

MITIGATION PLAN

Final

November 2018

DRY CREEK MITIGATION PLAN

Durham County, NC
NCDEQ Contract No. 6827
DMS ID No. 97082

Neuse River Basin
HUC 03020201

USACE Action ID No. SAW-2016-00880
DWR Project No. 2016-0369
RFP #: 16-006477

PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
312 W Millbrook Road, Suite 225
Raleigh, NC 27609
Phone: (919) 851-9986

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

October 26, 2018

Regulatory Division

Re: NCIRT Review and USACE Approval of the Dry Creek Mitigation Plan; SAW-2016-00880; NCEEP Project # 97082

Mr. Tim Baumgartner
North Carolina Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Division of Mitigation Services (NCDMS) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the Dry Creek Mitigation Plan, which closed on October 6, 2018. These comments are attached for your review.

Based on our review of these comments, we have determined that no major concerns have been identified with the Draft Mitigation Plan, which is considered approved with this correspondence. However, several minor issues were identified, as described in the attached comment memo, which must be addressed in the Final Mitigation Plan.

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) Application for Nationwide permit approval of the project along with a copy of this letter. Issues identified above must be addressed in the Final Mitigation Plan. All changes made to the Final Mitigation Plan should be summarized in an errata sheet included at the beginning of the document. If it is determined that the project does not require a Department of the Army permit, you must still provide a copy of the Final Mitigation Plan, along with a copy of this letter, to the appropriate USACE field office at least 30 days in advance of beginning construction of the project. Please note that this approval does not preclude the inclusion of permit conditions in the permit authorization for the project, particularly if issues mentioned above are not satisfactorily addressed. Additionally, this letter provides initial approval for the Mitigation Plan, but this does not guarantee that the project will generate the requested amount of mitigation credit. As you are aware, unforeseen issues may arise during construction or monitoring of the project that may require maintenance or reconstruction that may lead to reduced credit.

Thank you for your prompt attention to this matter, and if you have any questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please call me at 919-554-4884.

Sincerely,

Todd Tugwell
Mitigation Project Manager

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Jeff Schaffer, NCDMS
Lindsay Crocker, NCDMS

November 7th, 2018

Wilmington District, Regulatory Division
U.S. Army Corps of Engineers
11405 Falls of Neuse Road
Wake Forest, NC 27587

Attention: Todd Tugwell

Subject: Final Mitigation Plan
Dry Creek Mitigation Project, Durham County
Neuse River Basin HUC 03020201
DMS Project ID No. 97082 / DEQ Contract # 6827

Dear Todd:

We have reviewed the IRT's comments on the draft mitigation plan and draft construction documents for the Dry Creek Stream and Buffer Mitigation Site. We have made the necessary revisions to the report and draft plans and we are submitting revised versions of the documents along with this letter. Below are responses to each of the IRT's comments from the U.S. Army Corps of Engineers memo dated October 12, 2018. The original comments are provided below followed by our responses in bold italics.

Mac Haupt, NCDWR, 11 October, 2018:

1. Section 6.3- Regulatory Considerations- 401/404 – Wildlands states that a net gain of wetland function will be achieved through increasing hydrologic interaction with the floodplain. DWR will recommend later to install gauges to document this assertion.

   No response required.

2. Section 7.0- Mitigation Site Goals and Objectives – DWR recommends including the maintenance and enhancement of current riparian wetland function in your goal statements.

   We have added text to the existing goal of reconnecting channels with floodplains to explicitly state that raising the stream bed will also result in the outcome of enhancing hydration of riparian wetlands.

3. Table 22- Monitoring Components- DWR recommends that bank pins only be used on larger channels if sections of a reach start to show excessive bank movement. DWR does not believe any bank pin arrays are necessary on the tributaries.

We agree with this comment. We have taken the bank pin arrays out of the monitoring plan but we have added a statement that we will install them on Dry Creek if we observe excessive bank movement.

4. Some of the Figures have the New River Basin, should be the Neuse River Basin.

   This has been revised.

5. Design sheets- 1.1- DWR would like an explanation for the extreme Radius of Curvature proposed from station 102+00 to station 104+50.

   This portion of the design has a very flat slope, so Wildlands took the opportunity to create a portion of the alignment that is appropriate for the slope and adds complexity to the pattern.

6. Design sheet 1.3- DWR recommends placing a groundwater gauge on stream right at station 109+50. DWR realizes there is no proposed wetland credit on this project, however, the gauge serves the purpose of documenting increased floodplain connection as stated in Section 6.3 and verifying that the wetland is at least maintaining wetland hydrology.

   We have added a groundwater gauge in this location to Figure 11 and will get the gauge installed soon.

7. Please add or show your typical for filling the relict channel. Also, please include some information or a typical on how you plan to fill the ponds.

   We do not have a detail for filling the old channel but that activity is covered in our specifications. The main points of the specification are to place soil in lifts, compact each lift, do not use more than 10% organic material, and what would constitute unsuitable fill material. There is no standard requirement for compaction. The usual field direction for contractors would be to overfill channels slightly if there is enough material. There usually is not, however, so most channel areas will be filled to grade with some intermittent low spots allowed. This prevents a secondary channel from forming on the floodplain and eroding over time. Regarding comment #8 below, there is potential for wetlands to form in low spots. We have added text to the mitigation plan (Section 8.6) to describe the removal of the ponds.

8. DWR believes there is an opportunity to not only demonstrate that wetland function is being at least maintained but enhanced/restored on this project. There are two areas which could contribute to this result. One is the filling of the relict channel and ponds. Depending on how this is done, and their proximity to the new channel will likely result in the formation of wetland characteristics. The second area is along reach UT1. Much of this reach is underlain by soils mapped as Wehadkee. By raising the channel bed along reach 2 of UT1 should result in the restoration of adjacent riparian wetlands.

   We agree that wetland functions will be enhanced by this project. The gauge we will install adjacent to Dry Creek Reach 1 will provide information to verify that. We also agree that wetlands are likely to form in some of the areas you mentioned.

9. Reach UT1A- it should be noted that this reach was called ephemeral by DWR on the stream/buffer determination visit and letter. Also, DWR requests the flow gauge be installed at station 300+50.

We understand that this stream was called ephemeral by DWR. However, our environmental scientists scored it as intermittent. It is our experience that because of the DWR requirement that streams show up on soils maps to be determined 'subject to the rules' we occasionally see spring fed streams with intermittent to perennial flow that are called ephemeral by DWR . Though the JD has not been issued yet, we have received confirmation from the USACE representative who performed the JD site visit that he agreed with our calls of the limits of jurisdictional waters on the site. We will proceed with this reach as enhancement 1 but we will install the flow gauge at the station on this stream that you have requested. This flow gauge was already planned for this reach as shown on Figure 11.

10. Reach UT2- DWR would like a flow gauge installed at station 400+75.

    We will install this flow gauge. It is now shown on Figure 11.

11. DWR likes the way Wildlands lays out their Design Sheets.

    Noted, thanks.

12. DWR believes UT4 is more of an enhancement reach than a preservation reach.

    We are doing some restoration-oriented work on the lower part of this reach but this is necessary to tie it in to the new Dry Creek channel. Most of this stream will be treated as preservation, so we are willing to accept the 10:1 credit ratio for this portion of the project.

13. DWR recalls during the site visit that most of Dry Creek has a mature riparian buffer. DWR recommends whenever possible to avoid existing mature trees. DWR realizes that some trees will have to come down in the construction corridor. From the design sheets we have noted a number of trees that are targeted for protection. Given past projects (Agony Acres, Candy Creek, Little Troublesome) where Wildlands has constructed a stream channel through a mature canopy, has Wildlands given any thought to studying how many of these protected trees survive (or what is the mortality rate) through the required monitoring period?

    We have done our best to avoid mature trees along the construction corridor and we will take measures to protect trees during construction. We have not formally studied tree mortality along past construction corridors, but we have made some observations of conditions that cause trees to die. For example, we attempt to leave clusters of trees in place where possible as much as large, individual trees because intact groups seem to have better survival. We have followed this approach to avoid clusters of trees on this project.

Todd Bowers, USEPA, 11 October, 2018:

Section 3.5/Pages 8-9:

1. Dry Creek – Reach 3 is shown above the confluence with UT5 in Figure 6.

   This has been corrected on the figure.

2. UT1 – Recommend adding some language to address the impoundment upstream of the road crossing outside of the easement. This pond is almost certainly causing some hydrological stress on UT1 and limiting full function.

   We have added text to state that there is a pond on the stream above the easement.

3. UT5 – include flow regime (intermittent) for this tributary and/or reaches.

   We have added text to indicate that this stream is intermittent.

Section 5.1/ Page 10:

4. While no uplift or potential for uplift is likely for the hydrology function, I recommend that the current status (not-functioning, functioning-at-risk, or functioning) is included in analysis. Many ponds adjacent to the site will still be in operation so their detriment to a fully functioning watershed should be included.

   We have added text to point out that ponds exist in the watershed and have an affect on stream hydrology. However, we still do not have any information (such as stream gauge data) to rate the hydrologic function and the ponds outside of the easement will not be removed. Therefore, we have not included the functional status for hydrology.

Section 5.7/Page 12:

5. The site description of constraints should be corrected to one internal easement crossing and four external crossings per Table 9 and Figure 7 Concept Design Map.

   This correction has been made.

6. Table 9 locations should denote the reach # of each crossing. For example, crossing No. 1 is on UT1 Reach 2.

   This information was added.

Section 7.0/Table 12/Page 15:

7. The goal "Exclude cattle from project streams" is an objective (actually stated in the objectives) to achieve an improvement in water quality. Recommend amending this goal to "Improve water quality leaving the project".

   We disagree with your comment. The goal is to keep cattle out of streams or "exclude" them. The objective is to install fencing around the easement or move the cattle to another location – which is what is stated in the objective column. The outcome is improved water quality. We have not changed the wording of this goal.

Section 8.7/Pages 25-26:

8. Recommend stating the targeted plant community for the riparian buffer Zone 3 planting areas. This may necessarily need to be addressed in the Buffer Mitigation Plan as well.

   We have added the community type to the text.

9. The planted area within the conservation easements needs to be stated in order to determine the recommended number of vegetation monitoring plots. Currently there are 10 permanent and 4 random plots proposed for monitoring. This is sufficient if the planted area is approximately 14 acres.

   The planted area was originally 16.94 acres. If we round up to 17 acres the number of veg plots needed would be:

   (17 acres x 2% of the easement used as vegetation monitoring plots) / 0.025 acres per vegetation plot = 13.6 plots.

   So, we rounded the number of veg plots to 14. **We have now adjusted the planted area because we have more information on where clearing will need to be done along the reconstructed stream corridor and we have reduced the planted area to 14.04 acres.** ***This is now stated in Section 8.7 in addition to Table 1. The new calculation is (14 x 2%)/0.025 = 11.2 plots. We have rounded that number up to 12 plots and that is now reflected on Figure 11 and Table 22.***

10. The planted tree densities for stem survival should be stated as minimums to meet performance standards. Current language implies that the minimum density (320 stems/acre) at year three is the target.

    We have changed the text in Section 8.7 to read that the target density after MY7 is 210 stems per acre. The interim densities for other monitoring years are included in Section 9.2 which describes performance standards for vegetation.

11. Recommend showing vegetation monitoring locations in Appendix 9 Planting Plan similar to Figure 11 Monitoring Components Map.

    We do not understand the comment. Appendix 9 is "Financial Assurances" and does not have a planting plan. Appendix 1, the Buffer Mitigation Plan does have a map that shows monitoring veg plots. We do not put veg plots on construction plans but do show them on As-Built documents.

12. Table 21/Page 29: See comment for Table 12 above.

    Please refer to the response for comment #7 above.

13. Section 14/Page 33: Add Shafale and Weakely's Classification of Natural Communities of North Carolina, Third Approximation, 1990 to the list of references cited. Citation necessary if a targeted plant community is proposed.

    This reference has been added.

14. Recommend adding beaver/nuisance fauna monitoring and a contingency plan/statement for dealing with beaver presence and/or damage caused in Appendix 7.

    We have added a comment about beaver management to the stream component/feature in Appendix 7.

15. Appendix 8 Credit Release Schedule: Please provide rationale for combining the credit release for Milestones 1 and 2 into a 30% release rather than 15% for each milestone.

We have changed the information in the credit release schedule to show that 15% will be released for each milestone.

Todd Tugwell, USACE, 12 October, 2018:

1. Concur with the previous comments, and in particular DWR comment 5 relating to the extreme sinuosity, and also regarding flow gauge placement. Several of the tributaries have especially small watersheds, which is concerning, particularly in the slate belt. Even though there are no specific performance standards proposed for flow, please note that they are in the Oct 2016 guidance, which the mitigation plan says will be adhered to. Regardless, if a stream is determined to be non-jurisdictional after construction, credit may not be approved.

   We understand your concerns and hopefully we have addressed the previous comments adequately. We understand that credit may not be approved for non-jurisdictional streams. We believe that all of the project streams are jurisdictional and have agreed to put flow gauges on the two that DWR specifically questioned.

2. Section 8.7 states "Since sweetgums provide many benefits, the vegetative performance success criteria will not be dependent on treating and removing sweetgum". Please note that if during monitoring, it is determined that excessive sweetgum volunteers are affecting survival of planted, desirable species, treatment and removal of sweetgums may be required for credit release. Please reword or remove this statement.

   We have reworded the statement to say: "Since sweetgums provide many benefits, the vegetative performance success criteria will not be dependent on treating and removing sweetgum, unless it is determined that sweetgum volunteers are affecting the survival of planted, desirable species."

3. The Oct. 2016 monitoring guidance is referenced in Section 9 on Performance Standards; however, not all of the requirements are included, such as the height/vigor standard. Please review the October 2016 guidance to ensure that the proposed monitoring plan and performance standards comply.

   Section 9 was updated to include the requirements in the October 2016 monitoring guidance. Specifically, text was added to include the planted vegetation height requirement and specify which vegetation data will be recorded annually.

4. Design sheets 2.1 and 2.2 showing the buffer planting zones appear to show that the majority of the project will be planted; however, this conflicts with Figure 6 that shows that the lower portion of the site will be buffer preservation. Additionally, it appears that there are no vegetation monitoring plots within the buffer planting zone that is identified as buffer enhancement or buffer preservation. (Concur with EPA comment 11.) Please clarify.

   We have amended the planting plan drawing on design sheets 2.1 and 2.2 to show less planting – it will mostly be kept to one side of the stream along the corridor that will be disturbed during reconstruction of the stream. However replanting of buffer preservations zones is allowed and in this case has been approved by NCDWR.

Per 15A NCAC 02B .0295 Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers (commonly referred to as the Consolidated Buffer Rules), monitoring vegetation for riparian buffer mitigation is required in restoration areas only, not in the buffer enhancement/cattle exclusion or buffer preservation areas. Therefore, there will be 8 vegetation plots in the buffer restoration areas that will be reported to DMS and DWR each year to document the site is meeting the performance standards required for riparian buffer restoration and there will be 4 additional vegetation plots in the stream construction/planting area that will be reported to DMS and the IRT related to the stream mitigation performance standards.

5. Be sure to account for impacts to existing wetlands in the permit application for NWP 27, including specifying if the impacts are temporary or permanent.

   We have accounted for temporary and permanent impacts to wetlands in the PCN which has been submitted to DMS.

Please contact me at 919-851-9986 x103 if you have any questions.

Thank you,

Jeff Keaton, PE
Project Manager

FINAL MITIGATION PLAN

DRY CREEK MITIGATION SITE

Durham County, NC
NCDEQ Contract No. 6827
DMS ID No. 97082
Neuse River Basin
HUC 03020201
USACE Action ID No. SAW-2016-00880
DWR Project No. 2016-0369

PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
312 W Millbrook Road, Suite 225
Raleigh, NC 27609
Phone: (919) 851-9986

This mitigation Plan has been written in conformance with the requirements of the following:

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

These documents govern DMS operations and procedures for the delivery of compensatory mitigation.

Contributing Staff:
Jeff Keaton, PE, *Project Manager*
Nicole Macaluso, PE*, Lead Designer*
John Hutton, *Principal in Charge*
Jesse Phillips, *Designer*
Carolyn Lanza, *Existing Conditions Analysis*
Win Taylor, PWS, *Wetland Delineations, Permitting*
Christine Blackwelder, *Lead Quality Assurance*

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 Introduction

The Dry Creek Mitigation Site (Site) is located in Durham County approximately three miles northwest of Butner, NC and approximately 2 miles west of the Granville County/Durham County line (Figures 1 and 2). The project is located within the NC Division of Mitigation Services (DMS) targeted local watershed for the Neuse River Basin Hydrologic Unit (HU) 03020201010050 and NC Division of Water Resources (DWR) Subbasin 03-04-01. The Site was selected by DMS to provide stream mitigation units (SMUs) and buffer credits in the Neuse River Basin 03020201 (Neuse 01). The project involves the restoration, enhancement, and preservation of 9,961 existing linear feet of incised and straightened streams on Dry Creek and eight unnamed tributaries (UT1 – UT7; UT1a). Restoration of these streams will provide 8,458 SMUs. The project will also restore, enhance, and preserve riparian buffer area within the project area, which will provide 420,733 buffer credits. The Buffer Mitigation Plan is located in Appendix 1. The Site will be protected by a 29.8-acre conservation easement. The Site Protection Instrument detailing the easement is located in Appendix 2. General project information is shown in Table 1.

Table 1: Project Attribute Table Part 1

Project Information	
Project Name	Dry Creek Mitigation Site
County	Durham
Project Area (acres)	29.8
Project Coordinates (latitude and longitude)	36° 11' 07.92"N 78° 49' 39.00"W
Planted Acreage (acres of woody stems planted)	14.04

2.0 Watershed Approach and Site Selection

The Site contains tributaries to Lake Michie on Flat River, which flows directly into Falls Lake. Flat River is classified as water supply waters (WS-III) and nutrient sensitive waters (NSW). In the 2011 DWR Lake & Reservoir Assessments Report for the Neuse River Basin, Lake Michie was determined to be eutrophic. Eutrophic waters are rich in nutrients resulting in dense algal blooms that deplete dissolved oxygen concentrations when they decompose. Flat River below Lake Michie was rated in the 2012 North Carolina Integrated Report for 305(b) and 303(d) listings as impaired for aquatic life due to low dissolved oxygen concentrations.

The 2009 Neuse River Basinwide Water Quality Plan lists major stressors in Subbasin 03-04-01 to be total suspended solids (TSS), nutrients, and chlorophyll α. The 2010 Neuse River Basin Restoration Priorities (RBRP) highlights the importance of riparian buffers for stream restoration projects. Riparian buffers retain and remove nutrients and suspended sediments. Of the 123 miles of streams in the Neuse 01 CU, 23% do not have adequate riparian buffers. The RBRP states that "priority [restoration] projects should increase or improve buffers." Another goal of the RBRP for the Neuse 01 HU is to support the Falls Lake watershed plan. The Falls Lake water supply is downstream of the Site and is classified as water supply waters (WS-IV) and nutrient sensitive waters (NSW). The RBRP also states that a goal for the Neuse 01 CU is to, "…promote nutrient and sediment reduction in agricultural areas by restoring and preserving wetlands, streams, and riparian buffers."

The Neuse River basin is also discussed in the 2005 North Carolina Wildlife Resource Commission's (NCWRC) Wildlife Action Plan (WAP). In the report, non-point source pollution including nutrient loading and erosion from stream channelization for agriculture attributed to degraded aquatic habitats in the basin. Additionally, fertilizers and livestock contribute 60 percent of the nitrate and phosphate found in

the Neuse River basin according to the report. This report notes the importance of stream restoration and land protection efforts in the watershed to address the observed stressors.

The Dry Creek Mitigation Site was selected because of its location within the targeted local watershed and its potential to address the goals of the Basinwide Water Quality Plan, the RBRP, and the WAP through stream and buffer restoration, enhancement, and preservation. The proposed treatments of streams on the Site will directly and indirectly address stressors identified in the planning documents by creating stable stream banks, restoring meandering pattern, and restoring, enhancing, and preserving forested riparian buffers. The project will slow surface runoff, increase retention times, provide shade to streams, and reconnect the streams to their historic floodplains and riparian wetlands, which will reduce sediment and nutrient loads which contribute to eutrophication of downstream waters. In addition, restoration will provide and improve instream and terrestrial (riparian) habitats while improving stream stability and overall hydrology.

3.0 Baseline and Existing Conditions

The Site watershed (Table 2 and Figure 3) is located in a northern HU of the Neuse 01 CU. It is situated in the rural countryside in Durham County upstream of the intense growth and development pressure associated with the Raleigh-Durham metropolitan area. The following sections describe the existing conditions of the watershed and watershed processes, including disturbance and response.

Table 2: Project Attribute Table Part 2

Project Watershed Summary Information	
Physiographic Province	Piedmont
Ecoregion	Slate Belt
River Basin	Neuse River
USGS HUC (8 digit, 14 digit)	03020201, 03020201010050
NCDWR Sub-basin	03-04-01
Project Drainage Area (acres)	807
Project Drainage Area Percentage of Impervious Area	<1%
CGIA Land Use Classification	50% forested; 40% managed herbaceous cover/pasture; 9% Residential Area; <1% Shrub; <1% Woody Wetland

3.1 Landscape Characteristics

3.1.1 Physiography and Topography

The Site is located in the Piedmont Physiographic Province of North Carolina. The Piedmont Province is characterized by gently rolling, well rounded hills with long low ridges and elevations ranging from 300-1,500 feet above sea level. The Site topography and relief are typical for the region, as illustrated in Figure 4. Dry Creek has a gently-sloped (0.04% to 0.60%) alluvial valley that varies significantly in width throughout the project area. Throughout most of the length of Dry Creek within the project area the floodplain is well-defined and flat and the creek is somewhat confined by steep valley walls. Generally, the valley width is approximately 160 feet. A few short reaches of the creek are confined in a tight valley with valley widths as low as 50 feet. The tributaries are in steeper, narrower, less well-defined valleys with valley slopes ranging from 1.6% to 4%.

3.1.2 Geology and Soils

The Site is located in the Carolina Slate Belt of the Piedmont physiographic province. The Piedmont is characterized by gently rolling, well-rounded hills with long low ridges, with elevations ranging anywhere from 300 to 1500 feet above sea level. The Carolina Slate Belt consists of metamorphosed igneous and sedimentary rock including gneiss and schist that has been intruded by younger granitic rocks (NCGS, 2013). The underlying geology of the proposed Site is mapped as late Proterozoic to Cambrian (1 billion to 500 million years in age) felsic meta-volcanic rock (CZfv) and metamorphosed granitic rock (CZg) (NCGS, 1985). The felsic meta-volcanic rock is described as metamorphosed daeitic to rhyolitic flows and tuffs that are light gray to greenish gray in color that interbedded with intermediate metavolcanic rock. The metamorphosed granitic rock is characterized as a megacrytic, well-foliated unit that locally contains hornblende.

The proposed project is mapped by the Durham County Soil Survey. Project area soils are described below in Table 3. Figure 5 is a soil map of the Site.

Table 3: Project Soil Types and Descriptions

Soil Name	Description
Cartecay and Chewacla	These soils are about 60 percent Cartecay soil and 30 percent Chewacla soil. These soils are poorly drained soils on floodplains with a slope of 0 to 2 percent. The surface layer of the series is very dark grayish-brown and brown silt loam about 10 inches thick. The subsoil is mottled brown about 50 inches thick.
Georgeville silt loam	This series consists of gently sloping to strongly sloping, well-drained soil on uplands with a slope of 2 to 15 percent. The surface layer is reddish-brown to brown silt loam about 6 inches thick. The subsoil is red, firm silty clay or silty clay loam. The subsoil is about 38 inches thick.
Helena sandy loam	This series consists of well-drained soil on uplands with a slope of 2 to 30 percent. The surface layer is grayish-brown sandy loam about 8 inches thick. The underlain by a 4 inch layer of light yellowish-brown sandy loam. The subsoil is about 34 inches thick.
Herndon silt loam	This series consists of gently sloping to sloping, well-drained soils on uplands. The slopes range from 2 to 10 percent. The surface layer is yellowish-silt loam about 8 inches thick. The subsoil is about 36 inches thick. The upper 4 inches is strong-brown, friable silty clay loam; the next 22 inches is yellowish-red, firm silty clay that is mottled at a depth of 19-28 inches; and the lower 10 inches is mottled red, friable silty clay loam.
Wehadkee silt loam	This is a poorly drained soil on narrow flood plains and formed in fine loamy alluvium washed from soils on uplands. The slopes range from 0 to 2 percent. The surface layer is brown silt loam about 7 inches thick. The subsoil to a depth of about 46 inches is mottled light-gray, friable silty clay loam.

3.2 Land Use/Land Cover

Land uses draining to the project reaches are primarily managed herbaceous cover/pasture and forest with some residential area. The watershed areas and current land use are summarized in Table 4, below. The impervious area within the project watershed was calculated to be 6.6 acres, or approximately 0.82% of the watershed.

Aerial photos of the project site and surrounding area from 1940 to 2018 were reviewed for changes in land use and land cover. The land use and land cover patterns in this area have stayed very consistent over that time period. The northern half of the drainage area was likely deforested between 1942 and 1946 when Camp Butner was established as a major collection and training ground for troops preparing

to travel to the Western Front in World War II. The land was later turned over to the NC Army National Guard and now houses a federal correctional facility. The northern half of the watershed has been in forest since the 1950s while the southern half has remained primarily in agricultural use since at least 1940, which is the date of the oldest available aerial photograph. A few small areas (<5 acres) have been cleared or allowed to regrow during the period for which aerial photos were reviewed and a few small homes and farm buildings were constructed. A couple of small ponds were built – one in the 1970's or early 1980's and one in the mid-2000's. Currently, landowner Ellis rotationally grazes cattle along UT1, UT1a, and Dry Creek downstream from the impoundment to the UT3 confluence. Cattle access to these streams has resulted in significant ecological impacts. In general, this area has maintained its rural, farming character over the last 78 years with only minor changes in land cover. This consistency in land use within the project watershed indicates that watershed processes affecting hydrology, sediment supply, and nutrient and pollutant delivery have not varied widely over this time period. With a lack of developmental pressure, watershed processes and stressors from outside the project limits are likely to remain consistent throughout the implementation, monitoring, and closeout of this project. These stressors and processes are discussed further in Section 4, below.

Table 4: Drainage Areas and Associated Land Use

Reach Name	NCDWR Stream Identification Form Scores	Intermittent/ Perennial	Watershed Area (acres)	Watershed Area (sq. mi.)	Land Use
Dry Creek	50.5	Perennial	807	1.26	50% forested; 40% managed herbaceous cover/pasture; 9% Residential Area; <1% Shrub; <1% Woody Wetland
UT1	32.25	Perennial	85	0.13	23% forested; 68% managed herbaceous cover/pasture; 9% Residential Area
UT1a	27.5	Intermittent	22	0.03	2% forested; 83% managed herbaceous cover/pasture; 15% Residential Area
UT2	24.5	Intermittent	4	0.006	25% forested; 60% managed herbaceous cover/pasture; 15% Residential Area
UT3	26	Intermittent	17	0.03	22% forested; 76% managed herbaceous cover/pasture; 2% Residential Area
UT4	24	Intermittent	33	0.05	69% forested; 24% managed herbaceous cover/pasture; 7% Residential Area
UT5	25.5	Intermittent	40	0.06	33% forested; 61% managed herbaceous cover/pasture; 5% Residential Area; <1% Scrub; <1% Woody Wetland;
UT6	36	Perennial	17	0.03	45% forested; 44% managed herbaceous cover/pasture; 4% Residential Area; 7% Woody Wetland
UT7	35.5	Perennial	64	0.1	32% forested; 41% managed herbaceous cover/pasture; 14% Residential Area; 11% Scrub; 2% Woody Wetland

3.3 Existing Vegetation

Pasture grasses, such as fescue (*Festuca* spp.), dominate the pasture areas of the Dry Creek Site. The forested sections of Dry Creek's floodplain are primarily composed of deciduous species. Mature hardwoods such as red maple (*Acer rubrum*), green ash *(Fraxinus pennsylvanica*), sweetgum (*Liquidambar styraciflua*), river birch (*Betula nigra*) and several species of oak trees, including northern red oak (*Quercus rubra*) and white oak (*Quercus alba*) are present. The understory is open and contains limited herbaceous vegetation. Minimal invasive vegetation was observed; however species present include Japanese honeysuckle (*Lonicera japonica)* and Chinese privet (*Ligustrum sinense*). Other observed species include green briar (*Smilax rotundifolia*), which is consistently dominant all along the right bank of Dry Creek, and patches of dense Japanese stiltgrass (*Microstegium vimineum*), located midway downstream on the right floodpalin. The left floodplain has a variety of ferns species including Christmas fern (*Polystichum acrostichoides*), senstive fern (*Oncoclea sensibilis*) and grape fern (*Botrychium dissectum*). The pond near the Dry Creek/UT1 confluence contains dense duckweed (*Lemna minor*).

3.4 Existing Conditions - Wetlands

On September 18 and 19, 2017, Wildlands investigated on-site jurisdictional waters of the U.S. within the proposed project easement area. Jurisdictional areas were delineated using the US Army Corps of Engineers (USACE) Routine On-Site Determination Method. This method is defined by the 1987 Corps of Engineers Wetlands Delineation Manual and the subsequent Eastern Mountain and Piedmont Regional Supplement. All jurisdictional waters of the U.S. were located by sub-meter GPS or by traditional survey. Wetland determination forms representative of on-site jurisdictional areas as well as non-jurisdictional upland areas are included in Appendix 3. On-site wetlands are summarized in Tables 5 and 6.

The wetland delineation was confirmed on Site by USACE staff on March 7, 2018 and the jurisdictional determination was approved on March 7, 2018. There are nine jurisdictional wetland features located on-site (A-I) and five open water features (Pond A-E). Existing wetland features are classified as seeps and headwater forest using the North Carolina Wetland Assessment Method classification key and the evaluator's best professional judgement. The wetlands occur on the side slopes and the floodplains that drain to Site stream channels. These features exhibit saturation within the upper 12 inches of the soil profile, wetland plant communities, and a low chroma matrix. Common hydrophytic vegetation includes American sycamore (*Platanus occidentalis*), false nettle (*Boehmeria cylindrica*), rice cutgrass (*Leersia oryzoides*), button sedge (*carex bullata*), lizard's tail (*Saururus cernuus*), and common rush (*Juncus effuses*). Wetlands within the upper portion of the Site are significantly impacted due to livestock trampling and grazing. Uplift is expected for the majority of the existing wetlands as part of stream restoration and enhancement goals. Open water features include both on-line and off-line man-made farm ponds within the upper portion of the Site.

Table 5: Existing Wetlands A-D

Parameter	A	B	C	D
Size of Wetland (acres)[1]	0.013	1.430	1.283	0.122
Wetland Type (non riparian, riparian riverine or riparian non-riverine)	Riparian Riverine			
Mapped Soil Series	Herndon	Herndon/ Chewacla	Tatum/ Chewacla	Chewacla
Drainage Class	Well Drained	Well to Poorly Drained	Well to Poorly Drained	Poorly Drained
Soil Hydric Status	No	No / Yes	No / Yes	Yes
Source of Hydrology	Hillside Groundwater Seep			

Parameter	A	B	C	D
Restoration or enhancement method (hydrologic, vegetative, etc)	N/A			

1. Wetland areas are not proposed for restoration or enhancement credit.

Table 6: Existing Wetlands E-I

Wetland Summary Information					
Parameter	**E**	**F**	**G**	**H**	**I**
Size of Wetland (acres)[1]	0.236	0.007	0.009	0.010	0.114
Wetland Type (non riparian, riparian riverine or riparian non-riverine)	Riparian Riverine				
Mapped Soil Series	Herndon / Cartecay and Chewacla	Herndon / Cartecay and Chewacla	Georgeville	Cartecay and Chewacla	Georgeville / Cartecay and Chewacla
Drainage Class	Well Drained / Somewhat Poorly Drained	Well Drained / Somewhat Poorly Drained	Well Drained	Somewhat Poorly Drained	Well Drained / Somewhat Poorly Drained
Soil Hydric Status	No / Yes	No / Yes	No	Yes	No / Yes
Source of Hydrology	Hillside Groundwater Seep				
Restoration or enhancement method (hydrologic, vegetative, etc)	N/A				

1. Wetland areas are not proposed for restoration or enhancement credit.

3.5 Existing Conditions - Streams

The Site includes four perennial streams: Dry Creek, UT1, UT6, and UT7. It also includes five intermittent streams: UT1a, UT2, UT3, UT4, and UT5. The stream assessments were conducted by Wildlands on October 12th and October 16th, 2015 and January 26, 2018. NC DWR Stream Identification Forms (Version 4.11) and US Army Corps of Engineers (USACE) forms are included in Appendix 4. Stream features are described in detail below. Tables 7 and 8 provide a summary of existing stream conditions within the project limits. Existing conditions are also illustrated in Figure 6.

Dry Creek – Reach 1

Dry Creek enters the project area from a culvert under Hampton Road. A narrow, sparse buffer exists on both stream banks and beyond the buffer on both sides is pasture. The stream is straight despite the broad, alluvial floodplain, and has likely been straightened in the past for agriculture. The channel is undersized for the drainage area (the cross-sectional area at the top of bank is approximately half the value predicted by the rural Piedmont regional curve). It is the only reach of Dry Creek that is not significantly incised. The channel exhibits active scour along much of its length. This reach of Dry Creek most closely classifies as a C stream type with a width-to-depth ratio of 24.5 and entrenchment ratio of 9.5. Approximately 600 linear feet (LF) downstream of the Hampton Road culvert, the stream is impounded by a manmade dam located just downstream of Dry Creek's confluence with UT1. This area was once wooded, but the riparian trees died due to root inundation. The manmade dam is frequently utilized as a vehicular stream crossing by the landowner. The bed material in this reach is a mix of sand, gravel, and some cobble.

Dry Creek – Reach 2

Downstream of the pond dam, Dry Creek drops over a series of headcuts as it becomes incised. The floodplain along this section is forested with young trees, with larger, more mature trees interspersed along the stream banks. A portion of the right floodplain has been deforested. Pasture is present beyond the forested area. Cattle are grazed in these pastures and often wallow in Dry Creek and seek shade in the adjacent buffer. This reach has riffle and pool morphology and is deeply incised with a bank height ratio of 2.0. In spots, the stream has incised down to bedrock and is now eroding laterally. The stream has regained some pattern through this bank erosion, and bankfull benches are beginning to form at point bar locations. The lateral erosion is very active with raw banks, exposed roots, and some trees beginning to fall into the channel. This reach most closely classifies as an unstable G stream type, with a width-to-depth ratio of 11.2 and entrenchment ratio 1.2. Similar to Reach 1, the bed material along this reach is a mix of sand, gravel, and cobble.

Table 7: Stream Resources - Dry Creek

Parameter	Dry Creek R1	Dry Creek R2	Dry Creek R3	Dry Creek R4
Length of Reach (lf)	999	2,014	1,955	1,495
Valley Confinement (confined, moderately confined, unconfined)	Unconfined	Unconfined to Moderately Confined	Moderately Confined	Moderately Confined
Drainage Area (acres)	426	608	695	807
Perennial, Intermittent, Ephemeral	P	P	P	P
NCDWR Water Quality Classification	WS-III (NSW)			
Stream Classification[1]	C4	G4	E4	F4
Evolutionary Trend (Simon)	II Channelized	IV Degradation and Widening	IV Degradation and Widening	IV Degradation and Widening
FEMA Classification	Zone X			

1. The Rosgen classification system (Rosgen, 1994) is for natural streams. These channels have been heavily manipulated by livestock and man and therefore may not fit the classification category as described by this system. Results of the classification are provided as a basis for discussion of existing channel form.

Table 8: Stream Resources - Tributaries

Parameter	UT1	UT1a	UT2	UT3	UT4	UT5	UT6	UT7
Length of Reach (lf)	1,401	90	72	153	110	506	849	367
Valley Confinement (confined, moderately confined, unconfined)	Conf.	Conf.	Conf.	Unconf.	Conf.	Conf.	Conf.	Conf.
Drainage Area (acres)	85	22	4	17	33	40	17	64
Perennial, Intermittent, Ephemeral	P	I	I	I	I	I	P	P
NCDWR Water Quality Classification	WS-III (NSW)							
Stream Classification[1]	G4	E4	NA	NA	NA	G4	E4	NA
Evolutionary Trend (Simon)	IV Degradation and Widening			II Channel-ized	I Pre-modified	IV Degradation and Widening		
FEMA Classification	Zone X							

1. The Rosgen classification system (Rosgen, 1994) is for natural streams. These channels have been heavily manipulated by livestock and man and therefore may not fit the classification category as described by this system. Results of the classification are provided as a basis for discussion of existing channel form.

Dry Creek – Reach 3

Downstream of the confluence with UT5, Dry Creek remains deeply incised with a bank height ratio of 2.7. This reach continues to exhibit pattern development with active erosion on the outside bends and there are intermittent bedrock outcrops on the bed. This reach most closely classifies as an incised E stream type due to a low width-to-depth ratio of 7.6 and an entrenchment ratio of 2.0 (which is slightly lower than the typical 2.2 for a E stream type). The floodprone width, while 2.0 times the bankfull width, is contained within the eroded channel and the stream does not access the historic floodplain. The vegetation on the fllodplain of this reach is similar to Reach 2, however both floodplains are completely forested within the buffer zone. The bed material along this reach is mostly gravel and small cobble with some coarse sand.

Dry Creek – Reach 4

Reach 4 extends from the confluence with UT7 to the project boundary at Ellis Chapel Road. Along the lower half of this reach, Dry Creek is confined against the left valley wall. The landowner indicated that tobacco was grown in the floodplain here in the late 1800's and early 1900's. Although now wooded and no longer in agricultural production, the landowner believes that Dry Creek was relocated to its current position during the time the floodplain was used to grow tobacco. The reach is deeply incised and the banks are scoured. This reach is most similar to an F stream type. The bed material is a mix of sand, gravel, and cobble.

UT1

Reach 1 of UT1 enters the Site from a culvert under Hall Road. Above the road, the stream is impounded by a small farm pond. The reach flows through an active cattle pasture on the site and has a single row of mature Virginia pines (*Pinus virginiana*) or eastern red cedar (*Juniperus virginiana*) on each bank. From where UT1 enters the Site down to an in-line farm impoundment approximately 600 LF downstream, the stream is mostly incised and scoured except for a short section of approximately 50 LF where it appears more vertically and horizontally stable. Cattle actively cross this stream and cattle paths leading into and across the channel are present approximately every 20 LF. Just upstream of the in-line pond, Reach 2 begins where the physical condition of the stream channel deteriorates. At the beginning of this reach, the stream shallows and the stream banks are severely trampled by cattle. An off-line pond is present here in the right floodplain. Both ponds are overgrown with duckweed. Below the in-line impoundment, UT1 drops over a series of headcuts and becomes deeply incised. The stream here is heavily scoured, particularly on the right bank. The bedform is dominated by long pools with short riffles comprised of small gravel. Near the middle of this reach, the stream passes through a culvert under a farm road. Downstream of the culvert crossing, UT1 is maintained by the farmer as a deep canal with an overly wide bottom. This lower section has backwater from the impoundment on Dry Creek. This section of UT1 is devoid of any bedform diversity and is best described as a long, shallow run choked with wetland vegetation such as common rush (*Juncus effesus)* and common buttonweed (*Diodia virginiana*). UT1 is most similar to a G stream type due to a low width-to-depth ratio of 7.1 and an entrenchment ratio of 1.1. The bed material is comprised of a mix of sand, gravel and a less cobble. Existing Duke Energy overhead powerlines crosses UT1 in three places (Figure 2).

UT1a

UT1a is an intermittent stream that originates just outside the project limits at a gentle swale. Farm waste, including chunks of concrete, bricks, and cinder blocks, have been disposed of in this stream near the upstream project boundary. Just downstream of this area, UT1a drops over an active headcut and becomes incised. The stream exhibits scour on both banks. UT1a continues in this incised, scoured

condition to its confluence with UT1. Due to a bankfull bench feature, UT1a is classified as an E stream type though it is incised and disconnected from its original floodplain. The bed is comprised of gravel and cobble.

UT2

UT2 is another small intermittent stream that flows through a wooded area on the Dry Creek floodplain and joins Dry Creek approximately 600 feet downstream of UT1. This stream is incised and overly wide and has scour along some of sections of the banks. The substrate is predominantly sand and the bed forms are mostly a featureless plain bed with a few small pools.

UT3

UT3 originates outside the project limits at the outlet of a farm pond. It flows through an open pasture before entering the deciduous forest of Dry Creek's floodplain. This intermittent stream is relatively stable. The primary species within the pasture is fescue. There is little variability in the bed form and the substrate is primarily sand and small gravel.

UT4

UT4 originates outside the project limits. This intermittent stream is well-connected to the floodplain. It exhibits stable bedform dominated by large roots growing across the channel. UT4 is contained entirely within the Dry Creek forested buffer and very little understory exists in the vicinity of this channel. Groundcover along UT4 is limited to patches of Japanese stiltgrass and moss species along the streambank.

UT5

UT5 originates outside the project limits. Both banks of this intermittent stream are scoured for the entire project length. The bedform consists of riffle and pool morphology with some gravel and cobble in the riffles. UT5 crosses through a farm culvert, which will remain after project construction. Upstream of the culvert, Reach 1 has a sparse left buffer consisting of a very narrow strip of deciduous forest with pasture beyond. The right buffer of Reach 1 is similar in species composition to the deciduous forest described along Dry Creek but is much less mature. This reach is slightly incised and the bedforms along this reach have been degraded. Downstream of the culvert, Reach 2 is contained within what appears to be an old pond bed which is now vegetated by the Dry Creek riparian buffer. This reach is confined against the right valley wall, is extremely incised (bank height ratio is 3.0), and is actively eroding. Japanese stiltgrass is a dominant herbaceous species along the entire stream length. UT5 is most similar to a G stream type.

UT6

UT6 is a perennial stream that originates at a springhead within the project limits. Reach 1 drops over headcuts just below the springhead and becomes incised with bank height ratios greater than 3.0. Both banks of this reach are scoured. The bedform consists of riffle/pool and riffle/run morphology with some gravel and cobble in the riffles. This reach is best classified as a G stream type. As UT6 approaches the Dry Creek floodplain, Reach 2 begins where bank heights decrease and the stream reconnects to its floodplain. Within the Dry Creek floodplain, Reach 2 flows through a stable wetland/stream complex that parallels Dry Creek. This reach is most similar to an E stream type. At the confluence with Dry Creek the stream drops over a stable step structure comprised of mature tree roots. Vegetation throughout UT6 is similar in composition to the Dry Creek deciduous forest.

UT7

UT7 to Dry Creek is a short reach of perennial stream that originates outside the project limits. The length of the stream within the project area runs parallel to Dry Creek for most of its length. The

upstream section of the project reach is stable with meandering riffle/pool morphology, low banks, and an active floodplain bench. Where UT7 turns to join Dry Creek, the stream becomes incised and exhibits scour on both banks. UT7 is located entirely within the forested floodplain of Dry Creek, and exhibits the same vegetation community as Dry Creek.

4.0 Watershed and Channel Disturbance and Response

As discussed above in Section 3.2, there has been very little change in the watersheds of the project reaches for several decades. Some clearing of small areas of forest has occurred but these minor disturbances are the not the main driver of the degradation of the Site. The primary causes of degradation on the Site were the original clearing of portions of the Site and channelization of the project streams, which occurred prior to 1940 (the date of the earliest available aerial photo). The channelization involved straightening and deepening of the streams. This manipulation likely led to increased shear stresses which caused additional incision. Over time, the incision reduced the overall channel slope in Dry Creek which resulted in decreased stream power. As a result of the decreased stream power and bedrock control in certain locations, incision slowed and the channels began to widen through fluvial erosion and livestock trampling. Signs of on-going bank scour are apparent along most of the project reaches. The current condition of most the reaches on the Site is that they are severely incised, over-widened, and have on-going lateral erosion. They have not yet stabilized and begun to reform a bankfull channel at the lower elevation through aggradation processes.

5.0 Functional Uplift Potential

The potential for functional uplift is described in this section according to the Stream Functions Pyramid (Harman, 2012). The Stream Functions Pyramid describes a hierarchy of five stream functions, each of which supports the functions above it on the pyramid (and sometimes reinforces those below it). The five functions in order from bottom to top are hydrology, hydraulics, geomorphology, physicochemical, and biology.

5.1 Hydrology

The alterations in land cover discussed in Sections 3.2 and 4.0 typically result in reductions in rainfall interception and evapotranspiration which lead to increases in runoff and water yield (Dunne and Leopold, 1978). A primary result of these changes is an increase in both peak flows and base flows, though the magnitude of this effect is likely small in watersheds of this size. Initial increases in water yield usually change over time as vegetation regrows and crops are planted. There are multiple ponds within the watershed, some of which are outside the project boundary and cannot be removed. These ponds potentially affect instream flows by retaining water among other effects. There are no stream gauges within this watershed and, thus, no way to know the degree to which clearing of 40% of the land affected this particular watershed other than to say that water yields have almost certainly increased. Even though ponds retain water, it is difficult to estimate the long-term effects on stream flow once the ponds are filled to the outlet elevations. These changes to the watershed primarily occurred several decades ago (prior to available aerial photography) and additional clearing and pond construction in the watershed has been limited. The watershed has adjusted to its hydrologic regime and is stable now. Population growth in this rural area is essentially non-existent and not allowable in the portion controlled by the National Guard (Camp Butner Training Center). Therefore, future alteration to the land cover and associated effects on hydrology are not expected in the foreseeable future. No measurements of existing conditions in hydrology have been made to date for this project.

A stream restoration project performed at a specific Site does not often result in uplift to hydrology (Harman, 2012). Even though trees will be planted within the conservation easement, this will not result

in improvements to the rainfall-runoff relationship at the watershed scale. Therefore, there is no opportunity to improve the hydrology function.

5.2 Hydraulics

The streams on the Site are channelized and incised and not connected to their floodplains with the exception of UT2, UT3, and UT6 Reach 2. This has resulted in reduced hydraulic functioning of the channels. The bank height ratios on Dry Creek range from 1.3 to 2.6. The bank height ratios on UT1 range from 2.7 to 5.7. On UT4, the bank height ratio is 3.0 and on UT6 Reach 1 the bank height ratio is 6.9. Entrenchment ratios are below 1.4 on UT1, UT4, UT5, UT6 Reach 1, and Dry Creek Reaches 2, 3, and 4. Estimated bankfull flow velocities for Dry Creek range from 1.9 to 4.1 feet per second and on UT1 the estimated bankfull velocity ranges from 2.7 to 4.3. Overall hydraulic functions on the Site are severely degraded and would be classified as not-functioning.

The channels will be reconstructed and will be connected to their floodplains so that stream flows above bankfull stage will flood the floodplain. The bank height ratios for the Site streams will be 1.0. Bankfull flow velocities and shear stress will be maintained at functioning levels and groundwater exchange and adjacent wetland hydrology will be improved as a result of the increased frequency of floodplain inundation. The post-construction hydraulic function will be functioning.

5.3 Channel Geomorphology

The past channelization, incision, and on-going sloughing and widening described in Section 4 places Dry Creek, UT2, UT4, UT5 Reach 1, and UT6 at Stage IV of the Simon Channel Evolution Model. Currently, Dry Creek exhibits scour along 59% of the reach and is incised over 92% of its length. UT1 is moderately incised throughout with 31% of the length actively eroding. The tributaries slated for restoration and enhancement I are generally incised and eroding. The bedform is inconsistent on Dry Creek, UT1, UT5, and UT6 and pool to pool spacing ratios (22 - 127) vary widely over the project length. Existing geomorphology should be considered to be not-functioning.

There is an opportunity to improve the geomorphology function on the Site. The incision and bank erosion will be corrected. Bedform will be diversified and spaced with appropriate design ratios. LWD will be added to the system through construction of instream structures and bank revetments and the riparian buffer will be replanted anywhere it is disturbed or will be planted in areas that are currently in pasture. Post construction, the geomorphology function will be rated functioning.

5.4 Physicohemical

No water quality sampling has been conducted on the Dry Creek Site and there are no water quality monitoring stations within the watershed. The 2009 Neuse River Basinwide Water Quality Plan lists major stressors in Subbasin 03-04-01 to be total suspended solids (TSS), nutrients, and chlorophyll α.

There are agricultural operations throughout the watershed which likely contribute nutrients and other pollutants to the project streams. The suspected high nutrient load and lack of shade within portions of the riparian corridor may contribute to elevated levels of chlorophyll α. Sediment loading is likely high due to bank erosion on the project streams. Fecal coliform is another likely source of pollution within the watershed due to livestock operations. However, because no water quality data are available to evaluate the current level of physicochemical functioning, this function is not rated.

There is potential to improve the physicochemical functioning of the project streams. Water will flow over instream structures that will provide aeration, trees will be planted in deforested areas of the riparian zone to eventually shade and cool stream flow and help filter runoff, the stream will be reconnected to its floodplain and adjacent riparian wetlands to provide storage and treatment of overbank flows, and streambank erosion will be greatly reduced to nearly eliminate a source of

sediment and nutrients. However, the potential improvements to physicochemical functioning will not happen immediately and some aspects will not occur until a mature canopy is re-established.

5.5 Biology

There are no available biological data for the Site, however, the habitat conditions on the Site are poor. The banks are unstable with fluvial erosion and mass wasting. Many reaches are over-widened causing shallow flow and dry areas of the channels. Though there are some riffles, in general the bed forms consist of long runs and shallow pools.

There is opportunity to improve the instream and riparian habitat in addition to the physicochemical function described in Section 5.4. Habitat will be improved by reconstructing channels of appropriate size with a variety of types of riffles and pools of varying depth. Other types of instream structures with a variety of rock and woody materials will be incorporated into the restoration reaches further diversifying habitat types. In addition, stabilization of banks will reduce inputs of fine sediments. However, because there are no pre-construction biological data the functional uplift potential will not be rated.

5.6 Overall Functional Uplift Potential

Due to severely degraded hydraulics and geomorphology (both not-functioning) and suspected poor biology and physicochemical functions of the Site, there is substantial potential for ecological uplift. Due to the proposed improvements described above the functional uplift potential is a reclassification from not-functioning to functioning. This change in overall classification is related to improvements in hydraulics and geomorphology between the existing and proposed conditions and expected improvements in physicochemical and biology functions. The hydrology function will not be improved by the project because watershed-scale reforestation would be required to drive improvement in this function.

5.7 Site Constraints to Functional Uplift

The Site includes one internal easement crossing for farm use and four external crossings for farm and residential driveway use. Crossings are detailed below. All crossings are assigned a number and summarized in Table 9, below, and are depicted by number on Figure 7.

Table 9: Easement Breaks and Crossings

No.	Width (ft)	Location	Internal or External	Crossing Type
1	35	UT1 R2, at existing farm road crossing	External	Culvert – new construction
2	35	Dry Creek R2, below UT1 confluence at old manmade dam location	Internal	Culvert – new construction
3	60	UT5 R2, at existing crossing	External	Culvert – existing to remain
4	60	Dry Creek R2, above UT5 confluence, at existing bridge crossing	External	Bridge – existing to remain
5	40	Dry Creek R4, at Adcock driveway	External	Culvert – new construction

There is a power line that crosses UT1 twice near the internal easement break. Power poles and lines are shown in Figure 7. The power line and poles will be relocated such that the power line crossing aligns with the internal easement break in this area.

All streams proposed for mitigation credit provide the required 50-foot minimum riparian buffer for Piedmont streams except for one short section of UT5. The entire easement area can be accessed for construction, monitoring, and long-term stewardship from the Ellis farm road off Hall Road, Ellis Chapel Road, and the Adcock driveway off Adcock Road.

The valley width on the Site will allow for the development of pattern and channel dimensions to restore stable, functioning streams and there are no other known constraints to the functional uplift described above in this section. The degree to which the physicochemical and biology functions can improve on the Site is limited by the watershed conditions beyond the project limits, upstream water quality, and the presence of source aquatic communities upstream and downstream of the Site.

6.0 Regulatory Considerations

Table 10, below, is a summary of regulatory considerations for the Site. These considerations are explained in more detail in Sections 6.1-6.3.

Table 10: Regulatory Considerations

Parameters	Applicable?	Resolved?	Supporting Docs?
Water of the United States - Section 404	Yes	No	PCN[1]
Water of the United States - Section 401	Yes	No	PCN[1]
Endangered Species Act	Yes	Yes	Appendix 5
Historic Preservation Act	Yes	Yes	Appendix 5
Coastal Zone Management Act	No	No	N/A
FEMA Floodplain Compliance	No	No	N/A
Essential Fisheries Habitat	No	N/A	N/A

1. PCN to be provided to DMS with Final Mitigation Plan.

6.1 Biological and Cultural Resources

A Categorical Exclusion for the Dry Creek Mitigation Site was submitted on June 1, 2016 and approved by the Federal Highway Administration (FHWA) on July 24, 2017. This document included investigation into the presence of threatened and endangered species on Site protected under The Endangered Species Act of 1973, as well as any historical resources protected under The National Historic Preservation Act of 1966. According to the Categorical Exclusion research and response letter from the US Fish and Wildlife Service, the, “proposed action [this project] is not likely to adversely affect any federally listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act.” All correspondence with USFWS and a list of Threatened and Endangered Species in Durham County, NC is included in Appendix 5. The conclusion for cultural resources according to the Categorical Exclusion research and response by the State Historic Preservation Office is that there are no historic resources that would be affected by this project. For additional information and regulatory communications please refer to the Categorical Exclusion document.

6.2 FEMA Floodplain Compliance and Hydrologic Trespass

The Site is represented on the Durham County Flood Insurance Rate Map Panel 0848. The project streams are shown to occur within the 500-year floodplain (Figure 8). Wildlands will coordinate with the

Durham County Floodplain to determine if a Floodplain Development Permit will be required. We do not expect any modeling or a flood study to be required. The project will be designed so that any increase in flooding will be contained on the Site and will not extend upstream to adjacent parcels, so hydrologic trespass will not be a concern.

6.3 401/404

As part of the existing conditions assessment at the Site, Wildlands documented and classified the on-site wetlands. Classifications were applied based on wetland function and potential for wetland improvement through the stream design approach. Based on these classifications, Wildlands designers used this information to prioritize higher quality wetlands for avoidance and minimization and to incorporate stream design approaches to improve hydrologic and vegetative conditions of impaired wetlands.

Any wetlands within the conservation easement or limit of disturbance will be identified with safety fence during construction to prevent unintended impacts. This will be denoted in the final construction plans on the Erosion and Sediment Control plan and Detail plan sheets, as well as in the project specifications. Floodplain grading will result in temporary impacts to wetlands while channel realignment and pond removal will result in permanent impacts. Wildlands expects a net gain of wetland area, as construction of the new channel will enhance hydrologic interaction with existing wetlands and the floodplain. Table 11 estimates the anticipated impacts to wetland areas and open water on this project. The Pre-Construction Notification, including these data, will be provided in the Final Mitigation Plan.

Table 11: Estimated Impacts to Wetlands and Open Water

Jurisdictional Feature	Classification	Acreage	Permanent (P) Impact		Temporary (T) Impact	
			Type of Activity	Impact Area (acres)	Type of Activity	Impact Area (acres)
Wetland A		.066	Channel Re-alignment	.006	-	-
Wetland B		.382	Channel Re-alignment	.191	-	-
Wetland C		.021	Channel Re-alignment	.021	-	-
Wetland D		.195	Channel Re-alignment	.027	-	-
Wetland E		.236	-	-	Floodplain Grading	.005
Wetland F		.007	-	-	Floodplain Grading	.007
Wetland G		.008	Channel Re-alignment	.003	-	-
Wetland I		.114	Channel Re-alignment	.034	-	-
Pond A		.162	Pond Removal	.162	-	-
Pond B		.162	Channel Re-alignment	.062	-	-
Pond C		.055	Pond Removal	.055	-	-
Pond D		.441	Channel Re-alignment	.653	-	-

Jurisdictional Feature	Classification	Acreage	Permanent (P) Impact		Temporary (T) Impact	
			Type of Activity	Impact Area (acres)	Type of Activity	Impact Area (acres)
Pond E		.041	Pond Removal	.041	-	-
			Total P Impact	**1.255**	**Total T Impact**	**.012**

7.0 Mitigation Site Goals and Objectives

The project will improve stream functions as described in Section 5 through stream restoration, enhancement, and preservation as well as riparian buffer re-vegetation. The project goals and related objectives and outcomes are described in Table 12. Project goals are desired project outcomes and are verifiable through measurement and/or visual assessment. Objectives are activities that will result in the accomplishment of goals. The project will be monitored after construction to evaluate performance as described in Section 11 of this report.

Table 12: Mitigation Goals and Objectives

Goal	Objective	Expected Outcomes
Exclude cattle from project streams.	Install fencing around project areas adjacent to cattle pastures or remove cattle from Site.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Contribute to protection of or improvement to a Water Supply Waterbody.
Stabilize eroding stream banks.	Reconstruct stream channels slated for Restoration with stable dimensions. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to reaches to protect restored/enhanced streams.	Reduce sediment inputs; Contribute to protection of or improvement to a Water Supply Waterbody.
Improve the stability of stream channels.	Construct stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions.	Reduce and control sediment inputs; Contribute to protection of or improvement to a Water Supply Waterbody.
Improve instream habitat.	Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Improve aquatic communities in project streams.
Reconnect channels with floodplains.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Contribute to protection of or improvement to a Water Supply Waterbody; Enhance hydration of riparian wetlands.

Goal	Objective	Expected Outcomes
Restore and enhance native floodplain vegetation.	Plant native tree species in riparian zone where currently insufficient.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Provide a canopy to shade streams and reduce thermal loadings; Contribute to protection of or improvement to a Water Supply Waterbody.
Permanently protect the project Site from harmful uses.	Establish conservation easements on the Site.	Ensure that development and agricultural uses that would damage the site or reduce the benefits of project are prevented.

8.0 Design Approach and Mitigation Work Plan

8.1 Design Approach Overview

The design approach for this Site was developed to meet the goals and objectives described in Section 7 which were formulated based on the potential for uplift described in Section 5. The design is also intended to provide the expected outcomes in Section 7, though these are not tied to performance criteria. The project streams will be reconnected with an active floodplain and the channels will be reconstructed with stable dimension, pattern, and profile that will transport the water and sediment delivered to the system. The adjacent floodplain will be planted with native tree species were necessary. Instream structures will be constructed in the channels to help maintain stable channel morphology and improve aquatic habitat. The entire project area will be protected in perpetuity by a conservation easement.

The design approach for this Site utilized a combination of analog and analytical approaches for stream restoration. Reference reaches were identified to serve as the basis for design parameters. Channels were sized based on design discharge hydrologic analysis. Designs were then verified and/or modified based on a sediment transport analysis. This approach has been used on many successful Piedmont and Slate Belt restoration projects and is appropriate for the goals and objectives for this Site.

8.2 Reference Streams

Reference streams provide geomorphic parameters of a stable system, which can be used to inform design of stable channels of similar stream types in similar landscapes and watersheds. A total of nine reference reaches were identified for this Site and used to support the design of Dry Creek and its tributaries (Figure 9). Three reference reaches were selected to help develop design parameters for Dry Creek, and a separate set of three reference reaches was used for the tributaries. In addition, a third set of three reference reaches was included only for purposes of the discharge analysis to strengthen the discharge-drainage area curve. These reference reaches were chosen because of their similarities to the Site streams including drainage area, valley slope, morphology, and bed material. The reference reaches are all located within the Piedmont region of North Carolina, and a majority (6 of 9) are located in the Carolina Slate Belt Region of the Piedmont. Geomorphic parameters for these reference reaches are summarized in Appendix 6. The references to be used for the specific streams are shown in Table 13. Note that a gray X indicates the reference streams that were used for discharge analysis only. A description of each reference reach is included below.

Table 13: Stream Reference Data Used in Development of Design Parameters

	Long Branch	Spencer Creek 2	Foust Creek	UT to Varnals Creek	UT to Wells Creek	UT4 (UT to Cedar Creek)	UT to Cane Creek	UT to Henry Fork	Franklin Creek Trib, XS4
Stream Type:	**C4/E4**	**E4**	**C4**	**C4/E4**	**C4**	**C4**	**C4/E4**	**B4/A**	**B4**
Dry Creek	X	X	X	X					
Tributaries					X	X	X	X	X

8.2.1 Long Branch

Long Branch is located in Orange County, northwest of Chapel Hill. Long Branch was previously identified as a reference and discussed in the 2007 Collins Creek Restoration Plan by KCI Technologies. The Long Branch watershed is comprised of low-density residential, agricultural, and forested land. The valley slope is 0.6% and channel slope is 0.4%. The stream maintains an entrenchment ratio above 2.5. Wildlands visited the reference site to verify the data presented in the KCI report. Two riffles were surveyed during the site visit. These riffles had a width to depth ratio of 9.4 and 8.0 with entrenchment ratios of 11.7 and 12.1, respectively. The cross-sections surveyed are more typical of E stream types, however KCI identified the stream as a C4 in their previous analysis. The stream likely varies between a C4 and E4.

8.2.2 Spencer Creek Reach 2

Spencer Creek Reach 2 is located in western Montgomery County near Ophir, NC, less than two miles from the Spencer Creek reference site. This site was classified as an E4 stream type by Buck Engineering in 2004 and has a drainage area of 0.96 square miles. This reach flows through a mature forest and has a valley slope of 1.1% and a channel slope of 0.47%. The morphological parameters reported for the riffle cross-section include a width to depth ratio from 5.8 to 7.1 and an entrenchment ratio of 5.5 and 10.2.

8.2.3 Foust Creek

The Foust Creek reference reach is located approximately 600 feet upstream of the northernmost conservation easement boundary on the Foust Creek Mitigation Site in Alamance County, NC. It was identified by Wildlands in the Foust Creek Mitigation Site 2014 Mitigation Plan. Foust Creek has a gravel bed and a valley slope of 0.75%. The Foust Creek reference reach is classified as a Rosgen C4 stream type. This reach flows through a mature forest and although it is stable it lacks sinuosity. It was used in this project to provide additional discharge data and strengthen the drainage area and discharge relationship.

8.2.4 UT to Varnals Creek

The UT to Varnals Creek reference reach is located in south central Alamance County, NC near the Cane Creek Mountains. The site was identified by EcoLogic Associates and used as a reference reach for the Reedy Branch Stream Restoration Site in 2002. Wildlands visited UT to Varnals Creek in September 2014 and visually confirmed that the land use is unchanged from reported conditions and that the stream is laterally and vertically stable. Wildlands conducted a detailed morphological survey in October 2014. UT to Varnals Creek has a drainage area of 0.41 square miles and is classified as a Rosgen B4/E4b stream type for the majority of the reach.

8.2.5 UT to Wells Creek

The UT to Wells Creek reference reach is located in south central Alamance County, NC near the Cane Creek Mountains and just southwest of UT to Varnals Creek. The site was identified by Arcadis and used as a reference reach for the Wells Creek Stream Restoration Site in 2002. Wildlands visited UT to

Wells Creek in September 2014 and visually confirmed that the land use is unchanged from reported conditions and that the stream is laterally and vertically stable. UT to Wells Creek has a drainage area of 0.13 square miles and is classified as a Rosgen C4 stream type for the majority of the reach.

8.2.6 UT4 (UT to Cedar Creek)

UT4 (UT to Cedar Creek) is located in eastern Stanly County, NC just upstream of Lake Tillery on the Pee Dee River. The site was identified by Environmental Banc & Exchange (EBX) and used as a reference reach for the Rockwell Pastures Stream and Wetland Restoration Site in 2008. The site has a drainage area of 0.11 square miles that is mostly wooded and includes a series of three small ponds. Extensive pattern, profile, and cross-sectional data were gathered by EBX and Kimley-Horn and Associates, Inc. UT4 was classified as a Rosgen C4 stream type, with a width to depth ratio of 12.6 and an entrenchment ratio of 2.7. It has a channel slope of 1.6% and a valley slope of 1.7%.

8.2.7 UT to Cane Creek

UT to Cane Creek, is located in southern Alamance County less than 10 miles from the project site. This stream is classified as an C4/E4 stream type and has a drainage area of 0. 28 mi2. This reach also flows through a mature forest and has a channel slope of 0. 46%. The morphological parameters reported for the riffle cross section include a width to depth ratio of 13. 1 and an entrenchment ratio of >2. 2.

8.2.8 UT to Henry Fork

This reference reach is located immediately upstream of UT1 Reach 1 on the Henry Fork mitigation site in the western Piedmont and has a drainage area of about 0.1 square miles. This stream flows through a steep, confined valley with small intermittent flood benches. The channel slope of the surveyed reach is 4.2% and the width to depth ratio varies from 5.0 to 16.0. The entrenchment ratio is 1.7 to 2.0, typical of a B type stream. Rosgen classification is a B4a. Boulder/cobble and bedrock steps, pools, rock riffles, and other stable physical and habitat structure exist. UT to Henry Fork was used in this project to provide additional discharge data and strengthen the drainage area and discharge relationship.

8.2.9 Franklin Creek Tributary

Franklin Creek is a tributary to the Eno River located less than two miles southwest from the Buckwater Mitigation Site, another Wildlands project. Franklin Creek is located off Jack Franklin Road on a western boundary of the Eno River State Park. The site was identified by Wildlands to serve as a B channel reference reach for the Buckwater project. Wildlands conducted a detailed morphological survey on July 1, 2016. The Franklin Creek Tributary was used in this project to provide additional discharge data and strengthen the drainage area and discharge relationship.

8.3 Design Channel Morphological Parameters

Reference reaches were a primary source of information used to develop the pattern and profile design parameters for the streams. Ranges of pattern parameters were developed within the reference reach parameter ranges with some exceptions based on best professional judgement and knowledge from previous projects. The full range of reference reach data is located in Appendix 6. We found the lower limit of some of these parameters to be too low to build a stable system. They are likely low in reference reaches due to the presence of a mature forest and root system that both influences and stabilizes channel pattern and profile. For example, radius of curvature ratio in reference data has a lower limit of 1.1 and the meander width ratio had a minimum of 1.0, however we have found that for C/E channels, these ratios should be above 1.8 and 2.4 respectively to naturally dissipate energy through meander bends during high flow events to limit impacts of shear stress on streambanks. The lower limits of the radius of curvature ratio and meander width ratio are based on values used for many years and on many successful designs.

Reference reaches were also used to inform the design of the cross-sections on the streams. The streams were designed with pool widths to be approximately 1.4 times the width of riffles to provide space for point bars and riffle pool transition zones. Designer experience was used for pool design as well. Pool depths were designed to be a minimum of 2.3 times deeper than riffles to provide habitat variation. Cross-section parameters such as area, depth, and width were designed based on the design discharge and stable bank slopes. Key morphological parameters for the Site are listed in Tables 14 through 17 for Dry Creek and the tributaries where restoration is to occur, respectively. Complete morphological tables for existing, reference, and proposed conditions are located in Appendix 6.

Table 14: Summary of Morphological Parameters for Dry Creek Reaches 1 and 2

Parameter	Existing Parameters		Reference Parameters			Proposed Parameters	
	Reach 1	Reach 2	Long Branch	Spencer Creek 2	UT to Varnals	Reach 1	Reach 2
Contributing Drainage Area (acres)	427	609	954	614	262	427	609
Channel/Reach Classification	C4	F4	C4/E4	E4	C4/E4	C4	C4
Design Discharge Width (ft)	16.0	13.5	14.8 - 18.6	10.7 - 11.2	9.3 – 10.5	17.8	17.8
Design Discharge Depth (ft)	0.7	0.9	1.3 – 2.1	1.6 – 1.8	1.1 – 1.2	1.3	1.3
Design Discharge Area (ft^2)	11.0	12.8	25 – 34.6	17.8 – 19.7	10.3 - 12.3	23.6	23.6
Design Discharge Velocity (ft/s)	3.4	4.0	3.6 – 4	4.9 – 5.4	4.4 – 5.2	2.5	3.4
Design Discharge (cfs)	58	75	101 – 124	97	54	58	75
Water Surface Slope	0.006	0.005	0.0040	0.0047	0.0017	0.0032	0.0059
Sinuosity	1.19	1.07	1.3	2.3	1.2	1.30	1.20
Width/Depth Ratio	23.0	14.2	7.9 – 13.8	5.8 – 7.1	8.1 – 9.3	13.0	13.0
Bank Height Ratio	1.3	2.6	1.2 – 1.5	1.0	1.0	1.0	1.0
Entrenchment Ratio	8.9	1.1	>3.4	5.5 - >10.2	5.7 – 10.0	2.2 - 5	2.2 - 5
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	-	1.1, 4.5, 11.3, 47.3, 126.9, -, -	8.1, 26.6, 41.6, 124.8, 225.5, -, -	<0.062, 3, 8.8, 42, 90, -, -	-	-	1.1, 4.5, 11.3, 47.3, 126.9, -, -

Table 15: Summary of Morphological Parameters for Dry Creek Reaches 3 and 4

Parameter	Existing Parameters		Reference Parameters			Proposed Parameters	
	Reach 3	Reach 4	Long Branch	Spencer Creek 2	UT to Varnals	Reach 3	Reach 4
Contributing Drainage Area (acres)	695	807	954	614	262	695	807
Channel/Reach Classification	F4	F4	C4/E4	E4	C4/E4	C4	C4
Design Discharge Width (ft)	12.9 - 18.8	12.9 - 18.8	14.8 - 18.6	10.7 - 11.2	9.3 – 10.5	17.8	17.8
Design Discharge Depth (ft)	1.2 - 1.5	1.2 - 1.5	1.3 – 2.1	1.6 – 1.8	1.1 – 1.2	1.3	1.3
Design Discharge Area (ft^2)	15 - 27.9	15 - 27.9	25 – 34.6	17.8 – 19.7	10.3 - 12.3	23.6	23.6
Design Discharge Velocity (ft/s)	1.9 - 4.1	1.9 - 4.1	3.6 – 4	4.9 – 5.4	4.4 – 5.2	3.2	3.8

Parameter	Existing Parameters		Reference Parameters			Proposed Parameters	
	Reach 3	Reach 4	Long Branch	Spencer Creek 2	UT to Varnals	Reach 3	Reach 4
Design Discharge (cfs)	83	92	101 – 124	97	54	83	92
Water Surface Slope	0.004	0.004	0.0040	0.0047	0.0017	0.0054	0.0075
Sinuosity	1.39	1.39	1.3	2.3	1.2	1.20	1.20
Width/Depth Ratio	11.2 - 12.7	11.2 - 12.7	7.9 – 13.8	5.8 – 7.1	8.1 – 9.3	13.0	13.0
Bank Height Ratio	2.1	2.1	1.2 – 1.5	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.4	1.4	>3.4	5.5 - >10.2	5.7 – 10.0	2.2 - 5	2.2 - 5
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	0.9, 5.0, 9.5, 27.2, 55.4, -, -	-	8.1, 26.6, 41.6, 124.8, 225.5, -, -	<0.062, 3, 8.8, 42, 90, -, -	-	0.9, 5.0, 9.5, 27.2, 55.4, -, -	-

Table 16: Summary of Morphological Parameters for UT1 and UT1A

Parameter	Existing Parameters		Reference Parameters			Proposed Parameters	
	UT1 Reach 2	UT1A	UT to Wells	UT to Cane Creek	UT4 (UT to Cedar)	UT1 Reach 2	UT1A
Contributing Drainage Area (acres)	85	22	83	179	70	85	22
Channel/Reach Classification	-	-	C4/1	C4/E4	C4	C4	C4
Design Discharge Width (ft)	14.0	-	6.2 – 8.6	9.3	7.3	8.4	7.5
Design Discharge Depth (ft)	0.4	-	0.6 – 1.0	0.9	0.6	0.6	0.7
Design Discharge Area (ft^2)	5.1	-	3.9 – 6.3	8.6	4.2	5.4	5.2
Design Discharge Velocity (ft/s)	2.7	-	3.8	2.2	5.2 – 6.1	3.6	4.1
Design Discharge (cfs)	19.6	7.5	15.0	19.4	21.7 – 25.8	19.6	7.5
Water Surface Slope	0.016	0.010	0.020	0.0046	0.016	0.018	0.021
Sinuosity	1.05	1.10	1.41	1.20	1.05	1.20	1.20
Width/Depth Ratio	38.0	-	6.1 – 12.6	10.1	12.6	13.0	11.0
Bank Height Ratio	2.7	-	1.0 – 1.8	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.3	-	1.9 – 4.1	>3.2	2.7	2.2 - 5	2.2 - 5
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	<0.062, 1.7, 5.1, 18.4, 56.9, -, -	-	-	-	-	<0.062, 1.7, 5.1, 18.4, 56.9, -, -	-

Table 17: Summary of Morphological Parameters for UT5 and UT6

Parameter	Existing Parameters		Reference Parameters			Proposed Parameters	
	UT5	UT6	UT to Wells	UT to Cane Creek	UT4 (UT to Cedar)	UT5	UT6
Contributing Drainage Area (acres)	40	17	83	179	70	40	17
Channel/Reach Classification	-	E4	C4/1	C4/E4	C4	C4b	C4b

Parameter	Existing Parameters		Reference Parameters			Proposed Parameters	
	UT5	UT6	UT to Wells	UT to Cane Creek	UT4 (UT to Cedar)	UT5	UT6
Design Discharge Width (ft)	3.4	3.0–4.6	6.2 – 8.6	9.3	7.3	6.8	5.2
Design Discharge Depth (ft)	0.6	0.4–0.5	0.6 – 1.0	0.9	0.6	0.5	0.4
Design Discharge Area (ft^2)	1.9	1.4–1.9	3.9 – 6.3	8.6	4.2	3.7	2.0
Design Discharge Velocity (ft/s)	3.7	1.9–2.4	3.8	2.2	5.2 – 6.1	3.2	3.2
Design Discharge (cfs)	11.5	6.4	15.0	19.4	21.7 – 25.8	11.5	6.4
Water Surface Slope	0.033	0.026	0.020	0.0046	0.016	0.018	0.027
Sinuosity	1.17	1.15	1.41	1.20	1.05	1.15	1.15
Width/Depth Ratio	5.9	6.3-11.5	6.1 – 12.6	10.1	12.6	13.0	13.0
Bank Height Ratio	3.0	1.2–6.9	1.0 – 1.8	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.4	1.2->15	1.9 – 4.1	>3.2	2.7	2.2 - 5	2.2 - 5
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	-	1.2, 6.2, 10.6, 64.0, 119.3, -, -	-	-	-	-	1.2, 6.2, 10.6, 64.0, 119.3, -, -

8.4 Design Discharge Analysis

Multiple methods were used to develop bankfull discharge estimates for each of the project restoration reaches: the NC Rural Piedmont Regional Curve (Harman et al., 1999), NC Piedmont/Mountain Regional Curve (Walker, unpublished), a Wildlands Regional USGS Flood Frequency Analysis, a Site-Specific Reference Reach Curve, existing bankfull indicators using Manning's Equation, and data from previous successful design projects. The resulting values were compared and best professional judgment was used to determine the specific design discharge for each restoration reach.

8.4.1 Published Regional Curve Data

Discharge was estimated using the published NC Rural Piedmont Curve (Harman et al., 1999) as well as the updated curve for rural Piedmont and mountain streams, referred to as the NRCS Curve (Walker, unpublished).

8.4.2 Wildlands Regional Flood Frequency Analysis

Wildlands developed a regional flood frequency analysis tool based on methodology described in the 2009 USGS publication *Magnitude and Frequency of Rural Floods in the Southeastern United States, through 2006.* Of the 103 stations referenced in the publication, 23 were used in the development of the tool. The applicable stations were selected based on several criteria such as geographic region, drainage area, watershed characteristics, extent of available data, and dates of data collection. To fill gaps in data, five additional stations were added by Wildlands to represent streams with drainage areas less than one square mile. The five gages that were added are as follows:

- USGS 02085020 – Stony Creek Tributary near Hillsboro, NC (DA = 0.80 mi^2)
- USGS 02087140 – Lower Barton Creek Tributary near Raleigh, NC (DA = 0.70 mi^2)
- USGS 02087240 – Stirrup Iron Creek Tributary near Nelson, NC (DA = 0.25 mi^2)
- USGS 02101480 – Sugar Creek near Tramway, NC (DA = 0.85 mi^2)
- USGS 02115520 – Logan Creek near Smithtown, NC (DA = 0.90 mi^2)

The data from these 28 gage stations were used to develop flood frequency curves for the 1-year, 1.2-year, 1.5-year, 1.8-year, and 2-year recurrence interval discharges. These relationships can be used to estimate discharge of those recurrence intervals for ungauged streams in the same hydrologic region, and were solved for each project reach's discharge with the drainage area as the input.

8.4.3 Site Specific Reference Reach Curve

A total of nine reference reaches were identified for this project (Section 8.2). Each reference reach was surveyed to develop information for analyzing drainage area-discharge relationships as well as development of design parameters. Stable cross-sectional dimensions and channel slopes were used to compute a bankfull discharge with the Manning's equation for each reference reach. The resulting discharge values were plotted with drainage area and compared to other discharge estimation methods. Three reference reaches were selected to help develop design parameters for Dry Creek, and a separate set of three reference reaches was used for the tributaries. In addition, a third set of three reference reaches was included only for purposes of the discharge analysis to strengthen the discharge-drainage area curve.

8.4.4 Existing Bankfull Indicators (Manning's Equation)

A riffle cross-section was surveyed on each design reach on the Site, totaling ten cross-sections. Bankfull indicators were identified in the field during this survey. Manning's equation was used to calculate a corresponding discharge using the pebble count information for roughness and the survey data for channel slope. It can be difficult to identify clear bankfull indicators on incised and degraded channels, so the highest quality indicators were used to calibrate others. The highest quality indicators were identified on Dry Creek Reach 3 and UT6 Reach 2.

8.4.5 Design Discharge Analysis Summary

The results of the design discharge analysis provided a range of discharge values. The NC Rural Piedmont Regional Curve produced estimates approximately 1.5 – 2 times those of the NRCS Curve, which yielded lower estimates than all other estimation methods. The Wildlands regional flood frequency analysis produced results for the 1.2-year event that consistently fell between the results of the Piedmont Regional and NRCS Curves, while the results for the 1.5-year event were consistently higher than both regional curve estimates. There was some convergence between the estimates derived from the NC Rural Piedmont Regional Curve and the Reference Reach Curve. The results of the two methods had average difference of 12%. To a slightly lesser extent, there was also some similarity between the results of these two methods and the Wildlands regional flood frequency analysis 1.2-year results. This similarity was typically stronger with the Reference Reach Curve for Dry Creek and with the Piedmont Regional Curve for the tributaries. Due to the lack of significant bankfull indicators at surveyed cross sections, the methods described in Section 8.4.4 were ultimately not used in the discharge analysis.

Final design discharges are based on a strategic weighting of the methods discussed in this section. For the Dry Creek mainstem, the Piedmont Regional Curve was weighted most heavily followed by the regional flood frequency analysis 1.2-year event and the NRCS Curve estimates, then the Reference Reach Curve. However, there are few representative sites in the USGS, Regional Curve, or NRCS Curve data to describe the smaller drainage areas of the various tributaries. Consequently, the design discharges for the tributaries rely more heavily on the Reference Reach Curve followed by the Piedmont Regional curves, and regional flood frequency 1.2-year event. Design discharges for the small tributaries were chosen to be higher relative to the Dry Creek reaches. This will result in larger cross sections which will help maintain channels and prevent the the tributaries from being overwhelmed by encroaching vegetation.

Tables 18 and 19 give a summary of the discharge analysis. Figure 10 illustrates the design discharge data.

Table 18: Summary of Design Discharge Analysis for Dry Creek

		Dry Creek Reach 1	Dry Creek Reach 2	Dry Creek Reach 3	Dry Creek Reach 4
DA (acres)		427	609	695	807
DA(sq. mi.)		0.67	0.95	1.09	1.26
NC Rural Piedmont Regional Curve (cfs)		66	86	95	105
NRCS Curve (cfs)		41	54	59	67
Regional Flood Frequency Analysis (cfs)	1.2-year event	58	75	83	92
	1.5-year event	82	106	117	130
Site Specific Reference Reach Curve		68	85	93	103
Selected Design Discharge		**58**	**75**	**83**	**92**

Table 19: Summary of Design Discharge Analysis for Tributaries

		UT1 Reach 2	UT5 Reach 2	UT6 Reach 3
DA (acres)		85	40	17
DA(sq. mi.)		0.13	0.06	0.03
NC Rural Piedmont Regional Curve (cfs)		21	12	6.5
NRCS Curve (cfs)		11	6.3	3.3
Regional Flood Frequency Analysis (cfs)	1.2-year event	18	10	5.4
	1.5-year event	26	15	8.1
Site Specific Reference Reach Curve		23	14	8.2
Selected Design Discharge		**19.6**	**11.5**	**6.4**

8.5 Sediment Transport Analysis

As discussed in Section 3.1.2, small Slate Belt streams are generally low bedload sediment supply systems. To confirm that the streams on this Site are low bedload streams, Wildlands performed a qualitative assessment of the sediment load volume and sources in the project watershed. For this project, the watershed was assessed through historic and current aerial photography (Appendix 5) and field reconnaissance to characterize past and current land cover and potential sediment sources. There are two prominent potential sediment sources within the watershed: runoff from agricultural fields and streambank erosion and bed scour. There are a number of agricultural fields within the UT1 watershed that are likely sources of sediment however, the two ponds immediately upstream of the Site serve as a sink for any excess sediment and limit the amount of sediment delivered to the Site. There is minimal evidence of streambank erosion from the upstream reaches of Dry Creek delivering large sediment loads. A pond in the watershed likely captures any sediment loss from an upstream agricultural field. Additionally, Dry Creek has a forested buffer up to its headwaters on Camp Butner property. On-site streams were visually inspected several times during 2017 and 2018 to qualitatively assess aggradation and degradation within the channels. Streams exhibited evidence of on-going fluvial erosion on stream banks on Dry Creek, UT1, UT2, UT3, UT5, and UT6 Reach 1. There is only moderate evidence of sediment

deposition and accumulation throughout these reaches, indicating that aggradation within the reaches is not an issue. Once the project is constructed, on-site sediment sources will be addressed by protecting streambanks and reducing shear stress in the channels.

The watershed assessment indicates that the bedload supply is not high enough to cause the project streams to be capacity limited. The focus of sediment transport analysis for this design was verify that the designed channels will be stable over time and have the ability to pass sediment from the watersheds. A competence analysis was performed on the streams to aid in the development of the final channel designs.

8.5.1 Competence Analysis

Competence analyses were performed iteratively during design for four of the restoration reaches (the other two reaches of Dry Creek are also well represented by the by the two reaches analyzed). The analyses is performed by comparing shear stress associated with the design bankfull discharge, proposed channel dimensions, and proposed channel slopes with the size distribution of the existing bed load. The analysis utilized standard equations based on a methodology using the Shields (1936) curve and Andrews (1984) equation described by Rosgen (2001). Channel slope and design dimensions were varied until the resulting design verified that the stream reach could move the bed load supplied to the stream. The results of the analysis are shown in Table 20.

Table 20: Results of Competence Analysis

	UT1	Dry Creek – R2	Dry Creek – R3	UT6 - R1
Dbkf (ft)	0.6	1.3	1.3	0.4
Schan (ft/ft)	0.0179	0.0059	0.0054	0.0269
Bankfull Shear Stress, t (lb/sq ft)	0.69	0.47	0.43	0.62
Dmax Bar/Subpavement (mm)	13	45	45	45
Dcrit (ft)	0.1	0.4	0.82	0.2
Scrit (ft/ft)	0.00293	0.00179	0.00341	0.0195
Movable particle size (mm)	116.1	87.5	82	107.2
Predicted Shear Stress to move Dmax	0.04	0.19	0.19	0.19

The competence analysis was based on the size material naturally found in the stream in order to represent the potential bed load. The results of the analysis show excess shear stress in every reach. This indicates that there is enough shear stress to move the naturally occurring material. However, it also indicates that scour could be a problem. Therefore, the results of the analysis were used to size material that would not be mobile so that constructed riffles can be designed to provide grade control. The larger rock material along with log sills and other grade control structures were used in the design to prevent downcutting of the proposed channels. The results of the analysis indicates that particles of 87.5 mm (0.29 feet) would not be mobile in the Dry Creek reaches and particles of 116.1 mm (0.38 feet) and 107.2 mm (0.35 feet) would not be mobile in UT1 and UT6 respectively. Multiple riffles in each of these streams will be constructed with material larger than these sizes.

8.6 Project Implementation

A large portion of the streams on the Site will be restored through Priority 1 restoration, including Dry Creek Reaches 1 – 4, UT1 Reach 2, and UT6 Reach 1. There will be no Priority 2 restoration. The restored streams will be reconstructed on flat areas on the historic floodplains where the likely have previously existed. Reach 1 of Dry Creek has a very flat longitudinal slope (0.3%), so the design pattern

in this reach is more sinuous than the other reaches to reflect the relationship between sinuosity and slope observed in the reference streams. The design patterns of remaining restoration reaches with slope more characteristic of Piedmont streams are typical for Piedmont projects. To the extent possible, the design alignments have been developed to avoid impacts to existing wetlands and unnecessary removal of existing trees. The restored profiles will consist of alternating riffle-pool bed morphology.

A variety of structures will be used in restoration reaches to maintain restored bed grades, protect banks, add wood and rock into channels, and provide a variety of habitat types. Four types of constructed riffles are proposed including native material riffles, woody riffles, angled log riffles, and chunky riffles. Other types of structures will include brush toe bank revetments, angled log sills, rock sills, sod mats, log j-hooks, log vanes, cover logs, and vegetated soils lifts.

Riffle grade control material will be quarried from weathered parent material on-site for construction of riffles and other structures. Use of this material, along with the introduction of woody debris, will provide a heterogeneous mixture of riffle material that increases channel roughness and improves channel hydraulics and geomorphology. The gradation of material will provide varied pore spaces within the riffles and structures, benefitting hyporheic exchange processes and habitat niche formation.

UT1A and UT5 Reach 1 are proposed for enhancement I. The treatments for these reaches include raising the channel bed through the use of constructed riffles and/or sills and bank revetments where needed. These reaches are both short and the existing banks are mostly stable, though they are incised. Enhancement II is proposed for four reaches – UT1 Reach 1, UT2, UT3, and UT7. The treatments for these reaches include fencing out livestock and minor bank repairs where necessary. Bank repairs will primarily include regrading banks to flatter, more stable side slopes along with matting and live staking repaired areas. Some structures will be used to redirect flows away from banks. Two short reaches, UT4 and UT6 Reach 2, are stable and have well vegetated riparian buffers. These reaches are proposed for preservation.

Two in-line ponds will be removed as part of the stream restoration, one on UT1 Reach 2 and one on Dry Creek Reach 1. Two other off-line ponds near UT1 will also be removed. Fill material will be needed to fill the incised, over-widened existing channel and ponds. The dams will be breached and pumps will be used as necessary to dewater the ponds as the initial step in pond removal. The earthen dams will then be removed and the dam material will be used to fill the pond bottom to provide stable foundation for construction of the new channel. The remainder of the excavated material will be used to fill portions of the old channels in other areas of the site. Once the dams of the on-line ponds are removed, the stream restoration will be constructed through the existing impoundments. The offline ponds will be filled and planted to restore a natural floodplain.

Four culvert crossings will be constructed or remain on the project streams. One will be on UT1 Reach 2 at a 35-foot easement break. This easement break will also be used for a crossing of a relocated overhead power line. The second culvert will be on Dry Creek Reach 2 at a 35-foot internal crossing, the third will be on Dry Creek Reach 4 at a 40-foot easement break, and the fourth will be on UT5 at a 60-foot external easement break. An existing bridge will remain on Dry Creek Reach 2 at a 60-foot external easement break. The overhead powerline that currently crosses UT1 will be relocated away from the stream and conservation easement except for the location where it crosses at the 35-foot easement break and one other location where it will cross the easement (Figure 7).

Riparian buffer mitigation will also be performed on the Site. The Buffer Mitigation Plan in included in Appendix 1.

8.7 Vegetation and Planting Plan

The objective of the planting plan is to establish, over time, a thriving riparian buffer composed of native tree species to establish a bottomland hardwood forest community. This restored buffer will improve riparian habitat, help the restored streams stay stable, shade the streams, and provide a source for LWD and organic material to the streams. The Site will also generate Riparian Buffer Credits as well as SMUs for the Neuse 01 CU in accordance with 15A NCAC 02B .0295 (Effective November 1, 2015). The Site will be planted to the extents of the conservation easement, to include additional buffer areas for buffer credits. Riparian buffers will be seeded and planted with early successional native vegetation (a mixture of trees and shrubs). The specific species composition to be planted was selected based on the community type, observation of occurrence of species in riparian buffers adjacent to the Site, best professional judgement on species establishment and anticipated Site conditions in the early years following project implementation, and the requirement of a minimum of four species according to Rule 0295. Species chosen for the planting plan are listed on Sheet 2.0 of the Draft Plans. The Draft Plans also contain additional guidance on planting zones, Site preparation, and Site stabilization during construction. The planted riparian buffer area within the conservation easement will be approximately 14 acres.

The riparian buffer areas will be planted with bare root seedlings. Species planted as bare roots will be planted at 12-foot by 6-foot spacing (targeted densities after monitoring year 7 are 210 stems per acre). In addition, stream banks of the larger restoration channels (Dry Creek Reaches 1 – 4) will be planted with live stakes. Live stakes on these reaches will be planted on channel banks at a spacing of 3 to 4 feet on the outside of meander bends and 6 feet on both sides of tangent sections. They will be installed above base flow elevation. For the smaller tributaries where restoration work will be done and in sections where bank repairs are made, live stakes will be offset three feet from the top of the channel banks at the same spacing as the large reaches. The channel toe of restoration reaches will be planted with plugs of multiple herbaceous species at a spacing of 3 to 4 feet. Permanent herbaceous seed will be spread on streambanks, floodplain areas, and all disturbed areas within the project easement. Permanent herbaceous seed will also be placed within the internal easement break for the utility crossing.

To help ensure tree growth and survival, soil amendments may be added to areas of the floodplain along Dry Creek where overburden material is removed. Soil tests will be performed in areas of cut and fertilizer and lime will be applied based on the results. Additionally, topsoil will be stockpiled, reapplied, and disked before permanent seeding and planting activities take place.

Mature sweetgum (*Liquidambar styraciflua*) trees have been identified on the Site. While sweetgum has been identified as a nuisance species, it is in the project's best interest for the trees to be left. These mature trees provide appropriate shading, habitat, and slows stormwater runoff. They also provide a native seed source when competition with non-native invasive species like Chinese privet and multiflora rose may be a problem. In areas with potential low growth, having a hardy species is ideal to break up the soil and put nutrients back into the ground. Since sweetgums provide many benefits, the vegetative performance success criteria will not be dependent on treating and removing sweetgum, unless it is determined that sweetgum volunteers are affecting the survival of planted, desirable species.

The most prevalent invasive species on Dry Creek are Chinese privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora)*. Japanese honeysuckle (*Lonicera japonica*) and Japanese stiltgrass (*Microstegium vimineum*) are also scattered along the Site, but in lower quantities.

The goal of this project is to treat and remove as much existing invasive species as possible before and during construction. During the post-construction monitoring period, the presence and extents of invasive species will be monitored. Treatment of invasive species will continue as necessary throughout

the life of the project to ensure project stability and success of the riparian and streambank vegetation. Additional monitoring and maintenance issues regarding vegetation can be found in Sections 9 and 10 and Appendix 7.

8.8 Project Risk and Uncertainties

This project is low risk. There are four easement breaks for landowner crossings (Section 5.7). One break on UT1 will also be used for maintenance of an overhead utility line. This area may be mowed or maintained periodically by Duke Energy but should not otherwise be disturbed. Due to the rural nature of the area, there is very little risk that changes in land use upstream in the project watershed would alter the hydrology or sediment supply to the degree that the project is put at risk. Beaver may periodically be a problem. Wildlands will utilize the USDA to manage beaver throughout the monitoring period.

9.0 Performance Standards

The stream performance standards for the project will follow approved performance standards presented in the DMS Mitigation Plan Template (version 2.3, 12/18/2014), the Annual Monitoring Template (April 2015), and the Stream Mitigation Guidelines issued October 2016 by the USACE and NCIRT. Annual monitoring and routine site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, and vegetation. Performance standards will be evaluated throughout the seven-year post-construction monitoring period.

9.1 Streams

9.1.1 Dimension

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Per DMS guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored C and E channels to be considered stable. All riffle cross-sections should fall within the parameters defined for channels of the designed stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability. If excessive bank erosion is observed along Dry Creek during the monitoring period, an array of bank pins will be installed in representative areas where erosion is occurring. After installation bank pins will be monitored by measuring exposed rebar and maintaining pins flush to bank to capture bank erosion progression.

9.1.2 Pattern and Profile

Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability.

9.1.3 Substrate

Channel substrate materials will be sampled with the pebble count method along restoration, and enhancement I reaches. These reaches should show maintenance of coarser materials in the riffle features and smaller particles in the pool features. A reach-wide pebble count will be performed in each restoration reach each monitoring year for classification purposes. A pebble count will be performed at each surveyed riffle cross-section, only during the as-built survey to characterize the pavement.

9.1.4 Photo Documentation

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

9.1.5 Hydrology

The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented on enhancement I and restoration streams during the seven-year monitoring period. The four bankfull events must occur in separate years. Stream monitoring will continue until performance standards in the form of four bankfull events in separate years have been documented. Intermittent channels proposed for restoration or enhancement I activities will be monitored for hydrology and must demonstrate at least 30 consecutive days of stream flow.

9.2 Vegetation

Vegetative performance for riparian buffers associated with the stream restoration component of the project (buffer widths 0 – 50ft) will be in accordance with the Stream Mitigation Guidelines issued October 2016 by the USACE and NCIRT. The success criteria is an interim survival rate of 320 planted stems per acre at the end of monitoring year three (MY3), 260 stems per acre at the end of monitoring year 5 (MY5) and a final vegetation survival rate of 210 stems per acre at the end of monitoring year 7 (MY7). Planted vegetation must average 10 feet in height in each plot at the end of the seventh year of monitoring. Vegetation monitoring will be conducted between July 1st and the end of the of the growing season. Individual plot data will be provided and will include height, density, vigor, damage (if any), and survival. In fixed vegetation plots planted woody stems will be marked annually as needed and given a coordinate, based off a known origin, so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living planted stems and the current year's living planted stems.

A separate buffer monitoring report will be submitted to NCDWR no later than December 31 of each year for a minimum of five consecutive years after the first full growing season (MY1, 2, 3, 4, and 5). At the completion of monitoring year 5, DMS will request closeout of the buffer portion of the project, assuming vegetation criteria is met. The buffer mitigation success criteria are described in the Buffer Mitigation Plan in Appendix 1.

The extent of invasive species coverage will be monitored and controlled as necessary throughout the required monitoring period (MY7).

9.3 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above.

10.0 Monitoring Plan

The Site monitoring plan has been developed to ensure that the required performance standards are met and project goals and objectives are achieved. Annual monitoring data will be reported using the DMS Annual Monitoring Reporting Template (April 2015). The monitoring report shall provide project data chronology that will facilitate an understanding of project status and trends, ease population of DMS databases for analysis and research purposes, and assist in close-out decision making.

Using the DMS As-Built Baseline Monitoring Report Template (February 2014), a baseline monitoring document and as-built record drawings of the project will be developed within 60 days of the planting

completion and monitoring installation on the restored Site. Monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS by November 30. These reports will be based on the DMS Annual Monitoring Template (April 2015) and Closeout Report Template (March 2015). Full monitoring reports will be submitted to DMS in monitoring years 1, 2, 3, 5, and 7. Abbreviated monitoring reports will be submitted in monitoring years 4 and 6. Closeout monitoring period will be seven years beyond completion of construction or until performance standards have been met.

A separate buffer monitoring report will be submitted annually to NCDWR as described in section 9.2, in monitoring years 1,2,3,4, and 5. Also, a separate as-built report will be developed within 30 days of the planting completion and submitted to NCDWR. All reports submitted to NCDWR will follow the typical NCDWR format. Closeout monitoring period for buffers will be five years beyond completion of construction or until performance standards have been met.

Table 21, below, describes how the monitoring plan is set up in order to verify project goals and objectives have been achieved.

Table 21: Monitoring Plan

Goal	Objective	Performance Standard	Monitoring Metric
Exclude cattle from project streams.	Install fencing around project areas adjacent to cattle pastures or remove cattle from the site.	CE fencing will be maintained if cattle are present. Cattle are not accessing the mitigation Site.	Visual inspections of fencing and signs of cattle encroachment.
Stabilize eroding stream banks.	Reconstruct stream channels slated for Restoration with stable dimensions. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to reaches to protect restored/enhanced streams.	Cross-sections should be stable and show little change in bankfull area, and width-to-depth ratio.	Cross-section monitoring and visual inspections.
Improve the stability of stream channels.	Construct stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions.	Entrenchment ratio stays over 2.2 and bank height ratio below 1.2 with visual assessments showing progression towards stability.	Cross-section monitoring and visual inspections.
Improve instream habitat.	Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	There is no required performance standard for this metric.	N/A
Reconnect channels with floodplains.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Four bankfull events in separate years within monitoring period.	Crest gauges and/or pressure transducers recording flow elevations.

Goal	Objective	Performance Standard	Monitoring Metric
Restore and enhance native floodplain vegetation.	Plant native tree species in riparian zone where currently insufficient.	Survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7.	One hundred square meter vegetation plots will be placed on 2% of the planted area of the project and monitored annually.
Permanently protect the project Site from harmful uses.	Establish conservation easements on the Site.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.

10.1 Monitoring Components

Project monitoring components are listed in more detail in Table 22. Approximate locations of the proposed vegetation plots and groundwater gage monitoring components are illustrated in Figure 11.

Table 22: Monitoring Components

Parameter	Monitoring Feature	Quantity/ Length by Reach						Frequency	Notes
		Dry Creek R1, 2, 3, & 4	UT1 R2	UT1A	UT2	UT5	UT6		
Dimension	Riffle Cross-Sections	7	1	1	N/A	1	1	Year 1, 2, 3, 5, and 7	1
	Pool Cross-Sections	5	1	0	N/A	1	1		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Substrate	Reach wide (RW), Riffle (RF) 100 pebble count	4 RW, 7 RF	1 RW, 1 RF	1 RW, 1 RF	N/A	1 RW, 1 RF	1 RW, 1 RF	Reach Wide Year 1, 2, 3, 5, and 7	3
Hydrology	Crest Gage (CG)/ Flow Gage (FG)	2 CG	1 CG	1 CG, 1 FG	1 FG	1 CG	1 CG	Semi- Annual	4
Vegetation	CVS Level 2 Vegetation Plots	8 Fixed, 4 Random						Year 1, 2, 3, 5, and 7	5
Wetlands	Groundwater Well	1						Year 1, 2, 3, 4, 5, 6, and 7	
Visual Assessment		Y	Y	Y	Y	Y	Y	Semi-Annual	
Exotic and nuisance vegetation								Semi-Annual	6
Project Boundary								Semi-Annual	7
Reference Photos	Photographs	32						Annual	

1. Cross-Sections will be permanently marked with rebar to establish location. Surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate lack of stability and profile survey is warranted in additional years.
3. Reach wide pebble counts will be conducted each year a monitoring report is submitted. Riffle cross-section pebble counts will be conducted during as-built baseline monitoring only, unless observations indicate otherwise.
4. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every 3 hours. The transducer will be inspected and downloaded semi-annually.
5. Vegetation monitoring will follow CVS protocols, separate monitoring reports will be submitted to NCDMS and NCDWR.
6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

11.0 Long-Term Management Plan

The Site will be transferred to the North Carolina Department of Environmental Quality (NCDEQ) Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the Site to ensure that restrictions required in the conservation easement are upheld. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statue GS 113A-232(d)(3). Interest gained by the endowment fund may be used for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

The Site Protection Instrument can be found in Appendix 2.

Table 23: Long-term Management Plan

Long-Term Management Activity	Long-Term Manager Responsibility	Landowner Responsibility
Signage will be installed and maintained along the Site boundary to denote the area protected by the recorded conservation easement.	The long-term steward will be responsible for inspecting the Site boundary and for maintaining or replacing signage to ensure that the conservation easement area is clearly marked.	The landowner shall report damaged or missing signs to the long-term manager, as well as contact the long-term manager if a boundary needs to be marked, or clarification is needed regarding a boundary location. If land use changes in future and fencing is required to protect the easement, the landowner is responsible for installing fencing that meets the objectives of the mitigation project.

Long-Term Management Activity	Long-Term Manager Responsibility	Landowner Responsibility
The Site will be protected in its entirety and managed under the terms outlined in the recorded conservation easement.	The long-term manager will be responsible for conducting annual inspections and for undertaking actions that are reasonably calculated to swiftly correct the conditions constituting a breach. The USACE, and their authorized agents, shall have the right to enter and inspect the Site and to take actions necessary to verify compliance with the conservation easement.	The landowner shall contact the long-term manager if clarification is needed regarding the restrictions associated with the recorded conservation easement.

12.0 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Sections 9 and 10. Project maintenance will be performed during the monitoring years to address minor issues as necessary (Appendix 7). If, during the course of annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the DMS of the need to develop a Plan of Corrective Action. Once the Plan of Corrective Action is prepared and finalized Wildlands will:

- Notify the USACE as required by the Nationwide 27 permit general conditions;
- Revise performance standards, maintenance requirements, and monitoring requirements as necessary and/or required by the USACE;
- Obtain other permits as necessary;
- Implement the Corrective Action Plan; and
- Provide the USACE a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

13.0 Determination of Credits

The final stream credits associated with the Site are listed in Table 24. Stream Restoration is at a ratio of 1:1. All buffers meet the minimum 50-foot requirement except for a short section of UT5 Reach 2. For this 16-foot long section, the easement on one side is less than 15 feet wide, so no credit has been proposed. The credit release schedule is located in Appendix 8.

Table 24: Stream Asset Table

Mitigation Credits								
	Stream		Riparian Wetland		Non-Riparian Wetland			
Totals	8,458		N/A		N/A			
Project Components								
Project Component or Reach ID	**Existing Footage/ Acreage**	**Proposed Stationing Location**	**Restoration Level**	**Approach**	**Mitigation Plan Footage/ Acreage**	**Mitigation Ratio**	**Mitigation Credits[1]**	**Adjusted Mitigation Credits[2]**
Dry Creek Reach 1	999	100+80 - 113+57	R	PI	1278	1	1278	1278
Dry Creek Reach 2	2104	113+57 - 114+38; 114+82 - 131+63; 132+23 - 133+08	R	PI	1950	1	1847	1847
Dry Creek Reach 3	1955	133+08 - 149+11	R	PI	1603	1	1603	1603
Dry Creek Reach 4	1495	149+11 - 151+52; 152+37 - 160+50	R	PI	1140	1	1054	1054
UT1 Reach 1	456	200+08 - 202+24; 202+59 - 204+64	EII	N/A	456	2.5	168	168
UT1 Reach 2	945	204+64 - 210+94; 211+46 - 215+82	R	PI	1118	1	1067	1067
UT1A	90	300+00 - 301+66	EI	N/A	166	1.5	111	111
UT2	72	400+00 - 401+51	EII	N/A	151	2.5	60	60
UT3	153	500+15 - 501+71	EII	N/A	156	2.5	62	62
UT4	110	600+00 - 601+15	P	N/A	115	10	12	12
UT5 Reach 1	371	701+83 - 704+81	EI	N/A	378	1.5	199	199
UT5 Reach 2	135	705+61 - 706+80	R	PI	119	1	119	104
UT6 Reach 1	582	800+00 - 806+17	R	PI	617	1	617	617
UT6 Reach 2	209	806+17 - 808+26	P	N/A	209	10	21	21
UT6 Reach 3	58	808+26 - 809+15	R	PI	89	1	89	89
UT7	367	900+43 - 904+59	EII	N/A	415	2	166	166
Component Summation								
Restoration Level	**Stream (LF)[3]**	**Riparian Wetland (Acres)**	**Non-Riparian Wetland (Acres)**		**Buffer (sq. ft.)[4]**	**Upland (Acres)**		
Restoration	7,913	N/A	N/A		N/A	N/A		
Enhancement I	544	N/A	N/A		N/A	N/A		
Enhancement II	1,178	N/A	N/A		N/A	N/A		
Preservation	325	N/A	N/A		N/A	N/A		

1. Mitigation Credits are the total amount of credit based on reach lengths (not including crossings) divided by the mitigation ratio.
2. Adjusted Mitigation Credits are the final credit totals including adjustments made for narrow easement widths.
3. No credit proposed for UT5 Reach 2 Sta. 705+61 to 705+76 because easement width is less than 15 feet due to crossing.
4. Buffer credits are described in Appendix 1: Buffer Mitigation Plan.

14.0 References

Dunne, T. and L. B. Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Company. New York.

Giese, G.I and Robert R. Mason Jr. 1993. Low-Flow Characteristics of Streams in North Carolina. U.S. Geological Survey Water Supply Paper 2403.

Harman, W. R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. *A Function Based Framework for Stream Assessment and Restoration Projects.* US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, DC EPA 843-K-12-006.

Harman et al. 1999. Bankfull Hydraulic Geometry Relationships for North Carolina Streams. AWRA Wildland Hydrology Symposium Proceedings. Edited by: D. S. Olsen and J.P. Potyondy. AWRA Summer Symposium. Bozeman, MT.

Montgomery County Department of Environmental Protection Division of Water Resources Management. 1996. *Rapid Stream Assessment Technique (RSAT) Field Methods.* Montgomery County, Maryland.

Natural Resources Conservation Service (NRCS), 2011. Web Soil Survey. http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

North Carolina Division of Water Quality (NCDWQ), 2011. Surface Water Classifications. http://portal.ncdenr.org/web/wq/ps/csu/classifications

North Carolina Geological Survey (NCGS), 1985. Geologic map of North Carolina 1:500,000 scale. Compiled by Philip M. Brown at el. Raleigh, NC, NCGS.

North Carolina Natural Heritage Program (NHP), 2009. Natural Heritage Element Occurrence Database, Orange County, NC.

Rogers, John J.W., 2006. The Carolina Slate Belt. In Steponaitis, V.P., Irwin, J.D., McReynolds, T.E., and Moore, C.R. (Ed.), Stone Quarries and Sourcing in the Carolina Slate Belt (pp. 10 – 15). Retrieved from http://rla.unc.edu/Publications/pdf/ResRep25/Ch2.pdf

Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.

Rosgen, D.L. 2001. A stream channel stability assessment methodology. Proceedings of the Federal Interagency Sediment Conference, Reno, NV, March 2001.

Simon, A. 1989. A model of channel response in disturbed alluvial channels. Earth Surface Processes and Landforms 14(1):11-26.

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.

Shields, D. F., Copeland, R. R, Klingman, P. C., Doyle, M. W., and Simon, A. 2003. Design for Stream Restoration. Journal of Hydraulic Engineering 129(8): 575-582.

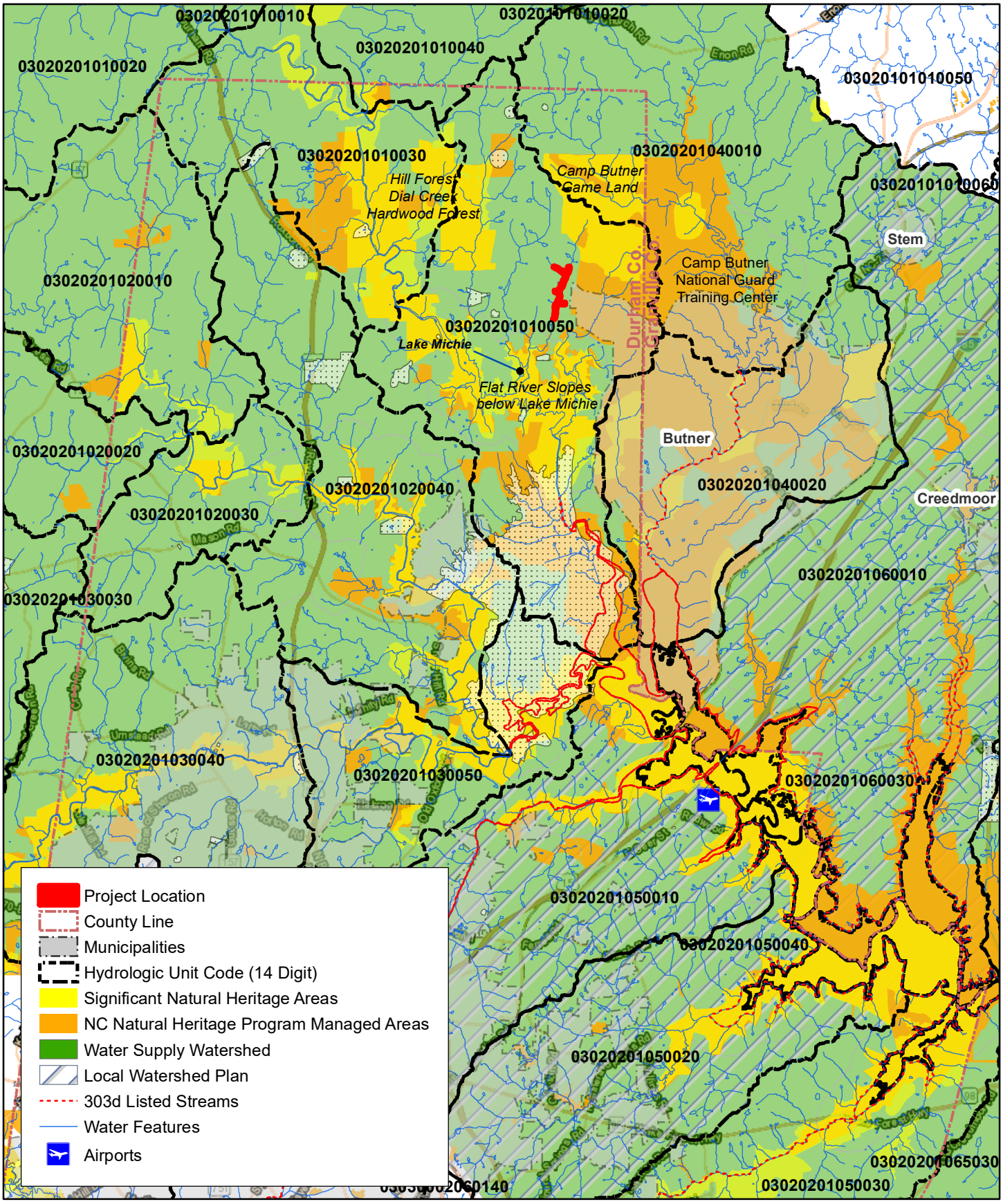
U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC), 2010. HEC-RAS River Analysis System User's Manual, Version 4.1. Accessed online at: http://www.hec.usace.army.mil/software/hec-ras/documentation/HEC-RAS_4.1_Users_Manual.pdf

United States Environmental Protection Agency (EPA), 2010. Spreadsheet Tool for Estimating Pollutant Load, version 4.1. http://it.tetratech-ffx.com/steplweb/models$docs.htm

United States Fish and Wildlife Service (USFWS), 2014. Endangered Species, Threatened Species, Federal Species of Concern and Candidate Species, Orange County, NC. http://www.fws.gov/raleigh/species/cntylist/orange.html

Walker, Alan, unpublished. NC Rural Mountain and Piedmont Regional Curve.

Figures



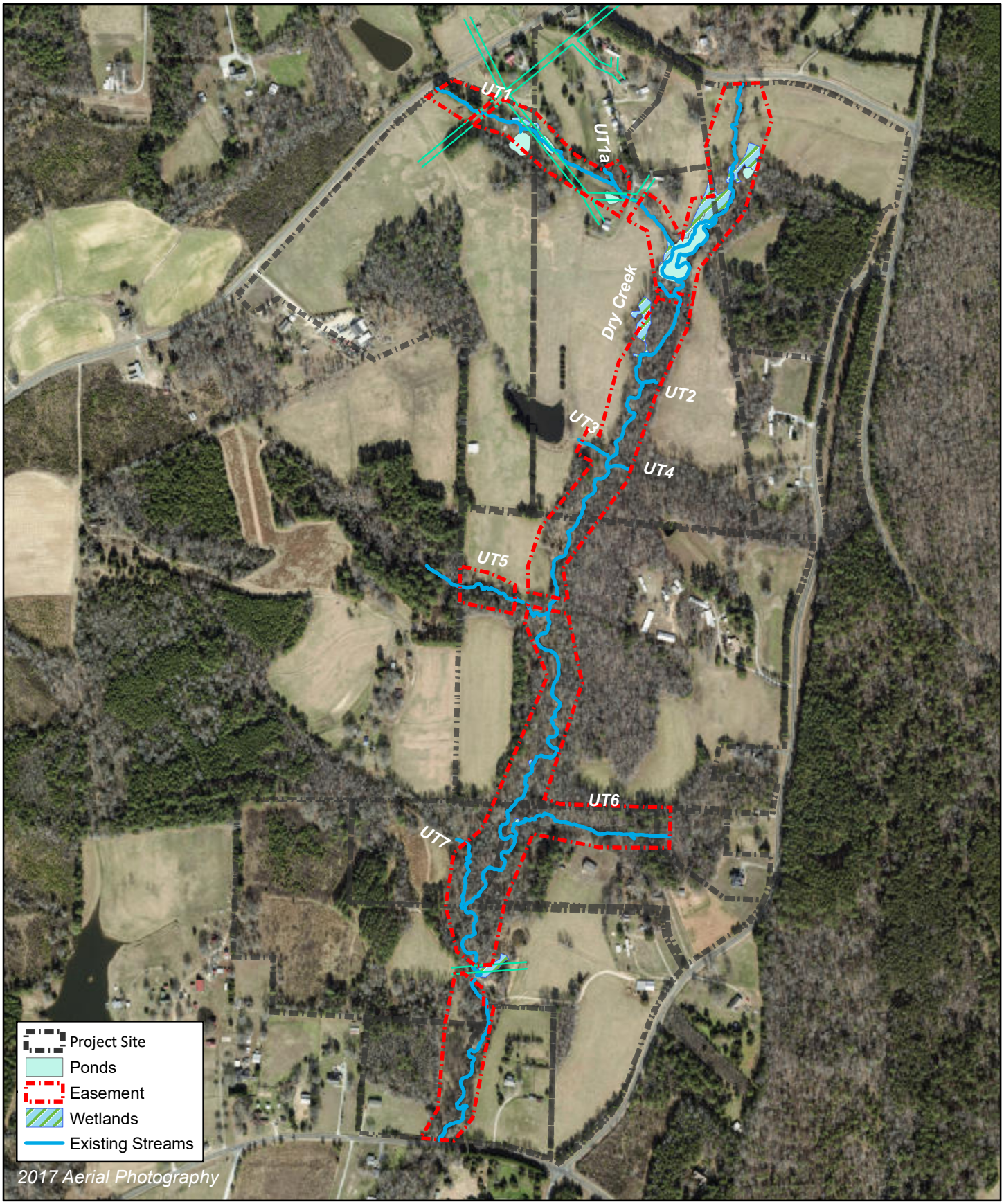
WILDLANDS ENGINEERING

0 2.5 Miles

N

Figure 1 Vicinity Map
Dry Creek Mitigation Site
Neuse River Basin 03020201

Durham County, NC



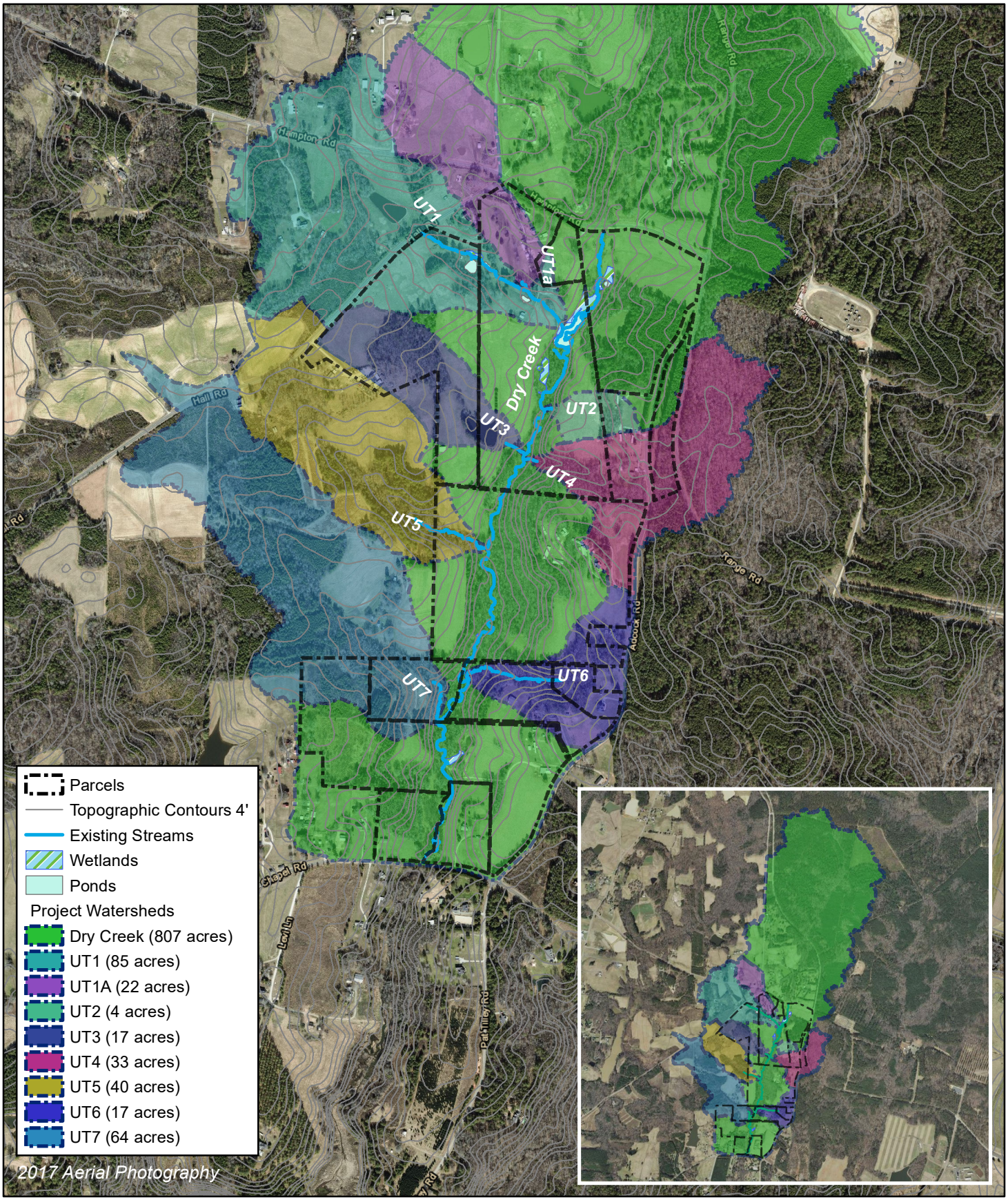
WILDLANDS ENGINEERING

0 600 Feet

N

Figure 2 Site Map
Dry Creek Mitigation Site
New River Basin (03020201)

Durham County, NC



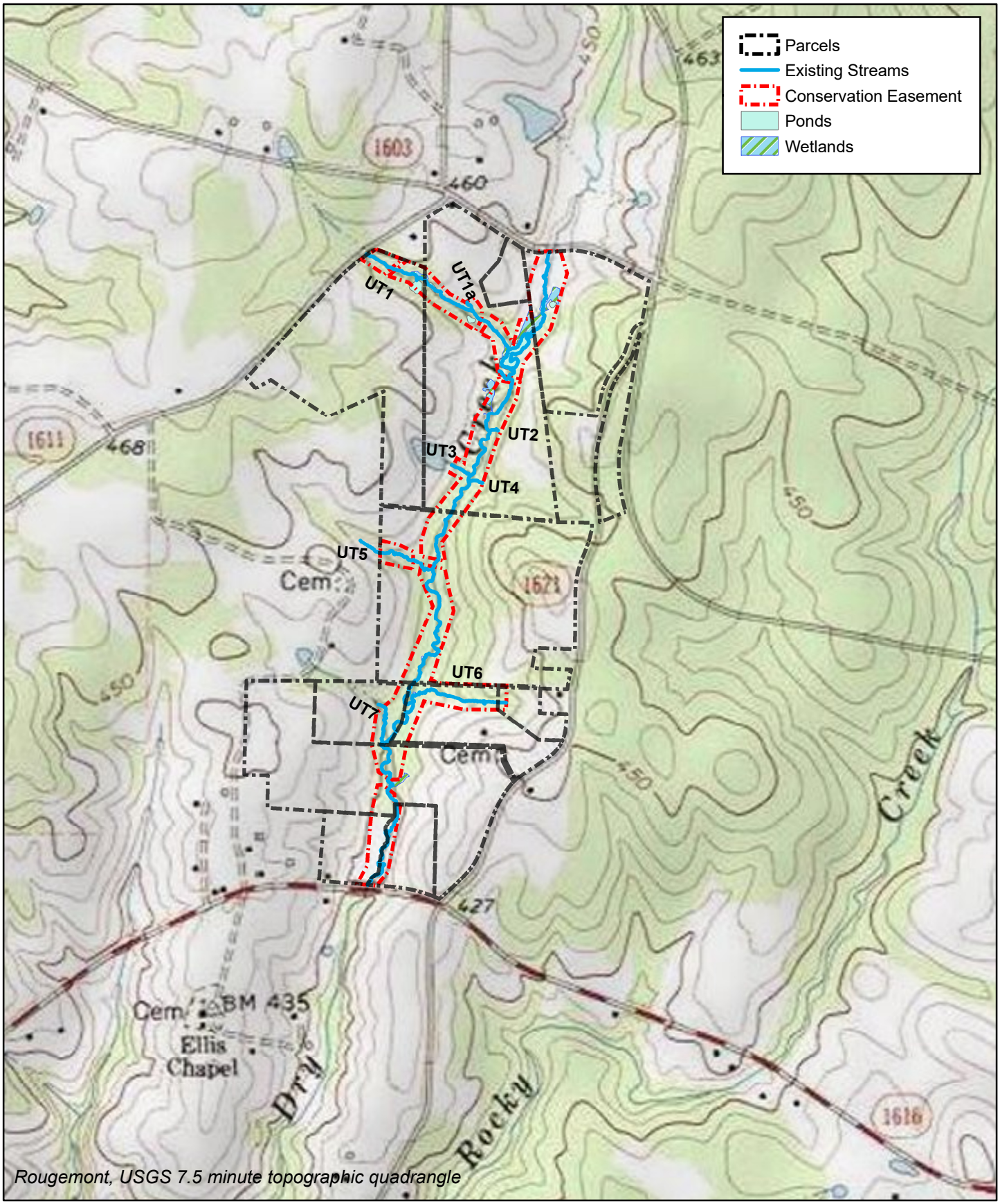
WILDLANDS ENGINEERING

0 1,000 Feet

N

Figure 3 Watershed Map
Dry Creek Mitigation Site
Neuse River Basin 03020201

Durham County, NC



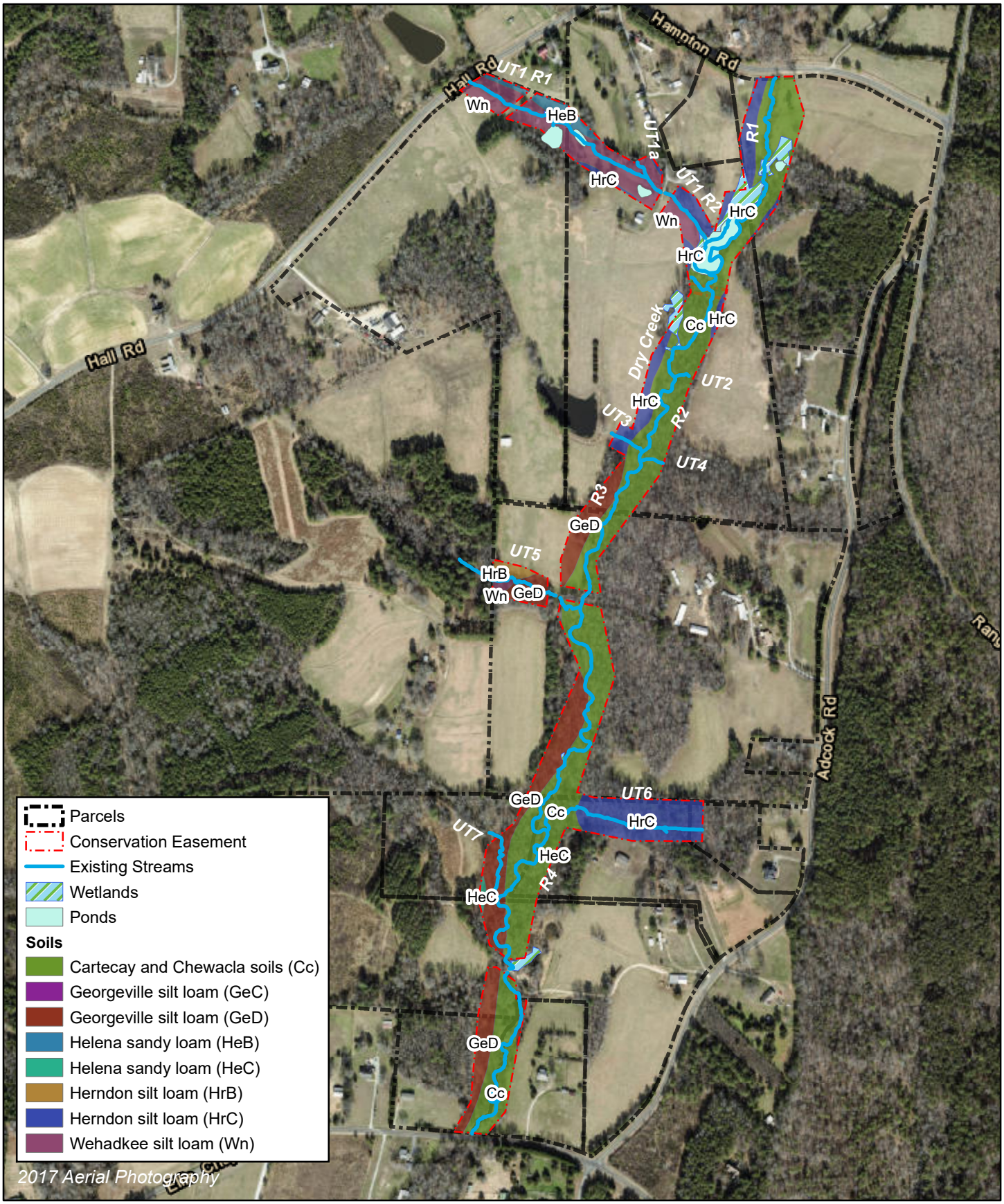
WILDLANDS ENGINEERING

0 1,000 Feet

N

Figure 4 Topographic Map
Dry Creek Mitigation Site
Neuse River Basin 03020201

Durham County, NC



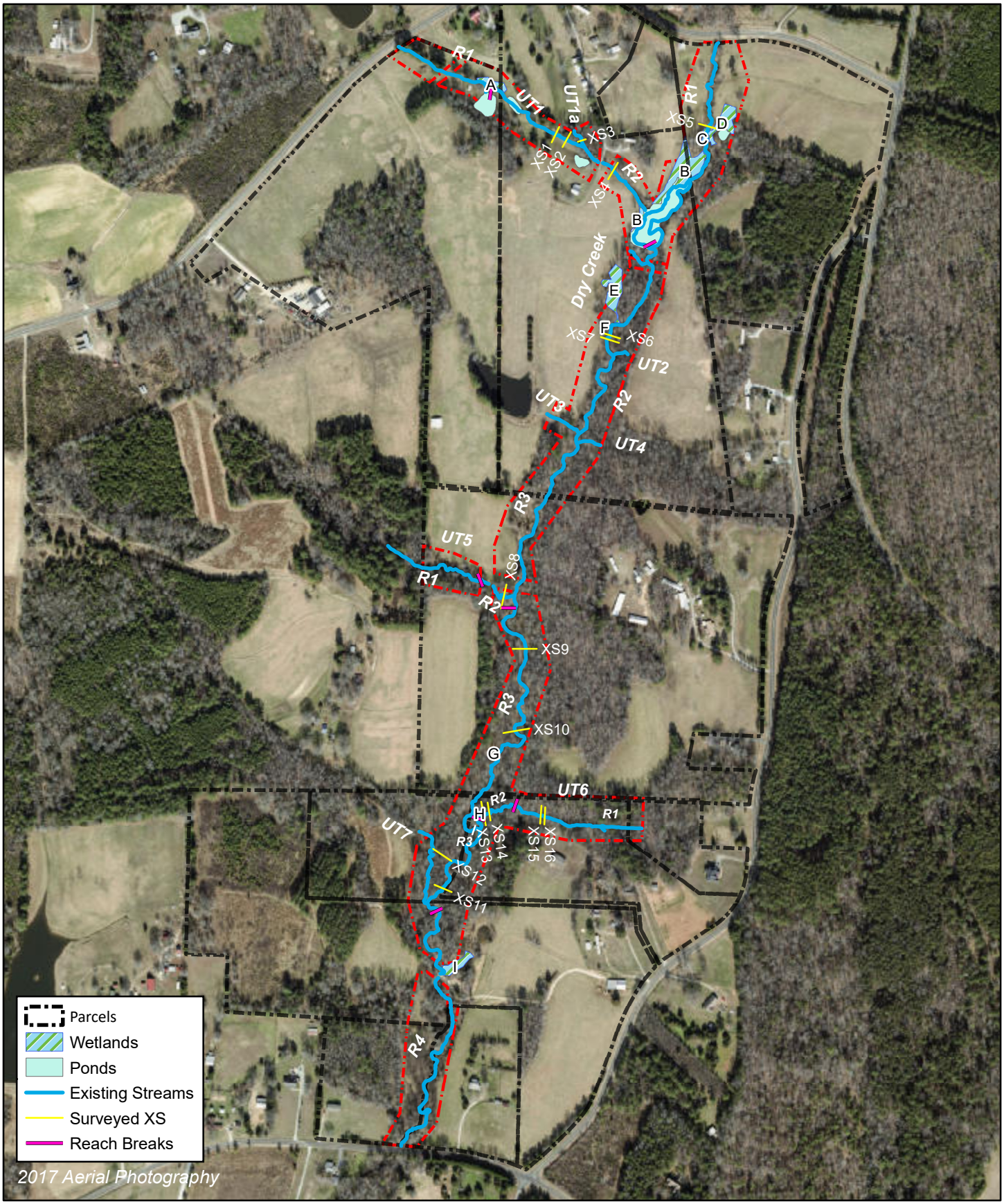
WILDLANDS ENGINEERING

0 600 Feet

N

Figure 5 Soils Map
Dry Creek Mitigation Site
New River Basin (03020201)

Durham County, NC



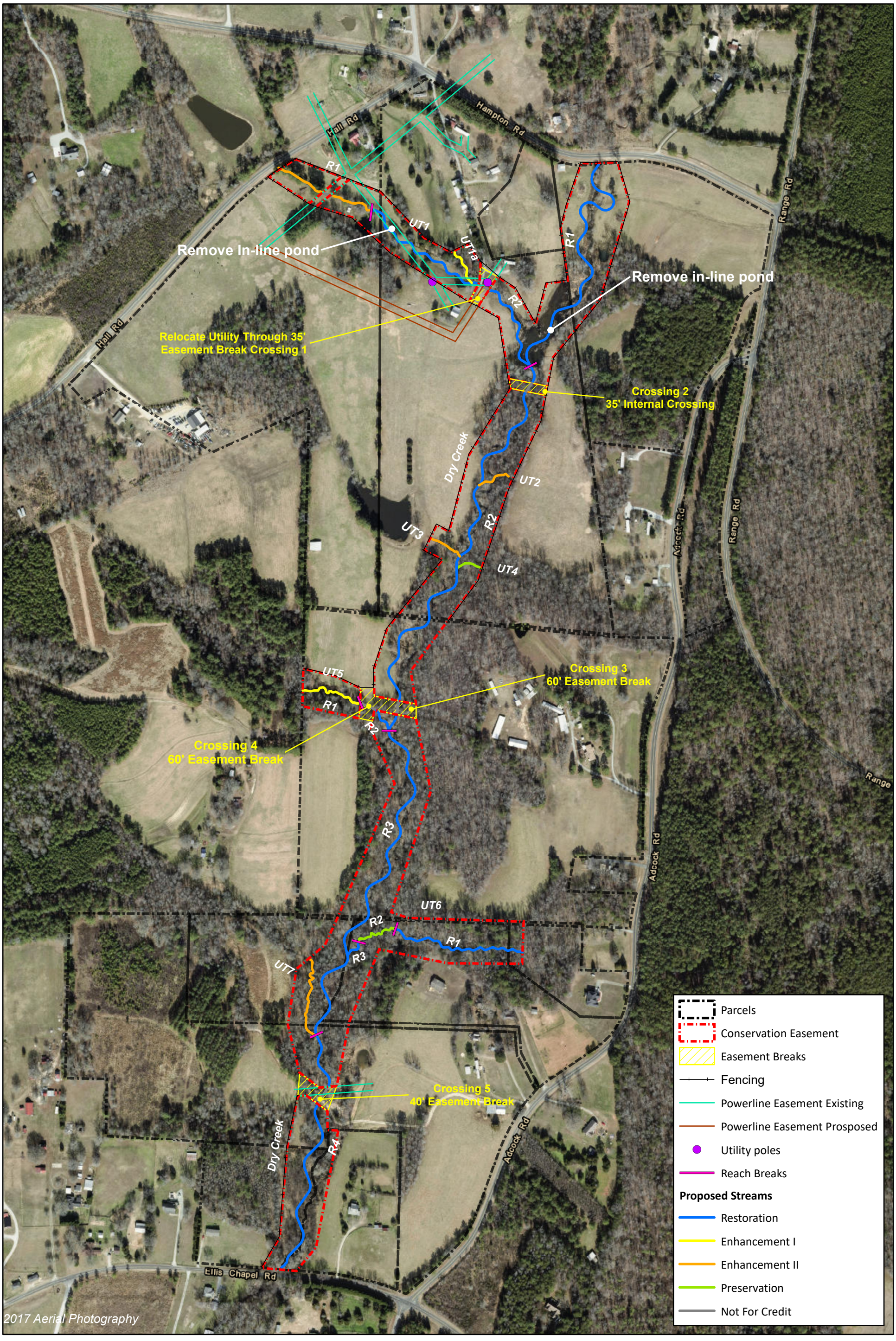
WILDLANDS ENGINEERING

0 600 Feet

N

Figure 6 Existing Conditions Map
Dry Creek Mitigation Site
New River Basin (03020201)

Durham County, NC



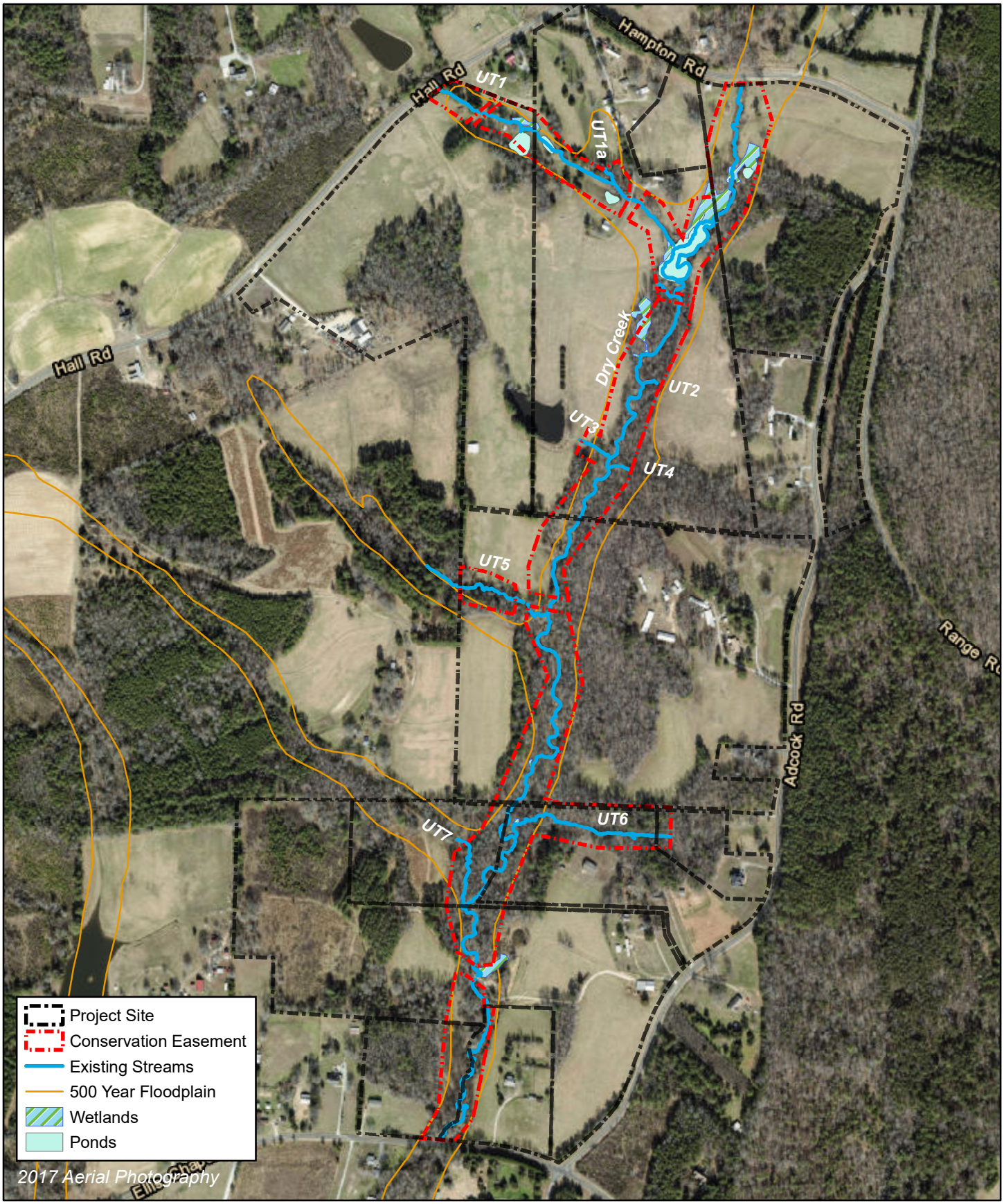
WILDLANDS ENGINEERING

0 400 Feet

N

Figure 7 Concept Design Map
Dry Creek Mitigation Site
New River Basin 03020201

Durham County, NC



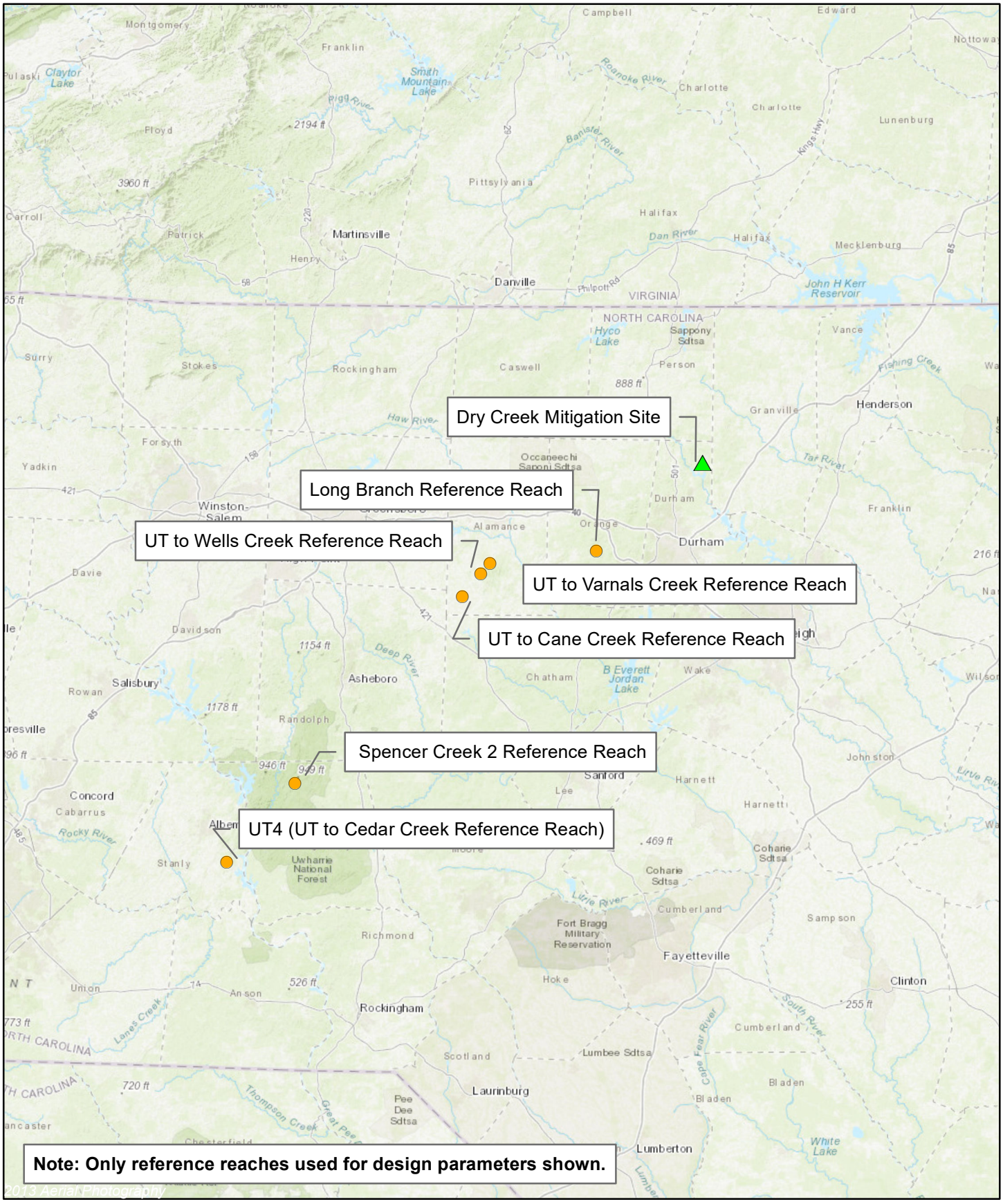
WILDLANDS ENGINEERING

0 600 Feet

N

Figure 8 FEMA Floodplain Map
Dry Creek Mitigation Site
New River Basin (03020201)

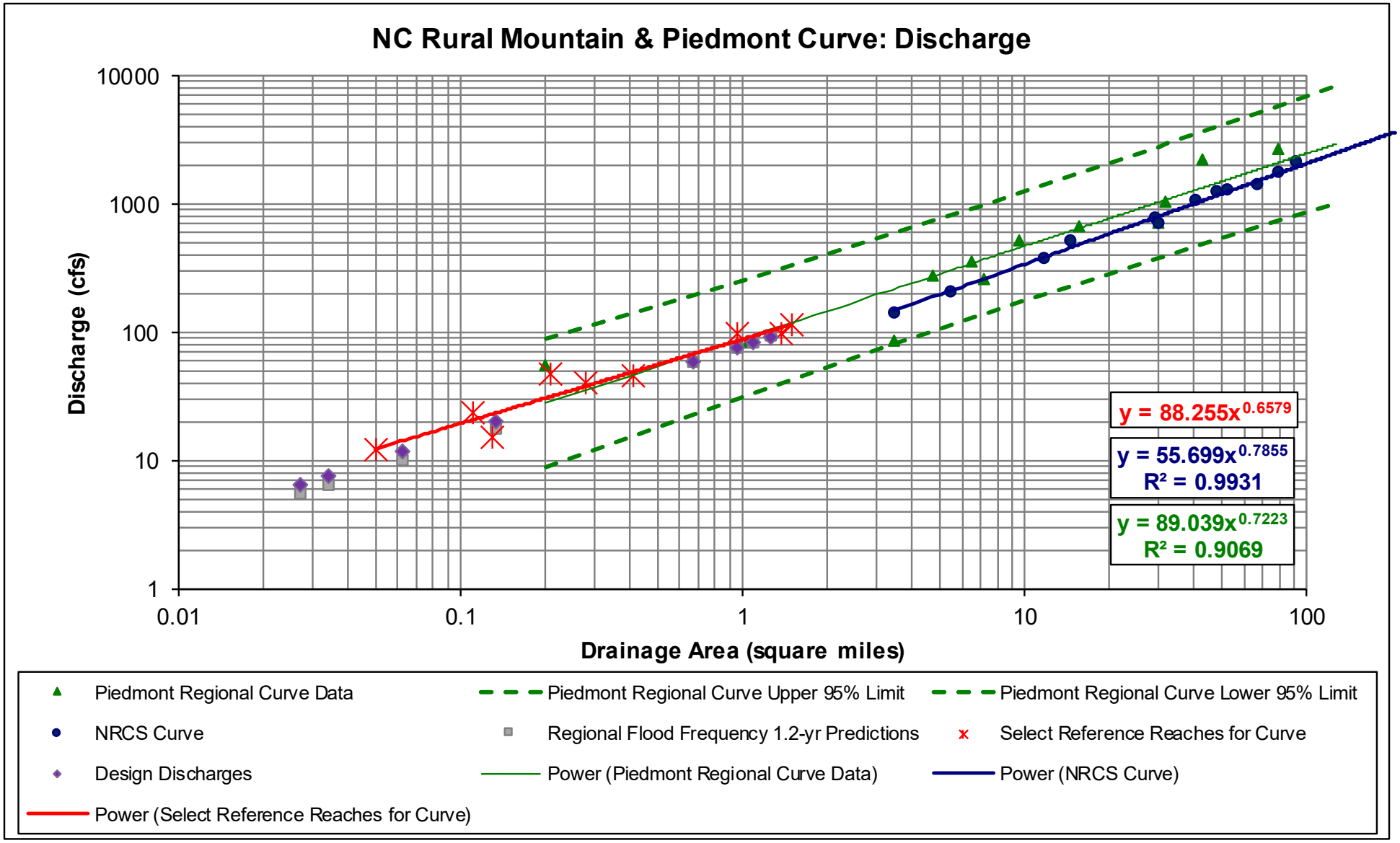
Durham County, NC



WILDLANDS ENGINEERING

Figure 9 Reference Reach Vicinity Map
Dry Creek Mitigation Site
Neuse River Basin (03020201)

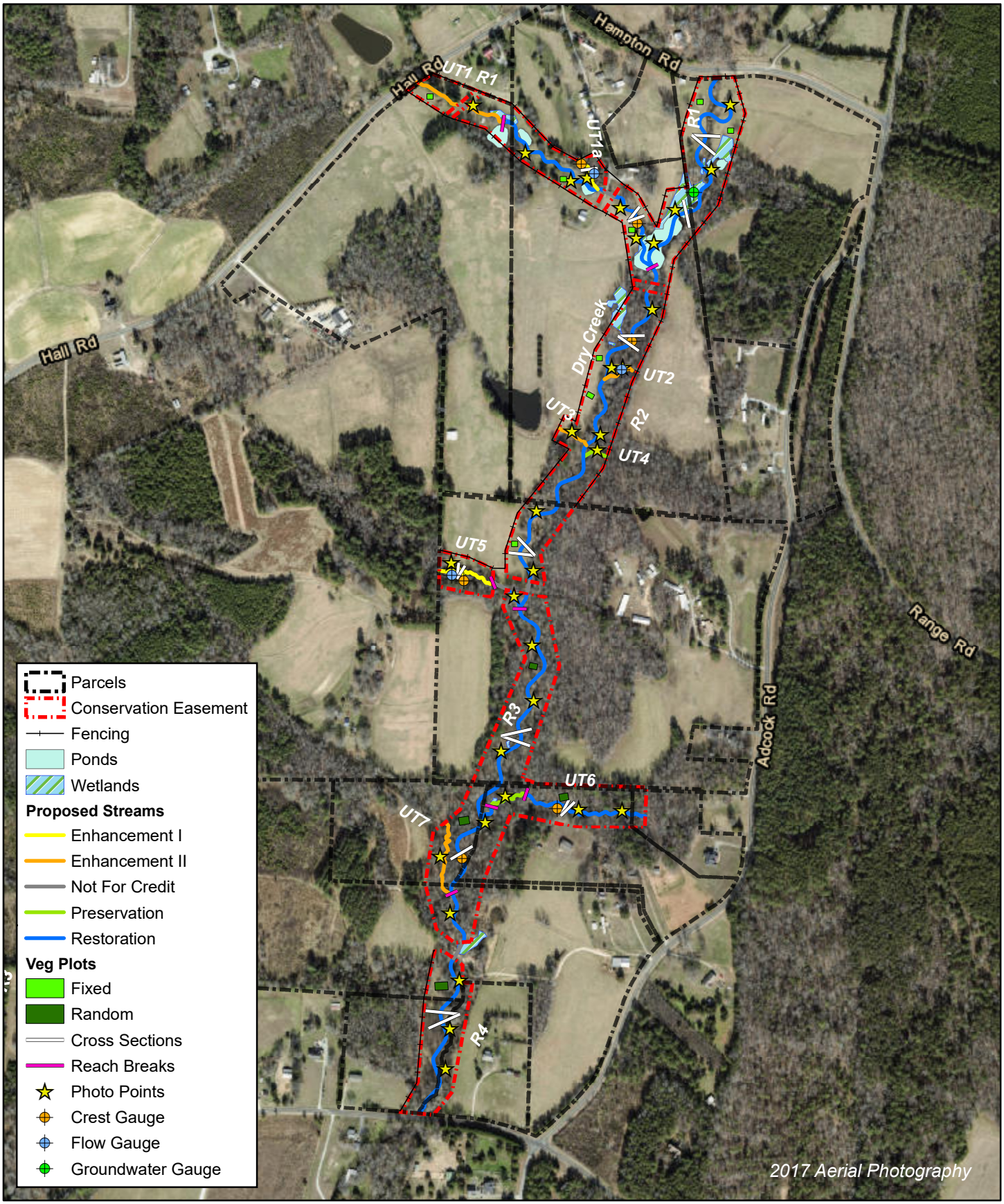
Durham County, NC



WILDLANDS ENGINEERING

Figure 10 Discharge Analysis Graph
Dry Creek Mitigation Site
Neuse River Basin (03020201)

Durham County, NC



WILDLANDS ENGINEERING

0 600 Feet

N

Figure 11 Monitoring Components Map
Dry Creek Mitigation Site
New River Basin (03020201)

Durham County, NC

Appendices

Appendix 1

RIPARIAN BUFFER MITIGATION PLAN

Final

January, 2019

DRY CREEK MITIGATION PLAN

Durham County, NC
NCDEQ Contract No. 6827
DMS ID No. 97082

Neuse River Basin
HUC 03020201

USACE Action ID No. SAW 2016-00880
DWR Project No. 2016-0369 v2
RFP #: 16-006477

PREPARED FOR:

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

November 5th, 2018

Ms. Katie Merritt
NCDEQ-DWR- 401 and Buffer Permitting Unit
512 N. Salisbury St.
Archdale Building – 9th Floor
Raleigh, NC 27604

Subject: Dry Creek Riparian Buffer Mitigation Plan DWR# 2016-0369 v2

Dear Katie:

We have reviewed the DWR's comments on the draft mitigation plan and draft construction documents for the Dry Creek Stream and Buffer Mitigation Site. We have made the necessary revisions to the report and draft plans and we are submitting revised versions of the documents along with this letter. Below are responses to each of the comments from the Department of Water Resources dated October 17, 2018. The original comments are provided below followed by our responses in bold italics.

Please contact me at 919-851-9986 x103 if you have any questions.

Thank you,

Jeff Keaton, PE
Project Manager

DWR staff (Katie Merritt) Comments:

- General comments
  - Since this is an Appendix to a larger Stream Mitigation plan, please make sure to include references to all applicable figures, maps, plan sheets, etc. from the Stream Mitigation Plan that include information that is pertinent for me to know to review this Buffer Plan. Just For example: (1) site constraints section should reference the map in the stream plan showing the power lines, which is very important thing to note in a buffer mitigation plan; and (2) parcel preparation includes more than just ripping the soil to plant, it also includes obtaining proper permits, draining ponds, draining impoundments, removal of any drain tiles (if applicable), fencing out cattle, and constructing stream channels. Since all of this must be completed prior to the planting, and your buffer credits are dependent on the stream channel being constructed, it's important to reference where those details are provided from the Stream Plan.

    We have addressed your concerns listed above. Specific locations of modifications are included below.
  - Site photos of riparian areas were not provided in the plan. Please provide site photos of current conditions and describe any changes in site conditions or land uses since the time of the stream determination and site viability assessment in April 2016.
    Site photos documenting the current site conditions are included in the Appendix to this report.
  - Please label the plan "Appendix 1" at top of the cover page since it is referenced that way in the stream mitigation plan.
    This has been added to the first page of the report.
  - The DWR project# for this site is 2016 -0369 v2. Currently, the plan doesn't specify "v2". Please correct. This is also the same comment I would make if reviewing the stream mitigation plan because the project numbers are the same for both.
    This has been corrected on the cover page of the report.
  - Figure 8- DWR requests a plot be placed within the footprint of the impoundment.
    Figure 8 has been updated to show a monitoring plot placed in the requested area.
  - Please define the service area for Buffer credits and Nutrient offset credits by providing a service area map for both mitigation types.

    A new figure has been added to the report, Figure 10, this figure details the areas applicable towards nutrient offsets.

Section 1.0: last sentence of 1st paragraph should include the units of measurement in both square feet and acres for the buffer credits.

We have updated the sentence to include the available credits in acres.

Section 2.0, Table 1: please revise the Objective for cattle exclusion to be in line with the expectations of 0295 (0)(6). It should be revised as follows: "Install fencing around project areas adjacent to cattle pastures"

Corrected in Table 1.

Section 2.1:

- Add a reference to photos that will be added

  We have added a photolog of the current site conditions in the appendix of the report and a reference to the current and recent historic characteristics of this site in paragraph two of

section 2.1

- The upper reach of Dry Creek near Hampton Rd was observed to be a "fescue lawn" as referenced in the viability letter. There should be a note here regarding that land use as being separate than the rest of the project area along Dry Creek.
  We have amended the land use history in paragraph four of section 2.1

- Last paragraph indicates how the site meets the rule for preservation. There is also an ephemeral channel {UT1a) being mitigated. Therefore, please indicate how this channel meets the rule (0295 (o)(7) for ephemerals.

  A new list has been added to the end of section 2.1 detailing the compliance to rule15A NCAC 02B .0295 (o)(7)

Section 2.2, Table 3

- UT1a is labeled as an Intermittent but a call was made in the field (as referenced in the viability letter), that this feature was an ephemeral channel. Please correct.
  Corrected

Section 2.6:

- References to powerlines along UTl were provided in the stream mitigation plan (section 5.7 & Figure 7). Please add a reference to those figures here since they are considered site constraints for buffer mitigation as well.

  A reference has been added in the second sentence of section 2.6
- The stream plan implied only one powerline will be relocated. When looking at Figure 7 from the stream plan, there is a second powerline that does not appear to be planned for relocation and is within the riparian buffer & crosses the stream. Please provide clarity on the situation with both powerlines.
  This has been clarified in the second sentence of section 2.6. The two powerlines will be combined and rerouted through the one easement break.
- Currently, the area along UT1 is proposed as Restoration. However, if a powerline and its associated easement is present within this area and isn't relocated, then that area is not viable for buffer credit (or nutrient offset).
  The over head power lines will be combined and pass through an easement break, so the area along UT1 will still qualify for buffer restoration

Section 5.0: Table 8a

- UT6 is a Non-subject stream and preservation is shown adjacent to UT6 in the corresponding figure. This should be represented in the table at 5:1.

  We have updated Table 8a. We are not claiming buffer or nutrient offset credits for UT6
- Please show "Enhancement" as "Enhancement via Cattle Exclusion".
  Corrected
- Please add a column for "Acres" to the right of the "Buffer Width" column and to the right of the "Riparian Buffer Credits (BMU)" column and show each acreage (to the hundredths). It's the acreage of buffer credits that are converted to pounds for nutrient offsets. Therefore, it is important that these acreages are used in Table 8b to calculate the pounds of N & P rather than the square feet.

  This table has been updated.
- changes are needed for DWR to confirm Ephemeral credits meet the rule
  We understand the concern and hopefully we have addressed this in table 8a.

- show the acreage of mitigation generated on the ephemeral channel, UT1a, as separate areas from the overall restoration acreage . It is recommended that a row be added to this table to accommodate for this

  A new row was added for UT1a, the subsequent credit changes were updated and included.
- Add a column to the right of the "Creditable Area" and title this column "Eligible Credit Area*". This is where to enter the maximum amount of credits allowed by the applicable rules referenced at the bottom of the table.
  We have added the suggested column and updated the values corresponding to this change.
- Add another"*" tothe bottom of the table referencing 0295 (o)(7)
  Completed
- If minimum buffer widths begin at 50' throughout this Phase, change the buffer width column from 30-100' to 50-100' to prevent confusion if possible. This will also help determine the nutrient offset viable areas (see comments below)

  All buffer and nutrient credit values are generated with a minimum 50-foot width. This is now noted at the bottom of the subject table.
- As provided in 0295 (g), the service area for buffer credits mitigated in the Upper Falls WS is the entire Falls WS (including the Lower Falls WS)
  A foot note was added to denote this rule.

Section 5.0: Table 8b

- This plan includes an asset table for nutrient offsets (8b). No asset map or figure is provided showing where the nutrient offsets can be generated. Please provide.

  A new figure has been generated to display the available nutrient offset zones, Figure 9.
- No clarification is provided in the plan indicating that the assets detailed in 5.0 are intended to be used as either buffer OR nutrient offset. This section inadvertently implies there is both nutrient and buffer credit being generated within the same footprint. Therefore, edits to the table, along with additional text and corresponding figures that represent this site's ability to use areas as buffer credit *or* nutrient offset credit should be provided to make that distinction clear.
  This has been clarified in the first sentence of section 5.0
- The viability letter indicates that some areas proposed as restoration and enhancement for buffer credit are not also viable to generating nutrient offsets. Please revise the asset table and supply corresponding map/figure to represent the areas viable for nutrient offsets.
  Table 8b has been updated and a new figure, Figure 9, has been included in this report.
- Nutrient Offsets credits can be generated only where there is a minimum width of 50' from top of banks. Please provide clarity that this minimum width requirement is met where nutrient offsets are proposed. Figure 7 shows two areas where it is difficult to determine whether the 50' minimum width is met. Specifically, the area along UT1 before its confluence with UT1a and the area along Dry Creek below the last crossing.
  The 50-foot minimum width is met where nutrient offsets are proposed, a footnote was added to clarify.
- Add a footnote to the bottom of the table that confirms all buffer width measurements are a minimum of 50' where being used for NOC.
  Recommended footnote was added
- Nutrient offsets are calculated based on the acres (not square feet) of riparian restoration. Therefore, please adjust the lbs. of Nitrogen & Phosphorus using acres and not square feet (using no more than the hundredths decimal place). Adding a column to represent this is highly

recommended.

Calculations were made using acres to the hundredths decimal place, subsequent column was included in table 8b.

- Add a row for "Total Nitrogen" and for "Total Phosphorus" in both pounds & acres.
  We have included these columns in table 8b.
- As provided in 0240 (b)(3) & detailed in 15A NCAC 02B .0282 (2)(c), the service area for nutrient offset credits generated in the Upper Falls WS is the Upper Falls WS only. This service area is more restrictive than 0295 for buffer mitigation and should be explained in this section to avoid any confusion.
  We have included a footnote at the bottom of table 8b to represent this ruling.

Section 6.1:

- The viability letter states that the area around the impoundment cannot be used to generate buffer mitigation credit in its current condition since it was determined to be a wetland onsite by the IRT. Unless a stream is restored through the pond bottom, buffer assets cannot be approved. Therefore, since Buffer assets are proposed within the relic pond bottom of the impoundment, please reference where the stream mitigation plan addresses the details regarding pond preparation - (breaching , dam removal, drained, draw-down time, etc.), permitting, stabilization efforts, etc. please mention that parcel preparation will include all things necessary to comply with the stream mitigation plan, including obtaining applicable permits, removing in- line ponds and impoundments, etc. It is requested that you reference figures in the stream mitigation plan that aren't found in this appendix where applicable .

  We have updated the first paragraph of section 6.1 to detail the work that will include the ponds and impoundment on the property.

Section 6.3: Add a figure or plan sheet showing where fencing will be constructed. Fencing is required in areas approved as Enhancement under (0)(6) of the Rule .0295.

Figures 6, 7 and 9 have been updated to include the area to be fenced for cattle exclusion.

Section 7.0:

- Section 5.1- 0295 (2)(E) indicates that the monitoring plan shall also include the *"health* and average stem densities" (emphasis added). Add clarity to this section to meet the rule expectation that vigor is an important parameter to note in the annual reports

  Section 7.1 has been updated to include that vigor is a parameter that will be monitored.
- Please commit to collecting vegetation data no earlier than the Fall of each year to follow the same policies as all our other buffer mitigation sites.
  We have included the commitment in section 8.2 under the monitoring plan.
- Performance standards sited in this section don't fully represent what it states in 0295 (n)(2)(b). Please add additional standards as provided in rule.
  Our phrasing has been updated to include that the vegetative composition will include a minimum of four native hardwood tree or shrub species and that no one species comprises more than 50 percent of stems.

Section 7.3: add the following to ensure compliance with 0295 (0)(6) which states having an "enhancement plan as set forth in 0295 (n)".

A visual assessment of the cattle exclusion and preservation areas within the conservation easement will also be performed each year to confirm:

Fencing is in good condition throughout the site; no cattle access within the conservation

easement area; no encroachment has occurred; diffuse flow is being maintained in the conservation easement area; and there has not been any cutting, clearing, filling, grading, or similar activities that would negatively affect the functioning of the buffer.

Any issues identified during the visual assessment of the cattle exclusion and preservation areas will be photographed and mapped as part of the annual monitoring report with remedial efforts proposed or documented.

Added, thanks.

Section 8.0 is titled "Monitoring Plan", but most of the monitoring components are mentioned in Section 7.0. I recommend reorganizing these two sections.

This section has been reorganized, the monitoring methods have been removed from section 7.0 "Performance Standards" and have been added to section 8.0.

Section 9.0: last paragraph- states that *"no livestock, fencing, or internal crossings are currently present or planned for the project area".* Please explain, as this statement conflicts with the project's existing and proposed conditions.

This has been clarified to include that no livestock, fencing, or internal crossings are currently present or planned for the project area by the land owner.

FINAL RIPARIAN BUFFER MITIGATION PLAN

DRY CREEK MITIGATION SITE
Durham County, NC
NCDEQ Contract No. 6827
DMS ID No. 97082

Neuse River Basin
HUC 03020201

PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
312 W Millbrook Road, Suite 225
Raleigh, NC 27609
Phone: (919) 851-9986

This Mitigation Plan has been written in conformance with the requirements of the following:

- 15A NCAC 02B .0295 Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers.
- 15A NCAC 02B. 0240, Nutrient Offset Payments Rule, amended effective September 1, 2010
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

These documents govern DMS operations and procedures for the delivery of compensatory mitigation.

Contributing Staff:

Jeff Keaton, PE, *Project Manager*
John Hutton, *Principal in Charge*
Jason Lorch, *Mitigation Plan Development*
Daniel Taylor, *Construction Administrator*
Carolyn Lanza, *Monitoring Lead*
Andrea Eckardt*, Lead Quality Assurance*

TABLE OF CONTENTS

TABLES

FIGURES

APPENDIX

1.0 Introduction

The Dry Creek Mitigation Site (Site) is a buffer restoration project in conjunction with a stream mitigation project. The Site is located in Durham County approximately three miles northwest of Butner, NC and approximately 2 miles west of the Granville County/Durham County line (Figures 1). The Site is comprised of approximately 29.8 acres along Dry Creek and eight additional unnamed tributaries. Currently, the Site is characterized by a mix of active pastures, fields, and woodlands. The project will restore, enhance, and preserve riparian buffer area within the project area, which will provide 457,993 buffer credits or 10.51 acres worth of buffer mitigation.

The Site is located within the Hydrologic Unit Code (HUC) 03020201010050 and North Carolina Department of Water Resources (NCDWR) Sub-basin 03-04-01. Dry Creek and the eight unnamed tributaries on the Site flow into the Lake Michie on Flat River, which flows directly into Falls Lake. Flat River is classified as water supply waters (WS-III) and nutrient sensitive waters (NSW). In the 2011 DWR Lake & Reservoir Assessments Report for the Neuse River Basin, Lake Michie was determined to be eutrophic. Eutrophic waters are rich in nutrients resulting in dense algal blooms that deplete dissolved oxygen concentrations when they decompose. Flat River below Lake Michie was rated in the 2012 North Carolina Integrated Report for 305(b) and 303(d) listings as impaired for aquatic life due to low dissolved oxygen concentrations.

The 2009 Neuse River Basinwide Water Quality Plan lists major stressors in Subbasin 03-04-01 to be total suspended solids (TSS), nutrients, and chlorophyll α. The 2010 Neuse River Basin Restoration Priorities (RBRP) highlights the importance of riparian buffers for stream restoration projects. Riparian buffers retain and remove nutrients and suspended sediments. Of the 123 miles of streams in the Neuse 01 CU, 23% do not have adequate riparian buffers. The RBRP states that "priority [restoration] projects should increase or improve buffers." Another goal of the RBRP for the Neuse 01 HU is to support the Falls Lake watershed plan. The Falls Lake water supply is downstream of the Site and is classified as water supply waters (WS-IV) and nutrient sensitive waters (NSW). The RBRP also states that a goal for the Neuse 01 CU is to, "…promote nutrient and sediment reduction in agricultural areas by restoring and preserving wetlands, streams, and riparian buffers."

This buffer restoration project will reduce sediment and nutrient loading, improve terrestrial and in stream habitats, and improve stream and bank stability. The area surrounding the streams proposed for restoration is a mixture of active pasture, fields, and woodlands. By removing cattle access to onsite tributaries to Lake Michie, restoring a forest to maintained buffer areas and protecting and preserving existing forested buffers; the project will reduce nutrient and sediment inputs to project streams, and ultimately to Lake Michie. The restored floodplain areas will filter sediment during rainfall events. The establishment of riparian buffers will create shading to minimize thermal pollution. Finally, invasive vegetation will


UT1

be treated within the project area as needed and the proposed native vegetation will provide cover and food for wildlife.

2.0 Mitigation Project Summary

The major goals of the proposed buffer restoration project are to provide ecological and water quality enhancements to the Falls Lake watershed of the Neuse River Basin by creating a functional riparian corridor and restoring the riparian buffer. Specific enhancements to water quality and ecological processes are outlined below in Table 1.

Table 1: Ecological and Water Quality Goals – *Dry Creek Mitigation Site*

Goal	Objective	CU-Wide and RBRP Objectives Supported
Decrease nutrient levels	Filtering runoff from the agricultural fields through restored native 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.	Reduce nutrient inputs to waters of the Falls Lake watershed.
Exclude cattle from project streams.	Install fencing around project areas adjacent to cattle pastures.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Contribute to protection of or improvement to a Water Supply Waterbody.
Decrease water temperature and increase dissolved oxygen concentrations	Establishment and maintenance of riparian buffers will create additional long-term shading of the channel flow to reduce thermal pollution.	Improve habitat to wildlife by providing additional habitat.
Restore and enhance native floodplain vegetation.	Plant native tree species in riparian zone where currently insufficient.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Provide a canopy to shade streams and reduce thermal loadings; Contribute to protection of or improvement to a Water Supply Waterbody.
Permanently protect the project Site from harmful uses.	Establish a conservation easement on the Site.	Protect aquatic habitat; protect water supply waters.

2.1 Existing Site Conditions

The proposed buffer restoration project will approximately put 29.8 acres of agricultural fields and woodlands along Dry Creek and several unnamed tributaries that drain into the Falls Lake watershed,

part of the Neuse River Basin (Table 2,) under a conservation easement. Out of the 29.8 acres, 16.1 acres will be proposed for a combination of riparian buffer restoration, enhancement, and preservation.

In general, this area has maintained its rural, farming character over the last 78 years with only minor changes in land cover (Appendix 1b. This consistency in land use within the project watershed indicates that watershed processes affecting hydrology, sediment supply, and nutrient and pollutant delivery have not varied widely over this time period. With a lack of developmental pressure, watershed processes and stressors from outside the project limits are likely to remain consistent throughout the implementation, monitoring, and closeout of this project.

The Site includes four perennial streams: Dry Creek, UT1, UT6, and UT7. It also includes four intermittent streams: UT2, UT3, UT4, UT5, and one ephemeral stream: UT1a. Please note that an additional jurisdictional stream, now called UT2, was added to the stream mitigation project after DWR's onsite assessment to determine buffer and nutrient offset mitigation suitability. However, no buffer or nutrient offset credit is proposed for UT2. To keep with a consistent naming convention, the tributaries downstream of the new UT2 were renamed. See Table 3, for the new naming system.

Dry Creek enters the project area from a culvert under Hampton Road. A narrow, sparse buffer exists on both stream banks and beyond the buffer on both sides is retired pasture, now a maintained fescue lawn. Approximately 600 linear feet (LF) downstream of the Hampton Road culvert, the stream is impounded by a manmade dam located just downstream of Dry Creek's confluence with UT1. This area was once wooded, but the riparian trees died due to root inundation. The manmade dam is frequently utilized as a vehicular stream crossing by the landowner. As part of the Dry Creek Stream Mitigation Project, the manmade dam will be removed.

The floodplain along Dry Creek – Reach 2 is forested with young trees, with larger, more mature trees interspersed along the stream banks. A portion of the right floodplain has been deforested. Pasture is present beyond the forested area. Cattle are grazed in these pastures and often wallow in Dry Creek and seek shade in the adjacent buffer.

Dry Creek – Reach 3 is completely forested within the buffer zone. The landowner indicated that tobacco was grown in the floodplain of Dry Creek Reach – 4 in the late 1800's and early 1900's. The reach in no longer in argicultural production and is now wooded.

UT1 and UT1a flows through an active cattle pasture and has a single row of mature Virginia pines (*Pinus virginiana*) or eastern red cedar (*Juniperus virginiana*) on each bank.

UT2 is a small stream that flows through a wooded area, with cattle access, on the Dry Creek floodplain and joins Dry Creek approximately 600 feet downstream of UT1.

UT3 originates outside the project limits at the outlet of a farm pond. It flows through an open pasture before entering the deciduous forest of Dry Creek's floodplain.

UT4 is contained entirely within the Dry Creek forested buffer and very little understory exists in the vicinity of this channel but has cattle through the reach. Groundcover along UT4 is limited to patches of Japanese stiltgrass (*Microstegium vimineum*) and moss species along the streambank.

Upstream of the culvert, UT5 has a sparse left buffer consisting of a very narrow strip of deciduous forest with pasture beyond. The right buffer of UT5 is similar in species composition to the deciduous forest described along Dry Creek but is much less mature. Downstream of the culvert, UT5 is entirely contained within the Dry Creek riparian buffer.

UT6 flows through a stable wetland/stream complex that parallels Dry Creek on its floodplain. Vegetation throughout UT6 and UT7 is similar in composition to the Dry Creek deciduous forest.

Table 2: Buffer Project Attributes – *Dry Creek Mitigation Site*

Project Name	Dry Creek Mitigation Site
Hydrologic Unit Code	03020201010050
River Basin	Neuse River
Geographic Location (Lat, Long)	36° 11' 07.92"N 78° 49' 39.00"W
Site Protection Instrument (DB, PG)	To be recorded
Total Credits (BMU)	420,733
Types of Credits	Riparian Buffer
Mitigation Plan Date	August 2018
Initial Planting Date	January 2020
Baseline Report Date	February 2020
MY1 Report Date	November 2020
MY2 Report Date	November 2021
MY3 Report Date	November 2022
MY4 Report Date	November 2023
MY5 Report Date	November 2024

In addition to buffer restoration on subject streams, per the Consolidated Buffer Mitigation Rules (15A NCAC 02B 0.0295 (o)), alternative mitigation is proposed 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:

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

- The buffer width is at least 30 feet from the stream (Figure 7).
- 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 area of buffer mitigation (Table 8).


Dry Creek

Buffer Restoration on Ephemeral Channels 15A NCAC 02B .0295 (o)(7):

- The ephemeral channel is directly connected to intermittent or perennial stream channels and will be protected under the same contiguous easement boundary (Figure 2).
- The area of the mitigation site on ephemeral channels does not compromise more than 25 percent of the total area of buffer mitigation.
- The mitigation area on the Site's ephemeral channels is located completely within its drainage area.
- The proposed area meets all applicable requirements of Paragraph (n) of (15A NCAC 02B .0295 (o)), for restoration or enhancement.

2.2 Watershed Characterization

The Site is approximately two miles northwest of the Town of Butner, NC and two miles west of the Granville County/Durham County line (Figure 1). The site is within the DMS targeted Neuse River Basin HUC 03020201010050 and NCDWR Subbasin 03-04-01. Topography, as indicated on the Rougemont, USGS 7.5-minute topographic quadrangles shows gently rolling, well rounded hills with long low ridges, as well as low slope floodplain areas along the unnamed tributaries (Figure 3).

Drainage areas for the streams and buffer areas were determined by delineating watersheds on the Rougemont USGS 7.5-minute topographic quadrangles. Figure 4 shows the watershed boundaries for each area. Each of the buffer watersheds is mix of active pastures, fields, and woodlands. The watershed and current land use are summarized in Table 3 below.

Table 3: Drainage Areas and Associated Land Use – *Dry Creek Mitigation Site*

Original Reach Name	Revised Reach Name	DWR Stream Designation	Buffer Area (Acres)	Watershed Area (acres)	Land Use
Dry Creek	Dry Creek	Perennial	11.76	807	50% forested; 40% managed herbaceous cover/pasture; 9% Residential Area; <1% Shrub; <1% Woody Wetland
UT1	UT1	Perennial	4.0	85	23% forested; 68% managed herbaceous cover/pasture; 9% Residential Area
UT1a	UT1a	Ephemeral	.14	22	2% forested; 83% managed herbaceous cover/pasture; 15% Residential Area
New Channel	UT2*	Intermittent	N/A	4	25% forested; 60% managed herbaceous cover/pasture; 15% Residential Area
UT3	UT3	Intermittent	.19	17	22% forested; 76% managed herbaceous cover/pasture; 2% Residential Area
UT4	UT4	Intermittent	N/A	33	69% forested; 24% managed herbaceous cover/pasture; 7% Residential Area
UT5	UT5	Intermittent	.01	40	33% forested; 61% managed herbaceous cover/pasture; 5% Residential Area; <1% Scrub; <1% Woody Wetland;
UT6	UT6	Perennial	N/A	17	45% forested; 44% managed herbaceous cover/pasture; 4% Residential Area; 7% Woody Wetland
UT7	UT7	Perennial	N/A	64	32% forested; 41% managed herbaceous cover/pasture; 14% Residential Area; 11% Scrub; 2% Woody Wetland
		Total:	**16.10**		

*UT2 was added to the stream mitigation project after DWR's onsite assessment to determine buffer and nutrient offset mitigation suitability.

2.3 Soils

Soil mapping units are based on the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Soil Survey for Durham County. Soils along the Dry Creek Buffer Mitigation project area are currently mapped as Cartecay and Chewacla, Georgeville silt loam, Helena sandy loam, Herndon silt loam, and Wehadkee silt loam. These soils are described below in Table 4 and shown in Figure 5.

Table 4: Project Soil Types and Descriptions – *Dry Creek Mitigation Site*

Soil Name	Description
Cartecay and Chewacla (0-2% slopes)	These soils are about 60 percent Cartecay soil and 30 percent Chewacla soil. These soils are poorly drained soils on floodplains. The surface layer of the series is very dark grayish-brown and brown silt loam about 10 inches thick. The subsoil is mottled brown about 50 inches thick.
Georgeville silt loam (2-15% slopes)	This series consists of gently sloping to strongly sloping, well-drained soil on uplands.. The surface layer is reddish-brown to brown silt loam about 6 inches thick. The subsoil is red, firm silty clay or silty clay loam. The subsoil is about 38 inches thick.
Helena sandy loam (2-30% slopes)	This series consists of well-drained soil on uplands. The surface layer is grayish-brown sandy loam about 8 inches thick. The underlain by a 4 inch layer of light yellowish-brown sandy loam. The subsoil is about 34 inches thick.
Herndon silt loam (2-10% slopes)	This series consists of gently sloping to sloping, well-drained soils on uplands. The surface layer is yellowish-silt loam about 8 inches thick. The subsoil is about 36 inches thick. The upper 4 inches is strong-brown, friable silty clay loam; the next 22 inches is yellowish-red, firm silty clay that is mottled at a depth of 19-28 inches; and the lower 10 inches is mottled red, friable silty clay loam.
Wehadkee silt loam (0-2% slopes)	This is a poorly drained soil on narrow flood plains and formed in fine loamy alluvium washed from soils on uplands. The surface layer is brown silt loam about 7 inches thick. The subsoil to a depth of about 46 inches is mottled light-gray, friable silty clay loam.

Source: *Durham County Soil Survey, USDA-NRCS, http://efotg.nrcs.usda.gov*

2.4 Geology

The Site is located in the Carolina Slate Belt of the Piedmont physiographic province. The Piedmont is characterized by gently rolling, well-rounded hills with long low ridges, with elevations ranging anywhere from 300 to 1500 feet above sea level. The Carolina Slate Belt consists of metamorphosed igneous and sedimentary rock including gneiss and schist that has been intruded by younger granitic rocks (NCGS, 2013). The underlying geology of the proposed Site is mapped as late Proterozoic to Cambrian (1 billion to 500 million years in age) felsic meta-volcanic rock (CZfv) and metamorphosed granitic rock (CZg) (NCGS, 1985). The felsic meta-volcanic rock is described as metamorphosed daeitic to rhyolitic flows and tuffs that are light gray to greenish gray in color that interbedded with intermediate metavolcanic rock. The metamorphosed granitic rock is characterized as a megacrytic, well-foliated unit that locally contains hornblende.

Sources:
http://www.geology.enr.state.nc.us/usgs/carolina.htm
http://www.geology.enr.state.nc.us/Mineral%20resources/mineralresources.html

2.5 Vegetation

Pasture grasses, such as fescue (*Festuca* spp.), dominate the pasture areas of the Dry Creek Site. The forested sections of Dry Creek's floodplain are primarily composed of deciduous species. Mature

hardwoods such as red maple (*Acer rubrum*), green ash *(Fraxinus pennsylvanica*), sweetgum (*Liquidambar styraciflua*), river birch (*Betula nigra*) and several species of oak trees, including northern red oak (*Quercus rubra*) and white oak (*Quercus alba*) are present. The understory is open and contains limited herbaceous vegetation. Minimal invasive vegetation was observed; however species present include Japanese honeysuckle (*Lonicera japonica)* and Chinese privet (*Ligustrum sinense*). Other observed species include green briar (*Smilax rotundifolia*), which is consistently dominant all along the right bank of Dry Creek, and patches of dense Japanese stiltgrass (*Microstegium vimineum*), located midway downstream on the right floodpalin. The left floodplain has a variety of ferns species including Christmas fern (*Polystichum acrostichoides*), senstive fern (*Oncoclea sensibilis*) and grape fern (*Botrychium dissectum*). The pond near the Dry Creek/UT1 confluence contains dense duckweed (*Lemna minor*).

2.6 Site Constraints and Access

The Site is accessible via a gravel driveway off Hall Road. Currently there are two overhead transmission lines within the site, these lines will be combined and rerouted through one easement break on UT1 (Stream Mitigation Plan Section 5.7 and Figure 7). In addition, there is one internal easement crossing for farm use and three external crossings for farm and residential driveway use. Breaks are not included in the credits calculated for the project. This site will extend beyond the required 50-foot minimum riparian buffer for streams in the Falls Lake Watershed, ranging between 100 and 200 feet on streams. There are no known airport facilities within five miles of the project area (Figure 1). There are no other known constraints on the proposed Site. A permanent access easement from Hall Road to the Site is recorded.

2.7 Current Site Resources

On April 6, 2016, Ms. Katie Merritt, with DWR, conducted on-site determinations to review features and land use within the project boundary. The resulting DWR site viability letter and map confirming the Site as suitable for riparian buffer mitigation has been enclosed in the Appendix . The on-site determination approval letter from NCDWR is also included in the Appendix.

2.8 Historic Site Resources

The Dry Creek Buffer Mitigation Site has historically been forested or used for agricultural purposes. Historic aerial photos are included in the Appendix and date back to 1940, showing the site in various stages of timber clearing, row crop production, and open pasture. In general, this area has maintained its rural, farming character over the last 78 years with only minor changes in land cover.

3.0 Site Protection Instrument

3.1 Site Protection Instruments Summary Information

The land required for buffer planting, management, and stewardship of the mitigation project includes portions of the parcels listed in Table 5. An option agreement for the project area has been signed by the property owner and a Memorandum of Option has been recorded at the Durham County Register of Deeds. The proposed conservation easement on this property has not yet been recorded.

Table 5: Site Protection Instrument – *Dry Creek Mitigation Site*

Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Number	Acreage to be Protected
Kenneth R. Mangum Nancy W. Mangum	0858-01-06-8472	Durham	Conservation Easement	DB: 7806 PG: 657-662	8.3

	0858-01-18-7320				
Van Buren Ellis	0858-01-18-1752 0858-01-08-5069	Durham	Conservation Easement	DB: 7799 PG: 477-482	11.1
Sandra D. Lowe David P. Lowe	0858-01-05-8447	Durham	Conservation Easement	DB: 7811 PG: 274-279	2.9
Paul S. Adcock Robert F. Adcock, Jr.	0858-01-05-0573 0858-03-05-1018	Durham	Conservation Easement	DB: 7811 PG: 268-273	2.9
James A. Clark Jr. Linda T. Clark	0858-03-04-3591	Durham	Conservation Easement	DB: 7811 PG: 280-285	.84
Kenneth M. Young	0848-03-94-9564	Durham	Conservation Easement	DB: 7811 PG: 263-267	1.5

All site protection instruments require 60-day advance notification to the Corps and the State prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

4.0 Regulatory Considerations

Table 6, below, is a summary of regulatory considerations for the Site. These considerations are expanded upon in Sections 4.1-4.3. A copy of the signed Categorical Exclusion Form for the project can be found in the Dry Creek Stream Mitigation Plan

Table 6: Project Attribute Table – *Dry Creek Mitigation Site*

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	(Appendix) Site Viability Letter
Water of the United States - Section 401	Yes	Yes	(Appendix) Site Viability Letter
Endangered Species Act	Yes	Yes	Dry Creek Stream Mitigation Plan Appendix (Categorical Exclusion)
Historic Preservation Act	Yes	Yes	Dry Creek Stream Mitigation Appendix (Categorical Exclusion)
Coastal Zone Management Act	No	No	N/A
FEMA Floodplain Compliance	No	No	N/A
Essential Fisheries Habitat	No	N/A	N/A

4.1 Threatened and Endangered Species

The NC Natural Heritage Program (NHP) database and the US Fish and Wildlife Service (USFWS) database were searched for federally listed threatened and endangered plant and animal species in Durham County, NC. Three federally listed species, the bald eagle (*Haliaeetus leucocephalus),* smooth coneflower (*Echinacea laevigata), and* Michaux's sumac *(Rhus michauxii*) are currently listed in Durham County. Table 7. list their federal status and habitat.

Table 7: Listed Threatened and Endangered Species in Durham County, NC – *Dry Creek Mitigation Site*

Species	Federal Status	Habitat
Vertebrate		
Bald eagle (*Haliaeetus leucocephalus*)	BGPA	Near large open water bodies: lakes, marshes, seacoasts, and rivers
Vascular Plant		
Smooth coneflower *(Echinacea laevigata)*	E	Glades, woodlands, cedar barrens and open areas over mafic rocks.
Michaux's sumac *(Rhus michauxii*)	E	Woodland edges, woodland, sandhills and sandy forest.

E = Endangered; BGPA=Bald & Golden Eagle Protection Act

The USFWS does not currently list any Critical Habitat Designations for any of the Federally listed species within Durham County. Wildlands requested review and comment from the United States Fish and Wildlife Service on April 15, 2016 in respect to the Dry Creek Mitigation Site and its potential impacts on threatened or endangered species. USFWS responded on May 5, 2016 and stated the "proposed action is not likely to adversely affect any federally listed endangered or threatened species, their formally designated critical habitat or species currently proposed for listing under the Act". All correspondence with USFWS is include in the approved Categorical Exclusion found in the Dry Creek Stream Mitigation Plan

As a result of a pedestrian survey conducted on October 12, 2015, no individual species, suitable habitat or critical habitat were found to exist on the site for the bald eagle, or the Michaux's sumac. There are areas of suitable habitat for the smooth coneflower in some areas of the project; however additional review was conducted June 1, 2016 during the time period when the flowering occurs, and it was confirmed that no individual species exist on the site. Wildlands determined that the project would have "no effect: on any of the three federally listed species.

4.2 Cultural Resources and Significant Natural Heritage Areas

The National Historic Preservation Act declares a national policy of historic preservation to protect, rehabilitate, restore, and reuse districts, sites, buildings, structures, and objects significant in American architecture, history, archaeology, and culture, and Section 106 mandates that federal agencies take into account the effect of an undertaking on a property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

There are no existing structures in the project area. The Site is not located near any sites listed on the National Register with the State Historic Preservation Office (SHPO). SHPO was contacted on April 15, 2016 and had no concerns or comments on the project site. The approved Categorical Exclusion for the project is located in the Dry Creek Stream Mitigation Plan.

4.3 FEMA Floodplain Compliance

The project streams are mapped as Other Flood Areas - Zone X on Durham County Flood Insurance Rate Map Panel 0848. The Zone X area on the Dry Creek site is not a designated Special Flood Hazard Area (SFHA). No hydraulic modeling is expected to be required for the proposed project.

4.4 Other Environmental Issues

An EDR Radius Map Report with Geocheck was ordered for the Site through Environmental Data Resources, Inc. on April 14, 2016. The target property and the adjacent properties are not listed in any of the Federal, State, or Tribal environmental databases searched by EDR. There were no known or potential hazardous waste sites identified within one mile of the Parcel.

5.0 Determination of Credits

Mitigation credits presented in Table 8a and 8b and Figures 6 and 9are projections based upon site design and are intended to be used as either riparian buffer credits or nutrient offset credits, dependent on the need. Upon completion of site construction, the project components and credits data will be revised to be consistent with the as-built condition.

Table 8a: Buffer Project Areas and Assets: Riparian Buffer Credits - *Dry Creek Mitigation Site*

Location	Jurisdictional Streams	Restoration Type	Feature Type	Reach ID / Component	Buffer Width (ft)	Creditable Area (ac)*	Creditable Area (sf)*	Eligible Credit Area (ac)**	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Riparian Buffer Credits (BMU)	Riparian Buffer Credits (ac)
Rural or Urban	Subject or Nonsubject	Restoration	Stream Type	Dry Creek, UT1, UT3, UT5	0-100	8.06	351150.00	8.06	1.00	1.00	1.00	351150.00	8.06
			Stream Type	Dry Creek, UT1, UT3, UT5	101-200	0.06	2655.00	0.06	1.00	0.33	6.06	438.07	0.01
			Ephemeral Channel	UT1a	0-100	0.13	5791.00	0.13	1.00	1.00	1.00	5791.00	0.13
			Ephemeral Channel	UT1a	101-201	0.00	0.00	0.00	1.00	0.33	6.06	0.00	0.00
Rural or Urban	Subject or Nonsubject	Enhancement via Cattle Exclusion	Stream Type	Dry Creek, UT3, UT4	0-100	3.83	167037.00	3.83	2.00	1.00	2.00	83518.50	1.92
				Dry Creek, UT3, UT4	101-200	0.00	0.00	0.00	2.00	0.33	6.06	0.00	0.00
Rural	Subject	Preservation	Stream Type	Dry Creek	0-100	3.57	155378.50	4.03	10.00	1.00	10.00	15537.85	0.36
Rural	Subject	Preservation		Dry Creek	101-200	0.22	9796.00	0.00	10.00	0.33	30.30	323.27	0.01
											Total:	**456,435.42**	10.48

* Preservation creditable area is over 25% of the total mitigation area, therefore the eligible creditable area has been reduced to 25% of the total creditable mitigation area. With that adjustment, the Site is in compliance with 15A NCAC 02B 0.0295(o)(5) which limits preservation mitigation area to no more than 25% of total mitigated area.

** Creditable area on ephemeral channels is <1% of the total eligible mitigation area and is therefore in compliance with 15A NCAC 02B 0.0295(o)(7) without any adjustments.

Table 8b: Buffer Project Areas and Assets: Nutrient Offset Credits - *Dry Creek Mitigation Site*

Location	Jurisdictional Streams	Restoration Type	Reach ID / Component	Buffer Width (ft)	Creditable Area (ac)*	Creditable Area (sf)*	Eligible Credit Area (ac)**	Convertible to Nutrient offset (Yes or No)	Nutrient Offset: N (lbs)	Nutrient Offset: P (lbs)
Rural or Urban	Subject or Nonsubject	Restoration	Dry Creek, UT1, UT3, UT5	0-100	6.39	278,158.00	6.39	Yes	14514.68	934.86
				101-200	0.01	624.00	0.01	Yes	32.56	2.10
			Dry Creek Fescue Lawn	0-100	1.68	72,992.00	1.68	No	0.00	0.00
				101-200	0.05	2,031.00	0.05	No	0.00	0.00
			UT1a	0-100	0.13	5,791.00	0.13	Yes	302.18	19.46
				101-200	0.00	-	0.00	Yes	0.00	0.00
Rural or Urban	Subject or Nonsubject	Enhancement via Cattle Exclusion	Dry Creek, UT3, UT4	0-100	3.83	167,037.00	3.83	No	0.00	0.00
				101-200	0.00	-	0.00	Yes	0.00	0.00
Rural	Subject	Preservation	Dry Creek	0-100	3.57	155,379.00	4.03	No	0.00	0.00
				101-200	0.22	9,796.00	4.03	No	0.00	0.00
								Total:	**14,849.42**	**956.42**

*The above creditable areas all meet the 50-foot minimum width for buffer or nutrient credit sales.

** Impacts that occur in the watershed of Falls Lake in the upper Neuse River Basin may be offset only by load reductions in the same watershed; 15A NCAC 02B .0282 (2) (Figure 10)

6.0 Mitigation Work Plan

The Wildlands Team proposes to restore high quality ecological function to Dry Creek and eight unnamed tributaries on the Site. The ecological uplift can be summarized as transforming agriculturally impacted areas to a protected forested riparian corridor. The project design will ensure that no adverse impacts to wetlands or existing riparian buffers occur. All riparian restoration activities will commence in concurrence with the stream mitigation activities and not before. Therefore, the mitigation area where riparian restoration is being performed may be altered slightly depending on the implementation of the Dry Creek Stream Mitigation Plan. Figure 7 illustrates the conceptual design for the Site. More detailed descriptions of the proposed restoration activity follow in Sections 6.1 through 6.3.

6.1 Parcel Preparation

Two in-line ponds will be removed as part of the stream restoration, one on UT1 Reach 2 and one on Dry Creek Reach 1 and two other off-line ponds near UT1 will also be removed (Mitigation Plan, Figure 7). There are no additional permits necessary outside of the 401/404 permits for the pond removals. Fill material will be needed to fill the incised, over-widened existing channel and ponds. This material will be obtained from construction of floodplain vernal pools, minor floodplain leveling in a few spots, and potentially other areas approved by landowners.

The restoration areas will be planted using hand labor with dibble bars or other acceptable forestry practices. While planting isn't anticipated to be needed in the buffer enhancement areas, except where required in the stream mitigation plan, a seed mix will be applied where cattle have caused bare soils and removed all vegetation. There will be no parcel preparation work done in the buffer preservation areas.

Several invasive species have been identified on site. During the construction for the Dry Creek Stream Mitigation Plan dense areas of invasive species will be removed.

6.2 Riparian Area Restoration Activities

The revegetation plan for the buffer restoration area will include permanent seeding, planting bare root trees, live stakes, and herbaceous plugs. These revegetation efforts will be coupled with controlling invasive species population. The specific species composition to be planted was selected based on the community type, observation of occurrence of species in riparian buffers adjacent to the Parcel, and best professional judgement on species establishment and anticipated site conditions in the early years following project implementation. Tree species planted across the buffer areas of the site will include a mixture of the following species: tulip poplar (*Liriodendron tulipifera*), cherrybark oak (*Quercus pagoda*), American sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), black willow (*Salix nigra*), eastern cottonwood (*Populus deltoids*), swamp chestnut oak (*Quercus michauxii)* and willow oak (*Quercus phellos*).

Trees will be 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 will be greater than 50% of the established stems. An appropriate seed mix will also be applied as necessary to provide temporary ground cover for soil stabilization and reduction of sediment loss during rain events in disturbed areas. This will be followed by an appropriate permanent seed mixture. Planting is scheduled to begin in January 2020.

Vegetation management and herbicide applications may be needed during tree establishment in the restoration areas to prevent establishment of invasive species that could compete with the planted native species.

6.3 Riparian Area Enhancement Activities

Cattle will be excluded using permanent fencing in the buffer enhancement areas (Figure 7) as followed by 15A NCAC 02B .0296(o). The enhancement area will be protected in perpetuity under a conservation easement.

6.4 Riparian Area Preservation Activities

There will be no parcel preparation work done in the buffer preservation areas, as allowed under 15A NCAC 02B .0295(o). The preservation area will be protected in perpetuity under a conservation easement.

7.0 Performance Standards

The performance criteria for the Site follows approved performance criteria presented in the guidance documents outlined in RFP 16-007242 and the Consolidated Buffer Rule (15A NCAC 02B .0295). Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. The buffer restoration project has been assigned specific performance criteria components for vegetation. Performance criteria will be evaluated throughout the five-year post-construction monitoring. An outline of the performance criteria components follows.

7.1 Vegetation

The final vegetative success criteria will be the health, survival, and density of at least 260 stems per acre at the end of the fifth year of monitoring, with a minimum of four native hardwood tree or shrub species composition and no one species comprises more than 50 percent of stems. Vigor, species composition, and density will all be assessed. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

7.2 Photo Reference Stations

Photographs will be taken within the project area once a year to visually document stability for five years following construction. Permanent markers will be established and located with GPS equipment so that the same locations and view directions on the Site are photographed each year.

7.3 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above. Visual assessments will 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 or encroachment). Areas of concern will be mapped and photographed accompanied by a written description in the annual report. Problem areas with be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

To ensure compliance with 0295 (0) (6): A visual assessment of the cattle exclusion and preservation areas within the conservation easement will also be performed each year to confirm:

- Fencing is in good condition throughout the site; no cattle access within the conservation easement area; no encroachment has occurred; diffuse flow is being maintained in the conservation easement area; and there has not been any cutting, clearing, filling, grading, or similar activities that would negatively affect the functioning of the buffer.

- Any issues identified during the visual assessment of the cattle exclusion and preservation areas will be photographed and mapped as part of the annual monitoring report with remedial efforts proposed or documented.

7.4 Reporting Performance Criteria

Using the DMS Riparian Buffer and Nutrient Offset Buffer Baseline and Annual Monitoring Report Template version 2.0 (May 2017), a baseline monitoring document and as-built record drawings of the project will be developed for the constructed Site. 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). The monitoring period will extend five years beyond completion of construction or until performance criteria have been met.

7.5 Maintenance and Contingency Plans

The Wildlands Team will develop necessary adaptive measures or implement appropriate remedial actions in the event that the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase will identify an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously, and will include a work schedule and updated monitoring criteria (if applicable).

8.0 Monitoring Plan

The Site monitoring plan has been developed to ensure that the required performance standards are met and project goals and objectives are achieved. The monitoring report shall provide project data chronology that will facilitate an understanding of project status and trends, ease population of DMS databases for analysis and research purposes and assist in close-out decision making.

8.1 Monitoring Components

Project monitoring components are listed in more detail in Table 9 and Figure 8.

8.2 Vegetation

Vegetation monitoring quadrants will be installed across the Site to measure the survival of the planted trees (Figure 8). The first annual monitoring activities will commence at the end of the first growing season, at least five months after planting has been completed, and will be reassessed annually no earlier than the Fall of each year. Species composition, density, and survival rates will be evaluated on an annual basis by plot and for the entire site. The number of monitoring quadrants required and frequency of monitoring will be based on the DMS monitoring guidance documents. Vegetation monitoring will follow the CVS-EEP Protocol for Recording Vegetation (2008) or another DMS approved protocol. Reference photographs of the vegetation plots and Site will be taken during the annual vegetation assessments.

8.3 Photo reference stations

Photographs will be taken within the project area once a year to visually document stability for five years following construction. Permanent markers will be established and located with GPS equipment so that the same locations and view directions on the Site are photographed each year.

8.4 Visual Assessment

Visual assessments will 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 or encroachment).

Table 9: Monitoring Components – *Dry Creek Mitigation Site*

Parameter	Monitoring Feature	Quantity	Frequency
Vegetation	CVS Level 2	7	Annual
Visual Assessment		Yes	Semi-Annual
Exotic and nuisance vegetation			Semi-Annual
Project Boundary			Semi-Annual

9.0 Long-Term Management Plan

The Site will be transferred to the North Carolina Department of Environmental Quality (NCDEQ) Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statue GS 113A-232(d)(3). Interest gained by the endowment fund may be used for stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

The Stewardship Program will periodically install signage as needed to identify boundary markings as needed (Table 10). No livestock, fencing, or internal crossing changes are currently present or planned by the land owner for the project area. Any future livestock or associated fencing or permanent crossings will be the responsibility the owner of the underlying fee to maintain.

Table 10: Long-term Management Plan – *Dry Creek Mitigation Site*

Long-Term Management Activity	Long-Term Manager Responsibility	Landowner Responsibility
Signage will be installed and maintained along the Site boundary to denote the area protected by the recorded conservation easement.	The long-term steward will be responsible for inspecting the Site boundary and for maintaining or replacing signage to ensure that the conservation easement area is clearly marked.	The landowner shall report damaged or missing signs to the long-term manager, as well as contact the long-term manager if a boundary needs to be marked, or clarification is needed regarding a boundary location. If land use changes in future and fencing is required to protect the easement, the landowner is responsible for installing appropriate approved fencing.

Long-Term Management Activity	Long-Term Manager Responsibility	Landowner Responsibility
The Site will be protected in its entirety and managed under the terms outlined in the recorded conservation easement.	The long-term manager will be responsible for conducting annual inspections and for undertaking actions that are reasonably calculated to swiftly correct the conditions constituting a breach. The USACE, and their authorized agents, shall have the right to enter and inspect the Site and to take actions necessary to verify compliance with the conservation easement.	The landowner shall contact the long-term manager if clarification is needed regarding the restrictions associated with the recorded conservation easement.

10.0 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Section 8. Project maintenance will be performed during the monitoring years to address minor issues as necessary. If, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the members of DMS/NCDWR and work with the DMS/NCDWR to develop contingency plans and remedial actions.

The Wildlands Team will develop necessary adaptive measures or implement appropriate remedial actions in the event that the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase will identify an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria (if applicable).

11.0 References

Natural Resources Conservation Service (NRCS). Web Soil Survey of Durham County. http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

North Carolina Division of Water Quality (NCDWQ), 2011. Surface Water Classifications. http://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications

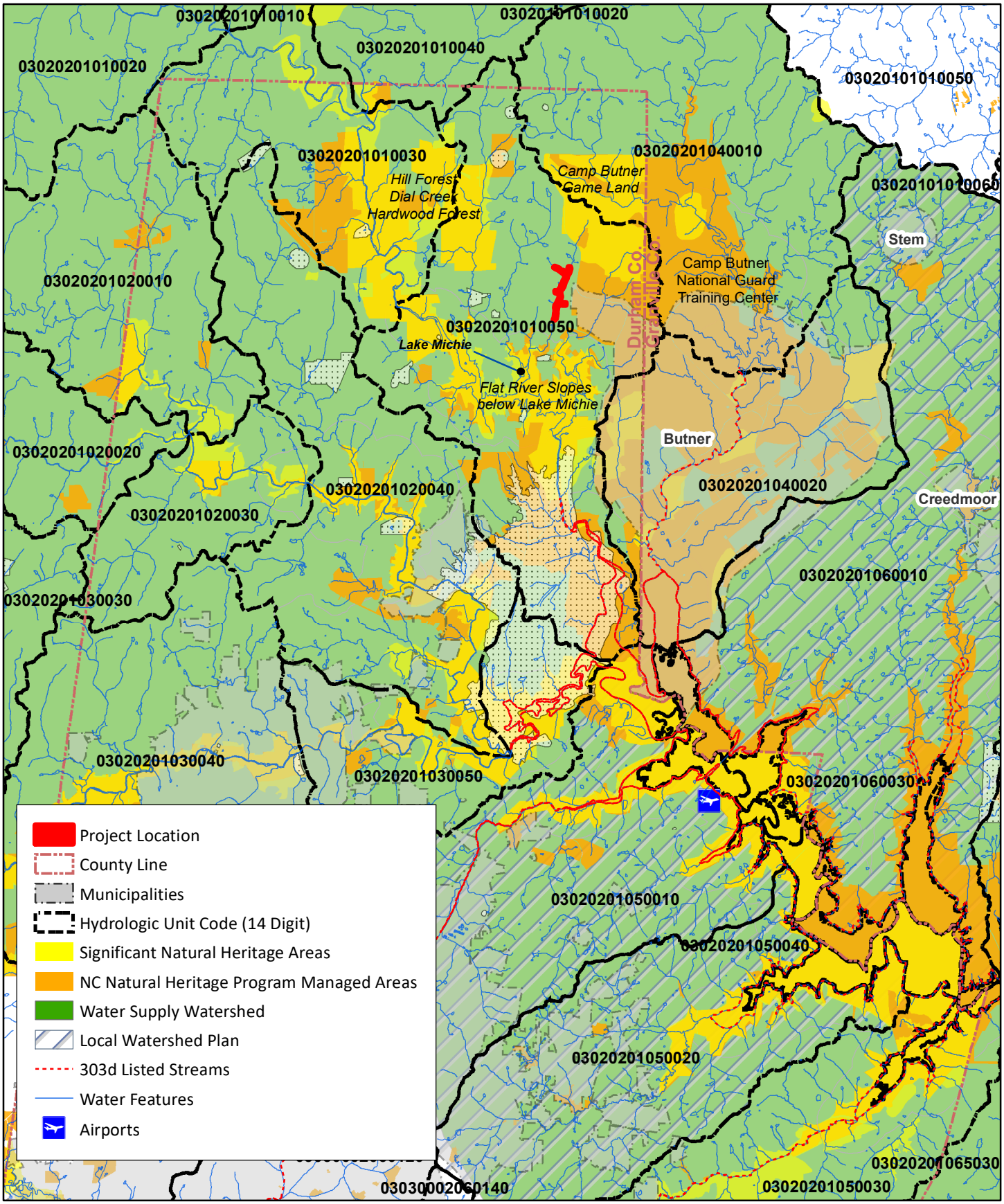
North Carolina Geological Survey (NCGS), 1985, Geologic Map of North Carolina: Raleigh, North Carolina Department of Natural Resources and Community Development, Geological Survey Section, scale 1:500,00, in color.

NCGS, 2013. Mineral Resources. http://deq.nc.gov/about/divisions/energy-mineral-land-resources/north-carolina-geological-survey/mineral-resources

North Carolina Natural Heritage Program (NHP), 2018. Natural Heritage Element Occurrence Database, Durham County, NC.

United States Fish and Wildlife Service (USFWS), 2018. Endangered Species, Threatened Species, Federal Species of Concern and Candidate Species, Durham County, NC. https://www.fws.gov/raleigh/species/cntylist/durham.html

Figures



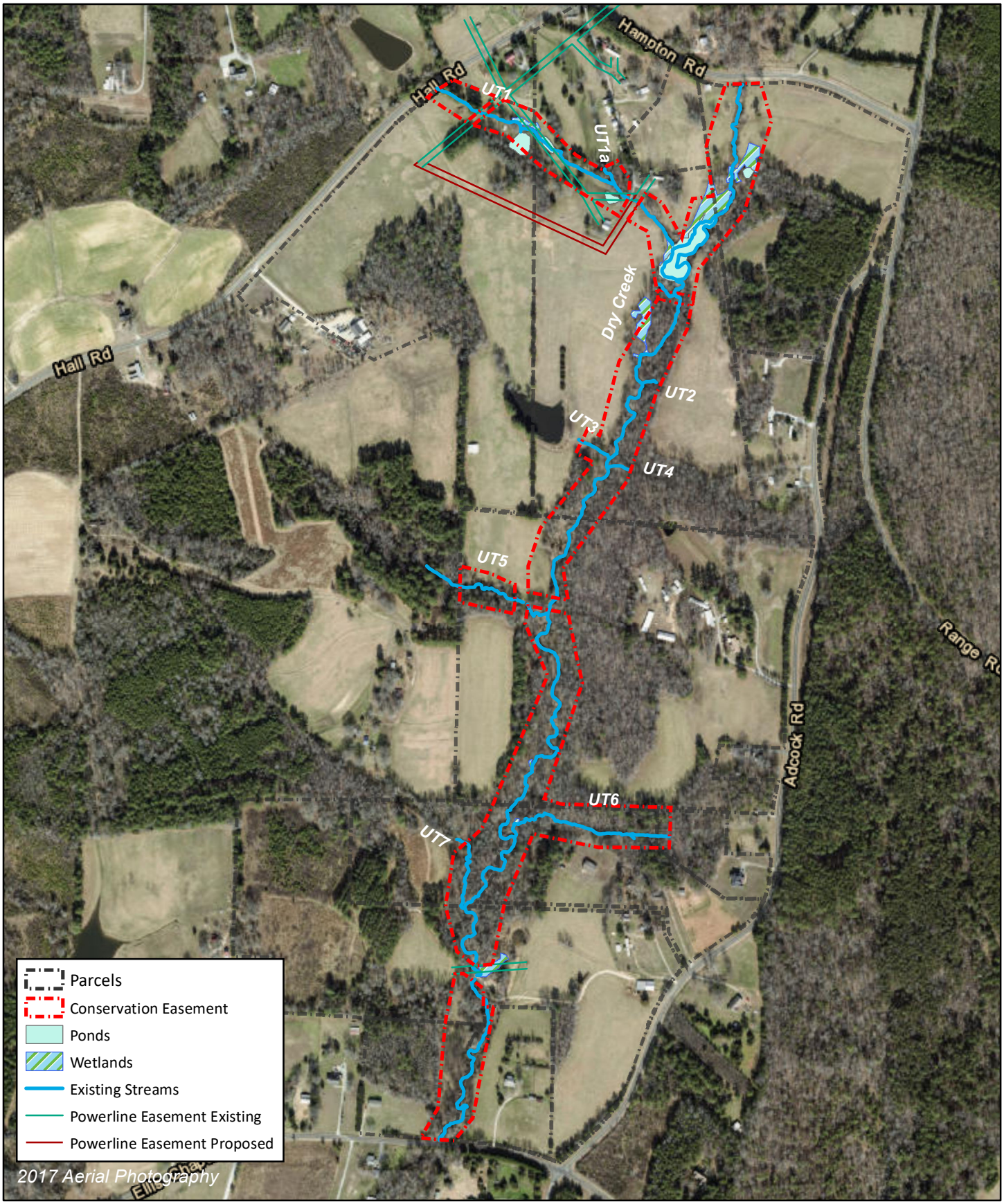
WILDLANDS ENGINEERING

0 2.5 Miles

N

Figure 1 Vicinity Map
Dry Creek Mitigation Site
Neuse River Basin 03020201

Durham County, NC



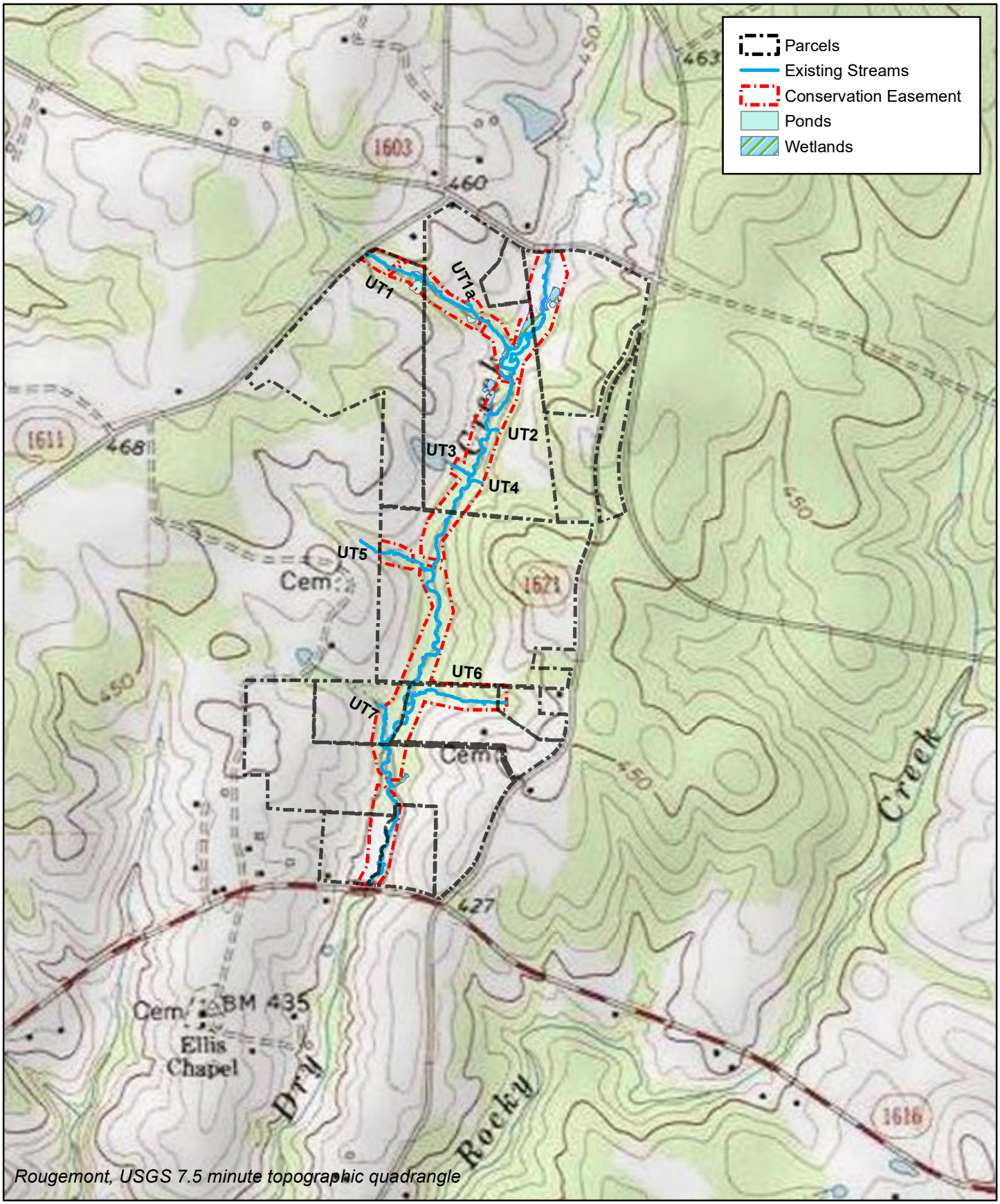
WILDLANDS ENGINEERING

0 600 Feet

N

Figure 2 Site Map
Dry Creek Mitigation Site
Nuese River Basin (03020201)

Durham County, NC



Rougemont, USGS 7.5 minute topographic quadrangle

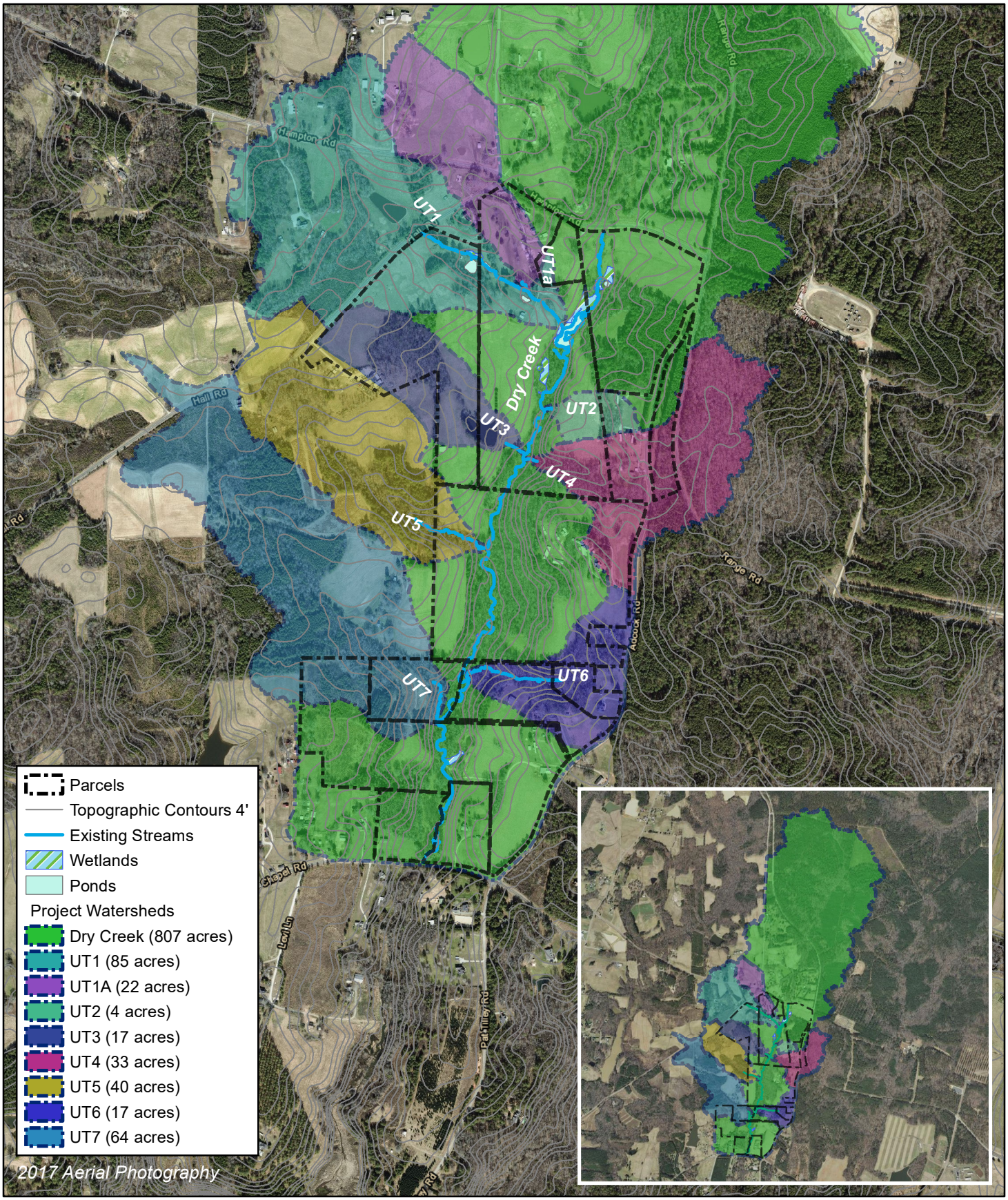
WILDLANDS ENGINEERING

0 1,000 Feet

N

Figure 3 Topographic Map
Dry Creek Mitigation Site
Neuse River Basin 03020201

Durham County, NC



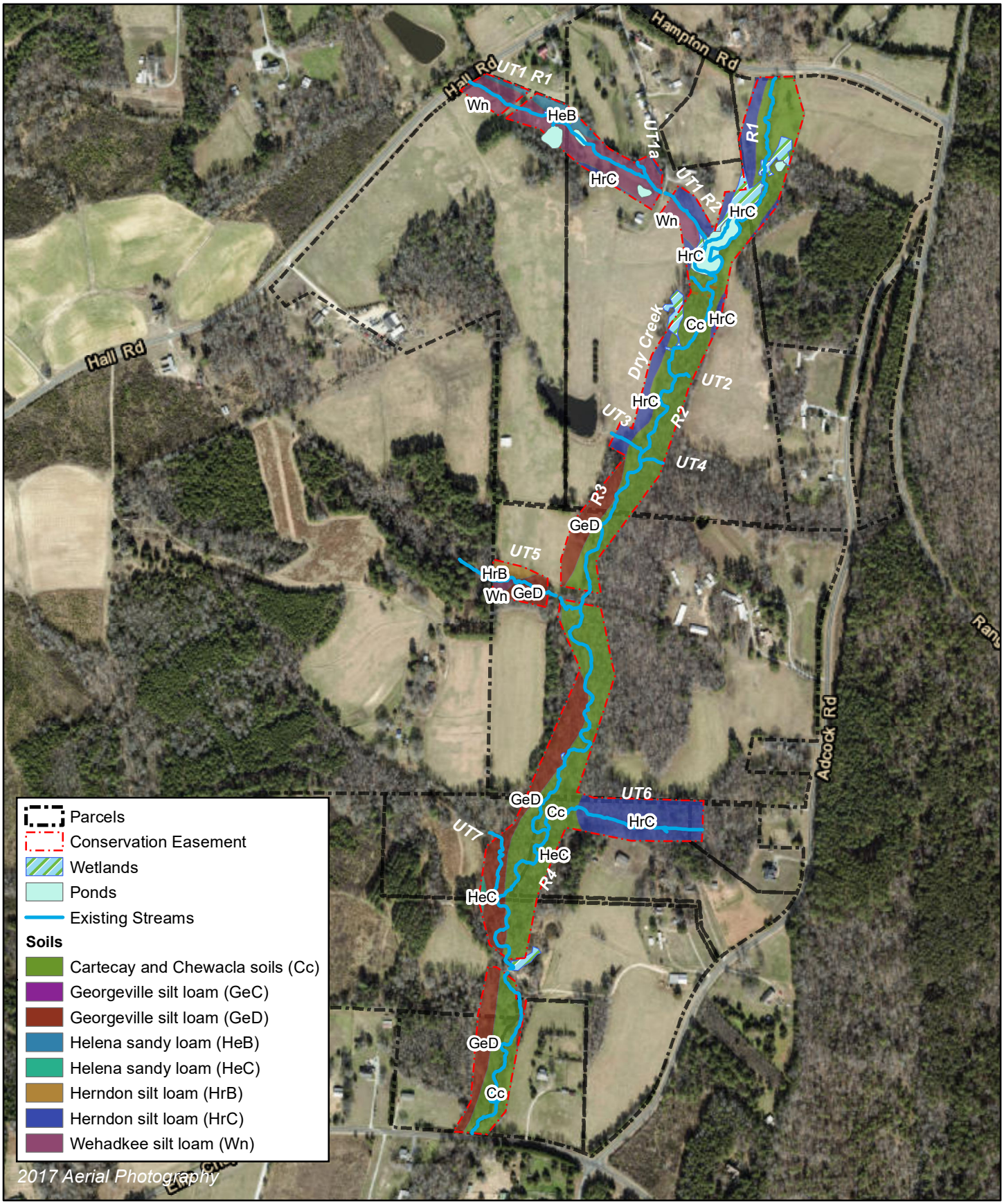
WILDLANDS ENGINEERING

0 1,000 Feet

N

Figure 4 Watershed Map
Dry Creek Mitigation Site
Neuse River Basin 03020201

Durham County, NC

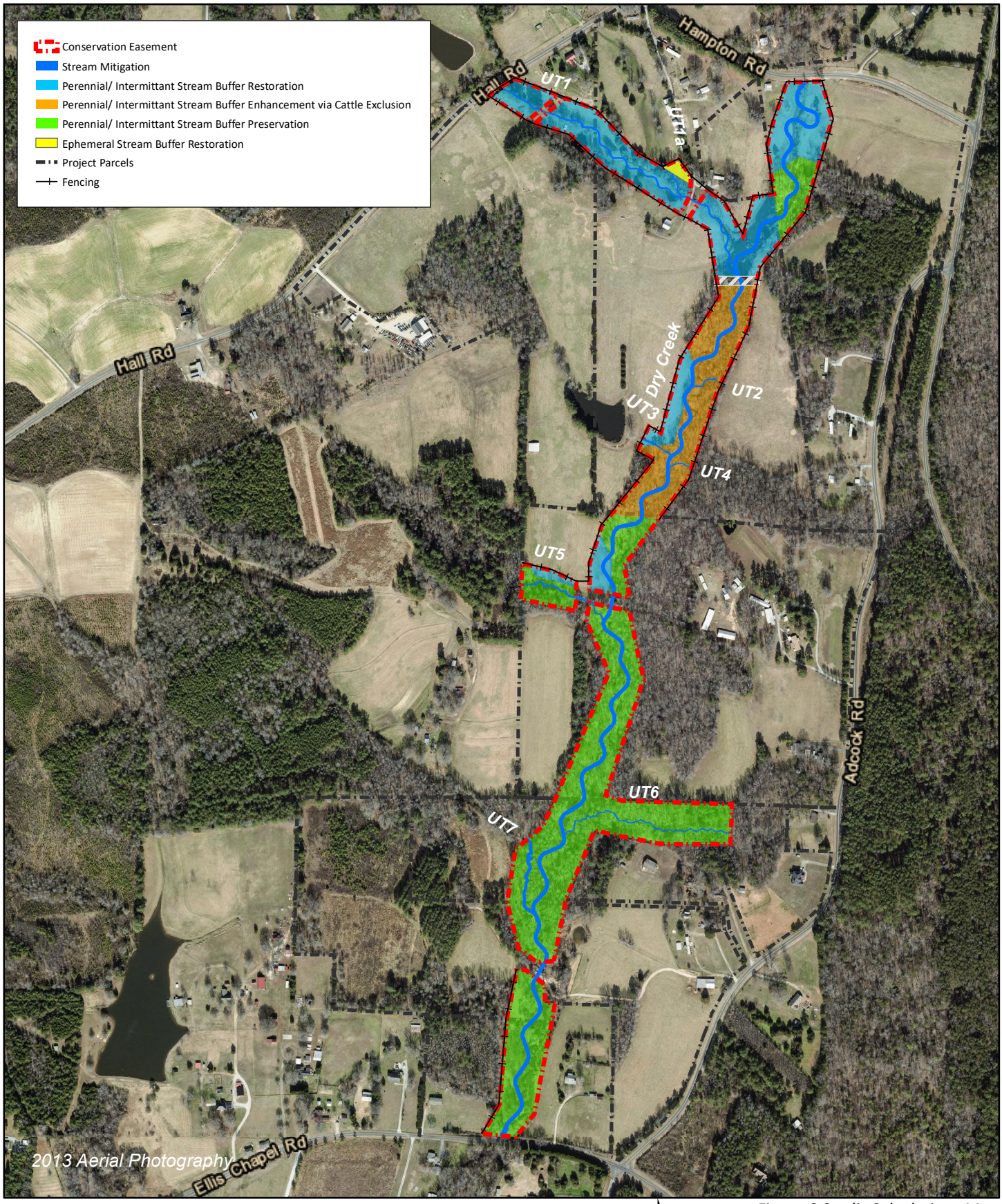


WILDLANDS ENGINEERING

0 600 Feet

Figure 5 Soils Map
Dry Creek Mitigation Site
Nuese River Basin (03020201)

Durham County, NC



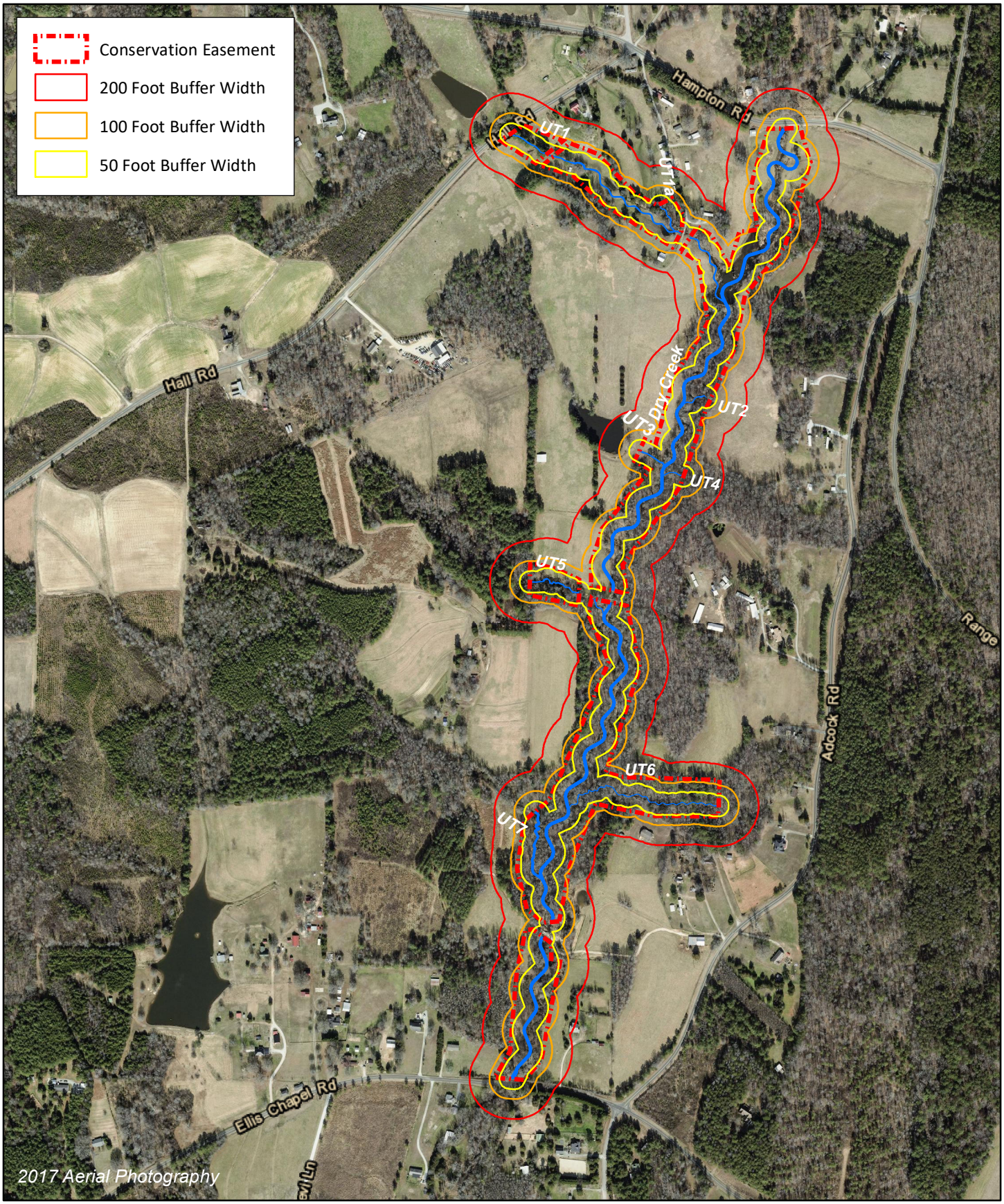
WILDLANDS ENGINEERING

0 600 Feet

N

Figure 6 Credit Calculations Map
Dry Creek Mitigation Site
Nuese River Basin 03020201

Durham County, NC



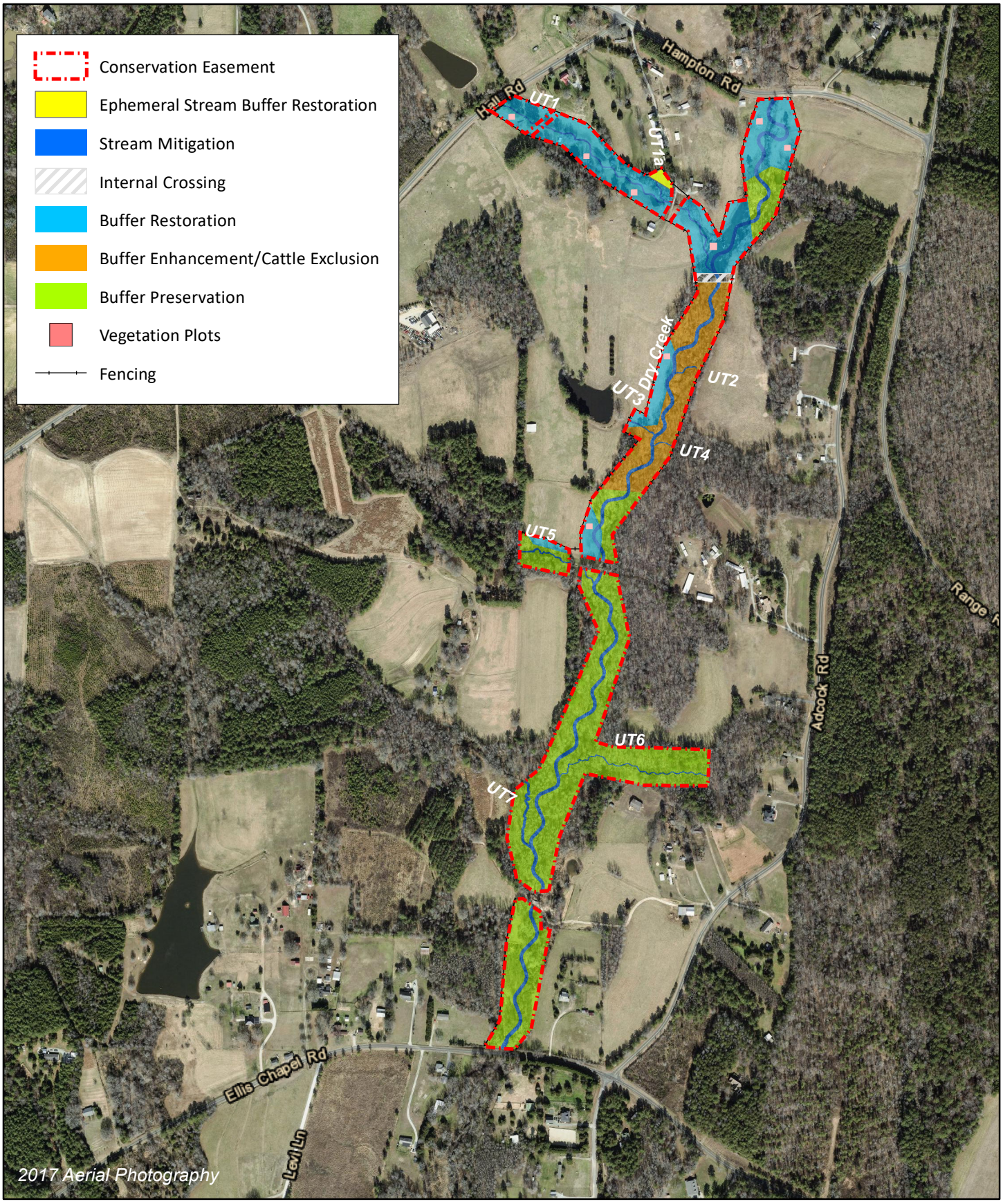
WILDLANDS ENGINEERING

0 600 Feet

N

Figure 7 Riparian Buffer Zones Map
Dry Creek Mitigation Site
Nuese River Basin 03020201

Durham County, NC



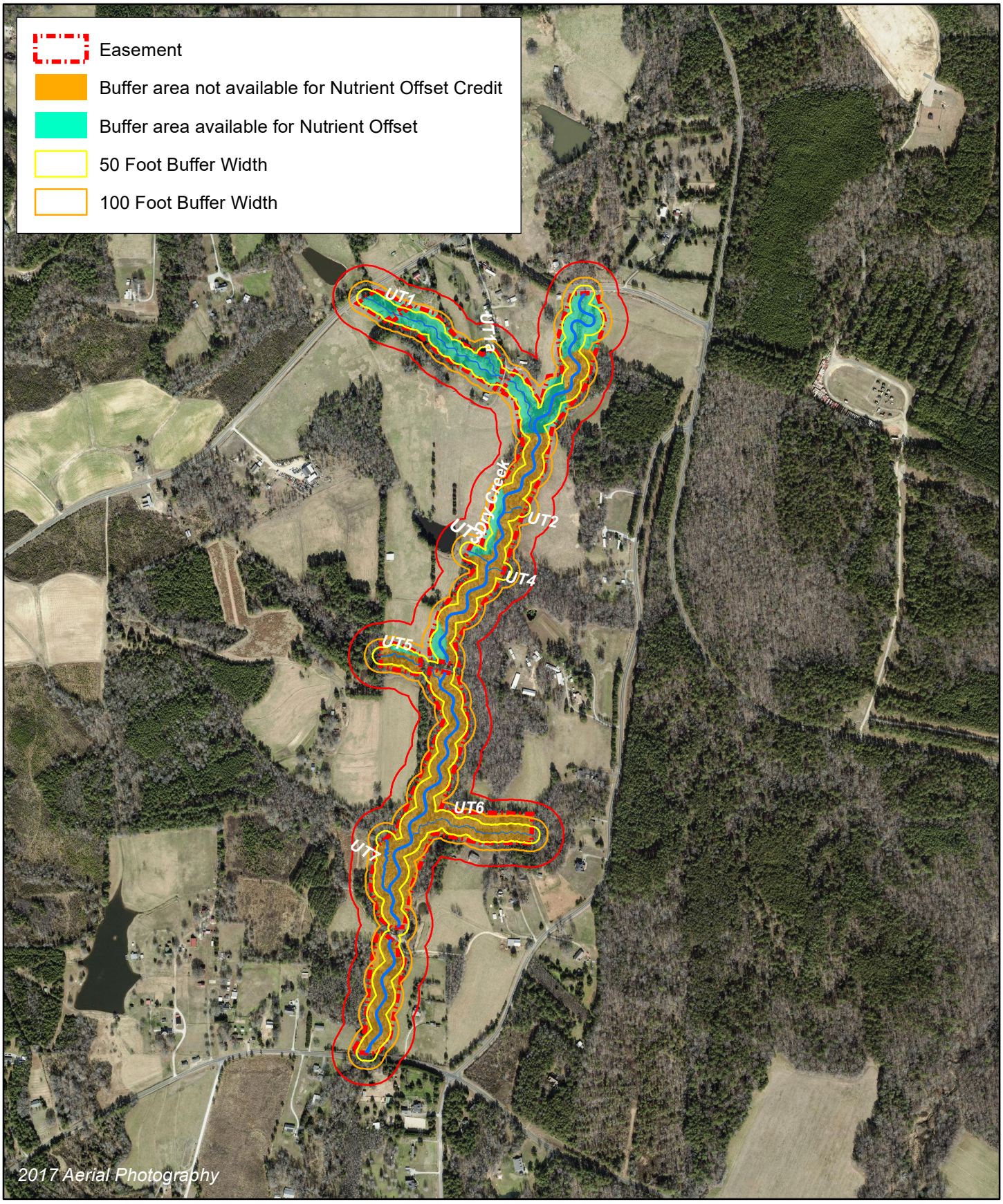
WILDLANDS ENGINEERING

0 600 Feet

N

Figure 8 Proposed Monitoring Map
Dry Creek Mitigation Site
Nuese River Basin 03020201

Durham County, NC



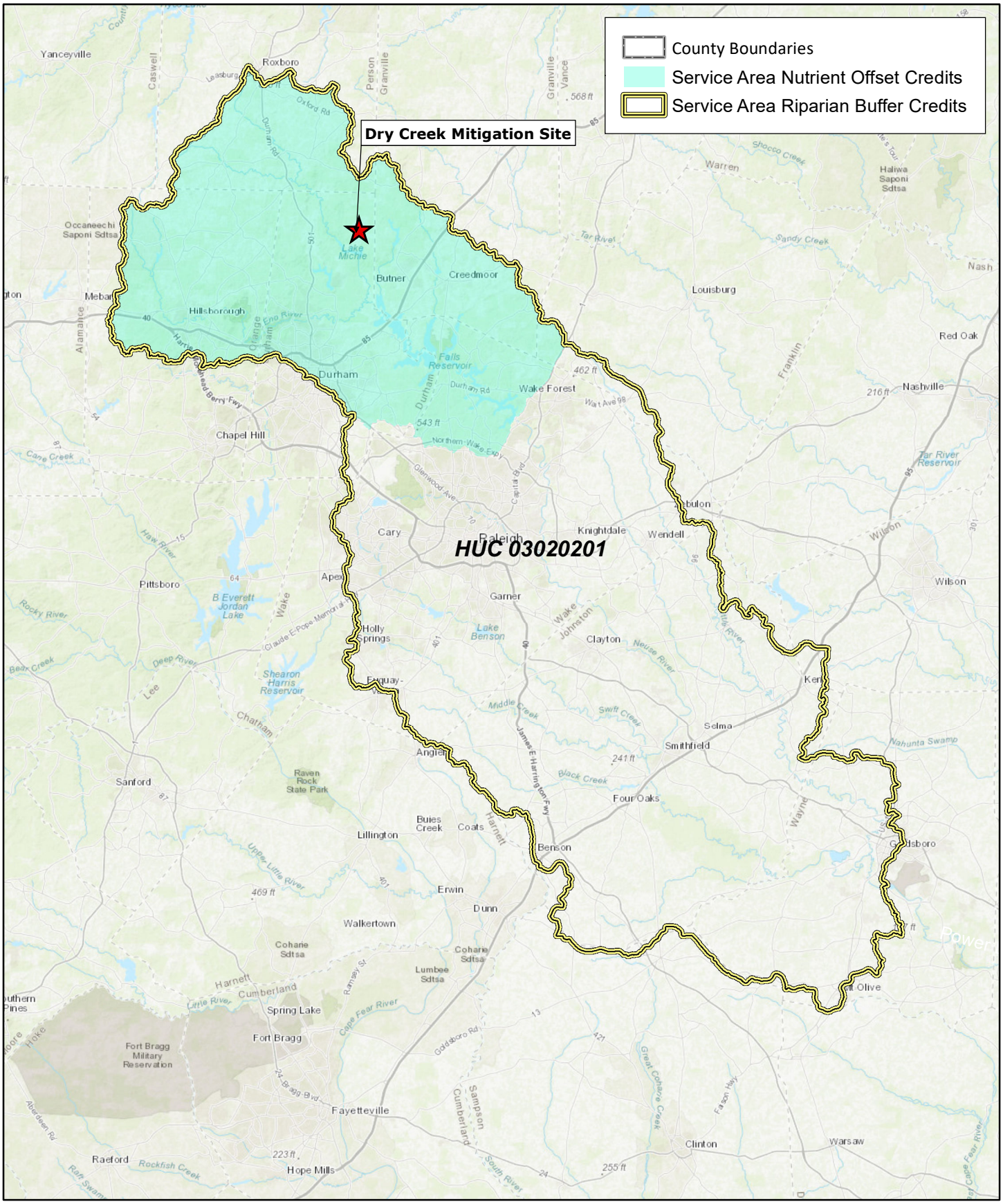
WILDLANDS ENGINEERING

0 600 Feet

N

Figure 9 Nutrient Offset Zones Map
Dry Creek Mitigation Site
Nuese River Basin 03020201

Durham County, NC



WILDLANDS ENGINEERING

Figure 10 Service Area Map
Dry Creek Mitigation Sitel

Neuse River Basin 03020201
Durham County, NC

Appendix 1a

Water Resources
ENVIRONMENTAL QUALITY

PAT MCCRORY
Governor
DONALD R. VAN DER VAART
Secretary
S. JAY ZIMMERMAN
Director

April 28, 2016

John Hutton
Wildlands Holdings II, LLC
312 West Millbrook Rd, Suite 225
Raleigh, NC 27609
(via electronic mail)

DWR Project #: 2016-0369

Re: Site Viability for Buffer Mitigation & Nutrient Offset – Dry Creek Mitigation Site
9507 Hampton Rd, Rougemont, NC
Durham County

Dear John,

On April 6, 2016, Katie Merritt, with the Division of Water Resources (DWR), assisted staff with Wildlands Engineering Inc. at the proposed Dry Creek Mitigation Site (Site) in Rougemont, NC. The Site is located in the Upper Falls Watershed of the Neuse River Basin within the 8-digit Hydrologic Unit Code 03020201. The Site is being proposed as part of a full-delivery stream restoration project for the Division of Mitigation Services (RFP #16-006477). The Interagency Review Team (IRT) was also present onsite. At your request, Ms. Merritt, performed a site assessment of features onsite to determine suitability for buffer and nutrient offset mitigation. Features are more accurately shown in the attached maps signed by Ms. Merritt on April 15, 2016. If approved, mitigating this site could provide stream mitigation credits, riparian buffer credits and/or nutrient offset credits.

Ms. Merritt's evaluation of the features from Top of Bank (TOB) out to 200' for buffer and nutrient offset mitigation pursuant to Rule 15A NCAC 02B .0295 (effective November 1, 2015) and Rule 15A NCAC 02B .0240 is provided in the table below:

Feature	Classification	[1]Subject to Buffer Rule	Adjacent Land uses	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273 lbs/acre	Mitigation Type
Dry Creek - (Hampton Rd to UT1 confluence)	stream	Yes	Managed fescue lawn; Native hardwood forest w/ canopy downstream	Yes	No	Forested areas = Preservation per 15A NCAC 02B .0295 (o)(5) Fescue Lawn = Restoration
In-line impoundment (to be drained)	Wetland (according to IRT onsite)	No	Pasture actively grazed by cattle	No	Yes	Restoration *(if impoundment is drained, a stream determination by DWR must be performed if proposing buffer credit)*

Dry Creek - Below Impoundment to Ellis/Mangum Property Boundary)	Stream	Yes	Pasture actively grazed by cattle and narrow closed canopy of native hardwoods	Yes	Yes *(outside of forested area only)*	Narrow closed canopy of hardwoods = Enhancement per 15A NCAC 02B .0295 (o)(6); Outside of forested areas = Restoration
Dry Creek - Ellis/Mangum property boundary to Ellis Chapel Rd	Stream	Yes	Native hardwood forest w/ closed canopy	Yes	No	Preservation per 15A NCAC 02B .0295 (o)(5)
UT3 & UT6	Streams	Yes	Native hardwood forest w/ closed canopy	Yes	No	Preservation per 15A NCAC 02B .0295 (o)(5)
UT1	Stream	Yes	Pasture actively grazed by cattle w/ narrow forest fringe of pines and sparse mature hardwoods	Yes	Yes	Restoration
UT1a	ephemeral channel	No	Pasture actively grazed by cattle	Yes	Yes	Restoration per 15A NCAC 02B .0295 (o)(7)
UT2 (upstream)	Stream	Yes	Pasture actively grazed by cattle	Yes	Yes	Restoration
UT2 (confluence w/ Dry Creek)	Stream	Yes	Pasture actively grazed by cattle w/ closed canopy of native hardwoods	Yes	No	Enhancement per 15A NCAC 02B .0295 (o)(6)
UT3	Stream	Yes	Pasture actively grazed by cattle w/ closed canopy of native hardwoods	Yes	No	Enhancement per 15A NCAC 02B .0295 (o)(6)
UT4	Stream	Yes	Left Bank= closed canopy of native hardwoods adjacent to active pasture Right Bank= closed canopy of native hardwoods	Yes	Yes *(left bank in pasture only)*	Forested Areas= Preservation per 15A NCAC 02B .0295 (o)(5) Pasture/field= Restoration
UT5	Stream	No	Native hardwood forest w/ closed canopy	Yes	No	Preservation per 15A NCAC 02B .0295 (o)(4)

[1]Subjectivity calls were determined 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]For nutrient offset viability to be determined, the landowner must provide proof in writing that the land is being used for agriculture or has been used for agriculture previously (prior to rule baseline). Dates, supported by photos or other written records, must be included to confirm that the uses of the open fields onsite are/were for hay crop cultivation/row crop/cattle.

Maps showing the project site and the features are provided and are signed by Ms. Merritt on April 15, 2016. This letter should be provided in all future mitigation plans for this Site. In addition, 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 credits. Where buffer and nutrient offset credits are viable in the same area, only one credit type is allowed to be generated for credit, not both.

For any areas depicted as not being viable for nutrient offset credit, one could propose a different measure other than riparian restoration/enhancement, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset according to 15A NCAC 02B .0240.

Please contact Katie Merritt at (919)-807-6371 if you have any questions regarding this correspondence.

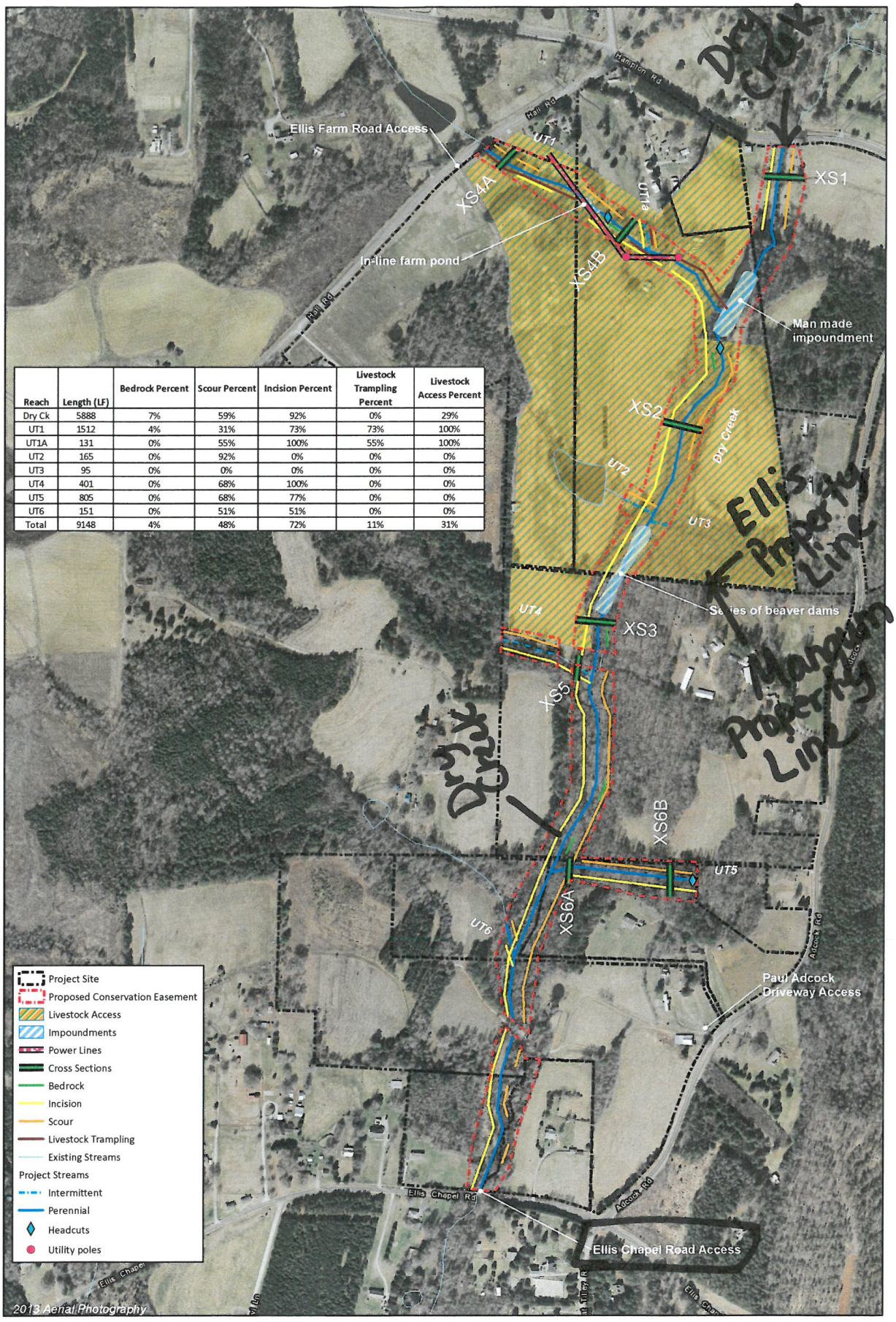
Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 and Buffer Permitting Branch

KAH/*km*
Attachments: Site Aerial Map, Topographic Map, Durham County Soil Survey

cc:File Copy (Katie Merritt)
DMS – Jeff Schaffer (via electronic mail)



Reach	Length (LF)	Bedrock Percent	Scour Percent	Incision Percent	Livestock Trampling Percent	Livestock Access Percent
Dry Ck	5888	7%	59%	92%	0%	29%
UT1	1512	4%	31%	73%	73%	100%
UT1A	131	0%	55%	100%	55%	100%
UT2	165	0%	92%	0%	0%	0%
UT3	95	0%	0%	0%	0%	0%
UT4	401	0%	68%	100%	0%	0%
UT5	805	0%	68%	77%	0%	0%
UT6	151	0%	51%	51%	0%	0%
Total	9148	4%	48%	72%	11%	31%

WILDLANDS ENGINEERING

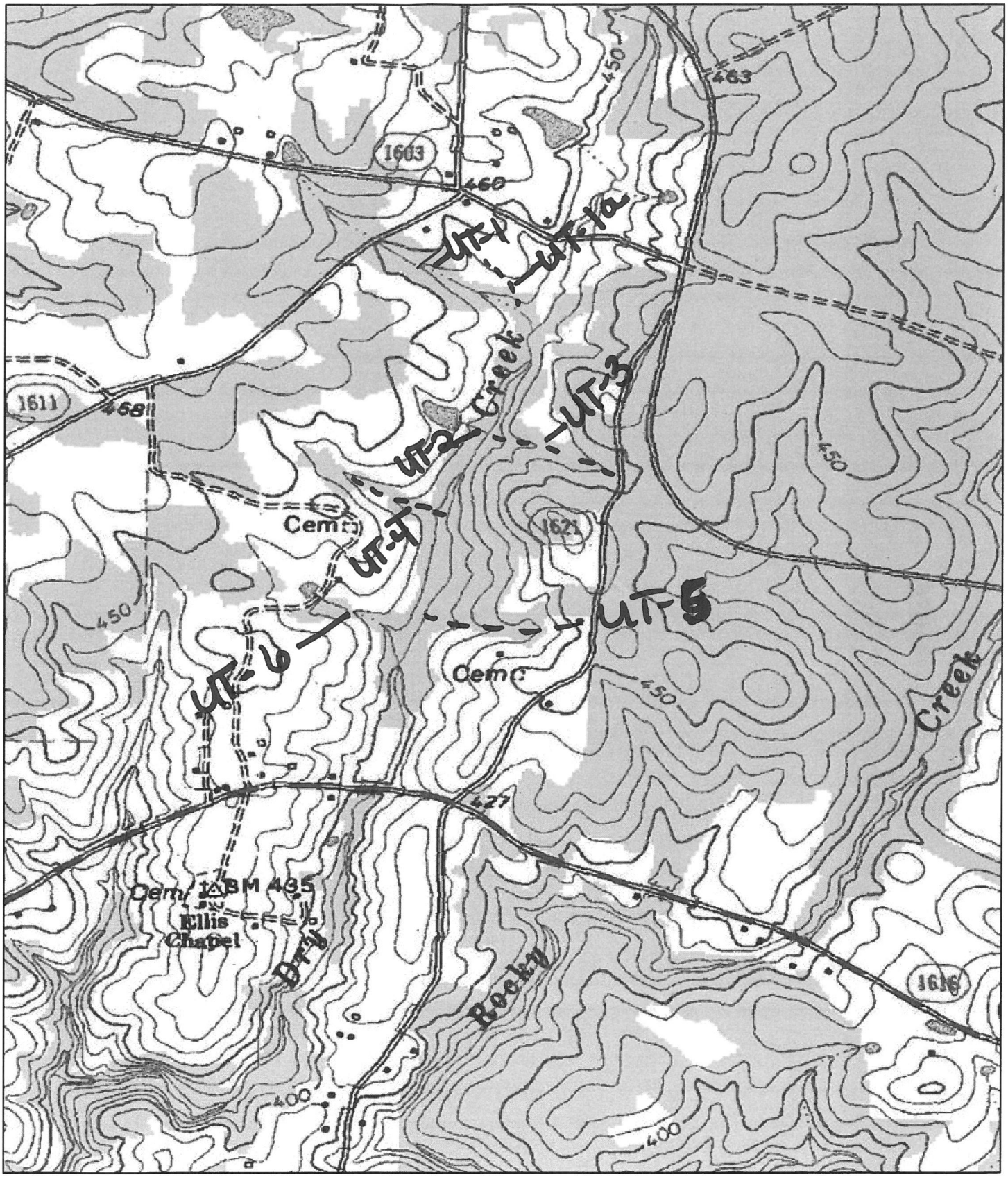
0 400 Feet

Figure 2 Site Map and Channel Stability Map
Dry Creek Mitigation Site
New River Basin 03020201
Durham County, NC

kym 2/15/16
DWR# 2016-0369

Name
4/15/19
Duke#
2016-0309
"Dry Creek Site"

NC USGS Topo & Parcels Map



April 15, 2016

1:14,048

0 0.1 0.2 0.4 mi

0 0.175 0.35 0.7 km

4/15/16

DWR # 2016-0369

"Dry Creek Site"

Participating NC Counties, NCCGIA, NC OneMap, US EPA

Appendix 1b

Appendix 2

Site Protection Instrument

The land required for construction, management, and stewardship of this mitigation project includes portions of the parcels listed in Table 1. This area totals 29.8 acres. The deed book and page number listed are for the agreements on an option to purchase a conservation easement. A conservation easement will be recorded on the parcels and includes streams being restored along with their corresponding riparian buffers.

Table 1: Site Protection Instrument

Property Owner	Parcel ID Number	County	Site Protection Instrument	Memorandum of Option Deed Book (DB) and Page Number (PG)
Kenneth R. Mangum Nancy W. Mangum	0858-01-06-8472 0858-01-18-7320	Durham	CE	DB: 7806 PG: 657-662
Van Buren Ellis	0858-01-18-1752 0858-01-08-5069	Durham	CE	DB: 7799 PG: 477-482
Sandra D. Lowe David P. Lowe	0858-01-05-8447	Durham	CE	DB: 7811 PG: 274-279
Paul S. Adcock Robert F. Adcock, Jr.	0858-01-05-0573 0858-03-05-1018	Durham	CE	DB: 7811 PG: 268-273
James A. Clark Jr. Linda T. Clark	0858-03-04-3591	Durham	CE	DB: 7811 PG: 280-285
Kenneth M. Young	0848-03-94-9564	Durham	CE	DB: 7811 PG: 263-267

All site protection instruments require 60-day advance notification to the USACE and or DMS prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

Appendix 3

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland A - DP1

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.192066 Long: W -78.829045 Datum:

Soil Map Unit Name: Helena Sandy Loam (HeB) NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No ✓ (If no, explain in Remarks.)

Are Vegetation ✓, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No ✓

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.
Vegetation significantly disturbed due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No _____ Depth (inches): 0 - 12+

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Wetland A - DP1

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Acer rubrum	5	Yes	FAC
2. Nyssa sylvatica	5	Yes	FAC
3. Carpinus caroliniana	2	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	12 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	30	Yes	FAC
2. Festuca paradoxa	20	Yes	FAC
3. Persicaria longiseta	15	Yes	FAC
4. Carex bullata	10	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	75 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wetland A - DP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/1	90	10YR 4/6	10	C	PL	Silt Loam	
3-10	10YR 5/1	98	10YR 4/6	2	C	PL	Silt Loam	
10-12	10YR 6/1	98	10YR 6/8	2	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP2

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): hillside slope Slope (%): 1

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.192150 Long: W -78.829127 Datum:

Soil Map Unit Name: Helena Sandy Loam (HeB) NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.
Vegetation significantly disturbed due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Upland - DP2

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Festuca paradoxa	98	Yes	FAC
2. Physalis pubescens	2	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Upland - DP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 5/3	98	10YR 5/6	2	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland B - DP3

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.190967 Long: W -78.826288 Datum:

Soil Map Unit Name: Herndon Silt Loam (Hrc) NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.
Vegetation significantly disturbed due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): 0 - 12+

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: Wetland B - DP3

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	10 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Persicaria longiseta	30	Yes	FAC
2. Leersia oryzoides	30	Yes	OBL
3. Microstegium vimineum	10	No	FAC
4. Juncus effusus	5	No	FACW
5. Caltha palustris	5	No	OBL
6. Dichanthelium clandestinum	2	No	FAC
7. Amaranthus spinosus	2	No	FACU
8.			
9.			
10.			
11.			
12.			
	84 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wetland B - DP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 5/2	98	10YR 4/6	2	C	PL	Silt Loam	
2-12	10YR 5/1	90	10YR 5/8	10	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP4

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): <1

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.191322 Long: W -78.825956 Datum:

Soil Map Unit Name: Herndon Silt Loam (HrC) NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Upland - DP4

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	40	Yes	FAC
2. Acer rubrum	15	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	55	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Acer rubrum	10	Yes	FAC
2. Juniperus virginiana	5	Yes	FACU
3. Pinus taeda	3	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	18	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	45	Yes	FAC
2. Solidago altissima	3	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	48	= Total Cover	
Woody Vine Stratum (Plot size: 30')			
1. Lonicera japonica	10	Yes	FACU
2. Toxicodendron radicans	10	Yes	FAC
3. Smilax rotundifolia	5	Yes	FAC
4.			
5.			
6.			
	25	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Upland - DP4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/3						Loam	
4-8	2.5Y 6/3	99	10YR 5/6	1	C	PL	Loam	
8-12	2.5Y 5/3	95	10YR 5/6	5	C	PL	Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland C - DP5

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.191357 Long: W -78.825846 Datum:

Soil Map Unit Name: Cartecay and Chewalca (Cc) NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0 - 12+

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Wetland C - DP5

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Leersia oryzoides	95	Yes	OBL
2. Alternanthera philoxeroides	2	No	OBL
3. Persicaria longiseta	2	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	99 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wetland C - DP5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 5/2	98	10YR 3/4	2	C	PL	Silt Loam	
2-6	10YR 6/2	95	10YR 5/6	5	C	PL	Silt Loam	
6-12	10YR 6/2	98	10YR 4/6	2	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland D - DP6

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.191695 Long: W --78.825527 Datum:

Soil Map Unit Name: Cartecay Chewalca (Cc) NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.
Vegetation significantly disturbed due to mowing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0 - 12+

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Wetland D - DP6

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Carex bullata	45	Yes	OBL
2. Juncus effusus	10	No	FACW
3. Saururus cernuus	5	No	OBL
4. Vernonia noveboracensis	2	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	62 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wetland D - DP6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 5/1	90	10YR 5/8	10	C	PL	Clay Loam	
4-12	10YR 5/1	98	10YR 5/6	2	C	PL	Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland E - DP7

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.189758 Long: W -78.827192 Datum:

Soil Map Unit Name: Herndon Silt Loam (HrC) and Carteca & Chewalca (Cc) NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.
Vegetation significantly disturbed due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): 0 - 12+

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Wetland E - DP7

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	40	Yes	FAC
2. Platanus occidentalis	10	No	FACW
3. Liquidambar styraciflua	10	No	FAC
4. Quercus phellos	5	No	FAC
5.			
6.			
7.			
8.			
	65	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Nyssa sylvatica	5	Yes	FAC
2. Platanus occidentalis	2	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	7	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	60	Yes	FAC
2. Boehmeria cylindrica	5	No	FACW
3. Leersia oryzoides	2	No	OBL
4. Persicaria longiseta	2	No	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	69	= Total Cover	
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wetland E - DP7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 5/2	98	10YR 5/4	2	C	PL	Silt Loam	
2-12	10YR 5/1	95	10YR 5/6	5	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP8

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): <1

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.189531 Long: W -78.826992 Datum:

Soil Map Unit Name: Cartecay & Chewalca (Cc) NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.
Under story vegetation significantly disturbed due to livestock.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Upland - DP8

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	40	Yes	FACW
2. Acer rubrum	30	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Acer rubrum	5	Yes	FAC
2. Juniperus virginiana	2	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	7	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	50	Yes	FAC
2. Persicaria longiseta	1	No	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	51	= Total Cover	
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Upland - DP8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	2.5Y 6/3						Loam	
2-12	2.5Y 7/4						Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland F - DP9

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.189160 Long: W -78.827272 Datum:

Soil Map Unit Name: Carteca & Chewalca (Cc) NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.
Vegetation significantly disturbed due to livestock.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): 6 - 12+

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Wetland F - DP9

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Carpinus caroliniana	2	No	FAC
2. Liquidambar styraciflua	1	No	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	3 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	60	Yes	FAC
2. Persicaria longiseta	10	No	FAC
3. Boehmeria cylindrica	2	No	FACW
4. Lobelia cardinalis	1	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	73 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wetland F - DP9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 5/2	80	10YR 4/4	20	C	PL	Silt Loam	
4-12	10YR 5/1	95	10YR 5/6	5	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland G - DP10

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.184133 Long: W -78.828913 Datum:

Soil Map Unit Name: Georgeville Silt Loam (GeD) NWI classification: PF01A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): 0 - 12+

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Wetland G - DP10

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	5	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	5 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Acer rubrum	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	70	Yes	FAC
2. Leersia oryzoides	10	No	OBL
3. Boehmeria cylindrica	2	No	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	82 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wetland G - DP10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 5/2	98	10YR 5/6	2	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/18/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP11

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): <1

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.184214 Long: W -78.828901 Datum:

Soil Map Unit Name: Georgeville Silt Loam (GeD) NWI classification: PF01A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Upland - DP11

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	40	Yes	FAC
2. Platanus occidentalis	25	Yes	FACW
3. Fraxinus pennsylvanica	5	No	FACW
4. Ulmus americana	5	No	FACW
5.			
6.			
7.			
8.			
	75	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Acer rubrum	15	Yes	FAC
2. Lindera benzoin	5	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	20	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	60	Yes	FAC
2. Persicaria longiseta	2	No	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	62	= Total Cover	
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Upland - DP11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	2.5Y 6/3						Loam	
2-12	2.5Y 6/3	99	10YR 5/6	1	C	PL	Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/19/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland H - DP12

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.183409 Long: W -78.829089 Datum:

Soil Map Unit Name: Carteca & Chewalca (Cc) NWI classification: PF01A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): 0 - 12+

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Wetland H - DP12

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	40	Yes	FAC
2. Carpinus caroliniana	25	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	65	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Acer rubrum	10	Yes	FAC
2. Carpinus caroliniana	5	Yes	FAC
3. Lindera benzoin	2	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	17	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	80	Yes	FAC
2. Leersia oryzoides	5	No	OBL
3. Boehmeria cylindrica	2	No	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	87	= Total Cover	
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wetland H - DP12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2	85	10YR 3/6	15	C	PL	Silt Loam	
2-12	10YR 5/2	90	10YR 4/6	10	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/19/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP13

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.183394 Long: W -78.829166 Datum:

Soil Map Unit Name: Cartecay & Chewalca (Cc) NWI classification: PF01A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Upland - DP13

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	55	Yes	FAC
2. Carpinus caroliniana	20	Yes	FAC
3. Quercus phellos	15	No	FAC
4.			
5.			
6.			
7.			
8.			
	90	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Lindera benzoin	15	Yes	FAC
2.	5	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	20	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	30	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	30	= Total Cover	
Woody Vine Stratum (Plot size: 30')			
1. Lonicera japonica	2	No	FACU
2.			
3.			
4.			
5.			
6.			
	2	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Upland - DP13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 6/4						Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/19/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland I - DP14

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.181523 Long: W -78.829579 Datum:

Soil Map Unit Name: Carteca & Chewalca (Cc) NWI classification: PF01A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No ✓ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): 0 - 12+

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Wetland I - DP14

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Nyssa sylvatica	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	5 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Leersia oryzoides	35	Yes	OBL
2. Persicaria sagittata	30	Yes	OBL
3. Microstegium vimineum	20	Yes	FAC
4. Impatiens capensis	15	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wetland I - DP14

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 5/1	95	10YR 5/6	5	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Dry Creek Mitigation Site City/County: Bahama/Durham Sampling Date: 9/19/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP15

Investigator(s): Win Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.181624 Long: W -78.829664 Datum:

Soil Map Unit Name: Cartecay & Chewalca (Cc) NWI classification: PF01A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Current Drought Advisory for Durham County is D0 - Abnormally Dry.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Upland - DP15

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	20	Yes	FAC
2. Ulmus americana	20	Yes	FACW
3. Carya ovalis	15	Yes	FACU
4.			
5.			
6.			
7.			
8.			
	55	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. Acer rubrum	20	Yes	FAC
2. Carya ovalis	5	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	25	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	40	Yes	FAC
2. Boehmeria cylindrica	2	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	42	= Total Cover	

Woody Vine Stratum (Plot size: 30')			
1. Smilax rotundifolia	15	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	15	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 71 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Upland - DP15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 6/4						Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

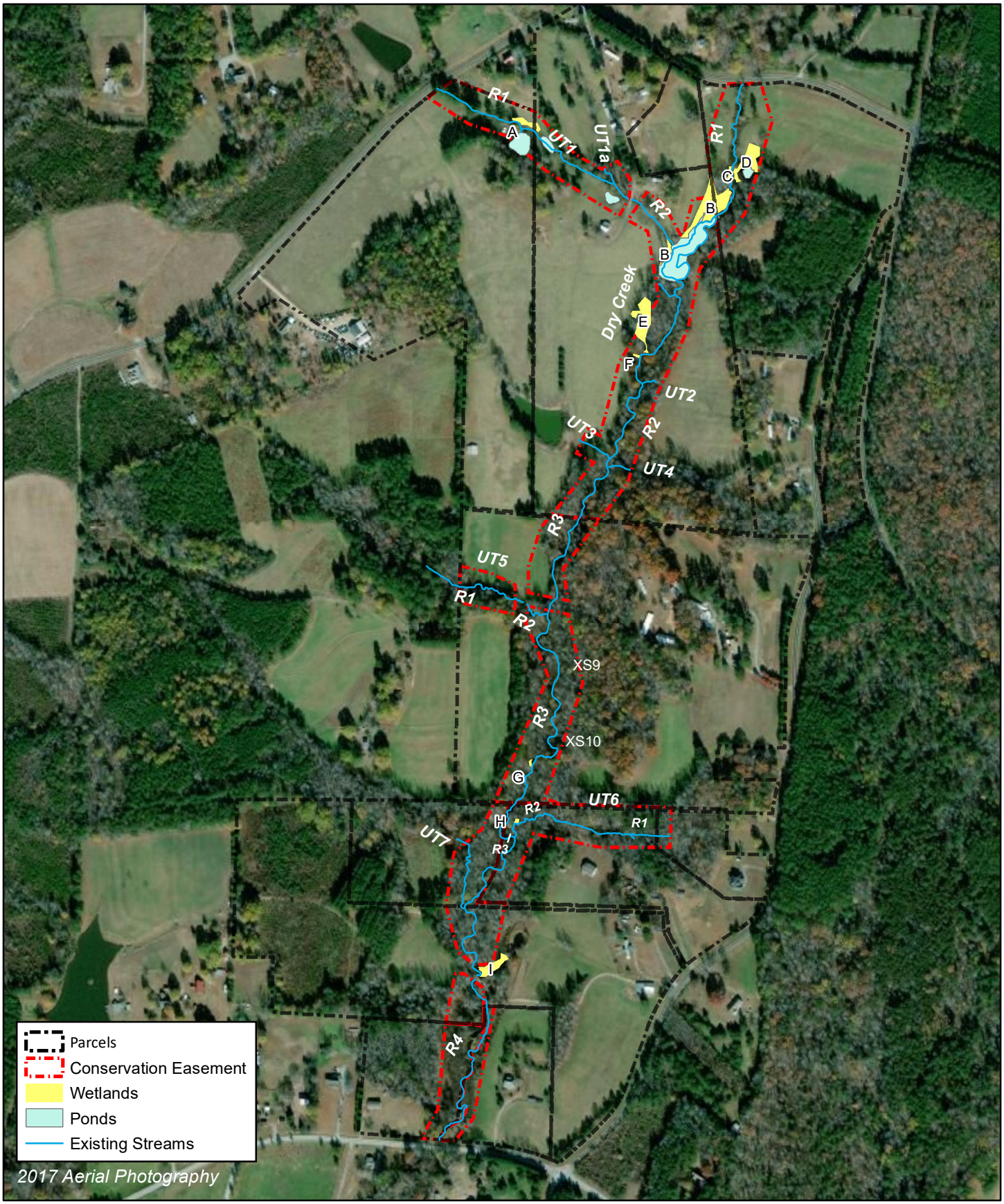
Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:



WILDLANDS ENGINEERING

0 600 Feet

Figure 3-1 Existing Conditions Wetlands Map
Dry Creek Mitigation Site
New River Basin (03020201)

Durham County, NC

Cindy Lassiter

From: Win Taylor
Sent: Tuesday, July 31, 2018 9:47 AM
To: Jeff Keaton
Subject: Fwd: Dry Creek PJD Request (UNCLASSIFIED)

FYI below
Get Outlook for iOS

From: Sullivan, Roscoe L III CIV (US) <roscoe.l.sullivan@usace.army.mil>
Sent: Friday, July 27, 2018 9:35 AM
To: Win Taylor
Subject: RE: Dry Creek PJD Request (UNCLASSIFIED)

Hey Win,

Unfortunately, I have been swamped with permits and haven't been issuing many standalone JDs. For most permit actions, you don't have to have an issued JD to get the permit, just a delineation. Further, I have visited the site and have concurred with the delineation map provided by you on 3/12/2018. You should be able to request a permit and include the email from me so that the regulator working the permit would know that the delineation has been reviewed and approved by me.

If you absolutely have to have the JD issued, then can try to squeeze it in sometime over the next couple of weeks.

Please feel free to contact me with any further questions.

Best,

Ross Sullivan, PWS, ISA Certified Arborist
Regulatory Specialist
Raleigh Regulatory Field Office
U.S. Army Corps of Engineers - Wilmington District
Wake Forest, North Carolina 27587
Office #: 919-554-4884. Ext. 25
Email: roscoe.l.sullivan@usace.army.mil

We would appreciate your feedback on how we are performing our duties. Our automated Customer Service Survey is located at: http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0
Thank you for taking the time to visit this site and complete the survey.

-----Original Message-----
From: Win Taylor [mailto:wtaylor@wildlandseng.com]
Sent: Monday, July 23, 2018 10:26 AM
To: Sullivan, Roscoe L III CIV (US) <Roscoe.L.Sullivan@usace.army.mil>
Subject: [Non-DoD Source] RE: Dry Creek PJD Request (UNCLASSIFIED)

Ross,

Hope all is well on your end. I just wanted to follow up with you on the Dry Creek PJD to see if it is getting anywhere closer to the top of the stack. We will be submitting the PCN in the near future and will need this to support. Thanks again.

Win

-----Original Message-----
From: Sullivan, Roscoe L III CIV (US) <Roscoe.L.Sullivan@usace.army.mil>
Sent: Friday, May 18, 2018 12:22 PM
To: Win Taylor <wtaylor@wildlandseng.com>
Subject: RE: Dry Creek PJD Request (UNCLASSIFIED)

Hey Win,

I conducted a site visit with you at the above referenced property on 3/7/2018 to review the above referenced property. I have determined that the revised map that you provided to me on 3/12/2018 labeled "Figure 3: Site Map" accurately depicts the limits of any potentially jurisdictional waters of the U.S. within the Project Study Area. Note that the USACE Action ID SAW-2016-00880 has been issued for this project. Please refer to this Action ID in future correspondence.

I will issue a more formal Preliminary Jurisdictional Determination for this project in the order that it was received, but note that I have a substantial backlog of permits and JD's to work through at this time so it may take several months.

Please feel free to contact me with any questions.

Best,

Ross

Ross Sullivan, PWS, ISA Certified Arborist Regulatory Specialist Raleigh Regulatory Field Office U.S. Army Corps of Engineers - Wilmington District Wake Forest, North Carolina 27587 Office #: 919-554-4884. Ext. 25
Email: roscoe.l.sullivan@usace.army.mil

We would appreciate your feedback on how we are performing our duties. Our automated Customer Service Survey is located at: Blockedhttp://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0
Thank you for taking the time to visit this site and complete the survey.

-----Original Message-----
From: Win Taylor [mailto:wtaylor@wildlandseng.com]
Sent: Monday, March 12, 2018 4:06 PM
To: Sullivan, Roscoe L III CIV (US) <Roscoe.L.Sullivan@usace.army.mil>
Subject: [Non-DoD Source] RE: Dry Creek PJD Request (UNCLASSIFIED)

Ross,

Attached is the PJD Package with the revisions we discussed while on site last week. Thanks again and let me know if you need anything else.

Win

-----Original Message-----

From: Sullivan, Roscoe L III CIV (US) <Roscoe.L.Sullivan@usace.army.mil>
Sent: Friday, March 9, 2018 1:57 PM
To: Win Taylor <wtaylor@wildlandseng.com>
Subject: RE: Dry Creek PJD Request (UNCLASSIFIED)

Hey Win,

It was great to meet you as well. That is the updated PJD form.

Thanks,

Ross

Ross Sullivan, PWS, ISA Certified Arborist Regulatory Specialist Raleigh Regulatory Field Office U.S. Army Corps of Engineers - Wilmington District Wake Forest, North Carolina 27587 Office #: 919-554-4884. Ext. 25
Email: roscoe.l.sullivan@usace.army.mil

We would appreciate your feedback on how we are performing our duties. Our automated Customer Service Survey is located at: BlockedBlockedhttp://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0
Thank you for taking the time to visit this site and complete the survey.
-----Original Message-----
From: Win Taylor [mailto:wtaylor@wildlandseng.com]
Sent: Friday, March 9, 2018 1:42 PM
To: Sullivan, Roscoe L III CIV (US) <Roscoe.L.Sullivan@usace.army.mil>
Subject: [Non-DoD Source] RE: Dry Creek PJD Request (UNCLASSIFIED)

Ross,

Nice to meet you the other day and thanks for your time and suggestions. Is the attached form the one you were referencing or is there another form you were wanting me to update/include? I hope to get the revised package out to early next week.

Thanks, Win

-----Original Message-----
From: Sullivan, Roscoe L III CIV (US) <Roscoe.L.Sullivan@usace.army.mil>
Sent: Wednesday, February 28, 2018 8:03 AM
To: Win Taylor <wtaylor@wildlandseng.com>
Subject: RE: Dry Creek PJD Request (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Hey Win,

We are still good to go.

Thanks,

Ross

Ross Sullivan, PWS, ISA Certified Arborist Regulatory Specialist Raleigh Regulatory Field Office U.S. Army Corps of Engineers - Wilmington District Wake Forest, North Carolina 27587 Office #: 919-554-4884. Ext. 25

Email: roscoe.l.sullivan@usace.army.mil

We would appreciate your feedback on how we are performing our duties. Our automated Customer Service Survey is located at: BlockedBlockedBlockedhttp://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0
Thank you for taking the time to visit this site and complete the survey.

-----Original Message-----
From: Win Taylor [mailto:wtaylor@wildlandseng.com]
Sent: Wednesday, February 28, 2018 7:53 AM
To: Sullivan, Roscoe L III CIV (US) <Roscoe.L.Sullivan@usace.army.mil>
Subject: [Non-DoD Source] RE: Dry Creek PJD Request (UNCLASSIFIED)

Ross,

Just following up with you to make sure we are still on for next week. Thanks and let me know if you need anything else from me prior to the site visit.

Win

-----Original Message-----
From: Sullivan, Roscoe L III CIV (US) [mailto:Roscoe.L.Sullivan@usace.army.mil]
Sent: Wednesday, February 7, 2018 8:49 AM
To: Win Taylor <wtaylor@wildlandseng.com>
Subject: RE: Dry Creek PJD Request (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Winn,

I received your application and have issued the Action ID SAW-2018-00230 for the proposed project site.

I am booked up until the first of March. Would a site visit on Wednesday, March 7, 2018 at 10 am work for your schedule?

Sincerely,

Ross Sullivan, PWS, ISA Certified Arborist Regulatory Specialist Raleigh Regulatory Field Office U.S. Army Corps of Engineers - Wilmington District Wake Forest, North Carolina 27587 Office #: 919-554-4884. Ext. 25
Email: roscoe.l.sullivan@usace.army.mil

-----Original Message-----
From: Win Taylor [mailto:wtaylor@wildlandseng.com]
Sent: Tuesday, February 6, 2018 12:52 PM
To: Sullivan, Roscoe L III CIV (US) <Roscoe.L.Sullivan@usace.army.mil>
Subject: [Non-DoD Source] Dry Creek PJD Request

Ross,

I am just following up on the Dry Creek Mitigation Site PJD request I sent out last week to see about getting a day scheduled for the site assessment. I am pretty flexible, so whatever works on your end should work for me.

Thanks and look forward to meeting with you.

Win

. . . . . .

Win Taylor PWS, FPC | Senior Environmental Scientist

O: 843.277.6221 x102 M: 843.412.6314

Wildlands Engineering, Inc. <BlockedBlockedBlockedBlockedBlockedhttp://www.wildlandseng.com/>

497 Bramson Ct, Suite 104

Mount Pleasant, SC 29464

CLASSIFICATION: UNCLASSIFIED

CLASSIFICATION: UNCLASSIFIED

Appendix 4

NC DWQ Stream Identification Form Version 4.11

Date: 10/12/15 & 10/16/15	**Project/Site:** Dry Creek	**Latitude:**
Evaluator: RD / KB	**County:** Durham	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 50.5	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 26)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	2	(3)
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		(Yes = 3)	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 13)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	1	2	(3)
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	0.5	1	(1.5)
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 11.5)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	0	(1)	2	3
22. Fish	0	0.5	1	(1.5)
23. Crayfish	0	0.5	(1)	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 (Other = 0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 10/12/15 & 10/16/15	**Project/Site:** DC - UT 1	**Latitude:**
Evaluator: RD / KB	**County:** Durham	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 32.25	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 13.5)

	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10)

12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 8.75)

18. Fibrous roots in streambed	3	2	(1)	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	0	0.5	1	(1.5)
23. Crayfish (Cambarus sp.; small	0	(0.5)	1	1.5
24. Amphibians	0	(0.5)	1	1.5
25. Algae	0	(0.5)	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

18. after culvert, there is creeping primrose & common buttonweed in stream but not above.

Sketch:

20. only found aquatic worms; time of season &/or recent rainfall event
22. seen after culvert (maybe back wash of lower pond
24. several sp. in/around ponds but only few in channel

NC DWQ Stream Identification Form Version 4.11

Date: 10/16/15	**Project/Site:** DC- UT 1a	**Latitude:**
Evaluator: KB	**County:** Durham	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27.5	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 16)

	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	(No = 0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4)

12. Presence of Baseflow	0	(1)	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	(No = 0)		Yes = 3	

C. Biology (Subtotal = 7.5)

18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	(0.5)	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Aquatic beetles in small pool near stream origin

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 1/26/18	**Project/Site:** Bay Creek UT2	**Latitude:** 36.188822
Evaluator: CL	**County:** Durham	**Longitude:** -78.827089
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25.5	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:* UT2

A. Geomorphology (Subtotal = 11)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	(1)	2	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	(No = 0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	1.5	1	0.5	(0)
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0 Ub			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Caddisfly larvae + scud

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 10/12/15 & 10/16/15	**Project/Site:** DC - UT3	**Latitude:**
Evaluator: RD / KB	**County:** Durham	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 26	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 9.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	(1)	2	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	(1) Small	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 11)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	0.5	1	(1.5)
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal =)				
18. Fibrous roots in streambed	3	(2)	1	0
19. Rooted upland plants in streambed	3	(2)	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1 juncus	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 10/12/15	**Project/Site:** DC - UT4	**Latitude:**
Evaluator: RD	**County:** Durham	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 24	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	(0)	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	0	1	2	(3)
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4)				
12. Presence of Baseflow	0	(1)	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	0.5	1	(1.5)
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 3)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	3	2	1	(0)
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 10/12/15 & 10/10/15	**Project/Site:** DC- UT5	**Latitude:**
Evaluator: RD | KB	**County:** Durham	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 12)

	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	(1)	2	3
5. Active/relict floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts top is a culvert	(0)	1	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)

12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	1.5	1	0.5	(0)
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 10)

18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 10/12/15 & 10/16/15	**Project/Site:** DC - UT6	**Latitude:**
Evaluator: RD | KB	**County:** Durham	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 36	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 20.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	1	2	(3) per Chris
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 9)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks Snails & eggs visible on leaf packs	0	(1)	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish located under rocks	0	(0.5)	1	1.5
24. Amphibians	0	(0.5)	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 10/12/15 & 10/16/15	**Project/Site:** DC - UT7	**Latitude:**
Evaluator: RD / KB	**County:** Durham	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 35.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 18)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 9)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	(0.5)	1	1.5
25. Algae	0	(0.5)	(1)	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Meets groundwater charge and becomes perennial due to soil based evidence and stronger presence of baseflow

Crawfish, salamander, crawfly

Appendix 5

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Dry Creek Mitigation Site
County Name:	Durham County
EEP Number:	97082
Project Sponsor:	Wildlands Engineering, Inc
Project Contact Name:	Andrea S. Eckardt
Project Contact Address:	1430 South Mint Street, Suite 104 Charlotte, NC 28203
Project Contact E-mail:	aeckardt@wildlandseng.com
EEP Project Manager:	Lindsay Crocker

Project Description

The Dry Creek Mitigation Site is a stream mitigation project located three miles northwest of the Town of Butner and two miles west of the Granville County border in Durham County, NC. The project includes Dry Creek and seven unnamed tributaries. The project site is currently characterized by a mix of active pastures, fields and woodlands. Many of the project reaches include man-made impoundments for agricultural purposes. The project will provide stream mitigation units to the Division of Mitigation Services in the Neuse River Basin (03020201).

For Official Use Only

Reviewed By: Lindsay Crocker

7/24/2017
Date

DMS Project Manager

Conditional Approved By:

Date

For Division Administrator
FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

7-24-17
Date

For Division Administrator
FHWA

Dry Creek
9511 Hampton Road
Rougemont, NC 27572

Inquiry Number: 4440324.1
October 16, 2015

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th Floor
Shelton, Connecticut 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Date EDR Searched Historical Sources:

Aerial Photography October 16, 2015

Target Property:

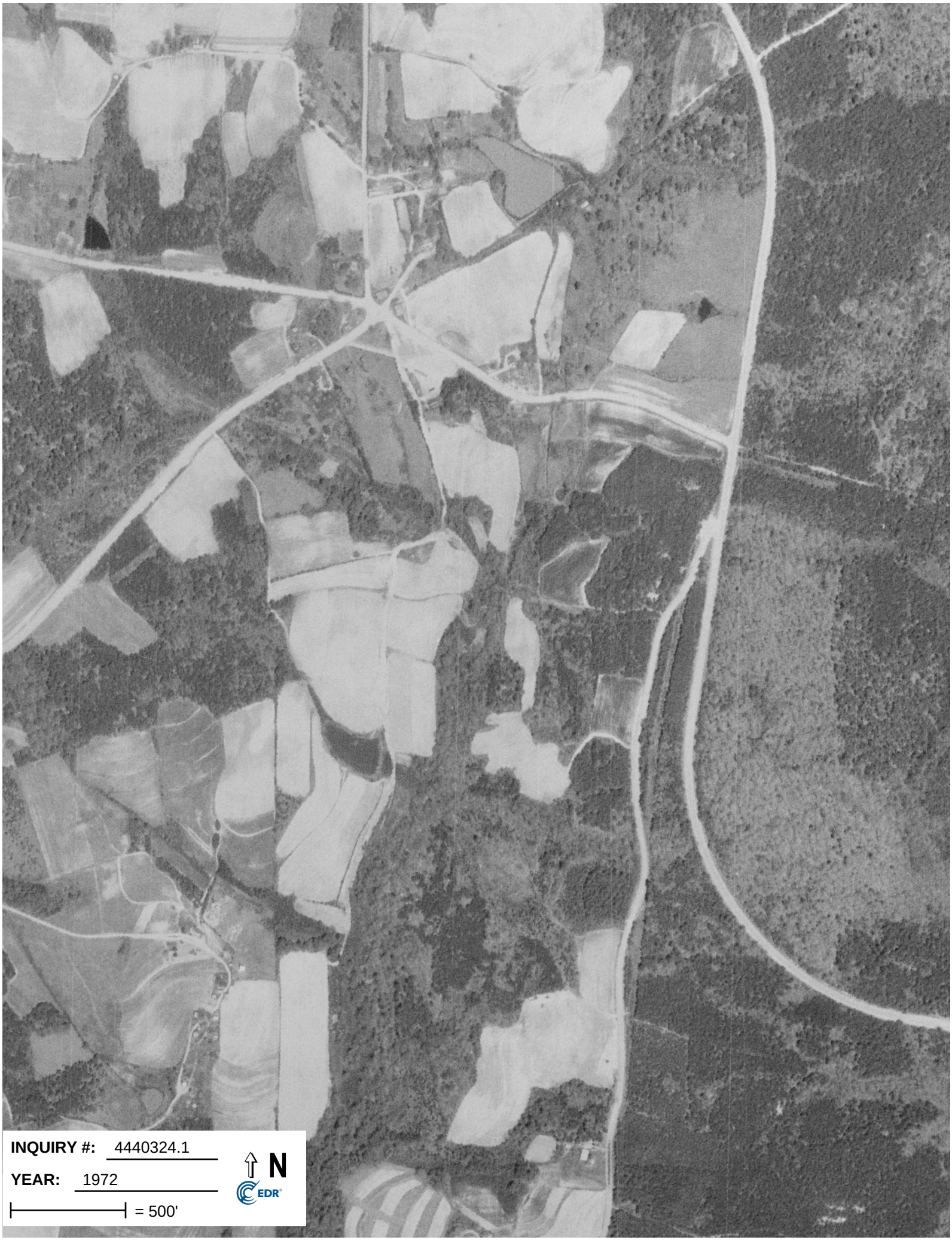
9511 Hampton Road

Rougemont, NC 27572

Year	***Scale***	***Details***	***Source***
1940	Aerial Photograph. Scale: 1"=500'	Flight Date: October 25, 1940	USGS
1955	Aerial Photograph. Scale: 1"=500'	Flight Date: March 30, 1955	USGS
1972	Aerial Photograph. Scale: 1"=500'	Flight Date: April 18, 1972	USGS
1975	Aerial Photograph. Scale: 1"=500'	Flight Date: November 16, 1975	USGS
1983	Aerial Photograph. Scale: 1"=500'	Flight Date: March 02, 1983	USGS
1993	Aerial Photograph. Scale: 1"=500'	DOQQ - acquisition dates: March 15, 1993	USGS/DOQQ
2005	Aerial Photograph. Scale: 1"=500'	Flight Year: 2005	USDA/NAIP
2006	Aerial Photograph. Scale: 1"=500'	Flight Year: 2006	USDA/NAIP
2008	Aerial Photograph. Scale: 1"=500'	Flight Year: 2008	USDA/NAIP
2009	Aerial Photograph. Scale: 1"=500'	Flight Year: 2009	USDA/NAIP
2010	Aerial Photograph. Scale: 1"=500'	Flight Year: 2010	USDA/NAIP
2012	Aerial Photograph. Scale: 1"=500'	Flight Year: 2012	USDA/NAIP


INQUIRY #: 4440324.1
YEAR: 1940
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 1955
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 1972
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 1975
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 1983
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 1993
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 2005
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 2006
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 2008
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 2009
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 2010
= 500'
N
EDR


INQUIRY #: 4440324.1
YEAR: 2012
= 500'
N
EDR

WILDLANDS
ENGINEERING

April 15, 2016

Renee Gledhill-Earley
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

Subject: Dry Creek Mitigation Site
Durham County, North Carolina

Dear Ms. Gledhill-Earley,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with the Dry Creek Mitigation Site. A USGS site map and aerial map with approximate project areas are enclosed.

The Dry Creek Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The northern half of the site has historically been disturbed due to agricultural use, primarily for livestock production; whereas, the southern half has remained forested.

We ask that you review this site based on the attached information to determine the presence of any historic properties.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the project.

Sincerely,

Ruby M. Davis
Environmental Scientist
rdavis@wildlandseng.com

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Pat McCrory
Secretary Susan Kluttz

Office of Archives and History
Deputy Secretary Kevin Cherry

April 26, 2016

Ruby Davis
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, NC 28203

Re: Dry Creek Mitigation Site, Durham County, ER 16-0698

Dear Ms. Davis:

Thank you for your letter of April 15, 2016, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona M. Bartos

WILDLANDS
ENGINEERING

April 15, 2016

Dale Suiter
US Fish and Wildlife Service
Raleigh Field Office
PO Box 33726
Raleigh, NC 27636

Subject: Dry Creek Mitigation Site
Durham County, North Carolina

Dear Mr. Suiter,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to endangered species, migratory birds or other trust resources associated with the proposed Dry Creek Mitigation Site. A USGS map and aerial maps showing the approximate project areas are enclosed. The topographic figure was prepared from the Rougemont, 7.5-Minute USGS Topographic Quadrangles.

The Dry Creek Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The northern half of the site has historically been disturbed due to agricultural use, primarily for livestock production; whereas, the southern half has remained forested.

According to your website (http://ecos.fws.gov/tess_public/reports/species-by-current-range-county), the bald eagle (*Haliaeetus leucocephalus*), smooth coneflower (*Echinacea laevigata*) and the Michaux's sumac (*Rhus* michauxii) are the federally-listed species in Durham County. We are requesting that you provide any known information on these species.

If we have not heard from you in 30 days we will assume that you do not have any comments regarding associated laws and that you do not have any information relevant to this projects at the current time.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

Ruby M. Davis
Environmental Scientist

Attachment:
USGS Topographic Map
Aerial Map

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Raleigh ES Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

May 5, 2016

Ruby Davis
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, NC 28203

Re: Dry Creek Mitigation Site – Durham County, NC

Dear Mrs. Davis:

This letter is to inform you that a list of all federally-protected endangered and threatened species with known occurrences in North Carolina is now available on the U.S. Fish and Wildlife Service's (Service) web page at http://www.fws.gov/raleigh. Therefore, if you have projects that occur within the Raleigh Field Office's area of responsibility (see attached county list), you no longer need to contact the Raleigh Field Office for a list of federally-protected species.

Our web page contains a complete and frequently updated list of all endangered and threatened species protected by the provisions of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act), and a list of federal species of concern[1] that are known to occur in each county in North Carolina.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes.

---

[1] The term "federal species of concern" refers to those species which the Service believes might be in need of concentrated conservation actions. Federal species of concern receive no legal protection and their designation does not necessarily imply that the species will eventually be proposed for listing as a federally endangered or threatened species. However, we recommend that all practicable measures be taken to avoid or minimize adverse impacts to federal species of concern.

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

With regard to the above-referenced project, we offer the following remarks. Our comments are submitted pursuant to, and in accordance with, provisions of the Endangered Species Act.

Based on the information provided and other information available, it appears that the proposed action is not likely to adversely affect any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act at these sites. We believe that the requirements of section 7(a)(2) of the Act have been satisfied for your project. Please remember that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

However, the Service is concerned about the potential impacts the proposed action might have on aquatic species. Aquatic resources are highly susceptible to sedimentation. Therefore, we recommend that all practicable measures be taken to avoid adverse impacts to aquatic species, including implementing directional boring methods and stringent sediment and erosion control measures. An erosion and sedimentation control plan should be submitted to and approved by the North Carolina Division of Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls should be installed and maintained between the construction site and any nearby down-gradient surface waters. In addition, we recommend maintaining natural, vegetated buffers on all streams and creeks adjacent to the project site.

The North Carolina Wildlife Resources Commission has developed a Guidance Memorandum (a copy can be found on our website at (http://www.fws.gov/raleigh) to address and mitigate secondary and cumulative impacts to aquatic and terrestrial wildlife resources and water quality. We recommend that you consider this document in the development of your projects and in completing an initiation package for consultation (if necessary).

We hope you find our web page useful and informative and that following the process described above will reduce the time required, and eliminate the need, for general correspondence for species' lists. If you have any questions or comments, please contact Emily Wells of this office at (919) 856-4520 ext. 25.

Sincerely,

Pete Benjamin
Field Supervisor

List of Counties in the Service's Raleigh Field Office Area of Responsibility

Alamance
Beaufort
Bertie
Bladen
Brunswick
Camden
Carteret
Caswell
Chatham
Chowan
Columbus
Craven
Cumberland
Currituck
Dare
Duplin
Durham
Edgecombe
Franklin
Gates
Granville
Greene
Guilford
Halifax
Harnett
Hertford
Hoke
Hyde
Johnston
Jones
Lee
Lenoir
Martin
Montgomery
Moore
Nash
New Hanover
Northampton
Onslow
Orange
Pamlico
Pasquotank
Pender
Perquimans
Person
Pitt
Randolph
Richmond
Robeson
Rockingham
Sampson
Scotland
Tyrrell
Vance
Wake
Warren
Washington
Wayne
Wilson

Natural Resources
Conservation Service

North Carolina
State Office

4407 Bland Road
Suite 117
Raleigh, NC 27609
Voice 919-873-2171
Fax 844-325-6833

May 23, 2016

Mr. Ian Eckardt
Environmental Scientist
Wildlands Engineering, Inc.
1430 S. Mint St, Suite 104
Charlotte, NC 28203

Dear Mr. Eckardt

Thank you for your letter dated April 14, 2016, Subject: Request for Comments – AD1006 Form - Dry Creek Mitigation Site - Durham County, NC. The following guidance is provided for your information.

Projects are subject to the Farmland Protection Policy Act (FPPA) requirements if they may irreversibly convert farmland (directly or indirectly) to non-agricultural use and are completed by a federal agency or with assistance from a federal agency. Farmland means prime or unique farmlands as defined in section 1540(c)(1) of the FPPA or farmland that is determined by the appropriate state or unit of local government agency or agencies with concurrence of the Secretary of Agriculture to be farmland of statewide local importance.

For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forestland, pastureland, cropland, or other land, but not water or urban built-up land.

Farmland does not include land already in or committed to urban development or water storage. Farmland *already in* urban development or water storage includes all such land with a density of 30 structures per 40-acre area. Farmland already in urban development also includes lands identified as *urbanized area* (UA) on the Census Bureau Map, or as urban area mapped with a *tint overprint* on the United States Geological Survey (USGS) topographical maps, or as *urban-built-up* on the United States Department of Agriculture (USDA) Important Farmland Maps.

The area in question meets one or more of the above criteria for Farmland. Farmland area will be affected or converted. Enclosed is the Farmland Conversion Impact Rating form AD1006 with PARTS II, IV and V completed by NRCS. The corresponding agency will need to complete the evaluation, according to the Code of Federal Regulation 7CFR 658, Farmland Protection Policy Act.

If you have any questions, please contact Milton Cortes, Assistant State Soil Scientist at 919-873-2171 or by email: milton.cortes@nc.usda.gov.

Again, thank you for inquiry. If we can be of further assistance, please do not hesitate to contact us.

Sincerely,

MILTON CORTES

Digitally signed by MILTON CORTES
DN: c=US, o=U.S. Government, ou=Department of Agriculture, cn=MILTON CORTES, 0.9.2342.19200300.100.1.1=12001000080173
Date: 2016.05.22 12:14:56 -04'00'

Milton Cortes
Assistant State Soil Scientist

cc:
Kent Clary, State Soil Scientist, NRCS, Raleigh, NC

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 4/14/16
Name Of Project Dry Creek Mitigation Site	Federal Agency Involved FHWA - NCDMS
Proposed Land Use Stream Restoration	County And State Durham County, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes ☑	No ☐	Acres Irrigated - None	Average Farm Size 90 acres
Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 132, 267	% 69	Amount Of Farmland As Defined in FPPA Acres: 118, 720	% 62
Name Of Land Evaluation System Used Durham Co., LESA	Name Of Local Site Assessment System None		Date Land Evaluation Returned By NRCS May 23, 2016 Bye email	

PART III *(To be completed by Federal Agency)*	Alternative Site Rating Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	27.7			
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	27.7	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	15.3			
B. Total Acres Statewide And Local Important Farmland	9.0			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.0			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	69.0			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	29			

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	15			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	10			
4. Protection Provided By State And Local Government	20	20			
5. Distance From Urban Builtup Area	0	0			
6. Distance To Urban Support Services	0	0			
7. Size Of Present Farm Unit Compared To Average	10	10			
8. Creation Of Nonfarmable Farmland	25	0			
9. Availability Of Farm Support Services	5	5			
10. On-Farm Investments	20	15			
11. Effects Of Conversion On Farm Support Services	25	0			
12. Compatibility With Existing Agricultural Use	10	0			
TOTAL SITE ASSESSMENT POINTS	160	85	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	29			
Total Site Assessment *(From Part VI above or a local site assessment)*	160	85	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	114	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)

This form was electronically produced by National Production Services Staff

Clear Form

Form AD-1006 (10-83)

WILDLANDS
ENGINEERING

April 15, 2016

Shannon Deaton
North Carolina Wildlife Resource Commission
Division of Inland Fisheries
1721 Mail Service Center
Raleigh, NC 27699

Subject: Dry Creek Mitigation Site
Durham County, North Carolina

Dear Ms. Deaton,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with the proposed Dry Creek Mitigation Site. A USGS map and aerial maps showing the approximate project areas are enclosed. The topographic figure was prepared from the Rougemont, 7.5-Minute USGS Topographic Quadrangles.

The Dry Creek Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The project will include stream restoration, enhancement, and preservation. The northern half of the site has historically been disturbed due to agricultural use, primarily for livestock production; whereas, the southern half has remained forested.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

Ruby M. Davis
Environmental Scientist

Attachment:
USGS Topographic Map
Aerial Map

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

3 May 2016

Ms. Ruby M. Davis
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, NC 28203

Subject: Dry Creek Mitigation Site, Durham County, North Carolina

Dear Ms. Davis:

Biologists with the North Carolina Wildlife Resources Commission have reviewed the subject information. Our comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) and North Carolina General Statutes (G.S. 113-131 et seq.).

The proposed project includes stream restoration, enhancement and preservation. Several sections of channel have been identified as significantly degraded. The northern site half of the site has been used primarily for livestock production, the southern half has remained forested. The mitigation site will provide in-kind mitigation for unavoidable stream impacts.

The project site includes Dry Creek, a tributary to Lake Michie in the Neuse River basin. The Natural Heritage Natural Area – Lake Michie Corridor – is located downstream of the site.

Stream restoration projects often improve water quality and aquatic habitat. We offer the following recommendations to minimize impacts to aquatic and terrestrial wildlife resources.

- Restoration activities should be designed to avoid impacts to any existing forested riparian buffers.
- Establishing native, forested buffers in riparian areas will help protect water quality, improve aquatic and terrestrial wildlife habitats, and provide a travel corridor for wildlife species.
- Measures should be used to minimize erosion and sedimentation from construction or restoration activities.

Mailing Address: Habitat Conservation • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

Thank you for the opportunity to review this proposed project. If we can provide further assistance, please contact Gabriela Garrison at (910) 409-7350 or gabriela.garrison@ncwildlife.org.

Sincerely,

Shari L. Bryant
Western Piedmont Coordinator
Habitat Conservation Division

ec: Gabriela Garrison, NCWRC

Appendix 6

Existing Conditions Geomorphic Parameters																						
Parameter	**Notation**	**Units**	**DC R1**		**UT1 R1**		**UT1 R2**		**UT1A**		**DC R2**		**UT5**		**DC R3 & 4**		**UT6**	
			Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
stream type			C4		-		-		-		F4		-		F4		E4	
drainage area	DA	*sq mi*	0.66		0.094		0.14		0.034		0.95		0.056		1.23		0.030	
bankfull cross-sectional area	A_{bkf}	*SF*	11		2.1	2.4	5.1		-		12.8		1.9		15.0	27.9	1.4	1.9
average velocity during bankfull event	v_{bkf}	*fps*	3.4		4.0	4.3	2.7		-		4.0		3.7		1.9	4.1	1.9	2.4
width at bankfull	w_{bkf}	*feet*	16		4.3	5.3	14.0		-		13.5		3.4		12.9	18.8	3.0	4.6
maximum depth at bankfull	d_{max}	*feet*	2.5		0.6	0.7	1.0		-		1.3		0.9		1.6	2.5	0.6	
mean depth at bankfull	d_{bkf}	*feet*	0.7		0.5		0.4		-		0.9		0.60		1.2	1.5	0.4	0.5
bankfull width to depth ratio	w_{bkf}/d_{bkf}		23		8.8	11.5	38.0		-		14.2		5.9		11.2	12.7	6.3	11.5
low bank height		*feet*	3.1		3.1	4.1	2.6		-		3.4		2.7		3.4	5.3	0.8	3.9
bank height ratio	BHR		1.3		5.4	5.7	2.7		-		2.6		3.0		2.1		1.2	6.9
floodprone area width	w_{fpa}	*feet*	140		5.1	5.7	18.2		-		14.9		4.7		18.0	25.5	3.5	150.0
entrenchment ratio	ER		8.9		1.1	1.2	1.3		-		1.1		1.4		1.4		1.2	32.4
max pool depth at bankfull	d_{pool}	*feet*	-		1.2		-		1.1		1.90		-		2.1	2.4	0.4	0.8
pool depth ratio	d_{pool}/d_{bkf}		-		2.4		-		-		2.11		-		1.4	2.0	0.8	2.0
pool width at bankfull	w_{pool}	*feet*	-		3.3		-		4.1		8.6		-		14.9	20.6	3.1	3.4
pool width ratio	w_{pool}/w_{bkf}		-		0.6	0.8	-		-		0.6		-		0.8	1.6	0.7	1.1
bankfull pool cross-sectional area	A_{pool}	*SF*	-		3.1		-		3.1		11.4		-		20.2	27.5	1.0	1.5
pool area ratio	A_{pool}/A_{bkf}		-		1.3	1.5	-		-		0.9		-		0.7	1.8	0.5	1.1
pool-pool spacing	p-p	*feet*	24	115	27	147	48	112	23		24	125	23	116	22	127	17	283
pool-pool spacing ratio	$p\text{-}p/W_{bkf}$		1.5	7.3	5.1	34.2	3.4	8.0	-	-	1.8	9	6.8	34	1.2	10	3.7	94
valley slope	S_{valley}	*feet/foot*	0.006		0.017		0.016		0.011		0.006		0.040		0.006		0.029	
channel slope	$S_{channel}$	*feet/foot*	0.006		0.016		0.016		0.010		0.005		0.033		0.004		0.026	
sinuosity	K		1.19		1.07		1.05		1.10		1.21		1.17		1.39		1.15	
belt width	w_{blt}	*feet*	27	57	15	25	23	25	11	20	41	89	22	33	45	107	13	30
meander width ratio	w_{blt}/w_{bkf}		1.7	3.6	2.9	5.7	1.6	1.8	-	-	3.1	7	6.4	10	2.4	8.3	2.8	10.0
meander length	L_m	*feet*	90	199	54	165	93	145	40	53	98	346	47	175	108	422	25	141
meander length ratio	L_m/w_{bkf}		5.7	13	10.2	38	6.6	10	-	-	7	26	14	51	5.7	33	5.4	47
linear wavelength	LW		80	175	45	155	59	150	33	41	91	281	32	138	77	334	20	137
linear wavelength ratio	LW/w_{bkf}		5.1	11	8.4	36	4.2	11	-	-	7	21	9	41	4.1	26	4.4	46
radius of curvature	R_c	*feet*	16	33	10	33	6	13	6	13	19	69	9	25	24	78	5	47
radius of curvature ratio	R_c/ w_{bkf}		1.0	2.1	1.8	7.8	0.4	1.0	-	-	1.4	5	2.5	7	1.87	6.0	0.4	15.7

Proposed Geomorphic Parameters																	
	Notation	Units	Dry Creek R1			Dry Creek R2			Dry Creek R3			Dry Creek R4			UT1 R2		
			Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max
stream type			C4			C4			C4			C4			C4		
drainage area	DA	*sq mi*	0.67			0.95			1.09			1.26			0.13		
design discharge	Q	*cfs*	58.0	-		75.0	-		83.0	-		92.0	-		19.6	-	
bankfull cross-sectional area	A_{bkf}	*SF*	23.6	-		23.6	-		23.6	-		23.6	-		5.4	-	
average velocity during bankfull event	v_{bkf}	*fps*	2.5	-		3.4	-		3.2	-		3.8	-		3.6	-	
Cross Section																	
width at bankfull	w_{bkf}	*feet*	17.8	-		17.8	-		17.8	-		17.8	-		8.4	-	
maximum depth at bankfull	d_{max}	*feet*	2.0	-		2.0	-		2.0	-		2.00	-		1.0	-	
mean depth at bankfull	d_{bkf}	*feet*	1.3	-		1.3	-		1.3	-		1.3	-		0.6	-	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		13.0	-		13.0	-		13.0	-		13.0	-		13.0	-	
max depth ratio	d_{max}/d_{bkf}	*feet*	1.5	-		1.5	-		1.5	-		1.5	-		1.5	-	
bank height ratio	BHR		-	1.0		-	1.0		-	1.0		-	1.0		-	1.0	
floodprone area width	w_{fpa}	*feet*	-	39	89	-	39	89	-	39	89	-	39	89	-	18	42
entrenchment ratio	ER		-	2.2	5.0	-	2.2	5.0	-	2.2	5.0	-	2.2	5.0	-	2.2	5.0
Slope																	
valley slope	S_{valley}	*feet/foot*	0.0061			0.0094			0.0076			0.0054			0.016		
channel slope	S_{chnl}	*feet/foot*	-	0.0032	0.0051	-	0.0059	0.0078	-	0.0054	0.0064	-	0.0041	0.0075	-	0.012	0.018
Profile																	
riffle slope	S_{riffle}	*feet/foot*	-	0.0056	0.021	-	0.0087	0.033	-	0.0071	0.027	-	0.0050	0.019	-	0.015	0.057
riffle slope ratio	S_{riffle}/S_{chnl}		-	1.2	4.2	-	1.2	4.2	-	1.2	4.2	-	1.2	4.2	-	1.2	4.3
pool slope	S_p	*feet/foot*	-	0.000	0.0020	-	0.000	0.0031	-	0.000	0.0025	-	0.000	0.0018	-	0.000	0.0053
pool slope ratio	S_p/S_{chnl}		-	0.00	0.40	-	0.00	0.40	-	0.0	0.40	-	0.0	0.40	-	0.0	0.40
pool-pool spacing	L_{p-p}	*feet*	-	28	126	-	28	126	-	28.0	126.0	-	28	126	-	13.0	52.0
pool spacing ratio	L_{p-p}/w_{bkf}		-	1.6	7.1	-	1.6	7.1	-	1.6	7.1	-	1.6	7.1	-	1.6	6.2
pool cross-sectional area	A_{pool}	*SF*	-	26.0	59.1	-	26.0	59.1	-	26.0	59.1	-	26.0	59.1	-	5.9	13.5
pool area ratio	A_{pool}/A_{bkf}		-	1.1	2.5	-	1.1	2.5	-	1.1	2.5	-	1.1	2.5	-	1.1	2.5
maximum pool depth	d_{pool}	*feet*	-	2.7	4.1	-	2.7	4.1	-	2.7	4.1	-	2.7	4.1	-	1.3	1.9
pool depth ratio	d_{pool}/d_{bkf}		-	2.0	3.1	-	2.0	3.1	-	2.0	3.1	-	2.0	3.1	-	2.1	3.1
pool width at bankfull	w_{pool}	*feet*	-	17.8	28.5	-	17.8	28.5	-	17.8	28.5	-	17.8	28.5	-	8.4	12.6
pool width ratio	w_{pool}/w_{bkf}		-	1.0	1.6	-	1.0	1.6	-	1.0	1.6	-	1.0	1.6	-	1.0	1.5
Pattern																	
sinuosity	K		-	1.30		-	1.20		-	1.20		-	1.20		-	1.20	
belt width	w_{blt}	*feet*	-	45	142	-	36	117	-	36	117	-	36	117	-	17	45
meander width ratio	w_{blt}/w_{bkf}		-	2.5	8.0	-	2.0	6.6	-	2.0	6.6	-	2.0	6.6	-	2.0	5.4
linear wavelength (formerly meander length)	LW	*feet*	-	107	274	-	107	214	-	107	214	-	107	214	-	50	101
linear wavelength ratio (formerly meander length ratio)	LW/w_{bkf}		-	6.0	15.4	-	6.0	12.0	-	6.0	12.0	-	6.0	12.0	-	6.0	12.0
meander length	L_m	*feet*	-	53	303	-	134	267	-	134	267	-	134	267	-	63	126
meander length ratio	L_m/W_{bkf}		-	3.0	17.0	-	7.5	15.0	-	7.5	15.0	-	7.5	15.0	-	7.5	15.0
radius of curvature	R_c	*feet*	-	36	89	-	36	53	-	36	53	-	36	53	-	17	25
radius of curvature ratio	R_c/ w_{bkf}		-	2.0	5.0	-	2.0	3.0	-	2.0	3.0	-	2.0	3.0	-	2.0	3.0

Proposed Geomorphic Parameters												
	Notation	Units	UT1A			UT5			UT6			
			Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max	
stream type			C4			C4b			C4b			
drainage area	DA	*sq mi*	0.03			0.06			0.03			
design discharge	Q	*cfs*	7.5	-		11.5	-		6.4	-		
bankfull cross-sectional area	A_{bkf}	*SF*	5.2	-		3.7	-		2.0	-		
average velocity during bankfull event	v_{bkf}	*fps*	4.1	-		3.2	-		3.2	-		
Cross Section												
width at bankfull	w_{bkf}	*feet*	7.5	-		6.8	-		5.2	-		
maximum depth at bankfull	d_{max}	*feet*	1.0	-		0.8	-		0.6	-		
mean depth at bankfull	d_{bkf}	*feet*	0.7	-		0.5	-		0.4	-		
bankfull width to depth ratio	w_{bkf}/d_{bkf}		11.0	-		13.0	-		13.0	-		
max depth ratio	d_{max}/d_{bkf}	*feet*	1.5	-		1.5	-		1.5	-		
bank height ratio	BHR		-	1.0		-	1.0		-	1.0		
floodprone area width	w_{fpa}	*feet*	-	17	38	-	15	34	-	11	26	
entrenchment ratio	ER		-	2.2	5.0	-	2.2	5.0	-	2.2	5.0	
Slope												
valley slope	S_{valley}	*feet/foot*	0.011			0.034			0.034			
channel slope	S_{chnl}	*feet/foot*	-	0.0085	0.021	-	0.018	0.028	-	0.026	0.028	
Profile												
riffle slope	S_{riffle}	*feet/foot*	-	0.010	0.039	-	0.031	0.120	-	0.031	0.121	
riffle slope ratio	S_{riffle}/S_{chnl}		-	1.2	4.3	-	1.2	4.3	-	1.2	4.3	
pool slope	S_p	*feet/foot*	-	0.000	0.0037	-	0.000	0.011	-	0.000	0.012	
pool slope ratio	S_p/S_{chnl}		-	0.0	0.40	-	0.0	0.40	-	0.0	0.40	
pool-pool spacing	L_{p-p}	*feet*	-	12	47	-	11	42	-	8	32	
pool spacing ratio	L_{p-p}/w_{bkf}		-	1.6	6.2	-	1.6	6.2	-	1.6	6.2	
pool cross-sectional area	A_{pool}	*SF*	-	5.7	13.1	-	4.1	9.2	-	2.2	5.1	
pool area ratio	A_{pool}/A_{bkf}		-	1.1	2.5	-	1.1	2.5	-	1.1	2.5	
maximum pool depth	d_{pool}	*feet*	-	1.4	2.1	-	1.1	1.6	-	0.8	1.2	
pool depth ratio	d_{pool}/d_{bkf}		-	2.0	3.0	-	2.0	3.0	-	2.0	3.0	
pool width at bankfull	w_{pool}	*feet*	-	7.5	11.3	-	6.8	10.2	-	5.2	7.8	
pool width ratio	w_{pool}/w_{bkf}		-	1.0	1.5	-	1.0	1.5	-	1.0	1.5	
Pattern												
sinuosity	K		-	1.20		-	1.15		-	1.15		
belt width	w_{blt}	*feet*	-	15	41	-	14	37	-	10	28	
meander width ratio	w_{blt}/w_{bkf}		-	2.0	5.4	-	2.0	5.4	-	2.0	5.4	
linear wavelength (formerly meander length)	LW	*feet*	-	45	90	-	41	82	-	31	62	
linear wavelength ratio (formerly meander length ratio)	LW/w_{bkf}		-	6.0	12.0	-	6.0	12.0	-	6.0	12.0	
meander length	L_m	*feet*	-	56	113	-	51	102	-	39	78	
meander length ratio	L_m/W_{bkf}		-	7.5	15.0	-	7.5	15.0	-	7.5	15.0	
radius of curvature	R_c	*feet*	-	15	23	-	14	20	-	10	16	
radius of curvature ratio	R_c/ w_{bkf}		-	2.0	3.0	-	2.0	3.0	-	2.0	3.0	

Appendix 7

Maintenance Plan

The site shall be monitored on a regular basis and a physical inspection of the site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two (2) years following site construction and may include the following:

Table1: Maintenance Plan

Component/Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank erosion. If beaver become active on the site, Wildlands will contract with the USDA to trap the beaver and remover the dams.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.

Appendix 8

1.0 Credit Release Schedule

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary DA authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Table A: Credit Release Schedule – Stream Credits

Credit Release Milestone	Credit Release Activity	Interim Release	Total Released
1	Site Establishment (includes all required criteria)	15%	15%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
6	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%*)
7	Year 5monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%*)
8	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%*)
9	Year 7 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	90% (100%*)

*10% reserve credits to be held back until the bankfull performance standard has been met.

1.1 Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by DMS without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan.
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; per the DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built

report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.

d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

1.2 Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after two bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

Appendix 9

Financial Assurances

Pursuant to Section IV H and Appendix III of the Division of Mitigation Service's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the US Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.