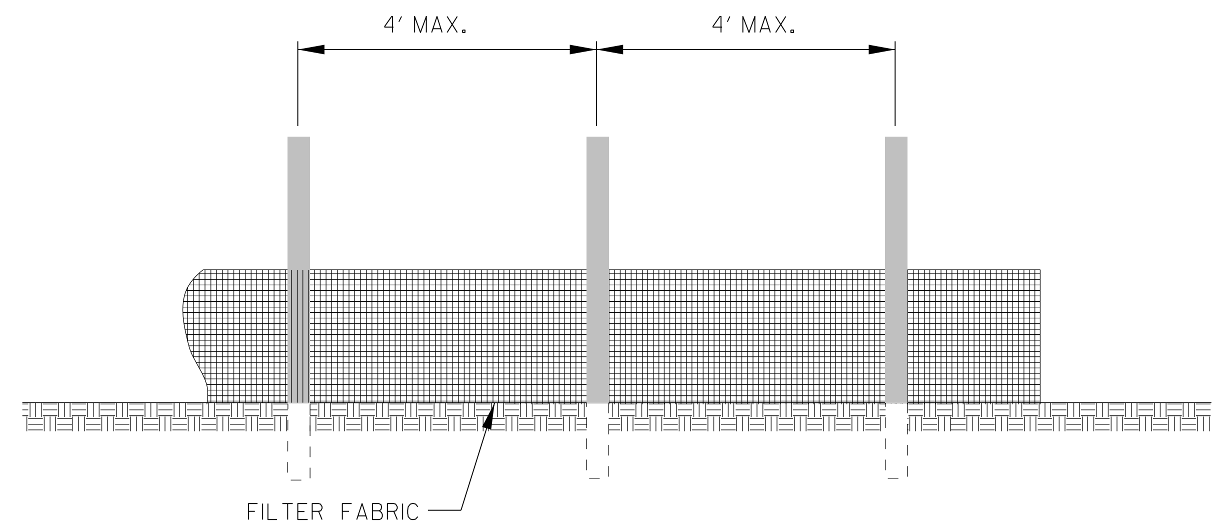
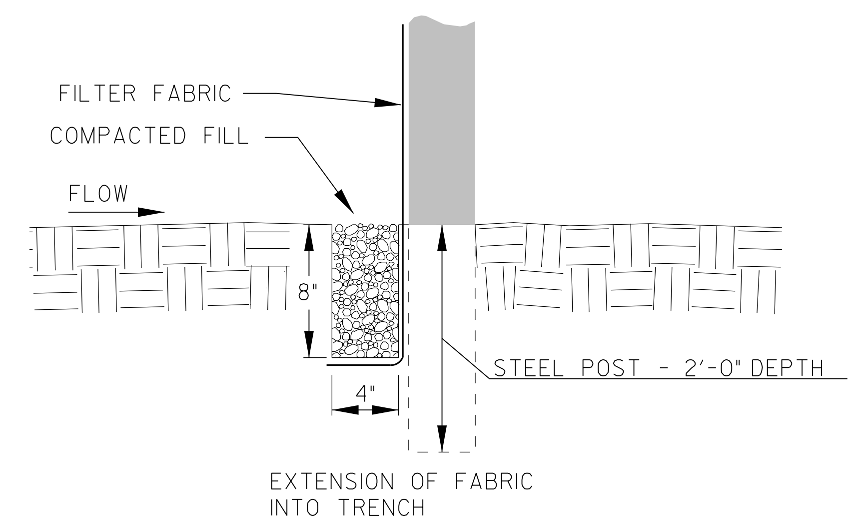
NOTES:

1. USE CLASS 'A' STONE ON PAD. PAD TO BE MINIMUM 100' LONG x 12' WIDE x 6" DEEP.
2. TURNING RADIUS SHOULD BE SUFFICIENT TO ACCOMODATE LARGE TRUCKS.
3. ENTRANCE(S) SHOULD BE LOCATED AS TO PROVIDE MAXIMUM UTILITY BY ALL CONSTRUCTION VEHICLES.
4. ENTRANCE(S) MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO ADJACENT ROADWAYS. PERIODIC TOP DRESSING WITH STONE MAY BE NECESSARY.
5. ANY MATERIAL WHICH FINDS ITS WAY ONTO THE ADJACENT ROADWAY MUST BE CLEANED UP IMMEDIATELY.



TEMPORARY CONSTRUCTION ENTRANCE/EXIT





NOTES:

1. FILTER FABRIC SHALL BE A MINIMUM OF 36" IN WIDTH AND SHALL BE FASTENED SECURELY TO THE POSTS.
2. STEEL POST SHALL BE 5'-0" IN HEIGHT AND BE OF THE SELF-FASTENER ANGLE STEEL TYPE.
3. WHEN JOINTS ARE NECESSARY, SECURELY FASTEN THE FABRIC AT A SUPPORT POST WITH OVERLAP TO THE NEXT POST.
4. FILTER FABRIC TO BE NYLON, POLYESTER, PROPYLENE, OR ETHYLENE YARN WITH EXTRA STRENGTH (50 LB/LIN. INCH MINIMUM) AND WITH A MINIMUM FLOW RATE OF 0.3 GAL/FT/MIN. FABRIC SHOULD CONTAIN ULTRAVIOLET RAY INHIBITORS AND STABILIZERS.

SILT FENCE

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SEAL
26971
ENGINEER
JOSHUA G. DALTON

1/17/2020
DATE:

SHEET NAME		SHEET NUMBER
EROSION CONTROL TYPICAL		E3C
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

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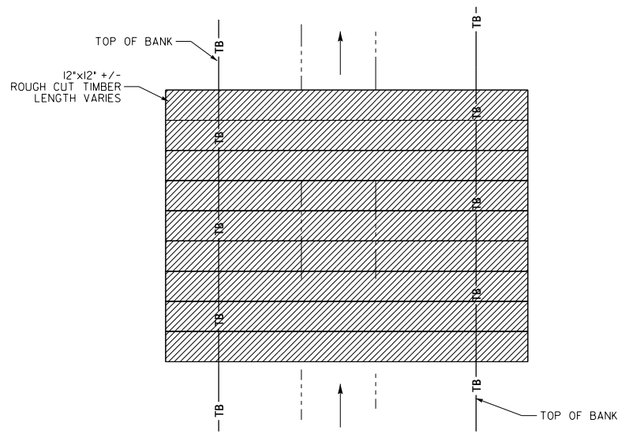
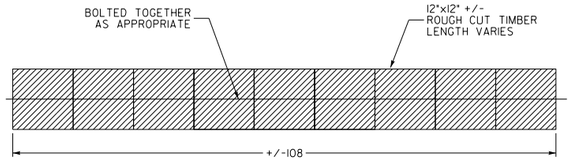
LOG MAT BRIDGE

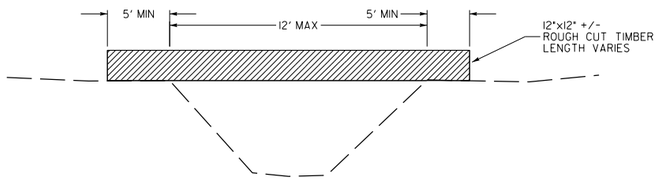


PLAN VIEW

NOTE:
DETAIL PROVIDED FOR INFORMATIONAL PURPOSES. USE OF LOG MAT BRIDGE IS AT CONTRACTORS DISCRETION.



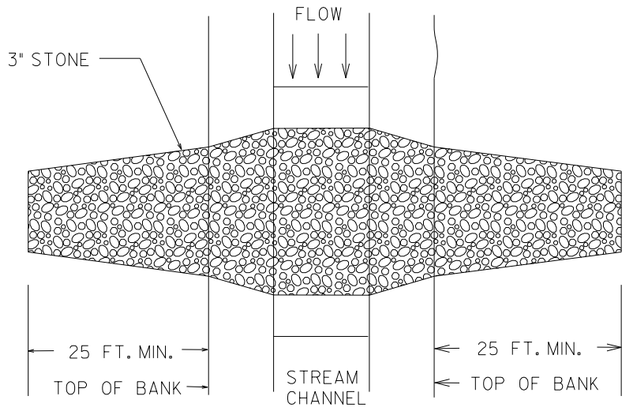
SECTION THROUGH LOG MAT BRIDGE



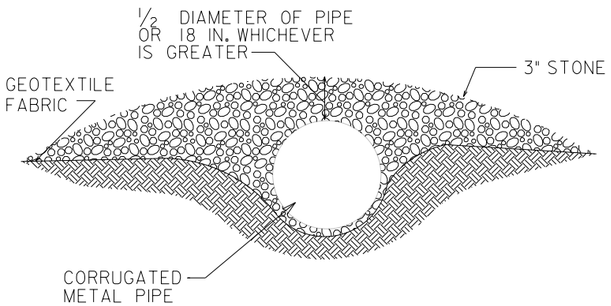
CROSS SECTION VIEW

TEMPORARY CULVERTED STREAM CROSSING

NOTE: FOR USE IN EXISTING CHANNELS ONLY.
NOT FOR USE IN RESTORED STREAMS.



PLAN VIEW



PROFILE VIEW

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phantom_Hyd_PSH_E03C (typ).dgn
jharvey

SHEET NAME	SHEET NUMBER
EROSION CONTROL TYPICAL	E3D
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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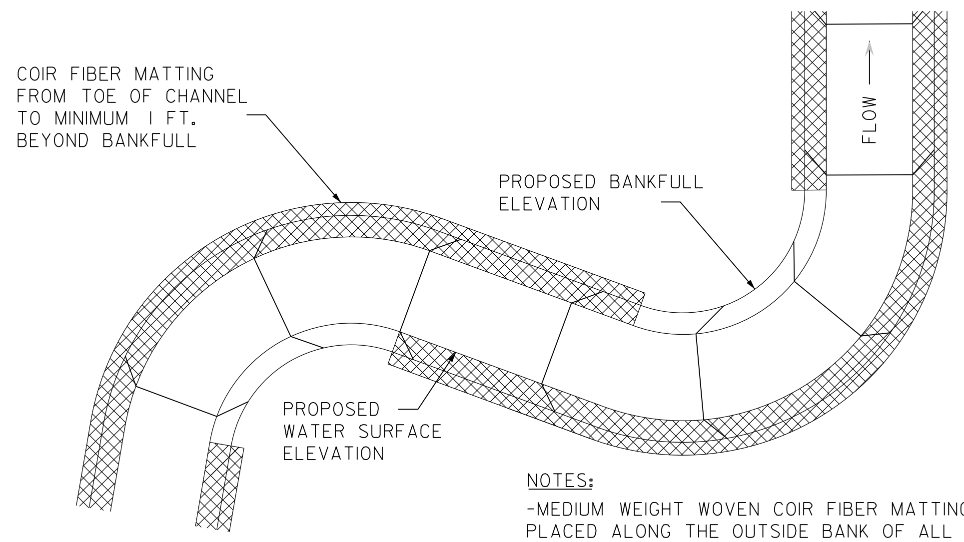
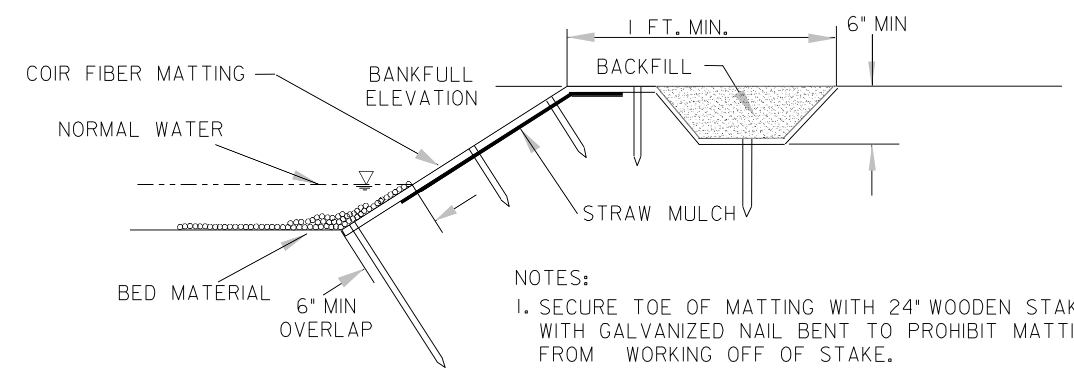
TYPICAL MATTING LOCATION



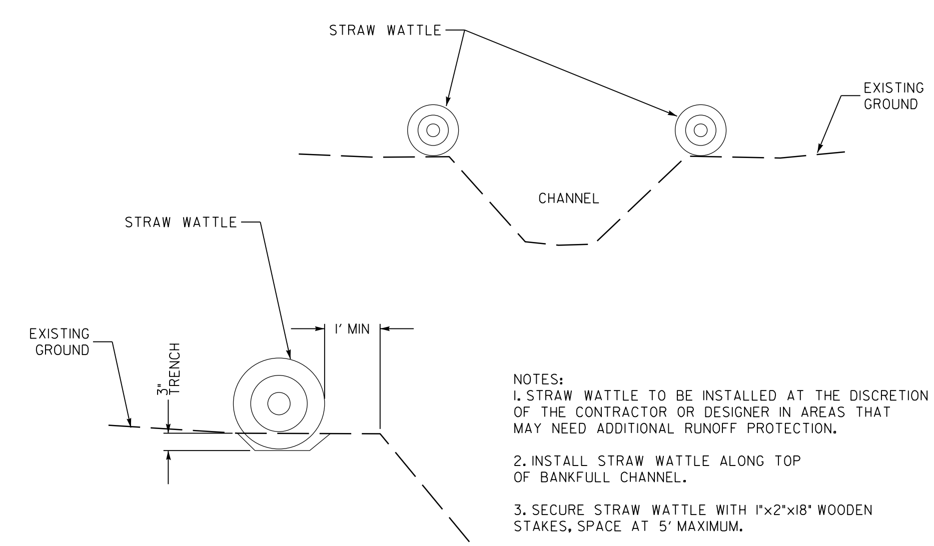
NOTES:
-MEDIUM WEIGHT WOVEN COIR FIBER MATTING SHALL BE PLACED ALONG THE OUTSIDE BANK OF ALL BENDS AND ALONG BOTH SIDES OFTHE CHANNEL IN TANGENT AREAS.
-FIELD ADJUSTMENTS TO MATTING LOCATION MAY BE MADE AT THE DESIGNERS OR CONTRACTORS DISCRETION AS NECESSARY.

COIR MATTING CROSS SECTION



NOTES:
1. SECURE TOE OF MATTING WITH 24" WOODEN STAKES WITH GALVANIZED NAIL BENT TO PROHIBIT MATTING FROM WORKING OFF OF STAKE.
2. USE 12" WOODEN STAKES ON 5' CENTERS OR AS DIRECTED BY MANUFACTURER'S RECOMMENDATIONS.
3. MINIMUM 1' WIDE, 6" DEEP TRENCH OVER TOP OF BANK WITH MATTING LAID FLAT AND STAKED. TRENCH TO BE BACKFILLED WITH EXCAVATED MATERIAL.

STRAW WATTLE



NOTES:
1. STRAW WATTLE TO BE INSTALLED AT THE DISCRETION OF THE CONTRACTOR OR DESIGNER IN AREAS THAT MAY NEED ADDITIONAL RUNOFF PROTECTION.
2. INSTALL STRAW WATTLE ALONG TOP OF BANKFULL CHANNEL.
3. SECURE STRAW WATTLE WITH 1"x2"x18" WOODEN STAKES. SPACE AT 5' MAXIMUM.
4. STRAW SHALL BE CERTIFIED WEED FREE.

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SHEET NAME	SHEET NUMBER
EROSION CONTROL TYPICAL	E3E
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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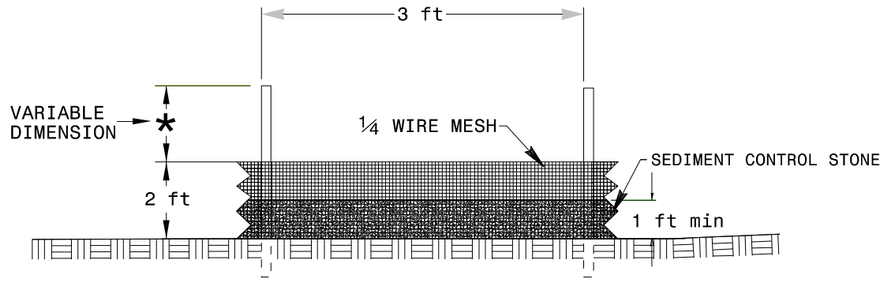
SPECIAL SEDIMENT CONTROL FENCE BREAK

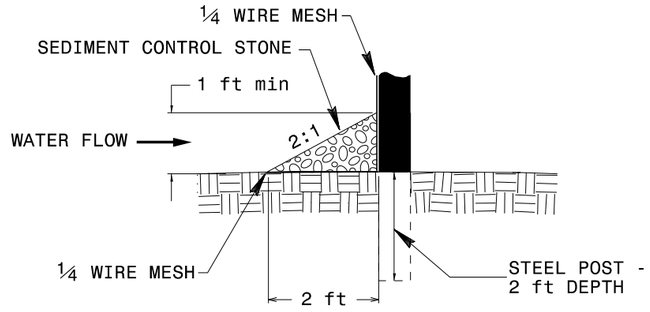


NOTE:

-INSTALL 9 FT SECTION OF SEDIMENT CONTROL FENCE AS A BREAK IN TEMPORARY SILT FENCE TO RELIEVE ACCUMULATION OF RUNOFF AS DIRECTED ON PLANS AND AS DEEMED NECESSARY BY CONTRACTOR OR DESIGNER.

CONSTRUCTION NOTES:

1. USE NO. 5 OR NO. 57 STONE FOR SEDIMENT CONTROL STONE.
2. USE HARDWARE CLOTH 24 GAUGE WIRE MESH WITH 1/4 INCH MESH OPENINGS.
3. INSTALL 5 FT. SELF FASTENER ANGLE STEEL POST 2 FT. DEEP MINIMUM.
4. SPACE POST A MAXIMUM OF 3 FT.



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SHEET NAME		SHEET NUMBER
HAUL ROADS		E03F
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ALAMANCE	DATE: 2019

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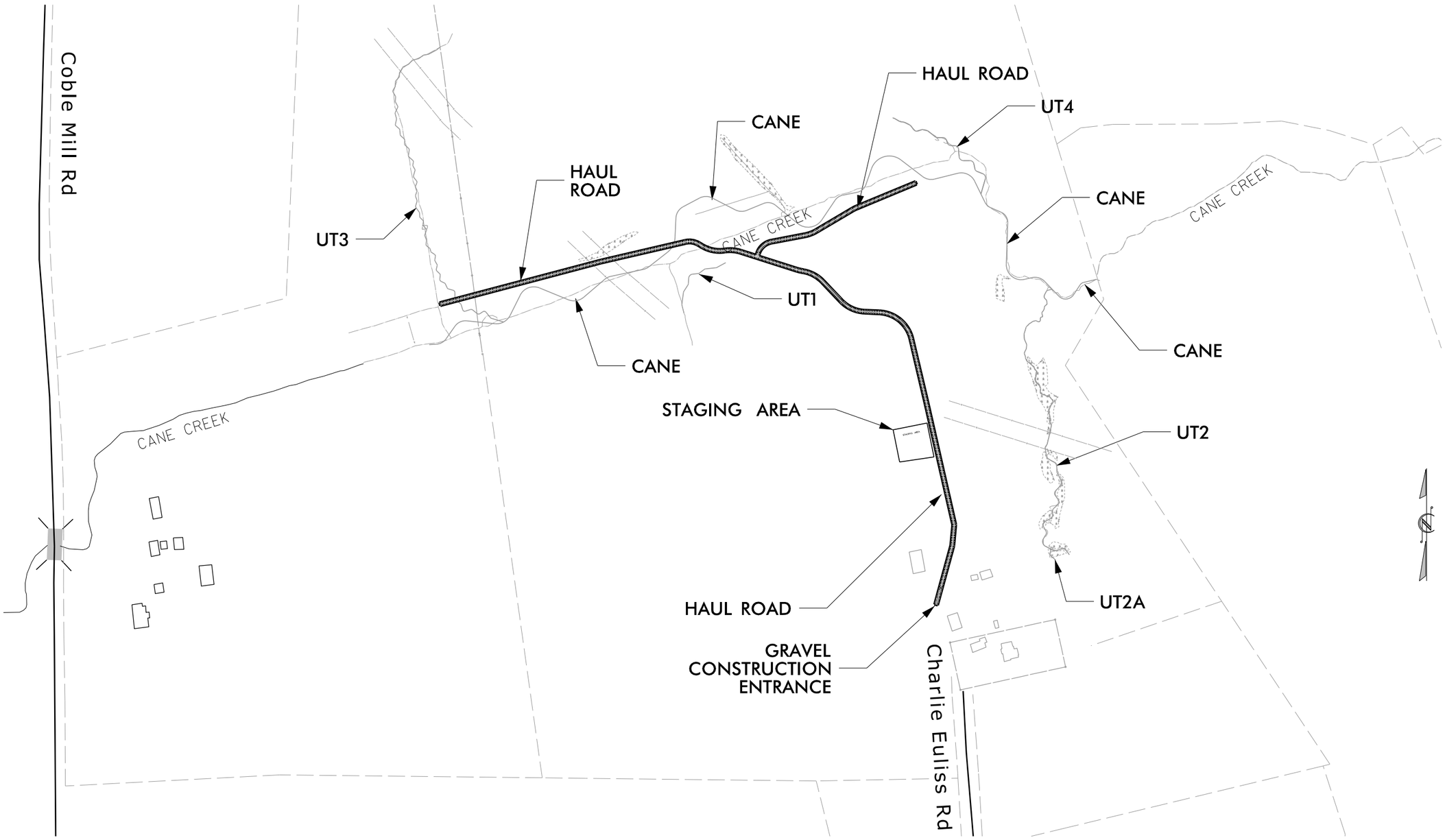

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harvey

SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	E4
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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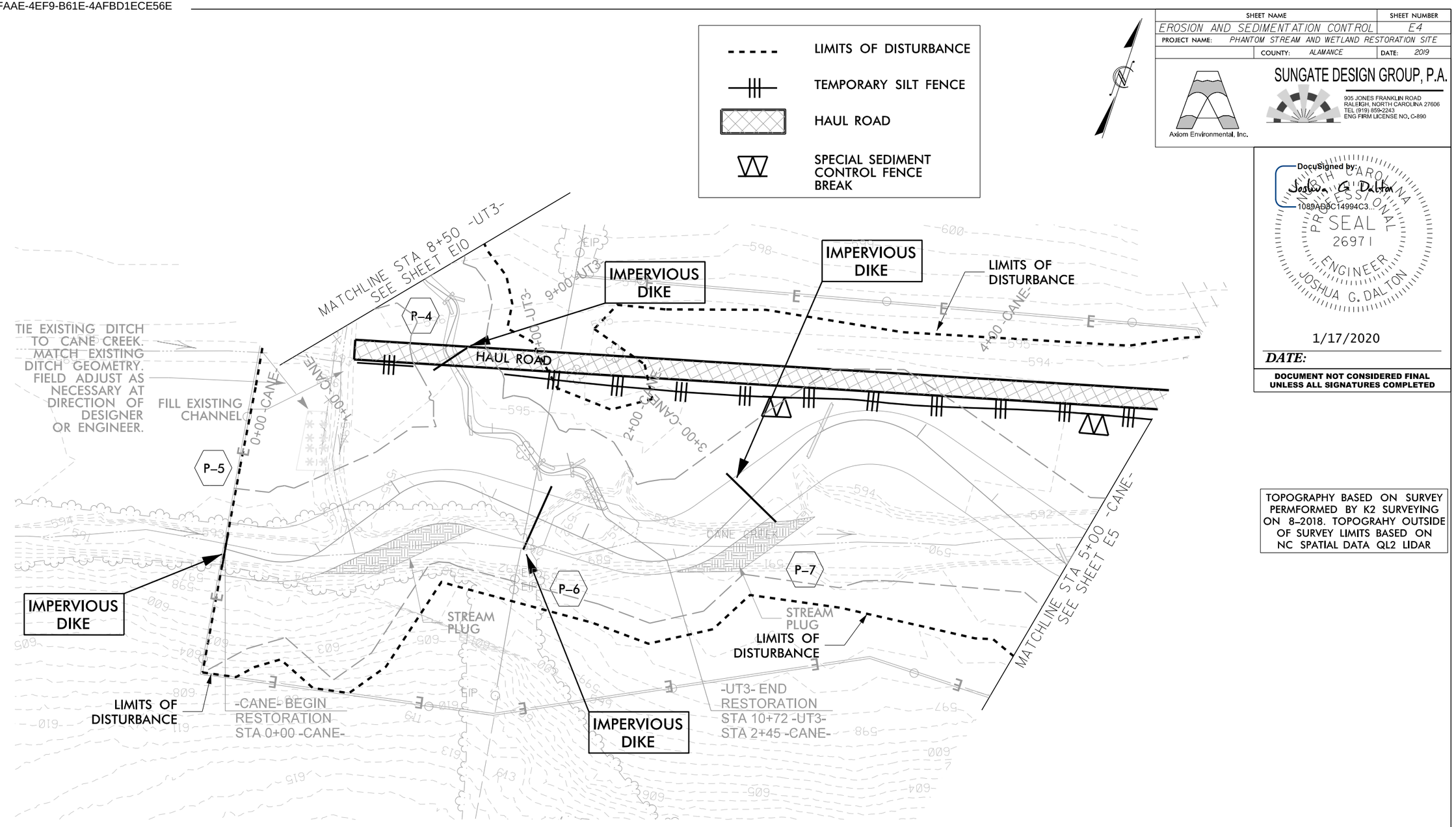

TOPOGRAPHY BASED ON SURVEY PERMFORMED BY K2 SURVEYING ON 8-2018. TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR

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harvey

SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	E5
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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LIMITS OF DISTURBANCE
TEMPORARY SILT FENCE
HAUL ROAD
SPECIAL SEDIMENT CONTROL FENCE BREAK

CONTRACTOR MUST CONTACT COLONIAL PIPELINE TO GET THEIR SPECIFICATIONS FOR CONSTRUCTING A PIPELINE CROSSING.

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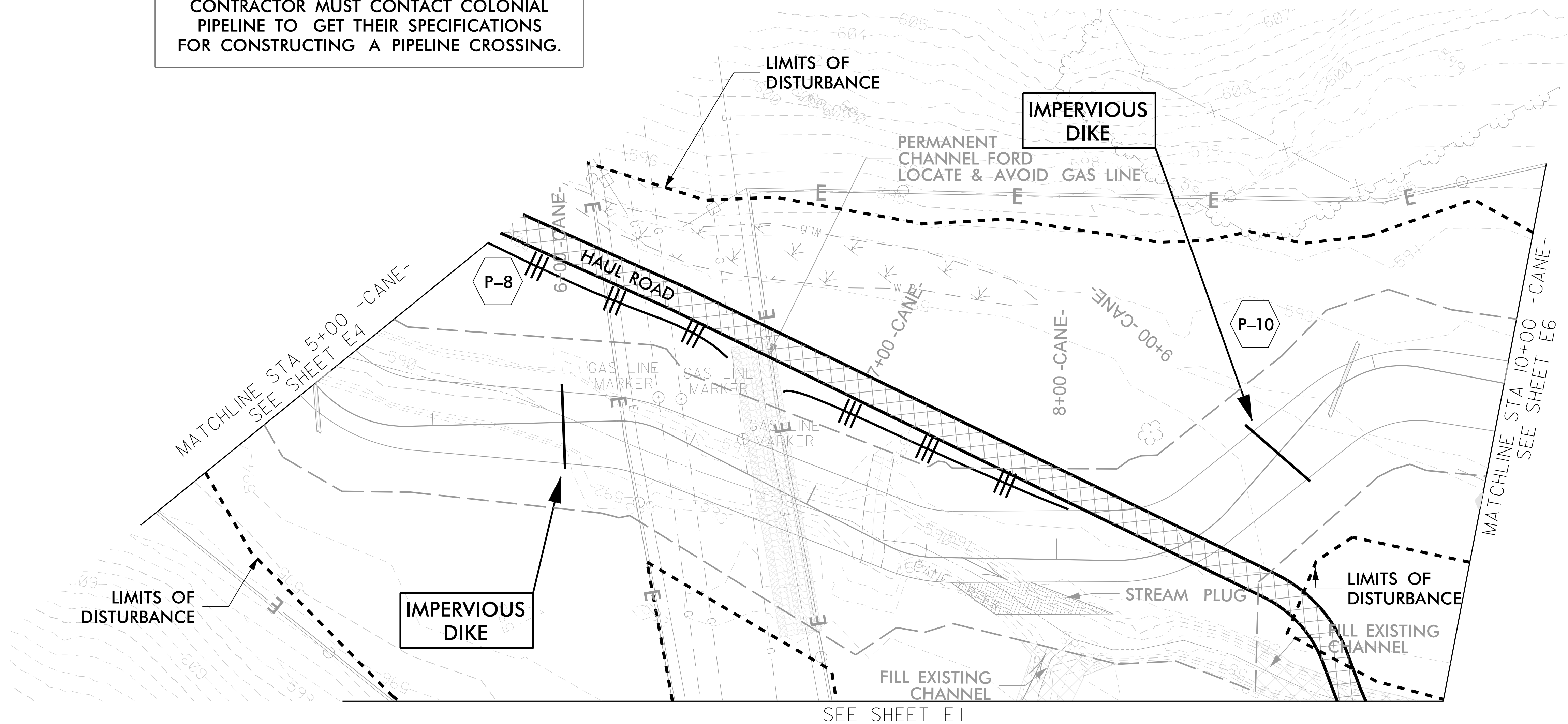

SEE SHEET E11

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SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	E6
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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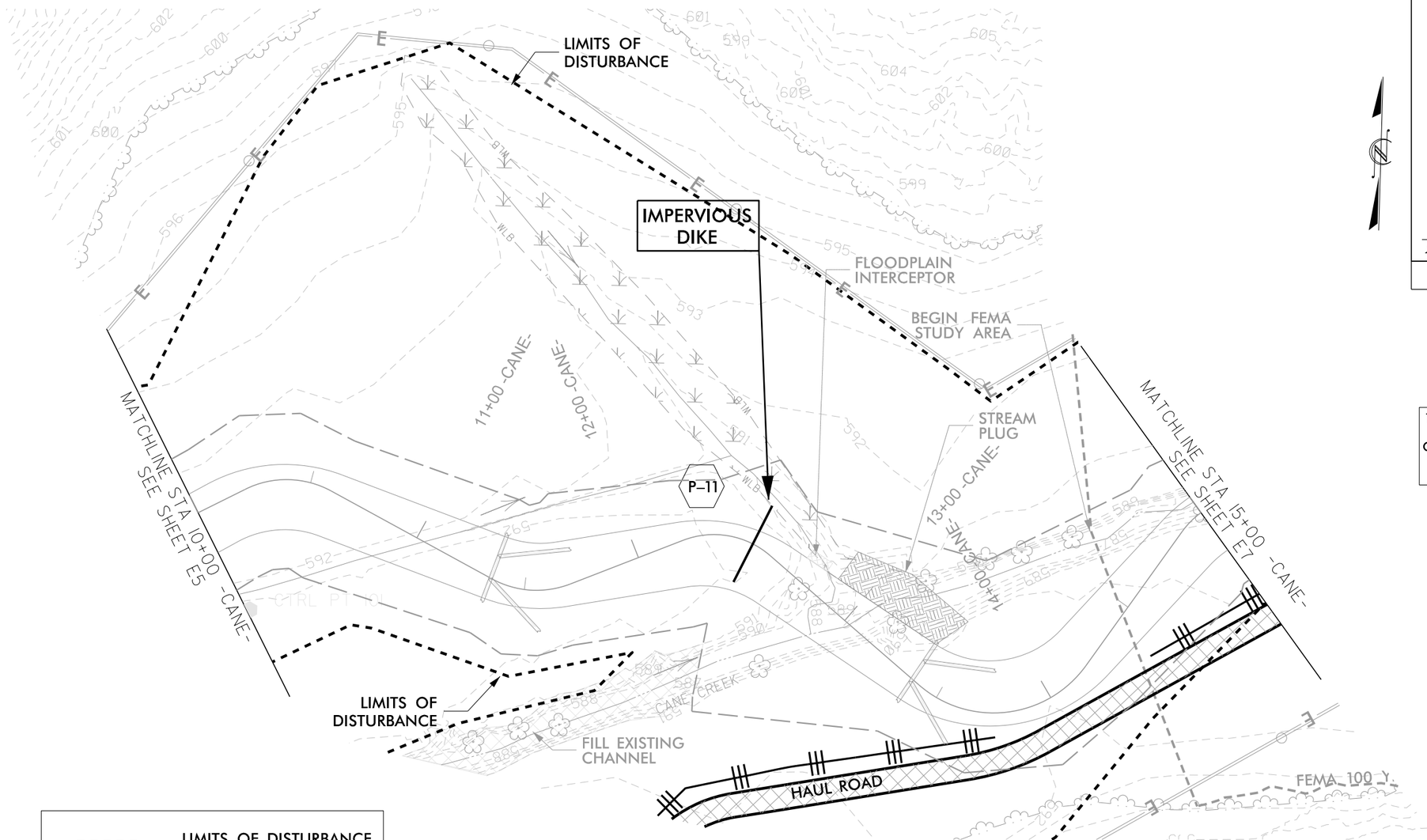

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jharvey

SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	E7
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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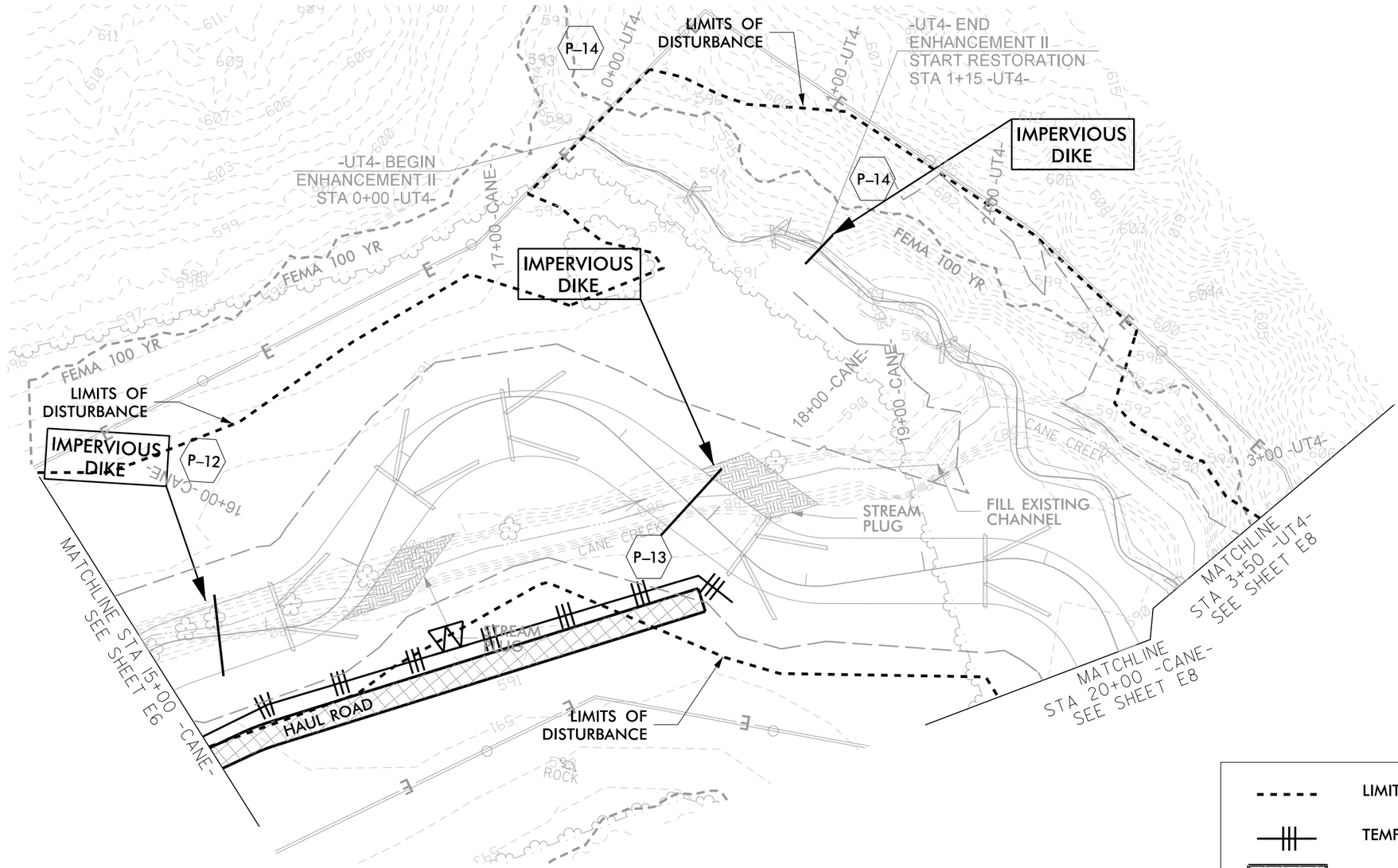

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- LIMITS OF DISTURBANCE
- TEMPORARY SILT FENCE
- HAUL ROAD
- SPECIAL SEDIMENT CONTROL FENCE BREAK

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SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	E8
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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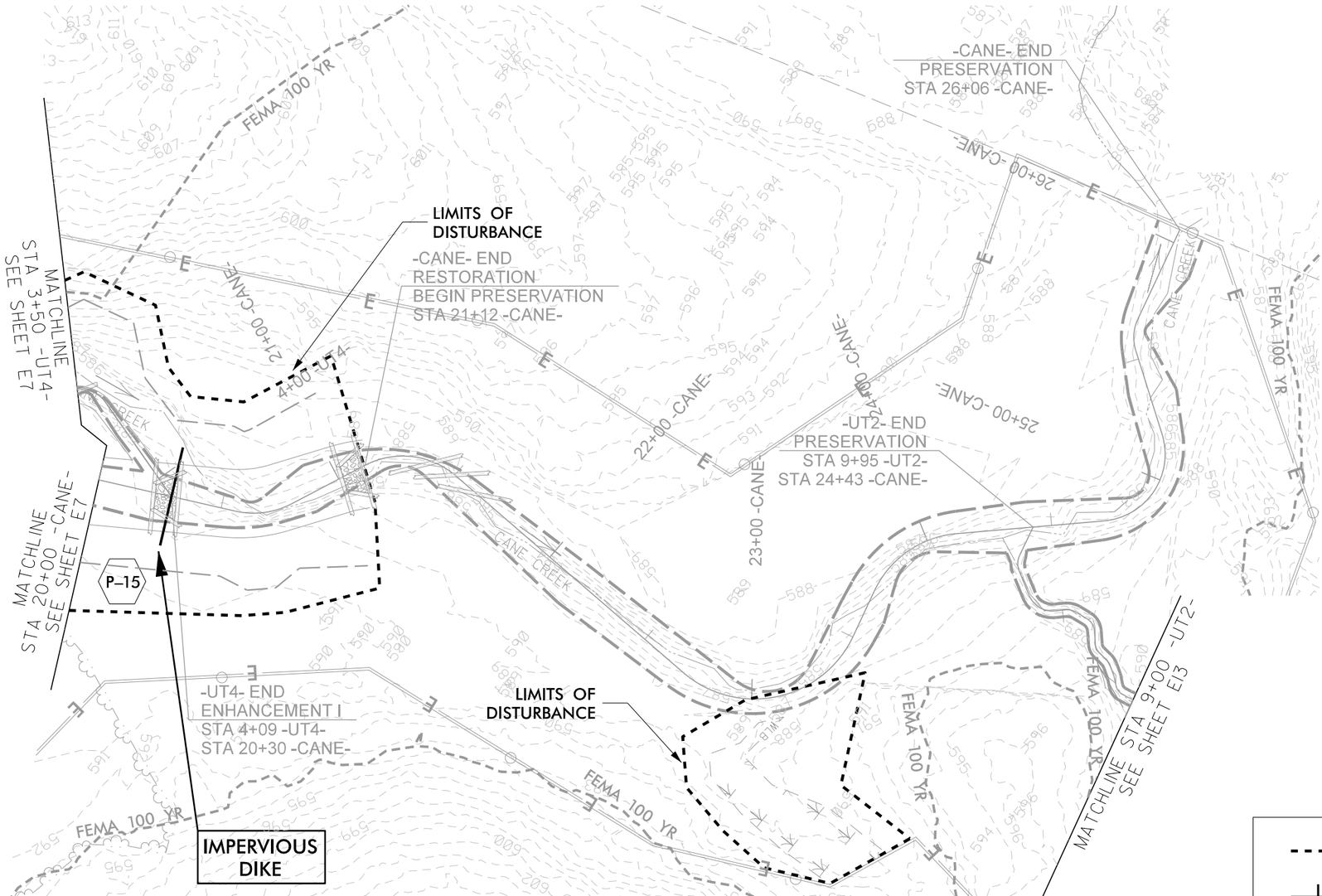

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- HAUL ROAD
- SPECIAL SEDIMENT CONTROL FENCE BREAK

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SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	E9
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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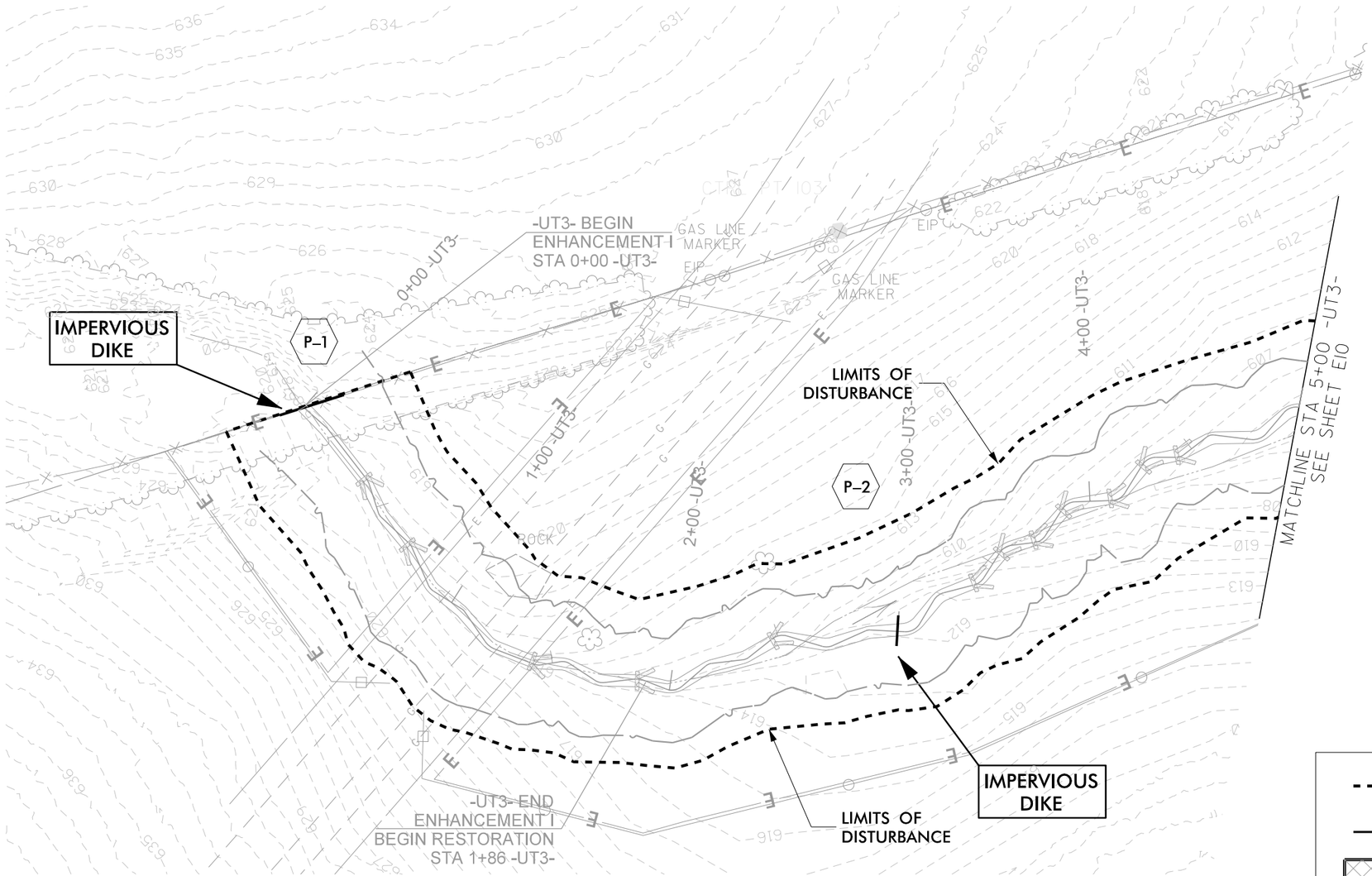

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- TEMPORARY SILT FENCE
- HAUL ROAD
- SPECIAL SEDIMENT CONTROL FENCE BREAK

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SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	EIO
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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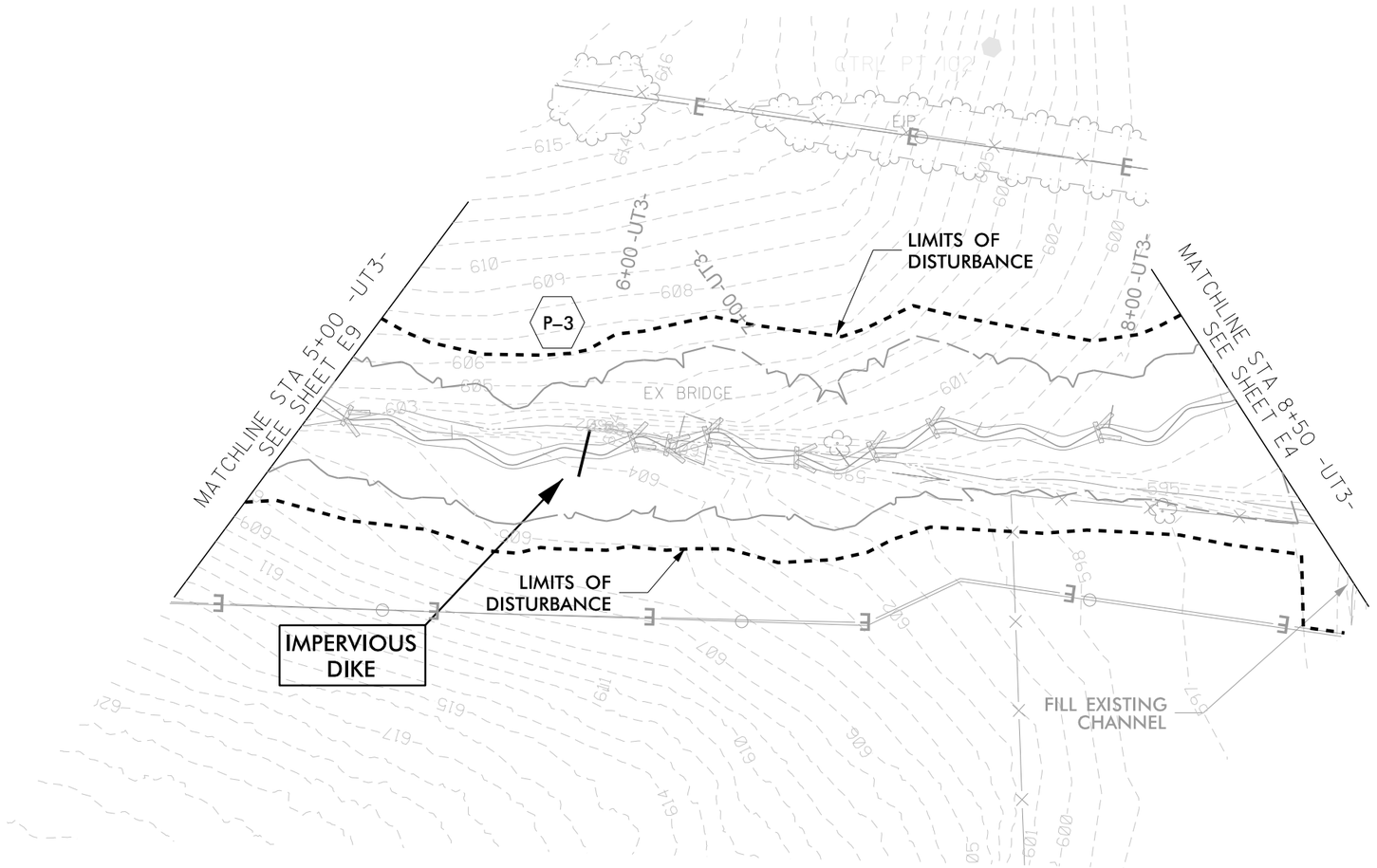
- LIMITS OF DISTURBANCE
- TEMPORARY SILT FENCE
- HAUL ROAD
- SPECIAL SEDIMENT CONTROL FENCE BREAK



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SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	E11
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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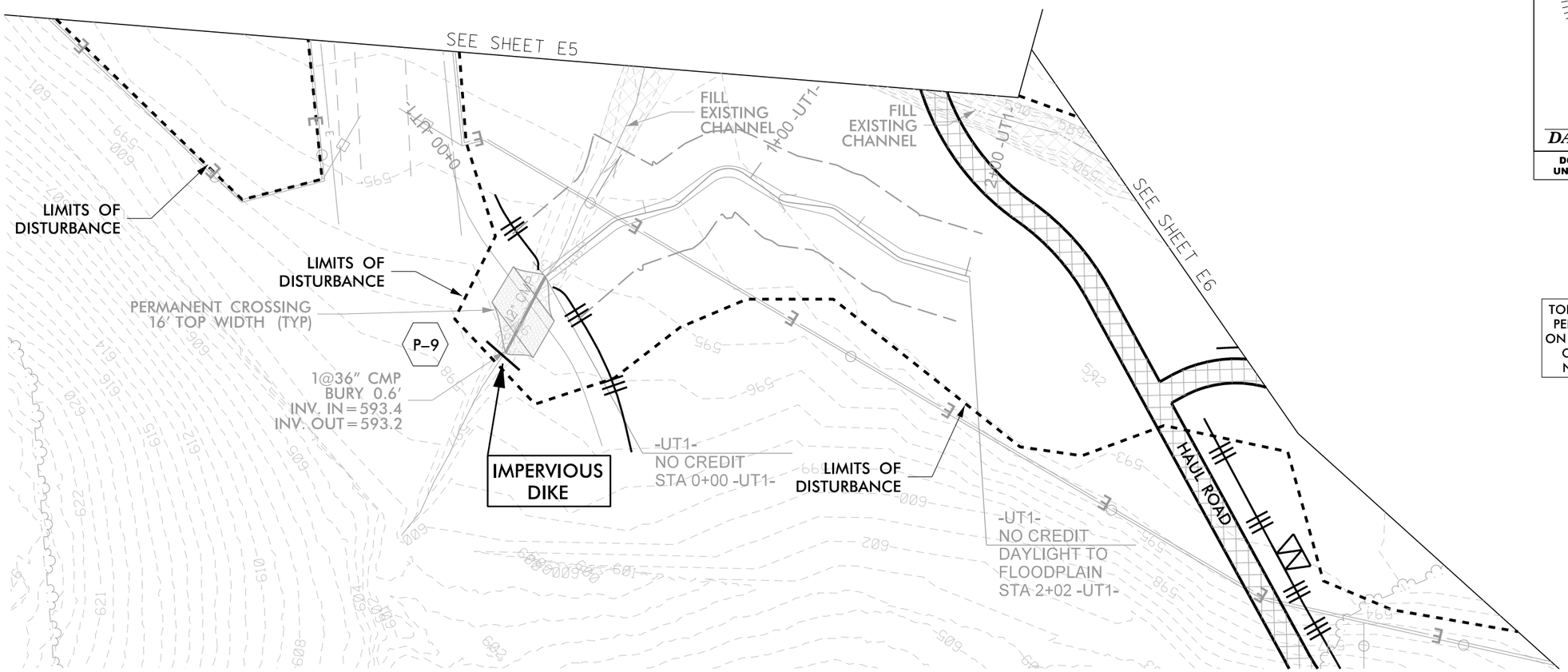
LIMITS OF DISTURBANCE
TEMPORARY SILT FENCE
HAUL ROAD
SPECIAL SEDIMENT CONTROL FENCE BREAK



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harvey

SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	E12
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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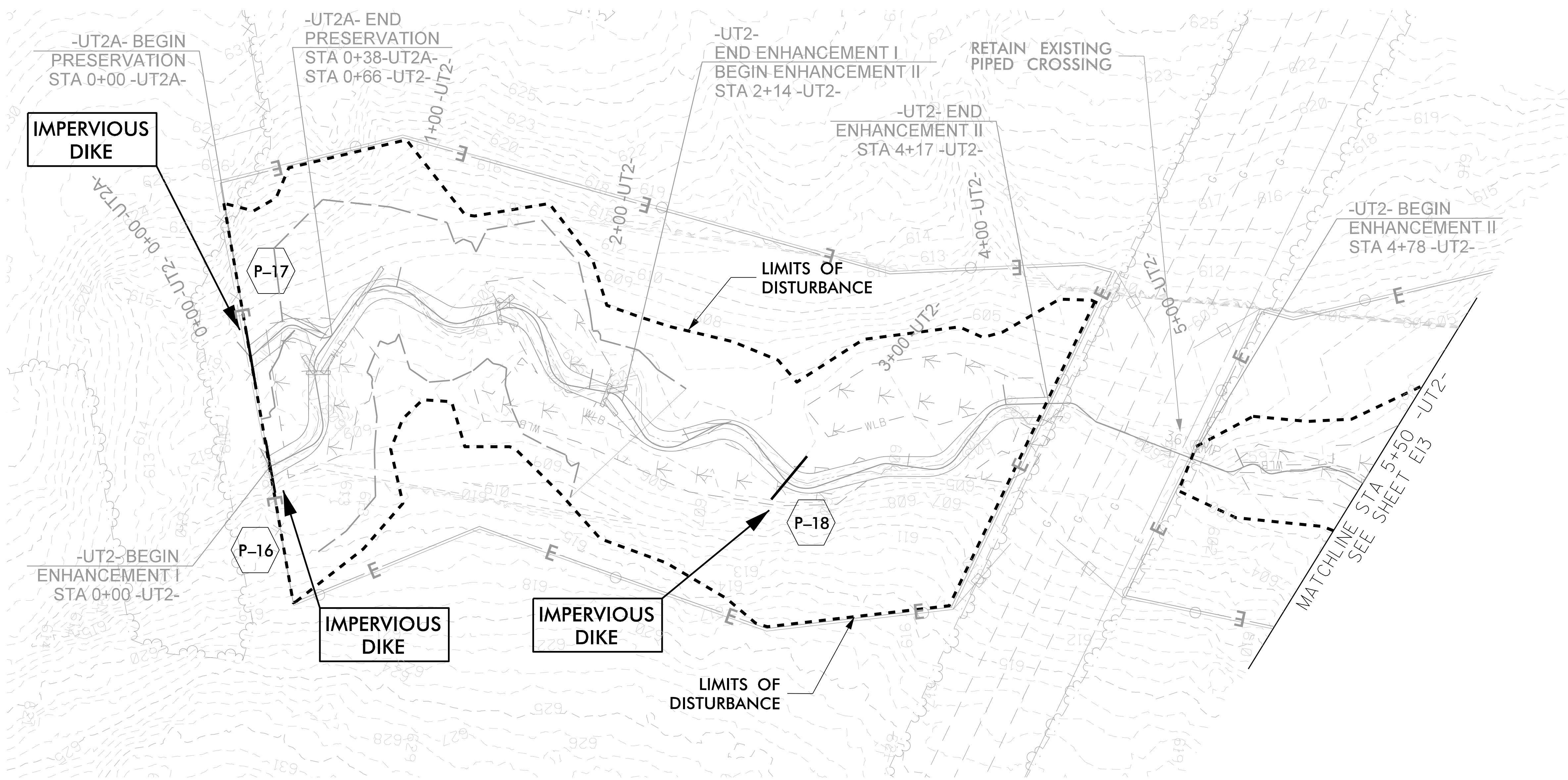
CONTRACTOR MUST CONTACT COLONIAL PIPELINE TO GET THEIR SPECIFICATIONS FOR CONSTRUCTING A PIPELINE CROSSING.

- LIMITS OF DISTURBANCE
- TEMPORARY SILT FENCE
- HAUL ROAD
- SPECIAL SEDIMENT CONTROL FENCE BREAK



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SHEET NAME	SHEET NUMBER
EROSION AND SEDIMENTATION CONTROL	E13
PROJECT NAME: PHANTOM STREAM AND WETLAND RESTORATION SITE	
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TEMPORARY SILT FENCE
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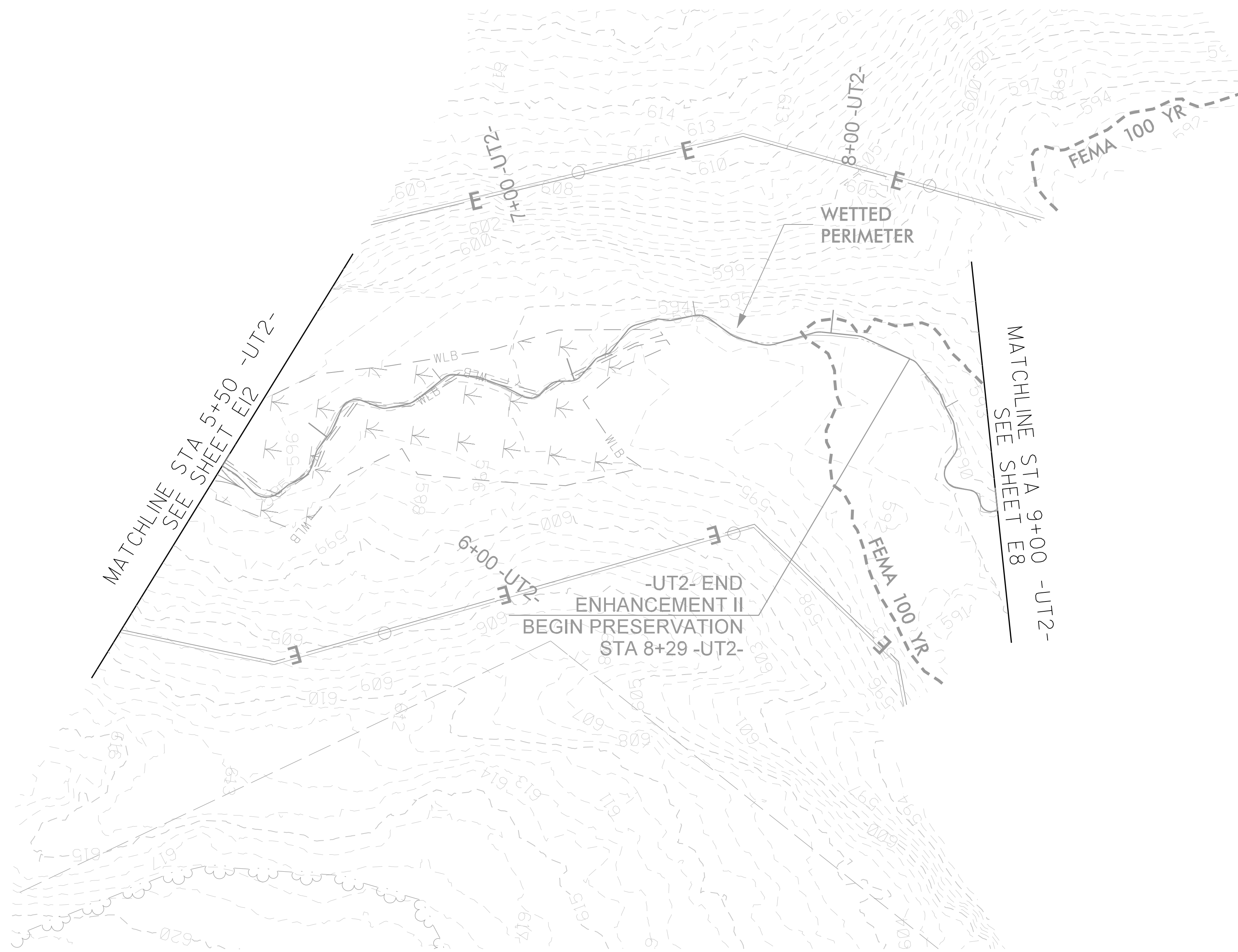

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