MONITORING YEAR 3 ANNUAL REPORT

Final

Mangum Homestead Mitigation Site

Orange County, NC
NCDEQ Contract No. 7859
DMS ID No. 100107
DWR No. 2019-0645

Jordan Lake-Upper New Hope
Cape Fear River Basin
HUC 03030002

RFP #: 16-007702

Data Collection Period: September 2022
Draft Submission Date: October 24, 2022
Final Submission Date: January 6, 2023

PREPARED FOR:

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

PREPARED BY:

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Phone: (919) 851-9986

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APPENDICES

Section 1: PROJECT OVERVIEW

1.1 Project Description

The Mangum Homestead Mitigation Site (Site) is in Orange County approximately three miles northwest of the Town of Carrboro (Figure 1). The Site involved riparian area restoration, enhancement, and preservation activities on four unnamed tributaries and three ephemeral channels that flow to New Hope Creek upstream of Jordan Lake. The Site was completed for buffer mitigation credit and nutrient offset credit in the Cape Fear River Basin HUC 03030002, Upper New Hope Watershed of Jordan Lake in accordance with the Consolidated Buffer Mitigation Rules (15A NCAC 02B .0295), the Jordan Water Supply Nutrient Strategy (15A NCAC 02B .0262) and the Nutrient Offset Payments Rule (15A NCAC 02B .0703). See Figure 2 for the Service Area of the Site. The Site is expected to generate 36,933.600 riparian buffer credits, 19,985.729 Nitrogen offset credits, and 1,259.783 Phosphorous Offset credits.

The project is located within the Cape Fear River Basin Hydrologic Unit Code (HUC) 03030002060110, Upper New Hope – Jordan Lake Sub-watershed, and NCDWR Subbasin 03-06-05. Project features flow approximately one mile to the confluence with New Hope Creek, which is classified as Nutrient Sensitive Waters (NSW) by the North Carolina Division of Water Resources (NCDWR). The project supports specific goals identified in the 2009 Cape Fear River Basin Restoration Priorities Plan (RBRP) by addressing nutrient reductions through buffer restoration and improving habitat for the native mussel species present in the HUC.

This nutrient offset and buffer mitigation project is reducing sediment and nutrient loading and improving terrestrial habitat. The area surrounding the streams prior to restoration was primarily open agricultural fields used for hay production. The restored vegetative riparian areas up to 200 feet from the streams are removing sediment and fertilizer inputs within the project area. The full establishment of riparian areas will create shading to minimize thermal pollution. Finally, invasive vegetation will be treated within the project area as needed and the planted native vegetation provides cover and food for wildlife.

Tables 2 and 4 in Appendix 1 provide detailed watershed and Site background information.

1.2 Project Goals and Objectives

The major goals of the nutrient offset and buffer restoration project are to provide ecological and water quality enhancements to Jordan Lake in the Cape Fear River Basin by creating a functional riparian corridor and restoring the riparian area.

Goals	Objectives
Decrease nutrient levels	Nutrient input will be decreased by filtering runoff from the agricultural fields through restored native buffer zones. The off-site nutrient input will also be absorbed on-site by dispersing flood flows through native vegetation.
Decrease sediment input	Sediment from off-site sources will be deposited on restored floodplain areas where native vegetation will slow overland flow velocities.
Reduce thermal pollution	Water temperature will decrease, and dissolved oxygen concentrations will increase with the establishment and maintenance of riparian areas creating additional long-term shading of the channel flow.
Reduce peak flows	Establishment of a riparian area that will slow flood flows and allows for greater infiltration, reducing peak flows downstream.
Create appropriate terrestrial habitat	Buffer areas will be restored by removing invasive vegetation and planting native vegetation.
Permanently protect the Site from harmful uses	Establish a conservation easement on the Site.

1.3 Project History

On July 19, 2019, NCDWR conducted on-site determinations to review features and land use within the project boundary. The resulting NCDWR site viability letter and map confirming the Site as suitable for riparian buffer mitigation is in Appendix 1. NCDWR also approved the seven project reaches as appropriate for buffer mitigation as related to the rules set forth in the Jordan Riparian Area Protection Rules (15A NCAC 02B .0267). The on-site determination approval letter from NCDWR is also included in Appendix 1.

The final mitigation plan was submitted and accepted by the NC Department of Mitigation Services (NCDMS) in January 2020. Planting activities were completed by Bruton Natural Systems, Inc. in April 2020 and the baseline monitoring and as-built survey were completed in June 2020. There were no significant deviations reported in the project elements in comparison to the design plans. Tables 2 and 3 in Appendix 1 provide more detailed project activity, history, and contact information.

1.4 Project Location

The Site is in Orange County, NC approximately three miles northwest of the Town of Carrboro (center of project 35.59795 N and -79.87855 W). Directions to the project are as follows: Traveling west on I-40W from Raleigh, take exit 263 (28.7 miles). Turn left onto New Hope Church Road. Continue onto Arthur Minnis Road (2.1 miles). The site will be on the right (Foggy Bottom Lane). Enter the Site via the gravel driveway. The property location is depicted on the Vicinity Map (Figure 1).

1.5 Project Design

The Wildlands Team restored high quality riparian areas along several unnamed tributaries on the Site. The project design ensured that no adverse impacts to wetlands or existing riparian buffers occurred. Figure 3 illustrates buffer zones for the Site. Site overview photographs are included in Appendix 2.

1.5.1 Riparian Area Restoration Activities

Prior to planting, the unnamed tributaries on-site lacked riparian buffers. Any areas disturbed during construction were tilled with a chisel plow to reduce soil compaction. The Site's ephemeral channels are

located fully within the conservation easement area and were completely buffered as part of the project; therefore, no land disturbance to maintain diffuse flow was required.

The revegetation plan for the buffer restoration area included permanent seeding in select areas and planting bare root trees. These revegetation efforts were coupled with the select treatment of invasive species. The planted species were selected based on the desired community type, observation of occurrence in riparian buffers adjacent to the Site, and best professional judgement on species establishment and anticipated site conditions in the early years following project implementation. The total number of tree species planted were as follows: Shumard Oak (*Quercus shumardii*) 1800 stems, Willow Oak (*Quercus phellos*) 1100 stems, American Sycamore (*Platanus occidentalis*) 2800 stems, River Birch (*Betula nigra*) 2300 stems, American Persimmon (*Diospuros virginiana*) 1000 stems, Boxelder (A*cer negundo*) 660 stems, and Swamp Chestnut Oak (*Quercus michauxii*) 450 stems. Eastern Cottonwood (*Populus deltoides*) was originally planned for planting, however, lack of availability led to its substitution with Shumard Oak. In total, 10,110 stems were planted.

Trees were planted at a density sufficient to meet the performance standards outlined in the Rule 15A NCAC 02B .0295 of 260 trees per acre at the end of five years. No one tree species planted was greater than 50% of the established stems. An appropriate seed mix was applied as necessary to provide temporary ground cover for soil stabilization and reduction of sediment loss during rain events in disturbed areas. This was followed by an appropriate permanent seed mixture. Planting was completed on April 16, 2020. Ring sprays were implemented around all planted trees.

1.5.2 Riparian Area Enhancement Activities

The revegetation plan for the buffer enhancement areas under 15A NCAC 02B .0295(n) included planting supplemental bare root trees and controlling invasive species growth.

1.5.3 Riparian Area Preservation Activities

No work was done in the buffer preservation areas, as allowed under 15A NCAC 02B .0295(o). The preservation area is protected in perpetuity under a conservation easement.

Section 2: DETERMINATION OF CREDITS

In addition to buffer restoration and enhancement on subject streams, per the Consolidated Buffer Mitigation Rules (15A NCAC 02B 0.0295 (o)), alternative mitigation was completed on the Site in the form of buffer restoration on ephemeral channels and preservation of forested buffer on subject streams. The proposed project is in compliance with these rules in the following ways:

Buffer Restoration on Ephemeral Channels (15A NCAC 02B 0.0295(o)(7)):

- NCDWR performed an evaluation of the Site and identified the perennial, intermittent, and ephemeral channels on the property.
- The mitigation area on the Site's ephemeral channels is located completely within their drainage areas.
- The ephemeral channels are directly connected to intermittent or perennial stream channels and will be protected under the same contiguous easement boundary.
- The mitigation area on the ephemeral channels is less than 25% of the total buffer mitigation area on the Site (Table 1, Appendix 1).

Preservation on Subject Streams (15A NCAC 02B .0295 (o)(5):

- The buffer width is at least 30 feet from the stream.
- The area meets the requirements of 15A NCAC 02R 0.0403(c)(7), (8), and (11) with no known structures, infrastructure, hazardous substances, solid waste, or encumbrances within the mitigation boundary.
- Preservation mitigation is being requested on no more than 25% of the total buffer mitigation area (Table 1, Appendix 1).

Mitigation credits are presented in Table 1 and Figure 3 in Appendix 1 and are based upon the as-built survey included in the Mangum Homestead Baseline Monitoring Report (2020).

Section 3: PERFORMANCE CRITERIA AND MONITORING PROTOCOLS

The performance criteria for the Site follows approved performance criteria presented in the Mangum Homestead Mitigation Site Mitigation Plan (Wildlands Engineering, Inc., 2020), the NC DMS Riparian Buffer and Nutrient Offset Buffer Baseline & Annual Monitoring Report Template, Version 2.0 (May 2017) and the Consolidated Buffer Rule (15A NCAC 02B .0295).

The nutrient offset and buffer restoration project has been assigned specific performance criteria components for vegetation. The monitoring period will extend for five years beyond the completion of construction or until performance criteria have been met. An outline of the performance criteria and monitoring components are described below.

3.1 Annual Monitoring and Reporting

Annual monitoring and semi-annual site visits are being conducted to assess the condition of the project. The extent of invasive species coverage will also be monitored and treated as necessary throughout the required monitoring period (five years). Complete monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS. Annual monitoring reports will be based on the above referenced DMS Template (May 2017).

3.2 Vegetation Success Criteria and Monitoring Protocol

The final vegetative success criteria will be the survival of 260 planted stems per acre in the riparian corridor at the end of monitoring year 5. The final performance standard shall include a minimum of four native hardwood tree species or four native shrub species, where no one species is greater than 50 percent of stems. Native hardwood and native shrub volunteer species may be included to meet the final performance standard of 260 stems per acre. Performance criteria will be evaluated throughout the five-year post-construction monitoring or until performance criteria have been met. Annual vegetation monitoring will follow the CVS-EEP Level 1 & 2 Protocol for Recording Vegetation (2008).

A total of thirteen vegetation monitoring quadrants were established within the project easement area using 12 standard 10 meter by 10 meter vegetation monitoring plots and one 20 meter by 5 meter plot. Plots were randomly established within planted portions of the riparian buffer areas to capture the heterogeneity of the designed vegetative communities. The plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs of the vegetation plots will be taken annually from the origin looking diagonally across the plot to the opposite corner.

Vegetation plot locations are depicted on the Integrated Current Conditions Plan View (CCPV) Map (Figure 4) in Appendix 2. Photos depicting the current conditions of the vegetation plots for MY2 are also presented in Appendix 2.

3.3 Overview Photographs

Photographs will be taken of the project area annually for five years to visually document vegetation growth following construction. A drone will be used to document the project's overall vegetative growth and ground cover. Overview photographs are shown in Appendix 2.

3.4 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above. Visual assessments will continue to be performed within the Site on a semi-annual basis during the five-year monitoring period. Problem areas with vegetative health will be noted (e.g. low stem density, vegetation mortality, invasive species, and/or encroachment). Areas of concern will be mapped,

photographed, and accompanied by a written description in the annual monitoring report. Problem areas will be re-evaluated during each subsequent visual assessment.

Section 4: Results of Year 3 Monitoring

The result of vegetative sampling shows an average planted stem density of 442 stems per acre, with individual plot densities ranging from 283 to 607 stems per acre. When including volunteers, the average total stem density is 573 stems per acre, with individual plots ranging from 364 to 1,416 total stems per acre. See Table 9 in Appendix 3 for additional information.

Vegetation plot 2 has 20 sweetgum (*Liquidambar styraciflua*) stems. Planted stems do not appear to be negatively affected; however, the plot will be monitored in future years to ensure that volunteer stems do not begin to out-compete planted stems.

Refer to Appendix 2 for visual assessment data and Appendix 3 for vegetation plot data and vegetation plot photographs.

4.1 Parcel Maintenance

Higher than expected tree mortality took place during monitoring year 2, including two vegetation plots which failed to meet the final density criterium of 260 stems per acre. To remediate this, a supplemental planting was performed during February 2022 which successfully increased stem density and diversity. A total of 992 stems were planted in densities ranging from 150 to 250 stems per acre across an area of approximately 5 acres. See Table 10 in Appendix 3 for details on species composition.

Soil tests were performed prior to the replant to determine if poor soil quality induced monitoring year 2 stem mortality and revealed that soil conditions were not the likely cause. While competition does not appear to be the primary cause of prior planted stem mortality, ring sprays were performed during February 2022 across approximately 2 acres along the upstream end of UT to New Hope Creek to further ensure planted stem success.

Additional adaptive measures will be developed, or appropriate remedial actions will be implemented if the Site or a specific component of the Site fails to achieve the success criteria outlined in the Mitigation Plan. Site maintenance will be performed to correct any identified problems on the Site that have a high likelihood of affecting project success. Such items include but are not limited to excess tree mortality caused by fire, flooding, drought, or insects. Any actions implemented will be designed to achieve the success criteria and will include a work schedule and updated monitoring criteria.

4.2 Conclusions

The 2022 vegetation monitoring data reflects that the Site is on track to meet the final criterium of 260 stems per acre. There is an average planted stem density of 442 stems per acre, with individual plots ranging from 283 to 607 stems per acre. When including volunteer stems, the average stem density is 573 stems per acre. A higher-than-expected tree mortality occurred during monitoring year 2, therefore, a supplemental planting was performed in February 2022. Vegetation plot data indicates the replant was successful in increasing stem density and diversity. To ensure success of planted stems, ring sprays were performed across a portion of the Site in February 2022.

Section 5: References

Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2008. CVS-EEP Protocol for Recording Vegetation Version 4.2. Retrieved from http://cvs.bio.unc.edu/protocol/cvs-eep-protocol-v4.2-lev1-5.pdf

North Carolina Ecosystem Enhancement Program. 2009. Cape Fear River Basin Restoration Priorities 2009. http://www.nceep.net/services/lwps/cape_fear/RBRP%20Cape%20Fear%202008.pdf

North Carolina Division of Mitigation Services (DMS). 2017. Riparian Buffer and Nutrient Offset Buffer Baseline & Annual monitoring Report Template (Version 2.0, 05-2017). Raleigh, North Carolina. https://ncdenr.s3.amazonaws.com/s3fs-public/Mitigation%20Services/Document%20Management%20Library/Guidance%20and%20Template%20Documents/RB_NO_Base_Mon_Template_2.0_2017_5.pdf

North Carolina Interagency Review Team. 2016. Wilmington District Stream and Wetland Compensatory Mitigation Update. October 24, 2016.

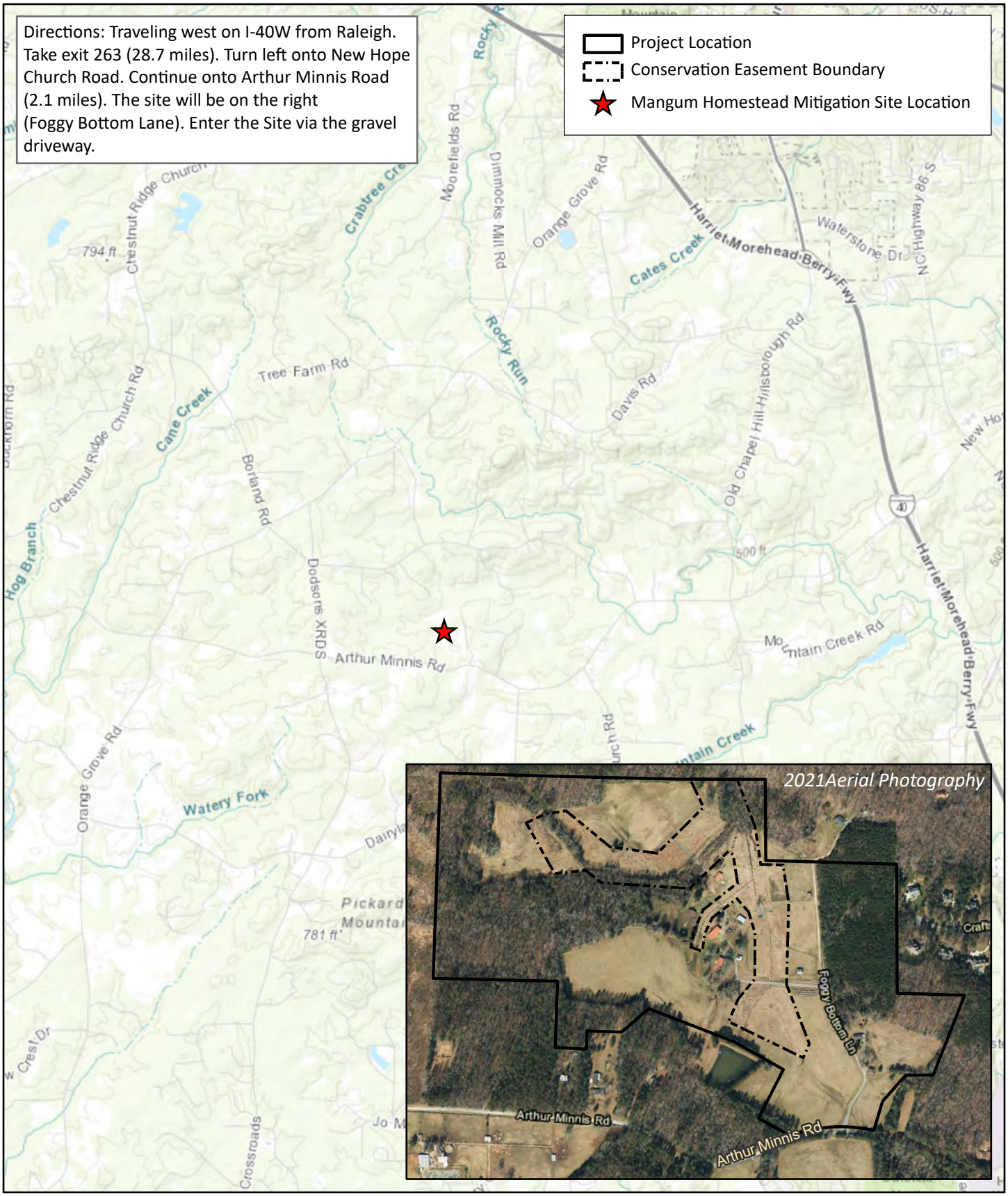
Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina, 3rd approx. North Carolina Natural Heritage Program, Raleigh, North Carolina.

United States Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

Wildlands Engineering, Inc. 2020. Mangum Homestead Mitigation Plan. DMS, Raleigh, NC. January, 2020.

Wildlands Engineering, Inc. 2020. Mangum Homestead Baseline Monitoring Report. DMS, Raleigh, NC. June, 2020.

APPENDIX 1. General Tables and Figures



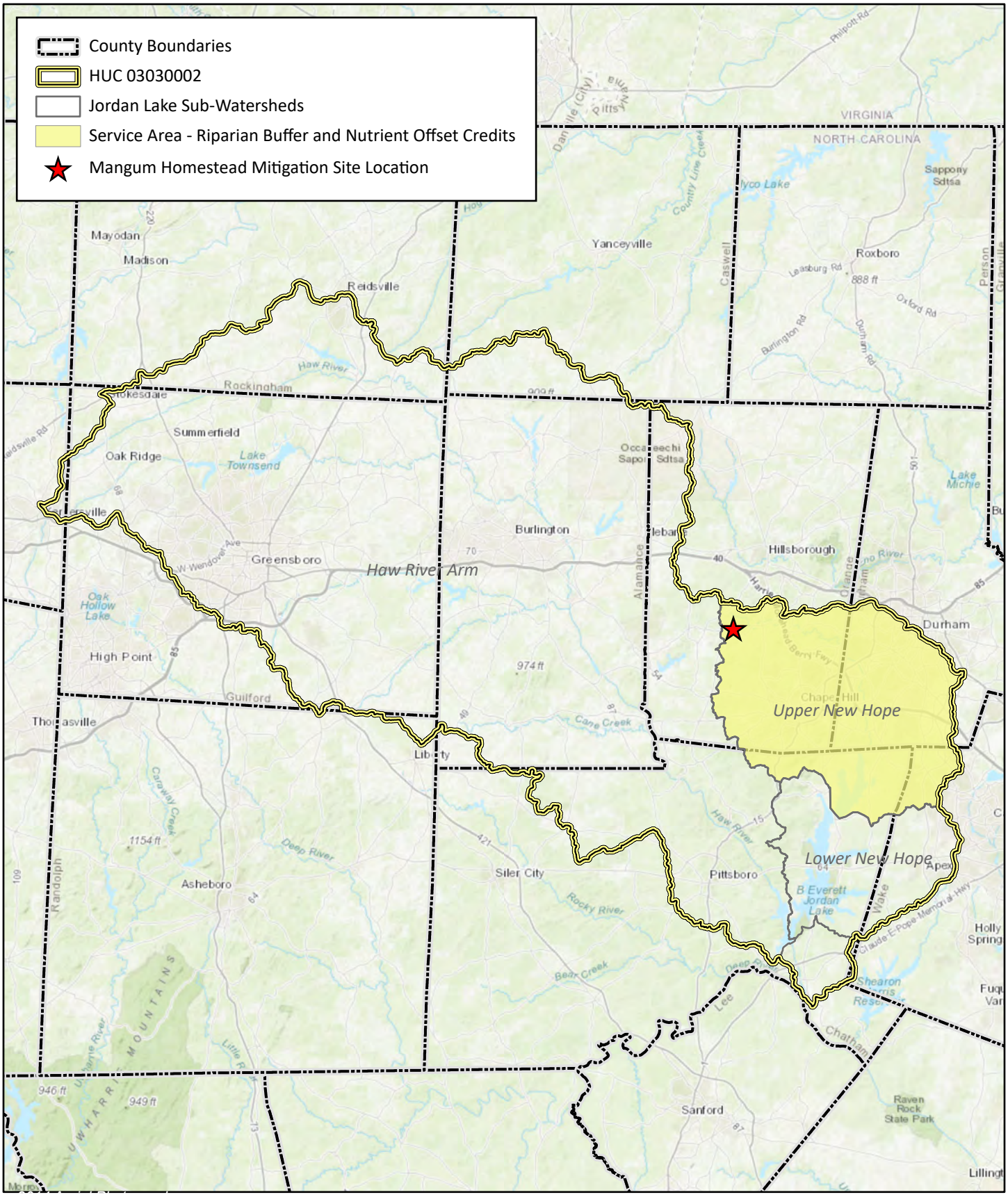
WILDLANDS ENGINEERING

0 0.5 1 Miles

N

Figure 1 Vicinity Map
Mangum Homestead Mitigation Site
Monitoring Year 3 Report
Cape Fear River Basin (03030002)

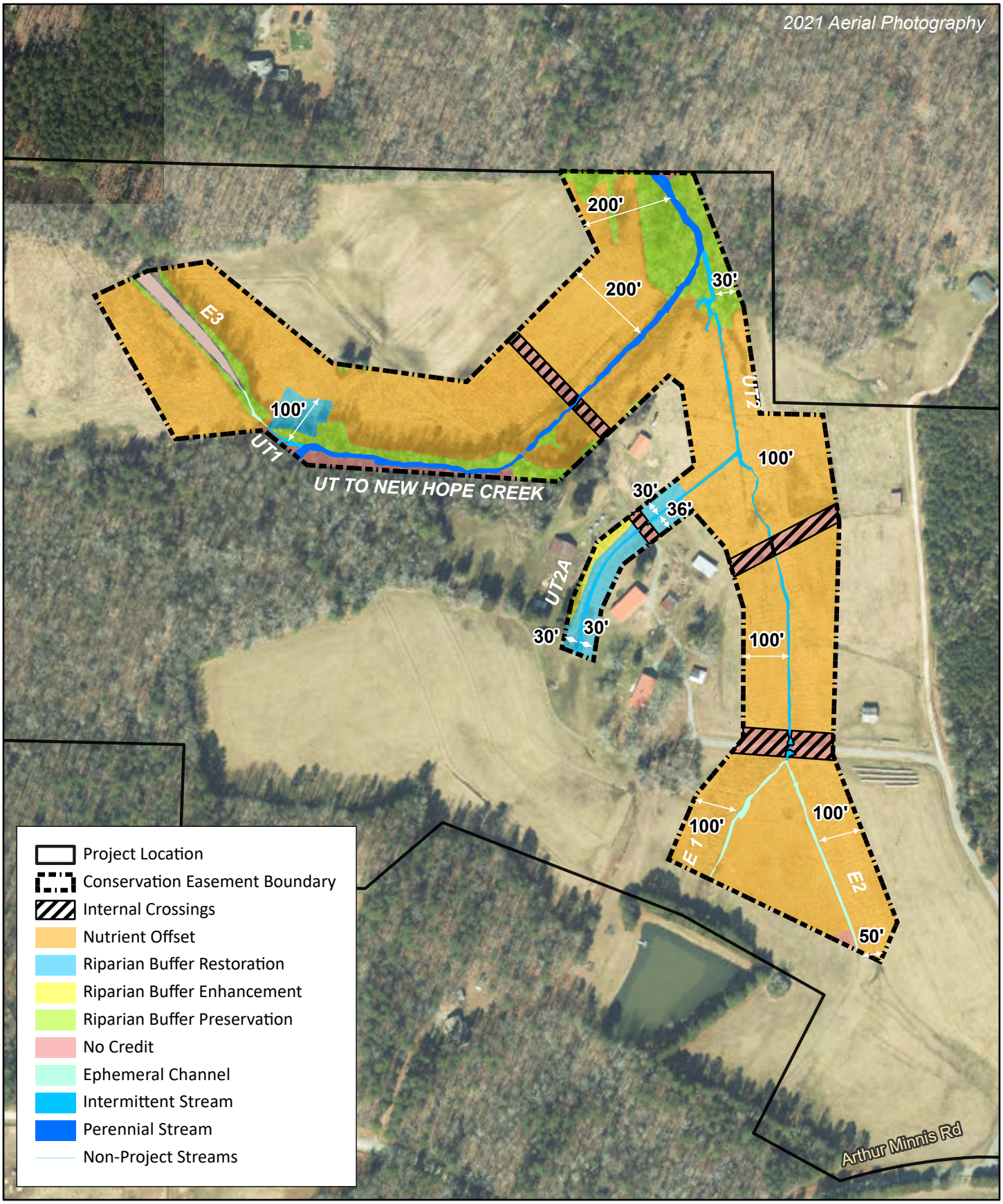
Orange County, NC



WILDLANDS ENGINEERING

Figure 2 Service Area Map
Mangum Homestead Mitigation Site
Monitoring Year 3 Report
Cape Fear River Basin (03030002)

Orange County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3 Project Component/Asset Map
Mangum Homestead Mitigation Site
Monitoring Year 3 Report
Cape Fear River Basin (03030002)

Orange County, NC

Table 1. Buffer Project Areas and Assets

Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

Cape Fear - Jordan Upper New Hope 03030002060110	**Project Area**
32.91899	**N Credit Conversion Ratio (ft^2/pound)**
522.2408	**P Credit Conversion Ratio (ft^2/pound)**

Credit Type	Location	Subject? (enter NO if ephemeral or ditch [1])	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (ft^2)	Total (Creditable) Area of Buffer Mitigation (ft^2)	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	Yes	I / P	Restoration	0-50	UT2A	23,810	23,810	1	100%	1.00000	Yes	23,810.000	No	—	—
Buffer	Rural	Yes	I / P	Restoration	0-100	UT1	9,445	9,445	1	100%	1.00000	Yes	9,445.000	Yes	286.916	18.086
Buffer	Rural	Yes	I / P	Enhancement	0-100	UT2A	4,819	4,819	2	100%	2.00000	Yes	2,409.500	No	—	—
Nutrient Offset	Rural	No	Ephemeral	Restoration	0-100	UT to New Hope Creek, UT2, E1, E2, E3	503,726	503,726	1	100%	1.00000	Yes	503,726.000	Yes	15,301.988	964.547
Nutrient Offset	Rural	No	Ephemeral	Restoration	101-200	UT to New Hope Creek, UT2, E1, E2, E3	154,184	154,184	1	33%	3.03030	Yes	50,880.771	Yes	4,683.740	295.235
						Totals:	695,984	695,984								

Enter Preservation Credits Below

Eligible for Preservation (ft^2): 12,691

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^2)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Riparian Buffer Credits
Buffer	Rural	Yes	I / P	Preservation	0-100	UT to New Hope Creek, UT2	74,537	12,691	10	100%	10.00000	1,269.100
	Rural	Yes	I / P		101-200	UT to New Hope Creek	4,922		10	33%		—
												—
												—
												—
												—
						Preservation Area Subtotal (ft^2):		12,691				
						Preservation as % Total Area of Buffer Mitigation:		25.0%				
						Ephemeral Reaches as % Total Area of Buffer Mitigation:		0.0%				

TOTAL AREA OF BUFFER MITIGATION (TABM)			
Mitigation Totals		**Square Feet**	**Credits**
Restoration:		33,255	33,255.000
Enhancement:		4,819	2,409.500
Preservation:		12,691	1,269.100
Total Riparian Buffer:		50,765	36,933.600
TOTAL NUTRIENT OFFSET MITIGATION			
Mitigation Totals		**Square Feet**	**Credits**
Nutrient Offset:	**Nitrogen:**	657,910	19,985.729
	Phosphorus:		1,259.783

Table 2. Project Activity and Reporting History

Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

Activity or Report	Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan Date	-	January 2020
Bare Roots Planting	-	April 2020
As-Built & Baseline Monitoring Document	April 2020	June 2020
Competitive Vegetation Treatment[1]	-	May 2020
Year 1 Monitoring Report Date	October 2020	December 2020
Year 2 Monitoring Report Date	October 2021	December 2021
Supplemental Planting	-	February 2022
Competitive Vegetation Treatment[1]	-	February 2022
Year 3 Monitoring Report Date	September 2022	December 2022
Year 4 Monitoring Report Date	2023	December 2023
Year 5 Monitoring Report Date	2024	December 2024

[1]Ring sprays conducted around planted stems

Table 3. Project Contact Table

Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

Designers	**Wildlands Engineering, LLC** 104 Charlotte, NC 28203 704.332.7754
Planting Contractor	**Bruton Natural Systems, Inc**
Nursery Stock Suppliers	**Dykes and Son Nursery**
Monitoring Performers	**Wildlands Engineering, Inc.** Jason Lorch 919.851.9986, ext. 107

Table 4. Project Information and Attributes

Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

PROJECT INFORMATION	
Project Name	Mangum Homestead Mitigation Site
USGS Hydrologic Unit 14-digit	03030002060110
River Basin	Cape Fear - Jordan Upper New Hope
Project Coordinates (latitude and longitude)	35° 59’ 49.23’’ N, 79° 8’ 44.77’’ W
Total Credits (BMU)	36,933.600
Total Credits (Nitrogen Offset)	19,985.729
Total Credits (Phosphorous Offset)	1,259.783
Types of Credits	Riparian Buffer & Nutrient Offset

Table 5. Monitoring Components Summary

Mangum Homestead Mitigation Site

DMS Project No. 100107

Monitoring Year 5 - 2022

Parameter	Monitoring Feature	Quantity/Length By Reach							Frequency
		UT to New Hope Creek	UT1	UT2	UT3	E1	E2	E3	
Vegetation	**CVS Level 1**	13							Annual
Visual Assessment	Y	Y	Y	Y	Y	Y	Y	Y	Semi- Annual
Exotic and Nuisance Vegetation	Y	Y	Y	Y	Y	Y	Y	Y	Semi- Annual
Project Boundary	Y	Y	Y	Y	Y	Y	Y	Y	Semi- Annual
Reference Photographs	Overview Photographs								Annual

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

September 4, 2019

Andrea Eckardt
Wildlands Engineering, Inc
1430 S. Mint St, Suite 104
Charlotte, NC 28203
(via electronic mail: aeckardt@wildlandseng.com)

DWR# 2019-0645
Orange County

Re: Site Viability for Buffer Mitigation & Nutrient Offset – Mangum Homestead Site
Located at 1449 Foggy Bottom Ln, Hillsborough, NC
Upper New Hope of Jordan Lake Watershed

Dear Ms. Eckardt,

On May 14, 2019, Katie Merritt, with the Division of Water Resources (DWR), received a request from Wildlands Engineering, Inc. (Wildlands) for an onsite mitigation determination near the above-referenced site (Site). The Site is located within the Upper New Hope sub-watershed of Jordan Lake in the Cape Fear River Basin. The Site is being proposed as part of a full-delivery riparian buffer mitigation and nutrient offset project for the Division of Mitigation Services (RFP #16-007702). On July 19, 2019, Ms. Merritt performed an onsite assessment of riparian land uses adjacent to streams and channels onsite, which are shown on the attached map labeled "Site Map". Staff from the Division of Mitigation Services were also present onsite.

Ms. Merritt's evaluation of the features onsite and their associated mitigation determination for the riparian areas are provided in the table below. This evaluation was made from Top of Bank (TOB) and landward 200' from each feature for buffer mitigation pursuant to 15A NCAC 02B .0295 (effective November 1, 2015) and for nutrient offset credits pursuant to 15A NCAC 02B .0240.

Feature	Classification onsite	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable	[5]Mitigation Type Determination w/in riparian areas
E1	Ephemeral	No	Non-forested hay field	[4]Yes	Yes	**Restoration Site** per 15A NCAC 02B .0295 (o)(7)
E2	Ephemeral	No	Non-forested hay field	[4]Yes	Yes	**Restoration Site** per 15A NCAC 02B .0295 (o)(7)
UT2	Stream	Yes	Mostly non-forested hay field with some forested areas downstream	[3]Yes	Yes *(non-forested areas only)*	Non-forested areas - **Restoration Site** per 15A NCAC 02B .0295 (n) Forested Areas - **Preservation Site** per 15A NCAC 02B .0295 (o)(5)
UT2A	Stream	No	Mostly non-forested grassed lawn with some trees along fence line	Yes	No	**Restoration Site** per 15A NCAC 02B .0295 (o)(3) Tree line - **Enhancement Site** per 15A NCAC 02B .0295 (o)(3)
E3	Ephemeral	No	Combination of forested areas mostly along the channel and non-forested hay fields	[3,4]Yes	Yes *(non-forested areas only)*	Non-forested areas - **Restoration Site** per 15A NCAC 02B .0295 (o)(7) Forested Areas - **Preservation Site** per 15A NCAC 02B .0295 (o)(7)
UT1 (at DWR flag)	Stream	Yes	Combination of forested areas mostly along the channel and non-forested hay fields	[3]Yes	Yes *(non-forested areas only)*	Non-forested areas - **Restoration Site** per 15A NCAC 02B .0295 (n) Forested Areas - **Preservation Site** per 15A NCAC 02B .0295 (o)(5)
UT to New Hope Creek	Stream	Yes	Combination of forested areas mostly along the channel and non-forested hay fields	[3]Yes	Yes *(non-forested areas only)*	Non-forested areas - **Restoration Site** per 15A NCAC 02B .0295 (n) Forested Areas - **Preservation Site** per 15A NCAC 02B .0295 (o)(5)

[1]Subjectivity calls for the features were determined by DWR in correspondence dated August 27, 2019 using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS .

[2] *NC Division of Water Resources - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment. Nitrogen and Phosphorus are calculated differently in the Jordan Lake Watershed.*

[3]The area of preservation credit within a buffer mitigation site shall comprise of no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 0295 (o)(5) and 15A NCAC 0295 (o)(4). Site cannot be a Preservation Only site to comply with this rule.

[4]The area of the mitigation site on ephemeral channels shall comprise no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 02B .0295 (o)(7).

[5]All features proposed for buffer mitigation or nutrient offset, must have a conservation easement established that includes the tops of channel banks when being measured perpendicular and landward from the channel, even when no credit is viable within the 50' riparian area.

The site map attached to this letter was prepared by Wildlands and edited by DWR to match this correspondence. This letter does not constitute an approval of this site to generate mitigation credits. Pursuant to 15A NCAC 02B .0295, a mitigation proposal and a mitigation plan shall be submitted to DWR for written approval **prior** to conducting any mitigation activities in riparian areas and/or surface waters for buffer mitigation credit. Pursuant to 15A NCAC 02B .0240, a proposal regarding a

proposed nutrient load-reducing measure for nutrient offset credit shall be submitted to DWR for approval prior to any mitigation activities in riparian areas and/or surface waters.

All vegetative plantings, performance criteria and other mitigation requirements for riparian restoration, enhancement and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and/or nutrient offset mitigation credits. For any areas depicted as not being viable for nutrient offset credit above, one could propose a different measure, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset in accordance with 15A NCAC 02B .0240.

This viability assessment will expire on September 4, 2021 or upon the submittal of an As-Built Report to the DWR, whichever comes first. **This letter should be provided in all stream and wetland, buffer and/or nutrient offset mitigation plans for this Site.**

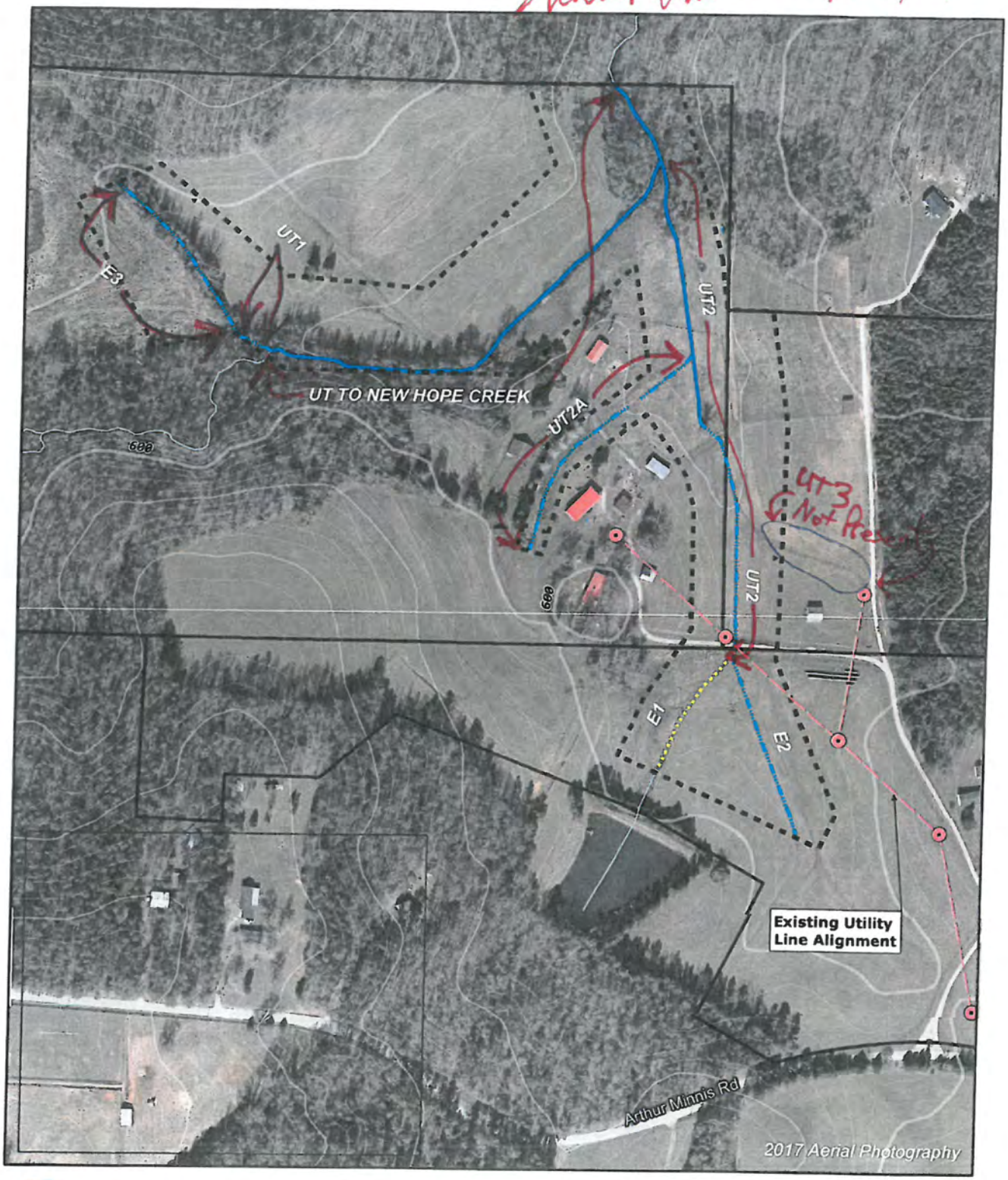
Sincerely,

Mac Haupt, Acting Supervisor
401 and Buffer Permitting Branch

MH/*km*
Attachments: Site Map

cc: File Copy (Katie Merritt)
Lindsay Crocker- DMS (via electronic mail)

8/26/19



WILDLANDS ENGINEERING

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Site Map
Mangum Homestead Mitigation Site
Cape Fear River Basin (03030002)

Orange County, NC

9/4/19

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

August 27, 2019

DWR Project # 2019-0645 V2
Orange County

Andrea Eckardt
Wildlands Engineering Inc.
1430 S. Mint Street, Suite 104
Charlotte, NC 28203

Subject: On-Site Determination for Applicability to the Jordan Buffer Rules (15A NCAC 02B .0267)
Project Name: Mangum Homestead Mitigation Site
Parcel ID Numbers: 9851671991, 9851778621, 9851763367
Address/ Location: 1449 Foggy Bottom Lane, Hillsborough, Orange County, NC
Stream(s) Evaluated: Unnamed Tributaries to New Hope Creek, Classified as WS-V; NSW
Determination Date: 7/19/2019 **Staff:** DWR, Shelton Sullivan

Dear Andrea,

On July 19, 2019, Shelton Sullivan of the Division of Water Resources (DWR) Central Office conducted an on-site review of features located on the subject property at the request of Wildlands Engineering Inc. The purpose of the review was to determine the applicability to the Jordan Riparian Area Protection Rules (15A NCAC 02B .0267) and perform stream determinations within the proposed project easement.

The enclosed site map indicates the features evaluated and this information is also summarized in the table below. Streams that are "Subject" are shown on the most recently published NRCS Soil Survey of Orange County and/or the most recent copy of the USGS Topographic (at 1:24,000 scale) maps, have been located on the ground at the site, and possess characteristics that qualify them to be at least intermittent streams. Features that are "Not Subject" are not depicted on the required maps, not present on the property, or have been determined to not be at least intermittent.

Please note that there may be other surface waters located on the property that may be subject to the Jordan Riparian Area Protection Rules, considered jurisdictional according to the US Army Corps of Engineers, and subject to the Clean Water Act.

See the following table for the features rated during the DWR site visit:

Feature ID	*E/I/P/ Other	Subject to Buffer Rules	Start @	Stop @	Depicted on Soil Survey	Depicted on USGS Topo
E3	"E"	No	Northwest project easement	Downstream of the pipe at flag and UT1 Start	Yes	No
UT1	"I"	Yes	Downstream of the pipe at flag and UT1 Start	Confluence of UT1 and UT to New Hope Creek	Yes	No
UT to New Hope Creek	"P"	Yes	Project easement	Continues throughout	Yes	Yes
E1	"E"	No	Southern project easement below pond.	Continues downstream to confluence with E2	Yes	Yes
E2	"E"	No	Southern project easement.	Continues downstream to confluence with E1	Yes	No
UT2	"I"	Yes	Confluence of E1 and E2, just upstream of culvert	Continues downstream to confluence of UT to New Hope Creek	Yes	Yes
**UT2A	"I"	No	Project easement.	Continues downstream to confluence with UT2	No	No
UT3	Not Present	No	Shown on aerials on east side of project easement	N/A	Yes	No

*Ephemeral, I: Intermittent, P: Perennial
**Please note that UT2A has an installed corrugated pipe that is impeding the stream flow to the downstream portion UT2A.

This on-site determination shall expire five (5) years from the date of this letter. Landowners or affected parties that dispute a determination made by the DWR may request a determination by the Director. An appeal request must be made within sixty (60) calendar days of the date of this letter to the Director in writing.

If sending via U.S. Postal Service:
DWR 401 & Buffer Permitting Branch Supervisor
1617 Mail Service Center
Raleigh, NC 27699-1617

If sending via delivery service (UPS, FedEx, etc.)
DWR 401 & Buffer Permitting Branch Supervisor
512 N Salisbury St.
Raleigh, NC 27604

This determination is final and binding as detailed above, unless an appeal is requested **within sixty (60) calendar days.**

This letter only addresses the features on the subject property and within the proposed project easement and does not approve any activity within buffers or within waters of the state. If you have any additional questions or require additional information, please call Shelton Sullivan at (919) 707-3636. This determination is subject to review as provided in Articles 3 & 4 of G.S. 150B.

Sincerely,

Paul Wojcik
for
Mac Haupt, Acting Supervisor
401 & Buffer Permitting Branch

Enclosures: Photographs, Site Map, Soil Survey, USGS Topographical Map

cc: Andrea Eckardt, Wildlands Engineering Inc. via email
Robert and Janie Mangum, 1449 Foggy Bottom Lane, Hillsborough, NC 27278
401 & Buffer Permitting Branch files

Photographs 7-19-2019

Pic 1. E3 Ephemeral

Pic. 2 UT1 Intermittent Start

Pic 3. Confluence of UT1 and UT to New Hope Creek

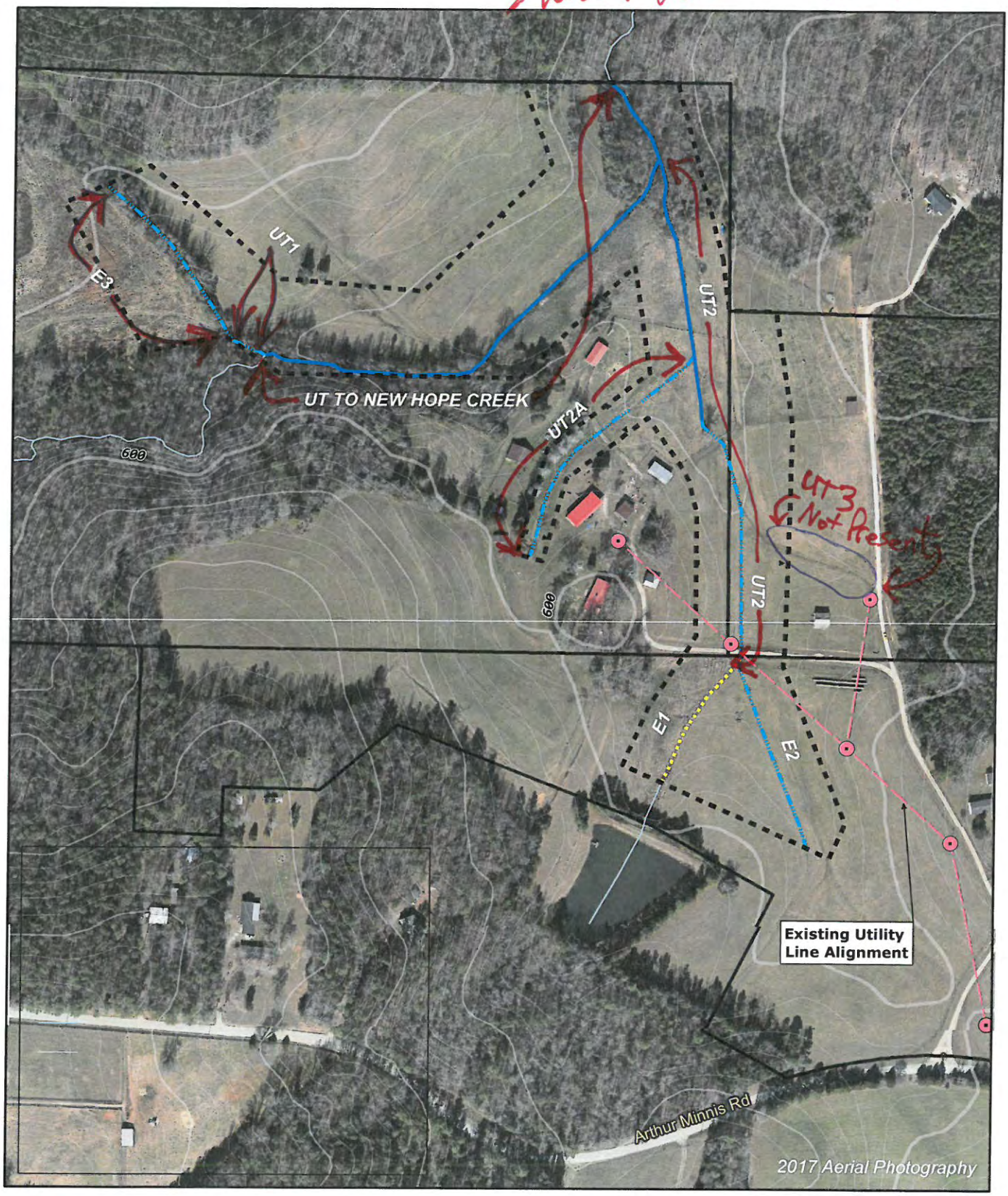
Photographs 7-19-2019 (continued)

UT2A looking upstream from path

UT2A looking downstream from path

No photographs of UT2 or UT3

8/26/19



WILDLANDS ENGINEERING

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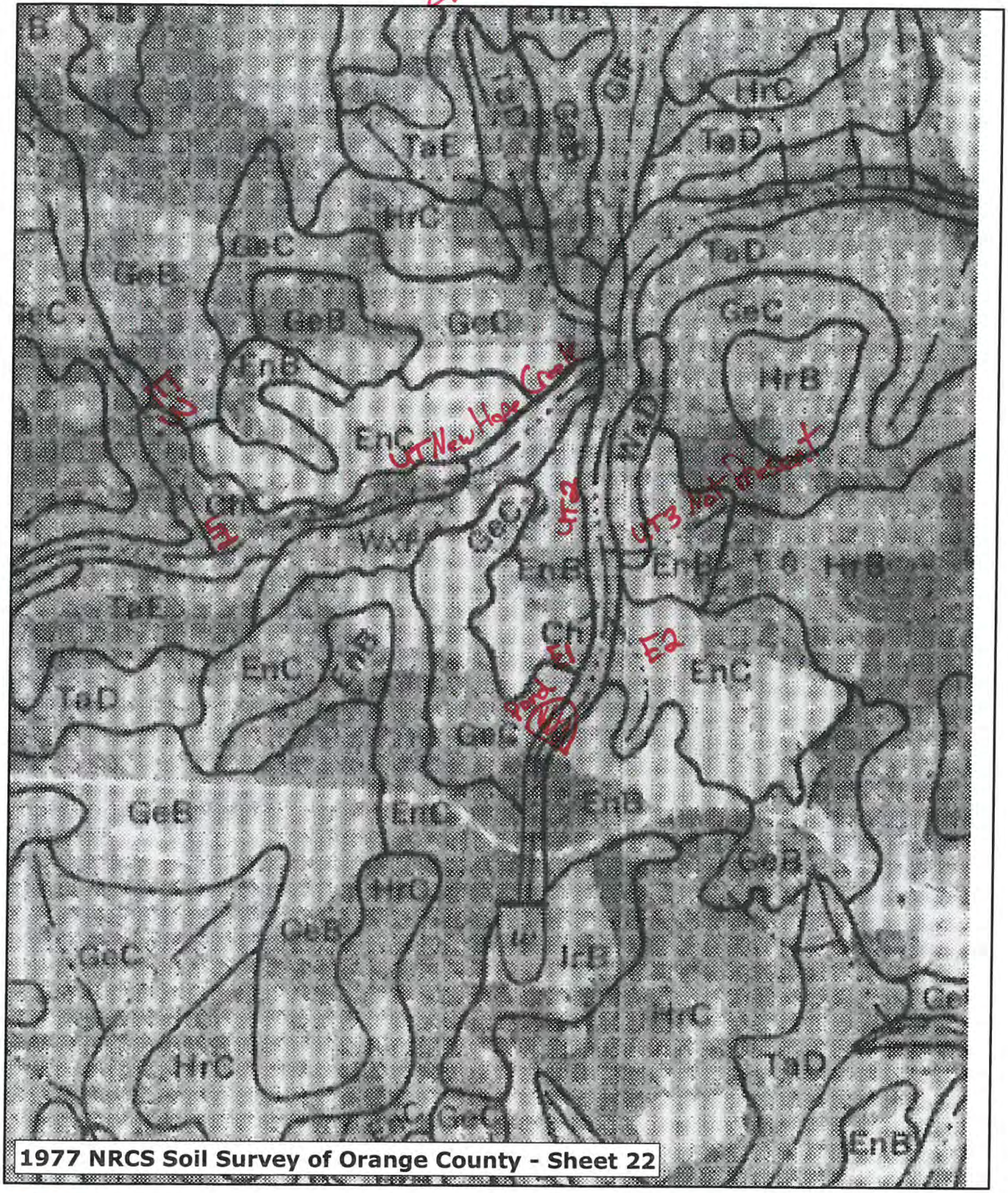
Site Map
Mangum Homestead Mitigation Site
Cape Fear River Basin (03030002)

Orange County, NC

8/26/19



WILDLANDS
ENGINEERING

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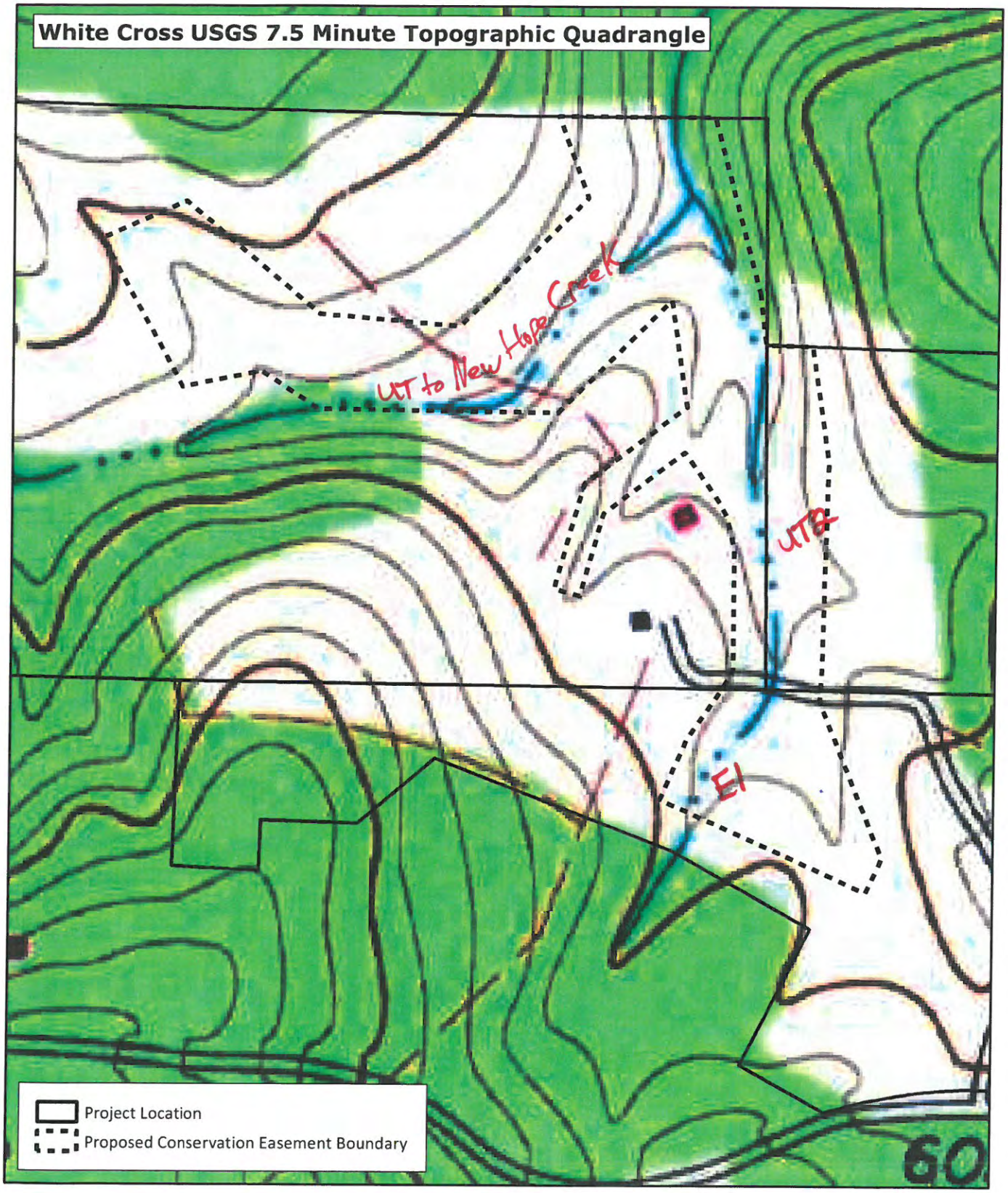
1977 NRCS Soil Survey Map
Mangum Homestead Mitigation Site
Cape Fear River Basin (03030002)

Orange County, NC

Shelby Fuller 8/26/19



WILDLANDS ENGINEERING

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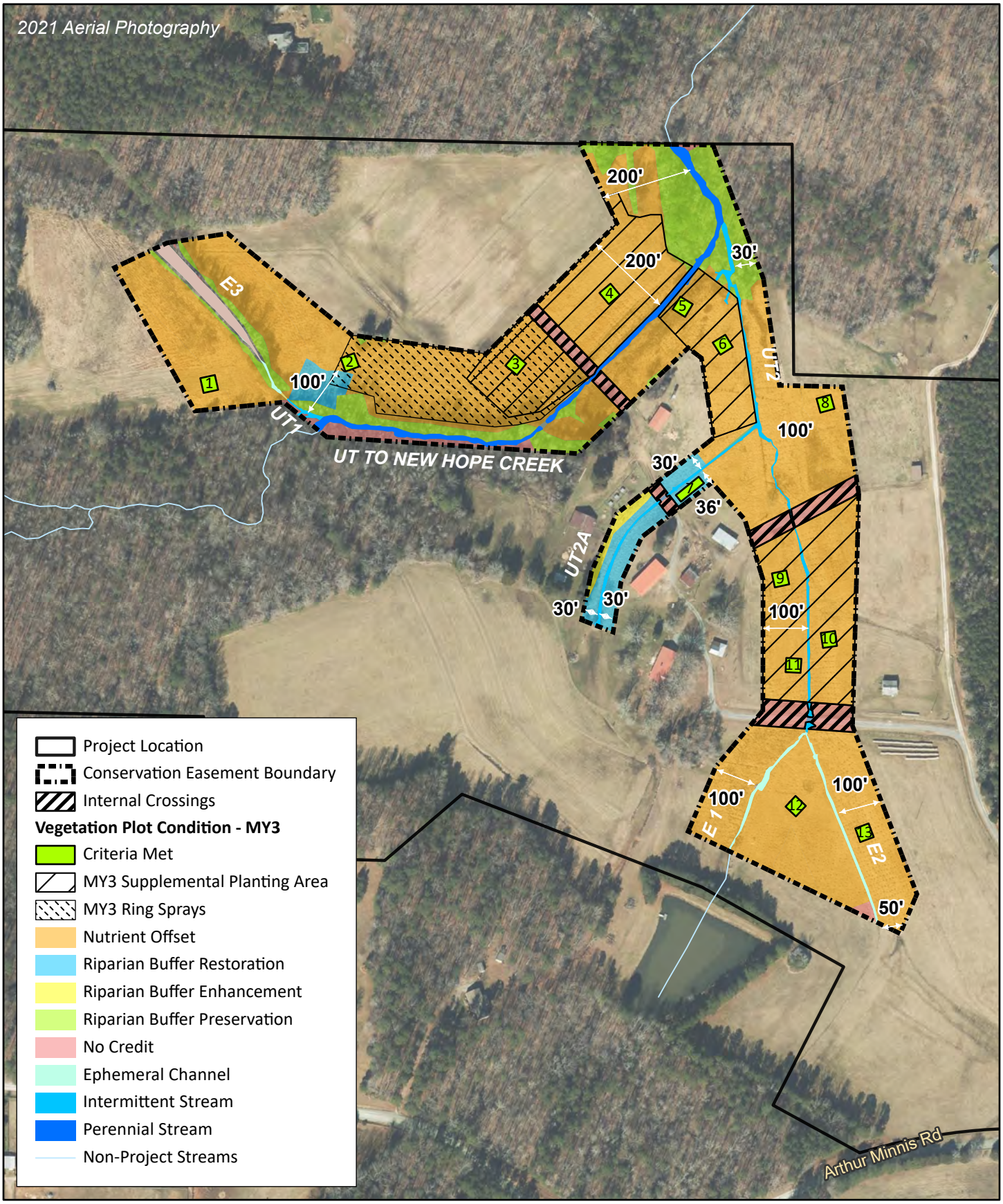
USGS Topographic Map
Mangum Homestead Mitigation Site
Cape Fear River Basin (03030002)

Orange County, NC

APPENDIX 2. Visual Assessment Data



WILDLANDS ENGINEERING

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Figure 4 Integrated Current Condition Plan View
Mangum Homestead Mitigation Site
Monitoring Year 3 Report
Cape Fear River Basin (03030002)
Orange County, NC

Table 6. Vegetation Condition Assessment Table

Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

Planted Acreage **17.14**

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	0.1	0	0	0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	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.	0.25 Ac	0	0	0%
		Cumulative Total	**0**	**0.0**	**0%**

Easement Acreage **19.89**

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	0.0%

OVERVIEW PHOTOGRAPHS

VEGETATION PLOT PHOTOGRAPHS

VEG PLOT 1 *(9/22/2022)*

VEG PLOT 2 *(9/22/2022)*

VEG PLOT 3 *(9/22/2022)*

VEG PLOT 4 *(10/4/2022)*

VEG PLOT 5 *(9/22/2022)*

VEG PLOT 6 (*9/22/2022)*

VEG PLOT 7 *(9/22/2022)*

VEG PLOT 8 *(9/22/2022)*

VEG PLOT 9 *(9/22/2022)*

VEG PLOT 10 *(9/22/2022)*

VEG PLOT 11 *(9/22/2022)*

VEG PLOT 12 *(9/22/2022)*

VEG PLOT 13 *(9/22/2022)*

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Table

Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

Plot	Success Criteria	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	
11	Yes	
12	Yes	
13	Yes	

Table 8. CVS Vegetation Tables - Metadata
Mangum Homestead Mitigation Site
DMS Project No.100107
Monitoring Year 3 - 2022

Report Prepared By	Rebecca Hogarth
Date Prepared	9/29/2022 12:54
Database Name	Mangum- CVS v2.5.0- MY3.mdb
Database Location	F:\Monitoring\Mangum\MY3
Computer Name	CARLYNN-PC
File Size	77819904
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, 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	100107
project Name	Mangum Homestead
Description	Buffer Restoration Site
Sampled Plots	13

Table 9. Planted and Total Stem Counts
Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

			Current Plot Data (MY3 2022)																	
			VP 1			VP 2			VP 3			VP 4			VP 5			VP 6		
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**
Acer negundo	Boxelder	Tree	1	1	1	2	2	2												
Betula nigra	River Birch	Tree	3	3	3	2	2	2	3	3	3	3	3	3	2	2	2	2	2	2
Carya tomentosa	Mockernut Hickory	Tree																		
Cephalanthus occidentalis	Common Buttonbush	Shrub Tree																		
Diospyros virginiana	American Persimmon	Tree	1	1	3	2	2	2	1	1	1	1	1	1			2	2	2	5
Juniperus virginiana	Eastern Red Cedar	Tree																		
Liquidambar styraciflua	Sweet Gum	Tree						20			2									
Liriodendron tulipifera	Tulip Poplar	Tree						1												
Nyssa sylvatica	Black Gum	Tree																		
Pinus taeda	Loblolly Pine	Tree						2												
Platanus occidentalis	Sycamore	Tree	5	5	5	2	2	3	2	2	2	5	5	5	7	7	7	5	5	5
Quercus michauxii	Swamp Chestnut Oak	Tree				2	2	2	3	3	3	1	1	1						
Quercus phellos	Willow Oak	Tree	1	1	1	1	1	1												
Quercus rubra	Northern Red Oak	Tree																		
Quercus shumardii	Shumard Oak	Shrub Tree										3	3	3	1	1	1	1	1	1
Ulmus alata	Winged Elm	Tree																		2
		Stem count	11	11	13	11	11	35	9	9	11	13	13	13	10	10	12	10	10	15
		size (ares)	1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	5	6	6	9	4	4	5	5	5	5	3	3	4	4	4	5
		Stems per ACRE	445	445	526	445	445	1,416	364	364	445	526	526	526	405	405	486	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 - Planted Stems Excluding Live Stakes
P-all - All Planted Stems
T - All Woody Stems

Table 9. Planted and Total Stem Counts
Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

			Current Plot Data (MY3 2022)																				
			VP 7			VP 8			VP 9			VP 10			VP 11			VP 12			VP 13		
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**
Acer negundo	Boxelder	Tree				1	1	1	3	3	3	2	2	2									
Betula nigra	River Birch	Tree	4	4	4	1	1	1	2	2	2	6	6	6	3	3	3	3	3	3	2	2	2
Carya tomentosa	Mockernut Hickory	Tree																					
Cephalanthus occidentalis	Common Buttonbush	Shrub Tree									1												
Diospyros virginiana	American Persimmon	Tree	3	3	3	3	3	3	5	5	5	2	2	2	1	1	1	2	2	2			
Juniperus virginiana	Eastern Red Cedar	Tree															1						
Liquidambar styraciflua	Sweet Gum	Tree												1						1			
Liriodendron tulipifera	Tulip Poplar	Tree																					
Nyssa sylvatica	Black Gum	Tree													1	1	1						
Pinus taeda	Loblolly Pine	Tree															3						
Platanus occidentalis	Sycamore	Tree	3	3	3	1	1	1	2	2	2	2	2	2				5	5	5	5	5	5
Quercus michauxii	Swamp Chestnut Oak	Tree	1	1	1	1	1	1	1	1	1				2	2	2				1	1	1
Quercus phellos	Willow Oak	Tree																					
Quercus rubra	Northern Red Oak	Tree										1	1	1									
Quercus shumardii	Shumard Oak	Shrub Tree				2	2	2	2	2	2							2	2	2	3	3	3
Ulmus alata	Winged Elm	Tree																					
		Stem count	11	11	11	9	9	9	15	15	16	13	13	14	7	7	11	12	12	13	11	11	11
		size (ares)	1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	4	4	4	6	6	6	6	6	7	5	5	6	4	4	6	4	4	5	4	4	4
		Stems per ACRE	445	445	445	364	364	364	607	607	647	526	526	567	283	283	445	486	486	526	445	445	445

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 - Planted Stems Excluding Live Stakes
P-all - All Planted Stems
T - All Woody Stems

Table 9. Planted and Total Stem Counts
Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

			Annual Means											
			MY3 (2022)			MY2 (2021)			MY1 (2020)			MY0 (2020)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Boxelder	Tree	9	9	9	7	7	7	12	12	12	14	14	14
Betula nigra	River Birch	Tree	36	36	36	30	30	30	40	40	40	45	45	45
Carya tomentosa	Mockernut Hickory	Tree												
Cephalanthus occidentalis	Common Buttonbush	Shrub Tree			1									
Diospyros virginiana	American Persimmon	Tree	23	23	30	15	15	20	20	20	25	18	18	18
Juniperus virginiana	Eastern Red Cedar	Tree			1			1						
Liquidambar styraciflua	Sweet Gum	Tree			24			8						
Liriodendron tulipifera	Tulip Poplar	Tree			1									
Nyssa sylvatica	Black Gum	Tree	1	1	1									
Pinus taeda	Loblolly Pine	Tree			5									
Platanus occidentalis	Sycamore	Tree	44	44	45	44	44	44	47	47	47	48	48	48
Quercus michauxii	Swamp Chestnut Oak	Tree	12	12	12	12	12	12	21	21	21	23	23	23
Quercus phellos	Willow Oak	Tree	2	2	2	4	4	4	20	20	20	26	26	26
Quercus rubra	Northern Red Oak	Tree	1	1	1									
Quercus shumardii	Shumard Oak	Shrub Tree	14	14	14	7	7	7	10	10	10	10	10	10
Ulmus alata	Winged Elm	Tree			2			1						
		Stem count	142	142	184	119	119	134	170	170	175	184	184	184
		size (ares)	13			13			13			13		
		size (ACRES)	0.32			0.32			0.32			0.32		
		Species count	9	9	15	7	7	10	7	7	7	7	7	7
		Stems per ACRE	442	442	573	370	370	417	529	529	545	573	573	573

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 - Planted Stems Excluding Live Stakes
P-all - All Planted Stems
T - All Woody Stems

Table 10. February 2022 Supplemental Planting

Mangum Homestead Mitigation Site
DMS Project No. 100107
Monitoring Year 3 - 2022

Common Name	Scientific Name	Number Planted	% of Total
Boxelder	*Acer negundo*	100	10%
River Birch	*Betula nigra*	150	15%
Mockernut Hickory	*Carya tomentosa*	42	5%
American Persimmon	*Diospyros virginiana*	200	20%
Swamp Chestnut Oak	*Quercus michauxii*	150	15%
Northern Red Oak	*Quercus rubra*	150	15%
Shumard's Oak	*Quercus shumardii*	100	10%
American Elm	*Ulmus americana*	20	2%
Black Gum	*Nyssa sylvatica*	80	8%