FINAL

YEAR 5 (2018) ANNUAL MONITORING REPORT

LITTLE LICK CREEK BUFFER RESTORATION

Durham County, North Carolina

DMS Project No. 92542, Contract No. 5908

Data Collection - October 2018

NEUSE RIVER BASIN

Cataloging Unit **03020201**

SUBMITTED TO/PREPARED FOR:

North Carolina Department of Environmental Quality

Division of Mitigation Services

1652 Mail Service Center

Raleigh, North Carolina 27699-1652

October 2018

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APPENDICES

Axiom Environmental, Inc.

Axiom Environmental, Inc.

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

October 29, 2018

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

RE: Little Lick Creek Monitoring (DMS Project # 92542, Contract #D13010S)
Final MY5 (2018) Annual Monitoring Report **12-004.19**

Dear Jeff:

Axiom Environmental, Inc. (AXE) is pleased to provide you with two hard copies and a CD of digital files for the Final Little Lick Creek Annual Monitoring Report. We received your comments via email on October 25, 2018 and have addressed them as follows:

1. The digital data and drawings have been reviewed and DMS had the following comments:
   a. NutrientOffsetCreditArea shapefile – When reviewing the attribute table, there did not appear to be an area depicted for FIDs 0, 1, 4 and 5, only a line when I clicked on each item. However, the attribute table does show an area. Please explain or correct.
   Upon review, it appeared that one of the shapefiles (Drip_Poy.shp – "Existing Mature Vegetation") had not been clipped properly to the final easement boundary. This resulted in several small, linear areas where Nutrient Offset credit and Riparian Buffer credit was being calculated where it shouldn't have been. The shapefiles have been corrected. This change resulted in a reduction of 0.01 acre (359 square feet) of Riparian Buffer credit area and 0.01 acre (548 square feet) of Nutrient Offset credit area. The Project Components and Mitigation Tables in the document were also updated to reflect the change in credit areas. Footnotes were added to the table in Section 1.0 of the report and Table 1 in Appendix A that read the following: "During the Year 5 (2018) annual monitoring report review, an error in GIS credit area calculation was discovered which resulted in a slight reduction of credit area (-359 ft^2 of Riparian Buffer credit and -548 ft^2 of Nutrient Offset credit). The areas listed in this table have been revised to reflect the existing project assets."

   b. Photo Point data source is using the wrong geographic coordinate system (GCS_NAD_1983_2011). Please revise to use NAD 1983 State Plane North Carolina (US Feet) per the digital drawing requirements.
   The geographic coordinate system was changed to NAD 1983 State Plane North Carolina (US Feet).

2. During the October 16, 2018 site visit, DMS staff was able to locate 13 corners on the property boundary. Some had green fence posts, others had rebar or other types of marking including aluminum caps. DMS will install additional posts and signage to better mark the property boundary.
   The sentence regarding easement markings in the first paragraph of Section 1.0 was revised as follows: "The easement boundary is currently marked with a combination of green fence posts, rebar, and aluminum caps; however NCDMS is currently in the process of installing additional posts and signage to better mark the boundary."

Axiom Environmental, Inc.

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
Project Scientist

Attachments: 2 hardcopies Final Little Lick Creek Annual Monitoring Report
1 CD containing digital support files

1.0 PROJECT SUMMARY

The North Carolina Department of Environmental Quality-Division of Mitigation Services (NCDMS, formerly NCEEP) has established the **Little Lick Creek Buffer Project** (Project) located approximately five miles east of Durham in Durham County, North Carolina. The Project is located within the Upper Neuse River Basin Hydrologic Unit and Targeted Local Watershed 03020201050020. This document details riparian buffer and nutrient offset buffer mitigation activities within an approximately 12.14-acre easement. The easement boundary is currently marked with a combination of green fence posts, rebar, and aluminum caps; however NCDMS is currently in the process of installing additional posts and signage to better mark the boundary. Completed project activities, reporting history, completion dates, project contacts, and project attributes are summarized in Tables 1-4 (Appendix A). This report (compiled based on the NC Division of Mitigation Services (NCDMS) *Procedural Guidance and Content Requirements for DMS Monitoring Reports* Version 1.5 dated 6/8/12) summarizes data for Year 5 (2018) monitoring.

The Little Lick Creek Buffer Restoration Project is located in the Little Lick Creek Local Watershed planning area, which is nested in the 700-square mile Falls Lake watershed. The Project watershed is located within 14-digit Hydrologic Unit Code (HUC) 03020201050020, which was identified as a Targeted Local Watershed (TLW) in the North Carolina Division of Mitigation Services (NCDMS) 2010 *Neuse River Basin Restoration Priority* (RBRP) plan and is identified in the 2009 *Little Lick Creek Local Watershed Plan* (LWP) Upper Neuse Project Atlas (Butler Road).

NCDMS developed a LWP for the 21-square mile Little Lick Creek watershed area that included land use analysis, water quality monitoring, and stakeholder input to identify problems with water quality, habitat, and hydrology. The Little Lick Creek watershed is relatively undeveloped and in an active state of rural to suburban transition with agriculture, forestry, rural, and undeveloped land comprising over 50 percent of the land uses. Durham laws zone this land for intensive development; therefore, this land is rapidly being converted to residential and commercial properties. Little Lick Creek is on the NC Section 303(d) list of impaired water bodies due to poor aquatic life ratings and low levels of dissolved oxygen as the result of trash dumping, poor maintenance of on-site wastewater treatment systems, small vehicle maintenance and repair operations, outdoor materials storage, grease storage, and wash water disposal.

The Little Lick Creek LWP project atlas includes this Project (Butler Road) with identified stressors resulting from anthropogenic activities related to the conversion of 80 percent of the watershed to disturbed land use/land cover with impervious surfaces covering over 14 percent of the watershed. Water quality is influenced due to the watershed slope (6 percent), the presence of moderately erodible soils, and its location within the Triassic Basin ecoregion. This project was identified for riparian buffer and nutrient offset restoration opportunities to improve hydrology, water quality, and habitat.

The goals of the Little Lick Creek Project (Butler Road) address stressors identified in the Project watershed and include the following.

- Restore riparian buffers associated with Little Lick Creek, a UT to Little Lick Creek, and water conveyances flowing to jurisdictional waters on site.

The project goals will be addressed by the following objectives.

- Reestablish natural vegetation along stream banks and water by planting existing cleared/disturbed land and treating invasive species.

Project restoration activities were completed between November 2013 and December 2013 with invasive species controls ongoing. Activities included 1) removal and treatment of invasive species including rose (*Rosa* sp.), Japanese honeysuckle (*Lonicera japonica*), and Chinese privet (*Ligustrum sinense*); 2) mowing and/or clearing of dense areas of loblolly pine (*Pinus taeda*) seedlings and blackberry (*Rubus argutus*); 3) soil amendments based on recommendations from soil samples analyzed by the NCDA&CS Agronomy Division; and 4) plant community restoration. The implemented mitigation is as follows.

Project Components and Mitigation Units Table

Mitigation Credits^						
Type	**Riparian Buffer**		**Nutrient Offset**			
Totals	**105,972 ft² (2.43 acres)**		**220,882 ft² (5.07 acres)** [minimum, see ** below] **Nitrogen: 11,525.939 lbs Phosphorous: 742.358 lbs**			
Projects Components						
Project Component/ Reach ID	**Restoration/ Restoration Equivalent**	**Restoration Acreage⁺**	**Mitigation Ratio**	**Pounds of Nitrogen Treated Over 30 Years**	**Pounds of Phosphorus Treated Over 30 Years**	**Comment**
*Riparian Buffer	Restoration	105,972 ft² (2.43 acres)	1:1	**5529.769 lbs	**356.159 lbs	Invasive/nuisance species removal and planting with native hardwood trees.
***Nutrient Offset	Restoration	220,882 ft² (5.07 acres)	1:1	11,525.939 lbs	742.358 lbs	

^Calculated in accordance with DWR Memorandum.

*These areas are between 0-100 feet from top of bank and will either be used for Riparian Buffer Mitigation OR Nutrient pound reduction, not both.

**Additional nutrient removal potential if used in lieu of Riparian Buffer square footage.

***This area is between 100-200 feet from top of bank and can ONLY be used for Nutrient Offset pound reduction.

⁺ During the Year 5 (2018) annual monitoring report review, an error in GIS credit area calculation was discovered which resulted in a slight reduction of credit area (-359 ft² of Riparian Buffer credit and -548 ft² of Nutrient Offset credit). The areas listed in this table have been revised to reflect the existing project assets.

Vegetation Success Criteria

An average density of 320 planted hardwood stems per acre must be surviving after five monitoring years in accordance with North Carolina Division of Water Resources Administrative Code 15A NCAC 02B.0242 (*Neuse River Basin, Mitigation Program for Protection and Maintenance of Existing Riparian Buffers*) (NCDWR 2007).

2.0 METHODOLOGY

Annual monitoring data will be reported using the NCDMS monitoring template. The monitoring report shall provide a chronology of project data that will facilitate an understanding of project status and trends, population of NCDMS databases for analysis, research purposes, and to assist in decision making regarding project close-out. The following table outlines monitoring requirements for this Project.

Monitoring Schedule/Requirements Table

Parameter	Quantity	Frequency	Notes
Vegetation	8 CVS plots (see Figure 3 in Appendix B for approximate locations)	Annually in Monitoring Years 1-5	Vegetation will be monitored using the Carolina Vegetation Survey (CVS) protocols
Exotic and nuisance vegetation		Semi-annual	Locations of exotic and nuisance vegetation will be mapped
Project boundary		Semi-annual	Locations of fence damage, vegetation damage, boundary encroachments, etc. will be mapped

Vegetation Monitoring

After planting was completed, an initial evaluation was performed to verify planting methods were successful and to determine initial species composition and density. Eight sample vegetation plots (10-meter by 10-meter) were installed and measured within the Site as per guidelines established in *CVS-DMS Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) (Figure 3, Appendix B). Vegetation plots are permanently monumented with 6-foot metal T-posts at each corner, and a ten foot tall pvc at the origin. In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will be documented by photograph. Vegetation plot information for MY5 (2018) was collected in October 2018 and can be found in Appendix C. Stem count measurements for MY5 (2018) indicate an average of 338 planted stems per acre (excluding livestakes) across the Project. Five out of eight vegetation plots met success criteria for MY5 (2018) monitoring based on planted stems. Plots 2 and 3 were both 3 stems shy of meeting success

criteria based on planted stems alone, and plot 7 was just one stem shy; however, when including natural recruits of green ash (*Fraxinus pennsylvanica*) and willow oak (*Quercus phellos*) in Plot 2, winged elm (*Ulmus alata*) in Plot 3, and green ash (*Fraxinus pennsylvanica*) and red maple (*Acer rubrum*) in plot 7, these plots were well above success criteria.

Planted stem mortality can be attributed to competition from the dense shrub layer consisting of large quantities of naturally recruited woody stems. Several dense patches of Japanese honeysuckle (*Lonicera japonica*) were observed throughout the Project during years 2 (2015) and 3 (2016). The vines were negatively affecting woody stems for several years before it appeared that the woody vegetation had out-competed it during years 4 (2017) and 5 (2018). The areas previously affected by Japanese honeysuckle appeared to have recovered well during year 5 (2018) monitoring. Additionally, a small patch of Chinese lespedeza (*Lespedeza cuneata*) was observed in the vicinity of Plot 3 during previous monitoring years, which had contributed to low planted stem counts in this plot. A few specimens were observed during year 5 (2018) monitoring, however the population has greatly reduced in size since originally observed; therefore, it is no longer considered an area of concern. Furthermore, two patches of dense blackberry were observed during previous monitoring years; one in the northeast portion of the site, near plot 1 and one on the eastern portion of the site along the sewer easement. During year 5 (2018), it appeared that the woody vegetation was out-competing the blackberry, and the blackberry was no longer posing a threat to Site success in these areas. Lastly, a small area of easement encroachment was observed in and around CVS plot 8 during previous monitoring years. An approximately 5 meter wide strip was mowed from Butler Road to the existing maintained sewer easement. It appears no further mowing has occurred in this area since reported during year 4 (2017), and the vegetation has recovered well.

3.0 REFERENCES

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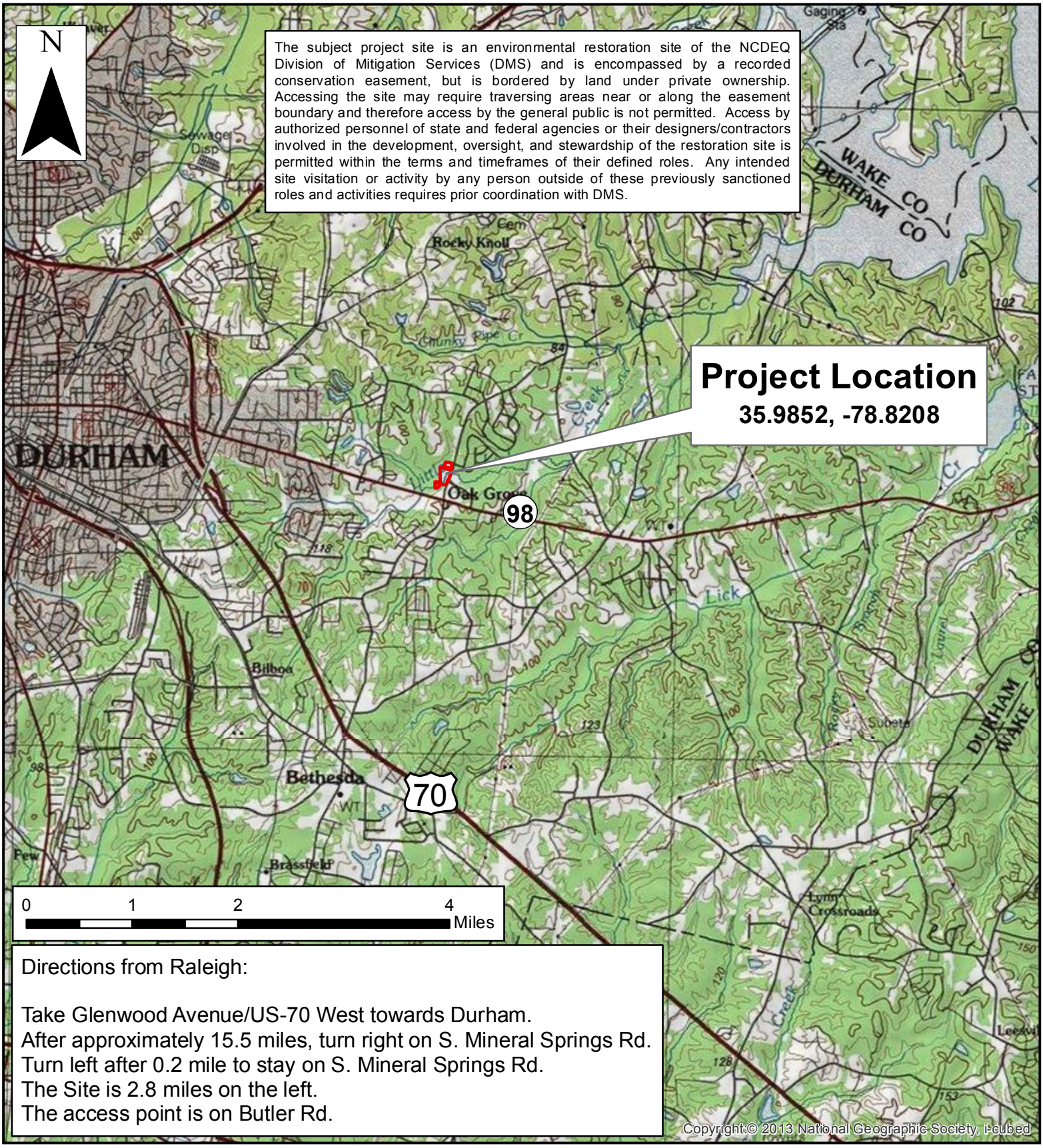
United States Geological Survey (USGS). 1974. Hydrologic Unit Map - 1974. State of North Carolina.

Appendix A.
Project Vicinity Map and Background Tables

Figure 1. Project Location Map
Table 1. Project Components and Mitigation Credits
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Attributes Table



Directions from Raleigh:

Take Glenwood Avenue/US-70 West towards Durham.
After approximately 15.5 miles, turn right on S. Mineral Springs Rd.
Turn left after 0.2 mile to stay on S. Mineral Springs Rd.
The Site is 2.8 miles on the left.
The access point is on Butler Rd.

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PROJECT LOCATION MAP
LITTLE LICK CREEK PROJECT
DMS PROJECT NUMBER 92542
Durham County, North Carolina

Dwn. by. KRJ	FIGURE
Date: October 2016	1
Project: 12-004.19	

Table 1. Project Components and Mitigation Credits
Little Lick Creek Buffer Restoration (DMS #92542)

Mitigation Credits^						
Type	**Riparian Buffer**		**Nutrient Offset**			
Totals	**105,972 ft² (2.43 acres)**		**220,882 ft² (5.07 acres)** [minimum, see ** below] **Nitrogen: 11,525.939 lbs Phosphorous: 742.358 lbs**			
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Project Component/ Reach ID	**Restoration/ Restoration Equivalent**	**Restoration Acreage⁺**	**Mitigation Ratio**	**Pounds of Nitrogen Treated Over 30 Years**	**Pounds of Phosphorus Treated Over 30 Years**	**Comment**
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Table 2. Project Activity and Reporting History
Little Lick Creek Buffer Restoration (DMS #92542)

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Mitigation Plan/Planting Plans	--	April 2013
Pine Removal & Invasive Species Control		August 2013
Bushhogging	--	November 2013
Invasive Species Controls	--	November 2013-present
Planting	--	December 2013
Baseline Monitoring Document (Year 0)	December 2013	February 2014
2014 Annual Monitoring Document (Year 1)	September 2014	October 2014
2015 Annual Monitoring Document (Year 2)	October 2015	November 2015
2016 Annual Monitoring Document (Year 3)	October 2016	November 2016
2017 Annual Monitoring Document (Year 4)	October 2017	December 2017
2018 Annual Monitoring Document (Year 5)	October 2018	October 2018

Table 3. Project Contacts Table
Little Lick Creek Buffer Restoration (DMS #92542)

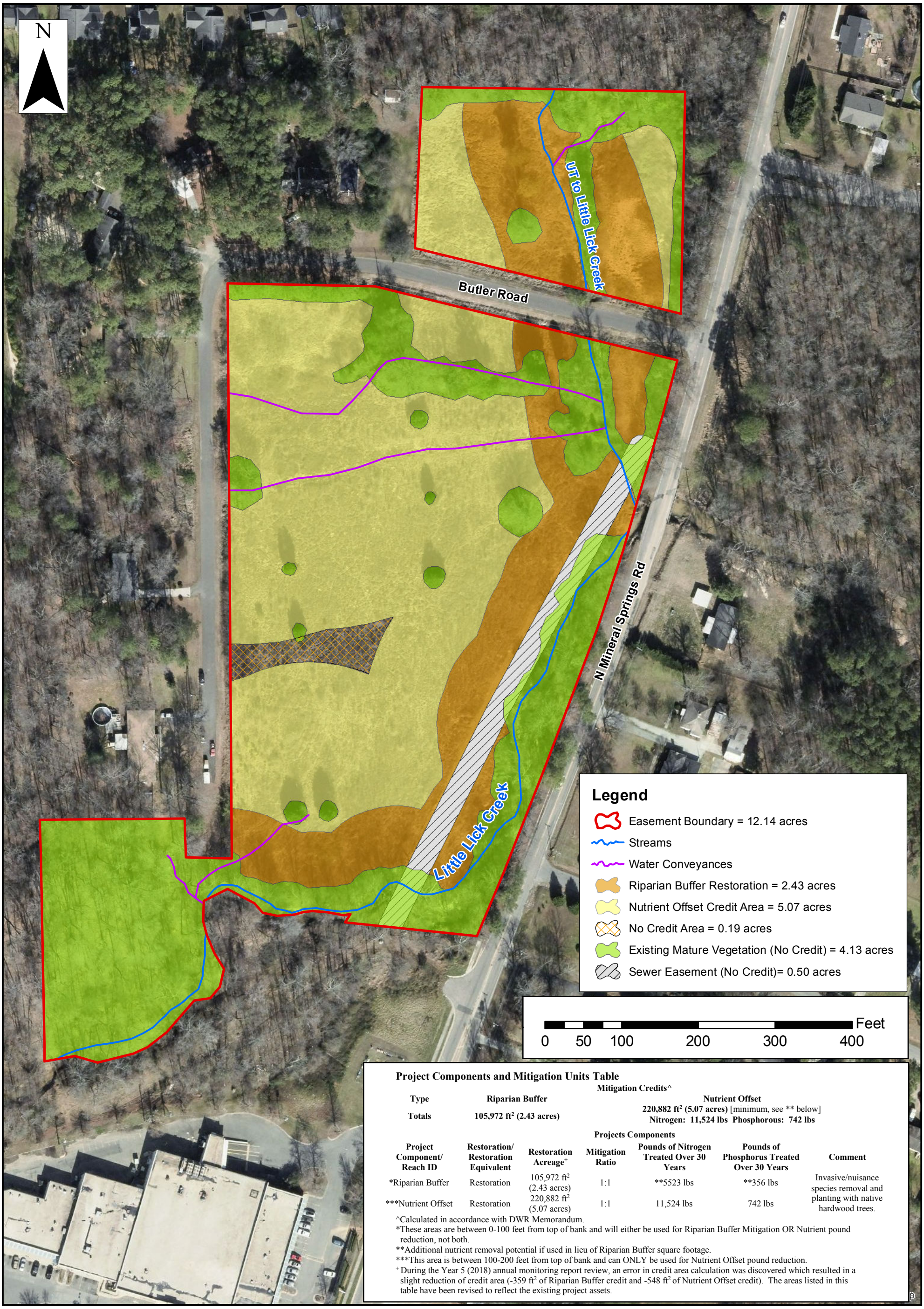
Designer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693
Planting/Vegetation Maintenance/Invasive Species Control Contractor	River Works, Inc. 6105 Chapel Hill Rd. Raleigh, NC 27607 George Morris 919-818-3984
Baseline Data Collection & Annual Monitoring	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Attribute Table
Little Lick Creek Buffer Restoration (DMS #92542)

Project Information		
Project Name	Little Lick Creek	
Project County	Durham	
Project Area	12.1434 acres	
Project Coordinates	35.9852 ºN, 78.8208 ºW	
Project Watershed Summary Information		
Physiographic Region	Piedmont	
Project River Basin	Neuse	
USGS 8-digit HUC	03020201	
USGS 14-digit HUC	03020201050020	
NCDWR Subbasin	03-04-01	
Project Drainage Area	6.0 square miles	
Project Drainage Area Impervious Surface	>14%	
Reach Summary Information		
Parameters	**Little Lick Creek**	**UT to Little Lick Creek**
Length of Reach (linear feet)	1254	510
Drainage Area (square miles)	6.04	0.27
NCDWR Index Number	27-9-(0.5)	27-9-(0.5)
NCDWR Classification	WS-IV, NSW	WS-IV, NSW
Dominant Soil Series	Chewacla and Wehadkee	
Drainage Class	Somewhat Poorly to Poorly Drained	
Soil Hydric Status	Hydric	
Slope	0-2 percent	
FEMA Classification	100-Year Floodplain	
Native Vegetation Community	Piedmont/Low Mountain Alluvial Forest	
Percent Composition of Exotic Invasives	5.6	
Regulatory Considerations		
Regulation	**Applicable**	
Waters of the U.S. –Sections 404 and 401	No	
Endangered Species Act	No	
Historic Preservation Act	No	
CZMA/CAMA	No	
FEMA Floodplain Compliance	No	
Essential Fisheries Habitat	No	

Appendix B.
Visual Assessment Data

Figure 2. Project Assets
Figure 3. Current Conditions Plan View
Table 5. Vegetation Condition Assessment
Vegetation Plot Photographs
Fixed-Station Photographs



Project Components and Mitigation Units Table

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Projects Components

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218 Snow Avenue
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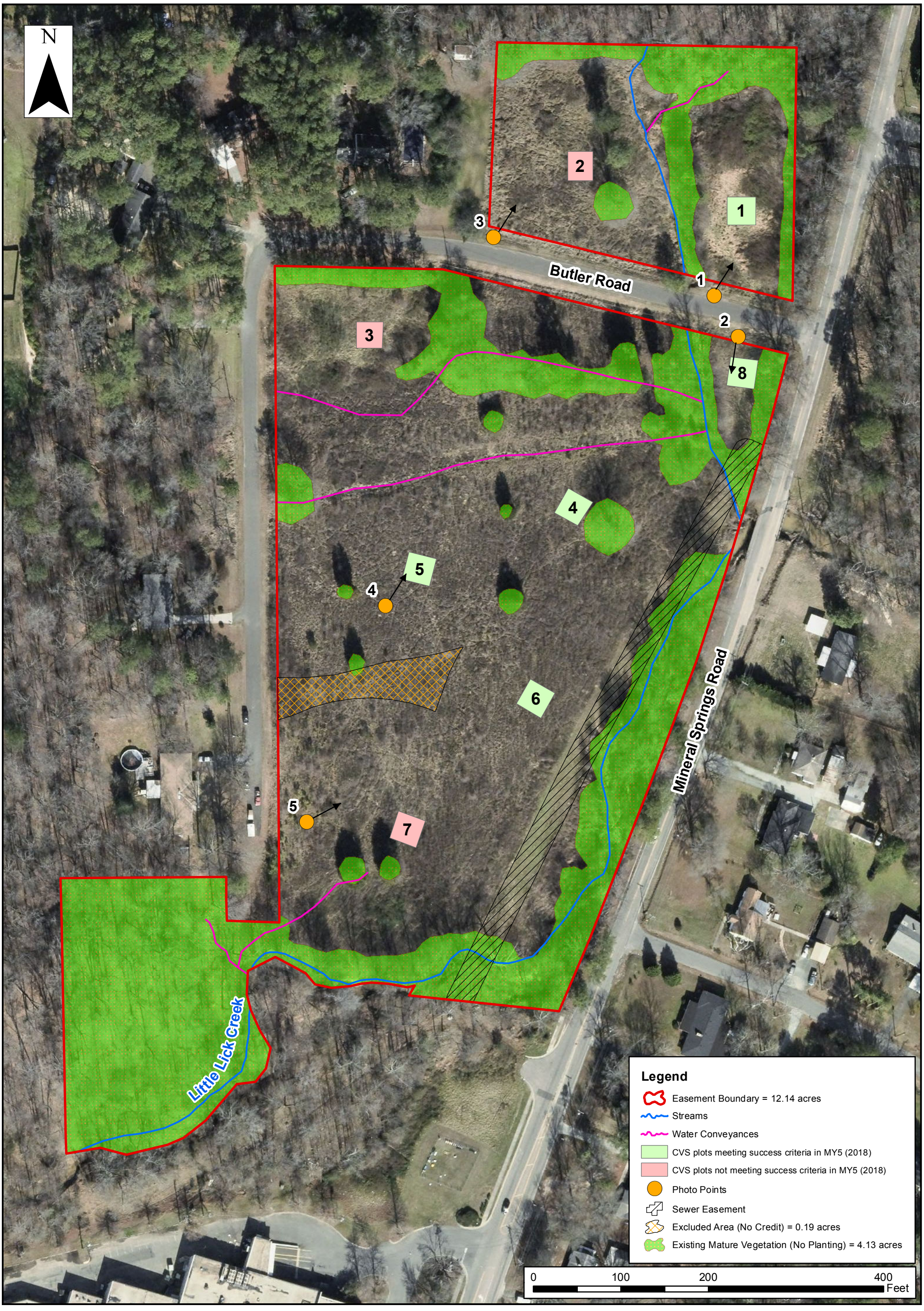
PROJECT ASSETS
LITTLE LICK CREEK SITE
DMS PROJECT NUMBER 92542
Durham County, North Carolina

Dwn. by: KRJ/CLF/PHP
Date: October 2018
Project: 12-004.19

FIGURE 2



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CURRENT CONDITIONS PLAN VIEW
LITTLE LICK CREEK SITE
DMS PROJECT NUMBER 92542
Durham County, North Carolina

Dwn. by.	KRJ
Date:	October 2018
Project:	12-004.19

FIGURE
3

Table 5 — Vegetation Condition Assessment

Little Lick Creek Buffer Restoration

Planted Acreage[1] **8.02**

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	N/A	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage[2] **12.14**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	None	1000 SF	N/A	0	0.00	0.0%
5. Easement Encroachment Areas[3]	None	none	N/A	0	0.00	0.0%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by DMS such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Little Lick Creek (Butler Road)
Vegetation Monitoring Photographs
Taken October 2018

Little Lick Creek (Butler Road)
Fixed-Station Photographs
Taken October 2018

Photo Point 1

Photo Point 2

Photo Point 3

Photo Point 4

Photo Point 5

Appendix C.
Vegetation Plot Data

Table 6. Planted Woody Vegetation
Table 7. Vegetation Plot Success by Project Access Type
Table 8. Total and Planted Stems by Plot and Species

Table 6. Planted Bare Root Woody Vegetation

Species	Quantity
American sycamore *(Platanus occidentalis)*	504
Green ash (*Fraxinus pennsylvanica*)	466
Hackberry (*Celtis laevigata*)	56
Red maple *(Acer rubrum)*	277
River birch (*Betula nigra*)	458
Swamp chestnut oak (*Quercus michauxii*)	310
Tulip Poplar *(Liriodendron tulipifera)*	429
Water oak (*Quercus nigra*)	300
Willow oak (*Quercus phellos*)	254
TOTAL	**3054**

Table 7. 2018 Vegetation Plot Success by Plot Type

Little Lick Creek (#92542)

Plot #	Riparian Buffer Stems[1]	Stream/ Wetland Stems[2]	Live Stakes	Invasives	Volunteers[3]	Total[4]	Unknown Growth Form
1	16	n/a	0	0	13	**29**	0
2	5	n/a	0	0	11	**16**	0
3	5	n/a	0	0	10	**15**	0
4	9	n/a	0	0	40	**49**	0
5	9	n/a	0	0	31	**40**	0
6	8	n/a	0	0	36	**44**	0
7	7	n/a	0	0	56	**63**	0
8	8	n/a	0	0	8	**16**	0

Stem Class	**characteristics**
[1]Buffer Stems	Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.
[2]Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
[3]Volunteers	Native woody stems. Not planted. No vines.
[4]Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Table 8. Total and Planted Stems by Plot and Species
DMS Project Code 92542. Project Name: Little Lick Creek

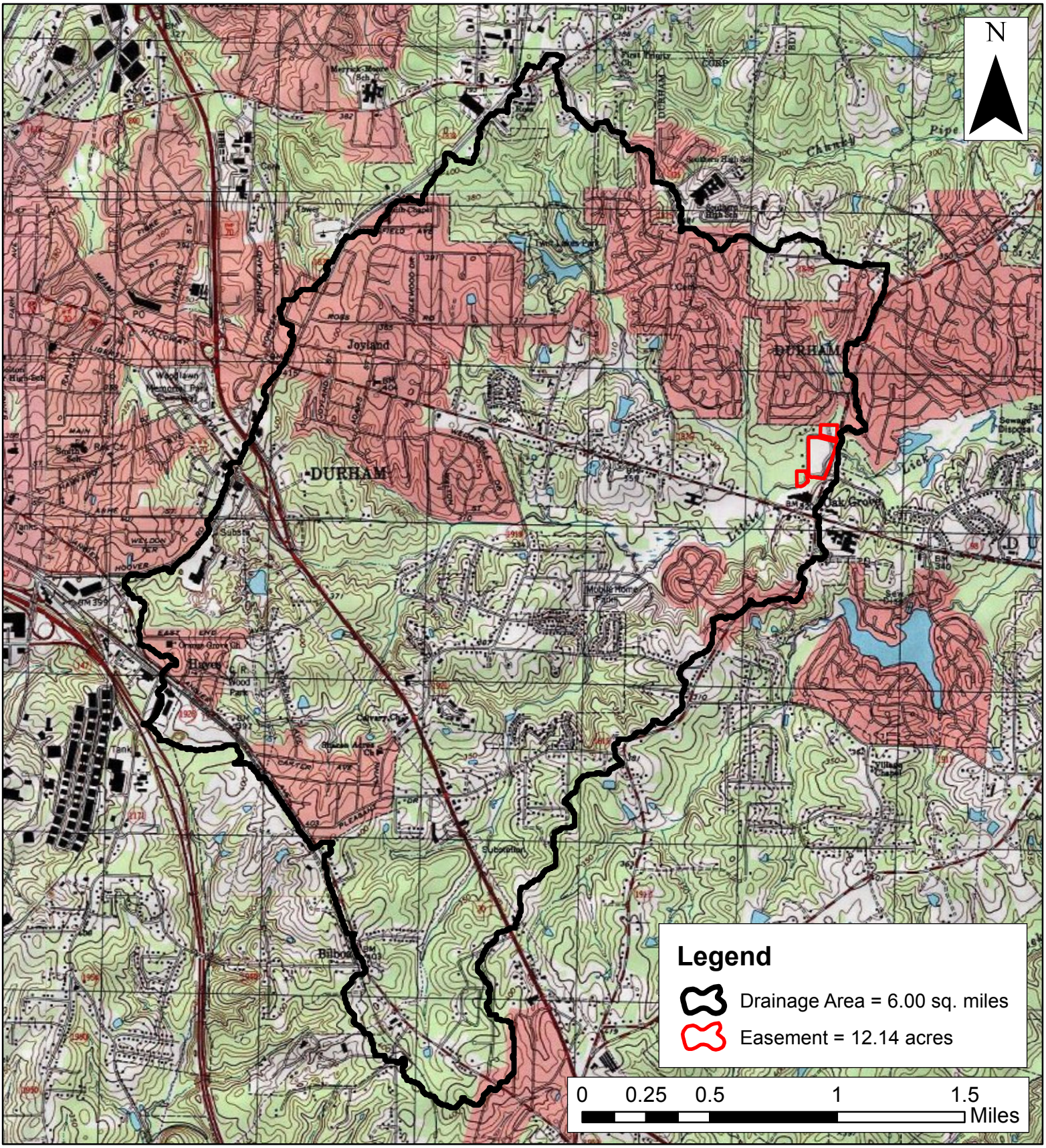
			Current Plot Data (MY5 2018)																								Annual Means																	
			92542-01-0001			92542-01-0002			92542-01-0003			92542-01-0004			92542-01-0005			92542-01-0006			92542-01-0007			92542-01-0008			MY5 (2018)			MY4 (2017)			MY3 (2016)			MY2 (2015)			MY1 (2014)			MY0 (2013)		
Scientific Name	**Common Name**	**Species Type**	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	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree							1	1	1	1	1	1	3	3	3			3			2				5	5	10	7	7	10	6	6	50	6	6	25	7	7	19	7	7	7
Baccharis halimifolia	eastern baccharis	Shrub						1																					1						1									
Betula nigra	river birch	Tree							1	1	1				1	1	1				2	2	2	1	1	1	5	5	5	5	5	5	5	5	5	7	7	7	8	8	8	12	12	12
Carya	hickory	Tree																																							2			
Carya alba	mockernut hickory	Tree																																				1						
Carya glabra	pignut hickory	Tree																																	1									
Cephalanthus occidentalis	common buttonbush	Shrub																																	3									
Cornus amomum	silky dogwood	Shrub															1												1			12			9			22			14			
Diospyros virginiana	common persimmon	Tree			9									4												1			14			35			34			24			55			
Fraxinus pennsylvanica	green ash	Tree	8	8	11	2	2	5	1	1	1			10	1	1	10	4	4	15			28	2	2	8	18	18	88	18	18	128	18	18	91	22	22	89	22	22	111	23	23	23
Liquidambar styraciflua	sweetgum	Tree						2						16			15			22			26						81			168			197			171			139			
Liriodendron tulipifera	tuliptree	Tree																						2	2	3	2	2	3	5	5	5	5	5	5	5	5	5	7	7	7	8	8	8
Pinus taeda	loblolly pine	Tree						1									3												4			5			2									
Platanus occidentalis	American sycamore	Tree	1	1	1				1	1	1				1	1	1	1	1	1	4	4	4	1	1	1	9	9	9	9	9	9	9	9	9	10	10	10	10	10	10	11	11	11
Prunus serotina	black cherry	Tree																														1												
Quercus michauxii	swamp chestnut oak	Tree	5	5	5	1	1	1				2	2	2	2	2	2	1	1	1				2	2	2	13	13	13	14	14	14	14	14	14	19	19	19	20	20	20	20	20	20
Quercus nigra	water oak	Tree	2	2	2	1	1	1	1	1	1	4	4	4				1	1	1							9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	11	11	11
Quercus pagoda	cherrybark oak	Tree																																							1			
Quercus phellos	willow oak	Tree			1	1	1	4				2	2	9	1	1	1	1	1	1	1	1	1				6	6	17	6	6	14	6	6	13	6	6	13	6	6	8	6	6	7
Quercus rubra	northern red oak	Tree																																				1						
Rhus copallinum	flameleaf sumac	shrub									7																		7			6			4						1			
Salix nigra	black willow	Tree						1																					1															
Ulmus alata	winged elm	Tree									3			3			3												9			11			22			4			11			1
Ulmus americana	American elm	Tree																														7			3			19						
		Stem count	16	16	29	5	5	16	5	5	15	9	9	49	9	9	40	8	8	44	7	7	63	8	8	16	67	67	272	73	73	439	72	72	472	84	84	419	89	89	415	98	98	100
		size (ares)	1			1			1			1			1			1			1			1			8			8			8			8			8			8		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.20			0.20			0.20			0.20			0.20			0.20		
		Species count	4	4	6	4	4	8	5	5	7	4	4	8	6	6	10	5	5	7	3	3	6	5	5	6	8	8	16	8	8	16	8	8	18	8	8	15	8	8	15	8	8	9
		Stems per ACRE	647.5	647.5	1174	202.3	202.3	647.5	202.3	202.3	607	364.2	364.2	1983	364.2	364.2	1619	323.7	323.7	1781	283.3	283.3	2550	323.7	323.7	647.5	338.9	338.9	1376	369.3	369.3	2221	364.2	364.2	2388	424.9	424.9	2120	450.2	450.2	2099	495.7	495.7	505.9

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.
Additional Data

Figure 4. Project Watershed Map (USGS Topography)
Figure 5. Project NRCS Soil Survey Map
Preconstruction Photographs



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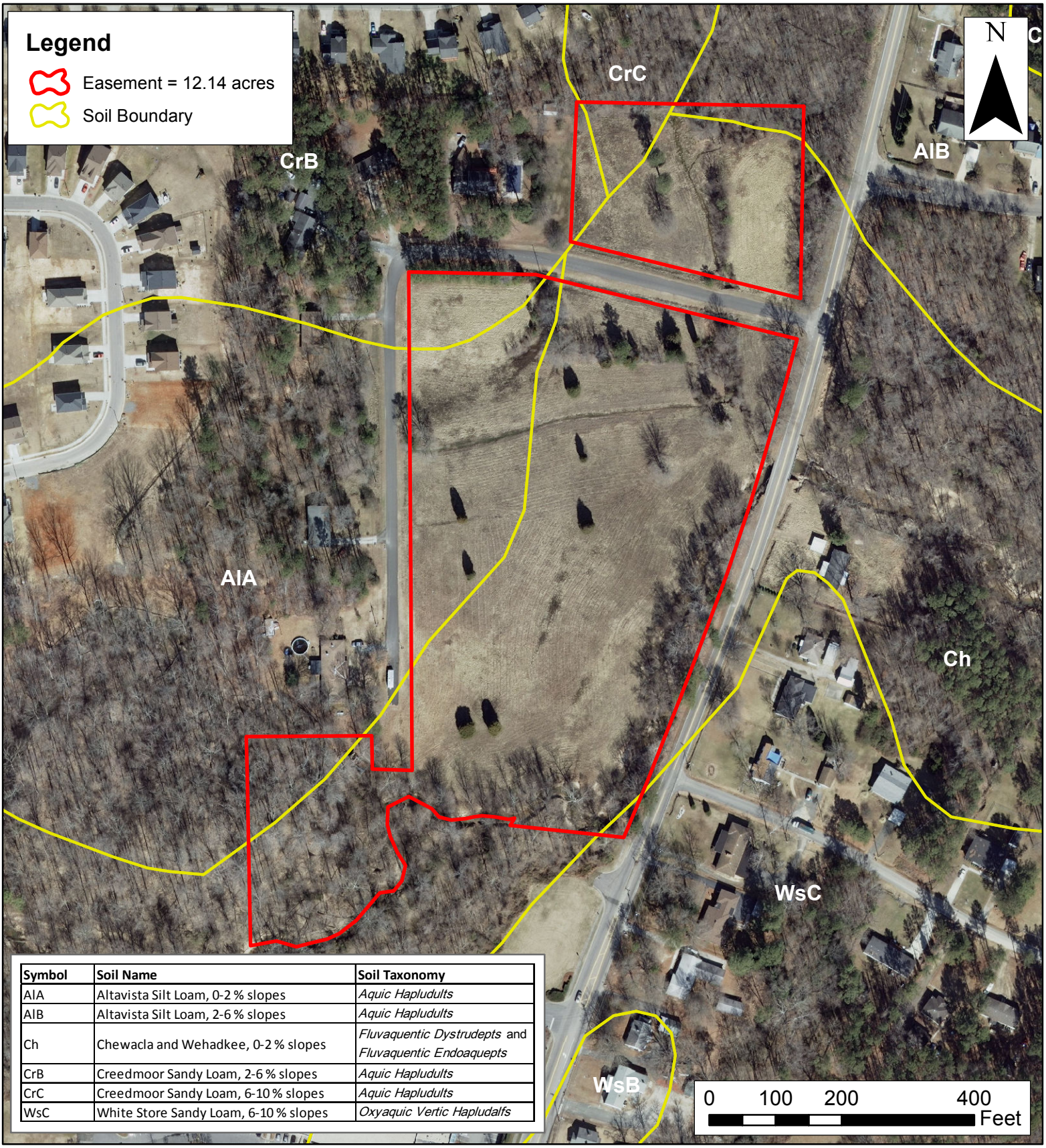
PROJECT WATERSHED MAP
(USGS Topography)
LITTLE LICK CREEK PROJECT
Durham County, North Carolina

Dwn. by. KRJ	FIGURE
Date: January 2013	4
EEP Project: 92542	



Symbol	Soil Name	Soil Taxonomy
AlA	Altavista Silt Loam, 0-2 % slopes	*Aquic Hapludults*
AlB	Altavista Silt Loam, 2-6 % slopes	*Aquic Hapludults*
Ch	Chewacla and Wehadkee, 0-2 % slopes	*Fluvaquentic Dystrudepts* and *Fluvaquentic Endoaquepts*
CrB	Creedmoor Sandy Loam, 2-6 % slopes	*Aquic Hapludults*
CrC	Creedmoor Sandy Loam, 6-10 % slopes	*Aquic Hapludults*
WsC	White Store Sandy Loam, 6-10 % slopes	*Oxyaquic Vertic Hapludalfs*

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PROJECT NRCS SOIL SURVEY MAP
LITTLE LICK CREEK PROJECT
Durham County, North Carolina

Dwn. by. KRJ	FIGURE
Date: January 2013	5
EEP Project: 92542	

Little Lick Creek (Butler Road)
Preconstruction Photographs
Taken January and February 2013