



**MONITORING YEAR 5
ANNUAL REPORT
Final**

MARTIN DAIRY BUFFER MITIGATION SITE

Orange County, NC
NCDEQ Contract No. 006831
DMS Project No. 97087
NCDWR Project No. 2016-0366

Data Collection Period: September 2022
Draft Submission Date: November 1, 2022
Final Submission Date: December 29, 2022

PREPARED FOR:



**NC Department of Environmental Quality
Division of Mitigation Services**
1652 Mail Service Center
Raleigh, NC 27699-1652



December 29, 2022

Jeremiah Dow
N.C. Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

RE: DMS Comments on the MY5 Report
Martin Dairy, Project ID #97087, DMS Contract 6831

Dear Mr. Dow,

We have reviewed the comments on the Monitoring Year 5 Report for the above referenced project dated December 22, 2022 and have revised the report based on these comments. The revised documents are submitted with this letter. Below are responses to each of your comments. For your convenience, the comments are reprinted with our response in italics.

Report

1. In the buffer report, please add a sentence where appropriate stating that the project is being proposed for 2023 closeout.

A statement was added in the buffer report indicating the project is being proposed for 2023 closeout.

Digital Files

2. Please verify that BHR is being calculated using static MY0 Bankfull area, the table submitted indicated variation in bankfull area.

The static MY0 bankfull area was implemented midway through this project. Wildlands did not go back and update the previous monitoring years after the static MY0 bankfull area was implemented. MY3 and MY5 are the only years that use the static MY0 bankfull area.

3. Please submit bankfull events data if available.

The bankfull events have been added to the support files.

4. Please submit vegetation database.

The vegetation database has been added to the support files.



If you have any questions, please contact me by phone (919) 851-9986, or by email (jlorch@wildlandseng.com).

Sincerely,

A handwritten signature in black ink, appearing to read "Jason Lorch".

Jason Lorch, *Monitoring Coordinator*

PREPARED BY:



Wildlands Engineering, Inc.
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Raleigh, NC 27609

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MARTIN DAIRY BUFFER MITIGATION SITE
Monitoring Year 5 Report

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Section 1: PROJECT OVERVIEW

1.1 Project Summary

Wildlands Engineering, Inc. (Wildlands) implemented a full delivery project at the Martin Dairy Mitigation Site (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) to restore a total of 2,135 linear feet of perennial streams in Orange County, NC. The Site included the restoration of two unnamed tributaries (Martin Dairy Creek and UT1). The project also restored 10.139 acres (441,654.84 ft²) of riparian buffer at the Site, which will provide 379,169.358 riparian buffer credits. The project Site was planned, designed, and constructed on land surrounding Martin Dairy Creek and UT1. The Site is located approximately eight miles northeast of Hillsborough, NC and eight miles south of Caldwell, NC (Figure 1) in the Neuse River Basin 8-Digit Hydrologic Unit Code (HUC) 03020201. The project is located within the Neuse River Basin HUC 03020201030030 and NC Division of Water Resources (DWR) Subbasin 03-04-01. The Site drains to Buckwater Creek, which flows to Falls Lake, which is classified as Water Supply Waters (WS-IV) and Nutrient Sensitive Waters (NSW). The 11.155 acre Site is protected with a permanent conservation easement.

The project has been planned, designed, and constructed per the Martin Dairy Mitigation Plan (Wildlands, 2017) and the Consolidated Buffer Mitigation Rule 15A NCAC 02B .0295 (effective November 1, 2015). The purpose of the riparian buffer restoration is to provide riparian buffer credits to compensate for buffer impacts within the HUC 03020201 and the Falls Lake Watershed. The service area for the riparian buffer credits is depicted in Figure 2. The mitigation credits generated from this Site are listed in Table 1 and shown in Figure 3.

1.2 Project Goals and Objectives

Prior to construction activities, the primary degradation on the Site was the original clearing of the Site and channelization of Martin Dairy Creek and UT1. The channelization involved straightening and deepening of the stream (as indicated by the amount of dredge spoil in the floodplain). In the past livestock were grazed on the Site, which contributed to bank sloughing. The restored riparian buffer areas within the Site will aid in protecting water quality.

The main objective of the project was to reduce nitrogen and phosphorus loading to the Neuse River tributaries by establishing a forested riparian buffer on land previously used for agricultural purposes. The riparian buffer will immobilize nutrients, reducing quantities available to downstream aquatic ecosystems in the Neuse River Basin.

The Site is protected with a 11.155 acre conservation easement. Out of the 11.155 acres, 10.139 acres were restored for Neuse River buffer credit and 1.017 acres will not generate buffer mitigation credit. In general, riparian buffer restoration area widths on streams extend out to 200 feet from top of bank for Neuse River buffer credits. Maps detailing the credit generation are provided in Figure 3.

1.3 Monitoring Year 5 Data Assessment

The final mitigation plan was submitted and accepted by DMS in March 2017. Construction activities were completed by Land Mechanic Designs, Inc in July 2017. The planting was completed by Bruton Natural Systems, Inc. in December 2017. The baseline as-built survey for the stream mitigation work was completed by Turner Land Surveying in August 2017 and for the buffer mitigation component in January 2018. Refer to Appendix 1 for detailed project activity, history, contact information, and watershed/site background information.

Vegetative performance for buffer restoration areas will be in accordance with 15A NCAC



02B .0295(n)(2)(B), and (n)(4) (effective November 1, 2015). To meet success criteria, areas generating buffer mitigation credits shall include a minimum of four native hardwood tree species and/or native shrub species, where no one species is greater than 50 percent of stems, and have a survival of 260 planted stems per acre at the end of the required monitoring period (MY5) (no interim success criteria required). In order for the monitoring to be terminated, DWR must provide written approval of vegetation success of the buffer restoration areas generating buffer credit.

1.3.1 Vegetative Assessment

The quantity of monitoring vegetation plots was determined in accordance with the Carolina Vegetative Sampling Protocol (CVS Levels II) such that at least two (2) percent of the Site is encompassed in monitoring plots. A total of eight (8) vegetation plots (10 meters by 10 meters) were randomly established between the conservation easement boundaries and five feet from the top of stream banks. The plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs will be taken at the origin looking diagonally across the plot to the opposite corner on an annual basis. Species composition, density, and survival rates will be evaluated on an annual basis by plot and for the entire site. The extent of invasive species coverage will also be monitored and controlled as necessary.

The MY5 vegetative survey was completed in September 2022. The 2022 vegetation monitoring resulted in an average stem density of 334 stems per acre, which exceeds success criteria of 260 planted stems per acre required at MY5 and 39% less than the baseline density recorded January 2018 (597 stems per acre). There is an average of 9 stems per plot in MY5 compared to 14 stems per plot in MY0. Vegetation plots 6 and 8 did not meet the final success criteria of 260 stems per acre, with vegetation plot 6 having 242 planted stems per acre, and vegetation plot 8 having 202 planted stems per acre. Despite the mortality of planted stems in these plots the number of desirable volunteer species remains high. When accounting for volunteers each of these plots surpass the success criteria with the number of stems per acre totaling 850 and 1,214 respectively. Volunteer species include persimmon (*Diospyros virginiana*), sycamore (*Platanus occidentalis*), and green ash (*Fraxinus pennsylvanica*). Along with a diverse successional canopy developing, the herbaceous vegetation is dense and providing wildlife habitat. The Site is being proposed for 2023 closeout.

To further ensure vegetative success, invasive removal of sporadic populations of Japanese honeysuckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), and Callery pear (*Pyrus calleryana*) was completed across site in April 2022 and will continue to be treated as needed throughout winter 2022.

Due to excessive deer browsing over the monitoring years, Wildlands experimented with capsaicin tablets as a deterrent around the base of each tree on the northeast side of the Site (Figure 4) in April 2022. Based off visual observations the results were mixed and ultimately found to not be an effective treatment on a large scale. Another effort to combat deer browsing and encourage successful tree height was adding soil amendments at the base of each tree in an effort to get the top of the tree above deer browsing level. This was completed along east side of the Site in May 2022 (Figure 4).

Refer to Appendix 3 for vegetation plot criteria attainment data, CVS vegetation plot metadata, and vegetation summary tables and Appendix 2 for vegetation plot photographs, vegetation condition assessment table, and monitoring plan view.

1.4 Monitoring Year 5 Summary

Overall, the 2022 vegetation monitoring data reflects that the Site meets the performance criteria. Although excessive deer browsing had an effect on planted trees, six out of eight vegetation plots met the MY5 success criteria. While the tree mortality rate of planted stems in vegetation plots 6 and 8



increased, the number of volunteer species have also increased. Despite the mortality of planted stems in vegetation plots 6 and 8 the total number of stems per acre and species diversity in each of the plots remains high. When including volunteer species, all vegetation plots meet and exceed performance criteria. In April 2022, an invasive vegetation treatment occurred across the Site to treat sporadic populations of invasive species. The Site will continue to receive follow up invasive treatment in winter 2022. Additionally, in April 2022, Wildlands experimented with capsaicin tablets as a deer deterrent along the northeast side of the project. In May 2022, soil amendments were added across the east side of the project to further combat deer browse and ensure tree height success. Overall, the Site has met its goals of preventing excess nutrients from entering the Falls Lake Water Supply Watershed and Neuse River tributaries. The Site is being proposed for 2023 closeout.

Summary information/data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Mitigation Plan documents available on DMS's website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.



Section 2: REFERENCES

Breeding, R. 2010. Neuse River Basin Restoration Priorities. North Carolina Ecosystem Enhancement Program.

Guidelines for Riparian Buffer Restoration. NC Department of Environment and Natural Resources, Ecosystem Enhancement Program. October 2004.

Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved from <http://www.nceep.net/business/monitoring/veg/datasheets.htm>.

Peet, R.K., T.R. Wentworth and P.S. White. 1998. A flexible, multipurpose method for recording vegetation composition and structure. *Castanea* 63:262-274. <http://cvs.bio.unc.edu/methods.htm>

Schafale, M.P. and Weakley, A.S. 1990. A Classification of the Natural Communities of North Carolina, Third Approximation.

Wildlands Engineering (2017). Martin Dairy Mitigation Site. NCDWR, Raleigh NC. <http://portal.ncdenr.org/web/wq/nutrientbufferbanks>

APPENDIX 1. General Figures and Tables

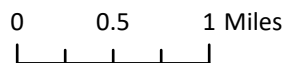
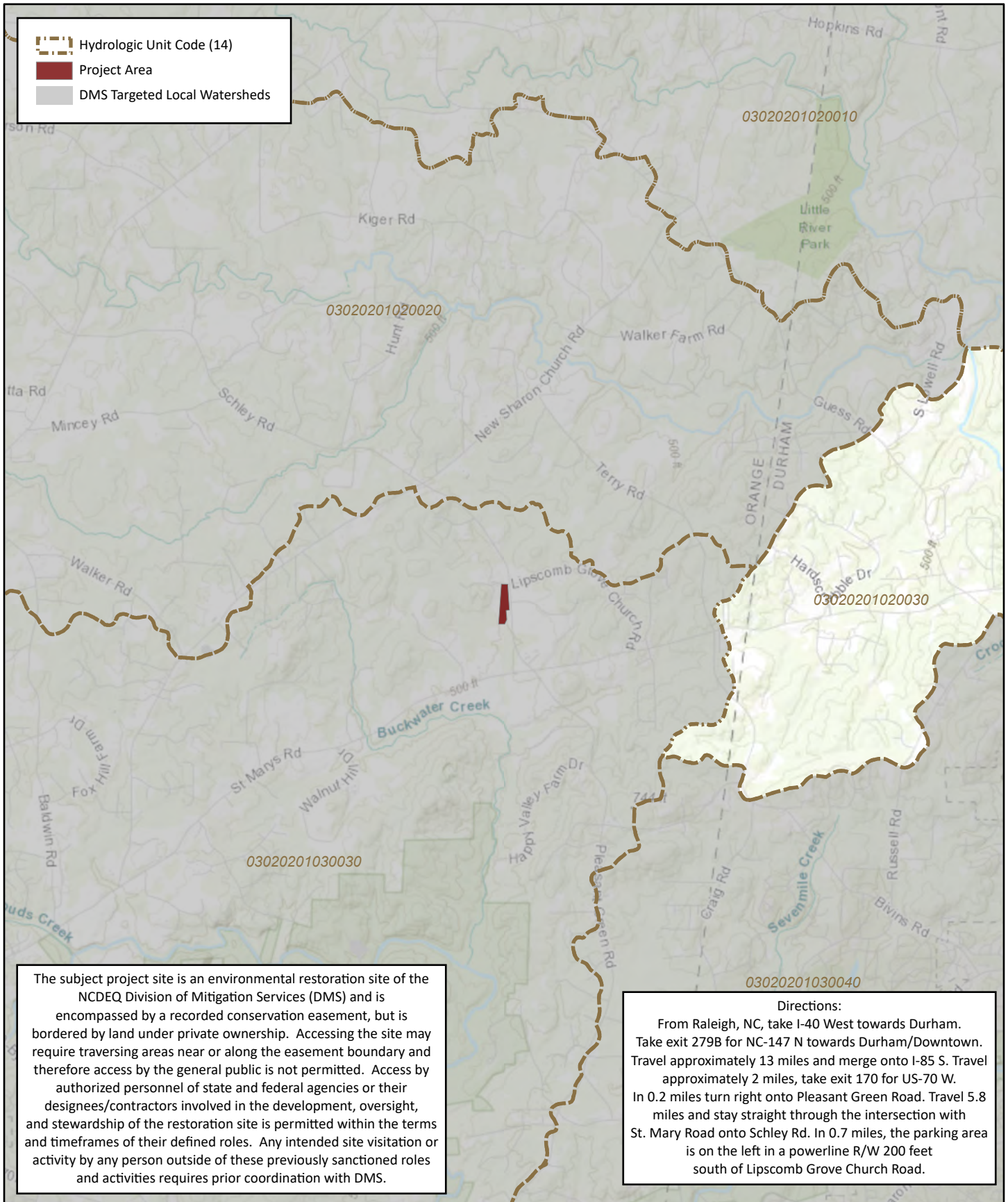
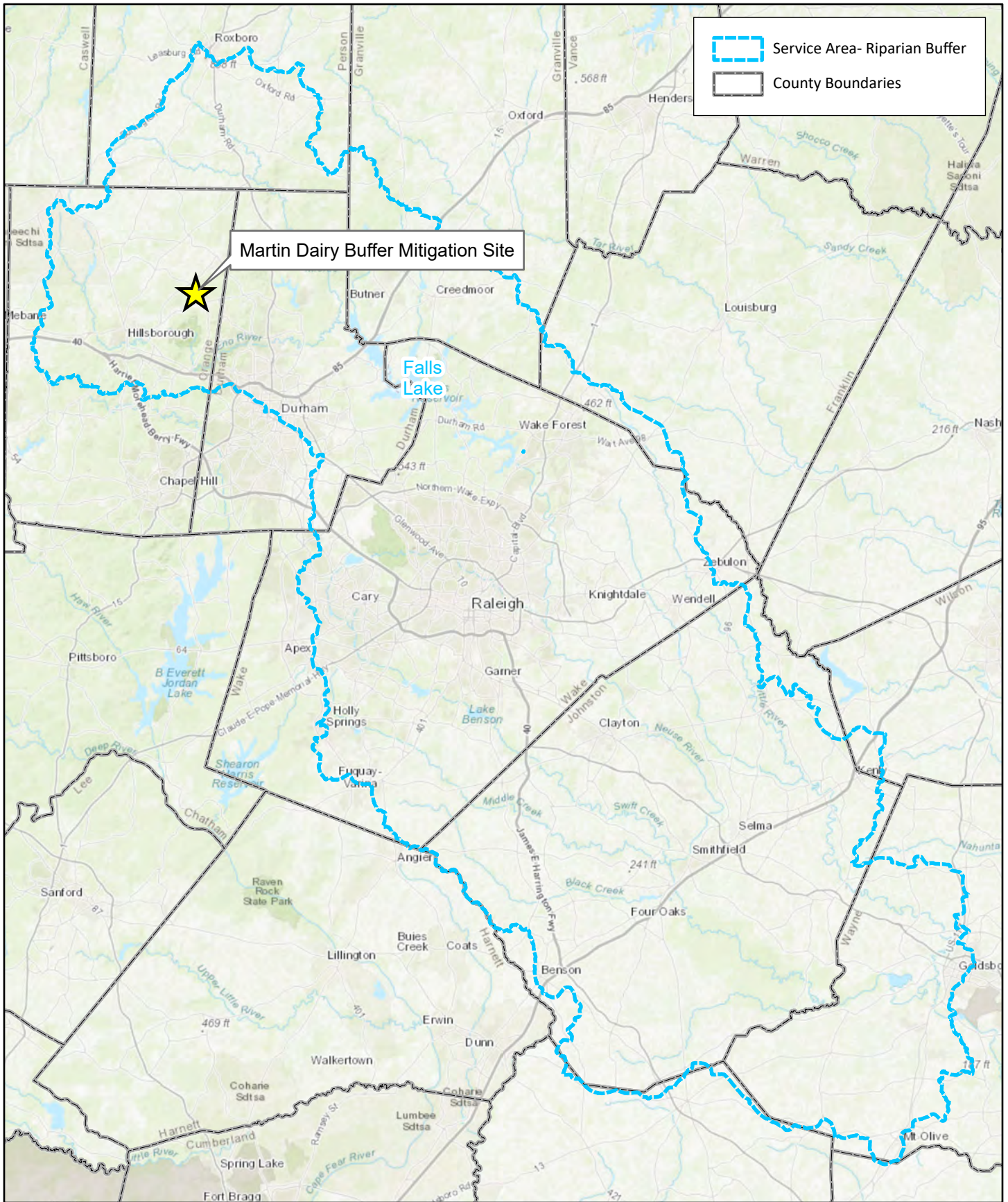




Figure 1. Project Vicinity Map
 Martin Dairy Buffer Mitigation Site
 DMS Project No. 97087
 Monitoring Year 5 - 2022
 Orange County, NC



Martin Dairy Buffer Mitigation Site

Falls Lake

 Service Area- Riparian Buffer
 County Boundaries

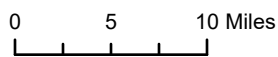


Figure 2. Service Area
 Martin Dairy Buffer Mitigation Site
 DMS Project No. 97087
 Monitoring Year 5 - 2022

Orange County, NC

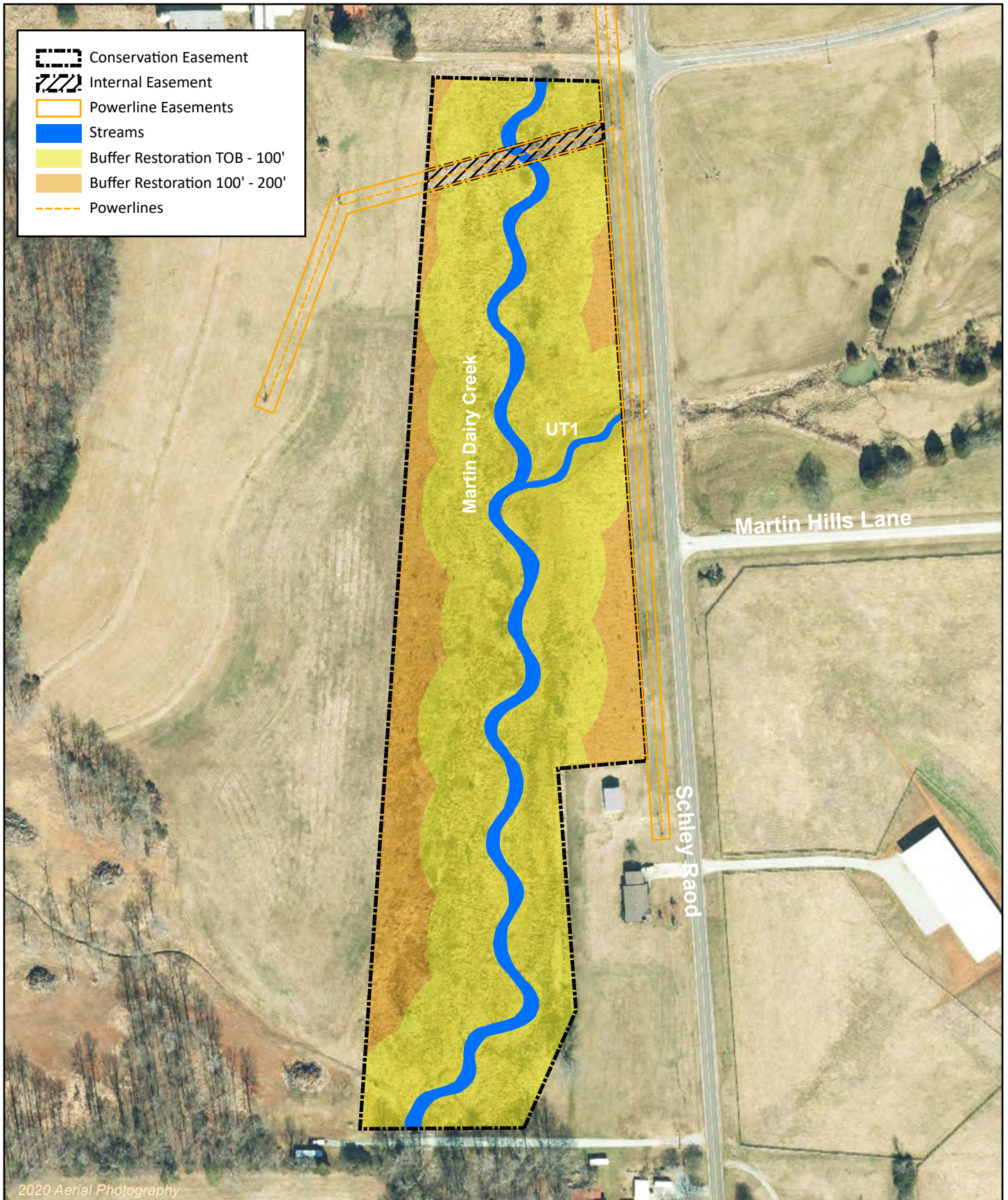


Figure 3. Project Component / Asset Map
 Martin Dairy Buffer Mitigation Site
 DMS Project No. 97087
 Monitoring Year 5 - 2022
 Orange County, NC

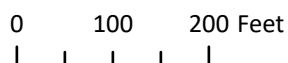


Table 1. Project Components and Mitigation Credits

Martin Dairy Buffer Mitigation Site
 DMS Project No. 97087
 Monitoring Year 5 - 2022

MITIGATION CREDITS												
Riparian Buffer (15A NCAC 02B.0295)											If Converted to Nutrient Offset	
Location	Jurisdictional Streams	Restoration Type	Reach ID /Component	Buffer Width (ft)	Creditable Area (square feet)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Riparian Buffer Credits (BMU)	Convertible to Nutrient Offset (Yes or No*)	Nutrient Offset: N (lbs)	Nutrient Offset: P (lbs)
Rural	Subject	Restoration	Martin Dairy	0-100	348,392.88	1	100%	1.00000	348,392.88	No	0.000	0.000
			Martin Dairy	101-200	93,261.96		33%	3.00000	30,776.45	No	0.000	0.000
SUBTOTALS					441,654.84				379,169.33		0.000	0.000

*Riparian buffer credits are not convertible to nutrient offset because the site was used for hay production and livestock have been removed.

Table 2. Project Activity and Reporting History

Martin Dairy Buffer Mitigation Site
 DMS Project No. 97087
 Monitoring Year 5 - 2022

Activity or Report	Date Collection Complete	Completion or Scheduled
Conservation Easement	N/A	November 2016
Mitigation Plan	March 2017	March 2017
Bare Root Planting	N/A	December 2017
As-Built & Baseline Monitoring Document	January 2018	January 2018
Year 1 Monitoring	September 2018	December 2018
Year 2 Monitoring	September 2019	December 2019
Supplemental Planting		January 2020
Year 3 Monitoring	September 2020	December 2020
Year 4 Monitoring	September 2021	December 2021
Invasive Removal		April 2022
Vegetation Height Management		April-May 2022
Year 5 Monitoring	September 2022	December 2022

Table 3. Project Contact Table

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

Designer Angela Allen, PE	Wildlands Engineering, Inc. 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
Planting Contractor	Bruton Natural Systems, Inc P.O. Box 1197 Fremont, NC 27830
Nursery Stock Suppliers	Dykes and Son Nursery
Monitoring Performers Monitoring, POC	Wildlands Engineering, Inc. Jason Lorch 919.851.9986, ext. 107

Table 4. Project Information and Attributes

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

PROJECT INFORMATION	
Project Name	Martin Dairy Buffer Mitigation Site
County	Orange County
Project Area (acres)	11.155
Planted Area (acres)	10.139
Project Coordinates (latitude and longitude)	36° 7' 25.76"N 79° 0' 14.26"W
PROJECT WATERSHED SUMMARY INFORMATION	
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province
River Basin	Neuse
USGS Hydrologic Unit 8-digit	03020201
USGS Hydrologic Unit 14-digit	03020201030030
DWR Sub-basin	03-04-01
Project Drainage Area (acres)	526.0
Project Drainage Area Percentage of Impervious Area	0.4%
CGIA Land Use Classification	59.0% forested, 40.6% cultivated, 0.40% impervious

Table 5. Adjacent Forested Areas Existing Tree and Shrub Species

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

Common Name	Scientific Name	Wetland Indicator Status
Red Maple	<i>Acer rubrum</i>	FAC
Water Hickory	<i>Carya aquatica</i>	OBL
Sugarberry	<i>Celtis laevigata</i>	FACW
Sweet Pepperbush	<i>Clethra alnifolia</i>	FACW
Swamp Titi	<i>Cyrilla racemiflora</i>	FACW
Persimmon	<i>Diospyros virginiana</i>	FAC
Water Ash	<i>Fraxinus caroliniana</i>	OBL
Deciduous Holly	<i>Ilex decidua</i>	FACW-
Virginia Sweetshrub	<i>Itea virginica</i>	FACW+
Eastern Red Cedar	<i>Juniperus virginiana</i>	FACU-
Sweetgum	<i>Liquidambar styraciflua</i>	FAC+
Yellow Poplar	<i>Liriodendron tulipifera</i>	FAC
Water Tupelo	<i>Nyssa aquatica</i>	OBL
Blackgum	<i>Nyssa sylvatica</i>	FAC
Loblolly Pine	<i>Pinus taeda</i>	FAC
American Sycamore	<i>Platanus occidentalis</i>	FACW-
Willow Oak	<i>Quercus phellos</i>	FACW-
Red Oak	<i>Quercus rubra</i>	FACU
Shumard Oak	<i>Quercus shumardii</i>	FACW-
Black Willow	<i>Salix nigra</i>	OBL

Table 6. Planted Tree Species

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

Common Name	Scientific Name	Number Planted	% of Total
River Birch	<i>Betula nigra</i>	926	16%
Eastern Redbud	<i>Cercis canadensis</i>	58	1%
Flowering Dogwood	<i>Comus florida</i>	58	1%
Green Ash	<i>Fraxinus pennsylvanica</i>	1,042	18%
Tulip Poplar	<i>Liriodendron tulipifera</i>	926	16%
Sycamore	<i>Platanus occidentalis</i>	1,274	22%
Pin Oak	<i>Quercus palustris</i>	811	14%
Willow Oak	<i>Quercus phellos</i>	695	12%
Total		5,790	100%

APPENDIX 2. Visual Assessment Data

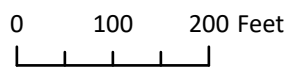
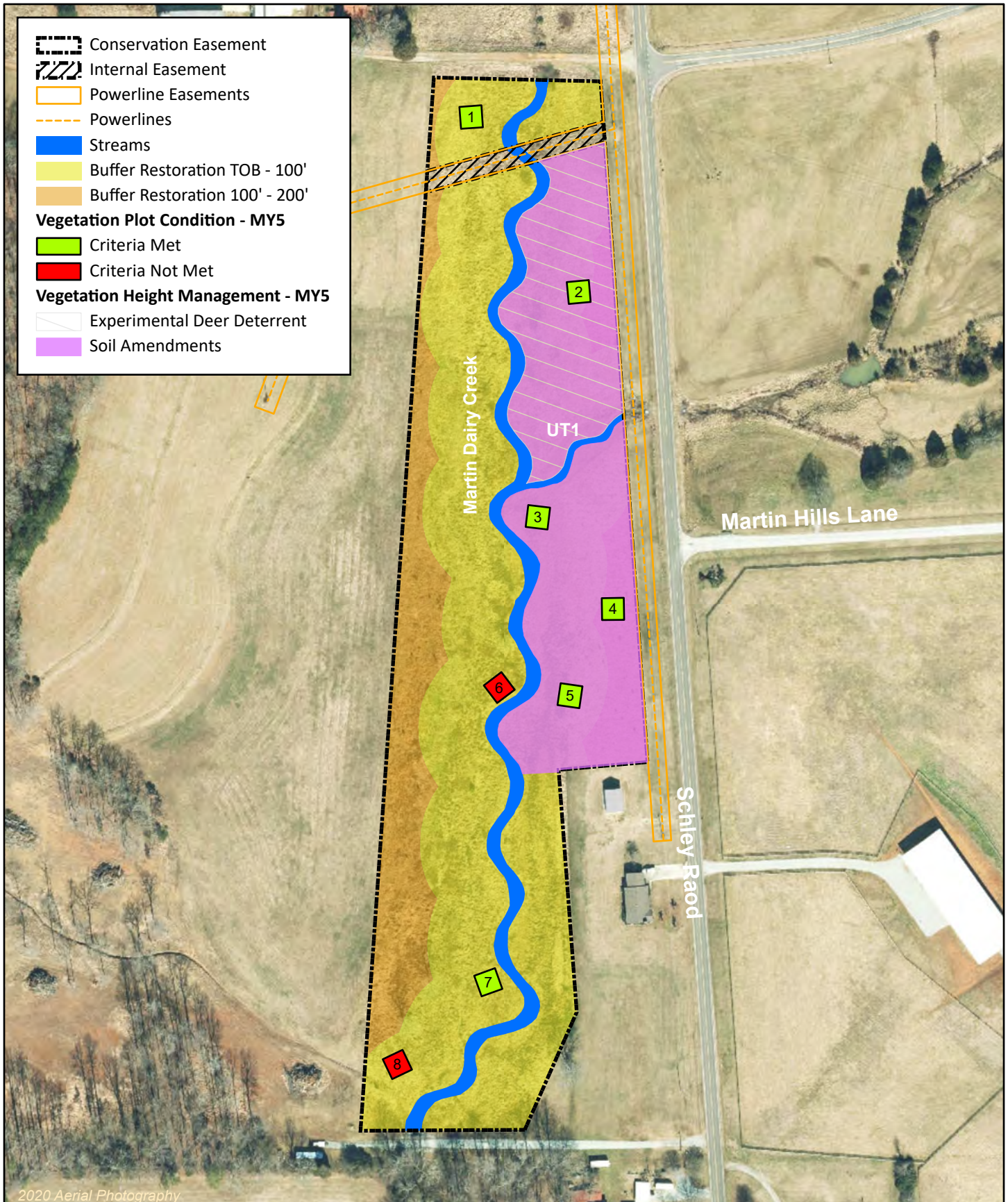


Figure 4. Monitoring Plan View
 Martin Dairy Buffer Mitigation Site
 DMS Project No. 97087
 Monitoring Year 5 - 2022
 Orange County, NC

Table 7. Vegetation Condition Assessment Table

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

Planted Acreage 10.139

Vegetation Category	Definitions	Mapping Threshold (Ac)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0	0	0	0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0	0	0	0%
Total			0	0	0%
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0	0	0	0%
Cumulative Total			0	0	0%

Easement Acreage 11.155

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1,000	0	0	0%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	0	0	0%

VEGETATION PLOT PHOTOGRAPHS



VEG PLOT 1 (09/13/2022)



VEG PLOT 2 (09/13/2022)



VEG PLOT 3 (09/13/2022)



VEG PLOT 4 (09/13/2022)



VEG PLOT 5 (09/13/2022)



VEG PLOT 6 (09/13/2022)



VEG PLOT 7 (09/13/2022)



VEG PLOT 8 (09/13/2022)

APPENDIX 3. Vegetation Plot Data

Table 8a. Vegetation Plot Criteria Attainment Table

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

Plot	Met Success Criteria	Tract Mean
1	Yes	75%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	No*	
7	Yes	
8	No*	

*Vegetation Plots 6 and 8 do not meet the MY5 success criteria of 260 stems per acre. However, when including desirable volunteers, both Vegetation Plots 6 and 8 do meet the MY5 success criteria for 260 stems per acre.

Table 8b. Average Vegetation Height by Plot

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

Average Height by Plot (feet)					
Plot	MY1	MY2	MY3	MY4	MY5
1	2.0	3.3	4.4	5.6	8.3
2	2.0	2.2	2.2	3.2	5.2
3	1.8	2.2	3.7	5.1	7.2
4	2.1	2.8	4.2	5.4	8.0
5	2.3	3.1	4.8	6.4	7.8
6	2.6	4.2	8.2	8.9	16.8
7	1.9	3.2	5.7	7.8	11.0
8	1.9	2.2	3.0	3.2	5.0
Average	1.7	2.3	3.6	4.6	8.6

Graph 1. Vegetation Plot Trends

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

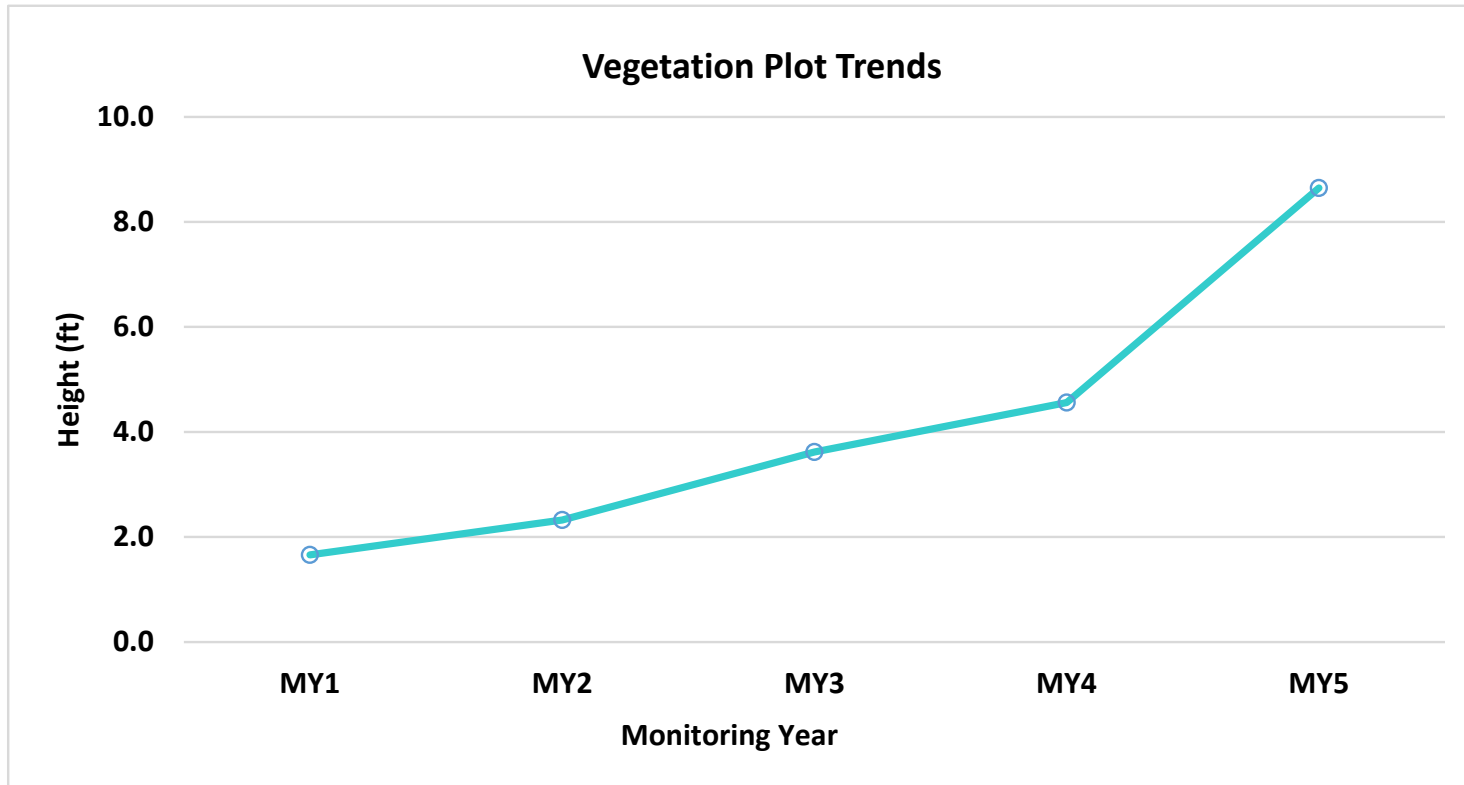


Table 9. CVS Vegetation Tables - Metadata

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

Report Prepared By	Jason Lorch
Date Prepared	9/13/2022 13:15
Database Name	Martin Dairy- cvs-v2.5.0.- MY5.mdb
Database Location	X:\Shared\Projects\W02158_Martin_Dairy\Monitoring\Monitoring Year 5 - 2022\Vegetation Assessment
Computer Name	SAVANNAH2021
File Size	51679232
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	97087
Project Name	Martin Dairy
Description	Stream Restoration Project
Sampled Plots	8

Table 10. Planted and Total Stem Counts

Martin Dairy Buffer Mitigation Site
 DMS Project No. 97087
 Monitoring Year 5 - 2022

Scientific Name	Common Name	Species Type	Current Plot Data (MYS 2022)											
			VP 1			VP 2			VP 3			VP 4		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Baccharis angustifolia</i>	False-willow	Shrub Tree									1			
<i>Baccharis halimifolia</i>	Silverling	Shrub Tree												
<i>Betula nigra</i>	River Birch	Tree	1	1	1	2	2	3	3	3	3	1	1	1
<i>Carya</i>	Hickory	Tree												
<i>Cephalanthus occidentalis</i>	Buttonbush	Shrub Tree												
<i>Cercis canadensis</i>	Eastern Redbud	Shrub Tree												
<i>Cornus amomum</i>	Silky Dogwood	Shrub Tree												
<i>Cornus florida</i>	Flowering Dogwood	Shrub Tree												
<i>Diospyros virginiana</i>	American Persimmon	Tree												
<i>Fraxinus pennsylvanica</i>	Green Ash	Tree	2	2	2	3	3	3	2	2	3	3	3	4
<i>Juglans nigra</i>	Black Walnut	Tree												
<i>Ligustrum sinense</i>	Chinese Privet	Exotic												
<i>Liquidambar styraciflua</i>	Sweet Gum	Tree			4			5			8			4
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree	2	2	2									
<i>Nyssa sylvatica</i>	Black Gum	Tree												
<i>Pinus taeda</i>	Loblolly Pine	Tree			2									
<i>Platanus occidentalis</i>	Sycamore	Tree	2	2	2	2	2	2	2	2	3	2	2	2
<i>Prunus serotina</i>	Black Cherry	Shrub Tree												
<i>Pyrus calleryana</i>	Bradford Pear	Exotic												
<i>Quercus palustris</i>	Pin Oak	Tree										2	2	2
<i>Quercus phellos</i>	Willow Oak	Tree	2	2	2	4	4	4	4	4	4	2	2	2
<i>Quercus rubra</i>	Southern Red Oak	Tree												
<i>Salix nigra</i>	Black Willow	Tree												
<i>Ulmus</i>	Elm	Tree												
<i>Ulmus alata</i>	Winged Elm	Tree												
<i>Ulmus americana</i>	American Elm	Tree												
<i>Ulmus rubra</i>	Slippery Elm	Tree												
Stem count			9	9	15	11	11	17	11	11	22	10	10	15
size (ares)			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02		
Species count			5	5	7	4	4	5	4	4	6	5	5	6
Stems per ACRE			364	364	607	445	445	688	445	445	890	405	405	607

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%
- Volunteers

PnoLS: Number of Planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total Stems

Table 10. Planted and Total Stem Counts

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 5 - 2022

Scientific Name	Common Name	Species Type	Current Plot Data (MYS 2022)											
			VP 5			VP 6			VP 7			VP 8		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Baccharis angustifolia</i>	False-willow	Shrub Tree												
<i>Baccharis halimifolia</i>	Silverling	Shrub Tree												
<i>Betula nigra</i>	River Birch	Tree	2	2	2	1	1	1	1	1	1	1	1	1
<i>Carya</i>	Hickory	Tree												
<i>Cephalanthus occidentalis</i>	Buttonbush	Shrub Tree												
<i>Cercis canadensis</i>	Eastern Redbud	Shrub Tree												
<i>Cornus amomum</i>	Silky Dogwood	Shrub Tree												
<i>Cornus florida</i>	Flowering Dogwood	Shrub Tree												
<i>Diospyros virginiana</i>	American Persimmon	Tree						12			2			5
<i>Fraxinus pennsylvanica</i>	Green Ash	Tree	1	1	1	1	1	4	1	1	3	2	2	5
<i>Juglans nigra</i>	Black Walnut	Tree												
<i>Ligustrum sinense</i>	Chinese Privet	Exotic												
<i>Liquidambar styraciflua</i>	Sweet Gum	Tree												
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree												
<i>Nyssa sylvatica</i>	Black Gum	Tree												
<i>Pinus taeda</i>	Loblolly Pine	Tree												
<i>Platanus occidentalis</i>	Sycamore	Tree	4	4	4	4	4	4	4	4	4	2	2	19
<i>Prunus serotina</i>	Black Cherry	Shrub Tree	1	1	1									
<i>Pyrus calleryana</i>	Bradford Pear	Exotic												
<i>Quercus palustris</i>	Pin Oak	Tree												
<i>Quercus phellos</i>	Willow Oak	Tree							1	1	1			
<i>Quercus rubra</i>	Southern Red Oak	Tree												
<i>Salix nigra</i>	Black Willow	Tree			2									
<i>Ulmus</i>	Elm	Tree												
<i>Ulmus alata</i>	Winged Elm	Tree												
<i>Ulmus americana</i>	American Elm	Tree												
<i>Ulmus rubra</i>	Slippery Elm	Tree												
Stem count			8	8	10	6	6	21	7	7	11	5	5	30
size (ares)			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02		
Species count			4	4	5	3	3	4	4	4	5	3	3	4
Stems per ACRE			324	324	405	243	243	850	283	283	445	202	202	1,214

Color for Density

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

PnoLS: Number of Planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total Stems

Table 10. Planted and Total Stem Counts

Martin Dairy Buffer Mitigation Site
 DMS Project No. 97087
 Monitoring Year 5 - 2022

Scientific Name	Common Name	Species Type	Annual Means																	
			MY5 (2022)			MY4 (2021)			MY3 (2020)			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
<i>Baccharis angustifolia</i>	False-willow	Shrub Tree			1															
<i>Baccharis halimifolia</i>	Silverling	Shrub Tree						3												
<i>Betula nigra</i>	River Birch	Tree	11	11	12	13	13	14	12	12	18	14	14	14	16	16	16	17	17	17
<i>Carya</i>	Hickory	Tree									1									
<i>Cephalanthus occidentalis</i>	Buttonbush	Shrub Tree											12				8			
<i>Cercis canadensis</i>	Eastern Redbud	Shrub Tree												1	1	1	3	3	3	
<i>Cornus amomum</i>	Silky Dogwood	Shrub Tree						5												
<i>Cornus florida</i>	Flowering Dogwood	Shrub Tree									4				2	2	2	2	2	
<i>Diospyros virginiana</i>	American Persimmon	Tree			19															
<i>Fraxinus pennsylvanica</i>	Green Ash	Tree	15	15	25	14	14	71	15	15	83	15	15	45	17	17	29	18	18	18
<i>Juglans nigra</i>	Black Walnut	Tree						1												
<i>Ligustrum sinense</i>	Chinese Privet	Exotic						1			1									
<i>Liquidambar styraciflua</i>	Sweet Gum	Tree			21			26			9			9			2			
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree	2	2	2	4	4	4	4	4	4	5	5	7	7	7	7	19	19	19
<i>Nyssa sylvatica</i>	Black Gum	Tree						18			24									
<i>Pinus taeda</i>	Loblolly Pine	Tree			2			4												
<i>Platanus occidentalis</i>	Sycamore	Tree	22	22	40	22	22	36	22	22	29	22	22	27	24	24	25	25	25	25
<i>Prunus serotina</i>	Black Cherry	Shrub Tree	1	1	1															
<i>Pyrus calleryana</i>	Bradford Pear	Exotic						3			2			3						
<i>Quercus palustris</i>	Pin Oak	Tree	2	2	2	2	2	2	3	3	3	12	12	12	16	16	16	20	20	20
<i>Quercus phellos</i>	Willow Oak	Tree	13	13	13	19	19	19	15	15	15	12	12	12	14	14	14	14	14	14
<i>Quercus rubra</i>	Southern Red Oak	Tree									1									
<i>Salix nigra</i>	Black Willow	Tree			2			2			2									
<i>Ulmus</i>	Elm	Tree											2			1				
<i>Ulmus alata</i>	Winged Elm	Tree						1												
<i>Ulmus americana</i>	American Elm	Tree						1												
<i>Ulmus rubra</i>	Slippery Elm	Tree						7			6									
Stem count			66	66	140	74	74	218	71	71	202	80	80	143	97	97	121	118	118	118
size (ares)			8			8			8			8			8			8		
size (ACRES)			0.20			0.20			0.20			0.20			0.20			0.20		
Species count			7	7	12	6	6	18	6	6	15	6	6	10	8	8	11	8	8	8
Stems per ACRE			334	334	708	374	374	1,103	359	359	1,022	405	405	723	491	491	612	597	597	597

Color for Density

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

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T: Total Stems

APPENDIX 4. Overview Photos



