

FINAL
MONITORING REPORT
YEAR 2 (2019)
MUD LICK CREEK MITIGATION SITE

Chatham County, North Carolina

NCDMS Project No. 93482

Contract No. 7683

USACE Action ID No. SAW-2014-00736 & DWR Project No 2014-1127

SCO No. 1209857-01

Data Collection: September 2019

Submission: January 2020



PREPARED FOR:

N.C. DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1601 MAIL SERVICE CENTER
RALEIGH, NORTH CAROLINA 27699-1601

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PREPARED BY:
AXIOM ENVIRONMENTAL, INC.
218 SNOW AVENUE
RALEIGH, NORTH CAROLINA 27603

Mitigation Project Name Mud Lick Creek
 DMS ID 93482
 River Basin Cape Fear
 Cataloging Unit 03030003

County Chatham
 Date Project Instituted 2/13/2013
 Date Prepared 6/13/2019

USACE Action ID 2014-00736
 NCDWR Permit No 2014-1127

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Date (Wetland)
Potential Credits (Mitigation Plan)	2,832.333													
Potential Credits (As-Built Survey)	2,832.333													
1 (Site Establishment)	N/A				N/A	N/A	N/A				N/A		N/A	N/A
2 (Year 0 / As-Built)	30%	849.700			2018	11/5/2018	N/A				N/A		N/A	N/A
3 (Year 1 Monitoring)	10%	283.233			2019	4/26/2019	N/A				N/A		N/A	N/A
4 (Year 2 Monitoring)	10%				2020		N/A				N/A		N/A	N/A
5 (Year 3 Monitoring)	10%				2021		N/A				N/A		N/A	N/A
6 (Year 4 Monitoring)	5%				2022		N/A				N/A		N/A	N/A
7 (Year 5 Monitoring)	10%				2023		N/A				N/A		N/A	N/A
8 (Year 6 Monitoring)	5%				2024		N/A				N/A		N/A	N/A
9 (Year 7 Monitoring)	10%				2025		N/A				N/A		N/A	N/A
Stream Bankfull Standard	10%						N/A				N/A			
Total Credits Released to Date		1,132.933												

NOTES:

CONTINGENCIES:


 Signature of Wilmington District Official Approving Credit Release

27 Sept 2019
 Date

- 1 - For NCDMS, no credits are released during the first milestone
- 2 - For NCDMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCDMS Portal, provided the following criteria have been met:
 - 1) Approval of the final Mitigation Plan
 - 2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
 - 3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan
 - 4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required
- 3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met



Axiom Environmental, Inc.

218 Snow Avenue, Raleigh, NC 27603 919-215-1693

January 29, 2020

Mr. Jeremiah Dow
North Carolina Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

RE: Mud Lick Creek Monitoring (DMS Project # 93482, Contract #7683)
Final MY2 (2019) Annual Monitoring Report

Dear Mr. Dow:

Axiom Environmental, Inc. (AXE) is pleased to provide you with one hard copy and a CD of digital files for the Final Mud Lick Creek MY2 (2019) Annual Monitoring Report. We received your comments via email on January 9, 2020 and have addressed them as follows:

1. Section 1.0:

- a. Under the Vegetation heading, please delete the last sentence of paragraph 4 that states “No additional vegetation data was collected during year 2 (2019).” This is somewhat confusing.

This sentence was deleted.

2. Appendix D:

- a. Table 11 – Please verify BF Cross Sectional Areas. All cross sectional areas are identical for MY0 through MY2 for all cross sections which seems highly unlikely, specifically, for example, cross sections 2, 7, 8, & 9.

According to the Industry Technical Work Group memorandum, the bankfull cross-sectional areas are fixed at MY0, and that area is used to calculate bank height ratio for the remainder of the monitoring period. A separate row was added to the summary data on the cross-section plots and tables 11A-11F showing the Low Bank Area for the current monitoring year. Additionally, during a 1/28/20 phone conversation with DMS staff, it was determined that entrenchment ratio will no longer be reported and tied to success criteria, in accordance with the Industry Technical Work Group memorandum. These values were removed from the MY2 data on the cross-section graphs and tables 11A-F, and a footnote was added to explain.

- b. Please add an additional line to riffle cross sections which shows the bankfull line based on MY0 cross sectional area applied to the current year cross section.

The MY0 bankfull line was added to the riffle cross section graphs.

- c. XS-7 has a BHR of 1.1 but the channel appears to be narrowing while maintaining the same depth which, with the new BHR calculation method, would be expected to be a BHR <1.

During MY0, the bankfull maximum depth and low bank height of XS-7 were set to an obvious bankfull shelf on the left bank of the channel. This depth was 1.2 feet. Between MY0 and MY2, the channel narrowed, and that bankfull shelf disappeared, so the new low bank height increased to 1.4 feet. Keeping to the method of using fixed bankfull cross-sectional area, the bankfull depth became 1.3 feet in MY2, giving a bank height ratio of 1.1.

- d. Please include a footnote in either the cross section figures or Table 11 that indicates that bank height ratios (BHR) were calculated using the methods specified in the Industry Technical Work group memorandum.

The following footnote was added to tables 11A, 11C, and 11E: "Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioners in NC (9/2018)."

- e. The cross sections identified on the pebble count charts appear to be incorrect.

The cross-section labels were updated on the pebble count charts.

Please let me know if you have any questions or comments regarding any component of this submittal. Thank you for the opportunity to continue to assist the Division of Mitigation Services with this important project.

Sincerely,
AXIOM ENVIRONMENTAL, INC



Kenan Jernigan

Attachments: 1 hard copy Final MY2 (2019) Mud Lick Creek Annual Monitoring Report
1 CD containing digital support files

PROJECT SUMMARY

The North Carolina Division of Mitigation Services (NCDMS) has established the Mud Lick Creek Mitigation Site (Site) located within the Cape Fear River Basin Cataloging Unit (CU) 03030003 in the Upper Rocky River local watershed planning (LWP) area and 14-digit HUC 03030003070010. The Site was identified as a priority mitigation project in the *Detailed Assessment and Targeting of Management Report* (Tetra Tech 2005). The main stressors to aquatic resources identified during the watershed assessments described in the LWP documents include the following.

- Nutrient (nitrogen and phosphorous) loading from farming;
- Sediment loading from overland runoff, disturbed surfaces, and streambank erosion;
- Cattle access to streams increasing bank erosion and fecal coliform contamination; and
- Insufficient bank vegetation.

The project will contribute to meeting management recommendations to offset these stressors as described above for the LWP area by accomplishing the following primary goals.

- Control and reduce nutrient sources from the Site;
- Reduce sediment loads from disturbed areas on the Site and from eroding stream banks;
- Increased aeration of flows within the project extent promoting increases in dissolved oxygen concentrations;
- Reduce sources of fecal coliform pollution;
- Improve instream habitat;
- Reduce thermal loadings;
- Reconnect channels with floodplains and raise local water table; and
- Restore riparian habitat.

These goals will be accomplished through the following objectives:

- Restore riparian vegetation on the Site and thereby reduce sediment loads to streams from stream banks and existing pastures, increase on-Site retention of sediment and nutrients, create riparian habitat, and provide shade for streams to reduce thermal loadings;
- Stabilize eroding streambanks to reduce sediment inputs;
- Install fencing around the perimeter of the conservation easement to eliminate livestock access to streams, thereby reducing sediment, nutrient, and fecal coliform inputs;
- Plant restored and stabilized streambanks with native species to improve stability and habitat;
- Install instream structures to improve stability, create habitat, and help aerate stream flows;
- Raise streambeds to reconnect restored channels to floodplains and raise local water tables; and
- Restore streams and vegetation so the Site looks natural and aesthetically pleasing.

Stream Success Criteria: The stream restoration performance criteria for the Site will follow approved performance criteria presented in the 2015 *Mud Lick Creek Mitigation Site Final Mitigation Plan* as described below.

Stream Dimension: Riffle cross-sections on the restoration reaches and enhancement II reaches, where banks were re-graded (three reaches of Mud Lick Creek), should be stable and should show little change in bankfull area, maximum depth, and width-to-depth ratio. Bank-height-ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored channels to be considered stable. All riffle cross-sections should fall within the parameters defined for channels of the appropriate stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in

the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability.

Stream Pattern and Profile: The as-built survey will include a longitudinal profile for the baseline monitoring report. Longitudinal profile surveys will not be conducted during the seven-year monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability.

Substrate: Substrate materials in the restoration reaches should indicate a progression towards or the maintenance of coarser materials in the riffle features and smaller particles in the pool features.

Hydraulics: Two bankfull flow events, in separate monitoring years, must be documented on the restoration reaches and enhancement II reaches where banks were re-graded (three reaches of Mud Lick Creek) within the seven-year monitoring period.

Vegetation Success Criteria: The final vegetative success criteria will be the survival of 210 planted stems per acre in the riparian corridor along restored and enhanced reaches at the end of the required monitoring period (year seven). The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of the third monitoring year and at least 260 stems per acre at the end of the fifth year of monitoring. If this performance standard is met by year five and stem density is trending towards success (i.e., no less than 260 stems/acre), monitoring of vegetation on the Site may be terminated with written approval by the USACE in consultation with the NC Interagency Review Team. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period (seven years).

Photo Documentation: Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent bars within the channel or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

Visual Assessments: Visual assessments should support performance standards as described above.

As per Sections 7.2 and 12.4 of the Mitigation Plan, physio-chemical and biological parameters were included as part of specialized monitoring, depending on the data that could be obtained during the baseline period. Monitoring of these parameters was for investigative purposes only and not tied to mitigation success or credit. The sample size and variability of the pre-construction physio-chemical data was inadequate for the purposes of post-construction comparison and therefore, these will not be monitored moving forward. However, fish and macrobenthos will be monitored at the stations indicated in the asset and monitoring features map (Figure 2, Appendix B).

Site Background: The Site is located in northwestern Chatham County, north of Siler City and northwest of Silk Hope (Figure 1, Appendix B). The Site is located within United States Geological Survey (USGS) Hydrologic Unit and Targeted Local Watershed 03030003070010 (North Carolina Division of Water Resources Subbasin 03-06-12) of the Cape Fear River Basin. Prior to construction, the Site was used for agricultural livestock production. The proposed project will improve water quality as well as provide numerous ecological benefits within the Cape Fear River Basin. The project will help meet management recommendations of the *Upper Rocky River Local Watershed Plan* by restoring a vegetated riparian buffer zone, stabilizing eroding stream banks, and removing livestock from streams and riparian zones. These activities will result in reduced nutrient, sediment, and fecal coliform inputs; improved aquatic and riparian habitat, and other ecological benefits.

Mitigation Components: Project mitigation efforts will generate 2832 Stream Mitigation Units (SMUs) as the result of the following (Table 1, Appendix A & Figure 2, Appendix B).

- Restoration of 1215 linear feet of Site streams
- Enhancement (Level II) of 2426 linear feet of Site streams

Site design was completed in June 2015. Site construction occurred May 24–August 25, 2017 (final walkthrough) and the Site was planted in February 2018. Completed project activities, reporting history, completion dates, project contacts, and project attributes are summarized in Tables 1-4 (Appendix A). The assets and credits in the report and shown in Table 1 are based upon approved as-built numbers as approved by the IRT on 11/1/2018.

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1.0 METHODS

Monitoring of restoration efforts will be performed for seven years, or until success criteria are fulfilled. Monitoring is proposed for the stream channel and vegetation. In general, the restoration success criteria, and required remediation actions, are based on the *Stream Mitigation Guidelines* (USACE et al. 2003). Monitoring features are summarized in the following table and described below; monitoring features are depicted on Figure 2 (Appendix B).

Monitoring Summary

Parameter	Monitoring Feature	Quantity	Frequency
Streams			
Dimension	Cross-sections	7 riffles & 3 pools	annually
Substrate	Pebble counts	3 riffles	annually
Hydrology	Crest gauges	3	annually
Vegetation	Vegetation Plots	12	annually
	Warranty Plots	10	MY1
Visual assessments		Entire Site	biannually
Exotic & nuisance species		Entire Site	annually
Project boundary		Entire Site	annually
Reference photographs		22	annually
Supplemental Monitoring			
Biological	Macrobenthos	5 sites (Preconstruction only) 3 sites (MY3, MY5, & MY7)	
	Fish	3 sites (Preconstruction only) 2 sites (MY4 & MY7)	

Streams

The restored stream reaches are proposed to be monitored for geometric activity as follows.

- 7 permanent riffle cross-sections
- 3 permanent pool cross-sections
- 3 riffle pebble count samples for substrate analysis
- 3 stream crest gauges

The data will be presented in graphic and tabular format. Data to be presented will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, and 5) width-to-depth ratio. Substrate analysis will be evaluated through pebble counts at three riffle cross-sections and data presented as a D50 for stream classification and tracking purposes. The stream will subsequently be classified according to stream geometry and substrate (Rosgen 1996). Significant changes in channel morphology including bank-height-ratios and entrenchment ratios will be tracked and reported by comparing data to asbuilt measurements in addition to each successive monitoring year. Annual photographs will include 22 fixed station photographs (12 vegetation plots and 10 cross-sections) (Appendix B). In addition, the Site contains three stream crest gauges to assist with documentation of bankfull events. Two bankfull events were documented during monitoring year 2 (2019), making a total of 3 bankfull events over the monitoring period to date (Table 12, Appendix E).

Three stream areas of concern were observed during monitoring year 2 (2019). Stream Area of Concern #1 was previously documented during year 1 (2018) along Mud Lick Creek R2 where approximately 50

feet of the right bank and 20 feet of the left bank had eroded to the point of bank sloughing. This area remains unchanged from year 1 (2018). Two additional areas of instability were documented during a site visit early in year 2 (2019). Area of Concern #2 was confined to approximately ten feet of an outer bend in the lower portion of Mud Lick Creek R1 that has sloughed, this area remains relatively unchanged from the previous site visit. Area of Concern #3 consists of scour and sloughing along an outer bend immediately downstream of cross-section 1. These areas of instability can be attributed to the impacts from storm events during the fall of 2018 (year 1). Stream areas of concern were only observed within enhancement II stream reaches; stream reaches generating restoration credit were stable throughout and functioning as designed. These areas are depicted on Figure 2 in Appendix B.

Vegetation

Restoration monitoring procedures for vegetation will monitor plant survival and species diversity. Planting occurred within the entire Site. After planting of the area was completed, 12 vegetation plots were installed and monitored at the Site; annual results can be found in Appendix C. Annual measurements of vegetation will consist of the following.

- 10 plant warranty inspection plots (only MY1)
- 12 CVS vegetation plots

A photographic record of plant growth should be included in each annual monitoring report; baseline photographs are included in Appendix B. During the first year, vegetation will receive a cursory, visual evaluation on a periodic basis to ascertain the degree of overtopping of planted elements by nuisance species. Subsequently, quantitative sampling of vegetation will be performed as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) in late fall/early winter of the first monitoring year and annually toward the end of the growing for the remainder of the monitoring period until vegetation success criteria are achieved.

Locations of exotic and nuisance vegetation will be documented and depicted on Figure 2 (Appendix B).

Measurements of temporary warranty plots and permanent CVS plots in Year 1 (2018) resulted in a total of 210 living planted stems in 22 plots (392 planted living stems per acre). Therefore, DMS sent a letter to the planting contractor invoking the warranty on survivability of planted stems. Approximately 700 bare roots were planted in five targeted areas within the site during January 2019. A map of these area as well as a plant list are provided in Appendix F.

Year 2 (2019) stem count measurements for 12 permanent CVS plots indicate the planted stem density across the Site is 340 planted stems per acre. Ten individual CVS plots met success criteria based on planted stems alone (Table 8, Appendix C). Several areas remain below success criteria primarily due to herbaceous competition. Additionally, several populations of dense Chinese pivet (*Ligustrum sinense*) and tree of heaven (*Ailanthus altissima*) were observed scattered throughout the Site. These are depicted on Figure 2 (Appendix B).

Project Boundaries & Visual Assessments

Locations of any fence damage, vegetation damage, boundary encroachments, etc. will be documented and included on mapping.

Visual assessments will be performed along all streams on a bi-annual basis during the seven-year monitoring period. Problem areas will be noted such as channel instability (i.e. lateral and/or vertical instability, in-stream structure failure/instability and/or piping, headcuts), vegetated buffer health (i.e. low

stem density, vegetation mortality, invasive species or encroachment), beaver activity, or livestock access. Areas of concern will be mapped and photographed accompanied by a written description in the annual report. Problem areas will be re-evaluated during each subsequent visual assessment.

Supplementary Monitoring

Supplemental monitoring will include biological monitoring in the Spring as follows.

- 3 benthos sampling sites (MY3, MY5, & MY7)
- 2 fish sampling sites (MY4 & MY7)

These parameters are being monitored for analytical purposes and are not tied to mitigation success and associated credit releases. The primary criteria for indication of improvement for the benthos and fish will be an increase of at least one bioclassification between the pre-con assessment and the post-con monitoring. Richness and EPT metrics will be analyzed as well.

2.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

North Carolina Division of Mitigation Services (NCDMS) 2015. Mud Lick Creek Mitigation Site Final Mitigation Plan.

Rosgen D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

Tetra Tech, 2005. Upper Rocky River Local Watershed Plan Preliminary Findings Report. Prepared for the North Carolina Ecosystem Enhancement Program.

United States Army Corps of Engineers (USACE), United States Environmental Protection Agency (USEPA), North Carolina Wildlife Resources Commission (NCWRC), Natural Resources Conservation Service (NRCS), and North Carolina Division of Water Quality (NCDWQ). 2003. Stream Mitigation Guidelines. State of North Carolina.

Appendix A.
Background Tables

- Table 1. Project Mitigation Components
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Attributes Table

Table 1. Mud Lick Creek (ID-93482) - Mitigation Assets and Components**

Project Component (reach ID, etc.)	Wetland Position and HydroType	Existing Footage	Stationing	Mitigation Plan Footage	As-Built Footage *	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
North Branch R1		318	100+10 - 103+28	327	318	EII	-	1.5	212.000	Planting, fencing
North Branch R2		522	103+28 - 108+66	520	538	R	PI	1	538.000	
North Branch R3		351	108+66 - 111+51	303	265	R	P2	1	265.000	20 LF of restoration was removed from North Branch Reach 2 in order to account for an easement break
East Branch R1		165	200+05 - 201+69	168	164	EII	-	1.5	109.333	Planting, fencing
East Branch R2		315	201+69 - 205+81	409	412	R	P2	1	412.000	
Mud Lick Creek R1		525	300+72 - 306+23	623	551	EII	-	1.5	367.333	Planting, fencing, bank repairs
Mud Lick Creek R2		718	306+23 - 313+14	693	660	EII	-	1.5	440.000	Planting, fencing, bank repairs; 31 LF of enhancement II was removed from Mud Lick Creek Reach 2 in order to account for an easement break
Mud Lick Creek R3		733	313+14 - 320+47	748	733	EII	-	1.5	488.667	Planting, fencing, bank repairs

*Reach start and end stationing may differ slightly from the mitigation plan due to removal of stream lengths that are outside the conservation easement. The upstream ends of Mud Lick Creek, North Branch, and East Branch experienced footage reductions of 72', 10', and 5' respectively, while the downstream end of Mud Lick Creek experienced a footage reduction of 17'.

**The assets and credits in the report and shown in Table 1 are based upon approved as-built numbers as approved by the IRT on 11/1/2018

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)
		Riverine	Non-Riverine	
Restoration	1215			
Enhancement				
Enhancement I				
Enhancement II	2426			
Creation				
Preservation				
High Quality Pres				

Overall Assets Summary

Asset Category	Overall Credits
Stream	2,832.333

**Table 2. Project Activity and Reporting History
Mud Lick Creek (ID-93482)**

Elapsed Time Since Grading Complete: 2 years 2 months

Elapsed Time Since Planting Complete: 1 year 8 months

Number of Reporting Years: 2

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Project Institution	--	February 13, 2013
Mitigation Plan	--	December 2015
404 Permit Date	--	March 25, 2016
Final Design – Construction Plans	--	June 2015
Construction	--	August 25, 2017
Bare Root; Containerized; and B&B Plantings for the Entire Project Site	February 2018	February 2018
Baseline Monitoring Document (Year 0 Monitoring Baseline)	July 2018	September 2018
Monitoring Year 1 (2018) Document	December 2018	December 2018
Monitoring Year 2 (2019) Document	September 2019	January 2020

Table 3. Project Contact Table

Mud Lick Creek (ID-93482)

Designer	Wildlands Engineering, Inc. (License No. F-0831) 312 West Millbrook Rd, Suite 225 Raleigh, NC 27609 Angela N. Allen, PE (919) 851-9986
Construction Plans and Sediment and Erosion Control Plans	Wildlands Engineering, Inc. (License No. F-0831) 312 West Millbrook Rd, Suite 225 Raleigh, NC 27609 Angela N. Allen, PE (919) 851-9986
Construction Contractor	North State Environmental, Inc. 2889 Lowery Street Winston Salem, NC 27101 Michael Anderson (336) 725-2010
Planting Contractor	North State Environmental, Inc. 2889 Lowery Street Winston Salem, NC 27101 Stephen Joyce (336) 725-2010
As-built Surveyors	Allied Associates, PA 4720 Kester Mill Road Winston Salem, NC 27103 David Alley (336) 765-2377
Baseline Data Collection	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis (919) 215-1693

Table 4. Project Baseline Information and Attributes**Mud Lick Creek (ID-93482)**

Project Information						
Project name	Mud Lick Creek Mitigation Site					
Project county	Chatham County, North Carolina					
Project area (Acres)	11.2					
Project coordinates (lat/long)	35.8128°N, 79.4350°W					
Planted Acres	9.6					
Project Watershed Summary Information						
Physiographic region	Carolina Slate Belt of the Piedmont Physiographic Province					
Project river basin	Cape Fear River Basin					
USGS hydrologic unit (8 digit/14-digit)	03030003/03030003070010					
NCDWR Sub-basin	03-06-12					
Project drainage area (mi ²)	3.64					
% Drainage area impervious	< 1%					
CGIA land use classification	Developed, Forested/Scrubland, Agriculture/Managed Herb., Open Water					
Reach Summary Information						
Parameters	Mud Lick Creek – R1	Mud Lick Creek – R2	Mud Lick Creek – R3	North Branch – R1	North Branch – R2	East Branch
Restored length (linear feet)	551	660	733	856	265	576
Valley confinement	Slightly confined - unconfined					
Drainage area (acres/mi ²)	1747/2.73	2170/3.39	2330/3.64	236.8/0.37	416/0.65	172.8/0.27
Perennial (P), Intermittent (I)	P	P	P	P	P	P
NCDWR water quality classification	WS-III, CA					
Stream Classification (existing)	E4	C4	E4	E4	B4c	B4c
Stream Classification (proposed)	E4	C4	E4	C4	C4	C4
Evolutionary trend (Simon & Hupp)	IV/V	IV/V	IV/V	IV	IV	IV
FEMA classification	AE	AE	AE	AE	AE	AE
Regulatory Considerations						
Regulation	Applicable?	Resolved?		Supporting Documentation		
Waters of the US – Section 404	Yes	Yes		SAW-2014-00736		
Waters of the US – Section 401	Yes	Yes		SAW-2014-00736		
Endangered Species Act	Yes	Yes		No Effect – CE Document		
Historic Preservation Act	No	NA		CE Document		
Coastal Zone Management Act (CZMA/CAMA)	No	NA		NA		
FEMA Floodplain Compliance	Yes	Yes		Chatham County Floodplain Development Permit #14-001		
Essential Fisheries Habitat	No	NA		NA		

Appendix B
Visual Assessment Data

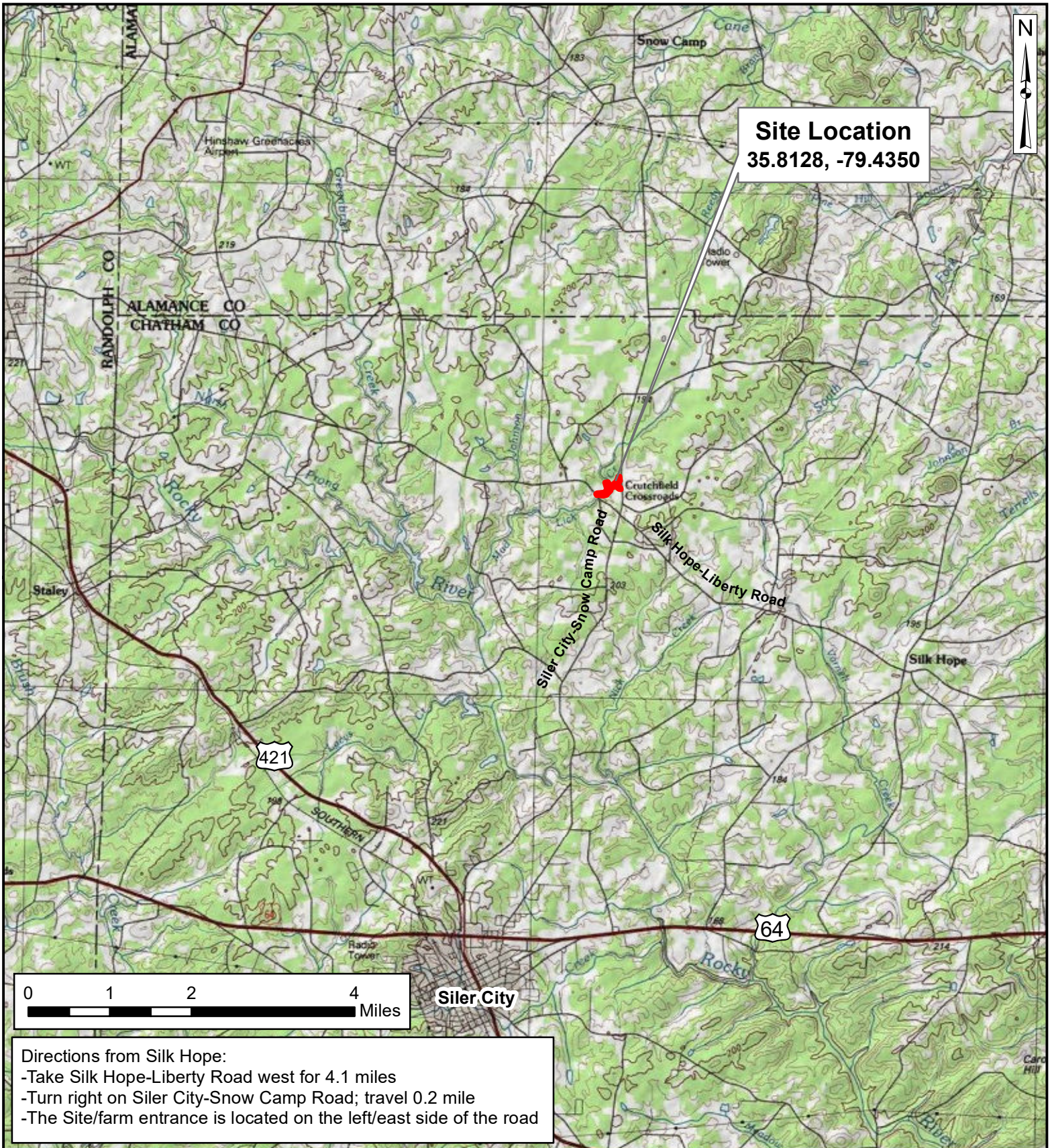
Figure 1. Site Location

Figure 2. Current Conditions Plan View

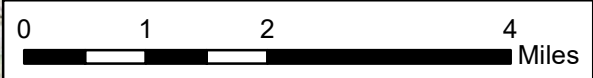
Tables 5A-5C. Visual Stream Morphology Stability Assessment

Table 6. Vegetation Condition Assessment

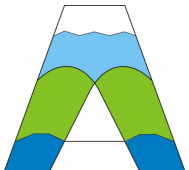
Vegetation Plot Photographs



Site Location
35.8128, -79.4350



Directions from Silk Hope:
 -Take Silk Hope-Liberty Road west for 4.1 miles
 -Turn right on Siler City-Snow Camp Road; travel 0.2 mile
 -The Site/farm entrance is located on the left/east side of the road



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

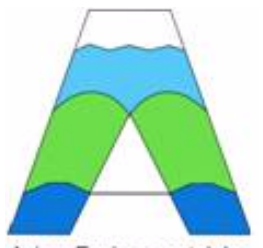
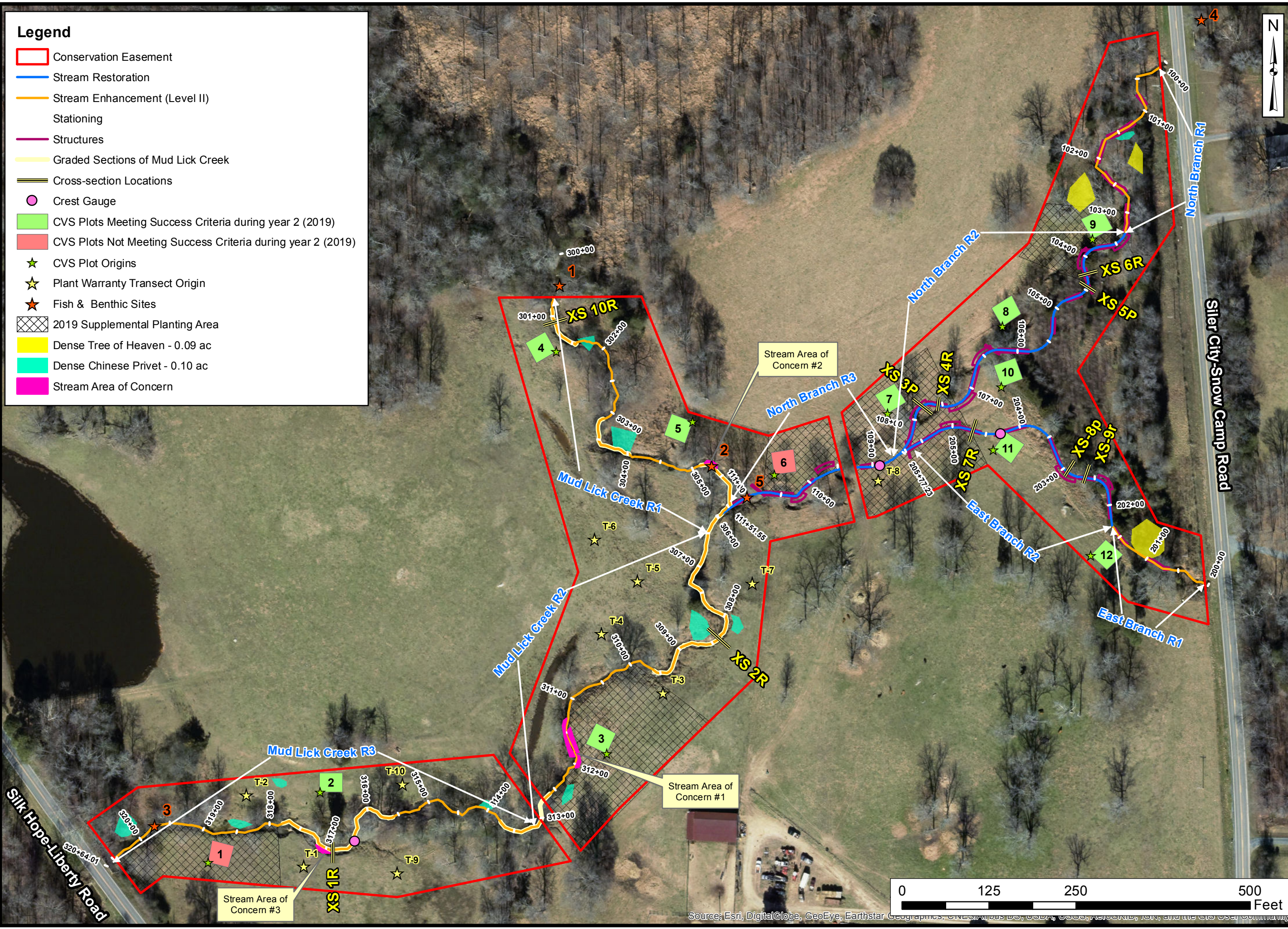
Axiom Environmental, Inc.

SITE LOCATION
MUD LICK CREEK MITIGATION SITE
DMS PROJECT NUMBER 93482
Chatham County, North Carolina

Dwn. by:	CLF	FIGURE 1
Date:	July 2018	
Project:	12-004.22	

Legend

- Conservation Easement
- Stream Restoration
- Stream Enhancement (Level II)
- Stationing
- Structures
- Graded Sections of Mud Lick Creek
- Cross-section Locations
- Crest Gauge
- CVS Plots Meeting Success Criteria during year 2 (2019)
- CVS Plots Not Meeting Success Criteria during year 2 (2019)
- ★ CVS Plot Origins
- ★ Plant Warranty Transect Origin
- ★ Fish & Benthic Sites
- 2019 Supplemental Planting Area
- Dense Tree of Heaven - 0.09 ac
- Dense Chinese Privet - 0.10 ac
- Stream Area of Concern



Axiom Environmental, Inc.

Prepared for:
 North Carolina
 Department of
 Environmental
 Quality
 Division of
 Mitigation Services

Project:
MUD LICK CREEK MITIGATION SITE
 DMS Project
 Number 93482
 Chatham County, NC

Title:
CURRENT CONDITIONS PLAN VIEW

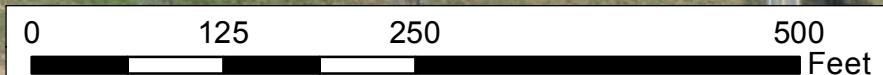
Drawn by:
 PHP, CLF

Date:
 Oct 2019

Scale:
 1:1,500

Project No.:
 12-004.22

FIGURE
2



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Table 5A
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 North Branch R-2
 538

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
Totals					0	0	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	8	8			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	8	8			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	8	8			100%			

Table 5B
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 North Branch R-3
 265

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
Totals					0	0	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	3	3			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	3			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	3	3			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	3	3			100%			

Table 5C
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 East Branch R-2
 412

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
Totals					0	0	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	5	5			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	5	5			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	5	5			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	5	5			100%			

Table 6 Vegetation Condition Assessment

Planted Acreage

9.6

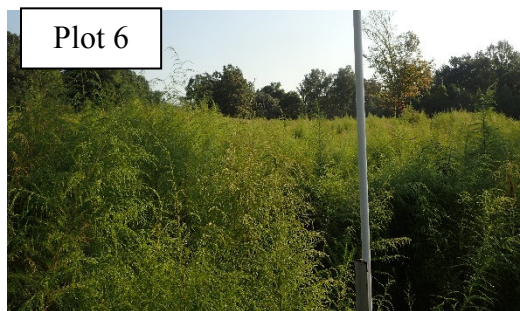
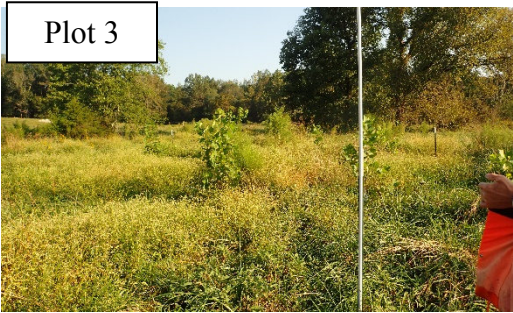
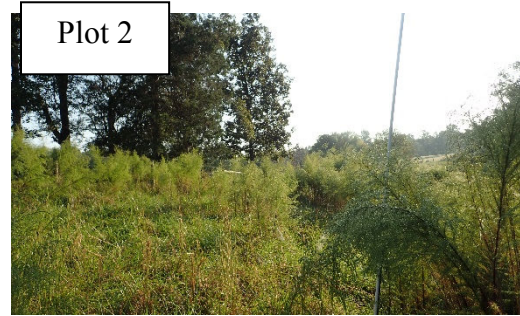
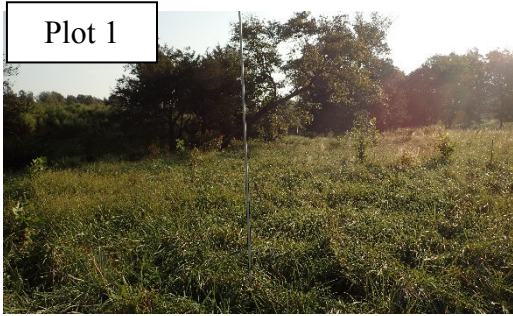
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	None	0.1 acres	None	0	0.00	0.0%
2. Low Stem Density Areas	None	0.1 acres	None	0	0.00	0.0%
Total				0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	None	0.25 acres	None	0	0.00	0.0%
Cumulative Total				0	0.00	0.0%

Easement Acreage

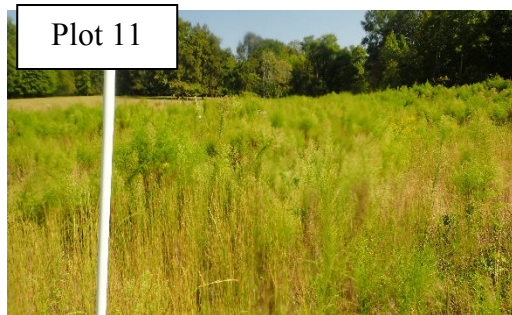
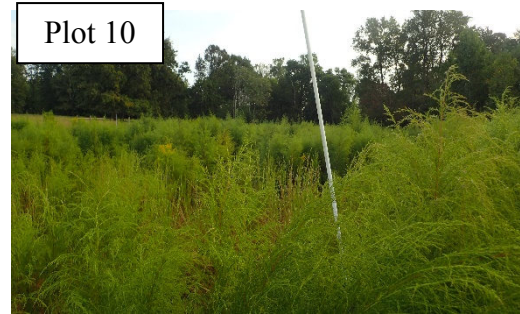
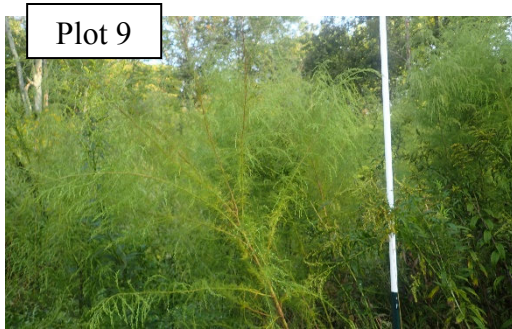
11.2

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Several small areas of dense Chinese privet and dense tree of heaven	200 SF	green and yellow polygons	12	0.19	1.7%
5. Easement Encroachment Areas	None	none	None	0	0.00	0.0%

**Mud Lick Creek Stream Restoration Site
MY-02 Vegetation Monitoring Photographs
Taken September 2019**



**Mud Lick Creek Stream Restoration Site
MY-02 Vegetation Monitoring Photographs
Taken September 2019**



Appendix C.
Vegetation Plot Data

Table 7. Planted Woody Vegetation
Table 8. Total and Planted Stems by Plot and Species

**Table 7. Planted Woody Vegetation
Mud Lick Creek Restoration Project (#93482)**

Species	Quantity
Green Ash (<i>Fraxinus pennsylvanica</i>)	300
Sycamore (<i>Platanus occidentalis</i>)	400
Eastern Redbud (<i>Cercis canadensis</i>)	400
Cottonwood (<i>Populus deltoides</i>)	300
River birch (<i>Betula nigra</i>)	300
Hackberry (<i>Celtis occidentalis</i>)	300
Black Gum (<i>Nyssa sylvatica</i>)	300
American Elm (<i>Ulmus americana</i>)	300
Eastern Hophornbeam (<i>Ostrya virginica</i>)	300
Elderberry (<i>Sambucus spp.</i>)	300
Black Locust (<i>Robinia psuedoaccia</i>)	300
Silky Dogwood (<i>Cornus ammomum</i>)	300
Witch Hazel (<i>Hamamelis virginica</i>)	550
Buttonbush (<i>Cephalanthus occidentalis</i>)	300
Persimmon (<i>Diospyros virginiana</i>)	300
Ironwood (<i>Carpinus caroliniana</i>)	400
Swamp Tupelo (<i>Nyssa biflora</i>)	100
Swamp Chestnut oak (<i>Quercus michauxii</i>)	100
Water oak (<i>Quercus nigra</i>)	100
Tulip Poplar (<i>Liridendron tulipifera</i>)	300
TOTAL	5950

Table 8. Total and Planted Stems by Plot and Species
 EEP Project Code 93482. Project Name: Mud Lick Creek

		Current Plot Data (MY2 2019)																											
Scientific Name	Common Name	Species Type	93482-01-0001			93482-01-0002			93482-01-0003			93482-01-0004			93482-01-0005			93482-01-0006			93482-01-0007			93482-01-0008			93482-01-0009		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree																											
Acer rubrum	red maple	Tree																											
Alnus	alder	Shrub																											
Baccharis halimifolia	eastern baccharis	Shrub																											
Betula nigra	river birch	Tree																											
Carpinus caroliniana	American hornbeam	Tree	1	1	1																								
Carya	hickory	Tree																											
Celtis laevigata	sugarberry	Tree	1	1	1	1	1	1																					
Celtis occidentalis	common hackberry	Tree																											
Cephalanthus occidentalis	common buttonbush	Shrub																											
Cercis canadensis	eastern redbud	Tree	1	1	1																								
Cornus amomum	silky dogwood	Shrub				1	1	1																					
Diospyros virginiana	common persimmon	Tree																											
Fraxinus pennsylvanica	green ash	Tree	1	1	1	1	1	1																					
Juglans nigra	black walnut	Tree																											
Liquidambar styraciflua	sweetgum	Tree																											
Liriodendron tulipifera	tuliptree	Tree	2	2	2																								
Nyssa	tupelo	Tree																											
Nyssa biflora	swamp tupelo	Tree				2	2	2	1	1	1	1	1	1															
Ostrya virginiana	hophornbeam	Tree																											
Platanus occidentalis	American sycamore	Tree	1	1	1																								
Populus deltoides	eastern cottonwood	Tree																											
Quercus	oak	Tree																											
Quercus michauxii	swamp chestnut oak	Tree																											
Quercus nigra	water oak	Tree																											
Robinia pseudoacacia	black locust	Tree																											
Ulmus americana	American elm	Tree				3	3	3	2	2	2																		
Ulmus rubra	slippery elm	Tree				1	1	1																					
Unknown		Shrub or Tree																											
Stem count			7	7	7	9	9	9	8	8	9	10	10	10	8	8	10	6	6	16	8	8	11	9	9	30	10	10	36
size (ares)			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			6	6	6	6	6	6	4	4	5	8	8	8	2	2	3	5	5	7	4	4	5	5	5	8	6	6	7
Stems per ACRE			283.3	283.3	283.3	364.2	364.2	364.2	323.7	323.7	364.2	404.7	404.7	404.7	323.7	323.7	404.7	242.8	242.8	647.5	323.7	323.7	445.2	364.2	364.2	1214	404.7	404.7	1457

Color for Density
 Exceeds requirements by 10%
 Exceeds requirements, but by less than 10%
 Fails to meet requirements, by less than 10%
 Fails to meet requirements by more than 10%

PnoLS = Planted excluding livestakes
 P-all = Planting including livestakes
 T = All planted and natural recruits including livestakes
 T includes natural recruits

Table 8. Total and Planted Stems by Plot and Species (continued)
 EEP Project Code 93482. Project Name: Mud Lick Creek

Scientific Name	Common Name	Species Type	Current Plot Data (MY2 2019)									Annual Means								
			93482-01-0010			93482-01-0011			93482-01-0012			MY2 (2019)			MY1 (2018)			MY0 (2018)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree											4	1	1	3	1	1	10	
Acer rubrum	red maple	Tree														2			10	
Alnus	alder	Shrub																	3	
Baccharis halimifolia	eastern baccharis	Shrub					1						2							
Betula nigra	river birch	Tree								8	8	8	6	6	6	4	4	4		
Carpinus caroliniana	American hornbeam	Tree				1	1	1	2	2	2	11	11	11	12	12	12	15	15	15
Carya	hickory	Tree																	1	
Celtis laevigata	sugarberry	Tree								2	2	2	2	2	2	1	1	1		
Celtis occidentalis	common hackberry	Tree	2	2	2	1	1	1				3	3	3	3	3	3	3	3	
Cephalanthus occidentalis	common buttonbush	Shrub										3	3	3	3	3	3	4	4	4
Cercis canadensis	eastern redbud	Tree										3	3	3	8	8	8	6	6	6
Cornus amomum	silky dogwood	Shrub				1	1	1	2	2	2	9	9	9	9	9	9	8	8	8
Diospyros virginiana	common persimmon	Tree	2	2	2	1	1	1	1	1	1	5	5	5	4	4	4	5	5	5
Fraxinus pennsylvanica	green ash	Tree							1	1	1	11	11	11	14	14	15	12	12	13
Juglans nigra	black walnut	Tree									2					1			5	
Liquidambar styraciflua	sweetgum	Tree			20			13			12			98		19			10	
Liriodendron tulipifera	tuliptree	Tree										4	4	7						
Nyssa	tupelo	Tree	1	1	1	1	1	1				2	2	2						
Nyssa biflora	swamp tupelo	Tree				1	1	1				5	5	5	6	6	6	6	6	6
Ostrya virginiana	hophornbeam	Tree										2	2	2	1	1	1	1	1	1
Platanus occidentalis	American sycamore	Tree	1	1	3							11	11	13	7	7	7	7	7	7
Populus deltoides	eastern cottonwood	Tree				1	1	1	1	1	1	3	3	3	4	4	4	3	3	3
Quercus	oak	Tree				1	1	1				1	1	1						
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	1	1	1	1	1	1	6	6	6	6	6	6	7	7	7
Quercus nigra	water oak	Tree	1	1	1							2	2	2	3	3	3	3	3	3
Robinia pseudoacacia	black locust	Tree				1	1	1				1	1	1	1	1	1	1	1	1
Ulmus americana	American elm	Tree										5	5	5	4	4	5			
Ulmus rubra	slippery elm	Tree										2	2	2						
Unknown		Shrub or Tree										2	2	2	3	3	3	3	3	3
Stem count			8	8	30	10	10	24	8	8	22	101	101	214	97	97	123	90	90	129
size (ares)			1			1			1			12			12			12		
size (ACRES)			0.02			0.02			0.02			0.30			0.30			0.30		
Species count			6	6	7	10	10	12	6	6	8	22	22	26	19	19	22	18	18	23
Stems per ACRE			323.7	323.7	1214	404.7	404.7	971.2	323.7	323.7	890.3	340.6	340.6	721.7	327.1	327.1	414.8	303.5	303.5	435

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

- PnoLS = Planted excluding livestakes
- P-all = Planting including livestakes
- T = All planted and natural recruits including livestakes
- T includes natural recruits

Appendix D.
Stream Geomorphology Data

Tables 10a-10c. Baseline Stream Data Summary
Tables 11a-11f. Monitoring Data-Dimensional Data Summary
Cross-section Plots
Substrate Plots

Table 10a. Baseline Stream Data Summary (Mud Lick Creek)
Mud Lick Creek Mitigation Project - NCDMS Project Number 93482

Parameter	Gauge	Regional Curve			Pre-Existing Condition (Mud Lick Creek)					Reference Reach(es) Data					Design (Mud Lick Creek)			Monitoring Baseline (Mud Lick Creek)					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Max	Med	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle Only																							
BF Width (ft)					18.2		22.0	24.6		5.3		10.8	12.3					18.3		19.8	21		3
Floodprone Width (ft)					250.0		306.0	378.0		14		60	125					100		100	100		3
BF Mean Depth (ft)					1.9		2.1	2.3		0.8		1.0	1.8					1.6		2.0	2.7		3
BF Max Depth (ft)					3.0		4.0	4.2		1.0		1.5	2.6					3.6		3.7	3.8		3
BF Cross Sectional Area (ft ²)					41.3		46.3	47.5		5.4		10.6	19.7					33.0		40.4	49.8		3
Width/Depth Ratio					8.0		10.5	12.8		5.2		8.6	14.4					6.8		9.9	13.1		3
Entrenchment Ratio					12.4		13.7	17.2		1.7		4.3	>10.2					4.8		5.1	5.5		3
Bank Height Ratio					1.1		1.2	1.2		1.0		1.0	1.1					1.0		1.0	1.3		3
Profile																							
Riffle length (ft)																							
Riffle slope (ft/ft)										0.0040		0.0188	0.0704										
Pool length (ft)																							
Pool Max depth (ft)					3.7		4.4	5.2		1.2		1.8	3.3										
Pool spacing (ft)										9.0		46.0	73.0										
Pattern																							
Channel Beltwidth (ft)					26.1		52.9	69.9		10		41	102										
Radius of Curvature (ft)					9.9		24.8	58.8		11		21	85										
Rc:Bankfull width (ft/ft)					0.5		1.1	2.39		1.3		2	9.1										
Meander Wavelength (ft)					59.9		159.6	244.4		-		-	-										
Meander Width ratio					1.4		2.2	3.8		1.6		4.4	8.9										
Transport parameters																							
Reach Shear Stress (competency) lbs/ft ²																							
Max part size (mm) mobilized at bankfull																							
Stream Power (transport capacity) W/m ²																							
Additional Reach Parameters																							
Rosgen Classification					E/C4					E/C4					E/C-type								
Bankfull Velocity (fps)					3.0 - 3.4					2.2 - 5.6													
Bankfull Discharge (cfs)					123.9 - 157.42					20 -97													
Valley Length (ft)																							
Channel Thalweg Length (ft)																							
Sinuosity					1.20 - 1.37					1.0 - 2.3													
Water Surface Slope (ft/ft)																							
BF slope (ft/ft)																							
Bankfull Floodplain Area (acres)																							
% of Reach with Eroding Banks																							
Channel Stability or Habitat Metric																							
Biological or Other																							

Table 10b. Baseline Stream Data Summary (North Branch)
Mud Lick Creek Mitigation Project - NCDMS Project Number 93482

Parameter	Gauge	Regional Curve			Pre-Existing Condition (North Branch)					Reference Reach(es) Data					Design (North Branch)			Monitoring Baseline (North Branch)				
		LL	UL	Eq.	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Max	Med	Min	Mean	Med	Max	SD
Dimension and Substrate - Riffle Only																						
BF Width (ft)					8.3			10.4		5.3		10.8	12.3		13.8	14.0		14.6		16.2	17.7	2
Floodprone Width (ft)					33.3			80.0		14		60	125		30	70		100		100	100	2
BF Mean Depth (ft)					0.7			1.5		0.8		1.0	1.8		1.0	1.2		0.8		0.9	1.0	2
BF Max Depth (ft)					1.5			2.3		1.0		1.5	2.6		1.3	2.0		1.8		1.8	1.8	2
BF Cross Sectional Area (ft ²)					7.7			12.7		5.4		10.6	19.7		14.4	16.3		14.2		14.4	14.5	2
Width/Depth Ratio					5.4			14.0		5.2		8.6	14.4		12.0	13.0		14.6		18.4	22.1	2
Entrenchment Ratio					1.9			10.1		1.7		4.3	>10.2		2.2	5.0		5.6		6.2	6.8	2
Bank Height Ratio					1.7			2.0		1.0		1.0	1.1		1.0	1.0		1.0		1.0	1.0	2
Profile																						
Riffle length (ft)																						
Riffle slope (ft/ft)										0.0040		0.0188	0.0704		0.0060	0.0340						
Pool length (ft)																						
Pool Max depth (ft)					2.1			2.7		1.2		1.8	3.3		1.3	4.7						
Pool spacing (ft)										9.0		46.0	73.0		19.0	92.0						
Pattern																						
Channel Beltwidth (ft)					11		26	38.5		10		41	102		41	125						
Radius of Curvature (ft)					6.1		17	37		11		21	85		25	42						
Rc:Bankfull width (ft/ft)					0.73		1.6	4.46		1.3		2	9.1		1.8	3						
Meander Wavelength (ft)					37.9		64.1	100.6		-		-	-		41	168						
Meander Width ratio					1.1		2.8	4.6		1.6		4.4	8.9		3	15						
Transport parameters																						
Reach Shear Stress (competency) lbs/ft ²																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m ²																						
Additional Reach Parameters																						
Rosgen Classification					E5/B5c					E/C4					C4			C-type				
Bankfull Velocity (fps)					3.3 - 3.5					2.2 - 5.6					2.4 - 4.3							
Bankfull Discharge (cfs)					25.41 - 44.45					20 -97					34.6 - 70.1							
Valley Length (ft)																						
Channel Thalweg Length (ft)																						
Sinuosity					1.22 - 1.32					1.0 - 2.3					1.2 - 1.3							
Water Surface Slope (ft/ft)																						
BF slope (ft/ft)																						
Bankfull Floodplain Area (acres)																						
% of Reach with Eroding Banks																						
Channel Stability or Habitat Metric																						
Biological or Other																						

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)

Mud Lick Creek Mitigation Project - NCDMS Project Number 93482

Parameter	Cross Section 1 (Mud Lick Cr)							Cross Section 2 (Mud Lick Cr)							Cross Section 10 (Mud Lick Cr)						
	Riffle							Riffle							Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	18.3	18.8	18.6					21.0	22.0	14.9					19.8	19.6	18.9				
Floodprone Width (ft) (approx)	100.0	100.0	100.0					100.0	100.0	100.0					100.0	100.0	100.0				
BF Mean Depth (ft)	2.7	2.6	2.7					1.6	1.5	2.2					2.0	2.1	2.1				
BF Max Depth (ft)	3.8	3.8	3.8					3.7	3.6	3.3					3.6	3.4	3.5				
Low Bank Height	5.0	5.1	5.0					3.7	3.6	3.9					3.6	3.4	3.7				
BF Cross Sectional Area (ft ²)	49.8	49.8	49.8					33.0	33.0	33.0					40.4	40.4	40.4				
Area at Low Bank (ft ²)	49.8	NA	75.8					33.0	NA	42.6					40.4	NA	43.2				
Width/Depth Ratio	6.7	7.1	6.9					13.4	14.7	6.7					9.7	9.5	8.8				
Entrenchment Ratio	5.5	5.3	NA**					4.8	4.5	NA**					5.1	5.1	NA**				
Bank Height Ratio*	1.3	1.3	1.3					1.0	1.0	1.2					1.0	1.0	1.1				
d50 (mm)	9.9	4.4	4.3					9.9	4.4	4.3					9.9	4.4	4.3				

*Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioners in NC (9/2018).

** Based on the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioners in NC (9/2018), entrenchment ratio is no longer reported for success criteria.

Table 11b. Monitoring Data - Stream Reach Data Summary

Mud Lick Creek Mitigation Project - NCDMS Project Number 93482

Parameter	Baseline (Mud Lick Creek)						MY-1 (Mud Lick Creek)						MY-2 (Mud Lick Creek)						MY-3 (Mud Lick Creek)						MY-4 (Mud Lick Creek)						MY-5 (Mud Lick Creek)					
Dimension and Substrate - Riffle Only	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	18.3		19.8	21		3	18.8		19.6	22		3	14.9		18.6	18.9		3																		
Floodprone Width (ft)	100		100	100		3	100		100.0	100		3	100		100	100		3																		
BF Mean Depth (ft)	1.6		2.0	2.7		3	1.5		2.1	2.7		3	2.1		2.2	2.7		3																		
BF Max Depth (ft)	3.6		3.7	3.8		3	3.4		3.6	3.8		3	3.3		3.5	3.8		3																		
BF Cross Sectional Area (ft ²)	33.0		40.4	49.8		3	33.0		40.4	49.8		3	33.0		40.4	49.8		3																		
Area at Low Bank (ft ²)	33.0		40.4	49.8		3	NA		NA	NA		NA	42.6		43.2	75.8		3																		
Width/Depth Ratio	6.8		9.9	13.1		3	7.0		9.3	14.7		3	6.8		6.9	9.0		3																		
Entrenchment Ratio	4.8		5.1	5.5		3	4.5		5.1	5.3		3	5.3		5.4	6.7		3																		
Bank Height Ratio	1.0		1.0	1.3		3	1.0		1.0	1.3		3	1.1		1.2	1.3		3																		
Riffle length (ft)																																				
Riffle slope (ft/ft)																																				
Pool length (ft)																																				
Pool Max depth (ft)																																				
Pool spacing (ft)																																				
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C-type						Ce-type						Ce-type																							
Channel Thalweg Length (ft)																																				
Sinuosity																																				
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)																																				
Ri%/RU%P%G%/S%																																				
SC%/SA%/G%/C%/B%BE%																																				
d16/d35/d50/d84/d95																																				
% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Table 11c. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)

Mud Lick Creek Mitigation Project - NCDMS Project Number 93482

Parameter	Cross Section 3 (North Branch)							Cross Section 4 (North Branch)							Cross Section 5 (North Branch)							Cross Section 6 (North Branch)						
	Pool							Riffle							Pool							Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	14.2	13.7	13.3					17.7	22.7	20.7					14.2	14.6	15.1					14.6	15.1	14.8				
Floodprone Width (ft) (approx)	NA	NA	NA					100.0	100.0	100.0					NA	NA	NA					100.0	100.0	100.0				
BF Mean Depth (ft)	1.1	1.1	1.2					0.8	0.6	0.7					1.3	1.3	1.2					1.0	1.0	1.0				
BF Max Depth (ft)	2.2	2.1	2.2					1.8	1.9	1.8					2.6	2.6	2.7					1.8	1.8	1.8				
Low Bank Height	2.2	2.1	2.3					1.8	1.9	1.8					2.6	2.6	2.8					1.8	1.8	1.8				
BF Cross Sectional Area (ft ²)	15.5	15.5	15.5					14.2	14.2	14.2					18.6	18.6	18.6					14.5	14.5	14.5				
Area at Low Bank (ft ²)	15.5	NA	18.0					14.2	NA	14.2					18.6	NA	20.3					14.5	NA	15.0				
Width/Depth Ratio	NA	NA	NA					22.1	36.3	30.2					NA	NA	NA					14.7	15.7	15.1				
Entrenchment Ratio	NA	NA	NA					5.6	4.4	NA**					NA	NA	NA					6.8	6.6	NA**				
Bank Height Ratio*	1.0	1.0	1.0					1.0	1.0	1.0					1.0	1.0	1.0					1.0	1.0	1.0				
d50 (mm)	--	--	--					18.8	8.0	8.4					--	--	--					18.8	8.0	8.4				

*Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioners in NC (9/2018).

** Based on the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioners in NC (9/2018), entrenchment ratio is no longer reported for success criteria.

Table 11d. Monitoring Data - Stream Reach Data Summary

Mud Lick Creek Mitigation Project - NCDMS Project Number 93482

Parameter	Baseline (North Branch)						MY-1 (North Branch)						MY-2 (North Branch)						MY-3 (North Branch)						MY-4 (North Branch)						MY-5 (North Branch)					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle Only																																				
BF Width (ft)	14.6		16.2	17.7		2	15.1		18.9	22.7		2	14.8		17.8	20.7		2																		
Floodprone Width (ft)	100		100	100		2	100		100.0	100		2	100		100	100		2																		
BF Mean Depth (ft)	0.8		0.9	1.0		2	0.6		0.8	1.0		2	0.7		0.9	1.0		2																		
BF Max Depth (ft)	1.8		1.8	1.8		2	1.8		1.9	1.9		2	1.8		1.8	1.8		2																		
BF Cross Sectional Area (ft ²)	14.2		14.4	14.5		2	14.2		14.4	14.5		2	14.2		14.4	14.5		2																		
Area at Low Bank (ft ²)	14.2		14.4	14.5		2	NA		NA	NA		NA	14.2		14.6	15.0		2																		
Width/Depth Ratio	14.6		18.4	22.1		2	15.1		26.5	37.8		2	14.8		17.8	20.7		2																		
Entrenchment Ratio	5.6		6.2	6.8		2	4.4		5.5	6.6		2	4.8		5.8	6.8		2																		
Bank Height Ratio	1.0		1.0	1.0		2	1.0		1.0	1.0		2	1.0		1.0	1.0		2																		
Profile																																				
Riffle length (ft)																																				
Riffle slope (ft/ft)																																				
Pool length (ft)																																				
Pool Max depth (ft)																																				
Pool spacing (ft)																																				
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C-type						C-type						C-type																							
Channel Thalweg Length (ft)																																				
Sinuosity																																				
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)																																				
Ri%/RU%P%G%/S%																																				
SC%/SA%/G%/C%/B%BE%																																				
d16/d35/d50/d84/d95																																				
% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Table 11e. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)

Mud Lick Creek Mitigation Project - NCDMS Project Number 93482

Parameter	Cross Section 7 (East Branch)							Cross Section 8 (East Branch)							Cross Section 9 (East Branch)						
	Riffle							Pool							Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	8.9	11.1	10.2					7.6	10.8	8.2					16.6	21.1	18.6				
Floodprone Width (ft) (approx)	100.0	100.0	100.0					NA	NA	NA					100.0	100.0	100.0				
BF Mean Depth (ft)	0.8	0.6	0.7					1.4	1.0	1.3					0.6	0.5	0.6				
BF Max Depth (ft)	1.2	1.4	1.3					2.4	1.5	2.1					1.5	1.6	1.5				
Low Bank Height	1.2	1.4	1.4					2.4	1.5	2.2					1.5	1.6	1.5				
BF Cross Sectional Area (ft ²)	6.7	6.7	6.7					10.5	10.5	10.5					10.6	10.6	10.6				
Area at Low Bank (ft ²)	6.7	NA	7.5					10.5	NA	11.7					10.6	NA	10.7				
Width/Depth Ratio	11.8	18.4	15.5					NA	NA	NA					26.0	42.0	32.6				
Entrenchment Ratio	11.2	9.0	NA**					NA	NA	NA					6.0	4.7	NA**				
Bank Height Ratio*	1.0	1.0	1.1					1.0	1.0	1.0					1.0	1.0	1.0				
d50 (mm)	14.3	3.7	5.4					--	--	--					14.3	3.7	5.4				

*Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioners in NC (9/2018).

** Based on the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioners in NC (9/2018), entrenchment ratio is no longer reported for success criteria.

Table 11f. Monitoring Data - Stream Reach Data Summary

Mud Lick Creek Mitigation Project - NCDMS Project Number 93482

Parameter	Baseline (East Branch)						MY-1 (East Branch)						MY-2 (East Branch)						MY-3 (East Branch)						MY-4 (East Branch)						MY-5 (East Branch)					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle Only																																				
BF Width (ft)	8.9		12.8	16.6		2	11.1		16.2	21.2		2	10.2		14.5	18.7		2																		
Floodprone Width (ft)	100		100	100		2	100		100	100		2	100		100	100		2																		
BF Mean Depth (ft)	0.6		0.7	0.8		2	0.5		0.6	0.6		2	0.6		0.7	0.7		2																		
BF Max Depth (ft)	1.2		1.4	1.5		2	1.4		1.5	1.6		2	1.3		1.4	1.5		2																		
BF Cross Sectional Area (ft ²)	6.7		8.7	10.6		2	6.7		8.7	10.6		2	6.7		8.7	10.6		2																		
Area at Low Bank (ft ²)	6.7		8.7	10.6		2	NA		NA	NA		NA	7.5		9.1	10.7		2																		
Width/Depth Ratio	11.1		19.4	27.7		2	18.5		30.5	42.2		2	14.6		22.9	31.2		2																		
Entrenchment Ratio	6.0		8.6	11.2		2	4.7		6.9	9		2	5.3		7.6	9.8		2																		
Bank Height Ratio	1.0		1.0	1.0		2	1		1	1		2	1.0		1.0	1.1		2																		
Profile																																				
Riffle length (ft)																																				
Riffle slope (ft/ft)																																				
Pool length (ft)																																				
Pool Max depth (ft)																																				
Pool spacing (ft)																																				
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C-type						C-type						C-type																							
Channel Thalweg Length (ft)																																				
Sinuosity																																				
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)																																				
Ri%/RU%P%G%/S%																																				
SC%/SA%/G%/C%/B%BE%																																				
d16/d35/d50/d84/d95																																				
% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

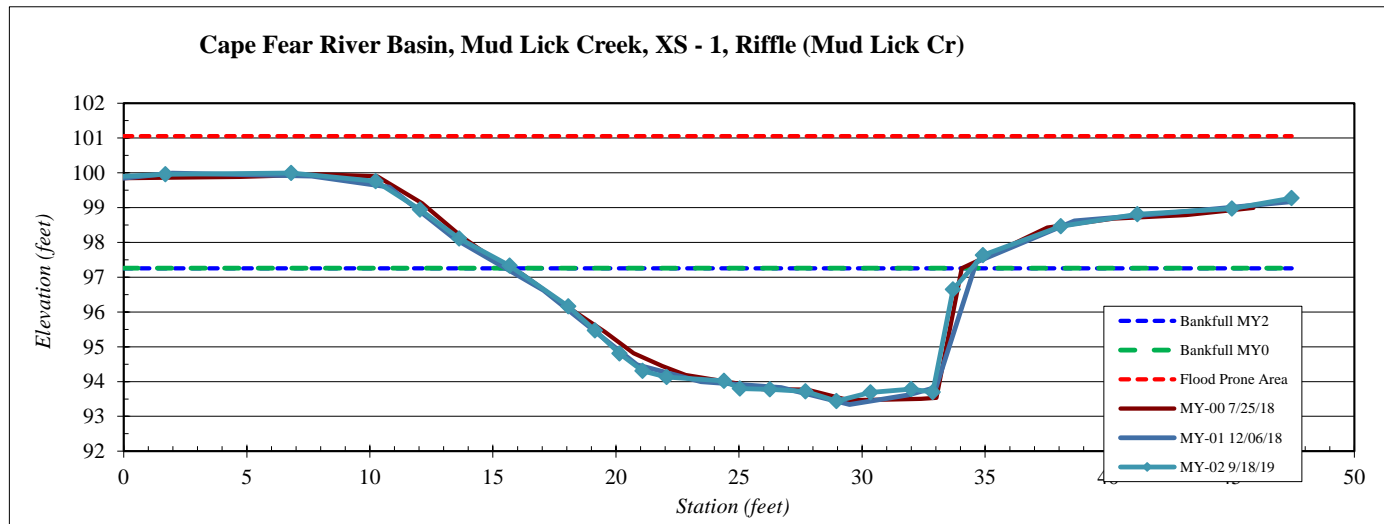
River Basin:	Cape Fear
Site Name	Mud Lick Creek
XS ID	XS - 1, Riffle (Mud Lick Cr)
Drainage Area (sq mi):	3.64
Date:	9/18/2019
Field Crew:	Perkinson, Radecki

Station	Elevation
-0.50	99.89
1.70	99.96
6.81	99.99
10.24	99.76
12.04	98.94
13.63	98.11
15.68	97.33
18.07	96.16
19.15	95.47
20.14	94.81
21.08	94.31
22.06	94.13
24.39	94.02
25.04	93.80
26.26	93.78
27.70	93.72
28.96	93.44
30.34	93.69
32.00	93.78
32.87	93.70
33.70	96.65
34.91	97.64
38.08	98.46
41.18	98.81
45.02	98.97
47.45	99.27

SUMMARY DATA	
Bankfull Elevation:	97.3
Bankfull Cross-Sectional Area:	49.8
Area at Low Bank:	75.8
Bankfull Width:	18.8
Flood Prone Area Elevation:	98.5
Flood Prone Width:	100.0
Max Depth at Bankfull:	3.8
Low Bank Height:	5.0
Mean Depth at Bankfull:	2.6
W / D Ratio:	7.1
Entrenchment Ratio:	NA
Bank Height Ratio:	1.3

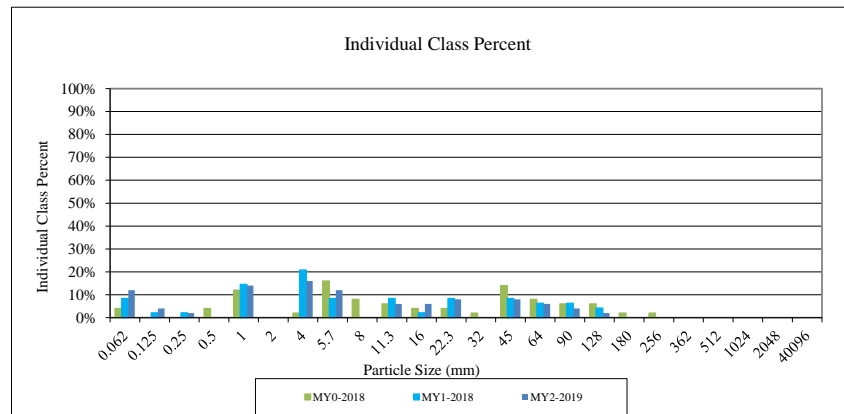
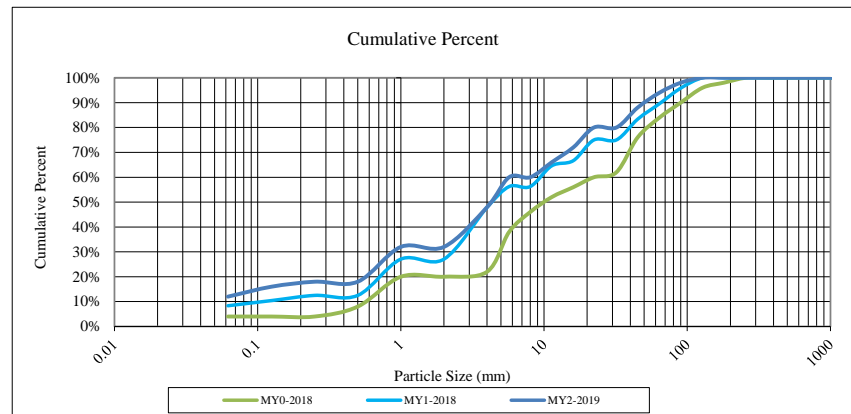


Stream Type	E
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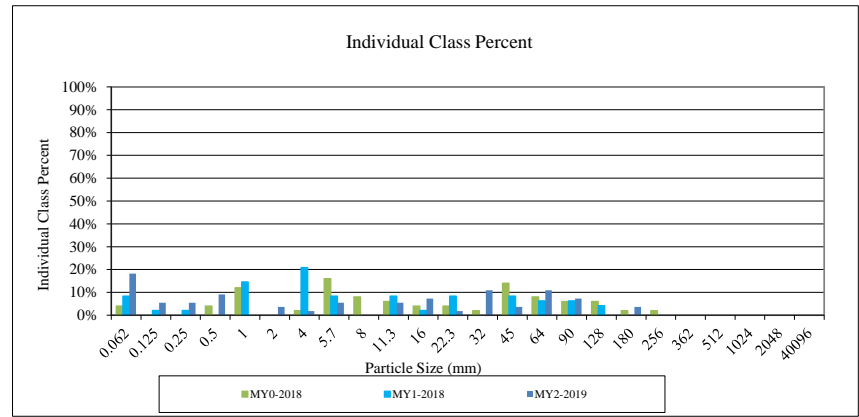
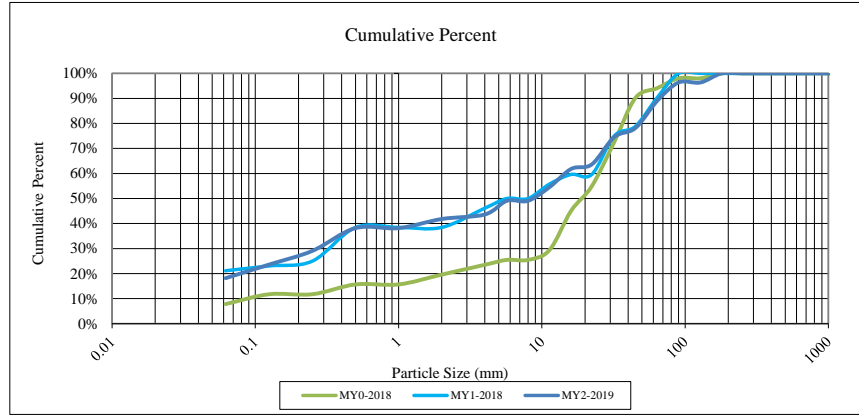
Project Name: Mudlick Creek					
Cross-Section: 2					
Feature: Riffle					
			2019		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay					
	silt/clay	0.062	6	12%	12%
Sand					
	very fine sand	0.125	2	4%	16%
	fine sand	0.250	1	2%	18%
	medium sand	0.50	0	0%	18%
	coarse sand	1.00	7	14%	32%
	very coarse sand	2.0	0	0%	32%
Gravel					
	very fine gravel	4.0	8	16%	48%
	fine gravel	5.7	6	12%	60%
	fine gravel	8.0	0	0%	60%
	medium gravel	11.3	3	6%	66%
	medium gravel	16.0	3	6%	72%
	course gravel	22.3	4	8%	80%
	course gravel	32.0	0	0%	80%
	very coarse gravel	45	4	8%	88%
	very coarse gravel	64	3	6%	94%
Cobble					
	small cobble	90	2	4%	98%
	medium cobble	128	1	2%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder					
	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock					
	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

Summary Data	
D16	0.125
D35	2.28
D50	4.3
D84	38
D95	70



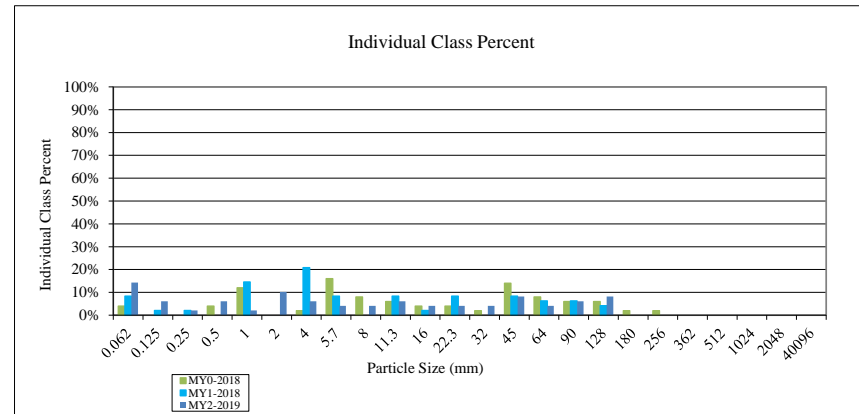
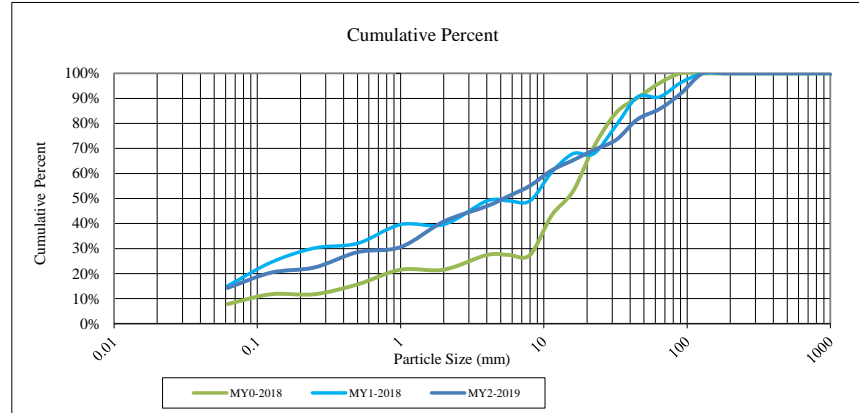
Project Name: North Branch					
Cross-Section: 4					
Feature: Riffle					
			2019		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	10	18%	18%
Sand	very fine sand	0.125	3	5%	24%
	fine sand	0.250	3	5%	29%
	medium sand	0.50	5	9%	38%
	coarse sand	1.00	0	0%	38%
	very coarse sand	2.0	2	4%	42%
Gravel	very fine gravel	4.0	1	2%	44%
	fine gravel	5.7	3	5%	49%
	fine gravel	8.0	0	0%	49%
	medium gravel	11.3	3	5%	55%
	medium gravel	16.0	4	7%	62%
	course gravel	22.3	1	2%	64%
	course gravel	32.0	6	11%	75%
	very coarse gravel	45	2	4%	78%
	very coarse gravel	64	6	11%	89%
	very coarse gravel	90	4	7%	96%
Cobble	small cobble	90	4	7%	96%
	medium cobble	128	0	0%	96%
	large cobble	180	2	4%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			55	100%	100%

Summary Data	
D16	NA
D35	0.39
D50	8.4
D84	54
D95	84



Project Name: East Branch					
Cross-Section: 7					
Feature: Riffle					
			2019		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	10	21%	21%
Sand	very fine sand	0.125	3	6%	27%
	fine sand	0.250	1	2%	29%
	medium sand	0.50	3	6%	35%
	coarse sand	1.00	1	2%	38%
	very coarse sand	2.0	5	10%	48%
Gravel	very fine gravel	4.0	3	6%	54%
	fine gravel	5.7	2	4%	58%
	fine gravel	8.0	2	4%	63%
	medium gravel	11.3	3	6%	69%
	medium gravel	16.0	2	4%	73%
	course gravel	22.3	2	4%	77%
	course gravel	32.0	2	4%	81%
	very coarse gravel	45	4	8%	90%
	very coarse gravel	64	2	4%	94%
	very coarse gravel	90	3	6%	100%
Cobble	small cobble	90	3	6%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			48	100%	100%

Summary Data	
D16	0.075
D35	1.35
D50	5.4
D84	55
D95	103



Appendix E.
Hydrology Data

Table 12. Verification of Bankfull Events

**Table 12. Verification of Bankfull Events
Mud Lick Creek Restoration Site (DMS Project No. 93482)**

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
December 6, 2018	October 16-17, 2018	Observations throughout floodplain and crest gauge indicate a bankfull event after 4.61 inches of rain fell over 48 hours.	1-2
May 8, 2019	February 24, 2019	Observation of wrack in floodplain and crest gauge data indicate a bankfull event after 2.27 inches of rain fell over 48 hours.	3
September 18, 2019	July 24, 2019	Observation of wrack on floodplain fences and crest gauge data indicate a bankfull event after 3.02 inches of rain fell over 48 hours.	4

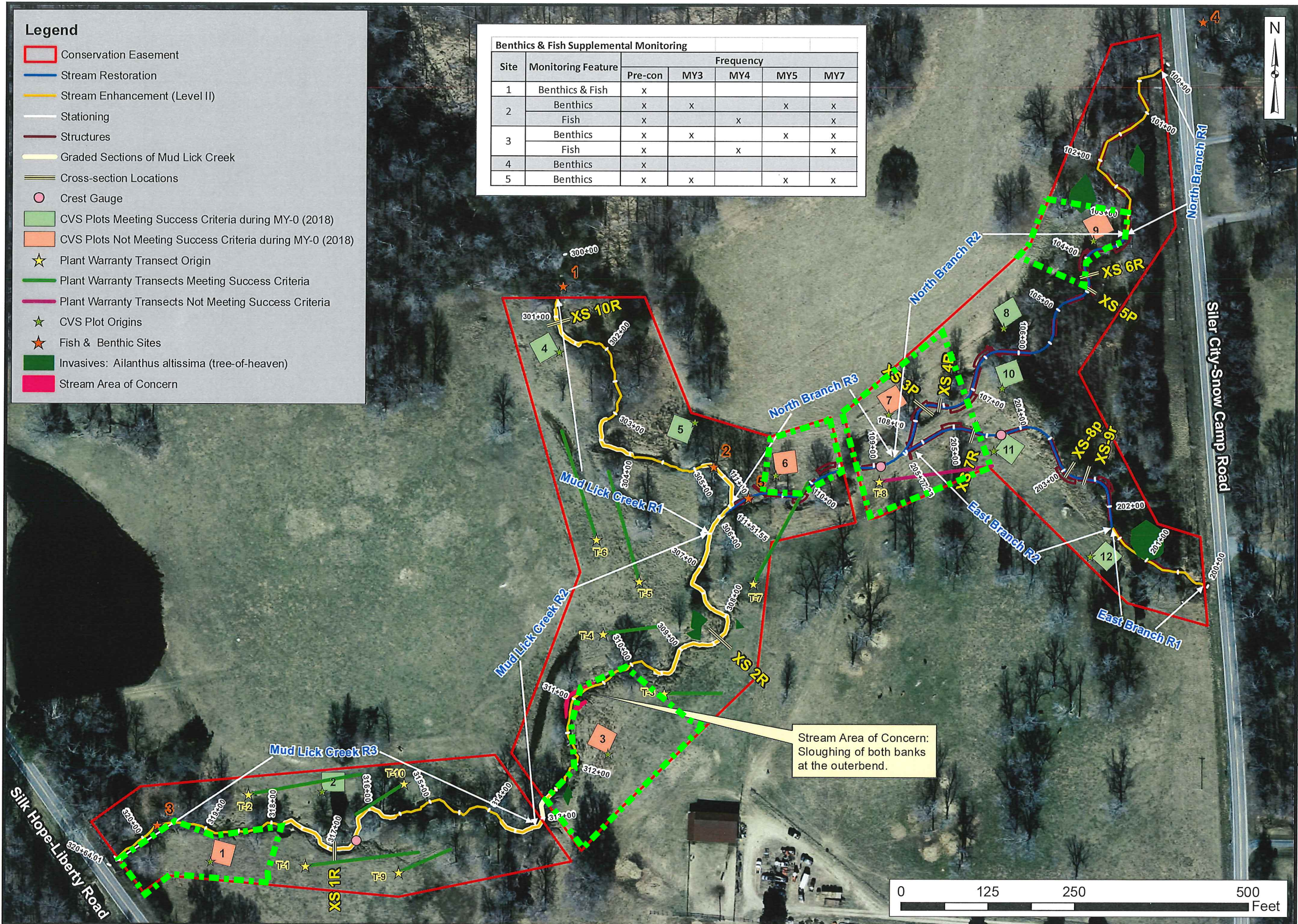


Appendix F.
2019 Warranty Replant Information

Legend

- Conservation Easement
- Stream Restoration
- Stream Enhancement (Level II)
- Stationing
- Structures
- Graded Sections of Mud Lick Creek
- Cross-section Locations
- Crest Gauge
- CVS Plots Meeting Success Criteria during MY-0 (2018)
- CVS Plots Not Meeting Success Criteria during MY-0 (2018)
- ★ Plant Warranty Transect Origin
- Plant Warranty Transects Meeting Success Criteria
- Plant Warranty Transects Not Meeting Success Criteria
- ★ CVS Plot Origins
- ★ Fish & Benthic Sites
- Invasives: *Ailanthus altissima* (tree-of-heaven)
- Stream Area of Concern

Benthics & Fish Supplemental Monitoring		Frequency				
Site	Monitoring Feature	Pre-con	MY3	MY4	MY5	MY7
1	Benthics & Fish	x				
2	Benthics	x	x		x	x
	Fish	x		x		x
3	Benthics	x	x		x	x
	Fish	x		x		x
4	Benthics	x				
5	Benthics	x	x		x	x



Stream Area of Concern:
Sloughing of both banks
at the outerbend.



Prepared for:
North Carolina
Department of
Environmental
Quality

Division of
Mitigation Services

Project:
**MUD
LICK
CREEK
MITIGATION
SITE**

DMS Project
Number 93482
Chatham County, NC

Title:
**CURRENT
CONDITIONS
PLAN
VIEW**

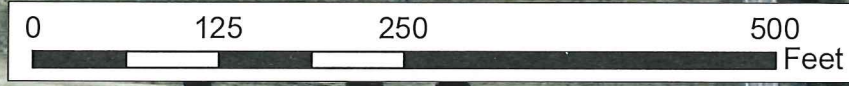
Drawn by:
PHP, CLF

Date:
Sept 2018

Scale:
1:1,500

Project No.:
12-004.22

FIGURE
A



Dykes & Son Nursery

825 Maude Etter Rd
 TN 37110

Packing Slip

Date	Invoice #
1/7/2019	23341

Ship To
NORTH STATE ENVIRONMENTAL 2889 LOWERY ST WINSTON SALEM, NC 27101

P.O. No.	Ship	Via	FOB	Project
mud lick/green tryon	1/7/2019			

Quantity	Item Code	Description
175	Bare Root	Mud Lick Creek
175	Bare Root	River Birch 12-18"
175	Bare Root	Tulip Poplar 12-18"
175	Bare Root	Sycamore 12-18"
		Red Bud 12-18"
100	Bare Root	Greens of Tryon
50	Bare Root	Poplar 12-18"
50	Bare Root	Sycamore 12-18"
1	Freight	River Birch 12-18"
1	Packing	UPS Charges
		Packing

No claims, errors, shortages, etc. will be considered unless made within 10 days of receipt.