

# THUNDER MITIGATION SITE

**Year 1 (2023) Monitoring Report**  
**Wayne County, North Carolina**  
**Neuse River Basin - 03020201**

DMS Project ID No. 100185  
Full Delivery Contract No. 0402-02  
DWR Project No. 2021 0018 v3  
RFP No. 16-20200402



Prepared for:



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

MY1 Data Collected: November 2023  
Date Submitted: February 2024



**Response to DMS Comments – MY1 (2023)**

Thunder Mitigation Site, Project ID #100185, DMS Contract #0402-02  
DWR Project No. 2021-0018 v3  
Neuse River Basin 03020201, Wayne County  
DMS Reviewers: Emily Dunnigan

Comments Received (Black Text) & Responses (Blue Text):

1. Pg. 6, Section 4.4: Please update “were used” to “will be used” in the last sentence.  
Response: The last sentence has been updated to read “will be used”.
2. Pg. 6, Section 4.4: Please italicize all scientific names.  
Response: Scientific names were italicized.
3. Figure 2: Please include the Phase B easement on the figure.  
Response: The phase B easement was added to the CCPV.
4. Figure 2: Please make the symbology for streams vs ditches different.  
Response: The symbology in the CCPV was updated in accordance with the NCDWR buffer viability letter. Streams are depicted in blue, ephemeral features in pink, and ditches in orange.
5. Please provide documentation of completed MY0 boundary inspection comment action items.  
Response: A response to the MY0 boundary inspection action items was added as Appendix C.
6. Please include the buffer credit table excel spreadsheet in the digital submittal.  
Response: The MY0 Buffer Credit Table – excel spreadsheet was added to the digital submittal.

## Thunder Year 1, 2023 Monitoring Summary

### General Notes

- Encroachment by the tenant farmer occurred in multiple locations around the Site totaling 0.7 acres. Restoration Systems (RS) met with the tenant farmer to remediate the encroached areas. RS added extra t-post and horse tape along encroached boundaries. RS replanted these areas in Q1 2024 with mitigation plan-approved species while planting the Thunder Phase B Site. Upgraded, high-visibility markings were installed around both Thunder and Thunder Phase B sites to prevent encroachment from occurring in Q1 2024 as well.
- No evidence of nuisance animal activity (i.e., heavy deer browsing, beaver activated, etc.) was observed.

### Vegetation

- Measurements of the 15 vegetation plots resulted in an average of 413 planted stems/acre. Fourteen of the fifteen individual plots met success criteria. Plot 5 was just 2 stems shy of meeting success criteria.

### Site Maintenance Report (2023)

Invasive Species Work	Maintenance work
5/24/23 Chinese privet, Chinaberry	06/15/23 – Additional t-post, easement signs, and horse tape were added to encroachment areas.
9/7/23 Chinese privet, Chinaberry	10/17/23 – Additional t-post and easement signs were added to encroachment area.

**FINAL  
MY1 (2023) MONITORING REPORT**

**THUNDER MITIGATION SITE**

Wayne County, North Carolina  
Neuse River Basin  
Cataloging Unit 03020201

DMS Project ID No. 100185  
Full Delivery Contract No. 0402-02  
DWR Project No. 2021 0018 v3  
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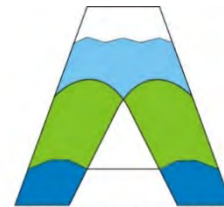


**Prepared by:**



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## 1.0 Mitigation Project Summary

Restoration Systems (RS) is pleased to provide the North Carolina Division of Mitigation Services (NC DMS) this **Year 1 Monitoring Report** for the **Thunder Mitigation Site (hereafter referred to as the "Project" or "Site")**. The Project has been implemented in accordance with State Rules 15A NCAC 02B .0295 (Consolidated Buffer Mitigation Rule – CMB Rule) to provide Neuse River Riparian Buffer Credits (RBC) and 15A NCAC 02B .0703 (Nutrient Offset Credit Trading Rule) to provide Neuse River Nutrient Offset Credits (NOC) for impacts within the Neuse River Basin USGS 8-digit HUC 03020201, excluding the Falls Lake Watershed. The Site is located within the warm waters of the United States Geological Society (USGS) Hydrologic Unit 03020201-170030 and NC DWR subbasin 03-04-12. The permanent conservation easement encompasses 41.78 acres within a single 78-acre track and provides 798,603.622 RBCs (Available RBC) and 724.903 lbs nitrogen NOCs (Available NOC). Additionally, 772,067.922 RBCs can potentially be converted to 41,540.101 lbs nitrogen NOCs at the request of NCDMS. The Project provides the State with the Available RBC while permanently protecting the restored riparian area and preserving the forested Thunder Swamp floodplain, a mapped FEMA Floodway (Map 3720256300K, Panel 2563, effective June 20, 2018).

Located in Wayne County, North Carolina, the Project encompasses 41.78 acres, of which 18.592 acres were in crop production, remaining area includes existing hardwood forest and water features. The Project restored the riparian buffer areas along five (5) unnamed tributaries and preserved the established riparian buffer along Thunder Swamp. Additionally, a mitigation bank parcel has been established adjacent to the project conservation easement, restoring 13.49 additional acres of riparian buffer area in the 101-200 feet from TOB zone. Detailed project mapping is provided in Appendix A, along with site-specific data in Appendix B.

The parcels were acquired by RS through a fee-simple purchase agreement with the former landowners (Betty Carraway and Myrtle Mangum) effective July 1, 2021. Following the purchase, RS assigned a conservation easement to the State Property Office recorded September 2, 2021.

A DWR representative conducted an on-site stream determination on January 21, 2021. A Stream Determination letter was provided on February 26, 2021. Further, A DWR representative conducted a Site Viability visit on March 24, 2021, and provided an approval letter on April 13, 2021.

RS began preparation for restoration of the riparian buffer by filling in two existing ditches and stabilizing eroding banks in November 2022 and then planting the Site in February 2023. Riparian buffer restoration activities included bank stabilization at 9 locations, treatment of herbaceous vegetation, live-stake planting, bare-root planting, and broadcast application of a permanent seed mix. On February 15, 2023, Axiom Environmental installed fifteen (15) Carolina Vegetation Survey (CVS) monitoring plots and collected as-built data. On November 1, 2023, Axiom Environmental returned to the site and collected monitoring year 1 (2023) vegetation data (Appendix B).

### 1.1 Project Goals and Objectives

The primary goals of the proposed nutrient offset project are to provide ecological and water quality enhancements to the Neuse River Basin by restoring the riparian area to create a functional riparian corridor. The Site is not located within a watershed planning unit but addresses watershed goals outlined by the Neuse River Basin Restoration Priorities (RBRP) report (NCEEP 2010 amended 2018). Table 1 summarizes the RBRP goals and provides site-specific objectives to address the RBRP goals. Specific enhancements to water quality and ecological processes are outlined in Table 1.

**Table 1. Ecological and Water Quality Goals**

<b>Goal</b>	<b>Objective</b>
Decrease nutrient levels	Nutrient input will be decreased by filtering runoff from the agricultural fields through restored riparian buffer zones. The off-site nutrient input will also be absorbed on-site by filtering flood flows through restored floodplain areas, where flood flows can disperse through native vegetation.
Decrease sediment input	Sediment from off-site sources will be captured by deposition on restored floodplain areas where native vegetation will slow overland flow velocities.
Decrease water temperature and increase dissolved oxygen concentrations	Planted riparian trees will shade the streams as they mature, reducing thermal pollution.
Create appropriate terrestrial habitat	Buffer areas will be restored by planting native vegetation.
Permanently protect the project Parcel from harmful uses	A permanent conservation easement will be recorded, protecting the Parcel's assets in perpetuity.

Ecological and water quality goals will be achieved by restoring 18.592 acres of forested riparian buffer and preserving 23.103 acres of existing riparian forest, including 13.9 acres of the FEMA Regulated Floodway along Thunder Creek.

### 1.2 Pre-construction Site Conditions

The Project encompasses 41.78 acres of which 18.592 acres were in crop production. The remaining area includes existing hardwood forest and water features. The Project will restore the riparian buffer areas along five (5) unnamed tributaries and preserve the established riparian buffer along Thunder Swamp. Detailed project mapping is provided in Appendix A.

Intensive agriculture practices existed across all proposed restoration areas. Agricultural fields within and adjacent to the Site were subject to routine fertilizer and herbicide applications. Site streams and ditches exhibited bank erosion due to long-term plowing and removal of native vegetation throughout the proposed restoration areas. Thunder Swamp is a braided stream system within an old-growth forest. Historic imagery dating back to 1959 indicates that land management practices are consistent with the Site's conditions prior to restoration (Restoration Systems, 2022).

Site tributaries ("features") two, four, and five originate less than one (1) mile south of NC HWY 55. Tributaries one and three originate on-site. All tributaries drain to Thunder Swamp.

### **2.0 Determination of Credits**

Within the 41.78-acre Site, 18.592 acres of agricultural fields historically used for row crops have been planted for riparian buffer restoration. The primary goals associated with restoring riparian areas within the Site will improve water quality, enhance flood attenuation, and restore wildlife habitat. These goals are being achieved by restoration of the 18.592 acres of forested riparian buffer and preserving a total of 23.103 acres of existing forest (6.091 acres eligible for riparian buffer preservation credit) and water

features, including 13.9 acres of the FEMA Regulated Floodway along Thunder Creek. Mitigation credits are presented in Table 8 and Figure 2 in Appendix A and are based upon the as-built survey.

### 3.0 Baseline Restoration Activities Summary

Riparian area restoration involved planting appropriate native tree species along the 200-foot-wide riparian corridor of streams and hydrologically connected ditches at a density of 680 stems per acre on 8ft x 8ft spacing. Vegetation management and herbicide applications may be needed over the first few years of tree establishment in the riparian restoration areas to prevent encroachment of undesirable species that may out-compete the planted native vegetation. Tree species planted across the riparian areas of the Parcel included those listed in Table 3. Stems were mixed prior to planting to ensure diversity of bare roots across the planted area. A seed mix including the species listed in Table 4 was applied to provide temporary and permanent ground cover for soil stabilization and reduction of sediment loss during rain events in areas without existing herbaceous cover. Planting took place on February 6, 2023.

**Table 2. Restoration Plan Activities**

Restoration Plan Activity	Phase Specific Actions
Ditch Fill & Bank Stabilization	<ol style="list-style-type: none"> <li>1. Two existing ditches were backfilled to create diffuse flow through the restored riparian buffer</li> <li>2. Stream banks were stabilized at nine locations along Features 4 and 5 by sloping the eroding banks back to a 3:1 slope, areas were further stabilized with erosion control matting, temporary and permanent seeding establishment, and planted live-stakes along with bare-root stems</li> </ol> <p>Total disturbed area = 0.453 acres</p>
Riparian Restoration	<ol style="list-style-type: none"> <li>1. Parcel-wide soil preparation herbaceous vegetation treatment ahead of planting</li> <li>2. Establishment of a native herbaceous community via site-specific seed mix (Table 4)</li> <li>3. Establishment of 18.592 acres of native hardwood forest via the planting of bare-root saplings from the top of the bank to the conservation easement boundary (Table 3)</li> </ol>

#### 3.1 Riparian Area Restoration Activities

Restoration of the riparian area allows for recolonization and expansion of characteristic species across the landscape. The riparian areas were restored according to the Consolidated Buffer Mitigation Rule 15A NCAC 02B.0295. Prior to planting a cover crop was planted to improve soil health, and by doing so it was determined that soil ripping and testing was not needed to facilitate restoration of the native hardwood forest. The planting plan for the riparian restoration area included planting 13,050 native bare-root hardwood saplings across 18.592 acres at a density of +/- 701 stems per acre. In addition, 600 live stakes were planted for stream bank stabilization where necessary. The planted species composition is intentionally diverse and while based on these communities, also accounted for local observations and nursery availability.

All species were selected based on their ability for: sediment stabilization, rapid growth rate, withstanding hydraulic forces associated with flood events, suitability to specific soil types, and Project conditions. Tree species were mixed thoroughly before planting to provide a diverse and random plant across the Site. Planting density was set to ensure sufficient diversity and density of planted stems outlined in Rule 15A



NCAC 02B.0295 of 260 trees per acre at the end of five years. No one tree species was greater than 50% of the established stems.

The bare root planting list is provided in Table 3 followed by the permanent seed mix in Table 4. Year 1 vegetation data is provided in Appendix B.

**Table 3. Planting List**

Vegetation Association		Coastal Plain Bottomland Hardwood		Dry Mesic Oak-Hickory Mixed Forest		Bank Stabilization (Live Stakes)		Total # Planted
Species	Indicator Status	# planted	% of total	# planted	% of total	# planted	% of total	
River birch ( <i>Betula nigra</i> )	FACW	700	15%					700
Black gum ( <i>Nyssa Sylvatica</i> )	FAC	<del>435</del> 420	<del>10</del> 9%	830	10%			1,250
Bitternut hickory ( <i>Carya cordiformis</i> )	FAC	450	10%					450
American elm ( <i>Ulmus americana</i> )	FAC	<del>220</del> 300	<del>5</del> 7%					300
Red bud ( <i>Cercis canadensis</i> )	UPL			850	10%			850
Persimmon ( <i>Diospyros virginiana</i> )	FAC			450	5%			450
Hackberry ( <i>Celtis occidentalis</i> )	FACU			850	10%			850
Green ash ( <i>Fraxinus pennsylvanica</i> )	FACW	250	5%					250
Sycamore ( <i>Platanus occidentalis</i> )	FAC	450	10%	1,250	15%			1,700
Tulip poplar ( <i>Liriodendron tulipifera</i> )	FACU	450	10%	850	10%			1,300
Red mulberry ( <i>Morus rubra</i> )	FACU			450	5%			450
Water oak ( <i>Quercus nigra</i> )	FACW	<del>435</del> 420	<del>10</del> 9%	830	10%			1,250
Swamp Chestnut oak ( <i>Quercus michauxii</i> )	FACW	<del>435</del> 500	<del>10</del> 11%					500
Red oak ( <i>Quercus rubra</i> )	FACU			1,250	15%			1,250
Willow oak ( <i>Quercus phellos</i> )	FACW	650	<del>15</del> 14%	850	10%			1,500
Black willow ( <i>Salix nigra</i> )	OBL					300	50%	300
Silky dogwood ( <i>Cornus amomum</i> )	OBL					300	50%	300
<b>TOTAL</b>		4,590	100%	8,460	100%	600	100%	<b>13,650</b>

Note: Table text in RED indicates a change from the mitigation plan based on plant availability.

**Table 4. Permanent Seed**

Permanent Seed					
Species*	%	Species*	%	Species*	%
<i>Achillea millefolium</i>	2	<i>Desmodium canadense</i>	2	<i>Liatris spicata</i>	1
<i>Baptisia australis</i>	3	<i>Dicanthelium clandestinum</i>	5	<i>Monarda fistulosa</i>	1
<i>Carex vulpinoidea</i>	1	<i>Echinacea purpurea</i>	6	<i>Panicum rigidulum</i>	0.5
<i>Chamaecrista fasciculata</i>	2	<i>Elymus virginicus</i>	5	<i>Penstemon digitalis</i>	2
<i>Chamaecrista nictitans</i>	2	<i>Eupatorium coelestinum</i>	1	<i>Rudbeckia amplexicaulis</i>	2
<i>Chrysanthemum leucanthemum</i>	5.5	<i>Eupatorium perfoliatum</i>	1	<i>Rudbeckia hirta</i>	4
<i>Chrysanthemum maximum</i>	4	<i>Gaillardia perennial</i>	3	<i>Schizachyrium scoparium</i>	5
<i>Coreopsis lanceolata</i>	5	<i>Helianthus angustifolius</i>	2	<i>Senna hebecarpa</i>	1
<i>Coreopsis tintoria</i>	5	<i>Heliopsis helianthoides</i>	2	<i>Trident flavus</i>	18
<i>Cosmos bipinnatus</i>	2	<i>Hibiscus mocheutos</i>	1	<i>Verbena hastata</i>	2
<i>Delphinium ajacis</i>	3	<i>Lespedeza capitata</i>	1		
<b>Total</b>					<b>100</b>

**4.0 Monitoring Protocol & Success Criteria**

**4.1 Monitoring Protocol**

Restoration monitoring procedures for vegetation will monitor plant survival and species diversity. Fifteen permanent 10 x 10-meter vegetation plots were installed for quantitative sampling as outlined in the *CVS Level 1-2 Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) (Figures 2A-B, Appendix A). Vegetation monitoring will occur no earlier than Fall of each year. A reference photo will be taken from the origin point of each plot. All planted stems in the plots will be marked with flagging tape and recorded. Data collected will include species, height, planting type (planted stem and/or volunteer) and vigor. Per the latest NCDWR guidance, the height of each individual planted stem and average vigor (by plot) will be reported during years 1, 3, and 5. Monitoring of the restoration efforts will be performed for five years or until success criteria are fulfilled. Monitoring will be conducted by Axiom Environmental, Inc based on the schedule in Table 5. A summary of monitoring is outlined in Table 6. Annual monitoring reports will be submitted to the NCDMS by Restoration Systems no later than December 1 of each monitoring year data.

Year 1 (2023) data was collected on November 1-2, 2023, by Axiom Environmental and derived an average planted stem density of 413 stems per acre. Additionally, all but one of the individual plots met success criteria. Plot 5 was just 2 stems shy of meeting success criteria. Appendix B includes Year 1 (2023) vegetation plot photographs along with planted and total stem counts.

**Table 5. Monitoring Schedule**

Resource	Year 1	Year 2	Year 3	Year 4	Year 5
Vegetation (2% of planted area)	x	x	x	x	x
Visual Assessment (100% of Site)	x	x	x	x	x
Report Submittal	x	x	x	x	x

**Table 6. Monitoring Summary**

Vegetation Parameters				
Parameter	Method	Schedule/ Frequency	Number/ Extent	Data Collected/Reported
Vegetation	15 Permanent vegetation plots 0.0247 acre (100 square meters) in size; <i>CVS-EEP Protocol for Recording Vegetation, Version 4.2</i> (Lee et al. 2008).	As-built (MY 0), MY 1, 2, 3, 4, and 5	15 plots across the restoration portion of the Site	Species, height, vigor, planted vs. volunteer, stems/acre. Reference photo at each monitoring plot.

**4.2 Success Criteria**

Success criteria will be based on the survival of planted species at a density of 260 stems per acre after five years of monitoring.

**Table 7. Success Criteria**

Vegetation
<ul style="list-style-type: none"> <li>• Within planted portions of the Site, in accordance with Rule 15A NCAC 02B .0295:               <ul style="list-style-type: none"> <li>a) a minimum of 260 stems per acre must be present at year 5, and</li> <li>b) a minimum of four native hardwood and native shrub species in each vegetation monitoring plot, where no one species is greater than 50 % of stems.</li> </ul> </li> <li>• Planted and volunteer stems are counted, provided they are included in the approved planting list for the Site; natural recruits not on the planting list may be considered by the DWR on a case-by-case basis.</li> </ul>

**4.3 Maintenance and Contingency Plans**

An adaptive management plan will be developed and implemented with the approval of DMS and DWR in the event the Site or a specific component of the Site fails to achieve success criteria as outlined above. Other vegetation maintenance and repair activities may include pruning, mulching, and fertilizing. If exotic invasive plant species require treatment, such species will be controlled by mechanical (physical removal with the use of a chainsaw) and/or herbicide application in accordance with North Carolina Department of Agriculture (NCDA) rules and regulations.

**4.4 2023 Encroachment / 2024 Replant**

Shortly after planting, the farmer encroached along the edges of the easement in nine separate areas (totaling 0.7 acres) while preparing the fields adjacent to the easement for row-crop planting. RS discussed the encroachment with the farmer by phone on May 18, 2023, and scheduled a site visit with the farmer to review the encroachment areas. On June 12, 2023, RS met with the farmer to ensure that row crop planting was performed outside the easement. Also, the easement boundary was walked with the farmer and no further evidence of easement encroachment was observed. On June 15, 2023, and October 17, 2023, RS installed additional T-posts, easement placards, and horse tape along areas of extreme encroachment to ensure diffuse flow into the buffer. Additionally, RS will replant 450 bare roots during the 2024 dormant season within the 0.7 acres of encroachment. Species from the approved Mitigation Plan will be used, including a minimum of five of the following species: black gum (*Nyssa sylvatica*), redbud (*Cercis canadensis*), persimmon (*Diospyros virginiana*), sycamore (*Platanus occidentalis*), tulip poplar (*Liriodendron tulipifera*), water oak (*Quercus nigra*), red oak (*Quercus rubra*), and willow oak (*Quercus*

*phellos*). Photo documentation of the planting will be added to the MY2 (2024) report. Photos of the additional easement marking are provided in Appendix A. Locations of the encroachment are depicted in Figure 2 (Appendix A).

## 5.0 References

Consolidated Buffer Mitigation Rule - 15A NCAC 02B .0295 (Published November 17, 2014)

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 Department of Environmental Quality, Division of Mitigation Services (NCDMS), 2017. Riparian Buffer and Nutrient Offset Buffer Baseline and Annual Monitoring Report Template version 2.0

North Carolina Division of Mitigation Services (NCDMS). 2010 amended 2018. Neuse River Basin Restoration Priorities (online). Available: [https://files.nc.gov/ncdeq/Mitigation%20Services/Watershed\\_Planning/Neuse\\_River\\_Basin/RB\\_RP-Neuse-201807-.pdf](https://files.nc.gov/ncdeq/Mitigation%20Services/Watershed_Planning/Neuse_River_Basin/RB_RP-Neuse-201807-.pdf) (September 11, 2020).

Restoration Systems, LLC, 2022. Thunder Mitigation Site – Mitigation Plan. North Carolina Department of Environmental Quality, Division of Mitigation Services, Raleigh, NC.

Schafale, M. P. and Weakley, 2012. A Classification of the Natural Communities of North Carolina, Fourth Approximation. North Carolina Natural Heritage Program, North Carolina Department of Environment and Natural Resources. Raleigh, North Carolina.

United States Department of Agriculture (USDA). 2019. Web Soil Survey (online). Available: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> [September 2, 2020].

US Fish and Wildlife Service, 2020. Endangered Species, Threatened Species, Federal Species of Concern, and Candidate Species, Wayne County, North Carolina (online, updated July 17, 2020). Available: <https://www.fws.gov/raleigh/species/cntylist/wayne.html> [September 2, 2020]

## **Appendix A: General Figures and Tables**

Figure 1. Parcel Location / Service Area

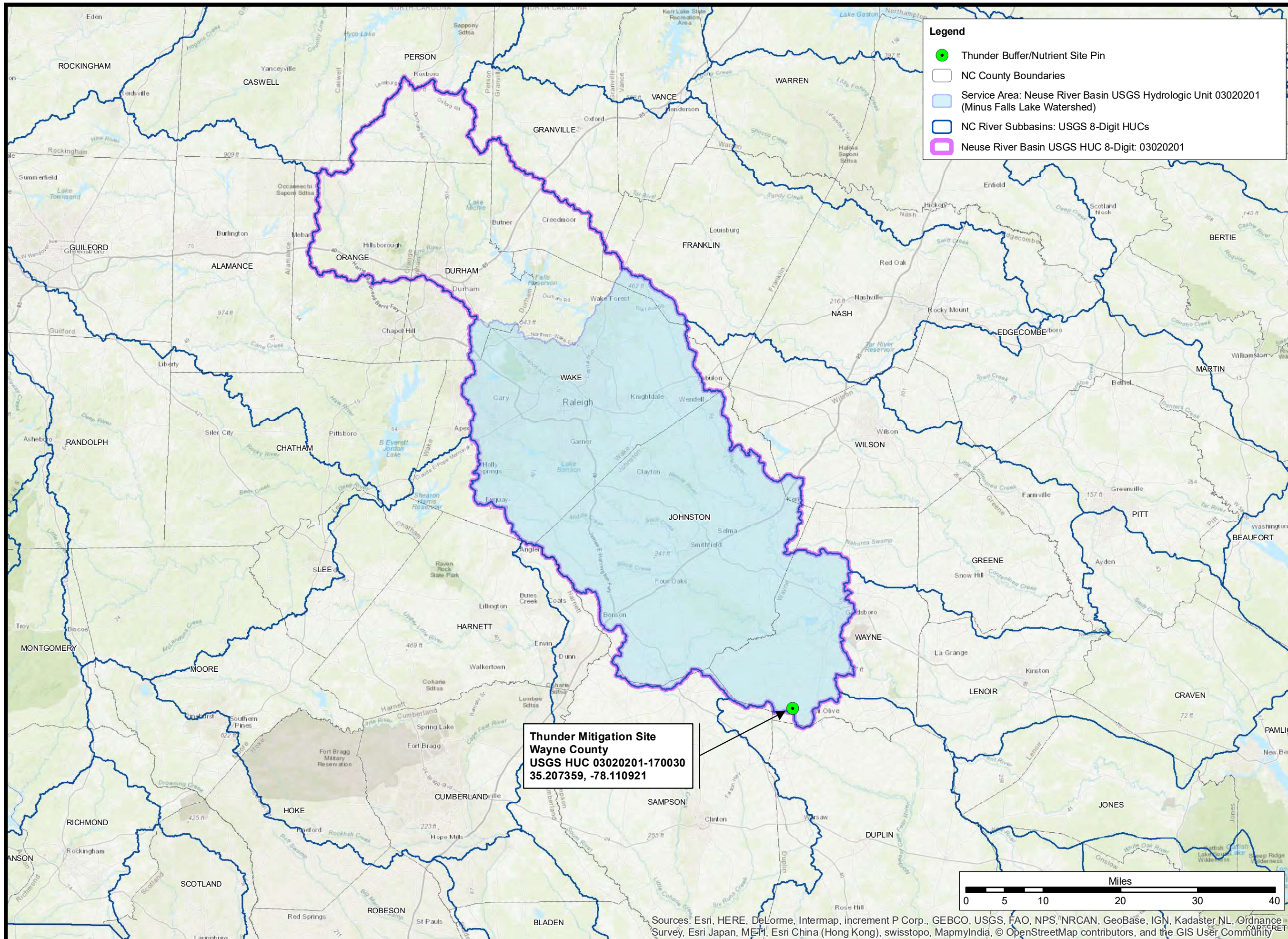
Figure 2. Current Conditions Plan View

Table 8. Project Components and Mitigation Credits

Table 9. Project Activity and Reporting History

Table 10. Project Contact

Table 11. Project Baseline Information and Attributes



**Legend**

- Thunder Buffer/Nutrient Site Pin
- ▭ NC County Boundaries
- ▭ Service Area: Neuse River Basin USGS Hydrologic Unit 03020201 (Minus Falls Lake Watershed)
- ▭ NC River Subbasins: USGS 8-Digit HUCs
- ▭ Neuse River Basin USGS HUC 8-Digit: 03020201

**Thunder Mitigation Site**  
**Wayne County**  
**USGS HUC 03020201-170030**  
**35.207359, -78.110921**



Prepared for:  
**NC DEQ**  
**Division of**  
**Mitigation Services**

Project:  
**THUNDER**  
**MITIGATION SITE**

WAYNE COUNTY  
 Title:  
**VICINITY MAP &**  
**SERVICE AREA**  
**MAP**

ESRI Open StreetMap 2023  
 Drawn by: RJH  
 Date: MARCH 2023  
 Scale: 1:1,000,000  
 Project No.: 100185

**FIGURE**  
**1**

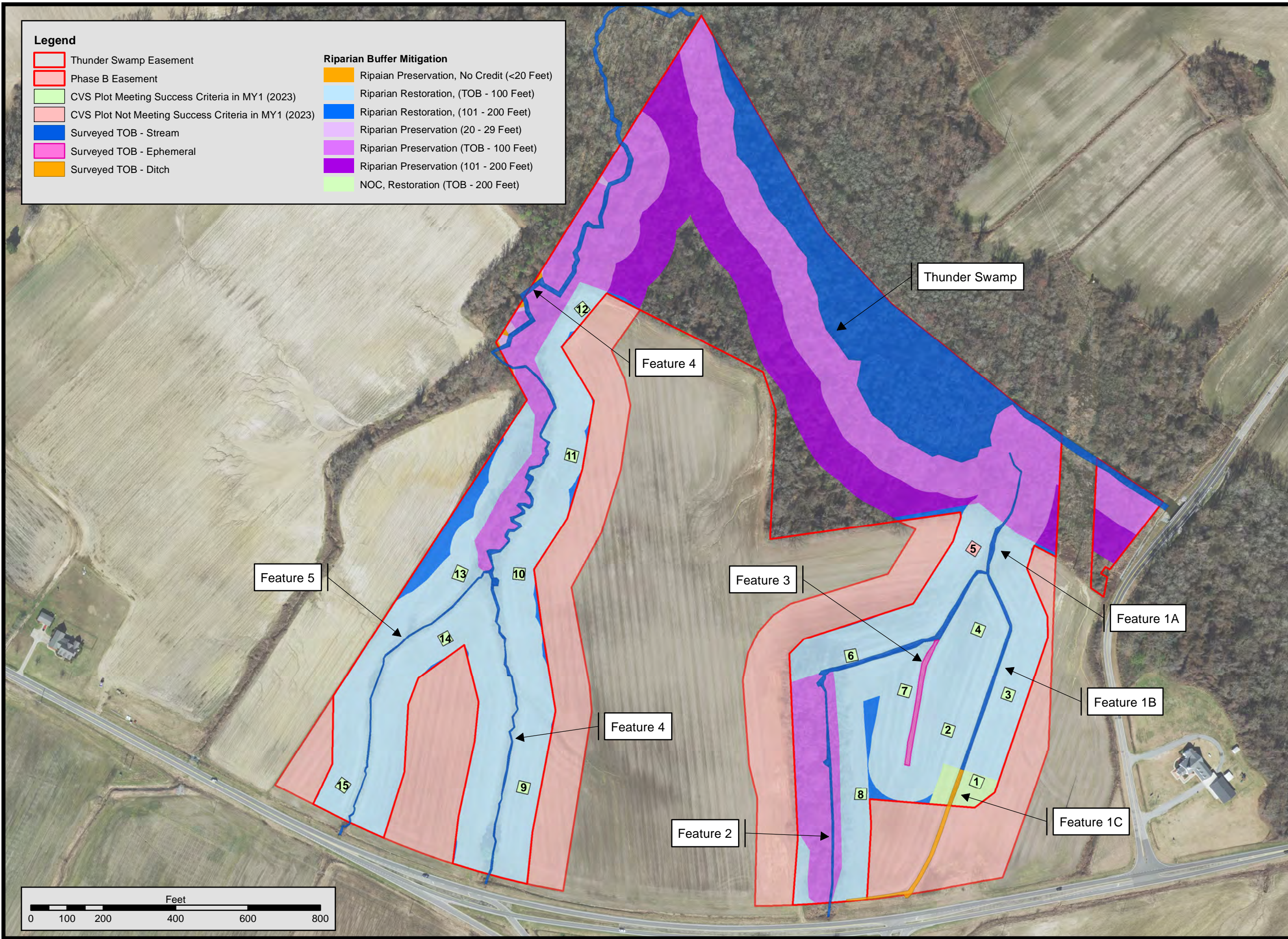
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, MEIT, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

**Legend**

- Thunder Swamp Easement
- Phase B Easement
- CVS Plot Meeting Success Criteria in MY1 (2023)
- CVS Plot Not Meeting Success Criteria in MY1 (2023)
- Surveyed TOB - Stream
- Surveyed TOB - Ephemeral
- Surveyed TOB - Ditch

**Riparian Buffer Mitigation**

- Riparian Preservation, No Credit (<20 Feet)
- Riparian Restoration, (TOB - 100 Feet)
- Riparian Restoration, (101 - 200 Feet)
- Riparian Preservation (20 - 29 Feet)
- Riparian Preservation (TOB - 100 Feet)
- Riparian Preservation (101 - 200 Feet)
- NOC, Restoration (TOB - 200 Feet)



Prepared for:



Project:

**THUNDER SWAMP  
NUTRIENT OFFSET  
BANK PARCEL**

Wayne County, NC

Title:

**CURRENT  
CONDITIONS  
PLAN VIEW**

Imagery: 2021 NC OneMap

Drawn by:

KRJ

Date:

JAN 2024

Scale:

1:3,000

Project No.:

23-009

**FIGURE**

**2**



**Table 8. Project Components and Mitigation Credits  
Thunder Mitigation Site, Project Credits (Asbuilt)**

Project Area																	
Neuse 03020201 - Outside Falls Lake																	
19.16394																	
N/A																	
Credit Type	Location	Subject? (enter NO if ephemeral or ditch <sup>1</sup> )	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (ft <sup>2</sup> )	Total (Creditable) Area of Buffer Mitigation (ft <sup>2</sup> )	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Convertible to Riparian Buffer?	Riparian Buffer Credits	Convertible to Nutrient Offset?	Delivered Nutrient Offset: N (lbs)	Delivered Nutrient Offset: P (lbs)	
Buffer	Rural	No	Ephemeral	Restoration	0-100	3	74,436	74,436	1	100%	1.00000	Yes	74,436.000	Yes	3,884.170	—	
Buffer	Rural	No	Ephemeral	Restoration	101-200	3	3,531	3,531	1	33%	3.03030	Yes	1,165.231	Yes	184.252	—	
Buffer	Rural	Yes	I / P	Restoration	0-100	1A, 2, 4, 5	590,597	590,597	1	100%	1.00000	Yes	590,597.000	Yes	30,818.141	—	
Buffer	Rural	Yes	I / P	Restoration	101-200	1A, 2, 4, 5, Thunder Swamp	32,146	32,146	1	33%	3.03030	Yes	10,608.191	Yes	1,677.421	—	
Buffer	Rural	No	I / P	Restoration	0-100	1B	95,212	95,212	1	100%	1.00000	Yes	95,212.000	Yes	4,968.289	—	
Buffer	Rural	No	I / P	Restoration	101-200	1B	150	150	1	33%	3.03030	Yes	49.500	Yes	7.827	—	
Nutrient Offset	Rural	No	Ditch	Restoration	0-100	1C	10,402	10,402	1	100%	1.00000	No	—	Yes	542.790	—	
Nutrient Offset	Rural	No	Ditch	Restoration	101-200	1C	3,490	3,490	1	33%	3.03030	No	—	Yes	182.113	—	
<b>Totals (ft2):</b>							<b>809,964</b>	<b>809,964</b>					<b>772,067.922</b>		<b>42,265.004</b>	<b>0.000</b>	
<b>Total Buffer (ft2):</b>							<b>796,072</b>	<b>796,072</b>									
<b>Total Nutrient Offset (ft2):</b>							<b>13,892</b>	<b>N/A</b>									

<b>Total Ephemeral Area (ft<sup>2</sup>) for Credit:</b>	<b>77,967</b>	<b>77,967</b>
<b>Total Eligible Ephemeral Area (ft<sup>2</sup>):</b>	<b>265,357</b>	<b>7.3%</b>
<b>Total Eligible for Preservation (ft<sup>2</sup>):</b>	<b>265,357</b>	<b>25.0%</b>

Enter Preservation Credits Below

Credit Type	Location	Subject?	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (sf)	Total (Creditable) Area for Buffer Mitigation (ft <sup>2</sup> )	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Riparian Buffer Credits
	Rural	Yes	I / P		20-29	4	2,170	0	10	75%		—
	Rural	Yes	I / P		0-100	1A, 2, 4, 5, Thunder Swamp	429,307	265,357	10	100%	10.00000	26,535.700
	Rural	Yes	I / P		101-200	1A, 4, Thunder Swamp	198,930	0	10	33%		—
<b>Preservation Area Subtotals (ft<sup>2</sup>):</b>							<b>630,407</b>	<b>265,357</b>				

TOTAL AREA OF BUFFER MITIGATION (TABM)		
Mitigation Totals	Square Feet	Credits
Restoration:	796,072	772,067.922
Enhancement:	0	0.000
Preservation:	265,357	26,535.700
<b>Total Riparian Buffer:</b>	<b>1,061,429</b>	<b>798,603.622</b>
TOTAL NUTRIENT OFFSET MITIGATION		
Mitigation Totals	Square Feet	Credits
Nutrient Offset:		
Nitrogen:	13,892	724.903
Phosphorus:		0.000

1. The Randleman Lake buffer rules allow some ditches to be classified as subject according to 15A NCAC 02B .0250 (5)(a).



**Table 9. Project Activity and Reporting History**

Activity / Milestone	Mitigation Plan Proposed Date	Actual Date
Mitigation Plan Approved	NA	December 9, 2022
Parcel Protection	NA	Recorded September 2, 2021
Planting	Q1 2023	February 6, 2023
As-built Data Collection	Q1 2023	February 15, 2023
Construction Completion Walkthrough	NA	February 6, 2023
As-built Report Submittal	NA	April 2023
Year 1 Data Collection	October 2023	November 2023
Year 1 Report Submittal	November 2023	December 2023
2024 Supplemental Planting	NA	Q1 2024
Year 2-5 Monitoring	Q4 2024 - 2027	On schedule

**Table 10. Project Contact**

	Firm	POC & Address
<b>Full Delivery Provider</b>	Restoration Systems, LLC	1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 John Preyer 919.755.9490
<b>Designer/Permitting:</b>	Restoration Systems, LLC	Raymond Holz: 919.755.9490 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604
<b>Planting Contractor:</b>	Restoration Systems, LLC	Josh Merritt: 919.755.9490 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604
<b>Seeding Contractor:</b>	Restoration Systems, LLC	Matthew Harrell: 919.755.9490 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604
<b>Nursery Stock Suppliers:</b>	Superior Trees, Inc. & Native Forest Nursery	1.888.888.7158
<b>Baseline Data Collection</b>	Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Ave. Raleigh, NC 27603
<b>Vegetation Monitoring:</b>	Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Ave. Raleigh, NC 27603

**Table 11. Project Baseline Information & Attributes**

Project Information			
Project Name		Thunder	
County		Wayne	
Project Area (acres)		41.78	
Project Coordinates (latitude and longitude)		35.207359°N, -78.110921°W (NAD83/WGS84)	
Project Watershed Summary Information			
Physiographic Province		Southeastern Plain	
River Basin		Neuse	
USGS Hydrologic Unit 8-digit	03020201	USGS Hydrologic Unit 14-digit	03020201170030
DWR Sub-basin		03-04-12	
Project Drainage Area, Total Outfall (acres)		Thunder Swamp: 6.5 square miles Features 1 – 3 = 160 acres, Feature 4 & 5 = 23 acres	
Project Drainage Area Percentage of Impervious Area		<5%	

**Appendix B: Vegetation Data and Project Photos**

Table 12. MY1 (2023) Vegetation Plot Data

Vegetation Plot Photos 1-15

Site Photo Log

MY1 Height and Vigor Data

Table 12. MY1 (2023) Vegetation Plot Data  
 neither Project Code 23009. Project Name: Thunder Mitigation Site

Scientific Name	Common Name	Species Type	Current Plot Data (MY1 2023)																							
			23009-01-0001			23009-01-0002			23009-01-0003			23009-01-0004			23009-01-0005			23009-01-0006			23009-01-0007			23009-01-0008		
			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
Betula nigra	river birch	Tree										3	3	3				2	2	2	1	1	1	3	3	3
Carya cordiformis	bitternut hickory	Tree	1	1	1	2	2	2																		
Celtis occidentalis	common hackberry	Tree																								
Cercis canadensis	eastern redbud	Tree							2	2	2															
Diospyros virginiana	common persimmon	Tree																1	1	1						
Fraxinus pennsylvanica	green ash	Tree																2	2	2						
Liriodendron tulipifera	tuliptree	Tree				4	4	4	1	1	1															
Morus rubra	red mulberry	Tree																								
Nyssa sylvatica	blackgum	Tree				1	1	1				1	1	1												
Platanus occidentalis	American sycamore	Tree	7	7	7	1	1	1				1	1	1										2	2	2
Quercus	oak	Tree	1	1	1				1	1	1															
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	5	5	5										1	1	1	7	7	7	2	2	2
Quercus nigra	water oak	Tree				1	1	1				3	3	3	1	1	1	5	5	5	2	2	2	3	3	3
Quercus phellos	willow oak	Tree				1	1	1	2	2	2							1	1	1	1	1	1	1	1	1
Quercus rubra	northern red oak	Tree				1	1	1	1	1	1				4	4	4	1	1	1				2	2	2
Ulmus americana	American elm	Tree															1	1	1							
Stem count			10	10	10	16	16	16	7	7	7	8	8	8	5	5	5	14	14	14	11	11	11	13	13	13
size (ares)			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		
Species count			4	4	4	8	8	8	5	5	5	4	4	4	2	2	2	8	8	8	4	4	4	6	6	6
Stems per ACRE			404.7	404.7	404.7	647.5	647.5	647.5	283.3	283.3	283.3	323.7	323.7	323.7	202.3	202.3	202.3	566.6	566.6	566.6	445.2	445.2	445.2	526.1	526.1	526.1

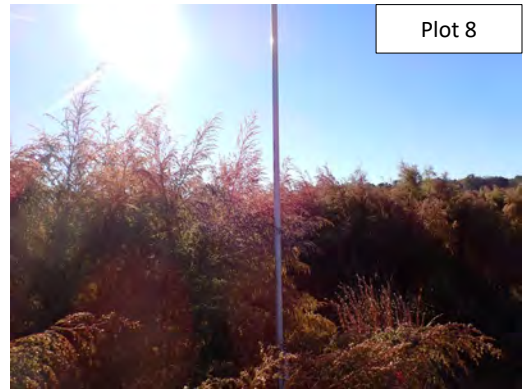
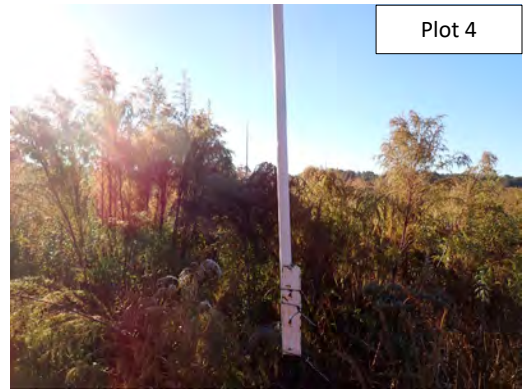
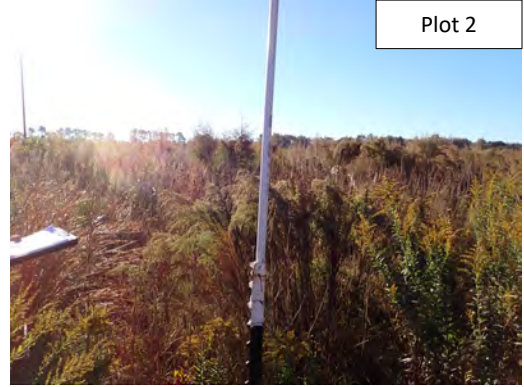
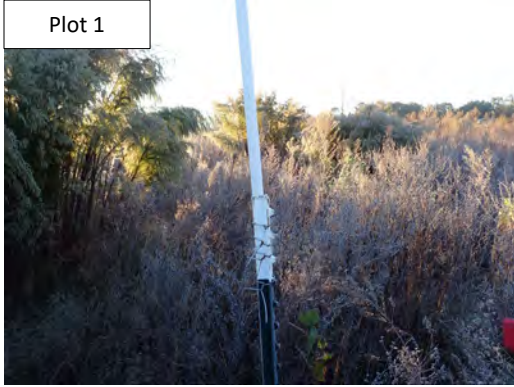
- Color for Density
- Exceeds requirements by 10%
  - Exceeds requirements, but by less than 10%
  - Fails to meet requirements, by less than 10%
  - Fails to meet requirements by more than 10%

Table 12. MY1 (2023) Vegetation Plot Data (continued)  
 neither Project Code 23009. Project Name: Thunder Mitigation Site

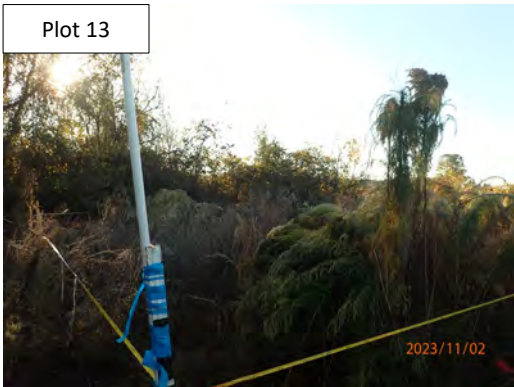
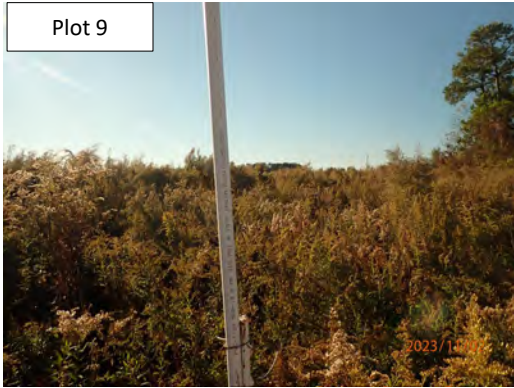
Scientific Name	Common Name	Species Type	Current Plot Data (MY1 2023)																		Annual Means															
			23009-01-0009			23009-01-0010			23009-01-0011			23009-01-0012			23009-01-0013			23009-01-0014			23009-01-0015			MY1 (2023)			MY0 (2023)									
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	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				
Betula nigra	river birch	Tree											2	2	2																11	11	11	14	14	14
Carya cordiformis	bitternut hickory	Tree																												3	3	3	4	4	4	
Celtis occidentalis	common hackberry	Tree																											2	2	2	2	1	1	1	
Cercis canadensis	eastern redbud	Tree														4	4	4																		
Diospyros virginiana	common persimmon	Tree																																		
Fraxinus pennsylvanica	green ash	Tree														1	1	1																		
Liriodendron tulipifera	tuliptree	Tree																																		
Morus rubra	red mulberry	Tree																																		
Nyssa sylvatica	blackgum	Tree																																		
Platanus occidentalis	American sycamore	Tree	7	7	7																															
Quercus	oak	Tree																																		
Quercus michauxii	swamp chestnut oak	Tree																																		
Quercus nigra	water oak	Tree																																		
Quercus phellos	willow oak	Tree	2	2	2	2	2	2	2	4	4	4	3	3	3																					
Quercus rubra	northern red oak	Tree	1	1	1	1	1	1	1																											
Ulmus americana	American elm	Tree																																		
Stem count			10	10	10	8	8	8	13	13	13	9	9	9	8	8	8	10	10	10	11	11	11	153	153	153	203	203	203							
size (ares)			1			1			1			1			1			1			1			15			15									
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.37			0.37									
Species count			3	3	3	3	3	3	6	6	6	4	4	4	4	4	4	5	5	5	5	5	5	15	15	15	16	16	16							
Stems per ACRE			404.7	404.7	404.7	323.7	323.7	323.7	526.1	526.1	526.1	364.2	364.2	364.2	323.7	323.7	323.7	404.7	404.7	404.7	445.2	445.2	445.2	412.8	412.8	412.8	547.7	547.7	547.7							

- 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%

Thunder Swamp  
MY1 (2023) Vegetation Monitoring Photographs (taken November 2023)



Thunder Swamp  
MY1 (2023) Vegetation Monitoring Photographs (taken November 2023)



**Thunder Mitigation Site  
MY-01 (2023) Photo Log**

Photo 1: Encroachment from MY0 addressed with t-posts and horse tape

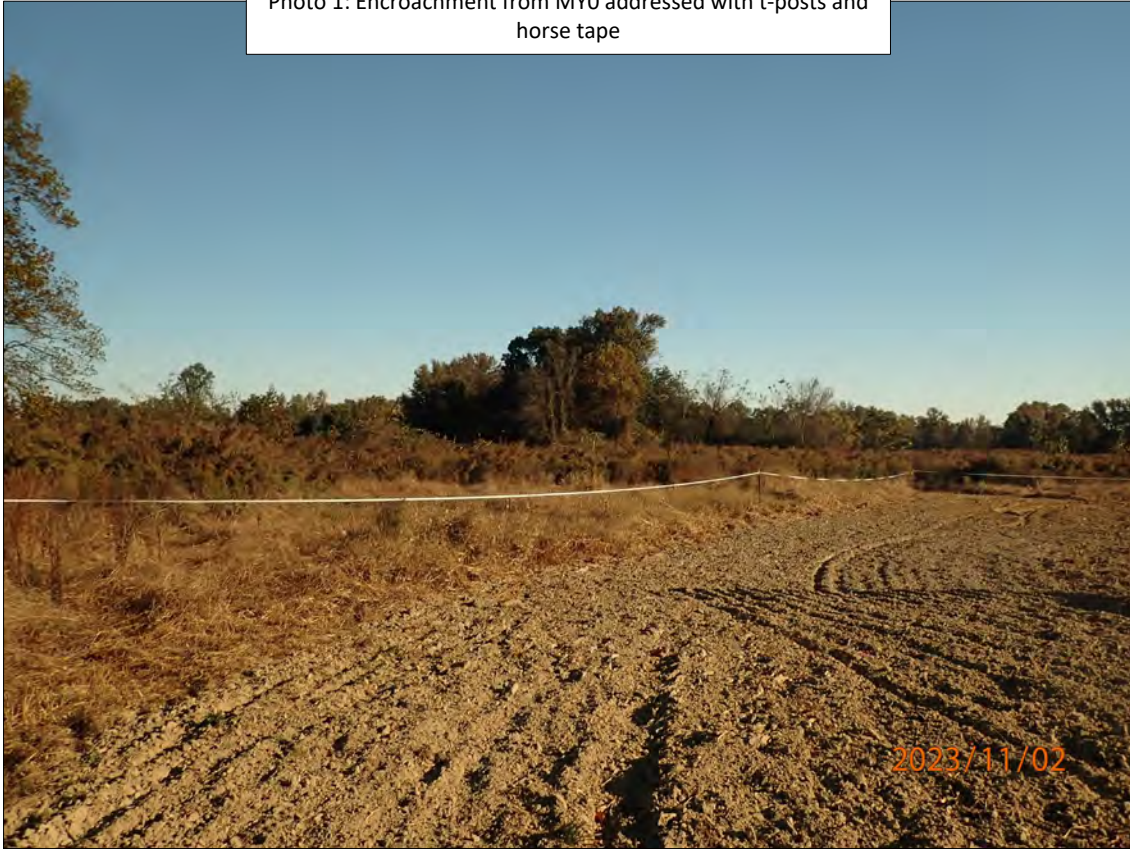


Photo 2: Easement markers along MY0 encroachment area





MY1 Stem Height and Vigor Data

Plot	Species	X	Y	Height (cm)	DBH (cm)	Vigor	Plot Average Vigor
1	Quercus michauxii	0.5	0.6	92		4	3.4
1	Platanus occidentalis	3.5	3.2	110		4	
1	Platanus occidentalis	2.9	0.8	100		4	
1	Platanus occidentalis	5.4	0.6	65		3	
1	Platanus occidentalis	8.3	0.4	105		3	
1	Platanus occidentalis	9.0	3.2	90		3	
1	Platanus occidentalis	8.6	8.4	75		4	
1	Quercus	6.1	7.8	57		2	
1	Liriodendron tulipifera	1.4	5.9	20		3	
1	Quercus rubra	1.9	8.3	60		4	
2	Quercus phellos	0	0.5	90		4	3.7
2	Quercus michauxii	2.8	0.6	58		4	
2	Quercus rubra	1	4.1	50		4	
2	Quercus nigra	3.2	4.0	74		4	
2	Quercus nigra	5.7	0.4	68		4	
2	Quercus rubra	8.4	0.5	76		4	
2	Quercus michauxii	6.6	4.2	75		4	
2	Quercus michauxii	9.5	4.3	45		4	
2	Nyssa sylvatica	6.3	6.1	36		4	
2	Diospyros virginiana	8.8	7.1	60		4	
2	Liriodendron tulipifera	9.3	9.3	20		2	
2	Liriodendron tulipifera	8.6	9.7	22		3	
2	Liriodendron tulipifera	3.8	9.3	70		4	
2	Liriodendron tulipifera	1.4	8.9	31		3	
2	Fraxinus pennsylvanica	0.7	6.2	45		4	
2	Liriodendron tulipifera	2.9	6.4	30		3	
3	Quercus rubra	0.2	0.6	60		2	3.0
3	Cercis canadensis	8.2	3.1	45		3	
3	Liriodendron tulipifera	5.1	5.0	40		3	
3	Quercus	8.1	5.4	20		3	
3	Cercis canadensis	8.2	7.8	44		4	
3	Cercis canadensis	5	7.4	25		3	
3	Quercus rubra	2.1	5.2	23		3	
4	Nyssa sylvatica	0.3	0.3	15		2	3.5
4	Platanus occidentalis	2.8	0.0	60		3	
4	Betula nigra	1.5	2.3	74		4	
4	Quercus nigra	6.1	5.0	35		3	
4	Betula nigra	6.7	1.4	83		4	
4	Betula nigra	9.4	1.0	70		4	
4	Quercus nigra	0.1	8.3	55		4	
4	Quercus nigra	2.5	5.4	70		4	
5	Quercus nigra	4.3	3.4	42		3	3.2
5	Quercus rubra	0.9	5.0	76		4	
5	Quercus rubra	5.1	1.2	90		3	
5	Quercus rubra	5.2	6.1	75		3	
5	Quercus rubra	0.2	7.1	60		3	
6	Quercus nigra	0	0.6	78		4	3.7
6	Quercus michauxii	4.8	1.1	60		4	
6	Quercus phellos	2.6	3.3	60		4	
6	Fraxinus pennsylvanica	7.3	3.8	55		4	
6	Quercus rubra	7.3	1.3	62		4	
6	Diospyros virginiana	9.6	3.9	38		3	
6	Quercus nigra	6	6.8	55		4	
6	Quercus rubra	8.7	6.9	20		4	
6	Ulmus americana	6.9	9.6	42		3	
6	Ulmus americana	9.7	9.8	72		4	
6	Quercus nigra	3	6.6	34		3	
6	Betula nigra	4.1	9.6	52		4	
6	Quercus nigra	0	6.2	66		4	
6	Fraxinus pennsylvanica	1	7.7	63		3	
7	Quercus nigra	0.2	0.2	1		4	3.5
7	Quercus michauxii	3.7	4.0	75		3	
7	Quercus phellos	1.3	3.8	47		3	
7	Betula nigra	8.4	1.8	150	2.1	4	
7	Quercus nigra	7.2	7.1	60		4	
7	Quercus michauxii	9.6	9.8	72		3	
7	Quercus michauxii	5.6	9.7	72		3	
7	Quercus michauxii	4.6	7	80		3	
7	Quercus michauxii	1.6	6.7	74		4	
7	Quercus michauxii	1.3	9.2	70		3	
7	Quercus michauxii	3.3	9.4	93		4	
8	Betula nigra	0.6	1.7	168	0.5	4	3.7
8	Quercus minima	2.7	2.3	55		4	
8	Quercus nigra	3.6	0	34		3	
8	Quercus rubra	2.2	4.3	62		4	
8	Betula nigra	6.2	1.8	168	0.5	4	
8	Betula nigra	5.5	4.2	90		4	
8	Quercus minima	7.4	4.7	30		3	
8	Quercus rubra	9	2.1	25		4	
8	Quercus phellos	9.4	9.6	65		4	
8	Quercus nigra	3	9.7	78		4	
8	Quercus nigra	3.3	7.5	42		3	
8	Platanus occidentalis	0.4	6.6	50		3	
8	Platanus occidentalis	1.9	3.8	50		4	

MY1 Stem Height and Vigor Data (continued)

Plot	Species	X	Y	Height (cm)	DBH (cm)	Vigor	Plot Average Vigor
9	Platanus occidentalis	2.7	0.7	36		2	3.4
9	Platanus occidentalis	1.1	3.9	80		4	
9	Platanus occidentalis	4.5	4.6	83		4	
9	Platanus occidentalis	5.2	1.2	71		4	
9	Platanus occidentalis	7.7	4.7	90		4	
9	Quercus rubra	9.2	7.6	45		3	
9	Quercus phellos	3.2	10	25		3	
9	Platanus occidentalis	0.1	6.8	40		4	
9	Platanus occidentalis	7.9	1.4	59		3	
9	Quercus phellos	0	9.4	70		3	
10	Quercus rubra	0.2	0.2	63		4	3.3
10	Quercus	3.2	1.9	45		4	
10	Quercus	7.7	2.1	40		2	
10	Quercus	7.3	0	20		3	
10	Quercus	7.6	5.3	40		2	
10	Quercus phellos	7.6	8.6	58		3	
10	Quercus phellos	1.4	8.7	55		4	
10	Quercus phellos	1.3	5.3	54		4	
10	Quercus phellos	4.7	5.1	40		4	
11	Quercus	0.1	0.3	100		4	
11	Cercis canadensis	2.7	1.2	55		3	3.0
11	Liriodendron tulipifera	1.7	2.9	45		1	
11	Cercis canadensis	5.5	1.8	20		1	
11	Platanus occidentalis	9.5	9	115		4	
11	Quercus phellos	6.7	9.3	46		4	
11	Quercus phellos	5.4	7.1	72		3	
11	Quercus phellos	4.6	9.4	60		3	
11	Quercus phellos	3.8	7.6	32		3	
11	Diospyros virginiana	0.5	7.3	23		4	
11	Quercus	0.1	9.9	30		2	
11	Cercis canadensis	4.5	3.2	40		3	
11	Cercis canadensis	6.6	3.9	38		4	
12	Quercus michauxii	0.1	1.9	69		4	3.2
12	Cercis canadensis	2.8	1.4	52		2	
12	Quercus phellos	2.3	4.5	60		3	
12	Betula nigra	5	4.5	136		4	
12	Quercus michauxii	5.6	1.3	15		1	
12	Quercus michauxii	8.2	1.2	55		4	
12	Quercus phellos	7.8	4.7	68		4	
12	Betula nigra	3.1	7.4	101		4	
12	Quercus phellos	0.6	6.9	0		3	
13	Cercis canadensis	1.4	3.4	36		4	
13	Quercus	2.5	0.9	60		4	4.0
13	Platanus occidentalis	4.5	5.7	50		4	
13	Platanus occidentalis	7	5.4	82		4	
13	Platanus occidentalis	1.6	5.7	80		4	
13	Platanus occidentalis	4.3	5.6	75		4	
13	Quercus rubra	7.6	8.3	55		4	
13	Quercus rubra	10	8.6	65		4	
14	Quercus	0.2	0.3	69		3	
14	Platanus occidentalis	2.4	0.3	126		4	
14	Platanus occidentalis	2.5	5	139	0.1	4	3.5
14	Cercis canadensis	3	2.6	25		1	
14	Quercus rubra	0.5	2.6	40		3	
14	Platanus occidentalis	0.3	4.8	98		4	
14	Quercus phellos	5.2	2.5	41		4	
14	Platanus occidentalis	5	4.6	132		4	
14	Platanus occidentalis	7.8	5	128		4	
14	Quercus michauxii	8.1	2.5	52		4	
15	Platanus occidentalis	0.2	0.2	70		4	3.5
15	Platanus occidentalis	3.2	0.9	55		3	
15	Platanus occidentalis	6.2	1.8	71		4	
15	Platanus occidentalis	9.8	2.8	80		4	
15	Platanus occidentalis	1.6	8	120		4	
15	Ulmus	0	4.3	69		2	
15	Celtis occidentalis	8.6	7.5	40		4	
15	Quercus phellos	0.7	9.5	41		3	
15	Platanus occidentalis	7.9	0.1	65		4	
15	Liriodendron tulipifera	2	5.4	25		3	
15	Celtis occidentalis	4.3	6.9	39		4	

## Appendix C: MY0 Boundary Inspection Action Items Documentation

ROY COOPER  
Governor

ELIZABETH S. BISER  
Secretary

MARC RECKTENWALD  
Director



May 11, 2023

Emily Dunnigan  
Project Manager – Eastern Region  
Division of Mitigation Services  
Green Square Office  
217 West Jones Street  
Raleigh, NC 27603  
Cell: (919) 218-0226

Subject: Boundary Inspection Report – MY0 Site  
Thunder, Wayne County, NC  
DMS ID No. 100185

Emily,

The MY0 boundary inspection was conducted by DMS on May 2, 2023. The inspection was conducted in accordance with the DMS Property Checklist which included an office review and a site visit to document site conditions. The entire easement boundary was inspected during the site visit to validate easement integrity and identify any potential issues on the site. This report summarizes those inspection results. Site photos and locations shown on the attached kmz map are shown as examples of site observations, not a complete inventory of all boundary issues.

**Office Review:**

- Aerial photos indicated potential scallop mowing along adjacent fields.

**Field Inspection:**

- Stamped caps were installed at the easement corners. Caps in wooded areas were difficult to locate due to missing witness posts or locations where the easement signs were posted on distant trees.
- Corner witness posts were commonly absent or not visible in wooded areas and several damaged markers were noted along field boundaries.
- In wooded areas, signs were incorrectly attached to trees using small roofing nails driven flush to the tree. An example photo is included on the kmz map.
- In-line marking was commonly absent/not visible within wooded areas and several markers were damaged along field boundaries. Signs installed in wooded areas were frequently only visible from a few feet distant due to obscuring vegetation.
- Active encroachments consisting of scallop mowing, crop fields extending into the easement and ditching were numerous along field boundaries.

**Action Items**

- Install a witness post with sign at each corner monument where signs are missing or not positioned immediately adjacent to the monument.  
*Response: Additional witness posts were added as requested.*
- Upgrade sign fasteners to a material that is likely to meet the longevity specifications in the marking requirements. Partially driven 16d aluminum nails are frequently used to allow room for the tree to grow without compromising the easement signs.  
*Response: Fasteners were upgraded as requested. See photos at end for typical.*



- A high failure rate was observed onsite where plastic insulators were used to attach the easement signs to the T-posts. These fasteners should also be upgraded.  
*Response: Plastic insulators were replaced with metal clips. See photos at end for typical.*
- Install missing in-line markings and consider decreasing the spacing to promote visibility in densely vegetated areas.  
*Response: Additional in-line markings were added as requested. In some dense areas visibility is still limited, however these are considered at low-risk for encroachment due to lack of access.*
- Install supplemental boundary markings along the overhead utility corridor to reduce the encroachment risk during utility maintenance.  
*Response: This area was more clearly marked as requested.*
- Eliminate all easement encroachments and restore the topography and vegetation to the design specifications. Coordination with the IRT should be initiated prior to replanting efforts.  
*Response: Encroachments were eliminated and replanted as required.*
- Landowner and farm operator coordination needs to be initiated to identify the easement boundary locations and allowed easement usage. In addition to mowing/planting, herbicide overspray/drift into the easement is also an encroachment and should be discussed during the coordination.  
*Response: Noted.*
- Supplemental boundary markings should be installed as necessary to prevent encroachment.  
*Response: Noted. Higher visibility poles were used to mark the Thunder Phase B easement which borders this easement, as well as sections of this easement which border farm fields.*
- Blazing the trees in wooded areas is recommended for easier identification of the site boundary.  
*Response: Recommendation noted. Corner trees do have blazes on this site, however yellow banding has not been implemented as the nature of the site makes encroachment through the wooded areas unlikely.*

Let me know if you have any questions or need additional information.

Sincerely,  
*Kelly Phillips*  
 Property Specialist  
 NCDEQ-DMS  
 610 East Center Avenue, Suite 301  
 Mooresville, NC 28115  
 Cell: (919) 723-7565

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1. High Visibility Witness post, typical



2. Additional in-line marking, typical



3. Upgraded fasteners, typical



4. Upgraded sign clip, typical



5. Additional markings bordering utility corridor.



6. High visibility posts along ag field along Phase B easement outside of original easement.



7. High visibility posts along ag field along Phase B easement outside of original easement.



8. High visibility posts along ag field at boundary where re-planting occurred.