

**Meadowbranch Swamp Wetland Restoration  
2013 Final Monitoring Report  
Monitoring Year Two**

**Ecosystem Enhancement Program Project Number 92351  
Ecosystem Enhancement Program Contract Number 004800**



Submitted to: NCDENR-Ecosystem Enhancement Program  
1652 Mail Service Center  
Raleigh, NC 27699-1652

Project Designed by: EcoEngineering – A Division of the John R. McAdams Co.  
2905 Meridian Parkway  
Durham, NC 27713  
Construction Complete: February 2011

Submitted: November 11, 2013



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2013 Final Monitoring Report  
Monitoring Year Two**

**Ecosystem Enhancement Program Project Number 92351  
Ecosystem Enhancement Program Contract Number 004800**



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## 1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The goal of this project was to restore, enhance, and preserve the project area. The project created low areas in an access road adjacent to the Meadowbranch Canal based on flood elevations, removed a former logging road, and planted native wetland vegetation in select areas. According to the Restoration Plan (The John R. McAdams Company, Inc, 2007) and the Baseline Monitoring Report (EcoEngineering, 2011), the intent of this project was to return the site to a more natural hydrologic state to accomplish the following objectives:

- Store and treat runoff from 1.8 square miles of developed land, nearly half of Lumberton, which drains to the project site.
- Allow for retention and treatment of sediment, nutrients, and toxins to improve water quality of the Lumber River, which is listed as impaired approximately six miles downstream of the project site.
- Support the goals outlined in the 2003 Lumber River Basinwide Water Quality Plan by implementing a project within a watershed that has been identified by the NC Wetlands Restoration Program (NCWRP) as having the greatest need.
- Assist in the improvement of water quality; the Basinwide Water Quality Plan indicates 406 miles of waters within Subbasin 03-07-51 are impaired.
- Provide a more natural flood regime and flood storage for waters in Meadowbranch Swamp.
- Connect to surrounding wetland areas and enhance the wildlife habitat present in the wetland.

The project site is approximately one-half mile west-northwest of Lumberton, in Robeson County, North Carolina. The site consists of a wooded parcel owned by the Lumber River Conservancy which encompasses approximately 55.4 acres. The site is located along Carthage Road which bounds the site to the south. Located immediately adjacent to the west of the site is a channelized water feature known as Meadowbranch Swamp Canal. There is an access road, which is maintained by the City of Lumberton, along Meadowbranch Swamp Canal which extends north from Carthage Road to NC 211. In addition, there was a former logging road located within the interior of the site which began approximately 100 feet from Meadowbranch Swamp Canal. The former logging road began at Carthage Road and extended north, roughly paralleling Meadowbranch Swamp Canal for a distance of approximately 2,000 feet. Along the eastern edge of the former logging road was a ditch feature.

The site is located in the Inner Coastal Plain Physiographic Region of North Carolina and lies within US Geological Survey (USGS) Hydrologic Unit Code 03040203 080010 (NCDENR, 2003), which falls within the Lumber River Basin. The NC Division of Water Resources (NCDWR) River Subbasin for the project area is listed as the Lumber 03-07-51 (NCDENR, 2003). The current state classification (NCDENR, 2012) for Meadowbranch Swamp (Stream Index # 14-12) from its source to the Lumber River, is C; Sw (swamp waters). Class C waters support aquatic life, wildlife, and they can also be used for secondary recreation and agriculture. The Sw classification is intended for waters which have low velocities and other natural characteristics different from adjacent streams.

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The project site is almost entirely forested primarily with young hardwoods and some areas of young pine. This is due to the fact that the site was logged approximately 15 years ago. Due to the timing of the logging, the site is currently at a stage of succession where the vegetation is very dense. Currently, there are a few small areas near the access road along Meadowbranch Swamp that still have stands of relatively older growth bald cypress (*Taxodium distichum*) and would be designated as Cypress-Gum Swamp. Other larger areas have some young bald cypress, but the areas are more dominated by red maple (*Acer rubrum*) and river birch (*Betula nigra*). Aside from the few areas of Cypress-Gum Swamp on the site, the remainder of the area could best be described as a disturbed site undergoing succession to a Coastal Plain Bottomland Hardwood (based on reference wetland conditions). In general, the majority of the site appears to have characteristics of a Coastal Plain Bottomland Hardwood forest. However, some portions of the site contained large concentrations of Chinese privet (*Ligustrum sinense*) which have been removed and treated. These areas have been replanted with native vegetation.

Monitoring Year 2 (MY2) field investigations took place on September 17, 2013. All vegetation plots were found to be in fair condition and all are meeting vegetative success criteria. However, vegetation plot 2 is beginning to show signs of distress. There was very little vegetative cover (including herbaceous weed growth) in the plot overall, bare ground was visible throughout, and there were many planted stems marked ‘missing.’

Two random transects were inventoried within the Chinese privet removal areas. Both transects contained large amounts of Chinese privet and very little else. It was difficult to distinguish between naturally regenerating native stems and planted native stems; however, the dominant shrub stratum in both transects was Chinese privet. There are some larger native canopy trees in the area, but native species were observed in very small numbers in the shrub and sapling stratum. There was a notable increase in the density of the shrub stratum since Monitoring Year 1 (MY1) measurements. The percentage of Chinese privet in the two random transects was 81 percent and 76 percent, respectively. These results are presented in Table 9 of Appendix C.

Overall, the site is in good condition, with the exception of the presence of Chinese privet. Chinese privet was observed scattered along the entirety of the canal road. During Year 1 monitoring, the presence of Chinese privet appeared to be most problematic within the transect areas leading to the groundwater gauges. These areas continue to be problematic, and appear to be expanding beyond the limits noted during MY1. This is likely due to the clearing that took place in the transect areas. The northern portions of the site continue to support the largest populations. The Chinese privet is particularly abundant between berm cuts 8 and 9 and along the canal road and removal areas. Very large specimens (20-30 feet) were observed in these areas.

The growing season is 213 days, and has been set from April 1 to October 30. Criteria established for the site state that groundwater levels must be at or above 12 inches of the ground surface for 10 percent of the growing season, or 21 days. All of the 13 groundwater gauges installed on-site met the hydrologic success criteria described above between April 1 and September 16 of 2013.

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A rain gauge was installed on the site in October of 2006. During MY1, it was discovered that the gauge was not functioning properly. Data were downloaded on November 16, 2012 and resulted in readings for two days only. A replacement gauge was installed on the site on April 24, 2013. A data download was attempted during MY2 (on September 17, 2013) and the device could not be read due to an empty battery. The device will be re-installed on the site at the beginning of the 2014 growing season. The NC Climate Retrieval and Observations Network of the Southeast (NC CRONOS) database was used to generate rainfall data for the site (NC CRONOS, 2013). Station 315177 – Lumberton was used. This station is less than two miles southeast (downstream) of the site. Normal annual precipitation for the station is 47.9 inches. Rainfall over the past 12 months totaled 52.4 inches, indicating that the past year has been slightly above normal.

On-site stream gauge data and USGS stream gauge data indicate two bankfull events over the course of the past 12 months (September 2012 to September 2013). Evidence of the bankfull events is present on-site and observed during MY2. There are drainage patterns from the canal into the wetlands on the back side of the access road and vegetation has been matted down in these areas.

Erosion was noted behind the matting at Roadway Cuts 1 and 2 during MY1. The erosion in these areas has not changed since MY1. More recent erosion was noted along the banks of Meadowbranch Canal in the vicinity of Roadway Cuts 3 and 4, and erosion is evident behind the matting at both of these areas. Photographs have been included with electronic files, but these areas were not identified as a problem at this time. The roadway cuts and bank condition will be monitored for changes during future monitoring events.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly Restoration Plan) documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

## **2.0        METHODOLOGY**

Three vegetation plots have been established along the former logging road within the project site. These plots were established according to CVS-EEP Protocol for Recording Vegetation (Lee et al., v.4.2, 2008) and are 20 meters by five meters in size. During MY1, the corners of each plot were marked with three-foot PVC piping and flagged. The southwest corner of each plot, or plot origin, was flagged with orange and the remaining three corners were flagged with blue. Planted stems were flagged with white.

Version 4.2 of the CVS-EEP Protocol for Recording Vegetation was used to inventory these plots (Level 1-2). Natural regeneration stems were recorded but not flagged. A reference photograph was taken from the origin of each plot, facing across the plot.

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Additionally, two random transects, 50 meters by two meters in size were established within the Chinese privet areas and inventoried for stems greater than one meter high. Stem counts included planted stems, volunteers, and invasive species (Chinese privet). Stem species and count were recorded. No stems were flagged within the transects.

Ten automated groundwater gauges, a stream gauge, and a rainfall gauge were installed at the site in October 2006. These gauges were installed in order to monitor the water table at the site during the initial project investigation and design. One of the 10 gauges was placed on the west side of Meadowbranch Swamp Canal in the reference wetland area in order to monitor reference wetland hydrology. Following the completion of construction, three additional automated groundwater gauges (gauges 11 through 13) were placed within the limits of the restored area of the former logging road to measure the groundwater table. All 13 gauges were located and marked with blue and white striped flagging. All 13 gauges are *Ecotone* brand water level monitors that were downloaded using a handheld *Meazura* MEZ1000 data logger. For the gauges where transects were used to locate them away from the former logging road or maintenance road, pink flagging was used to mark transect lines.

The stream gauge and rainfall gauge are also *Ecotone* brand monitors and were downloaded using the same equipment stated above.

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### 3.0 REFERENCES

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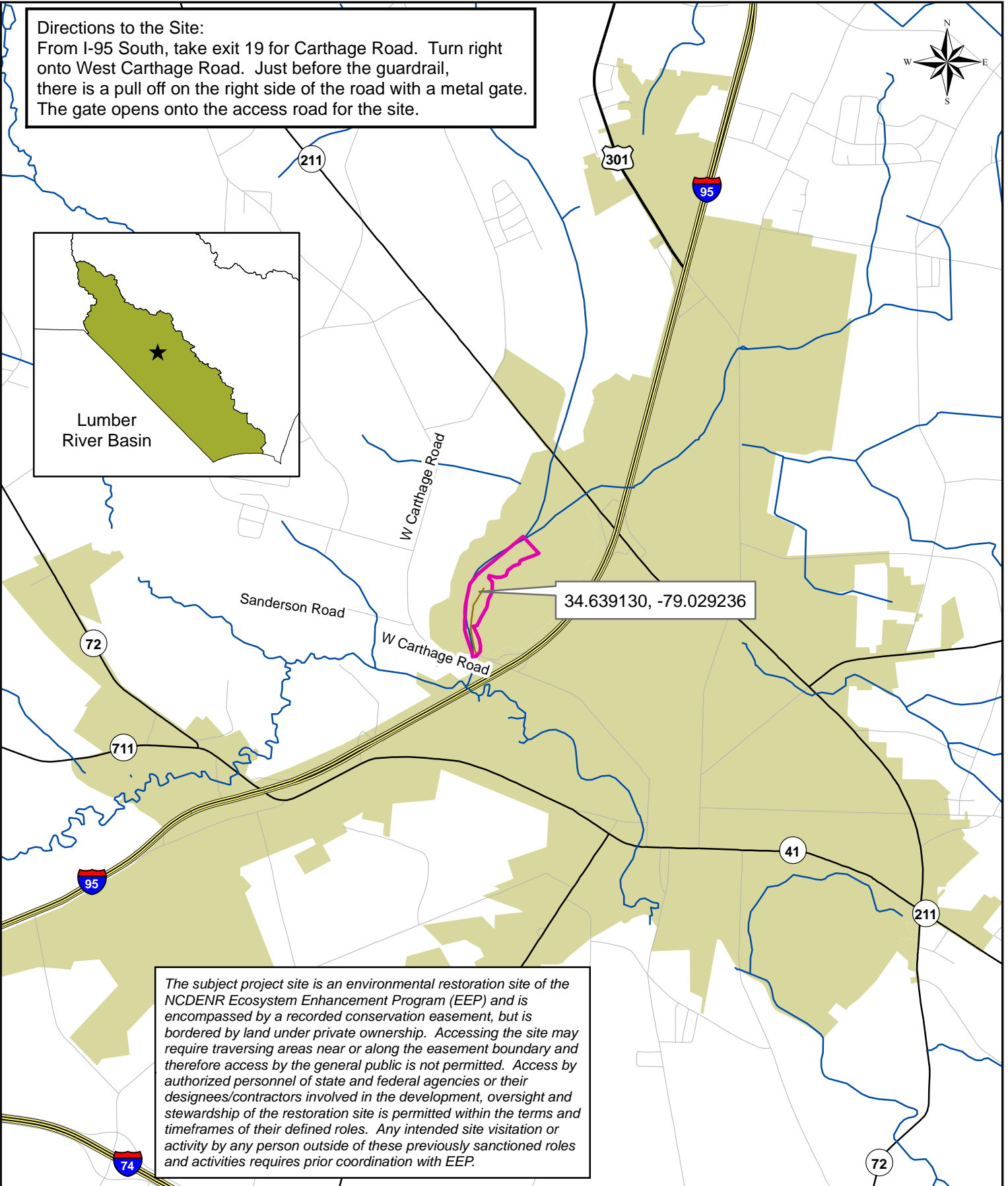
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**Appendices for Project Background, Condition and Performance Data**

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**Appendix A: Project Vicinity Map and Background Tables**

**Directions to the Site:**  
 From I-95 South, take exit 19 for Carthage Road. Turn right onto West Carthage Road. Just before the guardrail, there is a pull off on the right side of the road with a metal gate. The gate opens onto the access road for the site.



*The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP.*

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 NC Ecosystem Enhancement Program

**Project:** Meadowbranch Swamp  
 Wetland Restoration  
 Robeson County, NC  
 CU 03040203

<b>Project Number:</b> 92351	<b>Date:</b> October 2013
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**Legend**


- Project Area
- Former Logging Road
- Streams
- Interstate
- US Hwy
- NC Hwy
- Local Road
- Municipal Boundary

**Figure 1**  
 Vicinity Map and Directions

0 0.25 0.5 1 Miles

**Table 1a: Project Restoration Components**

Meadowbranch Swamp Wetland Restoration EEP Project Number 92351									
Project Component	Existing Acres	Restoration Level	Approach	Acreage	Stationing	Mitigation Ratio	Mitigation Units	BMP Elements	Comments
Former Logging Road	2.88	R1	Grading of Road, Removal of Ditch Feature, & Replanting	2.88	50+00 – 72+50	1:1	2.88		
Enhancement of Wetlands (Hydrological)	39.5	E	Improved Hydrologic Connections from Berm Cuts & Road Crossings	39.5		2:1	19.75		
Enhancement of Wetlands (Hydrological & Vegetative)	4.93	E	Improved Hydrologic Connections from Berm Cuts & Road Crossings, Privet Removal, Herbicide Treatment, & Replanting	4.93		2:1	2.47		
Enhancement of Wetlands (Vegetative)	0.35	E	Privet Removal, Herbicide Treatment, & Replanting	0.35		2:1	0.18		
Preservation (Wetlands)	0.87	P	Preservation of Existing Wetlands	0.87		5:1	0.17		

1 = BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond;  
 FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI – Natural Infiltration Area; O = Other  
 CF = Cattle Fencing; WS = Watering System; CH = Livestock Housing; Not Applicable = 

**Table 1b: Project Restoration Components**

Meadowbranch Swamp Wetland Restoration EEP Project Number 92351							
Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Riparian (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration		2.88					
Enhancement (Hydrological)		39.5					
Enhancement (Hydrological & Vegetative)		4.93					
Enhancement (Vegetative)		0.35					
Preservation (Wetlands)		0.87					
		48.53					
Totals (Acres)	0	48.53		0	0	0	0
MU Totals	0	25.45		0	0	0	0

Not Applicable = 

**Table 2: Project Activity and Reporting History**

**Elapsed Time Since Grading Complete: 2 yr 9 months**

**Elapsed Time Since Planting Complete: 2 yr 2 months**

**Number of Reporting Years: 2**

<b>Meadowbranch Swamp Wetland Restoration EEP Project Number 92351</b>		
<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Restoration Plan	Apr-07	Jun-07
Final Design – Construction Plans	Oct-10	Dec-10
Construction	N/A	Feb-11
Containerized, bare root and B&B plantings for reach/segments 1&2	N/A	Feb-11
Mitigation Plan/As-Built (Year 0 Monitoring – baseline)	Sep-11	Oct-11
Year 1 Monitoring	Nov-12	Jan-13
Year 2 Monitoring	Sep-13	Nov-13
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

**Table 3: Project Contacts Table**

<b>Meadowbranch Swamp Wetland Restoration EEP Project Number 92351</b>	
Designer  Primary project design POC	EcoEngineering – A Division of The John R. McAdams Co. 2905 Meridian Parkway Durham, NC 27713 George Buchholz 919-287-4262
Construction Contractor  Construction contractor POC	EQR, LLC 1405 Benson Court, Suite C Arbutus, MD 21227 James Walker 443-304-3314
Survey Contractor  Survey contractor POC	Turner Land Surveying PO Box 41023 Raleigh, NC 27629 David Turner 919-623-5095
Planting Contractor  Planting contractor POC	Natives, Inc. 550 East Westinghouse Boulevard Charlotte, NC 28273 Gregg Antemann 866-527-1177
Seeding Contractor  Seeding contractor POC	EQR, LLC 1405 Benson Court, Suite C Arbutus, MD 21227 James Walker 443-304-3314
Seed Mix Sources	ERNST Seeds 9066 Mercer Pike Meadville, PA 16335 800-873-3321
Nursery Stock Suppliers	NC Division of Forest Resources 1616 Mail Service Center Raleigh, NC 27699 919-733-2162
Monitoring Performers – Year 0  Monitoring POC	EcoEngineering – A Division of The John R. McAdams Co. 2905 Meridian Parkway Durham, NC 27713 George Buchholz 919-287-4262
Monitoring Performers – Year 1  Monitoring POC	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 Kathleen McKeithan 919-461-1597
Monitoring Performers – Year 2  Monitoring POC	URS Corporation – North Carolina 201 N Front Street, Suite 509 Wilmington, NC 28401 Susan Westberry 910-343-5994

**Table 4: Project Baseline Information and Attributes**

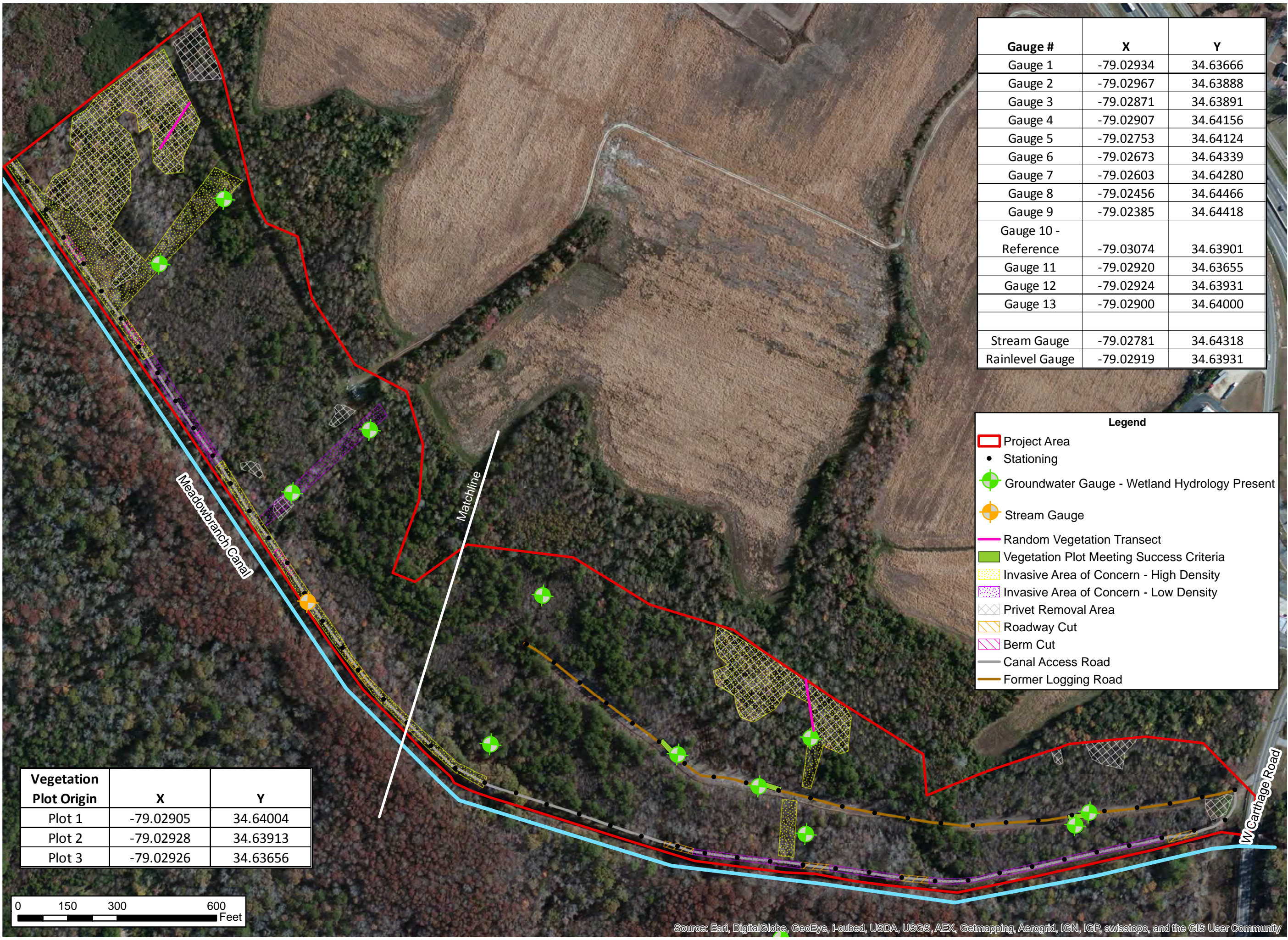
<b>Meadowbranch Swamp Wetland Restoration</b> EEP Project Number 92351	
Project County	Robeson
Physiographic Region	Inner Coastal Plain
Ecoregion	Southeastern Floodplains and Low Terrace
Project River Basin	Lumber
USGS HUC for Project (14 digit)	03040203 080010
NCDWQ Sub-basin for Project	03-07-51
Within extent of EEP Watershed Plan?	N/A
WRC Hab Class (Warm, Cool, Cold)	Warm
% of project easement fenced or demarcated	100%; by canal & by EEP markers
Beaver activity observed during design phase?	Yes
Restoration Component Attribute Table	
	<b>PROJECT SITE</b>
Meadowbranch Canal Drainage Area	34.4 ac
Stream order	3 <sup>rd</sup>
Restored length	N/A
Perennial or Intermittent	N/A
Watershed type (rural, urban, developing, etc.)	Developing
Watershed LULC Distribution	N/A
Watershed impervious cover	N/A
NCDWQ AU/Index number	14-12
NCDWQ classification	C; Sw
303(d) listed?	No*
Upstream of a 303(d) listed segment?	No*
Reasons for 303(d) listing or stressor	N/A
Total acreage of easement	55.4
Total vegetated acreage within the easement (wetland & privet areas)	50.61
Total planted acreage as part of the restoration (former logging road & privet areas)	8.16
Dominant soil series and characteristics	
Series	Bibb
Depth	N/A
Clay %	N/A
K	N/A
T	N/A

\* The Lumber River is not listed as impaired on the 2012 Draft 303(d) list, but was listed at the time of the project inception and construction.



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## **Appendix B: Visual Assessment Data**



Gauge #	X	Y
Gauge 1	-79.02934	34.63666
Gauge 2	-79.02967	34.63888
Gauge 3	-79.02871	34.63891
Gauge 4	-79.02907	34.64156
Gauge 5	-79.02753	34.64124
Gauge 6	-79.02673	34.64339
Gauge 7	-79.02603	34.64280
Gauge 8	-79.02456	34.64466
Gauge 9	-79.02385	34.64418
Gauge 10 - Reference	-79.03074	34.63901
Gauge 11	-79.02920	34.63655
Gauge 12	-79.02924	34.63931
Gauge 13	-79.02900	34.64000
Stream Gauge	-79.02781	34.64318
Rainlevel Gauge	-79.02919	34.63931

Legend	
	Project Area
	Stationing
	Groundwater Gauge - Wetland Hydrology Present
	Stream Gauge
	Random Vegetation Transect
	Vegetation Plot Meeting Success Criteria
	Invasive Area of Concern - High Density
	Invasive Area of Concern - Low Density
	Privet Removal Area
	Roadway Cut
	Berm Cut
	Canal Access Road
	Former Logging Road

Vegetation Plot Origin	X	Y
Plot 1	-79.02905	34.64004
Plot 2	-79.02928	34.63913
Plot 3	-79.02926	34.63656



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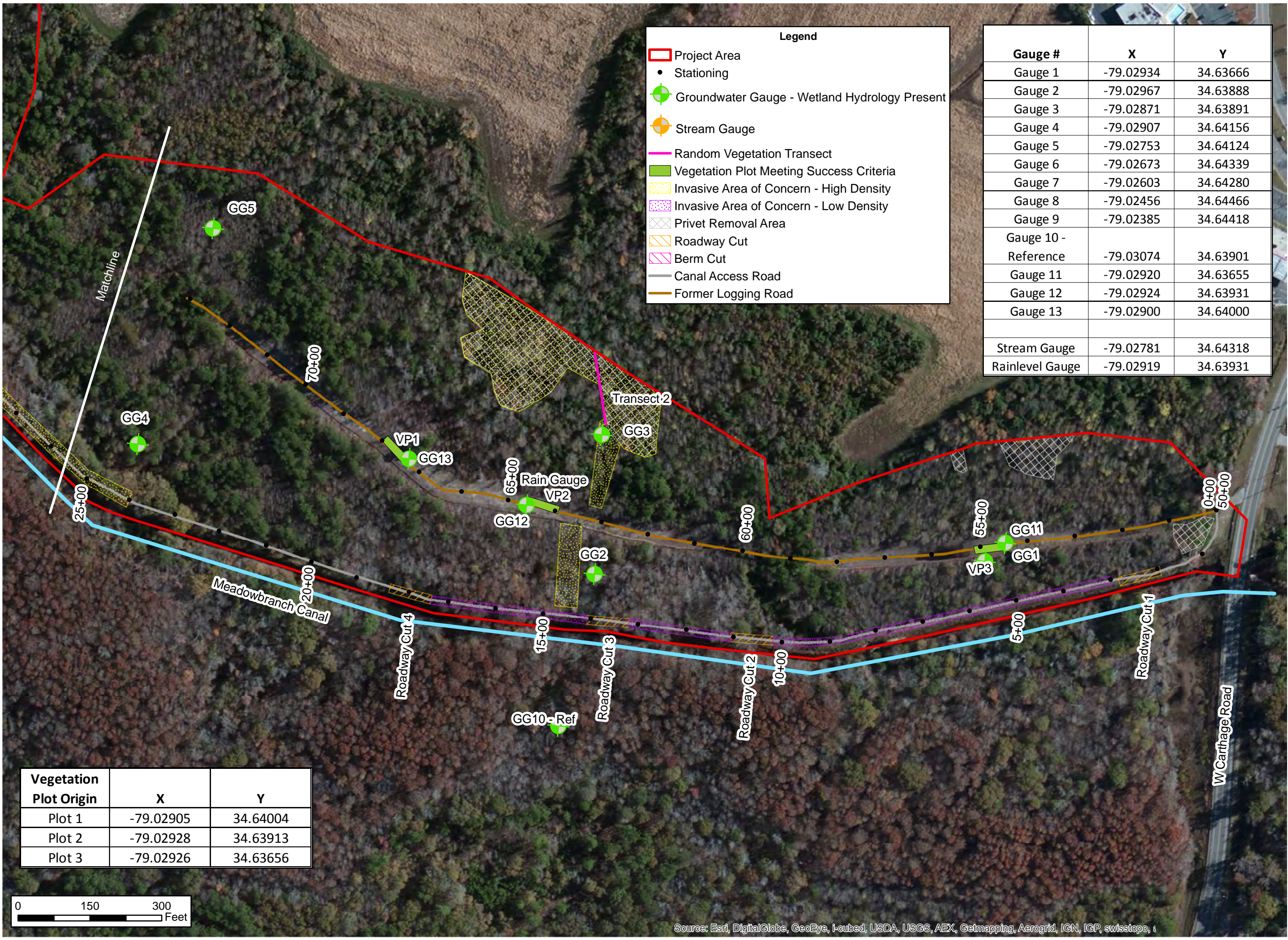
**Date:**  
 October 2013



2012 Aerial  
 Orthophotography  
 (Source: ESRI Basemap)

**Figure 2**  
 Current Condition  
 Plan View  
 Project Overview

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

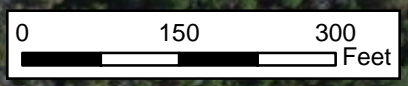


**Legend**

- Project Area
- Stationing
- Groundwater Gauge - Wetland Hydrology Present
- Stream Gauge
- Random Vegetation Transect
- Vegetation Plot Meeting Success Criteria
- Invasive Area of Concern - High Density
- Invasive Area of Concern - Low Density
- Privet Removal Area
- Roadway Cut
- Berm Cut
- Canal Access Road
- Former Logging Road

Gauge #	X	Y
Gauge 1	-79.02934	34.63666
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Gauge 3	-79.02871	34.63891
Gauge 4	-79.02907	34.64156
Gauge 5	-79.02753	34.64124
Gauge 6	-79.02673	34.64339
Gauge 7	-79.02603	34.64280
Gauge 8	-79.02456	34.64466
Gauge 9	-79.02385	34.64418
Gauge 10 - Reference	-79.03074	34.63901
Gauge 11	-79.02920	34.63655
Gauge 12	-79.02924	34.63931
Gauge 13	-79.02900	34.64000
Stream Gauge	-79.02781	34.64318
Rainlevel Gauge	-79.02919	34.63931

Vegetation Plot Origin	X	Y
Plot 1	-79.02905	34.64004
Plot 2	-79.02928	34.63913
Plot 3	-79.02926	34.63656



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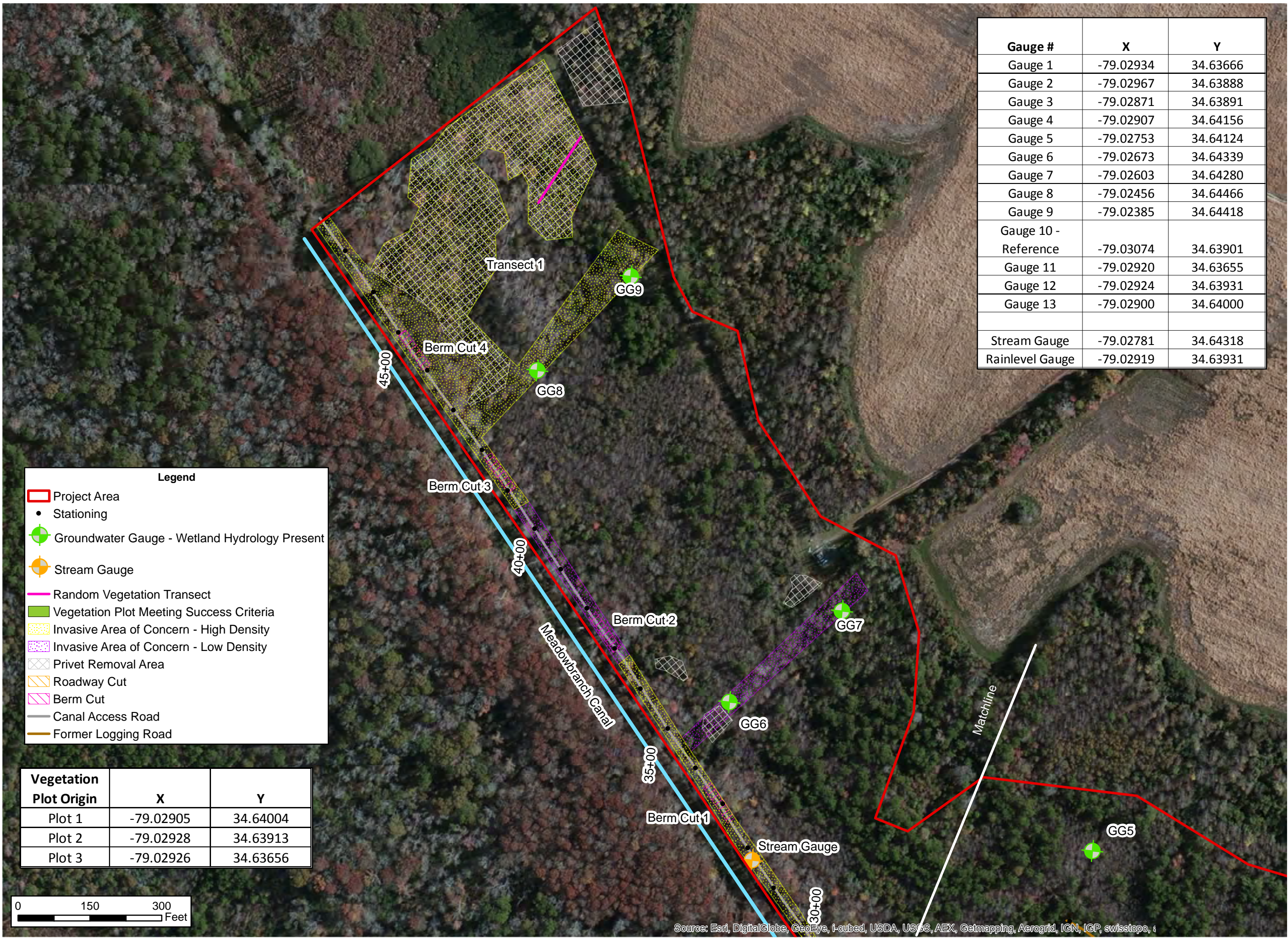
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2012 Aerial  
 Orthophotography  
 (Source: ESRI Basemap)

**Figure 2a**  
 Current Condition  
 Plan View

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, etc.



Gauge #	X	Y
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Prepared For:  
 NC Ecosystem  
 Enhancement Program

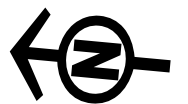


Project:  
 Meadowbranch Swamp  
 Wetland Restoration  
 Robeson County, NC  
 CU 03040203

Monitoring Year:  
 2 (2013)

Project Number:  
 92351

Date:  
 October 2013



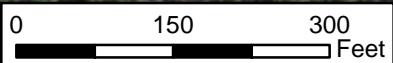
2012 Aerial  
 Orthophotography  
 (Source: ESRI Basemap)

Figure 2b  
 Current Condition  
 Plan View

**Legend**

- Project Area
- Stationing
- + Groundwater Gauge - Wetland Hydrology Present
- + Stream Gauge
- Random Vegetation Transect
- Vegetation Plot Meeting Success Criteria
- Invasive Area of Concern - High Density
- Invasive Area of Concern - Low Density
- Privet Removal Area
- Roadway Cut
- Berm Cut
- Canal Access Road
- Former Logging Road

Vegetation Plot Origin	X	Y
Plot 1	-79.02905	34.64004
Plot 2	-79.02928	34.63913
Plot 3	-79.02926	34.63656



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, etc.

**Table 5: Vegetation Condition Assessment Table**

Meadowbranch Swamp Wetland Restoration EEP Project Number 92351						
<b>Planted Acreage</b>	<b>8.16</b>					
<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
<b>1. Bare Areas</b>	Very limited cover of both woody and herbaceous material	0.1 acres	N/A	0	0	0
<b>2. Low Stem Density Areas</b>	Woody stem densities clearly below target levels based on 3, 4, or 5 stem count criteria	0.1 acres	N/A	0	0	0
<b>Total</b>				<b>0</b>	<b>0</b>	<b>0</b>
<b>3. Areas of Poor Growth Rates or Vigor</b>	Areas with woody stems of a size class that are obviously small given the monitoring year	0.25 acres	N/A	0	0	0
<b>Cumulative Total</b>				<b>0</b>	<b>0</b>	<b>0</b>
<b>Easement Acreage</b>	<b>55.4</b>					
<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
<b>4. Invasive Areas of Concern – High Density</b>	Areas of presence and/or re-growth of Chinese privet with high density	1000 SF	Yellow dot pattern	4	7.14	12.9
<b>5. Invasive Areas of Concern – Low Density</b>	Areas of presence and/or re-growth of Chinese privet with low density, or spotty growth	1000 SF	Purple dot pattern	5	9.79	17.7
<b>6. Easement Encroachment Areas</b>	Areas or points (if too small to render as polygons at map scale)	none	N/A	0	0	0

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## Vegetation Monitoring Plot Photos



VP1



VP2



VP3

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## **Appendix C: Vegetation Plot Data**



**Table 6: Vegetation Plot Mitigation Success Summary Table**  
**Meadowbranch Swamp Wetland Restoration**  
**EEP Project Number 92351**

Tract	Vegetation Plot ID	Vegetation Survival Threshold Met?
Meadowbranch	VP1	Yes
	VP2	Yes
	VP3	Yes

**Table 7: CVS Vegetation Metadata Table**

<b>Report Prepared By</b>	Susan Westberry
<b>Date Prepared</b>	9/23/2013 16:33
<b>database name</b>	Meadowbranch Swamp Canal_92351_MY2_2013.mdb
<b>database location</b>	Z:\Share\SW\Meadowbranch Monitoring\cvs-eep-entrytool-v2.3.1
<b>computer name</b>	1612LP-W70005
<b>file size</b>	59768832
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----</b>	
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Proj, planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Proj, total stems</b>	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
<b>ALL Stems by Plot and spp</b>	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
<b>PROJECT SUMMARY-----</b>	
<b>Project Code</b>	92351
<b>project Name</b>	Meadowbranch Swamp Wetland Restoration
<b>Description</b>	restore surface flow and groundwater elevations within the site area by removing the former logging road and modifying the canal access road
<b>River Basin</b>	Lumber
<b>length(ft)</b>	4788
<b>stream-to-edge width (ft)</b>	7
<b>area (sq m)</b>	6226.85
<b>Required Plots (calculated)</b>	3
<b>Sampled Plots</b>	3

Table 8: CVS Stem Count Total and Planted by Plot and Species

Scientific Name	Common Name	Species Type	Current Plot Data (MY2 2013)									Annual Means								
			E92351-01-0001			E92351-01-0002			E92351-01-0003			MY2 (2013)			MY1 (2012)			MY0 (2011)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree									4			4			6			
Betula nigra	river birch	Tree	7	7	34	4	4	25	5	5	32	16	16	91	15	15	16	16	16	16
Fraxinus pennsylvanica	green ash	Tree	2	2	2	1	1	1	4	4	4	7	7	7	5	5	5	7	7	7
Liquidambar styraciflua	sweetgum	Tree			8						7			15						
Morella cerifera	wax myrtle	shrub									4			4						
Pinus taeda	loblolly pine	Tree									5			5			1			
Quercus	oak	Tree							1	1	1	1	1	1	2	2	2	3	3	3
Quercus laurifolia	laurel oak	Tree				1	1	1				1	1	1	4	4	4	4	4	4
Quercus lyrata	overcup oak	Tree	2	2	2	2	2	2				4	4	4	3	3	4	6	6	6
Quercus nigra	water oak	Tree																3	3	3
Quercus pagoda	cherrybark oak	Tree																1	1	1
Quercus phellos	willow oak	Tree	1	1	1	2	2	2	5	5	5	8	8	8	12	12	12	15	15	15
Salix nigra	black willow	Tree									3			3						
Taxodium distichum	bald cypress	Tree	1	1	1							1	1	1	1	1	1	1	1	1
<b>Stem count</b>			13	13	48	10	10	31	15	15	65	38	38	144	42	42	51	56	56	56
<b>size (ares)</b>			1			1			1			3			3			3		
<b>size (ACRES)</b>			0.02			0.02			0.02			0.07			0.07			0.07		
<b>Species count</b>			5	5	6	5	5	5	4	4	9	7	7	12	7	7	9	9	9	9
<b>Stems per ACRE</b>			526.1	526.1	1942	404.7	404.7	1255	607	607	2630	512.6	512.6	1942	566.6	566.6	688	755.4	755.4	755.4

**Color for Density**

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

**Table 9: Stem Count Total by Random Transect Plot**

Scientific Name	Common Name	Species Type	Current Plot Data (MY2 2013)	
			Random Transect 1	Random Transect 2
			Total	Total
<i>Acer rubrum</i>	red maple	Tree	5	12
<i>Ligustrum sinense</i>	Chinese privet	Shrub/Tree	71	76
<i>Liriodendron tulipifera</i>	tulip tree	Tree		4
<i>Nyssa sylvatica</i>	black gum	Tree	3	
<i>Oxydendrum arboreum</i>	sourwood	Tree		4
<i>Sambucus canadensis</i>	elderberry	Shrub	5	
<i>Fraxinus pennsylvanica</i>	green ash	Tree	2	4
<i>Quercus falcata</i>	Southern red oak	Tree	1	
<i>Morella cerifera</i>	wax myrtle	Shrub/Tree	1	
<b>Total stem count</b>			88	100
<b>Invasive stem count</b>			71	76
<b>Native stem count</b>			17	24
<b>size (ares)</b>			1	
<b>size (ACRES)</b>			0.02	
<b>Species count</b>			7	5
<b>Native stems per acre</b>			850	1,200
<b>Percent of total stems invasive</b>			80.7	76.0

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## **Appendix D: Hydrologic Data**

**Table 10: Verification of Bankfull Events**  
**Meadowbranch Swamp Wetland Restoration**  
**EEP Project Number 92351**

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
7/2/13	7/2/13	Site photographs (canal over bankful, overtopping banks; logging road submerged)	990, 992
8/30/13	Unknown	Site photographs (flow patterns from canal into wetlands on back side of access road)	276
9/17/13	6/13/13 to 6/15/13; 7/11/13 to 7/15/13	On-site data logger ( <i>Ecotone</i> water level gauge)	
9/17/13	Unknown	Site photographs (sediment within reference wetland indicating water above bankfull)	37, 38
9/17/13	Unknown	Site photographs (sediment at berm cuts indicating water above bankfull)	7, 13
9/27/13	Two between 9/16/12 and 9/16/13	Proximal USGS gauge resource (supports findings of on-site data logger)	

The data logger on-site recorded two bankfull events between September 16, 2012 and September 16, 2013. Proximal USGS gauge data support this finding. Potential bankfull occurrence for the entire year (September 16, 2012 to September 16, 2013) was extrapolated based on USGS stream gauge discharge data for the Lumber River at Lumberton, NC. The USGS gauge plot is shown below (Figure 3). The gauge is located less than two miles downstream from the project site and has a drainage area of 708 square miles.

An estimate of the number of bankfull events between September 16, 2012 and September 16, 2013 was made by comparing the stream discharges from the USGS data in cubic feet per second (cfs) against the bankfull discharge estimated from the drainage area on the Coastal Plain Regional Curve. According to the regional curve, a bankfull event occurs on a stream with a 708-square mile drainage area when the discharge is about 2,000 cfs. This discharge was exceeded twice during the past year, and verifies the results from the on-site data logger. On June 11, 2013, the USGS gauge reached 2,210 cfs, it peaked during this event at 3,390 cfs on June 13, 2013 and receded below 2,000 cfs on June 18, 2013. On July 2, 2013, the USGS gauge reached 2,760 cfs, it peaked during this event at 3,830 cfs on July 6, 2013 and receded below 2,000 cfs on July 18, 2013.

Rainfall data are presented in Figure 4.



Photo 990. Canal above bankful at culvert on West Carthage Road



Photo 992. Old logging road submerged



Photo 276. Drainage patterns from canal into wetland on backside of access road



Photo 37. Sediment in reference wetland



Photo 38. Sediment in reference wetland





Photo 7. Sediment at berm cut



Photo 13. Sediment at berm cut

Figure 3: USGS Proximal Gauge: Lumber River at Lumberton, NC

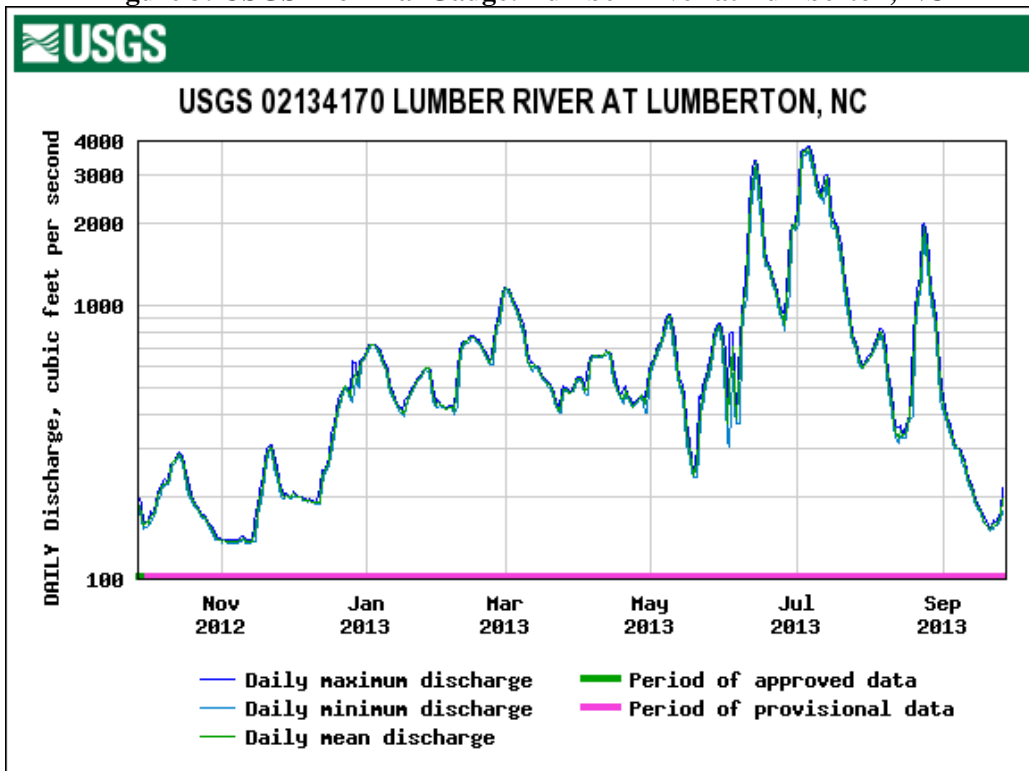
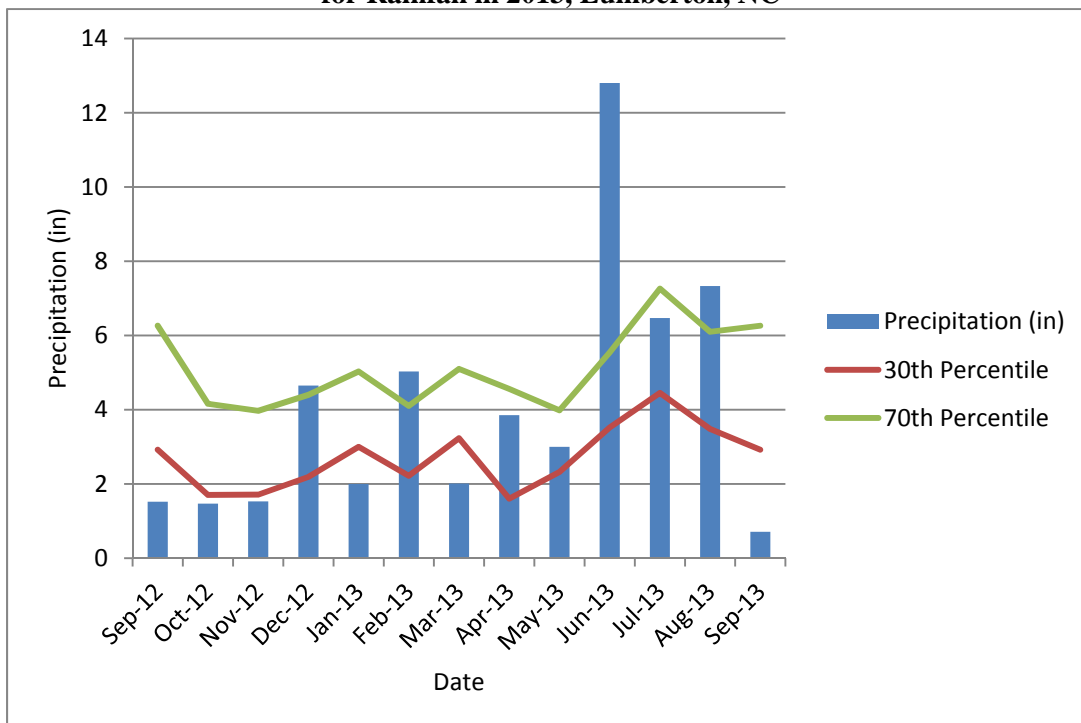
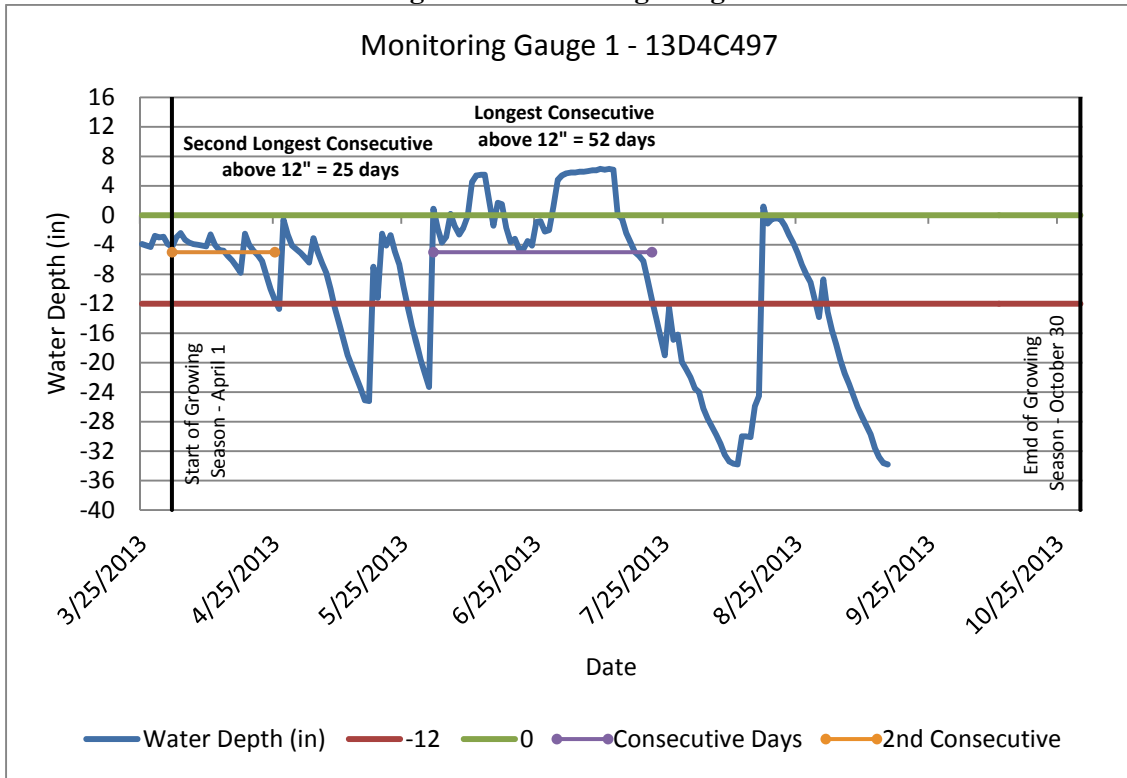


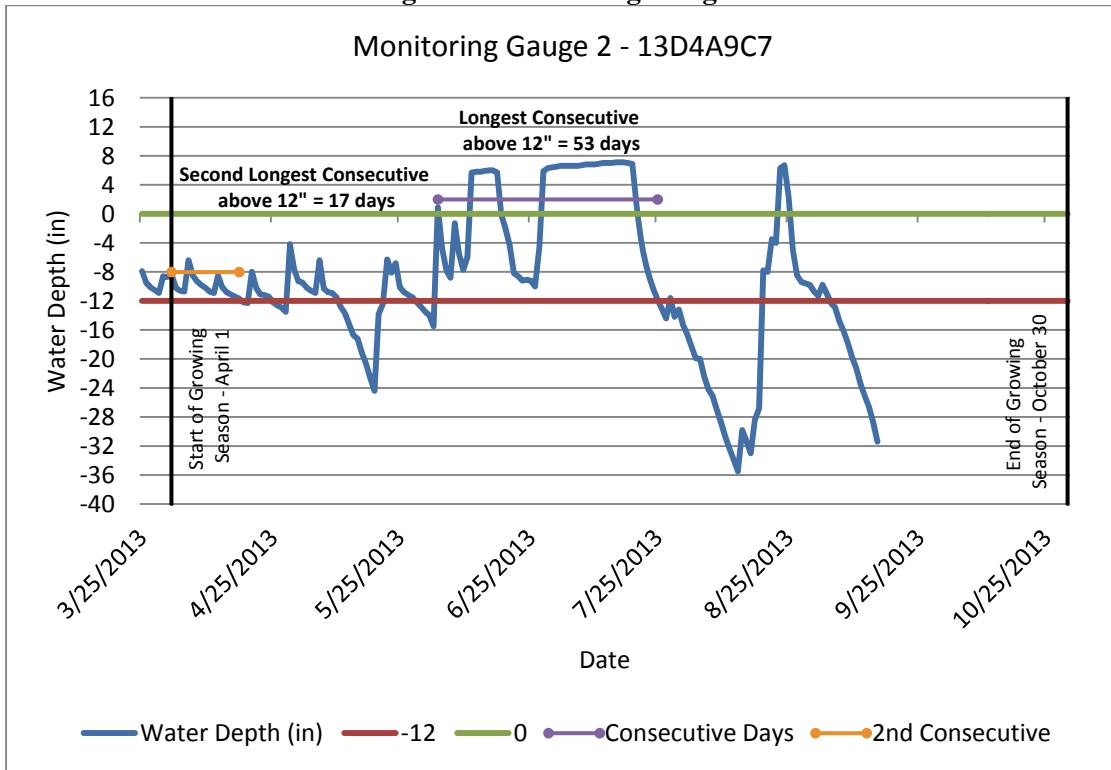
Figure 4: Meadowbranch Swamp Canal 30-70 Percentile Graph for Rainfall in 2013, Lumberton, NC



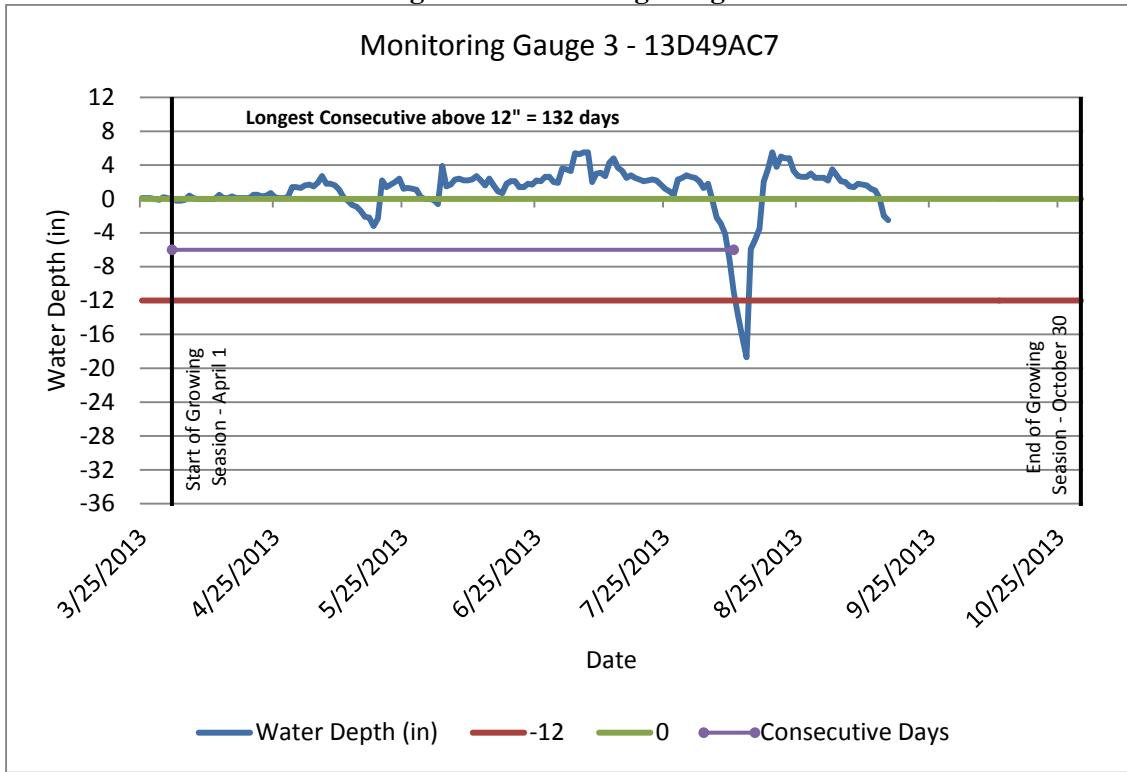
**Figure 5: Monitoring Gauge 1**



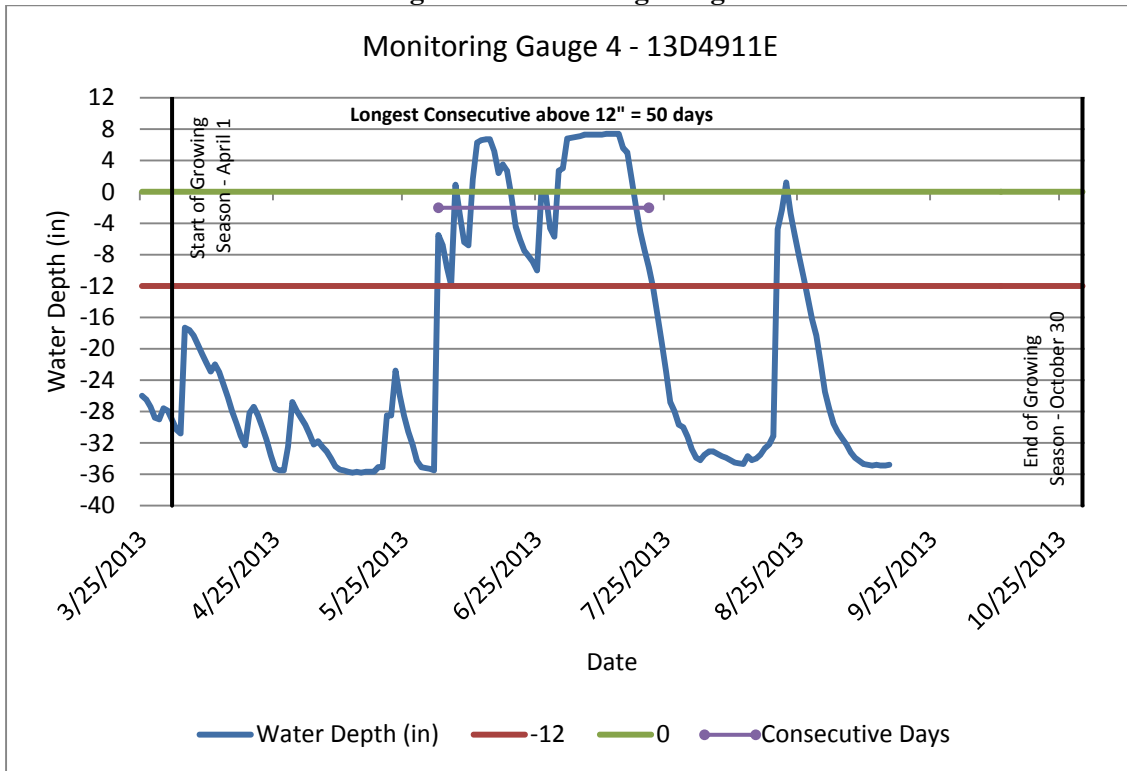
**Figure 6: Monitoring Gauge 2**



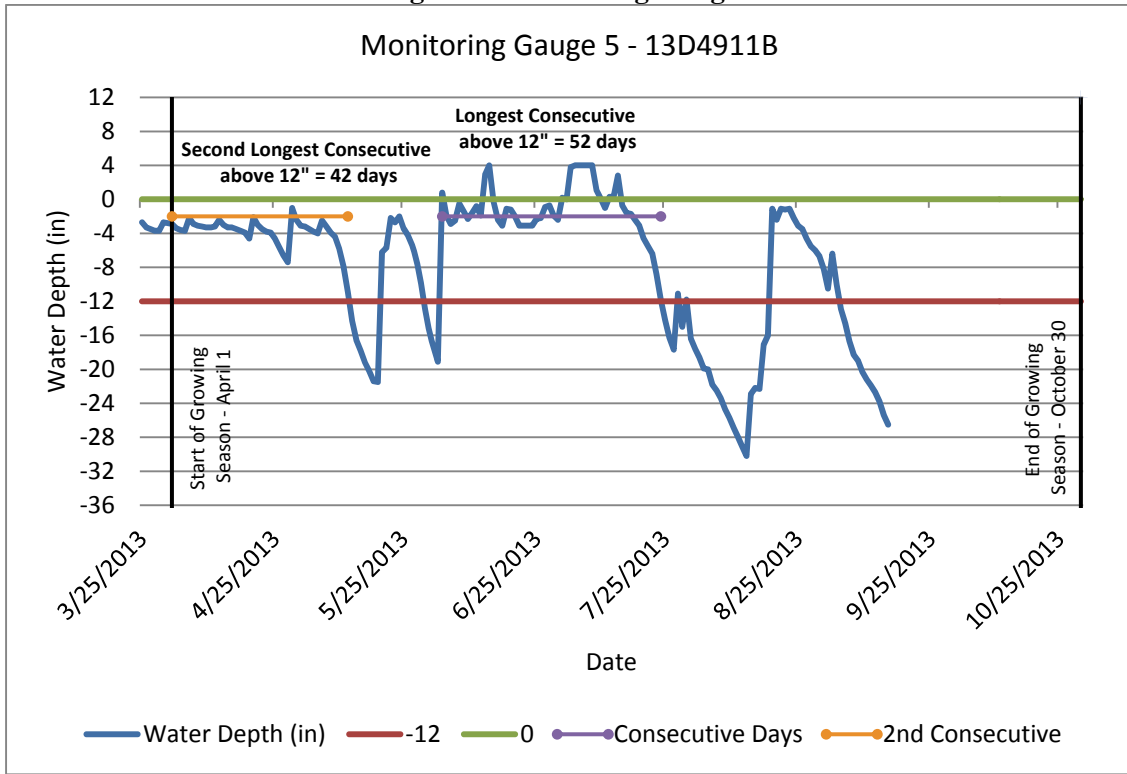
**Figure 7: Monitoring Gauge 3**



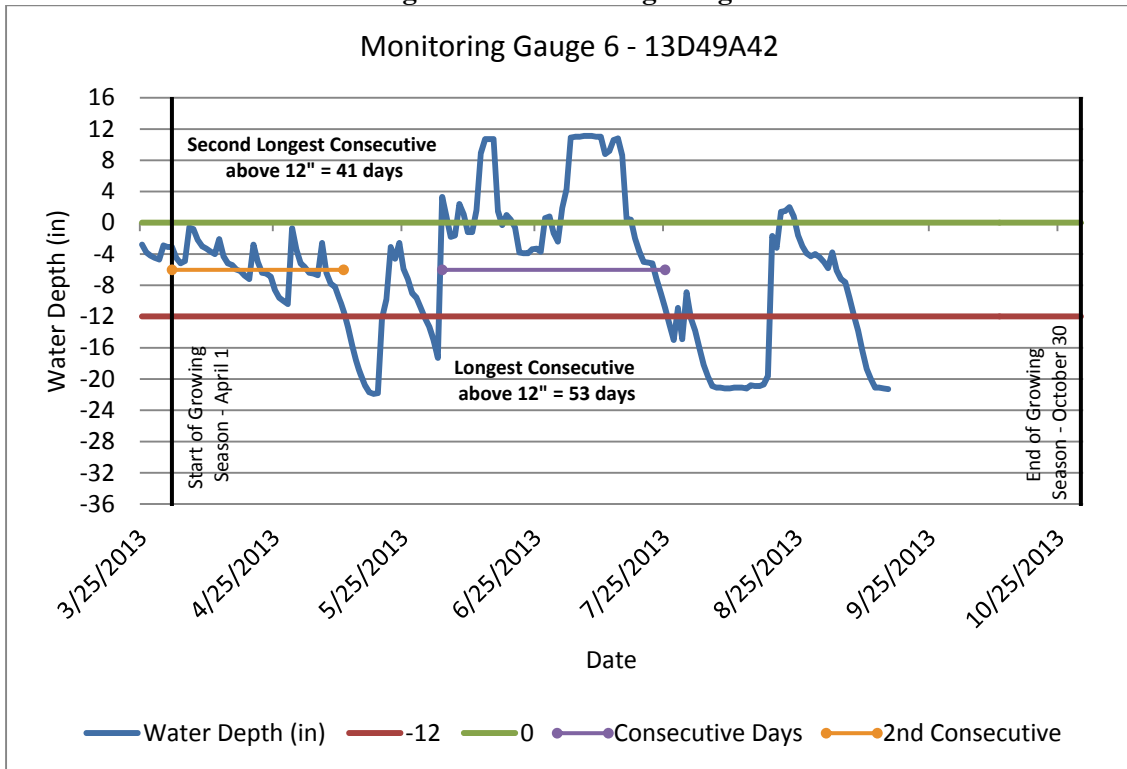
**Figure 8: Monitoring Gauge 4**



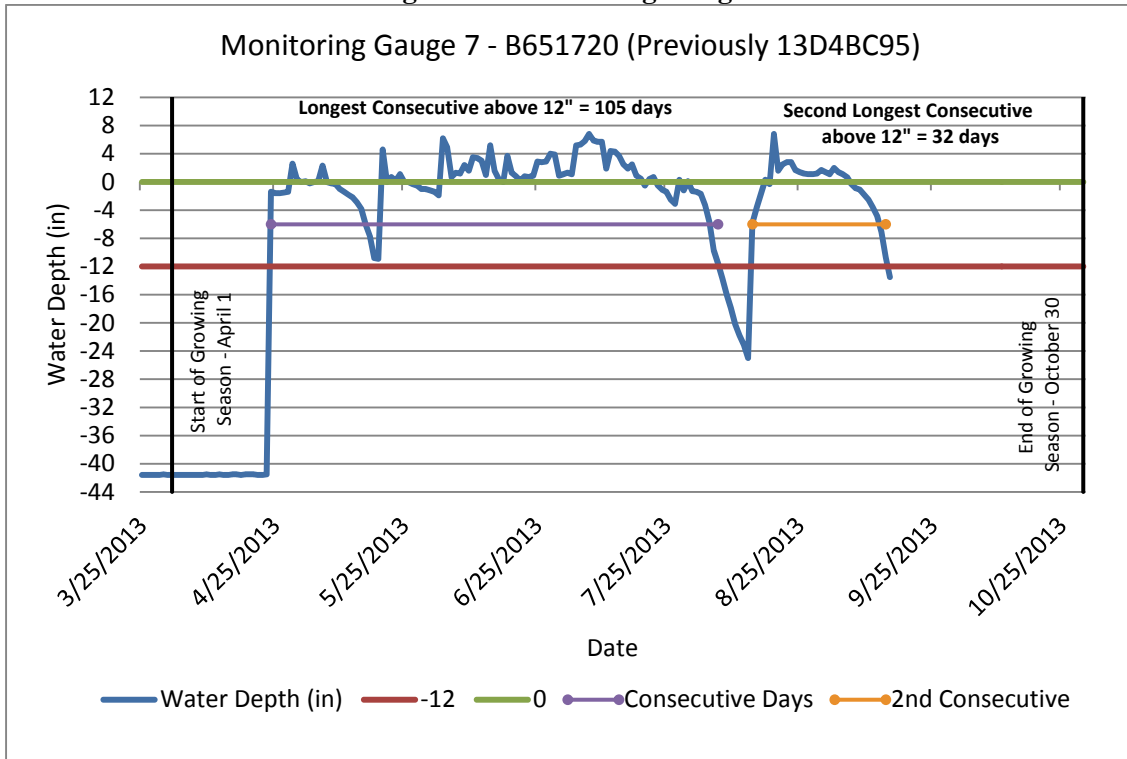
**Figure 9: Monitoring Gauge 5**



**Figure 10: Monitoring Gauge 6**

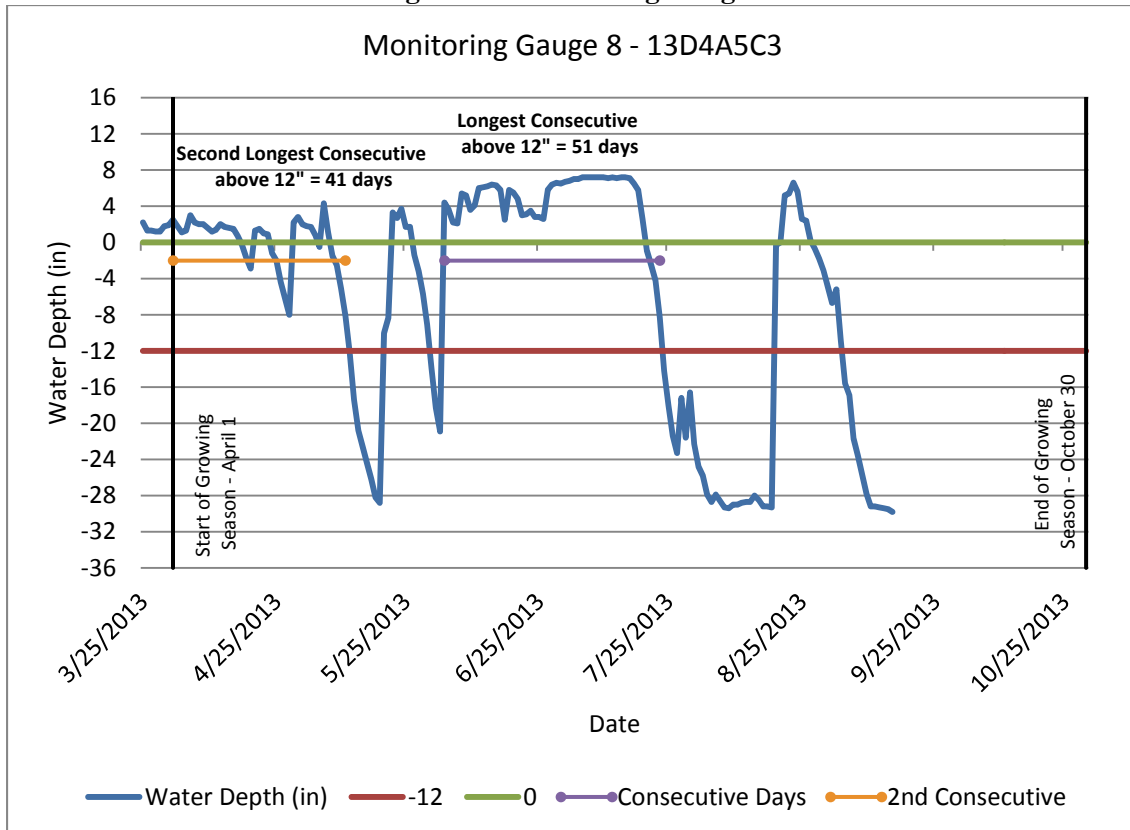


**Figure 11: Monitoring Gauge 7**

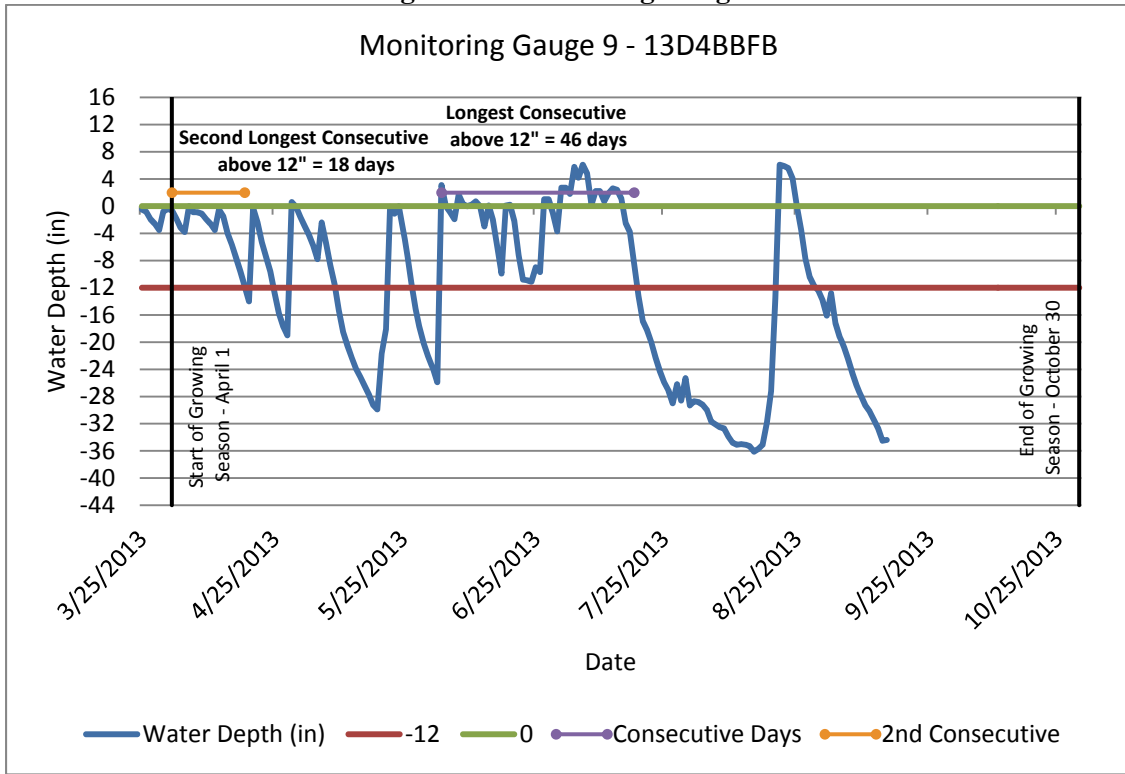


\*Note: Gauge was installed on April 24, 2013. Previously installed gauge was not functioning properly.

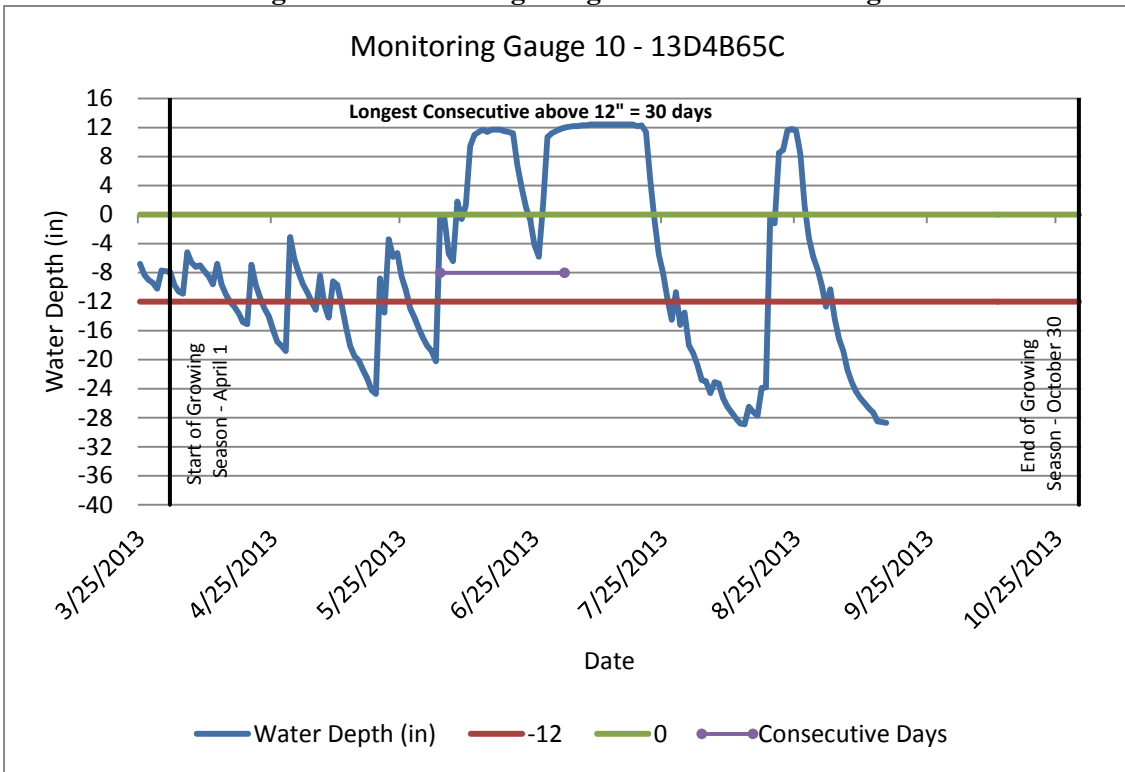
**Figure 12: Monitoring Gauge 8**



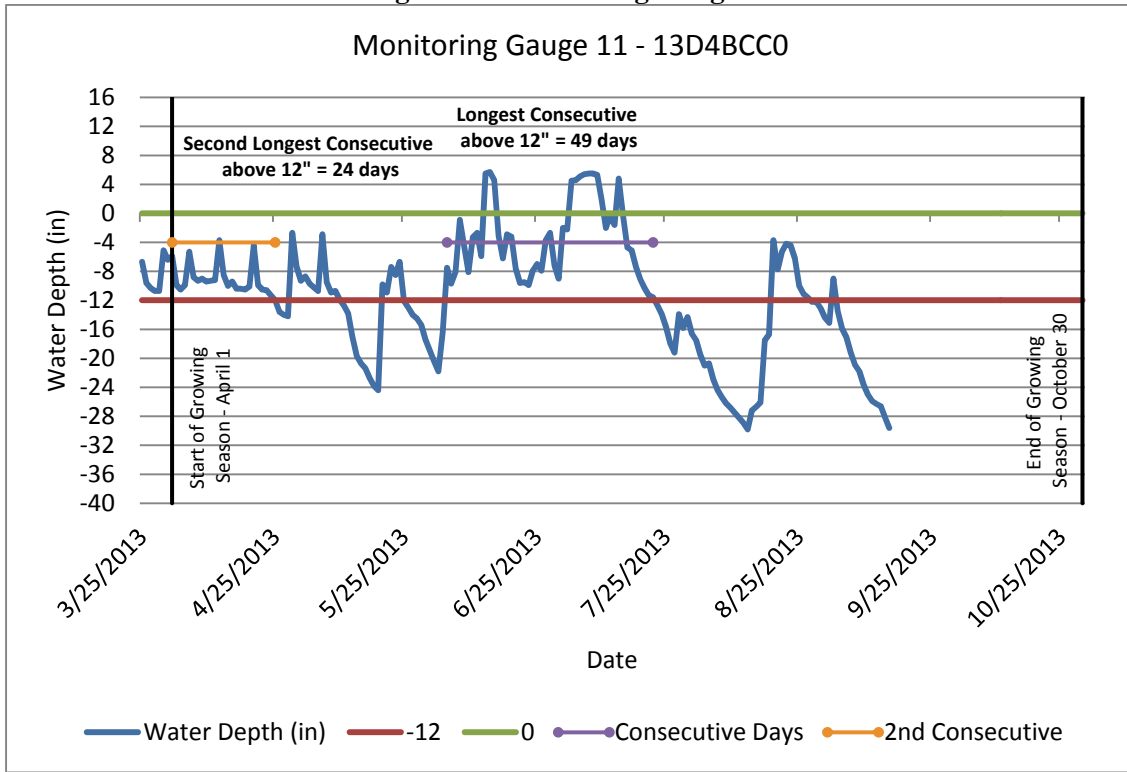
**Figure 13: Monitoring Gauge 9**



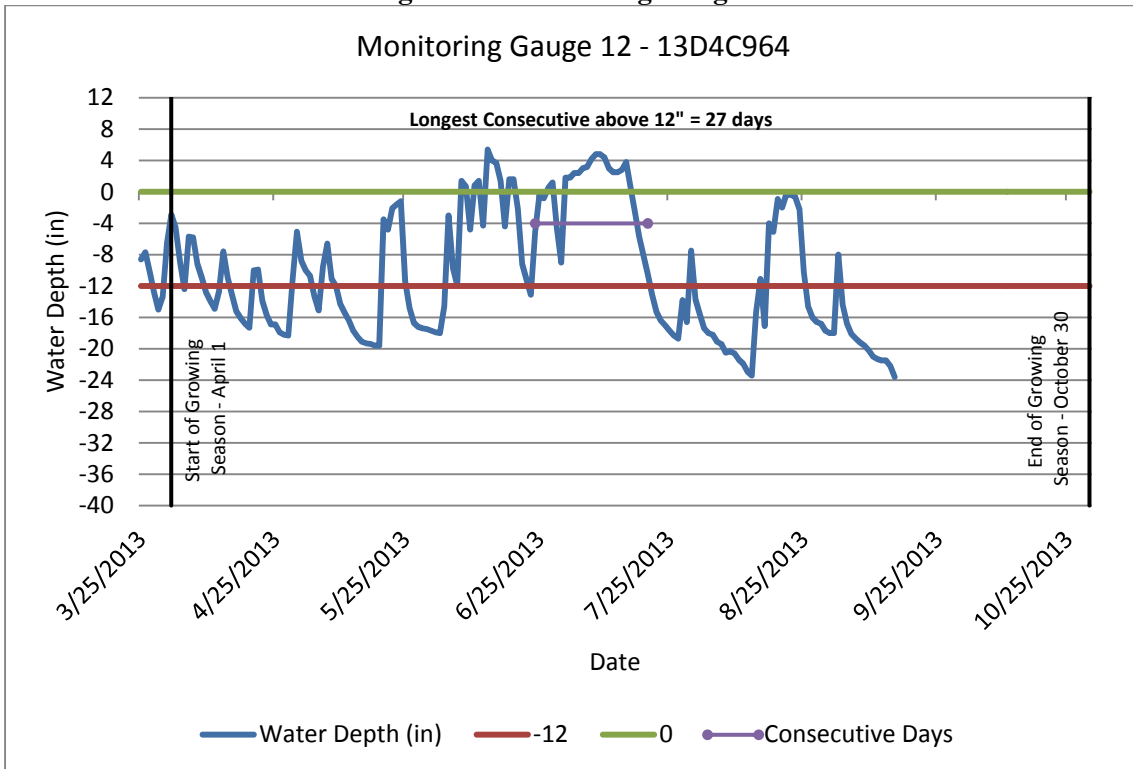
**Figure 14: Monitoring Gauge 10 – Reference Gauge**



**Figure 15: Monitoring Gauge 11**

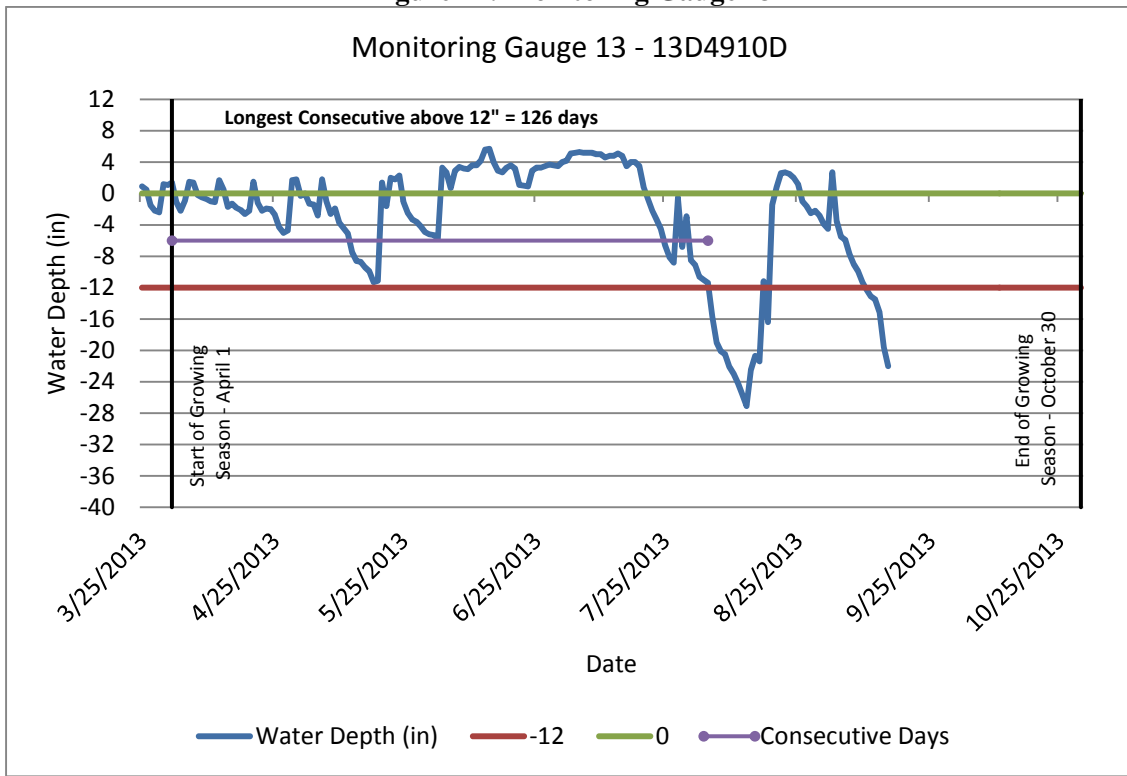


**Figure 16: Monitoring Gauge 12**





**Figure 17: Monitoring Gauge 13**



**Table 11: Wetland Hydrology Criteria Attainment**

Meadowbranch Swamp Wetland Restoration EEP Project Number 92351						
	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)*					
Gauge	Year 0 (2011)	Year 1 (2012)	Year 2 (2013)	Year 3 (2014)	Year 4 (2015)	Year 5 (2016)
1	No/0 (0%)	No/13 (6.1%)	Yes/52 (24.4%)			
2	Yes/50 (23.5%)	No/11 (5.2%)	Yes/53 (24.9%)			
3	No/0 (0%)	Yes/75 (35.2%)	Yes/132 (62.0%)			
4	No/8 (3.8%)	No/0 (0%)	Yes/50 (23.5%)			
5	Yes/55 (25.8%)	No/17 (8%)	Yes/52 (24.4%)			
6	Yes/73 (34.3%)	No/13 (6.1%)	Yes/53** (24.9%)			
7	Yes/83 (39%)	No/3 (1.4%)	Yes/105 (49.3%)			
8	No/13 (6.1%)	No/16 (7.5%)	Yes/51 (23.9%)			
9	Yes/50 (23.5%)	No/5 (2.3%)	Yes/46 (21.6%)			
10 - Ref	Yes/21 (9.9%)	No/7 (3.3%)	Yes/30** (14.1%)			
11	N/A	No/4 (1.9%)	Yes/49 (23.0%)			
12	N/A	No/12 (5.6%)	Yes/27 (12.7%)			
13	N/A	No/15 (7%)	Yes/126 (59.2%)			

\* Growing season is 213 days. Ten percent of growing season is equal to 21 days or more of consecutive readings above 12 inches.

\*\* Gauges 6 and 10 were both protruding from the ground. The elevations were adjusted to compensate for the distance between the calibration level and the ground surface. Gauge 6 was 7 inches above the ground, and gauge 10 was 5.2 inches above the ground.