NORWOOD GAINEY RIPARIAN BUFFER RESTORATION
MITIGATION REPORT

Wayne County, North Carolina

HUC 03020202
SUBBASIN 03-04-05

Project ID No. 050649301 (D06058S)

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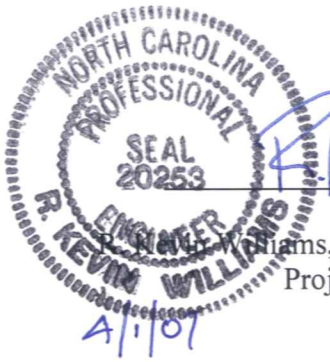

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EXECUTIVE SUMMARY

Pre-Construction Site Conditions:

The pre-construction condition of the riparian buffers consisted primarily of agricultural fields surrounded and dissected by agricultural ditches that flow into Bouge Swamp. The current condition of the buffers do not allow for diffuse flow into the ditches, nor do they provide adequate filtering capacity as is found in normal vegetated buffers.

The project study area was subjected to a jurisdictional delineation effort during the planning phase of the Norwood Gainey Riparian Buffer Restoration. This delineation effort, accepted by the U.S. Army Corps of Engineers (COE) on 3/10/2006 (Action ID No. 200610636), indicates the presence of jurisdictional wetland areas within the project study area consisting of open water and a palustrine, emergent (PEM) wetland pursuant to Cowardin *et.al*. (1979).

Restoration Plan:

The primary goal is to effectively restore forested riparian buffers along the agricultural ditches which convey surface water runoff toward Bouge Swamp and ultimately into the Neuse River. The 50-ft riparian buffers were planted with native bare root tree species on 10-ft centers providing a density of approximately 440 trees per acre. Shrubs were planted on 13-ft centers in Zone 2 providing a density of approximately 260 shrubs per acre. A seed mixture of perennial native grasses was planted outside the immediate 50-ft riparian buffer and throughout Zone 1 and Zone 2. The 5.4-acre wetland enhancement area was planted with native bare root wetland trees and shrubs on 10-ft centers providing a density of approximately 440 stems per acre.

Post Construction Site Conditions:

The buffer restoration efforts have resulted in approximately 13,660 linear ft of Zone 1 (30 ft) buffer restoration. This equates to approximately 14.0 acres of Zone 1 buffer restoration. Approximately 11,900 linear ft of Zone 2 (20 ft) buffer restoration has also been accomplished through this restoration effort. This equates to approximately 7.6 acres of Zone 2 buffer restoration. In addition to the Zone 1 and Zone 2 restoration efforts, approximately 26.2 acres outside of Zones 1 and 2 were restored with native grasses.

The wetland enhancement efforts have resulted in approximately 5.4 acres of wetland enhancement. The original PEM wetland has been enhanced through planting of native tree and shrub species to promote a forested wetland community and to provide increased habitat diversity.

Buffer restoration techniques will help improve the water quality of Bouge Swamp by reducing the amount of erosion, excess nutrients and stormwater runoff entering the system. The wetland enhancement will improve onsite aquatic habitats and the buffer restoration will improve terrestrial habitats and ultimately provide a forested wildlife corridor.

Area	Before	After	Credit Ratio[1]	WMU/ BMU[1]
EEP Easement Area (acres)	(58.4)	(58.4)	n/a	n/a
Existing Wetland Area within EEP Easement (acres)[2]	(7.7)	(7.7)	n/a	n/a
Wetland Enhancement (acres)	0.0	(5.4)	2:1	2.7
Zone 1 Buffer Restoration (acres) [linear ft]	0.0	(14.0) [13,660]	3:1	4.7
Zone 2 Buffer Restoration (acres) [linear ft]	0.0	(7.6) [11,900]	1.5:1	5.1
Herbaceous Buffer Restoration[3] (acres)	0.0	(26.2)	n/a	n/a

[1] Subject to regulatory approval. [2] 2.3 acres of 7.7 acre total is open water. [3] Outside of Zones 1 & 2

Monitoring Plan

Riparian buffer success criteria will be met if sample plots demonstrate that specific stem survival goals are met annually. For each of the first three complete years of monitoring, 320 stems per acre must have survived such that at the end of three years, 320 three-year old characteristic stems per acre have survived in the planted areas. In years four and five, 288 and 260 characteristic stems per acre, respectively, must have survived, such that at the end of year five, the site contains 260 characteristic stems five years of age. No quantitative sampling requirements are proposed for herbaceous and shrub assemblages as part of the vegetation success criteria; however, they will be visually assessed for growth patterns and vigor.

Wetland Enhancement Success Criteria - The vegetative success criteria of the wetland enhancement area are consistent with those described above for the riparian buffers. The hydrologic success criteria of the wetland enhancement consists meeting jurisdictional hydrology for a minimum of 12.5 percent of the growing season.

Riparian Buffer Monitoring Methodology – Using Ecosystem Enhancement Program (EEP) guidelines developed by the Carolina Vegetation Survey (CVS), eighteen (18) 10m X 10m plots were established within the 50 ft riparian buffer zone and twenty (20) 10m X 10m plots were established within the herbaceous zone. The 20 vegetation plots within the herbaceous zone will be monitored concurrently with the riparian buffer zone. Representative photographs of each plot will be taken and included in monitoring reports. No hydrologic monitoring is proposed within the riparian buffer restoration areas.

Wetland Monitoring Methodology - Seven (7) 10m X 10m plots were established within the wetland enhancement area. The 7 vegetation plots within the wetland enhancement area will be monitored annually. Representative photographs of each plot will be taken and included in monitoring reports. Two monitoring wells were installed in the wetland enhancement area in order to document seasonal hydrologic conditions. Hydrologic data will be downloaded from the two monitoring wells monthly during the growing season and every two months during the non-growing season.

EEP will be notified immediately upon the discovery of any site condition that may compromise the success of the site.

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I. NARRATIVE

The Norwood Gainey Riparian Buffer Restoration project is located south of Goldsboro in Wayne County, North Carolina. Care Road and residential housing border the project study area to the north. Undeveloped land consisting of timberland and Bouge Swamp borders the project study area to the west, south, and east.

Directions to the project study area from Goldsboro are as follows: From U.S. Highway 70 east, take N.C. Highway 111 south for approximately 3.75 miles. Take a right on Care Road (dirt road). Follow Care Road until you reach a metal gate; take a left before the gate. The project study area consists of the agricultural fields, surrounded by man-made ditches, and the existing borrow pit located along the southern project boundary.

The project study area is located within United States Geologic Survey (USGS) Hydrologic Unit Code (HUC) 03020202 (USGS 1974) and is located within the Neuse River Basin (subasin 03-04-05) (DWQ 2002). The drainage area of the 58.4-acre project study area is approximately 67 acres. Man-made drainage ditches surrounding the project study area intercept much of the water flow before it reaches the areas proposed for riparian buffer restoration.

The project study area is adjacent to Bouge Swamp, which is a historic oxbow swamp system of the Neuse River. Bouge Swamp has not been assigned an individual Stream Index Number (SIN) or a Best Usage Classification (BUC) according to the North Carolina Department of Environment and Natural Resources (DENR) (DWQ 2002). Therefore, it carries the same BUC as the named stream to which it is a tributary. The ditches located in the project study area flow generally in a southerly direction into adjacent Bouge Swamp and then into the Neuse River. This particular section of the Neuse River [SIN 27-(56)] has been assigned a BUC of **C**; **NSW**. Class **C** waters are freshwaters protected for secondary recreation, fishing, aquatic life (including propagation and survival), and wildlife. Secondary recreation is any activity involving human body contact with water on an infrequent or incidental basis. The supplemental classification **NSW** indicates Nutrient Sensitive Waters, which require limitations on nutrient inputs.

The project study area is located in the Coastal Plain physiographic province. The topography in the project study area is generally characterized as nearly level to gently sloping. Surface elevations in the project study area range from 55 feet (ft) to 58 ft above mean sea level. The ditch elevations range between 52 ft and 54.5 ft above mean sea level.

The project study area is rural in nature and with the surrounding landscape dominated by a mixture of forested communities and agricultural land. The project study area has been historically utilized for crop production. The most recent crops planted were soybeans. A small borrow pit has been excavated along the southern boundary of the project study area. A portion of this borrow area has become naturalized with the remainder consisting of open water. Adjacent land use consists of timberland, Bouge Swamp, and residential homes. The U.S. Department of Agriculture (USDA) Farm Service does not identify the agricultural land within the project study area as prior converted cropland.

The project study area was subjected to a jurisdictional delineation effort during the planning phase of the design process. The delineation effort, which was accepted by the U.S. Army Corps of Engineers (COE), indicates the presence of jurisdictional wetlands and surface waters within the project study area.

A. Restoration Summary

Riparian Buffer Goals and Objectives - The objective is to effectively restore forested riparian buffers along the onsite agricultural ditches that are conveying surface runoff toward Bouge Swamp and ultimately into the Neuse River. It is anticipated that approximately 13,660 linear ft of riparian buffer encompassing approximately 21.6 acres (based on 50-ft buffer on each side of ditch) can be restored along the onsite agricultural ditches. These restored buffers will consist of forested communities extending a minimum of 50 ft from the edge of each agriculture ditch. Zones of herbaceous buffer (grassland) may be incorporated beyond the initial 50-ft buffer. These grassland buffers will encompass approximately 26.2 acres. The restored buffers, once re-vegetated with woody stems promote stability and provide excess nutrient and sediment removal. Restoration of the riparian buffer along the ditches also helps to improve aquatic and terrestrial habitats and promote ditch stability by reducing any concentrated flow. The buffers will provide habitat protection as a result of the restoration (e.g., food for foraging wildlife). There will also be removal of nutrient source as a result of elimination of agricultural practices.

Riparian Buffer Restoration Approach - The 50-ft riparian buffer adjacent to the onsite agricultural ditches was planted with native bare root tree species on 10-ft centers providing a density of approximately 440 trees per acre. A density of 260 surviving stems per acre is necessary for success at the end of the anticipated 5-year monitoring period. Zones 1 and 2 of the restored riparian buffers were planted with the following bare root tree species based on commercial availability: persimmon (*Diospyros virginiana*), river birch (*Betula nigra*), water oak (*Quercus nigra*), swamp chestnut oak (*Quercus michauxii*), black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), American sycamore (*Platanus occidentalis*), black gum (*Nyssa sylvatica*), and flowering dogwood (*Cornus florida*).

Native shrub species were incorporated into the Zone 2 planting plan in order to provide more diversity and to enhance wildlife habitat. Shrubs were planted on 13-ft centers providing a density of approximately 260 shrubs per acre. The following shrub species were planted within Zone 2 based on commercial availability: silky dogwood (*Cornus amomum*) and red mulberry (*Morus rubra*).

A seed mixture of perennial native grasses was used in the herbaceous areas outside the immediate 50-ft riparian buffer. This native grass seed mixture was also spread throughout Zone 1 and Zone 2 in order to provide additional cover and increase the overall effectiveness of the riparian buffer. The native grass mixture consisted of a mixture of several of the following

native grass species: broomsedge (*Andropogon virginicus*), deertongue (*Panicum clandestinum*), switchgrass (*Panicum virgatum*), indiangrass (*Sorghastrum nutans*), purple-top (*Tridens flavus*).

Wetland Enhancement Goals and Objectives - Wetland enhancement will be accomplished by establishing native wetland trees and shrubs within the suitable portion of the existing borrow area. This borrow area has been determined to be jurisdictional by the COE. However, a portion of this borrow area currently consists of open water and cannot effectively be used for wetland enhancement under the current project goals and objectives. The open water area will remain in its current condition. It is anticipated that approximately 5.4 acres of riparian wetland enhancement will result from this project.

Wetland Enhancement Approach – The 5.4-acre wetland enhancement area was planted with native bare root wetland trees on 10-ft centers providing a density of approximately 440 per acre. A density of 260 surviving stems per acre is necessary for success at the end of the anticipated 5-year monitoring period. Tree species planting include the following based on commercial availability: sweet bay (*Magnolia virginiana*), river birch, and green ash (*Fraxinus pennsylvanica*). Shrub species that were planting include button bush (*Cephalanthus occidentalis*) and red mulberry. Two monitoring wells were installed in the wetland enhancement area in order to document seasonal hydrologic conditions.

B. Project Map

See As-Built plans for Project Map

C. Summary Table

Area	Before	After	Credit Ratio[1]	WMU/ BMU[1]
EEP Easement Area (acres)	(58.4)	(58.4)	n/a	n/a
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[1] Subject to regulatory approval
[2] 2.3 acres of 7.7 acre total is open water
[3] Outside of Zones 1 & 2

II. AS BUILTS

Riparian Buffer As-Built Vegetation Data - The mitigation plan called for two woody vegetation planting zones within the 50-ft restored riparian buffer and one additional herbaceous zone outside the 50-ft buffer. Bare root tree species were planted on 10-ft centers in both Zones 1 and 2. Bare root shrubs were planted on 13-ft centers in Zone 2 only.

Wetland Enhancement As-Built Vegetation Data – The mitigation plan proposed tree and shrub planting on 10-ft centers within the wetland enhancement area. The table below summarizes the species and abundance planted in each zone as identified by Carolina Silvics. Silky dogwood was originally proposed for planting in the wetland enhancement area; however, the all of silky dogwood was ultimately used in the Zone 2 planting.

Table 2. As-Built Vegetation Data.

Species Planted	Number Planted in Zone 1	Number Planted in Zone 2	Number Planted in Wetland Enhancement
Persimmon	1000	500	
River Birch	650	350	800
Water oak	650	350	
Swamp chestnut oak	650	350	
Black cherry	650	350	
Flowering dogwood	650	300	
Black walnut	650	350	
Sycamore	625	375	
Black gum	625	375	
Sweet bay			800
Green ash			800
Silky dogwood		650	
Mulberry		650	350
Buttonbush			700
TOTALS	6,150 stems	4,600 stems	3,450 stems

III. MONITORING PLAN

Riparian Buffer Monitoring and Success Criteria

Five percent of the total area restored as a forested riparian buffer will be sampled by establishing the appropriate number of 10 meter (m) x 10m vegetation plots. Using Ecosystem Enhancement Program (EEP) guidelines developed by the Carolina Vegetation Survey (CVS), eighteen (18) 10 m X 10m plots were established within the 50-ft riparian buffer zone and twenty (20) 10m X 10m plots were established within the herbaceous zone. The location of the plots is based on representative conditions for the mitigation type as a whole. The locations of the plots were captured with GPS and are depicted on the as-built drawings.

The 18 vegetation plots within the 50-ft buffer will be monitored annually. Using EEP guidelines, stem counts by species will be conducted for each plot, including vigor and damage estimates, to document surviving density. Natural recruitment of target species and volunteer trees are not included in the stem counts. Representative photographs of each plot will be taken and included in monitoring reports.

The 20 vegetation plots within the herbaceous zone will be monitored concurrently with the riparian buffer zone. The percent coverage of planted and naturally recruited vegetation will be visually estimated. Herbaceous coverage is not tied directly to success criteria, although coverage of at least 80 percent is desirable. Representative photographs of each plot will be taken and included in monitoring reports.

No hydrologic monitoring is proposed within the riparian buffer restoration areas.

Riparian buffer vegetative success criteria are as follows:

- For each of the first three complete years of monitoring, 320 stems per acre must have survived such that at the end of three years, 320 three-year old characteristic stems per acre have survived in the planted areas.
- In years four and five, 288 and 260 characteristic stems per acre, respectively, must have survived, such that at the end of year five, the site contains 260 characteristic stems five years of age.
- No quantitative sampling requirements are proposed for herbaceous and shrub assemblages as part of the vegetation success criteria; however, they will be assessed for growth patterns and vigor.

Baseline data has been collected to document the number of planted stems within each of the sample plots. The first annual monitoring event will occur after one complete growing season (Fall 2007). The results of the first annual monitoring event will be compiled into a report suitable for submittal to EEP. Subsequent annual monitoring reports will be conducted at approximately the same time each year to provide consistency in data collection and reporting.

Wetland Enhancement Monitoring and Success Criteria

Seven (7) 10m X 10m plots were established within the wetland enhancement area. The 7 vegetation plots within the wetland enhancement area will be monitored annually. Using EEP guidelines, stem counts by species will be conducted for each plot, including vigor and damage estimates, to document surviving density. Natural recruitment of target species and volunteer trees are not included in the stem counts. Representative photographs of each plot will be taken and included in monitoring reports. Two monitoring wells were installed in the wetland enhancement area in order to document seasonal hydrologic conditions. Hydrology data will be downloaded from the two monitoring wells monthly during the growing season and every two months during the non-growing season. No monitoring is proposed for the open water area adjacent to the wetland enhancement area. The locations of the plots and monitoring wells were captured with GPS and are depicted on the as-built drawings.

The vegetative success criteria of the wetland enhancement area are consistent with those described above for the riparian buffers. Wetland enhancement success criteria will be met if sample plots demonstrate that specific stem survival goals are met annually.

Vegetative wetland enhancement success criteria are as follows:

- For each of the first three complete years of monitoring, 320 stems per acre must have survived such that at the end of three years, 320 three-year old characteristic stems per acre have survived in the planted areas.
- In years four and five, 288 and 260 characteristic stems per acre, respectively, must have survived on the site, such that at the end of year five, the site contains 260 characteristic stems five years of age.

The hydrologic success criteria of the wetland enhancement consists of meeting jurisdictional hydrology for a minimum of 12.5 percent of the growing season.

III. MAINTENANCE & CONTINGENCY PLANS

EEP will be notified immediately upon the discovery of any site condition that may compromise the success of the site.

In the event that vegetation success criteria are not fulfilled, a mechanism for contingency will be implemented. For vegetation contingency, replanting and extending the monitoring period will be implemented if minimum distribution requirements are not fulfilled. Recommendations for contingency will be implemented until success criteria are achieved or until agency approval is received.

IV. REFERENCES

Cowardin, L.M., V. Carter, F.C. Goblet, and E.T. Laroe. 1979. Classification of Wetland and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, USFWS/OBS 79/31. U.S. Department of Interior. 131 pp.

[DOA] U.S. Army Corps of Engineers, 2003. Stream Mitigation Guidelines. 26 pp. + appendices.

[DWQ] Division of Water Quality. 2002. Neuse River Basinwide Water Quality Plan. N.C. Department of Environment and Natural Resources, Raleigh. 222 pp. + appendices.

[USGS] U.S. Geological Survey. 1982. Southeast Goldsboro, NC, 7.5-Minute Topographic Quadrangle.

[USGS] U.S. Geological Survey. 1974. Hydrologic Unit Map.