Baseline Monitoring Report
FINAL

Bowl Basin Wetland Restoration Site
Onslow County, North Carolina
DMS Contract 005012
DMS Project Number 95721

Submitted to:

NCDENR Division of Mitigation Services

NCDMS, 1652 Mail Service Center, Raleigh, NC 27699-1652

Monitoring Data Collected: May 2015
Date Submitted: July 2015

Monitoring and Design Firm

Prepared by:

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KCI Project No: 20122265

May 2015

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EXECUTIVE SUMMARY

The Bowl Basin Wetland Restoration Site, (BBWRS) completed in February 2015, restored 11.7 acres of non-riparian wetland. The BBWRS is non-riparian wetland system in the White Oak River Basin (03020106 8-digit HUC) in northeastern Onslow County, North Carolina that had substantially modified to maximize agricultural production. The completed project offers the chance to restore impacted agricultural lands to non-riparian wetland habitat. The project is located in the 14-digit HUC 03020106010010 (Upper White Oak), which the DMS has identified as a Targeted Local Watershed (TLW) (NCDENR, EEP 2010).

The project site is protected by an 11.7-acre permanent conservation easement held by the State of North Carolina. BBWRS is located on a single parcel located off of White Oak River Road approximately 13.5 miles north of Jacksonville, North Carolina. The site's 76.0-acre watershed is characterized by 93.8% agriculture, 3.7% forest, and 2.5% low-density residential. The project site is bounded by White Oak River Road to the east, a ditch along the property line to the south, agricultural land to the north and the Hoffman Forest (a research forest managed by North Carolina State University) to the west. Prior to construction, the site was actively used for row-crop farming.

The White Oak River Basin Restoration Priorities identified poor riparian zones and fragmented forests as major stressors within the BBWRS's 14-digit HUC (NCDENR EEP, 2010). The project goals for BBWRS are in line with the basin priorities and include the following:

- Slow and treat the runoff of upslope agricultural drainage
- Restore a hardwood flats community
- Create additional valuable wetland habitat in the Upper White Oak drainage basin

The project goals will be addressed through the following objectives:

- Fill field ditches to restore surface flow retention and elevate local groundwater levels
- Alleviate surface compaction and furrow drainage by surface roughening throughout the site
- Redevelop longer wetland flow patterns to increase surface flow retention time
- Restore a native forested hardwood wetland community using native trees and seed mixes

Project construction was completed in February 2015. BBWRS involved the restoration of approximately 11.7 acres of non-riparian wetlands. The primary restoration action involved filling the existing ditches. The wetland was constructed as designed with only one modification made to the design plan during construction: the southern portion of the site was graded to better capture hydrologic input from the pond located just off-site.

The monitoring components were installed in March and April 2015. Eight groundwater monitoring gauges were installed to evaluate the attainment of jurisdictional wetland hydrology. To determine the success of the planted mitigation area, ten permanent vegetation monitoring plots were established according to the CVS-EEP Level 1 protocol. Six permanent photo points have been established to be taken annually. The site will be monitored for at least seven years or until the success criteria are achieved. Reports will be submitted to the DMS each year. The first year of monitoring will take place in 2015.

The planted wetland must meet the success criteria of a site average of 320 stems/acre after three years, 288 stems/acre after four years, 260 stems/acre after five years, and 210 stems/acre after seven years to be considered successful. The baseline monitoring counted an average of 712 stems/acre in the 10 vegetation monitoring plots.

Wetland hydrology will be monitored with a series of automatic gauges that record water table depth. To meet the success criterion, the upper 12 inches of the soil profile must have continuously saturated or inundated conditions for at least 9% of the growing season with a 50% probability of reoccurrence during normal weather conditions. Due to the inherent variability in the site's soils and associated drainage characteristics, it is unlikely that the project will exhibit uniform hydrologic conditions across the site, making a single hydrologic performance criterion unrepresentative of the site's performance. As such, the gauge data can be evaluated and presented as a spatial average with each gauge representing the area half the distance to adjacent gauges. The spatial average will be the calculated value for comparison with the performance standard for credit validation. Gauges representing areas not achieving a minimum of 6.5% saturation will be considered non-attaining even if the spatial average exceeds the credit validation performance standard.

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1.0 PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Location and Setting

The North Carolina Division of Mitigation Services (DMS) has completed restoration of 11.7 acres of non-riparian wetlands at the Bowl Basin Wetland Restoration Site (BBWRS) to assist in fulfilling wetland mitigation goals in the area. The project site, which is protected by an 11.7-acre permanent conservation easement held by the State of North Carolina, is situated in Onslow County in the Carolina Flatwoods (Level IV 63h) ecoregion of the Coastal Plain physiographic province. The site is located on a single parcel located off of White Oak River Road, approximately 13.5 miles north of Jacksonville, North Carolina (Figure 1, Appendix A). The Site is within the 03020106 White Oak River Watershed Cataloging Unit (8-digit HUC) and the 03020106010010 Upper White Oak Local Watershed Unit (14-digit HUC) which has been identified as a Targeted Local Watershed (NCDENR, EEP 2010). The White Oak River Basin is experiencing increased habitat alteration due to population growth from Jacksonville and its surrounding metropolitan area. The BBWRS Project was identified as a wetland opportunity to improve habitat within the TLW.

1.2 Project Goals and Objectives

The project goals address stressors identified in the TLW and include the following:

- Slow and treat the runoff of upslope agricultural drainage
- Restore a hardwood flats community
- Create additional valuable wetland habitat in the Upper White Oak drainage basin

The project goals will be addressed through the following project objectives:

- Fill field ditches to restore surface flow retention and elevate local groundwater levels
- Alleviate surface compaction and furrow drainage by surface roughening throughout the site
- Redevelop longer wetland flow patterns to increase surface flow retention time
- Restore a native forested hardwood wetland community using native trees and seed mixes

1.3 Project Structure, Restoration Type and Approach

1.3.1 Project Structure

The mitigation work included approximately 11.7 acres of non-riparian wetland restoration for a total of 11.7 Wetland Mitigation Units as shown in Figure 2 and described in Table 1 in Appendix A. Planting occurred within the 11.7-acre conservation easement. The target natural community consists of Hardwood Flats Community (NCWAM, v. 4.1 2010).

1.3.2 Project Restoration Type and Approach

Prior to construction, the site had a long history of hydrologic modification in order to allow for farming to take place on the property. The site is located within a non-riparian area with elevations ranging from 38 to 43 feet. The topography of the site begins with the highest elevations at the southern edge of the site and extending from there to the southeastern most corner and up towards the northwestern most corner. Two primary ditches at the center of the project carried water from the western edge of the site towards the eastern main ditch. The eastern main ditch then carried flow north of the project area. A third ditch was essentially flat and held water rather than carrying flow across the site.

The modifications at the BBWRS focused on restoring an integrated wetland ecosystem that will buffer and support the Upper White Oak basin. Restoration actions focused on reestablishing an appropriate wetland hydroperiod by filling ditches, surface roughening, and planting the site with appropriate hydrophytes. A detailed topographic survey was used to design slight grading modifications to redirect and lengthen overland flow paths in order to retain and treat surface hydrology longer. Surface roughness variations were installed throughout the BBWRS to alleviate soil compaction and to enhance surface water storage.

A suitable reference wetland was found approximately 16 miles west of the BBWRS. The reference wetland is comprised of deciduous hardwoods over a shrub layer with broad-leaved evergreens and is consistent with the Hardwood Flats Community that will be the primary wetland type at the project site. A groundwater monitoring well has been installed to document the reference wetland hydrology during the course of monitoring.

1.4 Project History, Contacts and Attribute Data

The project was first identified for restoration by KCI Associates of NC as a full-delivery mitigation project for DMS. This project began in 2012 with the final mitigation plan completed in October 2014. Construction began in September 2014 and was completed in December 2014. BBWRS was planted in late February 2015. Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4 (Appendix A).

2.0 SUCCESS CRITERIA

The BBWRS will be monitored to determine if the project is on-track to meeting jurisdictional wetland status. The wetland restoration area will be deemed successful once hydrology is established and vegetation success criteria are met.

2.1 Wetland Vegetation

The site must demonstrate the re-establishment of targeted vegetative community based on the survival and growth of planted species and volunteer colonization, with an average stem density of 320 stems/acre required after three years, 288 stems/acre after four years, 260 stems/acre after five years, and 210 stems/acre after 7 years. Permanent monitoring plots (10 by 10 meters) have been established in the wetland restoration area at a density that statistically represents the total mitigation acreage. The average density of these plots will determine whether the site meets success criterion.

2.2 Wetland Hydrology

The site must present continuous saturated or inundated hydrologic conditions for at least 8% of the growing season with a 50% probability of reoccurrence during normal weather conditions. A "normal" year is based on NRCS climatological data for Onslow County using the 30th to 70th percentile thresholds as the range of normal as documented in the USACE Technical Report "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology, April 2000." According to the Natural Resources Conservation Service, the growing season for Onslow County is considered to extend from March 18th to November 16th (243 days). The water table of the restored wetlands must be within 12" of the soils surface continuously for at least 9% (22 days) of the 243-day growing season. KCI will monitor soil temperature to verify that the local growing season is consistent with the NRCS published data and reserves the right to present this information as a modifier to the number of days of saturation that are required to achieve jurisdictional status. Wetland hydrology will be monitored with eight automatic gauges that record water table depth.

Due to the inherent variability in the site's soils and associated drainage characteristics, it is unlikely that the project will exhibit uniform hydrologic conditions across the site, making a single hydrologic performance criterion unrepresentative of the site's performance. As such, the gauge data can be evaluated and presented as a spatial average with each gauge representing the area half the distance to adjacent gauges. The spatial average will be the calculated value for comparison with the performance standard for credit validation. Gauges representing areas not achieving a minimum of 6.5% saturation will be considered non-attaining even if the spatial average exceeds the credit validation performance standard.

3.0 MONITORING PLAN

Annual monitoring will be conducted during the first full growing season following project completion. Monitoring of BBWRS efforts will be performed for vegetation and wetland hydrology components of the site until the success criteria are fulfilled. The establishment, collection, and summarization of monitoring data shall be conducted in accordance with the DMS document entitled *Procedural Guidance and Content Requirements for EEP Monitoring Reports (version 1.5)* or a more current standard. Permanent monuments, marking monitoring feature locations, were established on-site in March/April 2015. The locations of these monitoring features are marked in Figure 3 (See Appendix A).

3.1 Wetland Hydrology

Eight groundwater monitoring gauges were set up and assessed for the baseline monitoring to evaluate the attainment of jurisdictional wetland hydrology. Verification of wetland hydrology will be determined by automatic recording well data collected within the project area and reference wetland. The wetland gauges will be checked and/or downloaded every other month. Daily data will be collected from the automatic gauges over the 7-year monitoring period following wetland construction. The nearby reference wetland will also be monitored using the same procedures for comparative analysis (See Figure 4 in Appendix A).

3.2 Wetland Vegetation

Ten vegetation plots were set up and assessed for the baseline vegetation monitoring. The plots were installed with flagged metal conduit at each corner and a flagged PVC pipe was installed at the photo corner. Vegetation data collection will follow the CVS-EEP Protocol for Recording Vegetation (Lee et al. 2008). The baseline vegetation monitoring was conducted as Level 1: Inventory of Planted Stems, as will the first-year monitoring. Beginning in Year Two and continuing throughout the rest of the monitoring period, the BBWRS will be monitored using the Level 2 protocol. Vegetation monitoring will occur in monitoring years 1, 2, 3, 5, and 7. Baseline vegetation plot information can be found in Appendix B.

3.3 Digital Photos

Six photograph reference points (PRPs) have been established as part of the baseline monitoring to assist in characterizing the BBWRS and to allow qualitative evaluation of site conditions. Starting in the first monitoring year, these photos will be taken in late summer, so that vegetative conditions are similar between monitoring years.

3.4 Watershed Conditions

Yearly monitoring will document any evident changes in the watershed. Any large hydrologic events in the watershed, such as tropical storms or hurricanes, will also be documented in the yearly monitoring reports.

3.5 Monitoring Guidelines

The first scheduled monitoring will be conducted during the first full growing season following project completion. Monitoring shall subsequently be conducted annually for a total period of seven years or until the project meets its success criteria. Annual monitoring reports will be prepared and submitted after all monitoring tasks for each year are completed. The report will document the monitored components and include all collected data, analyses, and photographs. Each report will provide the new monitoring data and compare the most recent results against previous findings. The monitoring report format will be similar to that set out in the most recent DMS monitoring protocol.

3.6 Maintenance and Contingency

KCI will monitor the BBWRS on a regular basis and conduct a physical inspection of the site 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 years following site construction and may include repairing constructed outlets and flow dispersement from seepage areas. Any maintenance activities will be documented in the yearly monitoring reports.

4.0 BASELINE CONDITIONS

Baseline monitoring data were collected in April 2015. The wetland was constructed as designed with the southern portion of the site graded to better capture hydrologic input from the pond located just off-site. Any changes made to the design during construction are documented in the As-Built Plan Sheets in Appendix C.

BBWRS was planted with a total of seventeen different species of bare root trees in February 2015. Baseline vegetation monitoring data were collected in May 2015. The Level 1 CVS-EEP protocol was used to collect vegetation data. Plot photos from all the vegetation plots can be found in Appendix B.

The results of the vegetation baseline monitoring show an average of 712 stems per acre in the planted restoration area (Table 5. Appendix B). Additionally, stem counts within each individual plot were well-above the required 320 stems per acre.

5.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm)

NCDENR, Ecosystem Enhancement Program. 6/8/2012. Procedural Guidance and Content Requirements for EEP Monitoring Reports. NCEEP Monitoring Report Template, Version 1.5. http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=7135626&name=DLFE-53021.pdf

NCDENR, Ecosystem Enhancement Program. 2010. White Oak River Basin Restoration Priorities 2010. Raleigh, NC. Last accessed 4/2015 at: http://portal.ncdenr.org/c/document_library/get_file?uuid=1c0b7e5a-9617-4a44-a5f8-df017873496b&groupId=60329

NCSU BAE. North Carolina State University, Biological and Agricultural Engineering. 2011. Method to Determine Lateral Effect of a Drainage Ditch on Adjacent Wetland Hydrology. Last accessed 11/2012 at: http://www.bae.ncsu.edu/soil_water/projects/lateral_effect.html

NC Wetland Functional Assessment Team. 2010. NC Wetland Assessment Method (NC WAM) User Manual, version 4.1. Last accessed 11/2012 at: http://portal.ncdenr.org/c/document_library/get_file?uuid=76f3c58b-dab8-4960-ba43-45b7faf06f4c&groupId=38364

APPENDIX A

General Tables and Figures

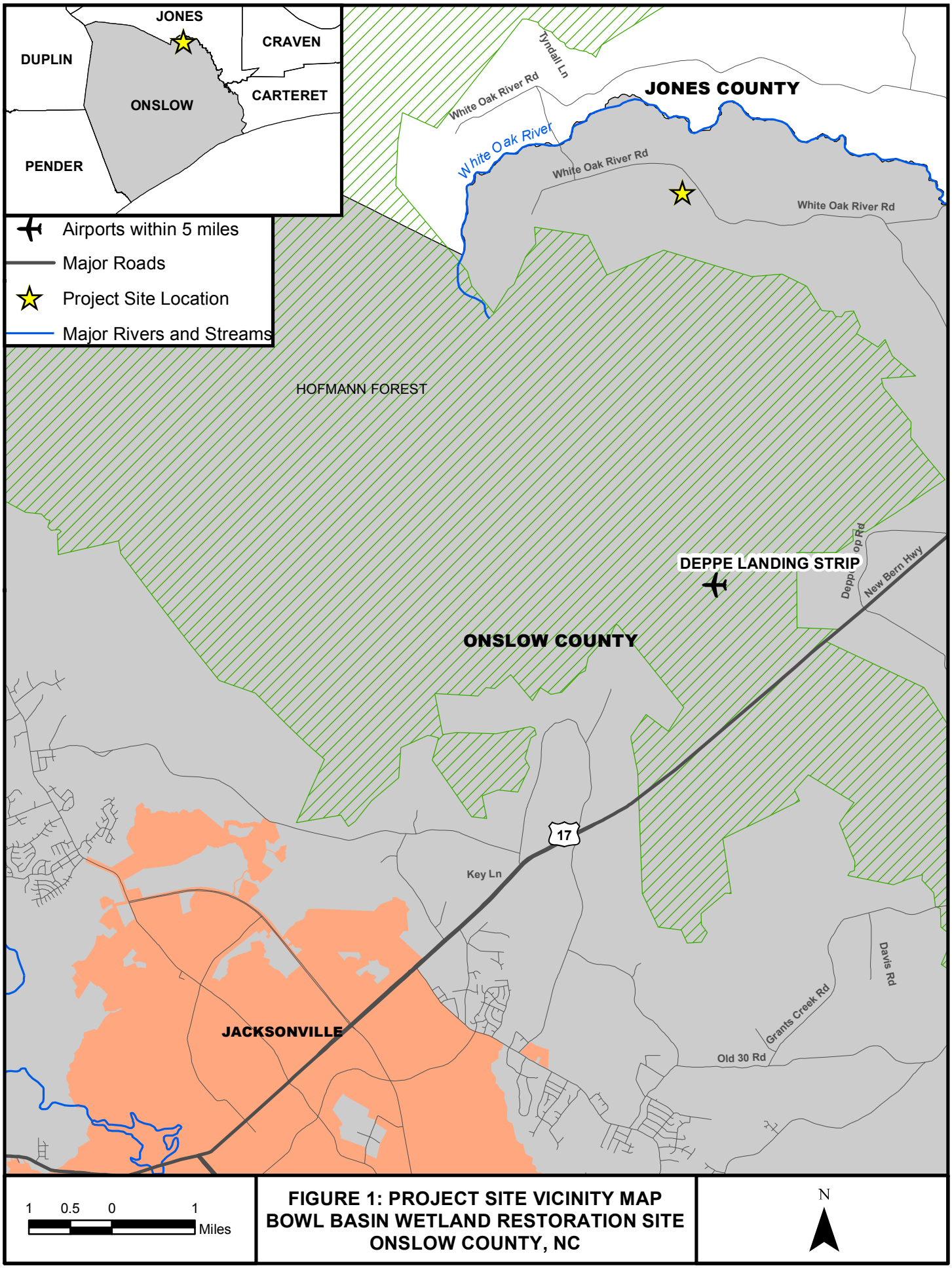


FIGURE 1: PROJECT SITE VICINITY MAP
BOWL BASIN WETLAND RESTORATION SITE
ONSLOW COUNTY, NC

FIGURE 2: PROJECT SITE PROPOSED MITIGATION PLAN VIEW
BOWL BASIN WETLAND RESTORATION SITE
ONSLOW COUNTY, NC

Image Source: NC 2010 Statewide Orthoimagery.

There were no BMP elements included in this project.

Table 1. Project Components and Mitigation Credits									
Bowl Basin Wetland Restoration Site, DMS Project # 95721									
Mitigation Credits									
	Stream		**Riparian Wetland**		**Non-riparian Wetland**		**Buffer**	**Nitrogen Nutrient Offset**	**Phosphorous Nutrient Offset**
Type	R	RE	R	RE	R	RE			
Acres					11.7				
Credits					11.7				
TOTAL CREDITS					11.7				
Project Components									
Project Component -or- Reach ID	**Stationing/ Location**		**Existing Footage/ Acreage**		**Approach (PI, PII etc.)**		**Restoration -or- Restoration Equivalent**	**Restoration Footage or Acreage**	**Mitigation Ratio**
Wetland Area	-		11.7 acres		-		Restoration	11.7 acres	1:1
Component Summation									
Restoration Level	**Stream (linear feet)**		**Riparian Wetland (acres)**		**Non-riparian Wetland (acres)**			**Buffer (square feet)**	**Upland (acres)**
			Riverine	Non-Riverine					
Restoration					11.7 acres				
Enhancement									
Enhancement I									
Enhancement II									
Creation									
Preservation									
High Quality Preservation									
TOTAL	**-**		**-**	**-**	**11.7 acres**			**-**	**-**
TOTAL WMU	**-**		**-**	**-**	**11.7**			**-**	**-**

LEGEND

- CONSERVATION EASEMENT
- VEGETATION PLOT (VP)
- PHOTO POINT (PP)
- GAUGE LOCATION (GA)
- FILLED DITCHES

IMAGE SOURCE: NC ORTHOIMAGERY

TRUE NORTH
GRID NORTH

-60′ -30′ 0′ 60′ 120′
GRAPHIC SCALE

CORNWALLIS ROAD

VP1 VP2 VP3 VP4 VP5 VP6 VP7 VP8 VP9 VP10

PP1 PP2 PP3 PP4 PP5 PP6

GA1 GA2 GA3 GA4 GA5 GA6 GA7 GA8

REVISIONS

SYM.	DESCRIPTION	DATE

NCDENR DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
460 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

BOWL BASIN
RESTORATION SITE
ONSLOW COUNTY, NORTH CAROLINA

DATE: JULY 2015
SCALE: GRAPHIC

MONITORING
PLAN VIEW

SHEET 1 OF 1

FIGURE 3

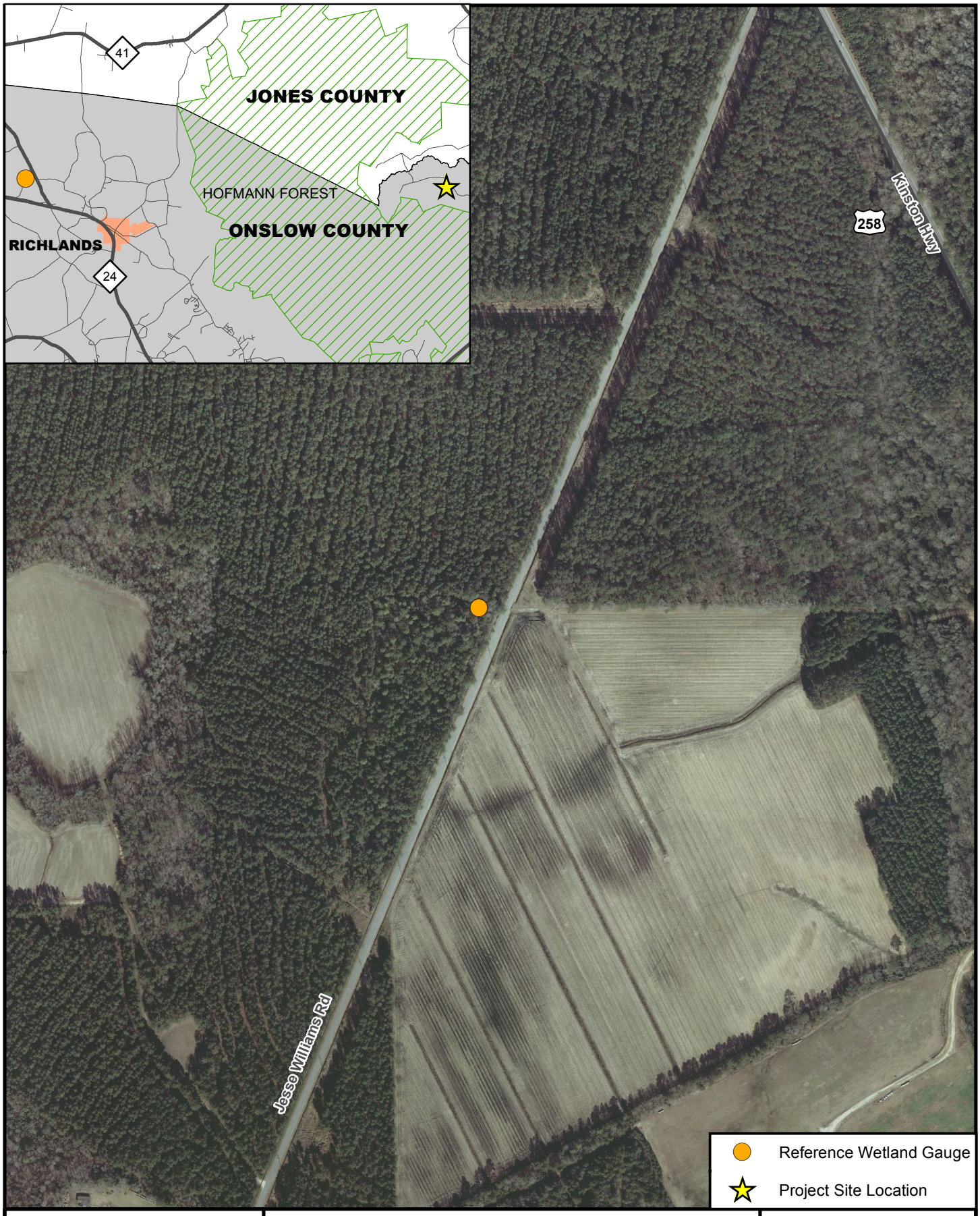


FIGURE 4: PROJECT SITE REFERENCE WETLAND BOWL BASIN WETLAND RESTORATION SITE ONSLOW COUNTY, NC

Table 2. Project Activity & Reporting History		
Bowl Basin Wetland Restoration Site, DMS Project # 95721		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		Oct 13
Final Design - Construction Plans		Dec 13
Construction		March 15
Planting		March 15
Baseline Monitoring/Report	April 15	May 15

Table 3. Project Contacts	
Bowl Basin Wetland Restoration Site, DMS Project # 95721	
Design Firm	KCI Associates of North Carolina, PC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Construction Contractor	KCI Environmental Technologies and Construction, Inc. Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Planting Contractor	Forestree Management Co. 1280 Maudis Road Bailey, NC 27807 Contact: Mr. Tony Cortez Phone: (252) 243-2513
Monitoring Performers	
MY-00	KCI Associates of North Carolina, PC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Information				
Bowl Basin Wetland Restoration Site, DMS Project # 95721				
Project Name	Bowl Basin Wetland Restoration Site			
County	Onslow County			
Project Area (acres)	11.7 acres			
Project Coordinates (lat. and long.)	34.922569 N , -77.319871 W			
Project Watershed Summary Information				
Physiographic Province	Coastal Plain			
River Basin	White Oak			
USGS Hydrologic Unit 8-digit	03020106	**USGS Hydrologic Unit 14-digit**	03020106010010	
DWQ Sub-basin	03-05-01b			
Project Drainage Area (acres)	76.0 acres			
Project Drainage Area Percentage of Impervious Area	1%			
CGIA Land Use Classification	94% Cultivated, 4% Forest, and 2% Low-Intensity Development			
Wetland Summary Information (Post-Restoration)				
Parameters	**Wetland Area**			
Size of Wetland (acres)	11.7 acres			
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Non-riparian			
Mapped Soil Series	Pantego loam by detailed soil investigation			
Drainage class	Poorly drained			
Soil Hydric Status	Drained Hydric			
Source of Hydrology	Groundwater / precipitation			
Hydrologic Impairment	Ditching and Crops			
Native vegetation community	Crops			
Percent composition of exotic invasive vegetation	0%			
Regulatory Considerations				
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**	
Waters of the United States – Section 404	Yes	Yes, received 404 permit	Jurisdictional Determination	
Waters of the United States – Section 401	Yes	Yes, received 401 permit	Jurisdictional Determination	
Endangered Species Act	No	N/A	N/A	
Historic Preservation Act	No	N/A	N/A	
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	No	N/A	FEMA Floodplain Checklist	
Essential Fisheries Habitat	No	N/A	N/A	

APPENDIX B

Baseline Data

Table 5. CVS Stem Count Total and Planted by Plot and Species

Bowl Basin Restoration Site (DMS Project Code 95721)			Current Plot Data (MY00 2015)																									
			95721-01-0001			95721-01-0002			95721-01-0003			95721-01-0004			95721-01-0005			95721-01-0006			95721-01-0007			95721-01-0008			95721-01-0009		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River birch	Tree				1	1	1	1	1	1	6	6	6	1	1	1							6	6	6			
Cephalanthus occidentalis	Common buttonbush	Shrub																			4	4	4	4	4	4	3	3	3
Fraxinus pennsylvanica	Green ash	Tree	4	4	4	5	5	5	10	10	10	4	4	4	11	11	11	3	3	3	4	4	4				1	1	1
Magnolia virginiana	Sweetbay	Tree	2	2	2	1	1	1																			1	1	1
Nyssa aquatica	Water tupelo	Tree													7	7	7												
Nyssa biflora	Swamp tupelo	Tree	1	1	1																								
Quercus michauxii	Swamp chestnut oak	Tree				6	6	6	5	5	5																3	3	3
Quercus pagoda	Cherrybark oak	Tree				1	1	1	2	2	2	1	1	1	2	2	2												
Quercus phellos	Willow oak	Tree				5	5	5	1	1	1	2	2	2	1	1	1												
Quercus shumardii	Shumard's oak	Tree	1	1	1							1	1	1															
Taxodium distichum	Bald cypress	Tree	8	8	8				3	3	3				1	1	1	17	17	17	7	7	7	7	7	7	2	2	2
		Stem count	16	16	16	19	19	19	22	22	22	14	14	14	23	23	23	20	20	20	15	15	15	17	17	17	10	10	10
		size (ares)	1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	5	6	6	6	6	6	6	5	5	5	6	6	6	2	2	2	3	3	3	3	3	3	5	5	5
		Stems per ACRE	647	647	647	769	769	769	890	890	890	567	567	567	931	931	931	809	809	809	607	607	607	688	688	688	405	405	405

Bowl Basin Restoration Site (DMS Project Code 95721)			Current Plot Data (MY00 2015)			Annual Means		
			95721-01-0010			MY0 (2015)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River birch	Tree	7	7	7	22	22	22
Cephalanthus occidentalis	Common buttonbush	Shrub				11	11	11
Fraxinus pennsylvanica	Green ash	Tree	9	9	9	51	51	51
Magnolia virginiana	Sweetbay	Tree				4	4	4
Nyssa aquatica	Water tupelo	Tree				7	7	7
Nyssa biflora	Swamp tupelo	Tree	2	2	2	3	3	3
Quercus michauxii	Swamp chestnut oak	Tree	1	1	1	15	15	15
Quercus pagoda	Cherrybark oak	Tree	1	1	1	7	7	7
Quercus phellos	Willow oak	Tree				9	9	9
Quercus shumardii	Shumard's oak	Tree				2	2	2
Taxodium distichum	Bald cypress	Tree				45	45	45
		Stem count	20	20	20	176	176	176
		size (ares)	1			10		
		size (ACRES)	0.02			0.25		
		Species count	5	5	5	11	11	11
		Stems per ACRE	809	809	809	712	712	712

Vegetation Monitoring Plot Photos

Vegetation Plot 1 – MY-00 – 5/20/15

Vegetation Plot 2 – MY-00 – 5/20/15

Vegetation Plot 3 – MY-00 – 5/20/15

Vegetation Plot 4 – MY-00 – 5/20/15

Vegetation Plot 5 – MY-00 – 5/20/15

Vegetation Plot 6 – MY-00 – 5/20/15

Vegetation Plot 7 – MY-00 – 5/20/15

Vegetation Plot 8 – MY-00 – 5/20/15

Vegetation Plot 9 – MY-00 – 5/20/15

Vegetation Plot 10 – MY-00 – 5/20/15

Photo Reference Points

PP1 – MY-00 – 5/26/15

PP2– MY-00 – 5/26/15

PP3 – MY-00 – 5/26/15

PP4 – MY-00 – 5/26/15

PP5 – MY-00 – 5/26/15

PP6 – MY-00 – 5/26/15

APPENDIX C

As-Built Plan Sheet

KCI JOB# : 20122939

CONTRACT #: 005012

STATE	CONTRACT NUMBER	SHEET NO	TOTAL SHEETS
N.C.	005012	1	3

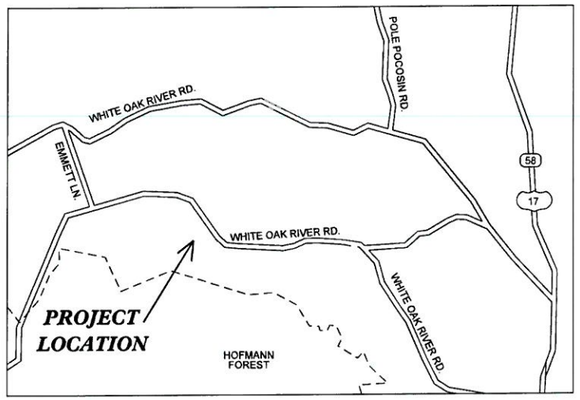
STATE OF NORTH CAROLINA
ECOSYSTEM ENHANCEMENT PROGRAM

AS-BUILT PLAN

BOWL BASIN RESTORATION SITE

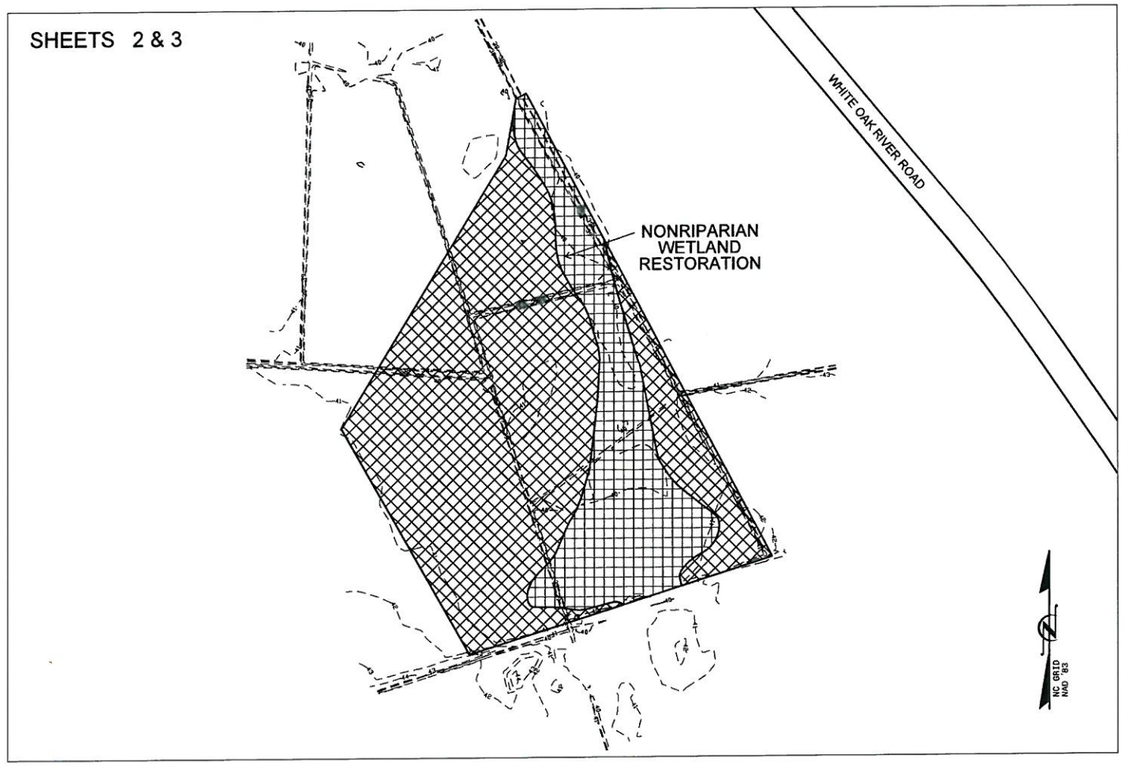
ONSLOW COUNTY, NORTH CAROLINA
WHITE OAK RIVER BASIN

UPPER WHITE OAK RIVER WATERSHED
03020106010010



VICINITY MAP
NOT TO SCALE

FROM RALEIGH TAKE I-40 EAST. TAKE EXIT 309 TO MERGE ONTO US-70 EAST. FOLLOW US-70 EAST TO KINSTON. AT KINSTON TAKE A RIGHT ONTO NORTH CAROLINA 58 SOUTH AND FOLLOW FOR APPOX. 30 MILES. TURN RIGHT ONTO COUNTRY ROAD 1119 / DAVIS FIELD ROAD. TAKE THE FIRST LEFT ONTO STATE COUNTRY ROAD 1115/POLE POCOSIN ROAD AND FOLLOW FOR 4 MILES. TURN LEFT ONTO STATE ROUTE 1116 / WHITE OAK RIVER ROAD AND FOLLOW FOR 2 MILES. TURN RIGHT ONTO COUNTRY ROAD 1118 / GIBSON BRIDGE ROAD AND FOLLOW FOR 1.8 MILES. TURN RIGHT ONTO WHITE OAK RIVER ROAD. ACCESS TO THE SITE WILL BE 3 MILES DOWN ON THE LEFT, JUST PAST THE DRIVEWAY AT 2457 WHITE OAK RIVER ROAD



INDEX OF SHEETS

GRAPHIC SCALES

–50 –25 0 50 100
SITE AND PLANTING PLANS

PROJECT DATA

NONRIPARIAN WETLAND RESTORATION = 11.74 ACRES

Prepared in the Office of:

KCI Associates of North Carolina, P.A.
SUITE 220 LANDMARK CENTER II, 4601 SIX FORKS RD., RALEIGH, NC 27609
ENGINEERS • PLANNERS • ECOLOGISTS

GARY M. MRYNCZA, P.E.
PROJECT ENGINEER

JOE PFEIFFER
WETLAND DESIGN

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

07.17.15

SIGNATURE: *P.E.*

Prepared for:

NCDENR DIVISION OF MITIGATION SERVICES

JEFF JUREK
CONTRACT ADMINISTRATOR

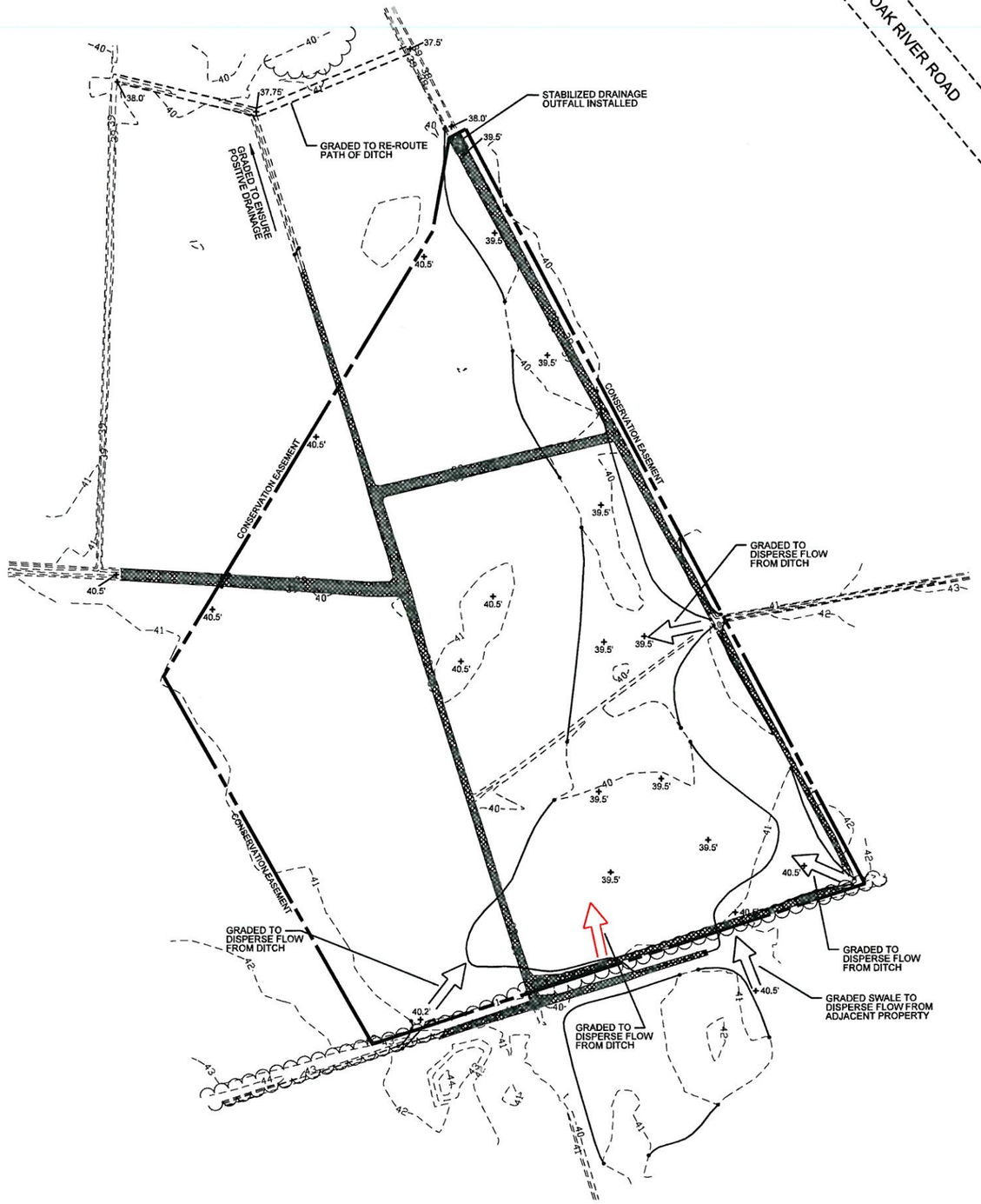
SITE PLAN LEGEND

- EASEMENT LINE
- PRE-RESTORATION CONTOUR LINES
- DESIGNED CONTOUR LINES
- OHW — EXISTING OVERHEAD WIRE
- ROCK STABILIZED OUTLET
- FILLED DITCH
- TREE LINE

NC GRID NAD 83

-80 -40 0 80 160

GRAPHIC SCALE



NOTE: SURFACE ROUGHENING WAS INSTALLED THROUGHOUT THE EASEMENT TO ALLEVIATE SOIL COMPACTION AND TO ENHANCE SURFACE WATER STORAGE.

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MARUCZA

07.17.15

SYM.	DESCRIPTION	REVISIONS

NCDENR DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

BOWL BASIN RESTORATION SITE

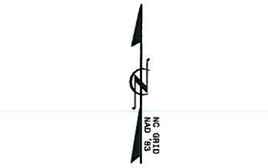
ONSLOW COUNTY, NORTH CAROLINA

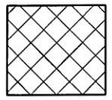
DATE: JUNE 2015

SCALE: GRAPHIC

AS-BUILT: SITE PLAN

SHEET 2 OF 3



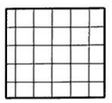


WETLAND PLANTING PLAN

NON-RIPARIAN WETLAND RESTORATION
HARDWOOD FLATS VEGETATIVE COMMUNITY (SEASONALLY SATURATED)
8.53 AC

18" - 24" BARE ROOT MATERIAL
909 STEMS/ACRE, RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME	WETLAND INDICATOR	% OF TOTAL	# OF PLANTS
SWAMP CHESTNUT OAK	QUERCUS MICHAUXII	FACW-	26	2000
RIVER BIRCH	BETULA NIGRA	FACW	25	1900
GREEN ASH	FRAXINUS PENNSYLNAVICA	FACW	18	1400
WILLOW OAK	QUERCUS PHELLOS	FACW-	17	1300
BALD CYPRESS	TAXODIUM DISTICHUM	OBL	6	500
SWEETBAY MAGNOLIA	MAGNOLIA VIRGINIANA	FACW	3	250
CHERRYBARK OAK	QUERCUS PAGODA	FAC	3	200
SHUMARD OAK	QUERCUS SHUMARDII	FACU	3	200
			100	7750

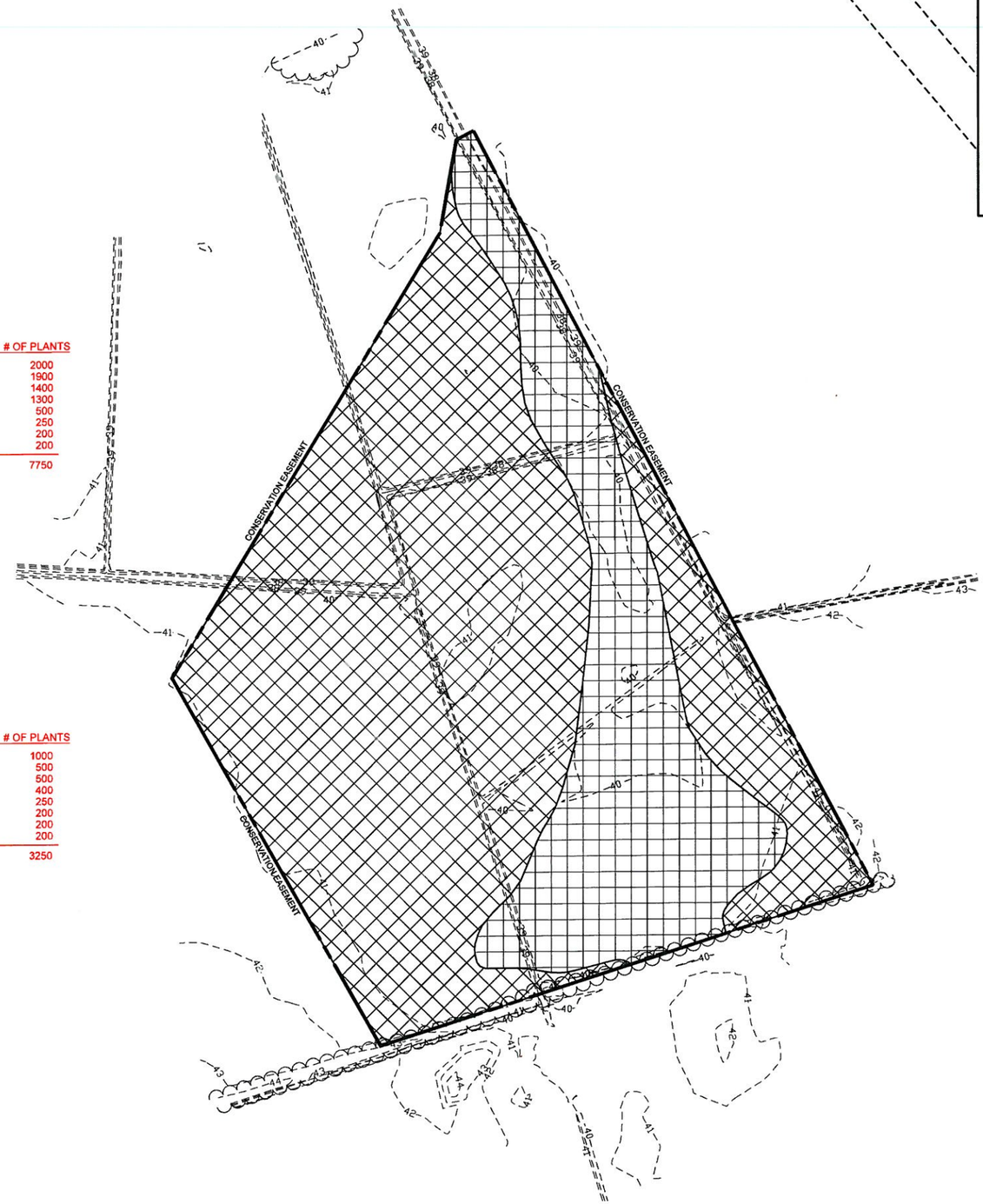


WETLAND PLANTING PLAN

NON-RIPARIAN WETLAND RESTORATION
HARDWOOD FLATS VEGETATIVE COMMUNITY (SEASONALLY INUNDATED)
3.21 AC

18" - 24" BARE ROOT MATERIAL
1012 STEMS/ACRE, RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME	WETLAND INDICATOR	% OF TOTAL	# OF PLANTS
BALD CYPRESS	TAXODIUM DISTICHUM	OBL	31	1000
BUTTONBUSH	CEPHALANTHUS OCCIDENTALIS	OBL	15	500
WATER TUPELO	NYSSA AQUATICA	OBL	15	500
SWAMP TUPELO	NYSSA BIFLORA	OBL	12	400
SWEETBAY MAGNOLIA	MAGNOLIA VIRGINIANA	FACW	8	250
SWAMP CHESTNUT OAK	QUERCUS MICHAUXII	FACW-	6	200
GREEN ASH	FRAXINUS PENNSYLNAVICA	FACW	6	200
RIVER BIRCH	BETULA NIGRA	FACW	6	200
			100	3250



NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MARNCIA
07.17.15

SYM.	DESCRIPTION	REVISIONS

NCDENR DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

BOWL BASIN RESTORATION SITE

ONSLOW COUNTY, NORTH CAROLINA

DATE: JUNE 2015
SCALE: GRAPHIC

AS-BUILT: PLANTING PLAN

SHEET 3 OF 3