

Meadowbranch Swamp Wetland Restoration

Robeson County

Restoration Plan



Prepared for:
North Carolina Department of the Environment and Natural Resources
Ecosystem Enhancement Program (NCDENR-EEP)
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Executive Summary

The Meadowbranch Swamp Wetland Restoration site has been selected for wetland restoration, enhancement, and preservation by the North Carolina Department of the Environment and Natural Resources, Ecosystem Enhancement Program (NCDENR-EEP). The purpose of this restoration project is to restore, enhance, and preserve a low lying area adjacent to Meadowbranch Swamp.

The project site is approximately one-half mile west-northwest of Lumberton, in Robeson County, North Carolina as depicted on **Figure 1**, Project Site and Reference Site Vicinity Map. The project lies within USGS Hydrologic Unit Code 03040203 080010 (USGS, 1974) and within NC DWQ Lumber River Subbasin 03-07-51 (NCDENR, 2003).

The project goal for this restoration plan is to restore surface flow and groundwater elevations within the site area by removing the former logging road and modifying the canal access road. The intent of this project is to change these site features to restore the wetland functions as closely as possible to that of pre-disturbance conditions. The design will be based on reference conditions, USACE guidance (USACE, 1987) and criteria that are developed during this project to achieve success.

Currently the site consists of a wooded parcel owned by the Lumber River Conservancy that encompasses approximately 57.0 acres. Channelized water features exist on and adjacent to the site. One drainage feature is located along the eastern edge of the former logging road and another more prominent feature, referred to as Meadowbranch Swamp, flows under SR 211 north of the project area and continues southward to the end of the project area at SR 1538 Carthage Road.

The primary actions to restore the site will include removal of the former logging road, and minor earthwork to modify the existing access road along the canal. Several road crossings, low areas built into the access road, will be designed to mimic the natural swale observed adjacent to the reference area. These road crossings will allow flood events onto the project parcel. The road modifications are necessary because the City of Lumberton will not allow any modifications to the existing channel and they require access along the maintenance road. The area located to the east of the former logging road is a prime example of an area partially isolated from overbank flooding. Soil excavated to create the former logging road will be returned to its original location. This will hydrologically reconnect the site east of the former logging road to the rest of the site, allowing water from overbank flood events to be distributed and stored over the entire site. Through these actions, it is expected that approximately 50 acres of riverine wetlands will be restored, enhanced, and preserved.

Tables 1 through **7**, within the text of this document, primarily apply to soils and vegetation and are referred to as "**Tables**". Tables referenced in an attached appendix (Section 8.0) are referenced as "**Exhibit Tables**". **Exhibit Tables 1** through **7** present project restoration structures and objectives, drainage areas, land use of watershed, groundwater monitoring summary, rainfall summary, designed vegetative communities (by zone), and a restoration summary. **Figures 1** through **9** primarily depict site and reference wetland conditions, and also depict historical site conditions. **Sheets 1** through **7** illustrate existing conditions, site cross-sections, proposed site conditions, and designed vegetative communities.

Appendices 1 through **5** contain photographs and data forms for the site and the reference sites. **Appendices 6** through **9** contain gauge data and charts, a Memorandum of Agreement between the City of Lumberton, the Lumber River Conservancy, and EEP, and the FEMA Reporting Form for the site.



1.0 Project Site Identification and Location

1.1 Directions to Project Site

The project site is approximately one-half mile west-northwest of Lumberton in Robeson County, North Carolina as depicted on **Figure 1**, Project Site and Reference Site Vicinity Map. To reach the site from Interstate 95, take exit 19 onto Carthage Road traveling west. Approximately 500 feet after exiting the interstate, the site is on the right (north). It is marked by Meadowbranch Swamp passing under Carthage Road.

1.2 USGS Hydrologic Unit Code and NC DWQ River Basin

The site lies within the USGS Hydrologic Unit Code 03040203 080010 (USGS, 1974), which falls within the Lumber River basin. The NC DWQ River Subbasin for the project area is listed as the Lumber 03-07-51 (NCDENR, 2003).

2.0 Watershed Characterization

2.1 Drainage Area

The drainage area for this site measured at the downstream end of the project area, directly above Carthage Road is 34.4 square miles. The drainage area at the reference area is 34.2 square miles.

2.2 Surface Water Classification

The current State classification for Meadowbranch Swamp (Stream Index # 14-12) from its source to the Lumber River, is Class C and Swamp Waters (Sw) waters (NCDENR, 2006). 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.

2.3 Physiography, Geology and Soils

The site is located in the Inner Coastal Plain Physiographic Region of North Carolina. Generally, topography of the Inner Coastal Plain is relatively flat with gently sloping uplands, or interstream divides, dissected by slow-moving coastal streams and swamps. The area is known for a prevalence of Carolina Bays, which are shallow oval depressions occurring mostly in the interstream divides.

According to the Geologic Map of North Carolina (1985) the City of Lumberton lies on the Yorktown Formation and Duplin Formation, Undivided. The description of these formations indicates that in the area of the state south of the Neuse River, the Duplin Formation is primarily found. The Duplin Formation consists of shelly medium to coarse grained sand, sandy marl, and limestone and is bluish gray.

The site itself consists of a channelized stream, or canal, forming the western boundary of the property and the relatively flat floodplain of this stream. The eastern portion of the site contains some slopes that grade up, off-site, to agricultural areas within the interstream divide.



The Robeson County Soil Survey shows the property as primarily Bibb soils, with two mapping units of Norfolk soils protruding from the east. Bibb soils are listed as hydric for the County. Bibb soils consist of nearly level, poorly drained soils on floodplains of natural drainageways, formed in recent alluvium. The surface layer is dark gray sandy loam, loamy sand, or loam, underlain by stratified dark gray sandy loam and gray sand. Permeability is moderately rapid, and shrink-swell potential is low. Seasonal high water table is at or near the surface, and frequent flooding occurs unless drained.

Norfolk soils consist of well-drained soils on gentle side slopes between nearly level soils and drainageways. The surface layer is grayish-brown loamy sand, underlain by a layer of yellowish-brown loamy sand. Permeability is moderate and the shrink-swell potential is low. The seasonal high water table is generally more than five (5) feet below surface.

2.4 Historical Land Use and Development Trends

**Table 1. Historical Land Use and Development Trends
 (Observations based on aerial imagery)**

Date	Land Use and Development Observations
1938	Site completely wooded, interstate I-95 not present.
1960	Site completely wooded, interstate I-95 present but no exit 19 exists, farming fields have been expanded.
1972	Sewer easement evident in northwest of site, exit 19 on interstate I-95 has been built, urban build-up at interstate exit is present.
1981	Site is the same as in 1972, increased urban build-up at exit 19 present.
1988	Site is the same as in 1981.
1998	Logging road and access road evident on site.
2007	Site is the same as in 1998.

Based on information provided by a local official, a grist mill was located in the vicinity of the project area. This structure was reportedly intact during the early 1900's and is the reason that the site area is sometimes called the old mill pond. During this time period Meadowbranch Swamp was not channelized and the flow through the area was not confined to a channel. Reportedly, the canal adjacent to the site was excavated during the late 1930's and early 1940's.

Aside from the channelization of Meadowbranch Swamp, it appears that no significant land disturbing activity occurred at the site between 1900 and the late 1980s. Verbal information provided by the City and review of historical aerial photographs (**Table 1**) support the notion that site disturbance activities were minimal or non-existent until the late 1980s. Sometime during the late 1980s and early 1990s a portion of the site was logged. It was during this timeframe that the logging road was constructed.



Aerial imagery along with information provided by the City indicates that the subject site was largely undeveloped woodlands until the 1990's. The historical aerial photograph from 1998 (**Figure 9**) depicts the subject parcel as partially timbered with a former logging road extending from Carthage Road north through the central portion of the parcel. All of the facts presented in this Section support the notion that the groundwater, vegetation, and surface drainage have been modified. Although most on-site soil series are classified as poorly drained, the channelization and dredging at the site has likely lowered the groundwater elevation when compared to historical groundwater elevations.

2.5 *Endangered / Threatened Species*

A search was conducted of the North Carolina Natural Heritage Program data for Robeson County, NC. This search produced a list of plant and animal species with varying federal and state status. Upon further review, it was determined that three of the species listed for Robeson County were listed as either federally endangered or threatened. These species are the *Alligator mississippiensis*, commonly known as the American Alligator, *Picoides borealis*, commonly known as the Red-Cockaded Woodpecker, and *Rhus michauxii*, commonly known as Michaux's Sumac (US Fish and Wildlife Service, 2006).

2.5.1 American Alligator

Description

The American Alligator is a large crocodylian species, blackish colored, with a broad snout lacking upward protruding conspicuous teeth. The juveniles exhibit yellow bands across their backs. This species grows to a maximum of 5.8 meters, but are generally less than 4 meters in length. The American Alligator differs from the American Crocodile in its broad snout and lack of protruding teeth (SCDNR, 2006).

The American Alligator inhabits fresh and brackish marshes, ponds, lakes, rivers, swamps, and other surface water features. They prefer deep open water areas to forage. They dig dens in the margin of rivers and lakes or in marshes, and stay primarily in the den during the winter months.

Biological Conclusion

Carolina Ecosystems personnel conducted a search of the site on November 1 and 2, 2006 in conjunction with the natural community characterization. Although the canal that forms the western boundary of the property could provide habitat for this species, it is relatively shallow and therefore not permanent habitat for the alligator. Due to the proximity of the site to the Lumber River, there is limited potential for this species to occur on the site, however no individuals of this species were observed during the site visit. The NCNHP database shows an occurrence of this species on the Lumber River approximately two miles southeast of the site. No adjacent inundated wetlands occur within the project site. The species, if temporarily using the canal to travel between habitats or forage, would not be harmed by the project. Habitat for the alligator could be improved by the increased inundation created by the project.

Although the project is not likely to adversely affect this species, a biological conclusion is not required. The American Alligator is listed due to its similarity of appearance to the American Crocodile, which does not occur in North Carolina. Unless a "take" of this species is anticipated no consultation with the USFWS is necessary.



2.5.2 Red-Cockaded Woodpecker

Description

The Red-Cockaded Woodpecker's (RCW) historic range included East Texas to Florida and north to New Jersey. Current distribution is excluded from Missouri, Maryland, and New Jersey. The remaining populations are isolated fragments of the original species distribution, which was tied to the range of the southern pines.

The RCW inhabits open stands of pines with a minimum age of 80 to 120 (Longleaf Pine) or 70 to 100 (Loblolly Pine) years. Longleaf Pines (*Pinus palustris*) are most commonly used but other pines are acceptable, and the majority suffers from red heart disease which softens the center of the trunk. Dense hardwood stands or pine stands with a dense hardwood understory are avoided. Foraging habitat is usually provided by pine and pine hardwood stands of at least 30 years. RCWs have a preference for pines of at least 10 inches diameter at breast height. They live in "clusters" of cavity trees in family groups of 4 or 5 to 9 individuals (USFWS, 2006b).

Biological Conclusion

Carolina Ecosystems personnel conducted a search of the site on November 1 and 2, 2006. Suitable habitat for the RCW was not found on the site. No open stands of suitably aged pines are present. Some young mixed hardwood and small pine stands exist within the site, but do not provide nesting or foraging habitat for this species. The NCNHP database shows two occurrences of this species approximately four miles east of the site. No individuals of this species were observed during the site visit. Therefore, the project will have no effect on this species.

2.5.3 Michaux's Sumac

Description

Michaux's Sumac is found throughout the coastal plain, sandhills, and piedmont regions in sandy forests, woodlands, and woodland edges. It grows in sandy or rocky open woods in association with basic soils. It usually is found in areas where some form of disturbance has provided an open area. A majority of the plant's remaining populations are on highway right-of-ways, roadsides, or the edge of artificially maintained clearings (utility lines, etc.). A few remaining populations occur in areas with periodic fires or where natural succession is ongoing. Michaux's Sumac is a densely hairy shrub with erect stems of 1 to 3 feet in height. The compound leaves are narrowly winged at the base and finely toothed on its edges. Flowers are greenish-yellow to white and 4-5 parted. Michaux's Sumac flowers from April to June, and fruits in October and November (USFWS, 2006c).

Biological Conclusion

Carolina Ecosystems personnel conducted a search of the Site on November 1 and 2, 2006. Potential habitat areas for this species were limited to the old roadbeds and the sewer line easement where continued disturbance from mowing maintains a clearing. However, these areas are either in or adjacent to wetlands and not suitable habitat for Michaux's Sumac. A known reference population on Barwell Road, just south of Poole Road in Raleigh NC, was checked prior to field surveys in order to verify the growth status of the plants for the time of year. No individuals of this species were observed during the site visit. Therefore, the project will have no effect on this species.



Therefore, it is concluded that no major elements for the American Alligator, Red-Cockaded Woodpecker, and Michaux's Sumac habitats exist on the site and no evidence of these species have been found. It is the professional opinion that this project will have no effect on the *Alligator mississippiensis*, American Alligator, the *Picoides borealis*, Red-Cockaded Woodpecker, or *Rhus michauxii*, Michaux's Sumac.

2.6 Cultural Resources

2.6.1 Site Evaluation Methodology

The categorical exclusion document was followed in order to address any cultural resource issues. The site is not located in a county claimed as "territory" by the Eastern Band of Cherokee Indians. The site is not federal or Indian lands and thus compliance is reached for the Antiquities Act, Archaeological Resources Protection Act, and the Indian Sacred Sites Executive Order 13007. The National Register of Historic Places was searched and no sites were identified near the site.

2.6.2 Field Evaluation

The site begins immediately north of SR 1528, Carthage Road, on the left bank side of Meadowbranch Swamp and ends approximately 2,000 feet north of Carthage Rd. The site was clear-cut within the last twenty (20) years as evidenced from the scrub floral growth found throughout the site. The project site was reviewed along five transects. Two soil borings were conducted along each transect to a depth ranging from one-half (1/2) meter to one (1) meter.

2.6.2.1 Potential for Historic Architectural resources

The project site has no buildings on the property. In addition, the project site does not contain any known historic trails. There is no potential for historic architectural resources.

2.6.2.2 Potential for Archaeological resources

Based on information provided by the City, the majority of the project site was timbered during the late 1980s and early 1990s. Meadowbranch Swamp appears to have been channelized and is currently maintained by the City of Lumberton. An access road runs along the branch and changes from left bank to right bank halfway through the site. This access road appears to have been built up and may have been constructed from fill dirt either from dredging or from on-site soils. The road extends north from SR1528 and south from SR 211 on either bank respectively. A former logging road exists to the east of the access road and parallels the access road through the southern portion of the site. This road also extends north from SR1528. A beaver impoundment along the former logging road was recently drained to allow access to the interior of the site.

The current site topography is relatively uniform and flat. The site is bordered to the east by farm land that is higher in elevation. There are two small "Carolina Bays" shown on the USGS Topographic map that are over a quarter (1/4) mile northwest of the project site. These "Carolina Bays" are very small and would not have offered enough resources for long term inhabitation. Consideration was given to the presence of the bays and the topography of the site, however, the logging activities, the observed conditions, and the lack of noted findings during previous work on the existing canal leads us to the conclusion that this site has a poor potential for archaeological resources. Two potential sites have been identified by SHPO, but they are outside of the property



boundary. These two sites will be addressed in the next section. Due to the minimal impact of the proposed restoration activities we have concluded that the project will not affect any future archaeological investigations.

2.6.3 SHPO/THPO Concurrence

A letter and maps of the project were submitted to the State Historic Preservation Office (SHPO) for review and comment on October 18, 2006. A SHPO response letter was received on December 5, 2006. The response letter contained reference to two sites known to SHPO, but not listed on the National Register of Historic Places, in the vicinity of the project. A meeting was conducted on December 18, 2006 to address the comments provided by SHPO. The site 31RB487 is an historic site, possibly a mill, identified by NCDOT in 2001. This site is to the west of Meadowbranch Swamp and is outside of the project area. The site 31RB488 is a prehistoric site identified by an independent researcher in 2004. This site is to the east of the project boundary and outside of the project area. Based on a project update provided by NSE during the December 18, 2006 meeting, SHPO has concurred that the site activities will not affect either of these sites.

2.7 Potential Constraints

2.7.1 Property Ownership and Boundary

This project will affect the following parcels: adjacent parcels to the north, east, and south are owned solely by Mr. James Britt and the adjacent parcel to the west is owned solely by the City of Lumberton. The main project parcel is owned solely by The Lumber River Conservancy.

2.7.2 Site Access

The site can be accessed from two locations. The primary access is a road which enters from SR 1528 to the south of the property. The secondary access point is the existing former logging road to the west of the existing canal access road. This former logging road extends to the middle of the property and will be removed as part of the restoration. The City will maintain access to the site through the use of the road along the canal.

2.7.3 Utilities and Easement

A pump station is located in the northeast corner of the site. The pump station is owned and operated by the City of Lumberton; access to the pump station is not inside the easement and will not be affected by the restoration project in any way. The City of Lumberton is involved in the project and is aware the pump station is inside the easement.



2.7.4 Hydrologic Trespass

Hydrologic trespass is not a major concern with the site. The site floods on a regular basis and is entirely located in the FEMA designated 100-year floodplain and floodway for Five Mile Branch, as depicted on FEMA FIRM Panel 3710939200J, effective January 19, 2005. Based on communication with City personnel, the pump station located in the northeastern portion of the property floods two to three times per year. Any action taken or change made to the site is not expected to raise the flood elevations above existing levels. The proposed changes at the site are only intended to re-distribute flow across the entire site by removing impediments such as the former logging road and access road. A “no-rise” study will be required as part of this project. This study will be completed prior to completion of the bid documents for the site. A letter of map revision (LOMR) will not be required if the results of the “no-rise” study indicate no increase in Base Flood Elevations.

3.0 Project Site Wetlands and Streams (existing conditions)

The site is located approximately 2,500 feet to the west of Interstate 95 near exit 19 in Lumberton, North Carolina. The project area encompasses 57 acres along the east side of Meadowbranch Swamp. The parcel which begins 2,500 feet downstream of SR 211, ends at SR 1528 Carthage Road and is situated in the 100-year floodplain. An access road has been established by the City of Lumberton along the canal. This road extends from Carthage Road along the western border of the project parcel and ends approximately 400 feet from the end of the parcel where the road begins on the other side of the canal and extends to SR 211. A former logging road parallels the canal an approximate distance of 2,000 feet from Carthage Road. Culverts placed under this road have been blocked from beaver activity. Land surface elevations along the eastern border are 120 feet in most locations. Elevations along the access road that borders the canal range between 114 and 116 feet. The drainage area of Meadowbranch Swamp at the most downstream end of the project site is 34.4 square miles. Two small drainage ways enter the project site from the east. The drainage way to the south has a drainage area of 56 acres while the drainage way to the north has a drainage area of 66 acres.

3.1 Jurisdictional Wetlands

A wetland delineation was completed for the entirety of the project area. The project is bound to the west by Meadowbranch Swamp. This stream has been channelized which has altered the hydrology of the site. The site is mapped almost entirely as a Bibb soil and is completely within the 100-year floodplain. An overbank event was observed during November 2006 and also during December 2006 while personnel were on site performing field investigations.

The site appears to be more groundwater dominated to the east further from the channel, and more of a mixture of groundwater and surface water closer to the channel. Although the former logging road and the canal access road have impeded surface flow, evidence suggests that the historical wetland areas within the project are still classifiable as jurisdictional wetlands. However, some alterations have occurred to the site in the past which have removed some areas from jurisdictional status. There is a maintenance road that has been built up along the channel to facilitate cleaning and maintenance of the channel. The other area is a former logging road which was built up for logging purposes. In addition to these altered areas, there are two natural upland areas that extend from the eastern property boundary and terminate near the western boundary. Please see **Figure 6** for a depiction of these areas.



3.2 Hydrologic Characterization

3.2.1 Preliminary Groundwater Characterization

Collection of groundwater elevation data at the site began in October of 2006 to enable the evaluation of pre- and post-project site conditions. The data collected during this initial period represents site conditions from October 27, 2006 to March 29, 2007. The depth to groundwater from ground surface at the individual monitoring wells ranged from 42.0 inches below ground surface to 12.0 inches above ground surface. Monitoring well 9 and the reference well were not installed until November 1, 2006. In the month of October when precipitation was low, the groundwater elevations were very low, most not reaching within 12.0 inches of ground surface. For the months of December 2006 to March 2007, the majority of the groundwater elevations reached within 12.0 inches of ground surface.

Recorded precipitation amounts during the initial monitoring period were 0 inches for October (10/27/06-10/31/06), 7.1 inches for November, 3.9 inches for December, 3.0 inches for January, 2.0 inches for February, and 1.7 inches for March (3/1/07-3/29/07), respectively. The typical average rainfall for in Red Springs/Lumberton area (State Climate Office of North Carolina, 2002) is 3.20 inches in October, 2.96 inches in November, 3.23 inches in December, 4.04 inches in January, 3.50 inches for February, and 4.34 inches in March; therefore, 2006 October-December and 2007 January-March rainfall is approximately 3 inches below normal. The average length of the growing season for Robeson County is about 225 days, from late March to early November (USDA, 1978).

The preliminary groundwater well results located in **Exhibit Table 4** and **Appendix 6** illustrate the affect of the precipitation that occurred during the observation period between October 2006 and March 2007. Long term data collection of pre- and post-project site conditions will assist in evaluating the groundwater at the site.

3.2.2 Surface Water Investigation

A hydrologic analysis was performed to determine the optimal flooding elevation of the site. The Meadowbranch Swamp Wetland Restoration project will restore portions of the property by allowing flood waters to inundate the site. Flood waters will enter the site through several low areas at specific target elevations. Data used in the analysis included historical gauge and rainfall data and to a lesser extent on-site data. A detailed explanation of the Hydrologic Analysis is presented in **Appendix 7**.

The core of the analysis involved determining the frequency at which specific site elevations had flooded in the past. This was accomplished by selecting a range of whole foot elevations from the site and then examining the flood frequency associated with each. Rainfall data and river height data were used in this analysis. River height data was available from a USGS gauge in Lumberton where the Lumber River passes under 5th Street.

Daily rain gauge data over the past six years was obtained from seven rain gauges spread throughout the Lumber River watershed. Historical water surface elevation data for Meadowbranch Swamp is extremely limited; therefore, a method was developed to use historical data from a nearby gauge on the Lumber River.

To determine the historical behavior of Meadowbranch Swamp, measurements were periodically collected from a culvert having a known elevation. During each site visit NSE measured the distance



from culvert to the water surface. This enabled a water surface elevation to be calculated by subtracting the distance from the top of the culvert to the water surface. These elevations were then compared to elevations of the Lumber River approximately two (2) miles down stream at USGS gauge 02134170.

Using the correlation between the site elevations and the USGS Lumber River gauge it was possible to directly examine the frequency of flood events at the site. This was accomplished by counting the number of times certain elevations were reached, within the six year span of time. Hydrologic analysis indicates that on average, elevation 114 has been inundated three times per year, elevation 115 has been inundated 2 times per year, and elevation 116 has been inundated once a year.

Table 2. Project Site Flooding Frequency

7/00	Average Number of Occurrences Per elevation-Since July 2000						Flooding Frequency		
	2001	2002	2003	2004	2005	2006	Flooded site elevation (ft)	Total Number of Occurrences	Avg. / yr.
7	12	13	25	16	15	18	109	106	17
6	7	11	25	13	12	13	110	87	14
5	6	7	25	12	8	9	111	72	11
4	3	3	24	9	6	8	112	57	9
2	-	-	16	5	3	5	113	31	5
1	-	-	9	4	-	3	114	17	3
1	-	-	4	3	-	2	115	10	2
-	-	-	1	2	-	1	116	4	1
-	-	-	-	1	-	-	117	1	0
-	-	-	-	1	-	-	118	1	0
-	-	-	-	1	-	-	119	1	0

3.3 Soil Characterization

3.3.1 Taxonomic Classification (including series)

The restoration site was investigated to determine the soil types on the site as well as the hydric nature of those soils. A wetland delineation was performed on the site. Two small areas of upland were found on the site. These areas were found to have non-hydric soils. They also matched up fairly well with the Robeson County Soil Survey mapping for Norfolk. The remainder of the site is mapped out as Bibb on the Robeson County Soil Survey. During the field investigation it was determined that pockets of Lumbee exist within the project area. Therefore, three (3) soil series were found to exist within the project limits with one of those being a non-hydric soil. These soils are as follows:



Hydric – within the jurisdictional wetland areas

Bibb - coarse-loamy, siliceous, active, acid, thermic Typic Fluvaquents

Lumbee - fine-loamy over sandy or sandy-skeletal, siliceous, subactive, thermic Typic Endoaquults

Non-Hydric – outside of the jurisdictional wetland area

Norfolk - fine-loamy, kaolinitic, thermic Typic Kandiudults

3.3.2 Profile Description

Based on the numerous soil borings completed throughout the site, the following profile descriptions are provided that typify the two (2) hydric soil series found within the restoration area. Bibb is the only soil that is a hydric soil.

Table 3. Hydric Soil Descriptions

Soil Horizon	Depth	Description
Bibb		
A	0-4 inches	Very dark gray (10YR 3/1) sandy loam; weak fine granular structure; friable; common fine roots; strongly acid; abrupt wavy boundary.
Ag	4-20 inches	Grayish brown (10YR 5/2) sandy loam; weak fine granular structure; friable; few fine roots and pores; common fine red (2.5 YR 4/6) stains around old roots; strongly acid; clear wavy boundary.
Cg1	20-36 inches	Light gray (10YR 7/1) and grayish brown (10YR 5/2) loamy sand; massive; friable; few fine roots and pores; common medium yellowish brown (10 YR 5/6) stains around old roots; some strata have bits of partially decomposed organic materials; very strongly acid; clear wavy boundary.
Cg2	36-42 inches	Gray (10YR 6/1) sand; massive; slightly sticky; common strata of sandy loam and loamy sand; strongly acid.
Lumbee		
A	0-8 inches	Very dark gray (10YR 3/1) sandy loam; weak fine granular structure; very friable; common fine roots; strongly acid; clear boundary
Btg1	8-18 inches	Grayish brown (10YR 5/2) sandy clay loam; common fine and medium red (2.5YR 4/6) masses of oxidized iron; weak medium subangular blocky structure; clear boundary.
Btg2	18-25 inches	Gray (10YR 5/1) sandy clay; common fine dark yellowish brown (10YR 4/6) stains around old roots and masses of oxidized iron; moderate medium subangular blocky structure; abrupt boundary.
Cg1	25-43 inches	Gray (10YR 5/1) loamy sand; many medium distinct dark yellowish brown (10YR 4/6) masses of oxidized iron.
Cg2	43-50 inches	Light gray (10YR 7/1) sand; single grained.



Table 4. Non-Hydric Soil Description

Soil Horizon	Depth	Description
Norfolk		
A	0-3 inches	Very dark gray (10YR 3/1) sandy loam; weak fine granular structure; very friable; nonsticky, nonplastic; few fine and medium roots; strongly acid; clear smooth boundary.
E	3-11 inches	Dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; very friable; nonsticky, nonplastic; few fine and medium roots; strongly acid; clear smooth boundary.
Bt1	11-17 inches	Brown (10YR 4/3) sandy clay loam; weak fine subangular blocky structure; friable; slightly sticky, slightly plastic; few fine roots; strongly acid; clear wavy boundary.
Bt2	17-38 inches	Yellowish brown (10YR 5/6) sandy clay loam; weak medium subangular blocky structure; few distinct light yellowish brown (2.5 Y 6/4) masses; slightly sticky, slightly plastic; strongly acid; gradual wavy boundary.
Bt3	38-58 inches	Yellowish brown (10YR 5/6) sandy clay loam; weak medium subangular blocky structure; friable; slightly sticky, slightly plastic; few faint strong brown (7.5YR 4/6) masses of oxidized iron and few fine distinct pale brown (10YR 6/3) iron depletions; strongly acid; gradual wavy boundary.
Bt4	58-70 inches	Yellowish brown (10YR 5/6) sandy clay loam; weak medium subangular blocky structure; friable; slightly sticky, slightly plastic; few faint clay films on faces of peds; common medium distinct yellowish red (5YR 5/8) masses of oxidized iron and pale brown (10YR 6/3) and light brownish gray (10YR 6/2) iron depletions; 1 percent, firm yellowish red plinthite nodules; strongly acid; gradual wavy boundary.
BC	70-82 inches	Variegated brownish yellow (10YR 6/6), strong brown (7.5YR 5/6), and yellowish red (5YR 5/6) sandy clay loam; weak medium subangular blocky structure; friable; slightly sticky, slightly plastic; 5 percent firm, brittle plinthite nodules; strongly acid; gradual wavy boundary.
C	82-100 inches	Variegated red (2.5YR 4/8), strong brown (7.5YR 5/8), brownish yellow (10YR 6/8) and gray (10YR 5/1) sandy clay loam; massive; friable; slightly sticky, slightly plastic; strongly acid.

3.4 Plant Community Characterization

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. Therefore, five (5) transects were cut through the site to aid in the site investigation. The following table describes the vegetation found along each of these transects. In general, the site is too disturbed to adequately assess the ultimate climax community types. Also, the increase in hydrology from the project may also adjust the community type boundary. Currently, there are a few small areas near the canal road that still have stands of relatively older growth *Taxodium distichum* and would be designated as Cypress-Gum Swamp. Other larger areas have some young *Taxodium distichum*, but the areas are more dominated by *Acer rubrum* and *Betula nigra* and it is not clear what community will ultimately predominate. Besides those few areas of Cypress-Gum Swamp on the site, the remainder of the area could probably 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 strong characteristics of bottomland hardwood. This will be discussed more in the restoration design section of this report. In general, large portions of the site are naturally regenerating with appropriate native vegetation and it would probably be counter-productive to intercede in this natural process. However, some portions of the site do need attention such as where a logging road was built into the site and in areas where *Ligustrum sinense* dominates. Those areas are where planting efforts will be focused for this project.



Table 5. Project Area Vegetation Transects

Species	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5
<i>Betula nigra</i>	common	common	common	occasional	common
<i>Acer Rubrum</i>	common	frequent	frequent	occasional	common
<i>Liriodendron tulipifera</i>		occasional		occasional	
<i>Salix nigra</i>		occasional		occasional	
<i>Myrica cerifera</i>		occasional			
<i>Ligustrum sinense</i>	occasional	occasional		common	
<i>Liquidambar styraciflua</i>			occasional	common	
<i>Pinus taeda</i>	common		occasional	common	
<i>Fraxinus pennsylvanica</i>				occasional	occasional
<i>Taxodium distichum</i>		occasional		occasional	common
<i>Ilex opaca</i>				occasional	
<i>Quercus nigra</i>			common		
<i>Quercus laurifolia</i>			common		
<i>Cyrilla racemiflora</i>					common

4.0 Reference Wetlands

4.1 Target Reference Conditions

At the outset of the project, the target was to find a reference wetland that was directly connected to surface waters with a similar watershed size. In addition, the reference wetland needed to have similar soils to the project area and to be relatively undisturbed. This meant that the site should contain older growth trees with minimal invasive plant species.

4.2 Reference Site Parameters

The project site is located on one side of a canal. During an early site visit after recent rains, it was noted that the other side of the canal had clear surface water connections to the canal and no man-made berms, dikes, or roads. The project site has a built up access road to provide a maintenance corridor along the canal. It was also evident that the other side of the canal had not been logged recently nor did it contain any visible invasive species. The reference area was reviewed based on aerials, soil survey data, floodplain data, and topography. It was determined that this area was an excellent candidate for a reference wetland. A site visit was conducted to the other side of the canal and preliminary soil borings indicated that this area would be a very good reference wetland for the project.

4.2.1 Soils

Multiple soil borings were conducted within the reference wetland. Borings were taken within both plant community types. The soil was found to consistently be the Bibb soil series. This finding is supported by the Robeson County Soil Survey which also has the reference wetland area mapped as



Bibb. Based on soil borings and the Robeson County Soil Survey, the following is the typical soil profile description for the reference wetland area.

Bibb - coarse-loamy, siliceous, active, acid, thermic Typic Fluvaquents

Table 6. Bibb Soil Series

Soil Horizon	Depth	Description
A	0-11 inches	Very dark gray (10YR 3/1) loam; weak fine granular structure; friable; common fine roots; strongly acid; abrupt wavy boundary.
Ag	11-23 inches	Dark grayish brown (10YR 4/2) sandy loam; weak fine granular structure; friable; few fine roots and pores; many fine red (2.5YR 5/8) masses of oxidized iron; strongly acid; clear wavy boundary.
Cg1	23-37 inches	Light brownish gray (10YR 6/2) loamy sand; common fine very pale brown (10YR 8/2) coarse sand; friable; few fine roots and pores; common medium red (2.5YR 5/8) masses of oxidized iron; very strongly acid; clear wavy boundary.
Cg2	37-43 inches	Very pale brownish (10YR 8/2) sand; massive; many medium brownish yellow (10YR 6/8) masses of oxidized iron; strongly acid.

4.2.2 Vegetation

As discussed above, the reference wetland area appears to have no recent significant disturbances. The area is regularly flooded due to overbank events of Meadowbranch Swamp. This brings trash and other small debris into the reference wetland area which might minimally impact the herbaceous layer. The following tables show the community types and plant species list found at the reference wetland.

Table 7: Reference Wetland Community Type

Community Type - Cypress-Gum Swamp (Brownwater Subtype)			Community Type - Coastal Plain Bottomland Hardwood (Brownwater Subtype)	
	Subcanopy	Canopy (%)	Subcanopy	Canopy (%)
<i>Taxodium distichum</i>		95%	<i>Quercus laurifolia</i>	30%
<i>Acer rubrum</i>	Frequent		<i>Quercus nigra</i>	30%
<i>Fraxinus caroliniana</i>	Occasional		<i>Acer rubrum</i>	15%
<i>Betula nigra</i>		5%	<i>Betula nigra</i>	10%
			<i>Pinus taeda</i>	10%
			<i>Liquidambar styraciflua</i>	5%
			<i>Fraxinus pennsylvanica</i>	Occasional

4.2.3 Hydrology and Topography

Topographic and water table data was collected during the reference reach surveys to better understand the physical setting of the reference area and to integrate the information into the restoration design. The reference wetland cross section is shown on **Sheet 3**. The mean elevation of the reference area is 111 feet in the location of the reference well, while the elevation of the site is approximately 114 feet. The difference in elevation may indicate that the canal was not excavated in the true center of the floodplain, but instead was located slightly off-center near higher ground. If the canal were located in the center of the floodplain, the reference area elevation would be much closer to the site area elevation. Despite the difference in elevation between the site and the reference area,



the duration that the soil within reference areas remains saturated will be beneficial when evaluating the site.

Approximately 23 acres immediately adjacent to the canal has an approximate elevation of 111 feet. Two small drainage ways enter the canal on either side of cross-section 2. The drainage ways have a bottom elevation that ranges from 111 within the floodplain to 110.5 where the natural swale intersects the canal.

5.0 Project Site Restoration Plan

5.1 Restoration Project Goals and Objectives

The goal of this project is to restore, enhance, and preserve the project area. This will be achieved by creating low areas in the access road based on flood elevations, removing an existing former logging road and adjacent canal within the site, and planting native wetland vegetation in select areas. This will return the site to a more natural hydrologic state which will:

- 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 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 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 design will be based on reference conditions, USACE guidance (USACE, 1987), and criteria that are developed during this project to achieve success.

5.1.1 Designed Wetland Type

The project area is located adjacent to Meadowbranch Swamp with a drainage area of 34.4 square miles. In addition, the site is located only about 1,000 feet above where Meadowbranch Swamp empties into the Lumber River. The direct Meadowbranch Swamp drainage, as well as the Lumber River, contribute to the overbank events at the site. As such, the project area regularly experiences hydrologic inputs from local rain events and more widespread “whole basin” events. The entire project area is located within a designated 100 year floodplain. Therefore, the type of wetland targeted for the project area will be a palustrine riverine floodplain wetland system. Alterations to the area from canal maintenance and from previous logging operations have modified the functions of the system. The project design will seek to counteract these impacts to the wetlands by improving hydrologic connections to Meadowbranch Swamp and by removing a constructed logging road which is impeding surface water movement across the site.



5.1.2 Target Wetland Communities / Buffer Communities

As discussed above, a reference wetland was located on the opposite bank of Meadowbranch Swamp. This reference wetland was investigated and found to contain two wetland community types within the palustrine riverine floodplain system. These two wetland community types are the Cypress-Gum Swamp and the Coastal Plain Bottomland Hardwood communities as described by Schafale and Weakley, 1990. Any locations that are disturbed during construction will be planted in a manner to promote the establishment of these two communities. **Section 5.5** discusses the plant communities in greater detail.

5.2 Best Management Practices

Individual stormwater best management practices (BMPs) have not been required for this project. If the opportunity presents itself during detailed design, stormwater BMPs will be implemented. The project itself is a wetland feature and is expected to capture, retain, and treat any stormwater runoff emanating from outside of the easement area. Stormwater management issues from future development of adjacent property will be governed by the applicable local and state ordinances and regulations.

5.3 Hydrologic Modifications (for wetland restoration or enhancement)

5.3.1 Narrative of Modifications

The first proposed modification is the installation of access road crossings (cuts in the access road to allow surface flow across the roadway surface) along the canal to promote temporary flooding of the site during overbank events. Currently the access road acts as a berm and restricts the natural surface flow regime near the edge of the existing waterway. The road modifications are necessary because the City of Lumberton will not allow any modifications to the existing channel and they also require access along the maintenance road.

The second proposed modification is the removal of the former logging road (as shown on **Sheet 5**) which currently is preventing surface flow across the site. A linear ditch feature immediately adjacent to the logging road (**Photo 4**) was created when soil material was removed to create the road. The former logging road is disrupting the natural surface flow regime within the site and its removal will restore surface flow to a pattern more similar to pre-disturbance conditions. Beaver activity has contributed to a large open water area to the east of the logging road. As part of the proposed modifications, the culverts underneath both the logging road and the access road will be removed. The reinforced crossings proposed along the access road will allow surface flow to pass when needed, and will provide a reinforced surface for vehicle traffic as required by the City of Lumberton. These actions will leave the site in a more natural state and will promote the retention of water within the project area.

In addition to retaining floodwaters, breaching an area across the upland located between cross-sections one and two, will promote a more diffuse and evenly distributed surface flow regime during flood conditions. The spoil material from this process could also provide material needed to fill the water feature to the east of the logging road.



Soil Restoration

The vast majority of the soils on-site appear to be in a relatively undisturbed state and no soil preparation or amendments are anticipated except for sediment and erosion control purposes. However, significant soil movement will take place with the removal of the built up logging road. Several soil borings were conducted along the length of the logging road during the course of the site investigation. The borings showed that the majority of the fill soil is sand with some areas of clay. The borings also indicated that the original soil surface is largely still intact under the road with little indication of significant subsidence. The key areas to making this a successful area will be to ensure that neither organic poor sand nor heavy clays remain near the final graded surface. It is likely that some topsoil placement will be needed to ensure an appropriate surface is attained.

5.5 Natural Plant Community Restoration

5.5.1 Narrative & Plant Community Restoration

The project site was logged approximately 15 years ago and the site is undergoing natural regeneration. Therefore, the current vegetative communities are not clearly defined. Although the site has been disturbed, the vegetation returning to the project area along with the reference wetland community types has provided strong evidence as to what the climax communities would be on the site. Some areas have invasive species, but most of the site is regenerating with native vegetation typically seen in a successional floodplain area. A few areas were not logged on the site, likely because they were too wet to enter during the logging operation. Since these were the wettest locations on the site, they are also the sites that have the lowest elevations in what would have been the Cypress-Gum Swamp. Since the project should improve hydrology on the site, it is likely that areas that have been marginalized by the canal road and the logging road will begin a stronger progression toward the Cypress-Gum Swamp. The likely areas for this to occur already have young cypress returning. Even with improved hydrologic function, it appears that the majority of the site will still develop into the Coastal Plain Bottomland Hardwood.

A wetland delineation was performed and a plant species list was developed for the site. This shows that the site still maintains jurisdictional wetland status across most of the area except where the canal maintenance road and the logging road were put in to the site. This investigation also found fairly large areas of *Ligustrum sinense*, chinese privet, that have invaded the site. The logging road will be removed and the privet will be controlled (as discussed below). These areas will be replanted based on the plants documented at the reference wetland and shown in **Table 7**. The other areas of invasion are not being controlled or replanted because they are too dense to plant without tree removal. The existing trees growing in those areas are trees found within the targeted community types. These areas are already fifteen years old and it would be impractical to improve upon the plant makeup of these areas at this stage of development. Although some areas will not be planted, a schematic (**Sheet 7**) showing the community types across the entire site indicates what the area should develop into over time with the restoration and enhancement efforts being undertaken.

The logging road will be removed as result of this project. The road was basically built by digging out a large ditch and using the spoil from the ditch to build up the road. The removal of the logging road will involve the removal of the road and the replacement of the material back into the ditch. Both



areas will be regraded close to the original soil surface with some surface microtopographic relief and then planted as a Coastal Plain Bottomland Hardwood.

5.5.2 On-site Invasive Species Management

As mentioned previously, there are some invasive species control issues on the site. Primarily, there are large areas that are dominant in *Ligustrum sinense*, chinese privet. The site is very dense and difficult to traverse. Therefore, high resolution color and infrared aerial imagery was used to determine potential areas of privet. Site visits were conducted with GPS equipment to review these areas and mark privet boundaries where the area was accessible. This GPS data and the aeriels were combined and a final map produced showing those areas dominated by privet.

These areas of privet will be controlled by aquatic approved herbicides. The trunks and branches will be removed from the site, but the stumps and the soil surface will remain minimally disturbed during the control process. Plants from the appropriate community type will then be planted in these areas. These areas will be reviewed for privet during subsequent monitoring visits.

6.0 Performance Criteria

6.1 Wetlands

The project area will be restored and enhanced as a palustrine riverine floodplain wetland system. The restored wetland will function as a bottomland hardwood forest, but will consist of Cypress-Gum Swamp and Coastal Plain Bottomland Hardwood communities (Schafale & Weakley, 1990) according to reference data. Plant community selection was based on the reference data (**Section 4.0**). Therefore, the wetlands restored on this project site shall target establishing a wetland with water tables near or at the surface.

Additionally, the site will experience overbank flooding events as an important part of its function. The water tables will be monitored by using ten automated groundwater gauges located on the site. Performance criteria for hydrology will be based on the reference site (USACE, 2002).

Specific performance criteria for the site indicating success shall consist of flood waters reaching the improved road crossings, at an elevation equal to the existing elevation of the adjacent wetlands, at least three (3) times per year. This flooding occurrence number is based on **Table 1** of **Appendix 7.0 - Hydrologic Analysis**, which illustrates that the mean site elevation 114 is flooded an average of three (3) times per year. The flooding occurrence performance criteria are only valid if rainfall amounts are equal to or greater than historical averages. An additional monitoring well will be placed within the limits of the restored area of the former logging road to measure the groundwater table. Groundwater table elevations within this area will be deemed successful if water tables are near or at the surface. More specifically, the water table shall be within 12 inches of the soil surface continuously for greater than 5% of the growing season under normal rainfall conditions (USACE, 1987), as measured in the restored area of the former logging road.



6.2 Vegetation

The project area will be planted in targeted areas with species appropriate for the two targeted community types on the site. Areas to be planted include the logging road after its removal and the privet areas after the privet is removed. Most of these areas will be planted as the Coastal Plain Bottomland Hardwood, but one area at the northwest corner of the project area will be planted as Cypress-Gum Swamp. For each community, the vegetation will be monitored on an annual basis to determine survival.

Areas of privet will be controlled by aquatic approved herbicides. The trunks and branches will be removed from the site, but the stumps and the soil surface will remain minimally disturbed during the control process. Plants from the appropriate community type will then be planted in these areas. These areas will be reviewed for privet during subsequent monitoring visits.

This monitoring process will be conducted in an effort to show the survival of a diverse target community such that the restored site has survival at a density of 320 stems/acre after three years. This data will be monitored using sample plots (USACE, 2003) and in accordance with the most recent version of the EEP document entitled “Content, Format, and Data Requirements for EEP Monitoring Reports”. In addition, the areas being controlled for privet will be assessed during monitoring for the return of privet. If the privet returns in a quantity that threatens the targeted plants, then corrective actions will need to be taken.

6.3 Flow Features

Low areas will be constructed across the canal access road as indicated on **Sheets 5 and 6**. The road modifications are necessary because the City of Lumberton will not allow any modifications to the existing channel and they require access along the maintenance road. The proposed low areas will be reinforced with a plastic grid and stone, and will provide a long-term crossing for maintenance vehicle traffic. The low areas that are to be installed will be visually inspected for function during monitoring. Existing culverts will be removed and replaced by the low areas along the access road as shown on **Sheets 5 and 6**.

6.4 Schedule / Reporting

Activities for the first year of monitoring will begin at the completion of major construction activities. A field investigation will be conducted to establish all monitoring locations (**Figure 3**). This will include the establishment of fixed photo points, and stem counts for the planted areas.

The appropriate number of monitoring wells will be installed/re-installed, immediately after construction, in a similar pattern to the pre-construction configuration. The establishment of monitoring features and the collection and summarization of monitoring data will be conducted in accordance with the most current version of the EEP document entitled “Content, Format, and Data Requirements for EEP Monitoring Reports”. As requested by EEP, a monitoring protocol similar to pre-construction will be adopted for post-construction monitoring. Once the appropriate time has passed, the first annual post-construction site monitoring will be conducted. A monitoring report of findings as it relates to identified success criteria will be prepared and submitted to the Ecosystem Enhancement Program.



7.0 References

NC Department of Environment and Natural Resources (NCDENR). December 2003. 2003 Lumber River Basinwide Water Quality Plan. Division of Water Quality.

NC Department of Environment and Natural Resources (NCDENR), 2005. North Carolina Waterbodies Listed by Subbasin. Report Date 9/30/05.

NC Department of Environment and Natural Resources (NCDENR), 2006. Surface Water Classifications. <http://h2o.enr.state.nc.us/csu/swc.html>

Pierce, Gary J. 1993. Planning hydrology for constructed wetlands. Wetland Training Institute, Inc. Poolesville, MD.

Rantz, S.E., et al. 1982a. Measurement and Computation of Streamflow, Volume 1, Measurement of Stage and Discharge, U.S. Geological Survey, USGS Water-Supply Paper 2175.

Schafale, Michael P. and Weakley, Alan S. 1990. Classification of the Natural Communities of North Carolina Third Approximation. NC Department of Environment, Health, and Natural Resources.

Schafale, Michael P. and Weakley, Alan S. 2003. Classification of the Natural Communities of North Carolina Fourth Approximation. NC Department of Environment, Health, and Natural Resources. Copy obtained through Carolina Vegetative Survey. Website obtained July 2006.

US Army Corps of Engineers (USACE), 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, January 1987.

US Army Corps of Engineers (USACE), 2002. Regulatory Guidance Letter. RGL No. 02-2, December 24, 2002.

US Army Corps of Engineers (USACE), 2003. April 2003 Stream Mitigation Guidelines.

U.S. Department of Agriculture (USDA), Soil Conservation Service, 1978. Soil Survey of Robeson County, North Carolina.

U.S. Department of Agriculture (USDA), 1997. Engineering Field Handbook. 210-EFH, Part 650, 1/92, revised 1997.

United States Geological Survey (USGS), 1974. North Carolina Hydrologic Unit Map.

US Army Corps of Engineers (USACE), 2005. Information Regarding Stream Restoration In The Outer Coastal Plain Of North Carolina. US Army Corps of Engineers, Wilmington District, Regulatory Division and North Carolina Department of Environment and Natural Resources, Division of Water Quality December 1, 2005

U.S. Fish and Wildlife Service, 2006. Robeson County Endangered Species, Threatened Species, and Federal Species of Concern. <http://www.fws.gov/nc-es/es/cntylist/robeson.html>



Section 8.0 – Exhibit Tables



**Exhibit Table 1. Project Restoration Structure and Objectives
 Meadowbranch Swamp**

Site area adjacent to the existing canal access road			
Restoration Area	Restoration Type	Designed Linear Footage or Acreage	Comment
Former Logging Road	Wetland Restoration	0.82 acres	The former logging road is preventing surface flow from being distributed across the site evenly. Removal of the logging road will restore surface flow pattern to a more natural hydrologic regime. Currently the former logging road is creating an impoundment.
Privet Areas	Wetland Enhancement	1.8 acres	Privet in these areas will be removed and treated, and subsequently planted with the appropriate vegetation.
Remaining site area containing disturbed surface flow regime	Wetland Enhancement	27.0 acres	Although the canal access road will remain outside of the primary site area, low areas will be integrated into the access road that will allow flood waters to enter the site while also allowing surface water to exit the site.
Site area upstream of the canal access road			
Privet Areas	Wetland Enhancement	3.4 acres	Privet in these areas will be removed and treated, and subsequently planted with the appropriate vegetation.
Remaining site area	Wetland Preservation	14.5 acres	Preservation is planned for the remaining portion of the site.



**Exhibit Table 2. Drainage Areas
Meadowbranch Swamp**

Area	Drainage Area (sq. mi.)
Project Site	34.4
Reference Site	34.2
Lumber River at Confluence of Saddletree Swamp	714
Small drainage way that enters project site on left bank	0.10


**Exhibit Table 3. Land Use of Watershed
Meadowbranch Swamp**

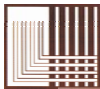
Landuse	Square Miles	Percentage
Forest / Swamps / Wooded	11.64	33.9%
Developed (Low & High Intensity)	1.81	5.3%
Open / Cultivated	20.94	60.8%



**Exhibit Table 4. Groundwater Monitoring Summary
Depth to Water from Ground Surface
Meadowbranch Swamp**

Well Cross Section		Cross Section 1	Cross Section 2				Cross Section 3		Cross Section 4		Cross Section 5		
		MW 1	MW 2	MW 3	REF	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW10	
Oct 06	High.	-4.0	-41.8	-6.4	no data	-21.4	-2.4	-19.9	-8.0	-21.4	no data	-41.8	
	Avg.	-10.5	-41.8	-11.4	no data	-21.5	-5.9	-20.6	11.7	-21.4	no data	-41.8	
	Low.	-16.8	-41.8	-20.4	no data	-21.6	-13.4	-21.6	-21.3	-21.5	no data	-41.8	
Nov 06	High.	3.3	2.5	3.1	3.0	3.2	2.9	4.1	3.0	-10.3	2.5	4.9	
	Avg.	-5.6	-12.5	-3.1	-15.7	-12.4	-2.6	-3.1	-3.1	-10.3	-13.6	-26.4	
	Low.	-17.2	-41.7	-16.2	-41.4	-21.4	-14.0	21.6	-21.6	-21.5	-21.4	-41.8	
Dec 06	High.	2.4	2.8	2.2	3.3	2.8	2.9	4.4	-0.5	-0.5	-3.6	-4.5	
	Avg.	-6.1	-4.6	0.7	-5.3	-6.5	1.7	3.4	-2.9	-11.1	-5.3	-30.8	
	Low.	-12.0	-9.0	0.4	-14.7	-14.4	0.0	3.0	-3.5	-13.3	-6.3	-41.6	
Jan 07	High.	-1.1	2.8	1.2	4.7	-1.5	3.5	4.6	-0.8	-10.3	-3.9	-11.6	
	Avg.	-5.2	-4.7	0.7	2.0	-5.0	3.2	3.5	-2.8	-2.8	-4.8	-30.5	
	Low.	-7.6	-8.7	0.4	-6.3	-7.7	2.8	2.7	-3.4	-12.7	-5.3	-40.8	
Feb 07	High.	-2.0	1.7	1.1	2.6	-0.2	3.6	3.3	-1.4	-10.6	-3.7	-18.5	
	Avg.	-7.4	-7.1	0.6	-5.8	-7.7	3.5	2.8	-2.9	-12.3	-5.1	-37.2	
	Low.	-11.1	-9.3	0.4	-13.5	-11.3	3.4	2.6	-3.4	-12.9	-6.0	-41.5	
Mar 07	High.	-2.6	-4.2	1.2	5.0	-4.1	3.8	3.6	-0.7	-10.8	-3.9	-30.0	
	Avg.	-9.5	-8.1	0.7	-7.3	3.7	3.7	2.7	-2.9	-12.9	-6.4	-39.4	
	Low.	-13.0	-14.8	0.6	-41.4	-12.6	3.5	2.5	-3.3	-14.4	-12.9	-41.7	

 Indicates groundwater is within 12 inches of ground surface.
 Monitoring well locations are provided on Figure 2.



**Exhibit Table 5. Rain Gauge Summary
Meadowbranch Swamp**

	Rain Gauge	Average Rainfall
Nov 06	7.1 in	0.058
Dec 06	3.9 in	0.031
Jan 07	3 in	0.023
Feb 07	2 in	0.017
Mar 07	1.7 in	0.01



**Table 6: Designed Vegetative Communities (by Zone)
 Meadowbranch Swamp**

Cypress-Gum Swamp				
Target Species	Common Name	Growth Habit	Propagation Method	Plant Spacing
<i>Taxodium distichum</i>	Bald Cypress	Tree	Bare Root	8x8
<i>Betula nigra</i>	River Birch	Tree	Bare Root	8x8
Coastal Plain Bottomland Hardwood				
Target Species	Common Name	Growth Habit	Propagation Method	Plant Spacing
<i>Quercus laurifolia</i>	Laurel Oak	Tree	Bare Root	8x8
<i>Quercus nigra</i>	Water Oak	Tree	Bare Root	8x8
<i>Quercus phellos</i>	Willow Oak	Tree	Bare Root	8x8
<i>Betula nigra</i>	River Birch	Tree	Bare Root	8x8
<i>Fraxinus pennsylvanica</i>	Green Ash	Tree	Bare Root	8x8

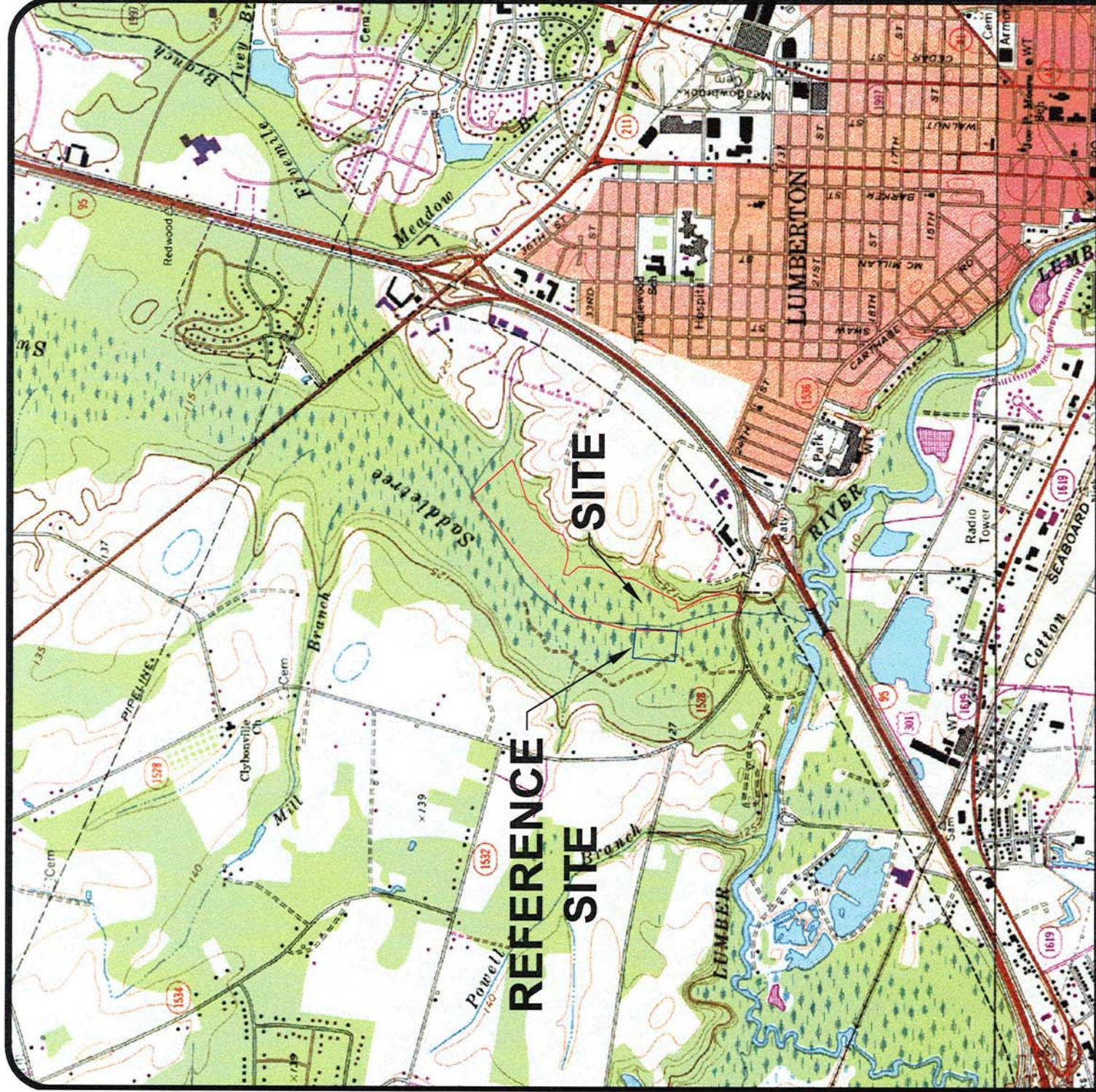
**Exhibit Table 7. Proposed Project Goals
 Meadowbranch Swamp**

Restoration Type	Acres
Wetland Restoration	0.8
Wetland Enhancement	32.1
Wetland Preservation	17.9



Section 9.0 - Figures



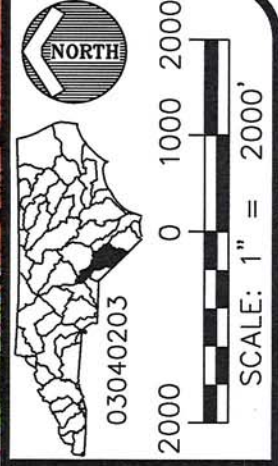


LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE REFERENCE AREA BOUNDARY

NOTES:

MAP SOURCE: 1982 USGS NW LUMBERTON QUAD
 PROJECT: MEADOWBRANCH, DENR #D07017S
 ROBESON COUNTY, NORTH CAROLINA

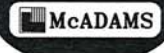


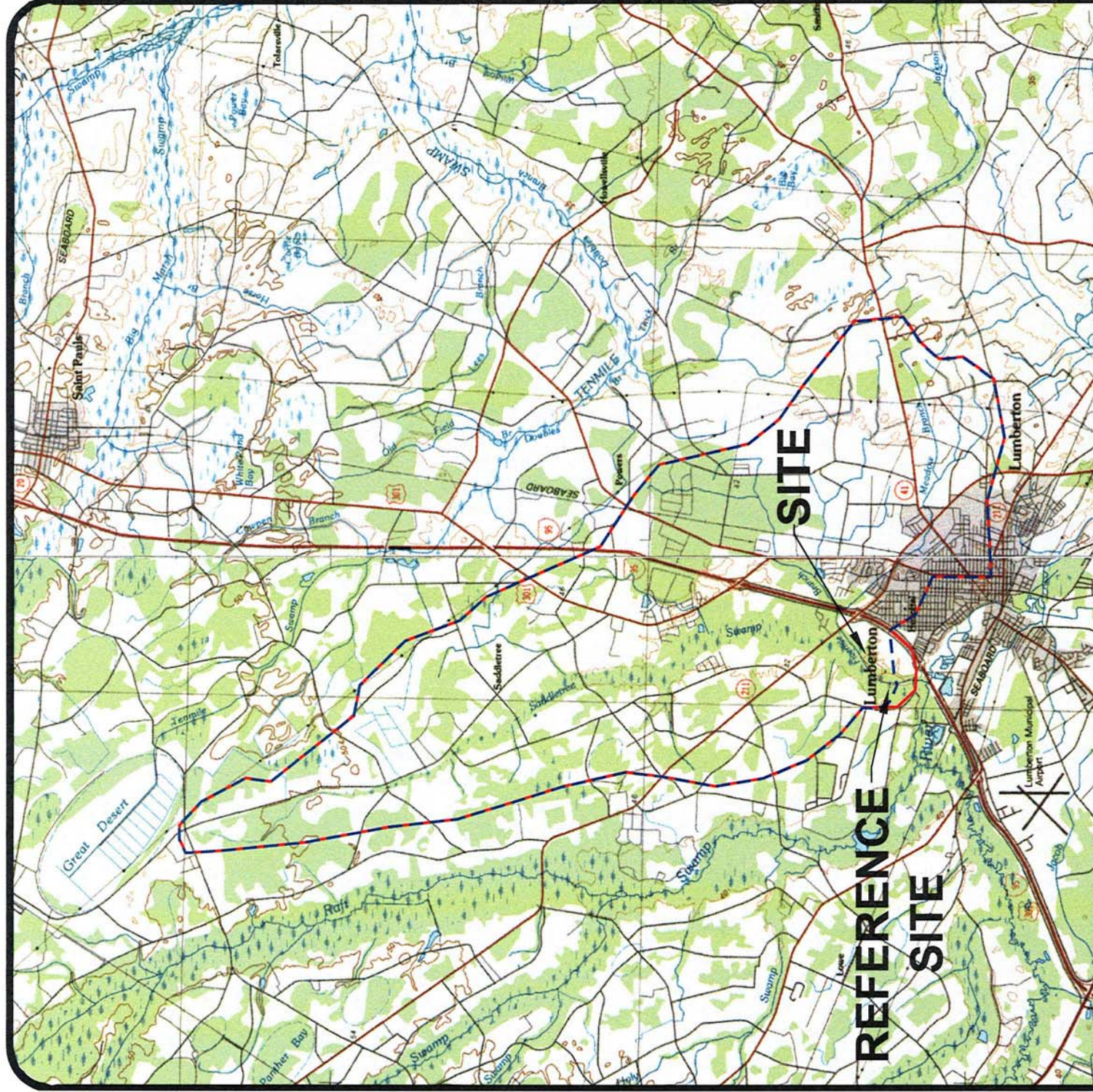
PROJECT NO.	EEP-06050
FILENAME:	EEP06050
SCALE:	1" = 2,000'
DATE:	06-04-07



PROJECT SITE & REFERENCE
 SITE VICINITY MAP
FIGURE 1

**THE JOHN R. McADAMS
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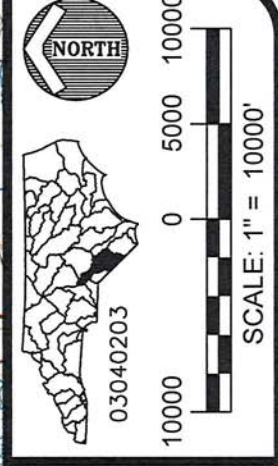


LEGEND:

- - - SITE WATERSHED BOUNDARY, AREA = 34.4 SQ. MI.
- - - REFERENCE SITE WATERSHED BOUNDARY, AREA = 34.2 SQ. MI.

NOTES:

ROBESON COUNTY, NORTH CAROLINA
 PROJECT: MEADOWBRANCH, DENR #D07017S
 JRM PROJECT No: EEP06050
 1982 1:100,000 USGS



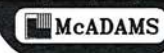
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DATE: 06-04-07

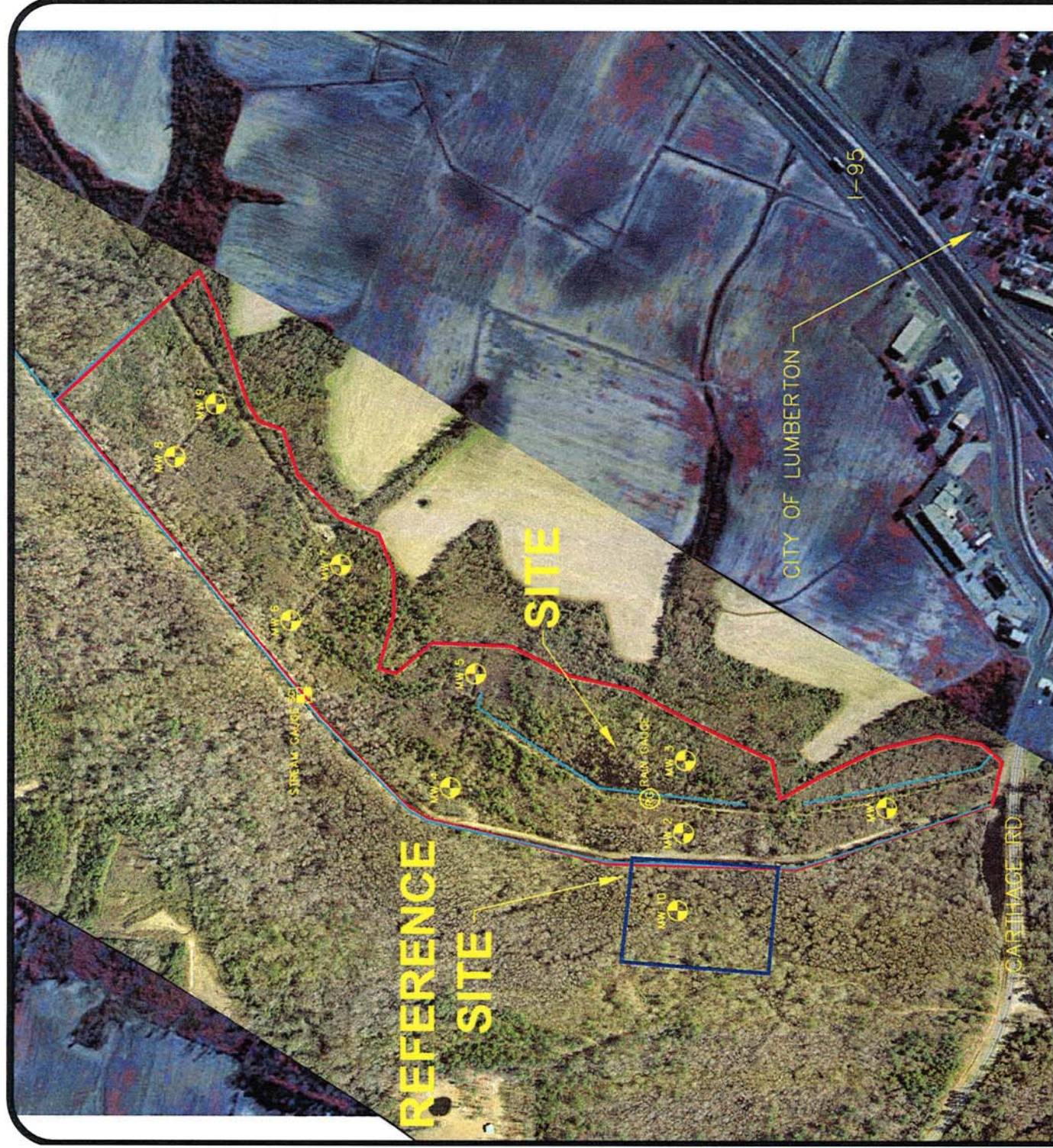


PROJECT SITE & REFERENCE SITE
 WATERSHED MAP

FIGURE 2

**THE JOHN R. McADAMS
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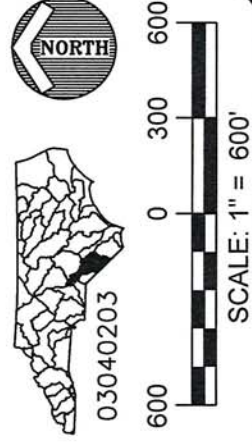


LEGEND:

- MONITORING WELL
- STREAM GAUGE
- RAIN GAUGE
- EXISTING HYDROLOGIC FEATURES
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE REFERENCE AREA BOUNDARY

NOTES:

PROJECT: MEADOWBRANCH, DENR #D07017S
 ROBESON COUNTY, NORTH CAROLINA
 2007 COLOR PHOTOGRAPH / 1998 COLOR INFRARED PHOTO



PROJECT NO. EEP-06050

FILENAME: EEP06050

SCALE: 1" = 600'

DATE: 04-16-07

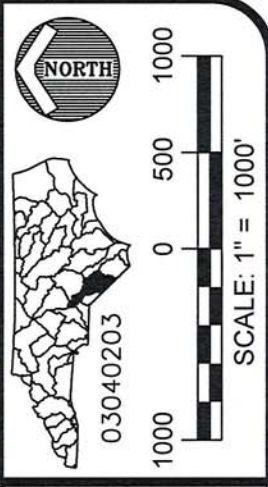
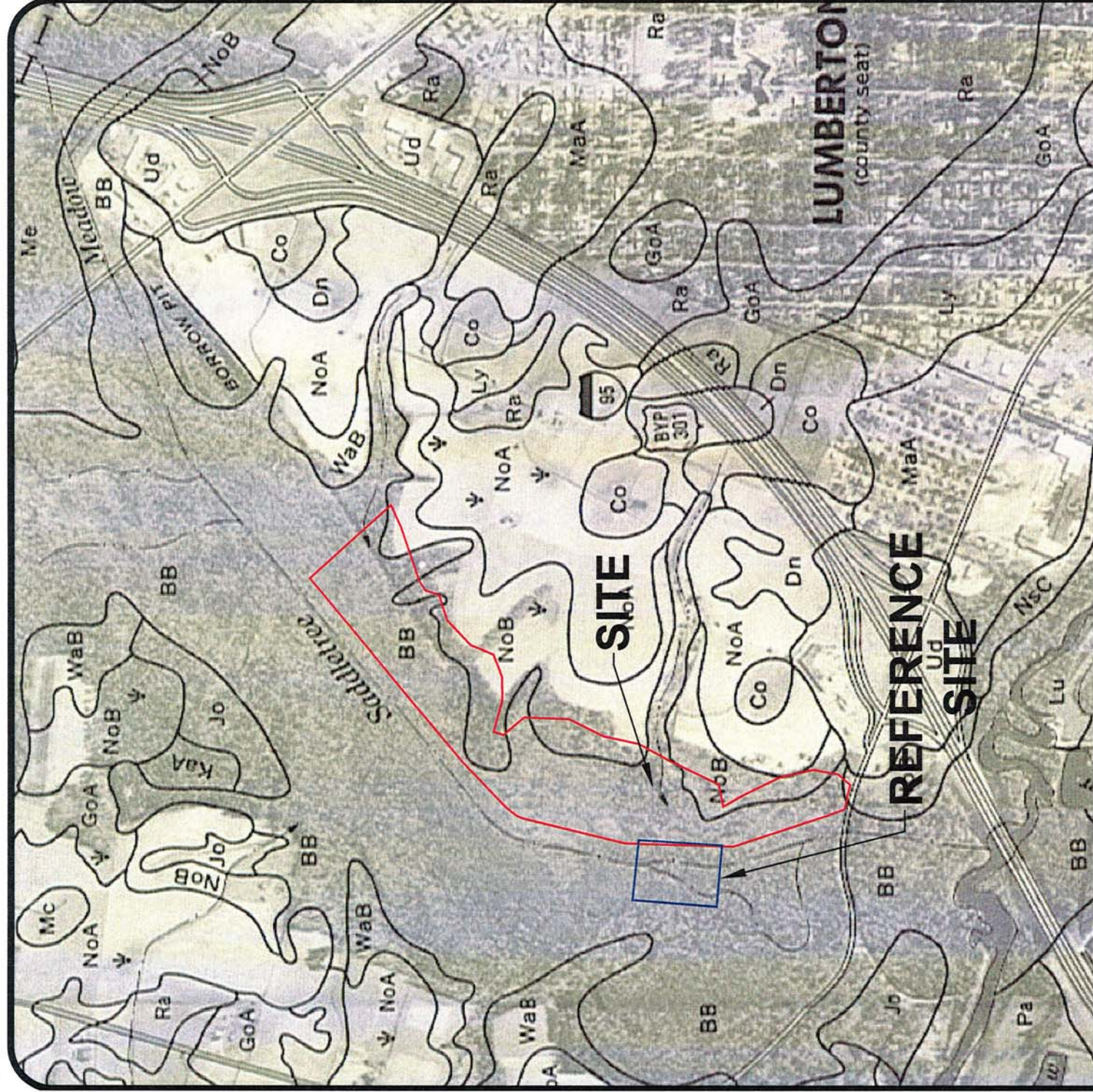


PROJECT SITE & REFERENCE SITE
 GAUGE LOCATIONS & HYDROLOGIC
 FEATURES

FIGURE 3

**THE JOHN R. McADAMS
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LEGEND:
 — APPROXIMATE PROPERTY BOUNDARY
 — APPROXIMATE REFERENCE AREA BOUNDARY

NOTES:
 PROJECT: MEADOWBRANCH, DENR #D07017S
 ROBESON COUNTY, NORTH CAROLINA
 1978 NRCS SOILS MAP

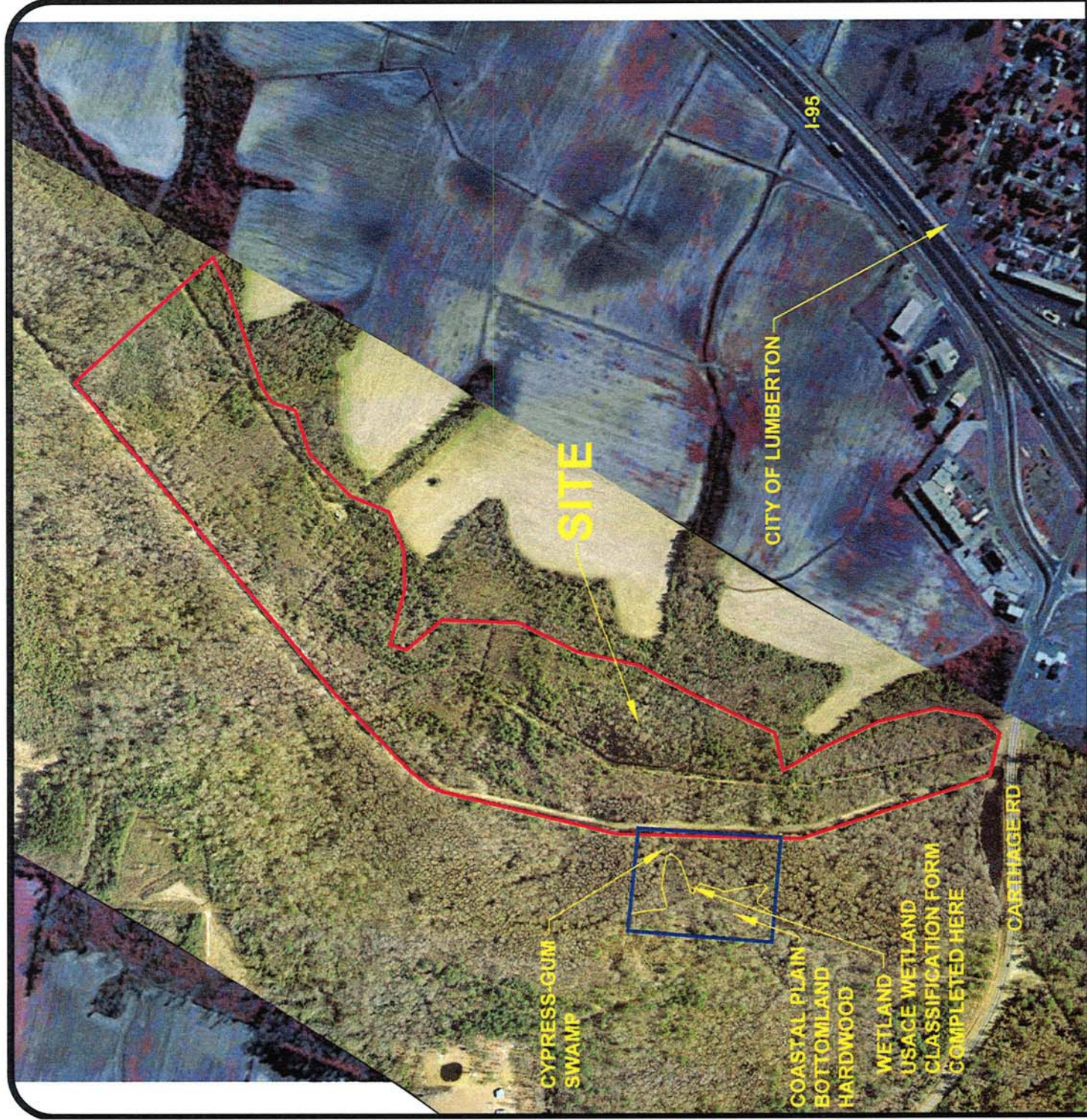
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 (919) 361-5000

PROJECT SITE &
 REFERENCE SITE
 NRCS SOIL SURVEY MAP
FIGURE 4



PROJECT NO.	EEP-06050
FILENAME:	EEP06050
SCALE:	1" = 1,000'
DATE:	06-04-07

McADAMS

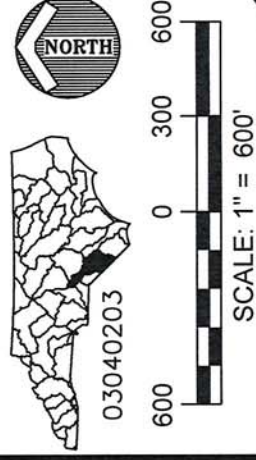


LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE REFERENCE AREA BOUNDARY

NOTES:

PROJECT: MEADOWBRANCH, DENR #D07017S
 ROBESON COUNTY, NORTH CAROLINA
 2007 COLOR PHOTOGRAPH / 1998 COLOR INFRARED PHOTO



PROJECT NO.	EEP-06050
FILENAME:	EEP06050
SCALE:	1" = 600'
DATE:	06-04-07

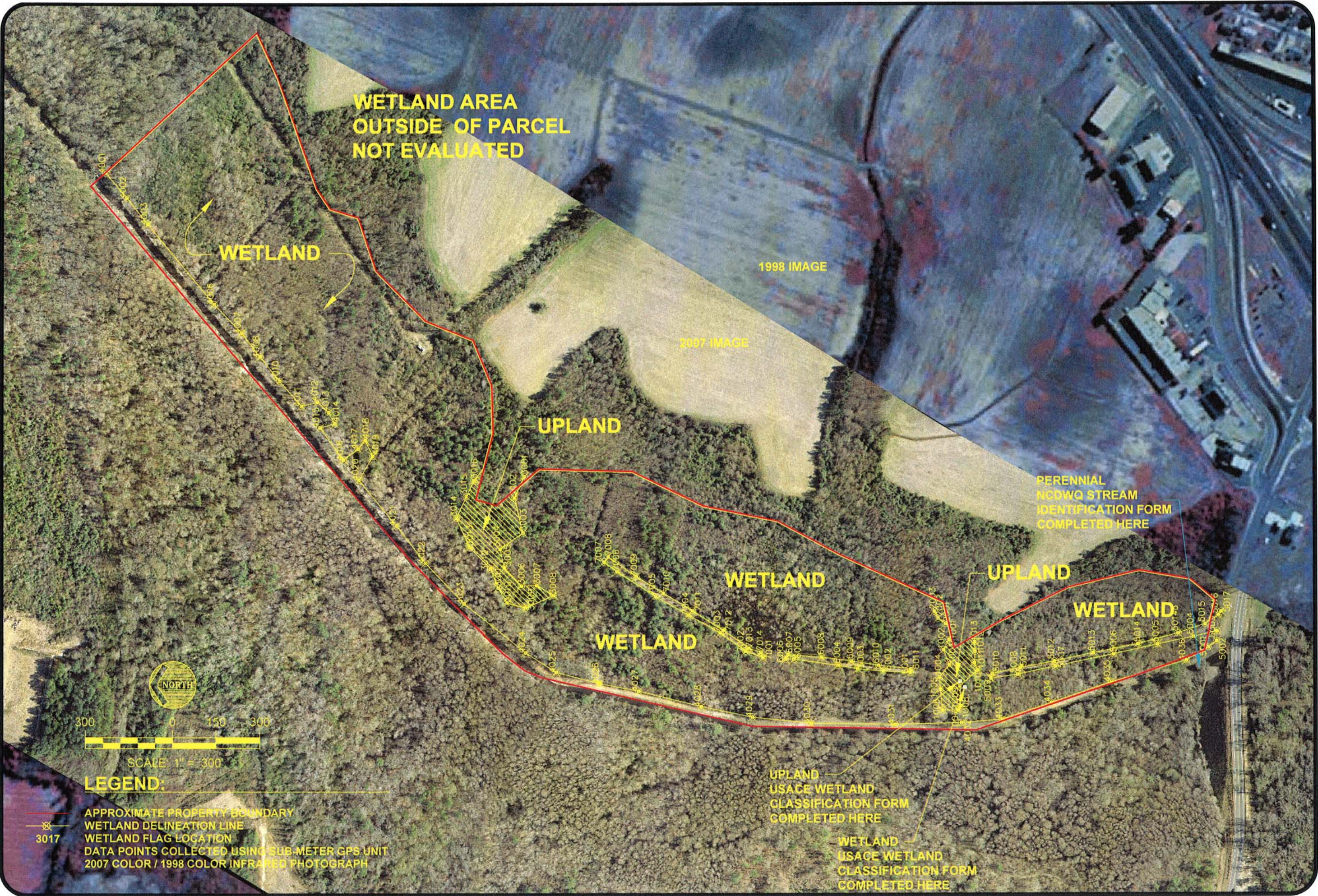


REFERENCE SITE WETLAND
 DETERMINATION SAMPLE LOCATIONS
 & COMMUNITIES MAP

FIGURE 5

**THE JOHN R. McADAMS
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**WETLAND AREA
OUTSIDE OF PARCEL
NOT EVALUATED**

WETLAND

1998 IMAGE

2007 IMAGE

UPLAND

PERENNIAL
NCDWQ STREAM
IDENTIFICATION FORM
COMPLETED HERE

WETLAND

UPLAND

WETLAND

WETLAND

UPLAND
USACE WETLAND
CLASSIFICATION FORM
COMPLETED HERE

WETLAND
USACE WETLAND
CLASSIFICATION FORM
COMPLETED HERE



SCALE 1" = 300'

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- WETLAND DELINEATION LINE
- WETLAND FLAG LOGATION
- DATA POINTS COLLECTED USING SUB-METER GPS UNIT
- 2007 COLOR / 1998 COLOR INFRARED PHOTOGRAPH

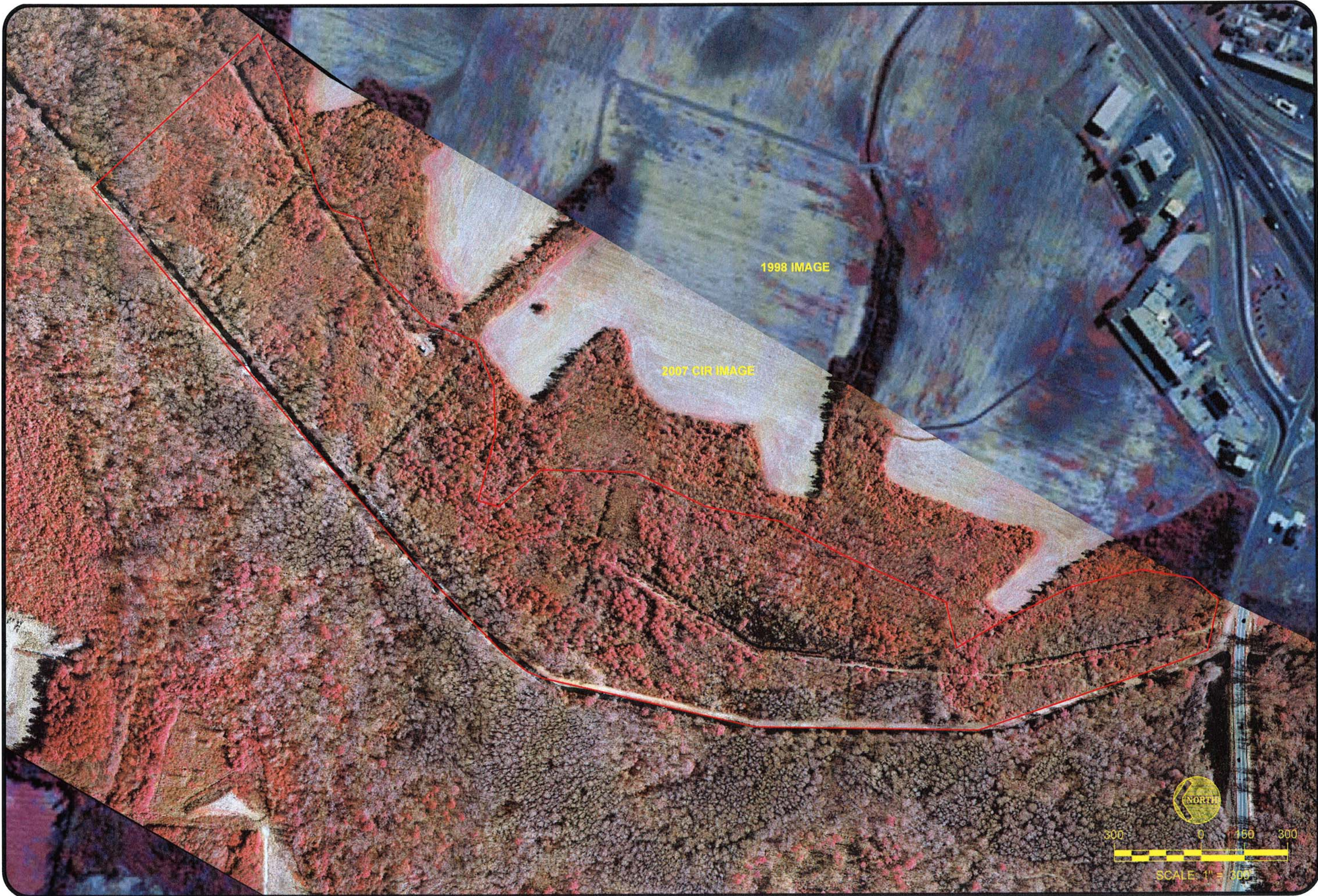
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**PROJECT SITE WETLAND DELINEATION MAP
MEADOWBRANCH WETLAND RESTORATION PROJECT
FIGURE 6**

PROJECT NO. EEP-06050
FILENAME: FIGURES_W1
SCALE: 1" = 300'
DATE: 06-04-07





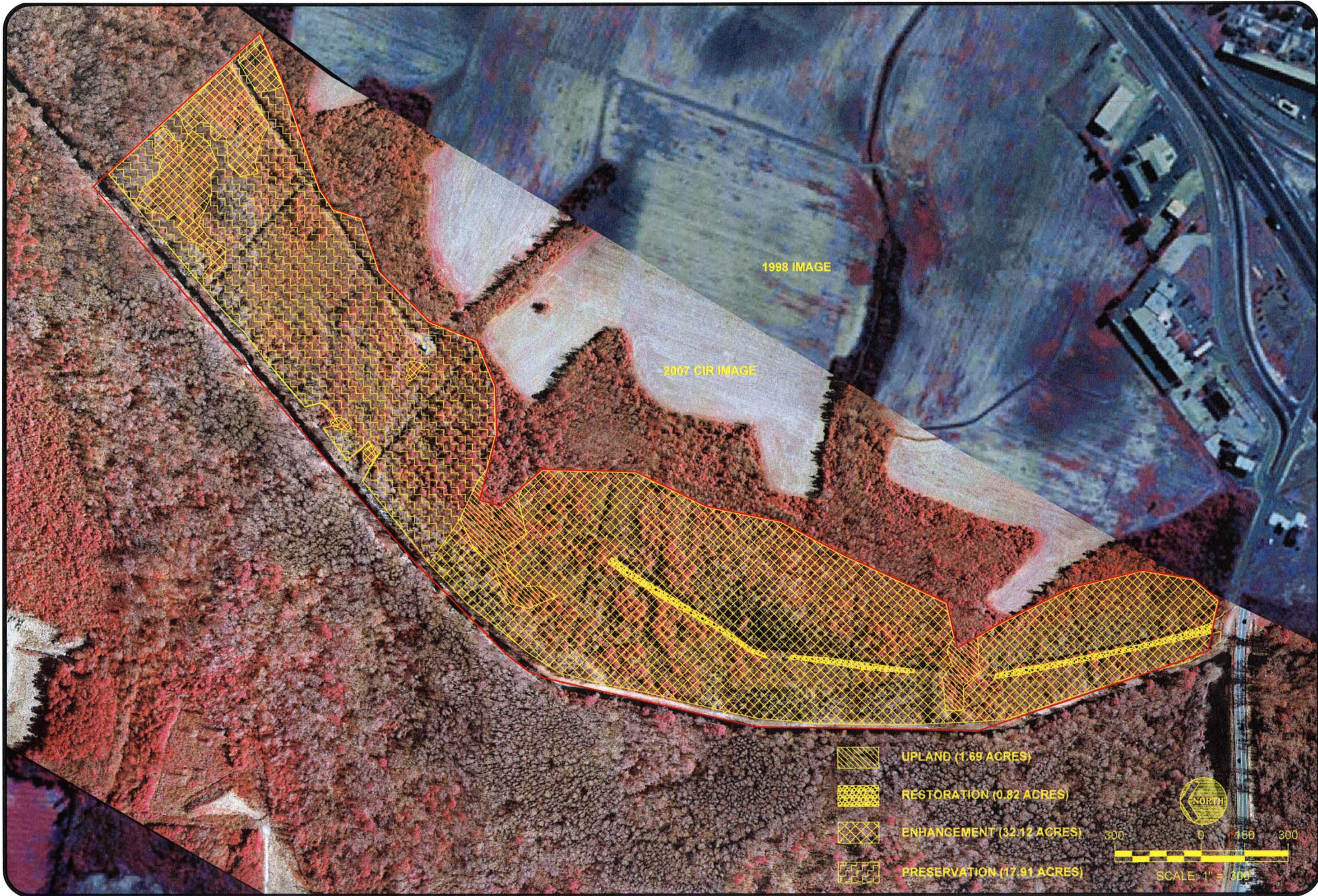
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PROJECT SITE COLOR INFRARED PHOTOGRAPH
MEADOWBRANCH WETLAND RESTORATION PROJECT
FIGURE 7

PROJECT NO. EEP-06050
 FILENAME: FIGURES_W1
 SCALE: 1" = 300'
 DATE: 06-04-07

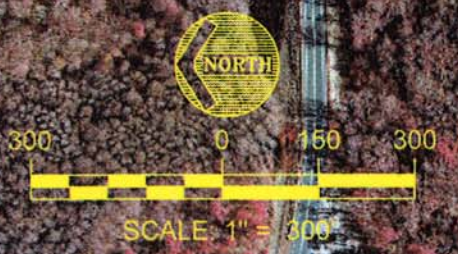




1998 IMAGE

2007 CIR IMAGE

-  UPLAND (1.69 ACRES)
-  RESTORATION (0.82 ACRES)
-  ENHANCEMENT (32.12 ACRES)
-  PRESERVATION (17.91 ACRES)

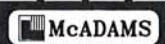


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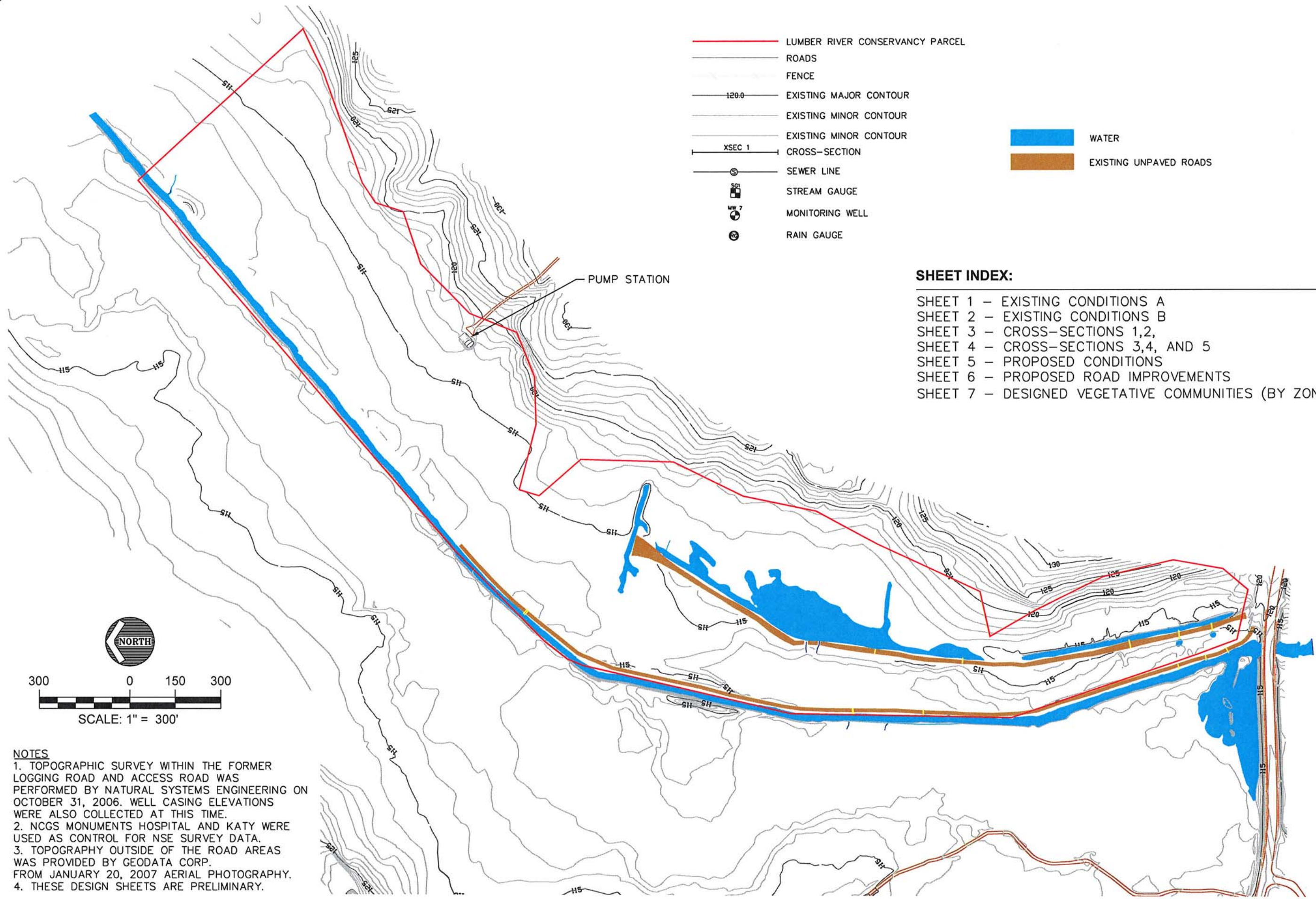
PROJECT RESTORATION SUMMARY
MEADOWBRANCH WETLAND RESTORATION PROJECT
FIGURE 8

PROJECT NO. EEP-06050
FILENAME: FIGURES_W1
SCALE: 1" = 300'
DATE: 06-04-07



Section 10.0 – Design Sheets





- LUMBER RIVER CONSERVANCY PARCEL
- ROADS
- FENCE
- 120.0 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING MINOR CONTOUR
- XSEC 1 — CROSS-SECTION
- ○ — SEWER LINE
- □ — STREAM GAUGE
- ⊙ — MONITORING WELL
- ⊙ — RAIN GAUGE
- WATER
- EXISTING UNPAVED ROADS

- SHEET INDEX:**
- SHEET 1 - EXISTING CONDITIONS A
 - SHEET 2 - EXISTING CONDITIONS B
 - SHEET 3 - CROSS-SECTIONS 1,2,
 - SHEET 4 - CROSS-SECTIONS 3,4, AND 5
 - SHEET 5 - PROPOSED CONDITIONS
 - SHEET 6 - PROPOSED ROAD IMPROVEMENTS
 - SHEET 7 - DESIGNED VEGETATIVE COMMUNITIES (BY ZONE)

NOTES

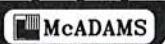
1. TOPOGRAPHIC SURVEY WITHIN THE FORMER LOGGING ROAD AND ACCESS ROAD WAS PERFORMED BY NATURAL SYSTEMS ENGINEERING ON OCTOBER 31, 2006. WELL CASING ELEVATIONS WERE ALSO COLLECTED AT THIS TIME.
2. NCGS MONUMENTS HOSPITAL AND KATY WERE USED AS CONTROL FOR NSE SURVEY DATA.
3. TOPOGRAPHY OUTSIDE OF THE ROAD AREAS WAS PROVIDED BY GEODATA CORP. FROM JANUARY 20, 2007 AERIAL PHOTOGRAPHY.
4. THESE DESIGN SHEETS ARE PRELIMINARY.

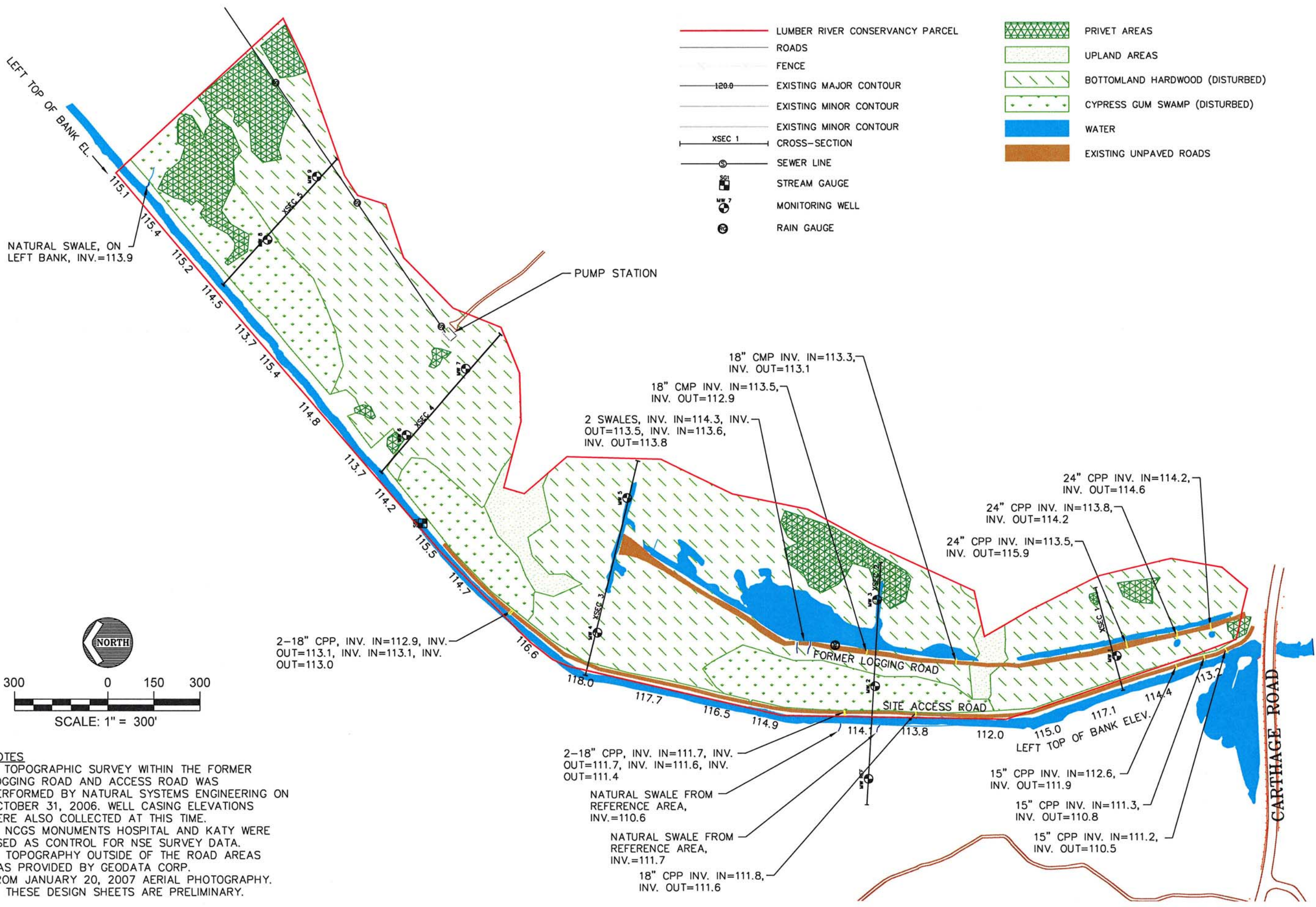
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EXISTING CONDITIONS A
MEADOWBRANCH WETLAND RESTORATION PROJECT
SHEET 1

PROJECT NO. EEP-06050
 FILENAME: FIGURES_C
 SCALE: 1" = 300'
 DATE: 06-04-07



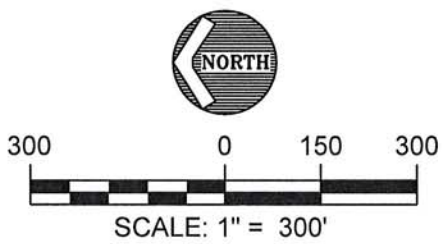


- LUMBER RIVER CONSERVANCY PARCEL
- ROADS
- FENCE
- 120.0 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING MINOR CONTOUR
- XSEC 1 — CROSS-SECTION
- SEWER LINE
- SG1 — STREAM GAUGE
- MW 7 — MONITORING WELL
- RG — RAIN GAUGE

- PRIVET AREAS
- UPLAND AREAS
- BOTTOMLAND HARDWOOD (DISTURBED)
- CYPRESS GUM SWAMP (DISTURBED)
- WATER
- EXISTING UNPAVED ROADS

NATURAL SWALE, ON LEFT BANK, INV.=113.9

PUMP STATION



- NOTES**
1. TOPOGRAPHIC SURVEY WITHIN THE FORMER LOGGING ROAD AND ACCESS ROAD WAS PERFORMED BY NATURAL SYSTEMS ENGINEERING ON OCTOBER 31, 2006. WELL CASING ELEVATIONS WERE ALSO COLLECTED AT THIS TIME.
 2. NCGS MONUMENTS HOSPITAL AND KATY WERE USED AS CONTROL FOR NSE SURVEY DATA.
 3. TOPOGRAPHY OUTSIDE OF THE ROAD AREAS WAS PROVIDED BY GEODATA CORP. FROM JANUARY 20, 2007 AERIAL PHOTOGRAPHY.
 4. THESE DESIGN SHEETS ARE PRELIMINARY.

- 18" CMP INV. IN=113.3, INV. OUT=113.1
- 18" CMP INV. IN=113.5, INV. OUT=112.9
- 2 SWALES, INV. IN=114.3, INV. OUT=113.5, INV. IN=113.6, INV. OUT=113.8
- 2-18" CPP, INV. IN=112.9, INV. OUT=113.1, INV. IN=113.1, INV. OUT=113.0
- 2-18" CPP, INV. IN=111.7, INV. OUT=111.7, INV. IN=111.6, INV. OUT=111.4
- NATURAL SWALE FROM REFERENCE AREA, INV.=110.6
- NATURAL SWALE FROM REFERENCE AREA, INV.=111.7
- 18" CPP INV. IN=111.8, INV. OUT=111.6
- 24" CPP INV. IN=114.2, INV. OUT=114.6
- 24" CPP INV. IN=113.8, INV. OUT=114.2
- 24" CPP INV. IN=113.5, INV. OUT=115.9
- 15" CPP INV. IN=112.6, INV. OUT=111.9
- 15" CPP INV. IN=111.3, INV. OUT=110.8
- 15" CPP INV. IN=111.2, INV. OUT=110.5

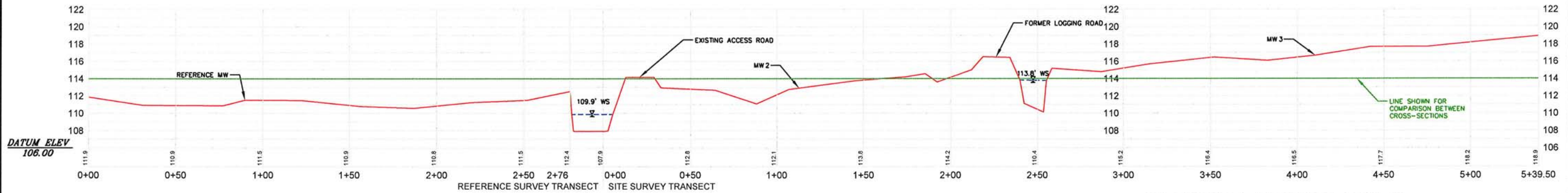
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EXISTING CONDITIONS B
 MEADOWBRANCH WETLAND RESTORATION PROJECT
 SHEET 2

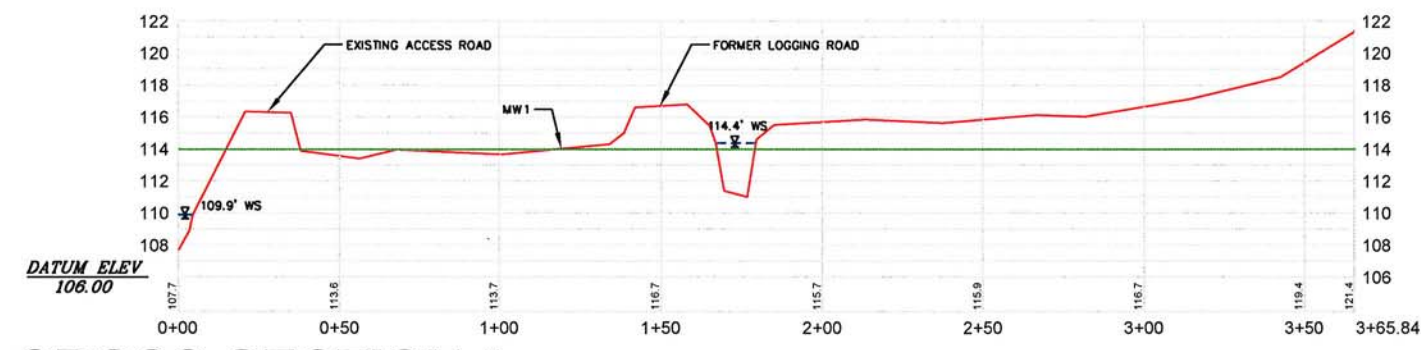
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SCALE: 1" = 300'
DATE: 06-04-07



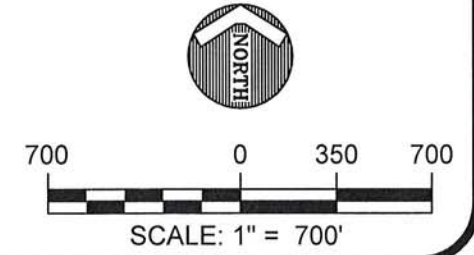
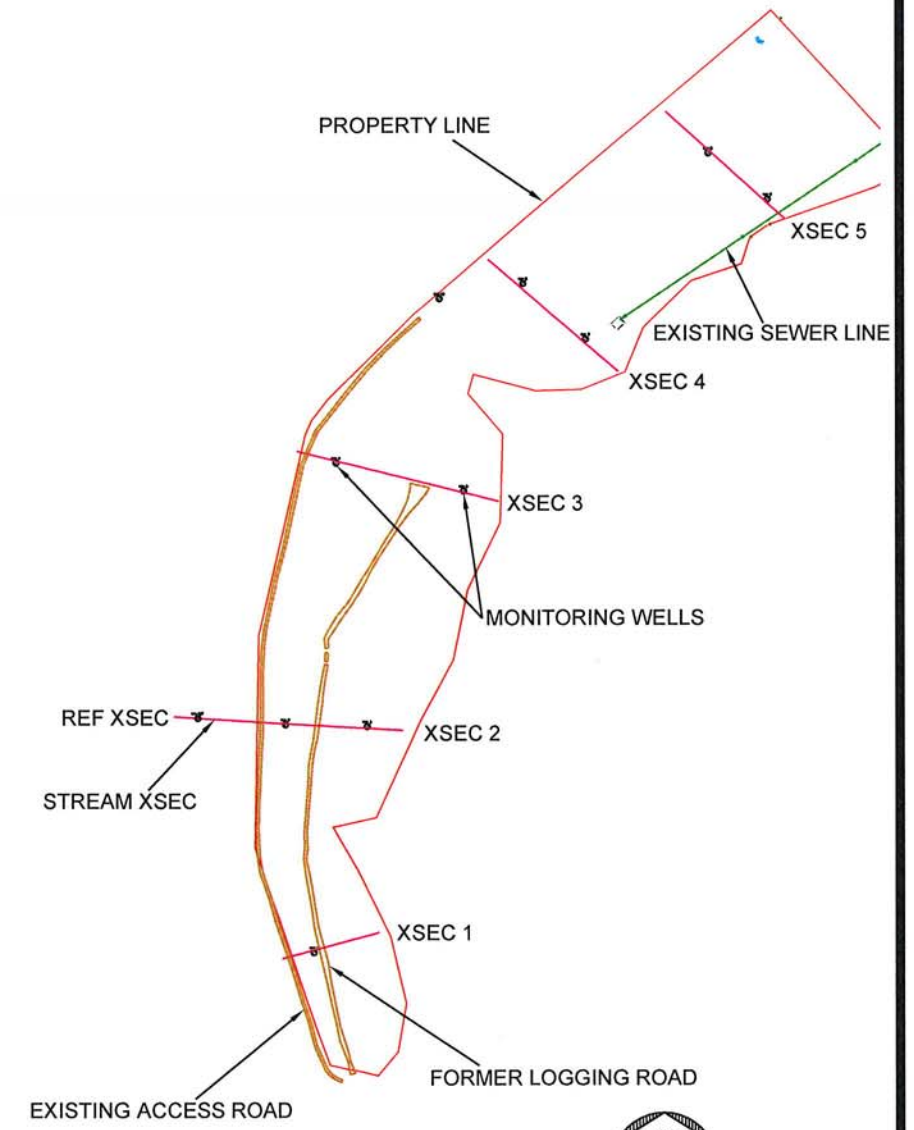


REFERENCE CROSS-SECTION
HORIZONTAL SCALE 1" = 60'

CROSS-SECTION 2
HORIZONTAL SCALE 1" = 60'



CROSS-SECTION 1
HORIZONTAL SCALE 1" = 60'



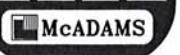
NOTE: WATER SURFACE ELEVATIONS FROM OCT 31, 2006

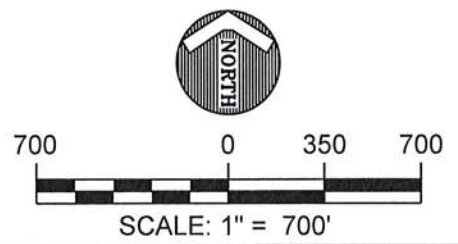
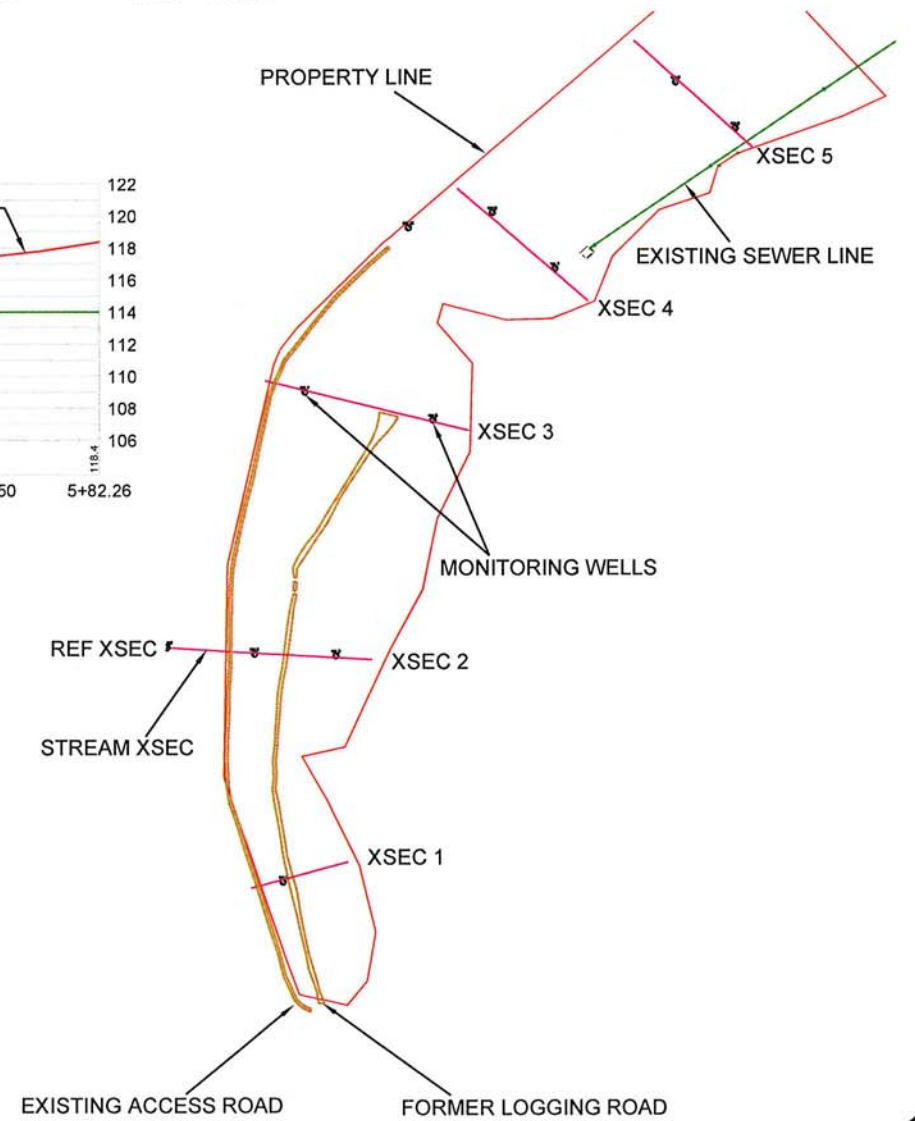
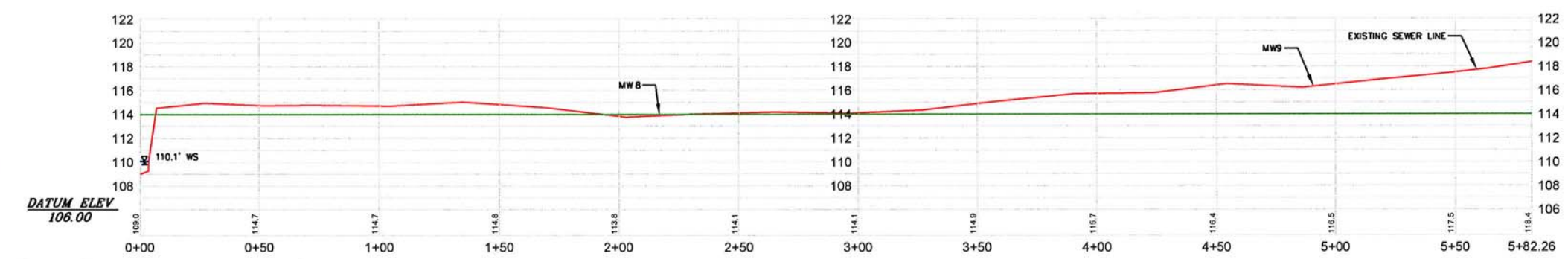
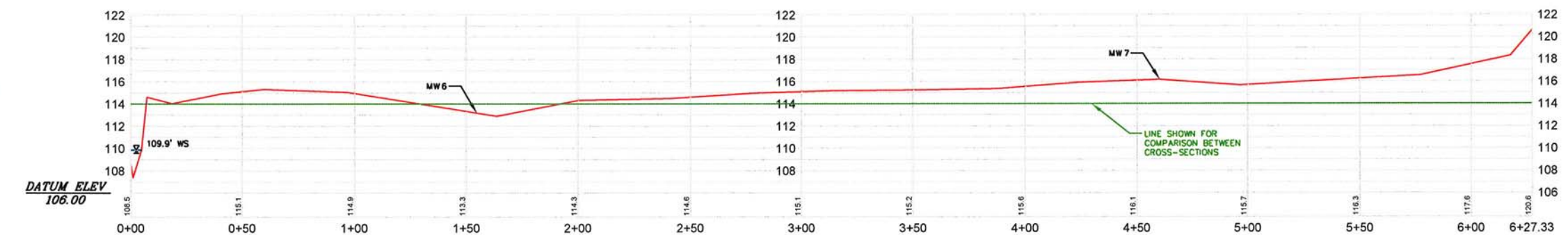
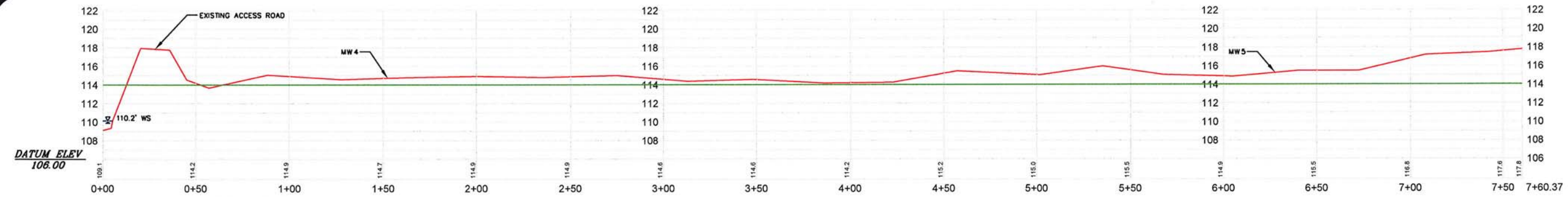
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CROSS-SECTIONS 1, 2, AND REFERENCE
MEADOWBRANCH WETLAND RESTORATION PROJECT
SHEET 3

PROJECT NO. EEP-06050
FILENAME: FIGURES_D
SCALE: 1" = 700'
DATE: 06-04-07





NOTE: WATER SURFACE ELEVATIONS FROM OCT 31, 2006

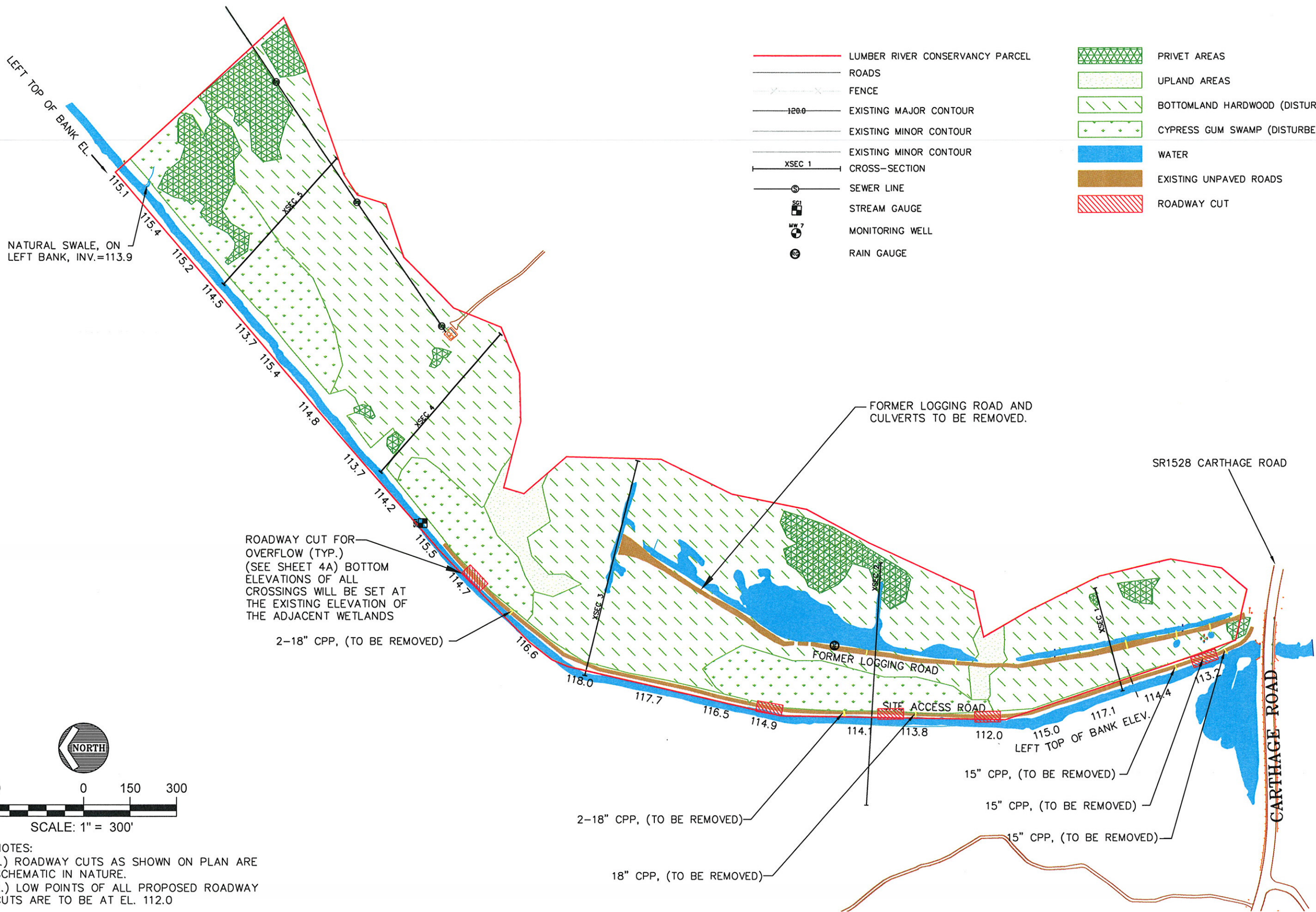
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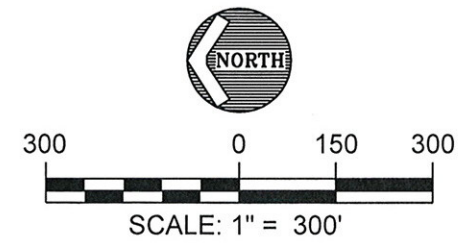
CROSS-SECTIONS 3, 4, AND 5
MEADOWBRANCH WETLAND RESTORATION
SHEET 4

PROJECT NO.	EEP-06050
FILENAME:	FIGURES_D
SCALE:	1" = 700'
DATE:	06-04-07





- LUMBER RIVER CONSERVANCY PARCEL
- ROADS
- - - FENCE
- 120.0 — EXISTING MAJOR CONTOUR
- — EXISTING MINOR CONTOUR
- — EXISTING MINOR CONTOUR
- XSEC 1 — CROSS-SECTION
- S — SEWER LINE
- SG1 — STREAM GAUGE
- MW 7 — MONITORING WELL
- RG — RAIN GAUGE
- PRIVET AREAS
- UPLAND AREAS
- BOTTOMLAND HARDWOOD (DISTURBED)
- CYPRESS GUM SWAMP (DISTURBED)
- WATER
- EXISTING UNPAVED ROADS
- ROADWAY CUT



NOTES:
 1.) ROADWAY CUTS AS SHOWN ON PLAN ARE SCHEMATIC IN NATURE.
 2.) LOW POINTS OF ALL PROPOSED ROADWAY CUTS ARE TO BE AT EL. 112.0

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PROPOSED CONDITIONS
MEADOWBRANCH WETLAND RESTORATION PROJECT
 SHEET 5

PROJECT NO. EEP-06050
 FILENAME: FIGURES_C
 SCALE: 1" = 300'
 DATE: 06-18-07

McADAMS

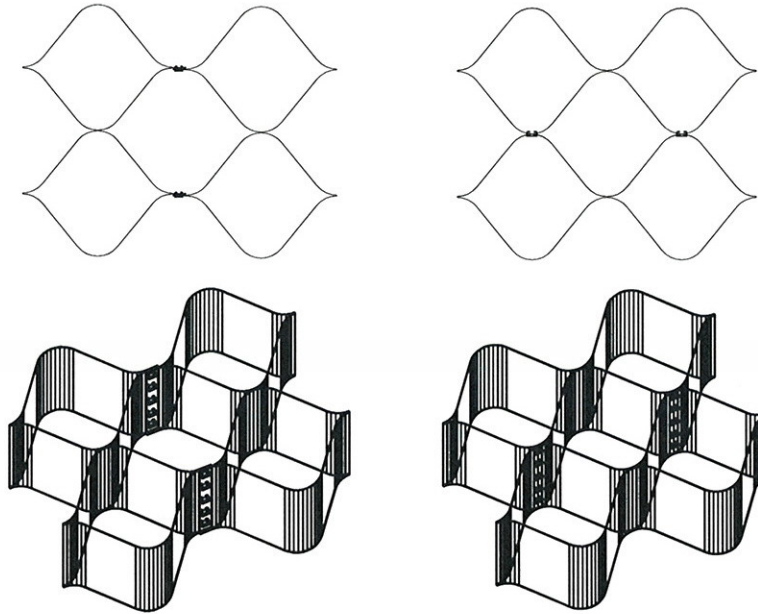
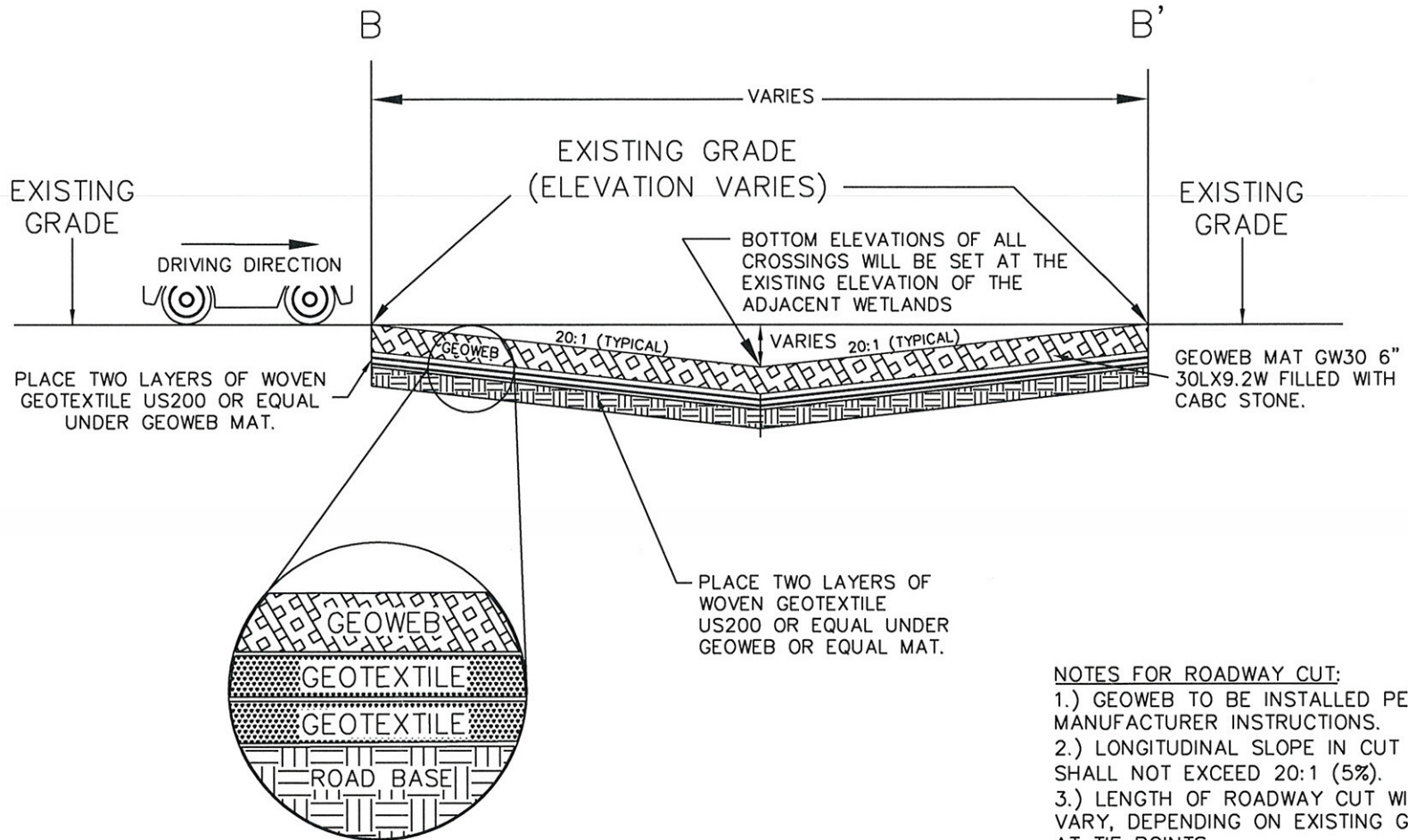


FIGURE A SIDE CONNECTION DETAIL - INTERLEAVED
FIGURE B END CONNECTION DETAIL - ABUTTED

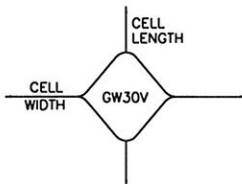
STAPLED END CONNECTION DETAILS



- NOTES FOR ROADWAY CUT:
- 1.) GEOWEB TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
 - 2.) LONGITUDINAL SLOPE IN CUT SECTION SHALL NOT EXCEED 20:1 (5%).
 - 3.) LENGTH OF ROADWAY CUT WILL VARY, DEPENDING ON EXISTING GRADE AT TIE POINTS.

GEOWEB® CELL SIZES

THE CELL		NON-STANDARD		NOMINAL CELL AREA cm ² (in ²)	DIMENSIONS AT RECOMMENDED CELL EXPANSION RANGE			
CELL DEPTHS mm (in)		200 (8)			MINIMUM		MAXIMUM	
75 (3)	100 (4) 150 (6)			LENGTH cm (in)	WIDTH cm (in)	LENGTH cm (in)	WIDTH cm (in)	
				460 (71.3)	260 (10.25)	289 (11.39)	315 (12.39)	360 (13.77)



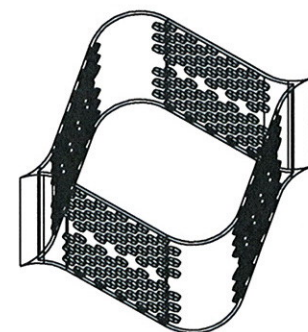
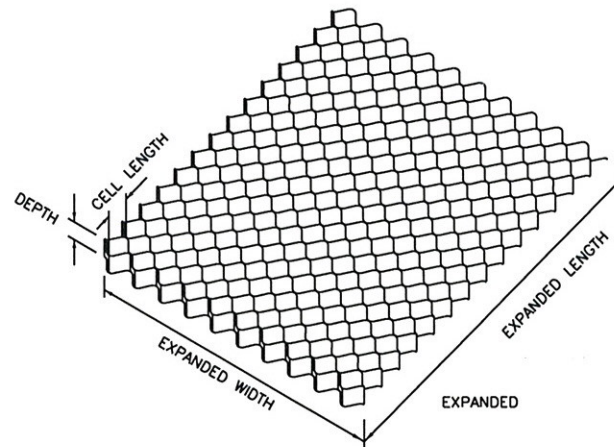
NOTE: ALL DIMENSIONS ARE NOMINAL AND ARE SUBJECT TO MANUFACTURING TOLERANCES

GEOWEB® SECTION SIZES

GW30V - 8 CELLS WIDE (FOR SLOPE & CHANNEL PROTECTION, AND LOAD SUPPORT)

	MINIMUM EXPANSION LENGTH		MAXIMUM EXPANSION LENGTH		NOMINAL AREA	
	ft	m	ft	m	ft ²	m ²
CELLS LONG	15.4	4.7	9.2	2.8	14.3	13.3
18	18.0	5.5			167	15.5
21	21.4	6.5			198	18.4
25	24.8	7.6			230	21.4
29	29.1	8.9			270	25.0
31	34.2	10.4			317	29.5

STANDARD GEOWEB® SECTION DIMENSIONS

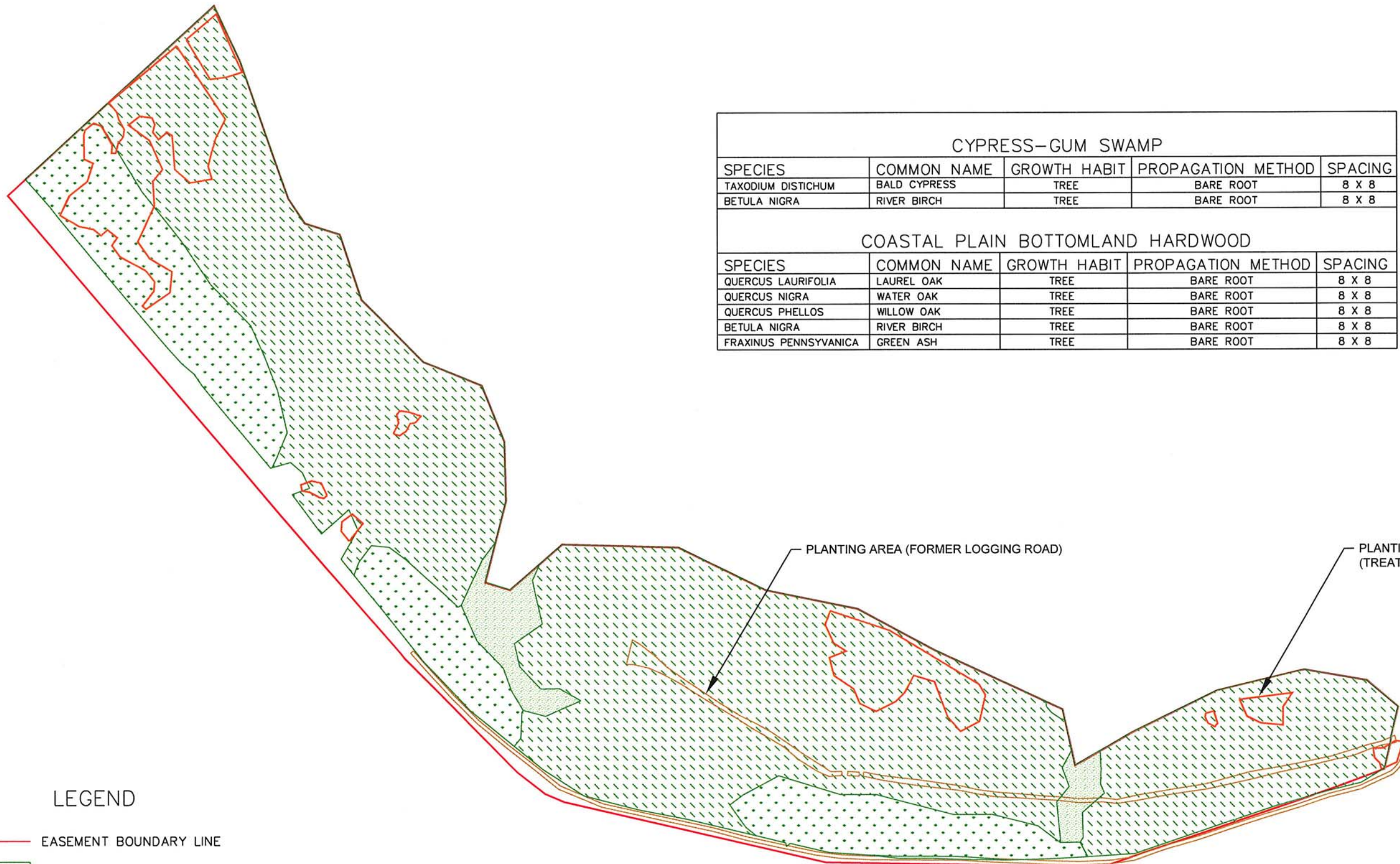


ISOMETRIC VIEW PERFORATED CELL






NOTES FOR STANDARD CONNECTIONS BETWEEN GEOWEB® SECTIONS:

1. ADJACENT GEOWEB SECTIONS ARE STAPLED TOGETHER USING MANUFACTURER APPROVED STAPLERS AND STAPLES
2. THE TOP EDGES OF ADJACENT CELL WALLS SHOULD BE HELD FLUSH WHEN STAPLING.
3. SIDE CONNECTIONS BETWEEN EXPANDED GEOWEB SECTIONS SHOULD BE INTERLEAVED AS SHOWN IN FIGURE A. WELDED EDGE SEAMS SHOULD BE ALIGNED WHEN STAPLING.
4. END CONNECTIONS BETWEEN GEOWEB SECTIONS SHOULD BE BUTTED AS SHOWN IN FIGURE B. THE LONGITUDINAL CENTER-LINES OF ABUTTING EXTERNAL CELLS SHOULD BE ALIGNED AND STAPLED AT THE CELL WALL CONTACT POINT.

ROADWAY CUT DETAIL (NTS)



LEGEND

-  EASEMENT BOUNDARY LINE
-  ZONE 1 CYPRESS-GUM SWAMP
-  ZONE 2 COASTAL PLAIN BOTTOMLAND HARDWOOD
-  UPLAND
-  TREATED PRIVET AREAS



SCALE: 1" = 300'

CYPRESS-GUM SWAMP				
SPECIES	COMMON NAME	GROWTH HABIT	PROPAGATION METHOD	SPACING
TAXODIUM DISTICHUM	BALD CYPRESS	TREE	BARE ROOT	8 X 8
BETULA NIGRA	RIVER BIRCH	TREE	BARE ROOT	8 X 8

COASTAL PLAIN BOTTOMLAND HARDWOOD				
SPECIES	COMMON NAME	GROWTH HABIT	PROPAGATION METHOD	SPACING
QUERCUS LAURIFOLIA	LAUREL OAK	TREE	BARE ROOT	8 X 8
QUERCUS NIGRA	WATER OAK	TREE	BARE ROOT	8 X 8
QUERCUS PHELLOS	WILLOW OAK	TREE	BARE ROOT	8 X 8
BETULA NIGRA	RIVER BIRCH	TREE	BARE ROOT	8 X 8
FRAXINUS PENNSYVANICA	GREEN ASH	TREE	BARE ROOT	8 X 8



Section 11.0 – Appendices

Project Site Photographs

Appendix 1.0



THE JOHN R. McADAMS
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Photo 1 – View of the access road and canal, at south end of site, looking north.



Photo 2 – Access road and canal during flood conditions at south end of site, looking south, Carthage road in background.





Photo 3 – Logging road (proposed restoration area)



Photo 4 – Water backed up behind former logging road.





Photo 5 – Significant undergrowth and some exotic vegetation (privet).
Eradication of privet and enhancement of these areas is recommended.



Photo 6 – Proposed preservation area, during flood conditions.



Project Site USACE Routine Wetland Determination Data Forms

Appendix 2.0



THE JOHN R. McADAMS
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DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: <u>Meadowbranch</u> Applicant / Owner: <u>NSE/EEP</u> Investigator: <u>LEF - P. May/B. Smith</u>	Date: <u>11/30/06</u> County: <u>Robeson</u> State: <u>NC</u>
Do normal circumstances exist on the site? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Is the site significantly disturbed (Atypical situation)? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Is the area a potential problem area? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (explain on reverse if needed)	Community ID: <u>Upland</u> Transect ID: _____ Plot ID: <u>W-1000</u>

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. <u>Panicum laetiflorum</u>	<u>T</u>	<u>FAC</u>	9. _____	_____	_____
2. <u>Quercus virginiana</u>	<u>T</u>	<u>FAC</u>	10. _____	_____	_____
3. <u>Acer rubrum</u>	<u>S</u>	<u>FAC</u>	11. _____	_____	_____
4. <u>Smilax rotundifolia</u>	<u>V</u>	<u>FAC</u>	12. _____	_____	_____
5. <u>Smilax rotundifolia</u>	<u>V</u>	<u>FAC</u>	13. _____	_____	_____
6. _____	_____	_____	14. _____	_____	_____
7. _____	_____	_____	15. _____	_____	_____
8. _____	_____	_____	16. _____	_____	_____

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks: No herb layer - heavy cover of pine needles. All facultative vegetation.

HYDROLOGY

<input type="checkbox"/> Recorded Data (Describe in Remarks): <input type="checkbox"/> Stream, Lake, or Tide Gauge <input type="checkbox"/> Aerial Photographs <input type="checkbox"/> Other <input checked="" type="checkbox"/> No Recorded Data Available Field Observations: Depth of Surface Water: _____ (in.) Depth to Free Water in Pit: <u>10</u> (in.) Depth to Saturated Soil: <u>4</u> (in.)	Wetland Hydrology Indicators Primary Indicators: <input type="checkbox"/> Inundated <input checked="" type="checkbox"/> Saturated in Upper 12" <input type="checkbox"/> Water Marks <input type="checkbox"/> Drift Lines <input type="checkbox"/> Sediment Deposits <input type="checkbox"/> Drainage Patterns in Wetlands Secondary Indicators: <input type="checkbox"/> Oxidized Roots Channels in Upper 12" <input type="checkbox"/> Water-Stained Leaves <input type="checkbox"/> Local Soil Survey Data <input type="checkbox"/> FAC-Neutral Test <input type="checkbox"/> Other (Explain in Remarks)
Remarks: <u>Recent heavy rains (74 inches) - Lumbea River flooded area.</u>	

SOILS

Map Unit Name
 (Series and Phase): Norfolk loamy sand, 2-6% clay Drainage Class: Well drained

Taxonomy (Subgroup): Uypic paleudults Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0		10YR 3/1	-	-	Sandy loam
3		10YR 4/4	-	-	loamy sand
7		10YR 4/3	3/1 + 2.5Y 6/4	Few distinct	" "

Hydric Soil Indicators:

<input type="checkbox"/> Histosol	<input type="checkbox"/> Concretions
<input type="checkbox"/> Histic Epipedon	<input type="checkbox"/> High Organic Content in Surface Layer in Sandy Soils
<input type="checkbox"/> Sulfidic Odor	<input type="checkbox"/> Organic Streaking in Sandy Soils
<input type="checkbox"/> Aquic Moisture Regime	<input type="checkbox"/> Listed On Local Hydric Soils List
<input type="checkbox"/> Reducing Conditions	<input type="checkbox"/> Listed on National Hydric Soils List
<input type="checkbox"/> Gleyed or Low-Chroma Colors	<input type="checkbox"/> Other (Explain in Remarks)

Remarks: No hydric soil indicators. Distinct transition from upland to wetland soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampling Point Within a Wetland?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Wetland Hydrology Present?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		
Hydric Soils Present?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: <u>Meander branch</u> Applicant / Owner: <u>NSE/EEP</u> Investigator: <u>CEI - P. May/B. Smith</u>	Date: <u>11/30/06</u> County: <u>Polk</u> State: <u>NC</u>
Do normal circumstances exist on the site? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Is the site significantly disturbed (Atypical situation)? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Is the area a potential problem area? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (explain on reverse if needed)	Community ID: <u>Wetland</u> Transect ID: Plot ID: <u>W-1009</u>

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. <u>Panicum laetiflorum</u>	<u>T</u>	<u>FAC</u>	9. <u>Carex sp.</u>	<u>H</u>	<u>-</u>
2. <u>Betula nigra</u>	<u>T</u>	<u>FACW</u>	10.		
3. <u>Panicum sp.</u>	<u>T</u>	<u>FAC</u>	11.		
4. <u>Spartina patens</u>	<u>T/S</u>	<u>FAC</u>	12.		
5. <u>Liquidambar styraciflua</u>	<u>S</u>	<u>FAC+</u>	13.		
6. <u>Asplenium platyneuron</u>	<u>S</u>	<u>FAC</u>	14.		
7. <u>Sagittaria arifolia</u>	<u>S</u>	<u>FACW</u>	15.		
8. <u>Sagittaria sp.</u>	<u>H</u>	<u>OBL/FACW</u>	16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks:

HYDROLOGY

<input type="checkbox"/> Recorded Data (Describe in Remarks): <input type="checkbox"/> Stream, Lake, or Tide Gauge <input type="checkbox"/> Aerial Photographs <input type="checkbox"/> Other <input checked="" type="checkbox"/> No Recorded Data Available Field Observations: Depth of Surface Water: <u>—</u> (in.) Depth to Free Water in Pit: <u>8</u> (in.) Depth to Saturated Soil: <u>2</u> (in.)	Wetland Hydrology Indicators Primary Indicators: <input type="checkbox"/> Inundated <input checked="" type="checkbox"/> Saturated in Upper 12" <input type="checkbox"/> Water Marks <input type="checkbox"/> Drift Lines <input type="checkbox"/> Sediment Deposits <input type="checkbox"/> Drainage Patterns in Wetlands Secondary Indicators: <input checked="" type="checkbox"/> Oxidized Roots Channels in Upper 12" <input checked="" type="checkbox"/> Water-Stained Leaves <input checked="" type="checkbox"/> Local Soil Survey Data <input checked="" type="checkbox"/> FAC-Neutral Test <input type="checkbox"/> Other (Explain in Remarks)
Remarks: <u>Sampling point near wetland edge. Indicators increase as you move down slope.</u>	

SOILS

Map Unit Name (Series and Phase): B.1.1.2 soils Drainage Class: Poorly drained

Taxonomy (Subgroup): Typic Fluvaquents Confirm Mapped Type? Yes No

Profile Description:					
Depth (Inches)	Horizon	Matrix Colors (Munsell Molst)	Mottle Colors (Munsell Molst)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0		10 YR 2/1			Lean
4		10 YR 3/3			Sandy loam
8		10 YR 3/2	2.5 Y 6/4	Lower distinct	Loamy sand

Hydric Soil Indicators:

<input type="checkbox"/> Histosol	<input type="checkbox"/> Concretions
<input type="checkbox"/> Histic Epipedon	<input type="checkbox"/> High Organic Content in Surface Layer in Sandy Soils
<input type="checkbox"/> Sulfidic Odor	<input type="checkbox"/> Organic Streaking in Sandy Soils
<input type="checkbox"/> Aquic Moisture Regime	<input type="checkbox"/> Listed On Local Hydric Soils List
<input type="checkbox"/> Reducing Conditions	<input type="checkbox"/> Listed on National Hydric Soils List
<input checked="" type="checkbox"/> Gleyed or Low-Chroma Colors	<input type="checkbox"/> Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampling Point Within a Wetland?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Wetland Hydrology Present?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		
Hydric Soils Present?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		

Remarks:

Project Site NCDWQ Stream Classification Forms

Appendix 3.0



THE JOHN R. McADAMS
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North Carolina Division of Water Quality -- Stream Identification Form; Version 3.1

Date: 12/15/06	Project: <i>Northwest</i>	Latitude: 34.655619**
Evaluator: <i>Brian Smith</i>	Site:	Longitude: -77.02926874
Total Points: Stream is at least intermittent if ≥ 19 or perennial if ≥ 30	County: <i>Robeson</i>	Other e.g. Quad Name: <i>Northwest Lumberton</i>

A. Geomorphology (Subtotal = 19.5)

	Absent	Weak	Moderate	Strong
1 ^a . Continuous bed and bank	0	1	2	(3)
2. Sinuosity	0	(1)	2	3
3. In-channel structure: riffle-pool sequence	0	(1)	2	3
4. Soil texture or stream substrate sorting	0	1	(2)	3
5. Active/relic floodplain	0	1	(2)	3
6. Depositional bars or benches	0	1	(2)	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	0	1	2	(3)
9 ^a . Natural levees	0	(1)	2	3
10. Headcuts	(0)	1	2	3
11. Grade controls	(0)	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	(1.5)
13. Second or greater order channel on existing USGS or NRCS map or other documented evidence.	No = 0		Yes = (3)	

^a Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 11.5)

14. Groundwater flow/discharge	0	1	2	(3)
15. Water in channel and > 48 hrs since rain, or Water in channel -- dry or growing season	0	1	2	(3)
16. Leaf litter	(1.5)	1	0.5	0
17. Sediment on plants or debris	0	0.5	(1)	1.5
18. Organic debris lines or piles (Wreck lines)	0	0.5	1	(1.5)
19. Hydric soils (redoximorphic features) present?	No = 0		Yes = (1.5)	

C. Biology (Subtotal = 10.5)

20 ^b . Fibrous roots in channel	(3)	2	1	0
21 ^b . Rooted plants in channel	(3)	2	1	0
22. Crayfish	(0)	0.5	1	1.5
23. Bivalves	0	1	(2)	3
24. Fish	0	0.5	1	(1.5)
25. Amphibians	(0)	0.5	1	1.5
26. Macroinvertebrates (note diversity and abundance)	0	0.5	(1)	1.5
27. Filamentous algae; periphyton	(0)	1	2	3
28. Iron oxidizing bacteria/fungus.	(0)	0.5	1	1.5
29 ^b . Wetland plants in streambed	FAC = 0.5; FACW = 0.75; OBL = 1.5 SAV = 2.0; Other = 0			

^b Items 20 and 21 focus on the presence of upland plants, Item 29 focuses on the presence of aquatic or wetland plants.

Notes: (use back side of this form for additional notes.)

Sketch:

relatively abundant downy myriophylls

This is a fairly large stream that is clearly perennial.

Reference Site 1- Photographs

Appendix 4.0



THE JOHN R. McADAMS
COMPANY, INC.



Photo 1 – Reference site, MW10.



Photo 2 – Reference site, cypress trees.





Photo 3 – Reference site.



Photo 4 – Reference site.





Photo 5 – Natural swale within wetland area, view looking east from reference area toward canal.



Photo 6 – Natural swale within wetland area, view looking west across canal from access road.



Reference Site 1- USACE Routine Wetland Determination Data Forms

Appendix 5.0



THE JOHN R. McADAMS
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DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: <u>Montgomery Creek Wetland Restoration</u> Applicant / Owner: <u>EEP</u> Investigator: <u>Roden Smith</u>	Date: <u>11/01/06</u> County: <u>Robeson</u> State: <u>NC</u>
Do normal circumstances exist on the site? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Is the site significantly disturbed (Atypical situation)? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Is the area a potential problem area? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (explain on reverse if needed)	Community ID: <u>8649</u> Transect ID: _____ Plot ID: _____

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. <u>Spartina patens</u>	<u>T</u>	<u>OBL</u>	9. _____	_____	_____
2. <u>Potamogeton nodosus</u>	<u>T</u>	<u>FACW</u>	10. _____	_____	_____
3. <u>Sagittaria arifolia</u>	<u>T/S</u>	<u>FAC</u>	11. _____	_____	_____
4. _____	_____	_____	12. _____	_____	_____
5. _____	_____	_____	13. _____	_____	_____
6. _____	_____	_____	14. _____	_____	_____
7. _____	_____	_____	15. _____	_____	_____
8. _____	_____	_____	16. _____	_____	_____

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). 100%

Remarks: This area is heavily dominated by Spartina

HYDROLOGY

<input type="checkbox"/> Recorded Data (Describe in Remarks): <input type="checkbox"/> Stream, Lake, or Tide Gauge <input type="checkbox"/> Aerial Photographs <input type="checkbox"/> Other <input checked="" type="checkbox"/> No Recorded Data Available	Wetland Hydrology Indicators Primary Indicators: <input type="checkbox"/> Inundated <input type="checkbox"/> Saturated in Upper 12" <input checked="" type="checkbox"/> Water Marks <input checked="" type="checkbox"/> Drift Lines <input checked="" type="checkbox"/> Sediment Deposits <input checked="" type="checkbox"/> Drainage Patterns in Wetlands
Field Observations: Depth of Surface Water: _____ (in.) Depth to Free Water in Pit: <u>20</u> (in.) Depth to Saturated Soil: _____ (in.)	Secondary Indicators: <input type="checkbox"/> Oxidized Roots Channels in Upper 12" <input checked="" type="checkbox"/> Water-Stained Leaves <input checked="" type="checkbox"/> Local Soil Survey Data <input checked="" type="checkbox"/> FAC-Neutral Test <input type="checkbox"/> Other (Explain in Remarks)
Remarks: <u>It is noted that this area is irrigated regularly</u>	

SOILS

Map Unit Name (Series and Phase): Bibb Drainage Class: Poor, Inundated

Taxonomy (Subgroup): Typic Fluvaquent Confirm Mapped Type? Yes ___ No

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A	10YR 3/1	10YR 6/4	Few / None	L GR ss
6-20+	C	10YR 7/1	10YR 3/1	Few / Distinct	S.M.

- Hydric Soil Indicators:**
- Histosol
 - Histic Epipedon
 - Sulfidic Odor
 - Aquic Moisture Regime
 - Reducing Conditions
 - Gleyed or Low-Chroma Colors
 - Concretions
 - High Organic Content in Surface Layer in Sandy Soils
 - Organic Streaking in Sandy Soils
 - Listed On Local Hydric Soils List
 - Listed on National Hydric Soils List
 - Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No ___
 Wetland Hydrology Present? Yes No ___
 Hydric Soils Present? Yes No ___

Is the Sampling Point Within a Wetland? Yes No ___

Remarks: The area is a typical cypress swamp that is regularly inundated.

Preliminary Gauge Data Summary Groundwater and Rainfall Charts and Data

Appendix 6.0



THE JOHN R. McADAMS
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Gauge Data Summary
Groundwater Elevation Information

Note: All data reported in inches from ground surface

Date	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW10	REF
10/27/2006	-16.8	-41.8	-20.5	-21.6	-13.4	-21.6	-21.3	-21.5		-41.8	
10/28/2006	-4.0	-41.8	-6.4	-21.4	-2.4	-19.9	-9.2	-21.4		-41.8	
10/29/2006	-8.4	-41.8	-8.8	-21.5	-3.7	-20.3	-8.0	-21.5		-41.8	
10/30/2006	-11.4	-41.8	-10.1	-21.5	-4.6	-20.5	-9.2	-21.5		-41.8	
10/31/2006	-12.8	-41.8	-11.0	-21.5	-5.7	-20.7	-10.8	-21.5		-41.8	
11/1/2006	-13.7	-41.7	-11.9	-21.4	-6.9	-21.4	-12.5	-21.4	-21.3	-41.8	
11/2/2006	-14.3	-29.2	-12.7	-21.4	-8.3	-21.4	-14.3	-21.4	-21.4	-41.8	-41.4
11/3/2006	-15.5	-30.2	-14.1	-21.4	-10.9	-21.5	-16.7	-21.5	-21.4	-41.8	-41.4
11/4/2006	-16.4	-30.9	-15.1	-21.4	-12.7	-21.6	-18.3	-21.5	-21.4	-41.8	-41.4
11/5/2006	-16.7	-31.2	-15.4	-21.4	-13.3	-21.6	-18.9	-21.5	-21.4	-41.8	-41.4
11/6/2006	-17.0	-31.6	-15.9	-21.4	-13.9	-21.6	-19.6	-21.4	-21.4	-41.8	-41.4
11/7/2006	-17.2	-31.8	-16.2	-21.4	-14.0	-21.5	-20.0	-21.3	-21.3	-36.8	-41.4
11/8/2006	-3.9	-15.2	-2.8	-21.4	-1.0	-3.0	-4.6	-5.9	-21.2	-41.7	-30.0
11/9/2006	-5.1	-14.1	-0.3	-21.4	-1.0	2.4	-4.4	-3.1	-21.2	-41.7	-21.0
11/10/2006	-6.4	-15.8	-0.9	-21.4	-1.8	1.8	-5.5	-4.3	-21.2	-41.8	-25.4
11/11/2006	-7.5	-16.6	-1.2	-21.4	-2.4	1.6	-5.9	-16.3	-21.3	-41.8	-27.5
11/12/2006	-6.7	-15.1	-0.8	-21.4	-2.2	1.7	-4.9	-20.0	-21.3	-41.8	-26.3
11/13/2006	-6.3	-15.3	-0.2	-21.4	-1.5	2.4	-4.9	-19.1	-21.4	-41.8	-23.5
11/14/2006	-7.4	-16.2	-0.3	-21.4	-2.0	2.2	-5.3	-19.9	-21.4	-41.8	-23.5
11/15/2006	-8.7	-16.8	-0.3	-21.4	-2.4	1.9	-5.5	-20.7	-21.4	-41.8	-23.5
11/16/2006	-2.8	-4.9	1.7	-17.7	0.4	3.5	-1.4	-7.8	-16.9	-23.5	-7.5
11/17/2006	-4.4	-1.7	1.4	-7.9	0.2	4.1	-3.2	-9.5	-5.7	-20.8	2.9
11/18/2006	-5.4	-6.4	0.9	-9.2	-0.4	3.8	-3.7	-12.9	-6.4	-32.3	-0.4
11/19/2006	-5.9	-7.8	0.7	-10.2	-0.8	2.9	-3.7	-13.3	-6.5	-37.7	-4.6
11/20/2006	-6.4	-8.5	0.6	-11.4	-0.5	2.9	-3.7	-13.3	-6.5	-41.2	-7.9
11/21/2006	-4.2	-5.9	0.9	-11.4	0.7	3.0	-2.4	-12.7	-6.2	-40.4	-8.8
11/22/2006	-0.8	-1.6	2.0	-6.3	2.0	3.1	-0.3	-7.7	-4.4	-5.9	-2.8
11/23/2006	3.1	2.3	2.8	2.2	2.6	3.3	2.4	2.9	-0.7	3.2	2.5
11/24/2006	3.2	2.4	3.1	2.9	2.9	3.7	3.0	3.0	2.5	3.6	2.7
11/25/2006	3.2	2.5	2.0	2.9	2.9	3.7	2.0	3.1	-2.1	3.8	2.8
11/26/2006	3.2	2.5	0.9	2.9	2.6	3.8	-2.0	3.1	-5.3	4.0	2.8



Gauge Data Summary
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Note: All data reported in inches from ground surface

Date	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW10	REF
11/27/2006	3.2	2.5	0.8	3.0	1.5	3.7	-2.7	3.1	-5.4	4.2	2.8
11/28/2006	3.2	2.5	0.8	3.0	2.0	3.8	-2.7	3.1	-5.4	4.5	2.8
11/29/2006	3.3	2.5	0.9	3.1	2.9	3.8	-2.7	3.2	-5.3	4.9	2.9
11/30/2006	3.3	2.7	0.9	3.2	0.9	3.8	-2.7	3.3	-5.3	4.3	3.0
12/1/2006	2.4	2.7	1.1	2.8	0.4	3.7	-2.4	-3.3	-5.0	-4.5	3.2
12/2/2006	-2.2	2.8	0.8	0.7	0.2	3.5	-2.7	-11.3	-5.0	-14.5	3.3
12/3/2006	-3.7	1.7	0.7	-0.6	0.0	3.4	-2.8	-12.5	-5.4	-22.4	3.2
12/4/2006	-3.9	-2.0	0.9	-1.2	0.4	3.4	-2.5	-12.0	-4.9	-27.4	3.0
12/5/2006	-5.0	-5.4	0.7	-3.0	0.1	3.4	-3.1	-12.5	-5.4	-32.7	2.5
12/6/2006	-5.3	-7.2	0.7	-4.5	0.1	3.5	-3.1	-12.7	-5.5	-37.0	-1.0
12/7/2006	-5.4	-7.7	0.8	-5.6	0.5	3.6	-3.0	-12.6	-5.4	-40.0	-4.0
12/8/2006	-6.4	-8.7	0.5	-7.1	0.6	3.2	-3.4	-13.1	-5.7	-41.1	-6.3
12/9/2006	-6.8	-9.0	0.4	-7.7	0.7	3.1	-3.5	-13.3	-5.9	-41.6	-7.0
12/10/2006	-7.0	-9.0	0.5	-8.7	0.9	3.1	-3.4	-13.3	-6.0	-41.5	-7.8
12/11/2006	-7.3	-8.9	0.5	-9.5	1.1	3.2	-3.3	-13.3	-5.9	-41.5	-8.3
12/12/2006	-7.7	-9.0	0.5	-10.3	1.3	3.2	-3.3	-13.3	-5.8	-41.5	-9.4
12/13/2006	-8.1	-8.8	0.5	-11.0	1.5	3.3	-3.3	-13.0	-5.8	-41.5	-10.7
12/14/2006	-8.2	-8.8	0.5	-11.4	1.8	3.5	-3.2	-12.9	-5.7	-41.5	-12.2
12/15/2006	-8.5	-8.8	0.6	-11.7	2.0	3.5	-3.1	-12.9	-5.6	-41.4	-13.0
12/16/2006	-8.9	-8.9	0.5	-12.0	2.2	3.3	-3.3	-13.1	-5.5	-41.5	-13.2
12/17/2006	-10.3	-8.9	0.5	-12.9	2.2	3.2	-3.4	-13.1	-5.9	-41.5	-13.8
12/18/2006	-10.6	-8.6	0.6	-13.2	2.2	3.2	-3.2	-13.2	-5.8	-41.5	-13.9
12/19/2006	-10.9	-8.7	0.5	-13.4	2.3	3.2	-3.3	-13.2	-5.8		-14.0
12/20/2006	-11.5	-8.9	0.5	-13.9	2.2	3.1	-3.4	-13.3	-6.0	-41.5	-14.5
12/21/2006	-12.0	-9.0	0.5	-14.4	2.2	3.0	-3.5	-13.3	-6.3	-41.6	-14.7
12/22/2006	-9.0	-6.7	0.9	-14.2	2.5	3.4	-2.1	-12.6	-5.8	-39.8	-12.6
12/23/2006	-2.7	-4.4	1.3	-1.7	2.9	3.5	-1.3	-10.4	-3.6	-33.3	-6.5
12/24/2006	-5.0	-6.4	0.9	-3.4	2.9	3.4	-2.8	-11.6	-4.7	-36.3	-7.1
12/25/2006	-3.2	-3.1	1.5	-4.1	2.9	3.5	-1.5	-8.1	-4.4	-31.3	-5.0
12/26/2006	-1.4	1.7	2.2	-0.5	2.9	3.6	-0.5	-0.5	-3.7	-6.5	0.7
12/27/2006	-3.2	2.7	1.2	0.4	2.9	3.6	-2.4	-1.9	-4.4	-10.1	3.1



**Gauge Data Summary
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Note: All data reported in inches from ground surface

Date	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW10	REF
12/28/2006	-3.4	2.7	0.9	-0.6	2.9	3.5	-3.0	-7.0	-4.8	-11.9	3.0
12/29/2006	-3.3	2.6	0.8	-1.4	2.8	3.5	-3.1	-9.4	-5.0	-12.7	2.9
12/30/2006	-3.7	2.6	0.8	-2.1	2.8	3.7	-3.0	-10.9	-5.0	-13.2	2.9
12/31/2006	-3.7	2.6	0.8	-2.7	2.8	4.4	-3.0	-10.9	-5.0	-12.3	2.9
1/1/2007	-2.7	2.7	0.9	-2.9	2.9	4.6	-2.7	-10.3	-4.8	-11.7	2.9
1/2/2007	-2.8	2.8	1.0	-2.5	2.9	4.5	-2.6	-10.8	-4.6	-14.3	3.1
1/3/2007	-4.3	2.7	0.6	-3.5	2.8	4.4	-3.2	-12.3	-5.0	-19.5	3.1
1/4/2007	-4.9	0.0	0.7	-4.5	2.9	4.5	-3.1	-12.4	-5.0	-25.5	3.0
1/5/2007	-5.0	-4.2	0.8	-4.8	2.9	4.6	-2.9	-12.3	-4.8	-31.3	3.1
1/6/2007	-3.6	-5.0	1.0	-3.2	2.9	4.6	-1.9	-11.2	-4.3	-31.6	3.3
1/7/2007	-4.8	-5.6	0.8	-4.0	2.9	4.5	-2.8	-11.8	-4.6	-29.7	4.3
1/8/2007	-2.5	-3.1	1.2	-2.7	3.0	4.6	-1.3	-10.9	-4.0	-26.2	4.7
1/9/2007	-4.6	-2.2	0.9	-2.5	2.9	4.5	-2.7	-11.7	-4.5	-24.9	4.6
1/10/2007	-5.6	-2.8	0.6	-4.3	2.8	4.4	-3.2	-12.3	-4.8	-26.8	4.4
1/11/2007	-6.3	-3.8	0.6	-5.6	2.8	3.4	-3.3	-12.6	-5.1	-28.7	4.3
1/12/2007	-6.3	-4.3	0.7	-6.1	2.8	3.1	-3.1	-12.5	-5.0	-29.6	4.3
1/13/2007	-6.3	-4.4	0.8	-6.3	2.9	3.2	-3.0	-12.5	-5.0	-29.7	4.4
1/14/2007	-6.4	-4.2	0.8	-6.6	2.9	3.2	-3.0	-12.5	-4.9	-29.6	4.4
1/15/2007	-6.5	-4.1	0.8	-6.8	3.1	3.3	-3.0	-12.4	-4.9	-29.6	4.5
1/16/2007	-6.3	-5.2	0.9	-6.7	3.5	3.3	-2.9	-12.3	-4.8	-31.2	4.6
1/17/2007	-7.6	-7.5	0.6	-7.5	3.5	3.0	-3.4	-12.7	-5.2	-34.6	2.5
1/18/2007	-4.9	-5.6	0.7	-6.6	3.5	2.9	-2.1	-12.3	-5.1	-37.3	-0.7
1/19/2007	-3.9	-6.6	0.8	-3.4	3.5	3.1	-2.3	-11.5	-4.3	-37.3	-1.8
1/20/2007	-5.6	-7.9	0.6	-5.9	3.5	3.0	-3.2	-12.3	-4.9	-39.3	-4.0
1/21/2007	-6.5	-8.2	0.6	-7.1	3.4	2.9	-3.2	-12.5	-5.1	-40.8	-6.3
1/22/2007	-1.1	-3.4	1.1	-2.9	3.5	3.0	-0.8	-10.9	-3.9	-32.4	-1.7
1/23/2007	-4.0	-6.0	1.0	-1.5	3.5	3.1	-2.5	-11.5	-4.4	-28.5	3.1
1/24/2007	-5.1	-5.6	0.9	-3.2	3.5	3.2	-2.9	-12.0	-4.8	-28.4	4.0
1/25/2007	-5.6	-6.0	0.7	-4.6	3.5	3.2	-3.0	-12.2	-4.9	-30.2	4.0
1/26/2007	-6.4	-7.3	0.5	-5.7	3.4	3.1	-3.3	-12.4	-5.1	-32.5	3.9
1/27/2007	-6.7	-7.9	0.7	-6.4	3.5	3.0	-3.2	-12.5	-5.2	-34.4	1.7



Gauge Data Summary
Groundwater Elevation Information

Note: All data reported in inches from ground surface

Date	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW10	REF
1/28/2007	-5.3	-6.5	0.9	-5.5	3.5	3.3	-2.4	-12.0	-4.7	-35.1	1.0
1/29/2007	-6.3	-8.4	0.4	-6.2	3.5	2.9	-3.3	-12.3	-5.0	-36.1	0.1
1/30/2007	-7.0	-8.5	0.5	-7.3	3.4	2.8	-3.3	-12.6	-5.3	-37.8	-1.5
1/31/2007	-7.6	-8.7	0.5	-7.7	3.4	2.7	-3.3	-12.7	-5.2	-40.1	-3.9
2/1/2007	-4.4	-5.5	0.9	-6.7	3.4	2.8	-1.7	-11.8	-4.8	-36.5	-3.6
2/2/2007	-2.0	-2.3	1.1	-0.2	3.4	2.9	-1.4	-10.6	-3.7	-22.2	2.4
2/3/2007	-4.5	1.7	0.9	-1.2	3.4	3.0	-2.6	-11.5	-4.5	-18.5	2.4
2/4/2007	-5.3	0.7	0.7	-2.5	3.5	3.2	-2.9	-11.9	-4.9	-21.9	2.4
2/5/2007	-5.8	-2.6	0.5	-3.7	3.4	3.0	-3.0	-12.2	-5.1	-26.6	2.4
2/6/2007	-6.3	-5.2	0.4	-5.1	3.4	2.9	-3.2	-12.4	-5.3	-30.3	2.4
2/7/2007	-5.9	-6.8	0.6	-5.7	3.5	3.0	-3.0	-12.1	-5.2	-32.4	2.6
2/8/2007	-6.6	-7.8	0.5	-6.5	3.5	2.9	-3.1	-12.4	-5.2	-34.2	1.9
2/9/2007	-7.1	-8.4	0.4	-7.1	3.4	2.8	-3.1	-12.5	-5.2	-36.0	0.1
2/10/2007	-7.4	-8.7	0.5	-7.6	3.4	2.8	-3.1	-12.5	-5.2	-38.2	-1.8
2/11/2007	-8.1	-9.0	0.5	-8.3	3.4	2.7	-3.2	-12.7	-5.4	-40.4	-4.3
2/12/2007	-8.2	-8.9	0.5	-8.7	3.5	2.8	-3.1	-12.6	-5.4	-41.0	-6.9
2/13/2007	-7.9	-8.6	0.8	-8.7	3.5	3.0	-2.9	-12.5	-5.1	-41.2	-9.2
2/14/2007	-4.5	-6.8	0.9	-6.0	3.6	3.3	-2.0	-11.5	-4.3	-41.2	-9.9
2/15/2007	-6.7	-8.8	0.4	-8.1	3.5	2.9	-3.1	-12.4	-5.0	-41.5	-11.3
2/16/2007	-7.8	-9.0	0.4	-9.1	3.5	2.7	-3.2	-12.7	-5.2	-41.4	-11.9
2/17/2007	-8.5	-8.9	0.4	-9.6	3.4	2.6	-3.2	-12.8	-5.3	-41.5	-12.1
2/18/2007	-8.9	-9.0	0.5	-9.9	3.5	2.7	-3.2	-12.7	-5.2	-41.5	-12.1
2/19/2007	-10.1	-9.3	0.4	-10.6	3.4	2.6	-3.4	-12.9	-5.6	-41.5	-11.0
2/20/2007	-9.9	-8.9	0.5	-10.6	3.5	2.7	-3.1	-12.7	-5.5	-41.5	-8.7
2/21/2007	-9.6	-8.7	0.8	-10.5	3.5	3.0	-3.1	-12.6	-5.1	-41.5	-6.7
2/22/2007	-9.4	-8.7	0.8	-10.3	3.5	3.0	-3.0	-12.5	-5.0	-41.3	-5.2
2/23/2007	-10.5	-9.1	0.6	-10.9	3.5	2.6	-3.3	-12.8	-5.4	-41.4	-6.4
2/24/2007	-11.1	-9.2	0.5	-11.4	3.5	2.6	-3.3	-12.9	-6.0	-41.5	-9.0
2/25/2007	-9.1	-7.6	0.8	-11.2	3.5	2.8	-2.4	-12.7	-5.9	-41.4	-11.0
2/26/2007	-5.3	-7.3	0.8	-6.5	3.6	3.3	-2.3	-11.7	-4.4	-41.3	-11.6
2/27/2007	-7.2	-8.4	0.6	-9.3	3.5	2.9	-3.1	-12.4	-5.1	-41.5	-12.9



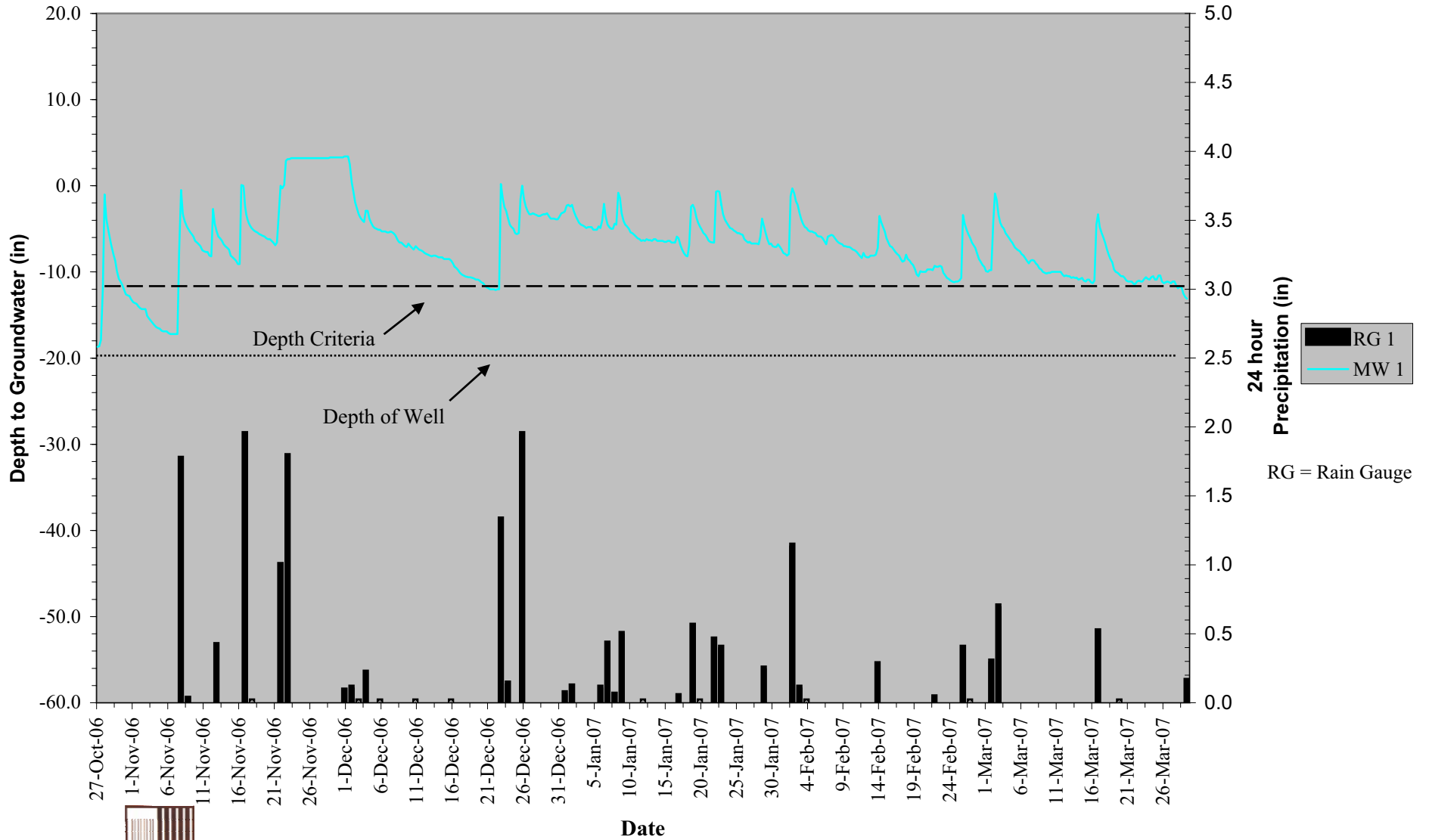
Gauge Data Summary
Groundwater Elevation Information

Note: All data reported in inches from ground surface

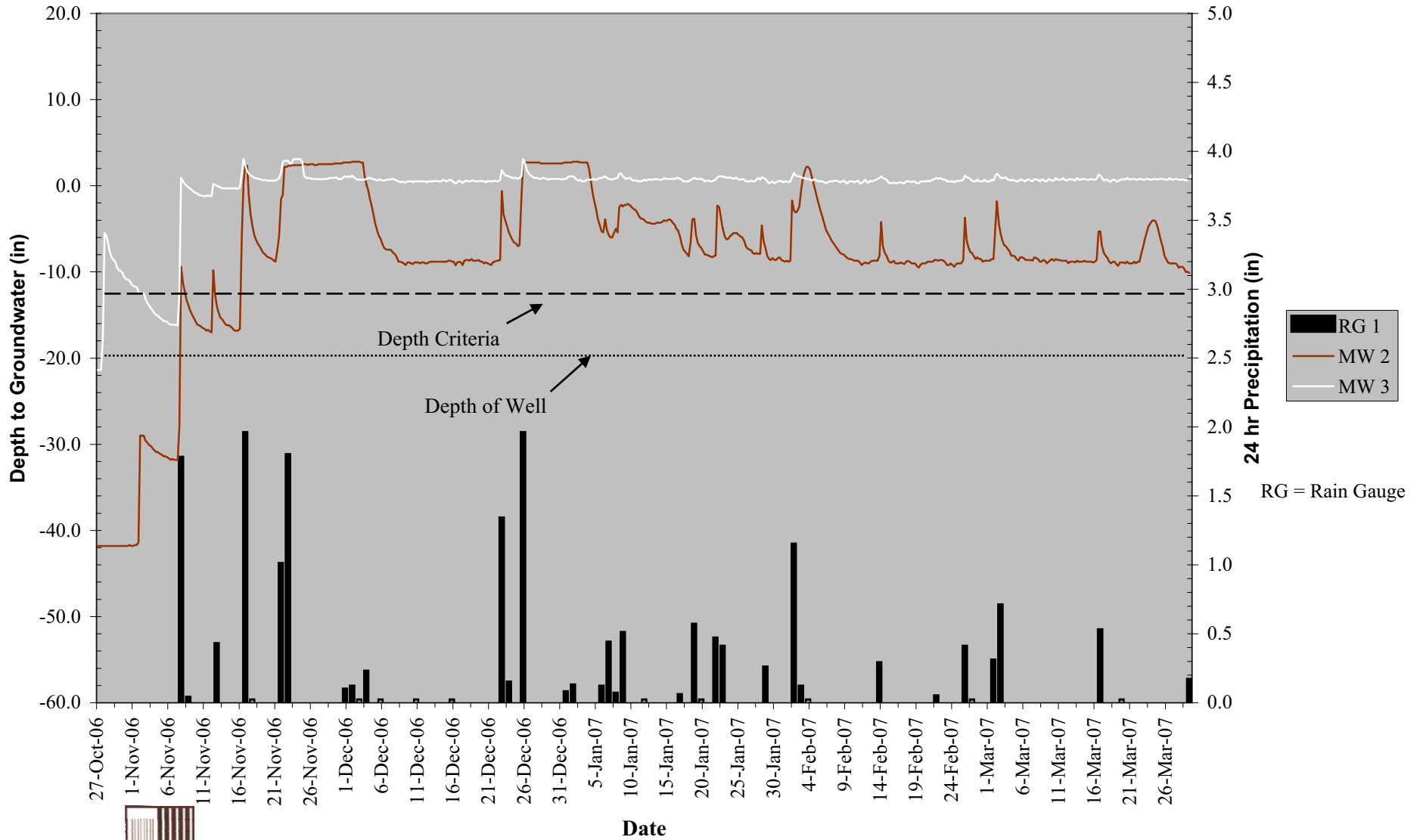
Date	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW10	REF
2/28/2007	-9.0	-8.7	0.6	-10.6	3.6	2.6	-3.2	-12.6	-5.2	-41.5	-13.5
3/1/2007	-9.9	-8.6	0.6	-11.1	3.7	2.7	-3.1	-12.7	-5.3	-41.5	-13.8
3/2/2007	-2.6	-4.2	1.2	-5.5	3.7	3.6	-0.7	-10.8	-3.9	-39.9	-9.6
3/3/2007	-4.9	-6.9	0.9	-4.1	3.8	3.3	-2.7	-11.8	-4.7	-40.8	-8.5
3/4/2007	-6.3	-8.0	0.7	-6.1	3.7	2.7	-3.1	-12.4	-5.1	-40.6	-5.9
3/5/2007	-7.4	-8.5	0.6	-7.5	3.7	2.6	-3.2	-12.7	-5.3	-40.6	-5.3
3/6/2007	-8.3	-8.6	0.6	-8.3	3.7	2.6	-3.1	-12.8	-5.4	-40.6	-5.0
3/7/2007	-8.8	-8.5	0.7	-8.8	3.7	2.7	-3.1	-12.8	-5.6	-40.1	-3.1
3/8/2007	-9.4	-8.7	0.7	-9.1	3.7	2.6	-3.1	-12.9	-5.6	-38.7	-1.5
3/9/2007	-10.1	-8.8	0.6	-9.6	3.7	2.6	-3.2	-12.9	-5.9	-37.6	-0.3
3/10/2007	-10.0	-8.6	0.7	-9.6	3.7	2.7	-3.1	-12.8	-5.8	-37.5	-0.1
3/11/2007	-10.1	-8.7	0.8	-9.6	3.8	2.7	-3.0	-12.8	-5.7	-39.8	-2.5
3/12/2007	-10.5	-8.8	0.7	-10.0	3.8	2.7	-3.1	-13.0	-5.9	-41.2	-6.4
3/13/2007	-10.7	-8.8	0.7	-10.3	3.8	2.7	-3.1	-12.9	-5.9	-41.4	-10.4
3/14/2007	-10.9	-8.8	0.8	-10.7	3.8	2.8	-3.0	-13.0	-6.0	-41.4	-12.4
3/15/2007	-11.0	-8.8	0.7	-11.1	3.7	2.7	-3.0	-13.0	-5.9	-41.4	-13.2
3/16/2007	-7.5	-7.0	1.0	-10.1	3.8	3.2	-1.7	-12.4	-5.5	-41.3	-12.0
3/17/2007	-5.7	-7.8	0.7	-6.8	3.8	3.0	-2.7	-12.0	-4.5	-41.5	-12.5
3/18/2007	-8.2	-8.9	0.6	-9.7	3.8	2.5	-3.3	-12.8	-5.3	-41.6	-13.7
3/19/2007	-10.0	-9.1	0.6	-10.9	3.7	2.5	-3.3	-13.0	-5.7	-41.6	-14.4
3/20/2007	-10.7	-8.9	0.8	-11.2	3.8	2.7	-3.1	-13.1	-5.8	-41.7	-13.4
3/21/2007	-11.2	-9.0	0.8	-11.5	3.8	2.7	-3.1	-13.1	-6.0	-40.9	-4.8
3/22/2007	-11.2	-8.2	0.8	-11.3	3.8	2.7	-3.0	-13.0	-6.2	-34.6	3.4
3/23/2007	-10.8	-5.2	0.8	-10.8	3.8	2.7	-3.1	-13.0	-6.4	-30.8	4.9
3/24/2007	-10.7	-4.2	0.8	-10.5	3.8	2.7	-3.1	-13.2	-7.0	-30.0	5.0
3/25/2007	-10.7	-6.8	0.8	-10.3	3.8	2.7	-3.1	-13.3	-7.7	-33.3	4.4
3/26/2007	-11.2	-8.9	0.8	-10.8	3.8	2.6	-3.2	-13.9	-9.1	-38.8	-1.1
3/27/2007	-11.3	-9.2	0.8	-11.1	3.7	2.7	-3.1	-14.0	-10.3	-41.2	-6.7
3/28/2007	-12.0	-9.6	0.7	-11.7	3.5	2.7	-3.2	-14.3	-11.4	-41.4	-11.1
3/29/2007	-13.0	-10.1	0.9	-12.6	3.7	2.6	-2.6	-14.4	-12.9	-41.4	-41.4



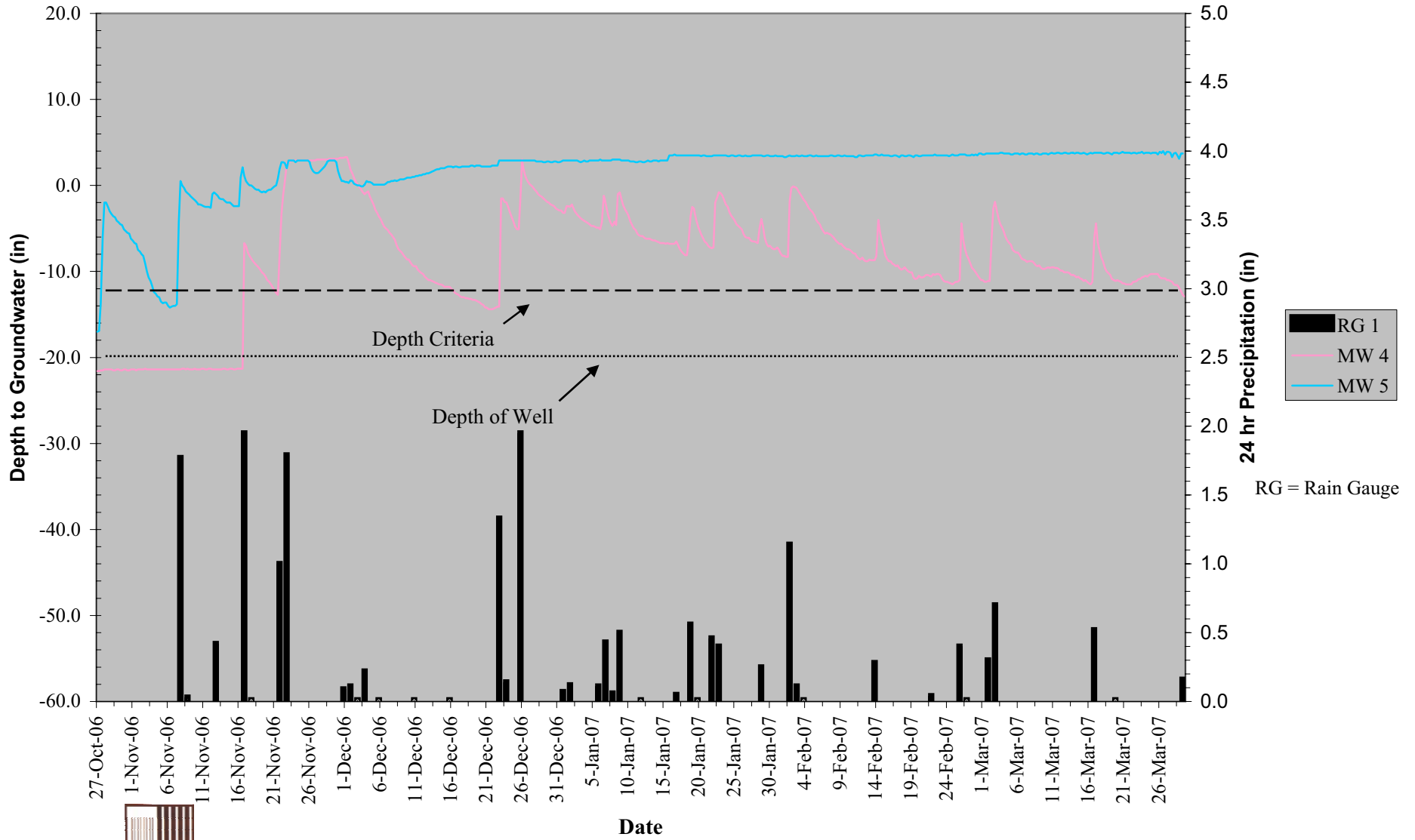
Well Cross-Section 1 Groundwater Elevations and Rainfall Data



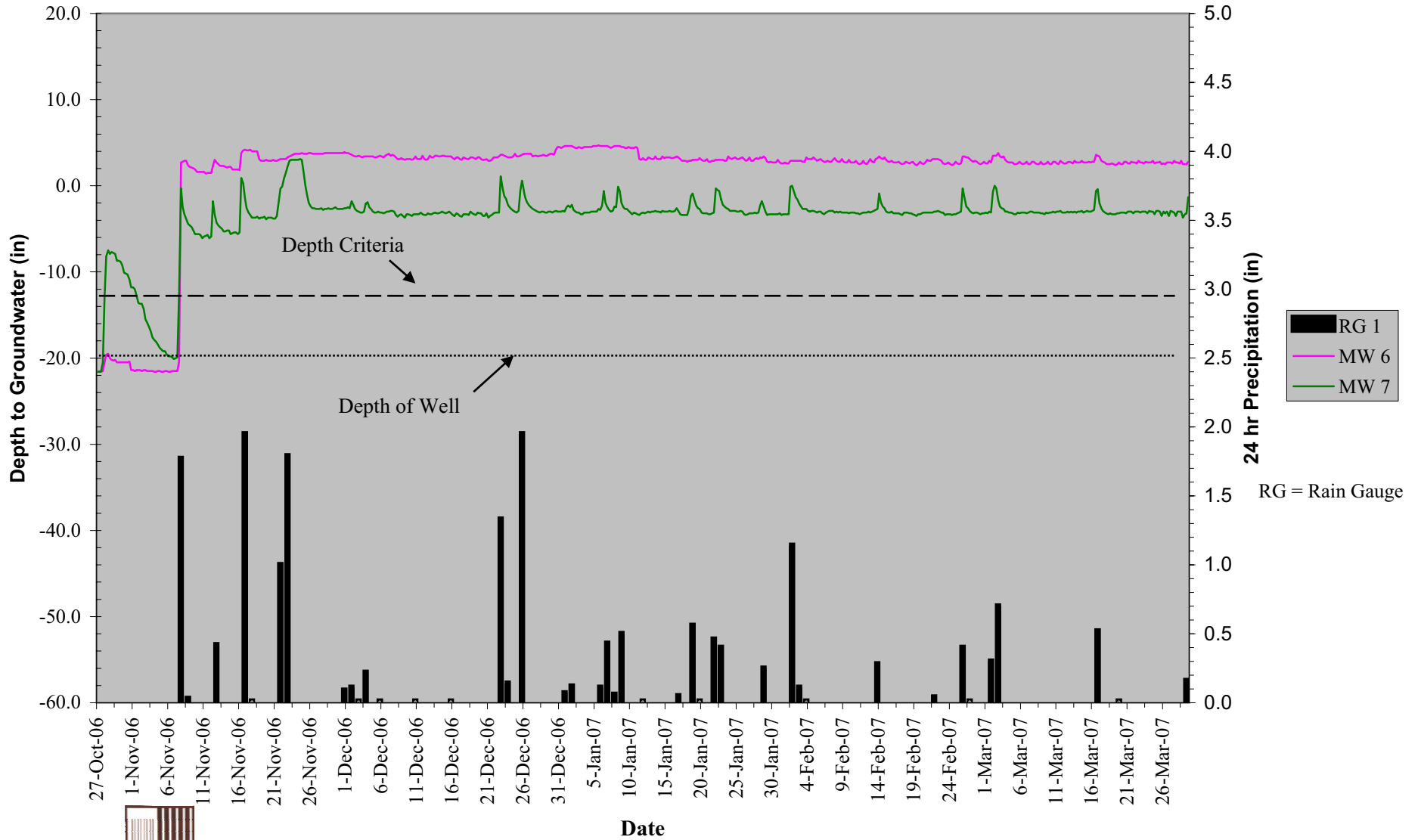
Well Cross-Section 2 Groundwater Elevations and Rainfall Data



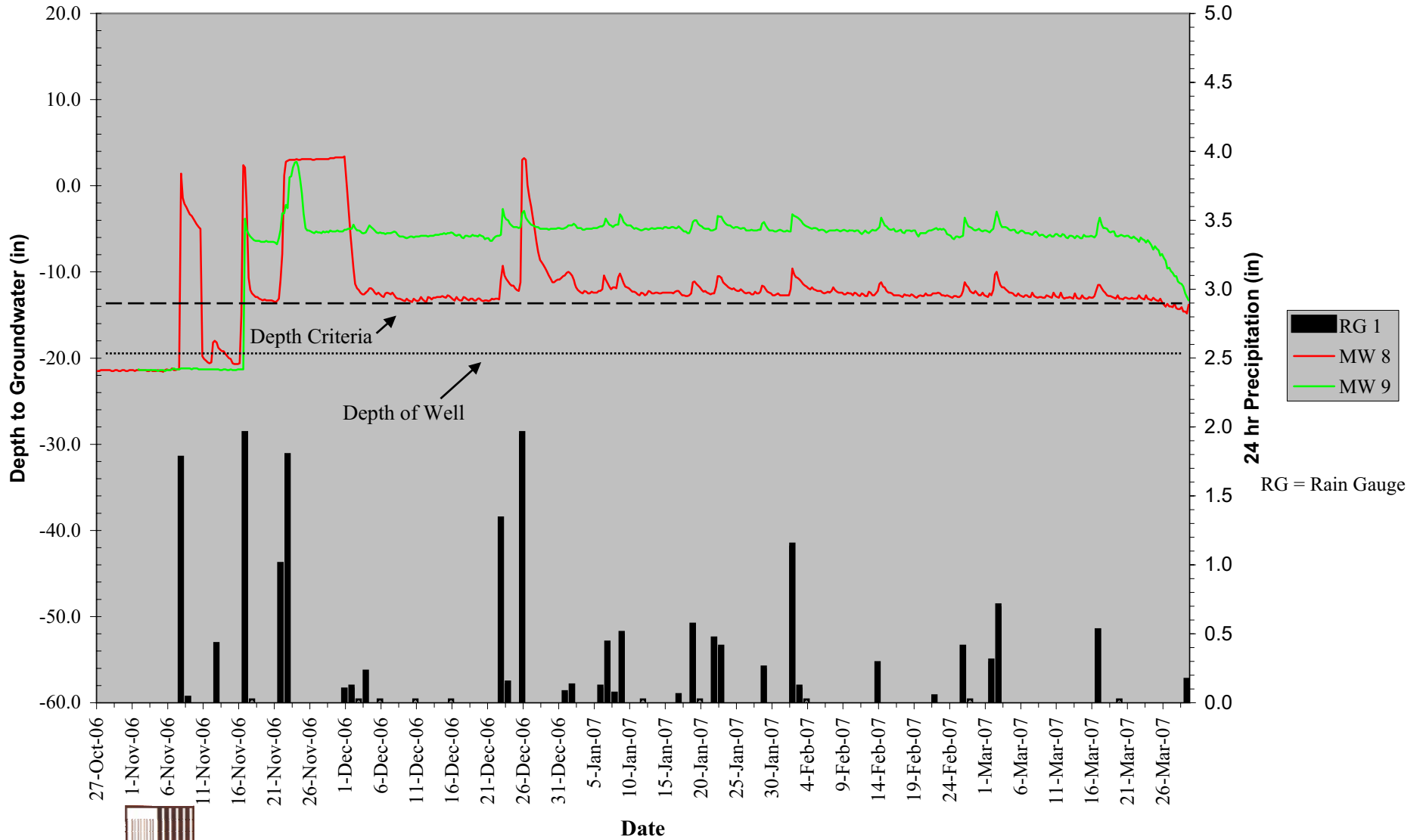
Well Cross-Section 3 Groundwater Elevations and Rainfall Data



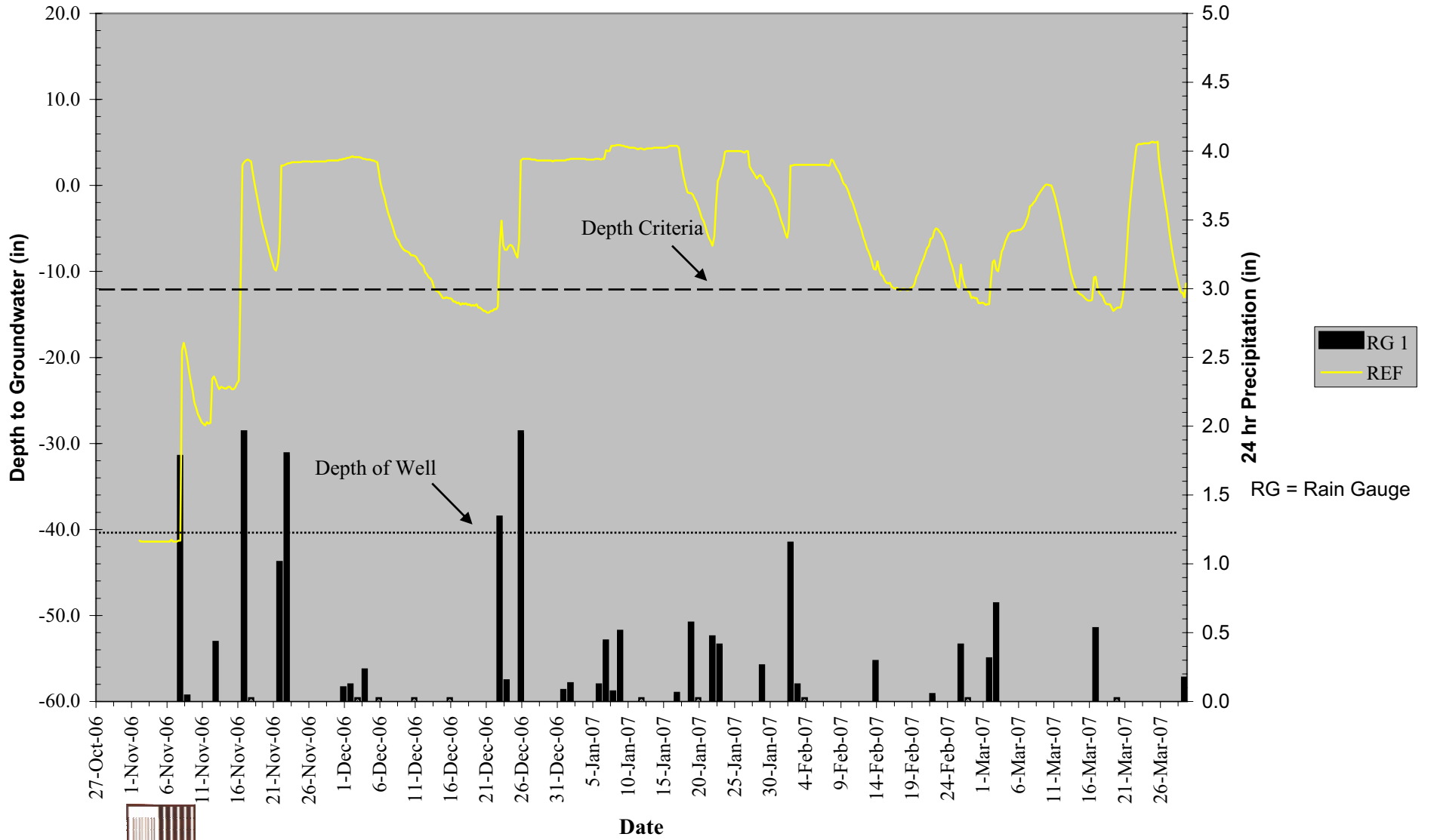
Well Cross-Section 4 Groundwater Elevations and Rainfall Data



Well Cross-Section 5 Groundwater Elevations and Rainfall Data



Reference Sites Groundwater Elevations and Rainfall Data



Hydrologic Analysis

Appendix 7.0



THE JOHN R. McADAMS
COMPANY, INC.

Hydrologic Analysis – December 2006

Meadowbranch Swamp Wetland Restoration Project

A. Introduction

The Meadowbranch Swamp Wetland Restoration project will restore portions of the project area by allowing flood waters to inundate the site. Flood waters will enter the site through several low areas at specific target elevations. A hydrologic analysis was performed to determine the optimal elevation to allow waters into the site. Data used in the analysis included historical gauge and rainfall data and to a lesser extent on-site data. The core of the analysis involved determining the frequency at which specific site elevations had flooded in the past. This was accomplished by selecting a range of whole foot elevations at the site and then examining the flood frequency associated with each.

B. Project Area

The Meadowbranch Swamp watershed is approximately 32 square miles. The land use is approximately 45% forest, 45% grassland, and 10% impermeable surfaces. The watershed has a calculated time of concentration of 8.5 hours. The Lumber River watershed 2 miles downstream of the site has a drainage area of 715 square miles, and the land use is very similar to the watershed of Meadowbranch Swamp, about 45% forest, 45% grassland, and 10% impermeable. The Lumber River watershed has a calculated time of concentration of 32 hours. The Lumber River watershed is 22 times larger than that of the Meadowbranch Swamp. Large rain events have a much greater impact on the Lumber River water surface elevation than they do on Meadow Branch swamp due to the larger drainage area. Based on site data and gauge information, backwater from the Lumber River directly affects water elevations at the site. The differences in watershed size and rainfall variability allow flood events to be caused by rainfall within the Meadowbranch Swamp watershed as well as long duration backwater conditions associated with the Lumber River.

C. Available Data

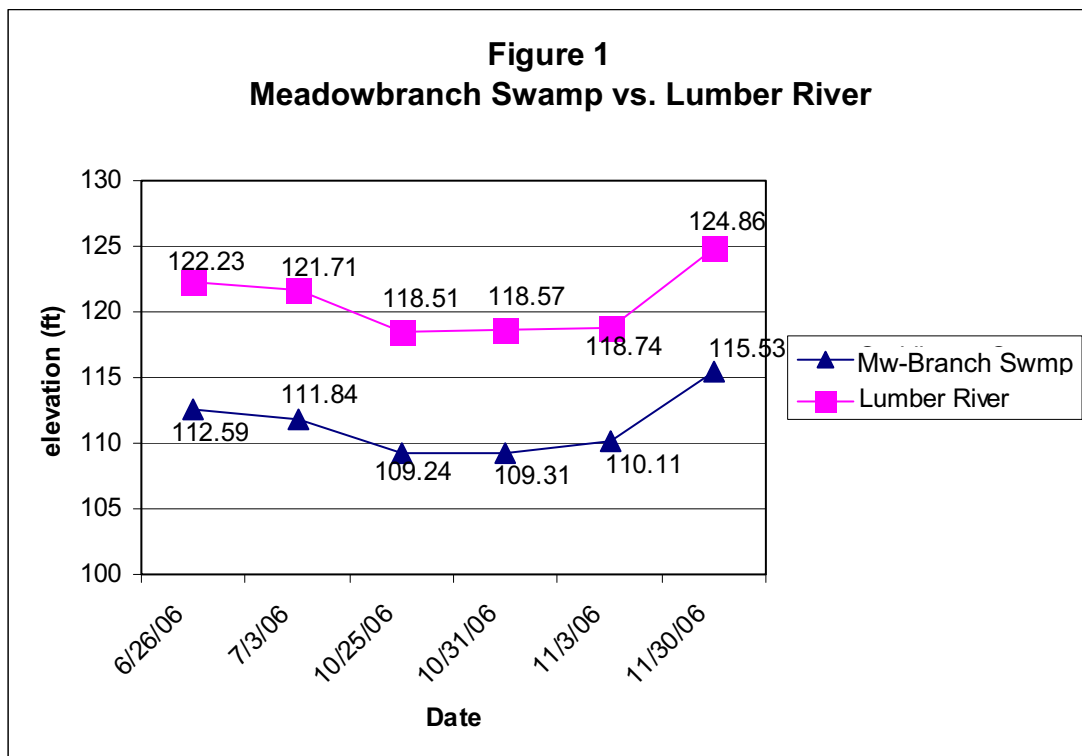
Rainfall data and river height data were used in this analysis. River height data is available and is recorded at a USGS gauge in Lumberton where the Lumber River passes under 5th Street. Measurements are taken hourly, the minimum, maximum, and daily average, are recorded and placed on the USGS website; the data is available to download. Water surface elevation measurements were taken on-site, and were used to find the correlation between the water surface elevation on-site, and the water surface elevation of the Lumber River. Daily rain gauge data over the last 6 years was obtained from 7 rain gauges spread throughout the watershed of the Lumber River.

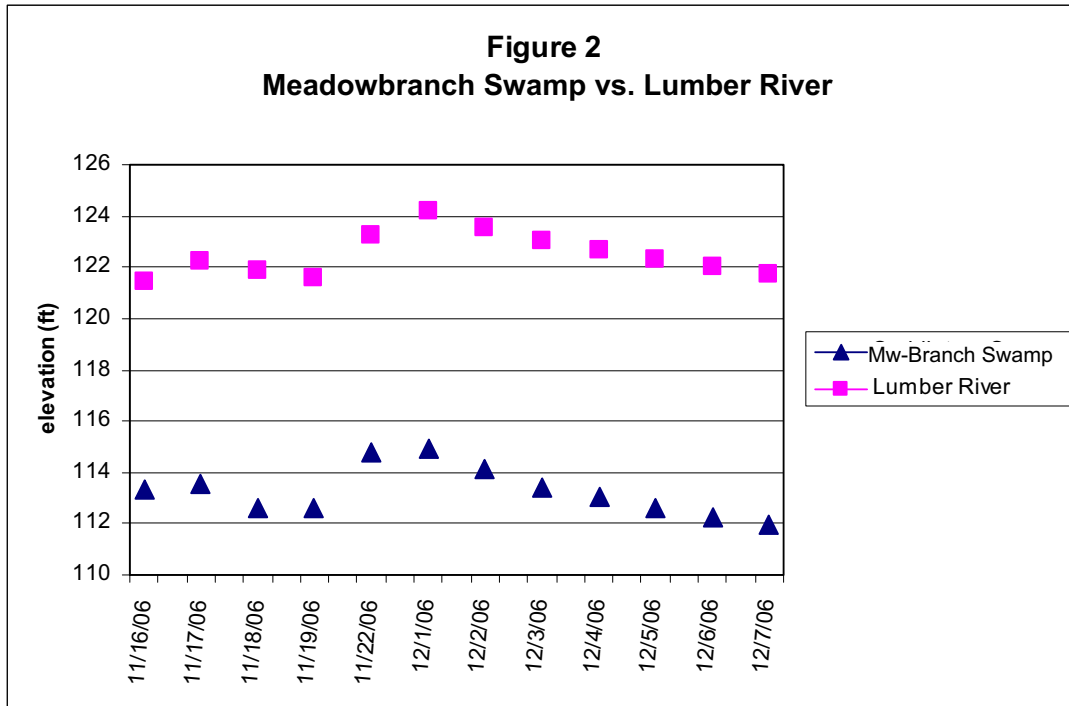
D. Data Analysis

Historical water surface elevation data for Meadowbranch Swamp is extremely limited. On-site elevation data collected by NSE only includes the months of November and December; therefore, a method was developed to use historical data from a nearby gauge on the Lumber River. At the south end of the site, a culvert allows Meadowbranch to flow under Carthage Road. This culvert was surveyed and the elevation at the top of the culvert was found to be 118.39 ft.

To determine the historical behavior of Meadowbranch Swamp, measurements were made from this known elevation to the surface of the water on each site visit made by Natural Systems Engineering (NSE). These elevations were then compared to elevations of the Lumber River approximately two (2) miles down stream at USGS gauge 02134170. Each time a measurement was taken on-site, it was compared to the elevation of the Lumber River on the same day (see **Figure 1**). The data contained in **Figure 2** was obtained after the placement of a stream gauge on site and verifies the data that was collected manually.

The reported elevation of the USGS gauge was not surveyed but was selected from a topographic map. The selected elevation was 110 ft and is merely used for comparison purposes with the analysis. The measurements taken on site correlate very closely with the elevations of the Lumber River. Each elevation measured onsite was 9.25 feet lower than the corresponding Lumber River gauge for that day, plus or minus a maximum error of 0.62 ft, as illustrated by the **Figure 1**. The Lumber River has a much larger watershed than Meadowbranch, and because the site is just above the confluence of the two bodies of water, it has been concluded that this direct relationship in elevation change is the result of a backwater affect caused by the Lumber River on Meadowbranch Swamp. Using the data shown in **Figure 1**, it can be assumed that subtracting 9.25 ft. from the Lumber River gauge is an acceptable estimate of historical Meadowbranch Swamp water surface elevations.





Analysis Methods

1. Primary Method - Determine flood frequency by direct measurement of on-site flood elevations by correlating site data to nearby USGS gauge data.
2. Secondary Methods – A secondary analysis approach involved comparing total storm event precipitation depth and return period with the corresponding rise in river elevation. Another approach was to determine flood frequency using a Log-Pearson analysis.

Primary Method

Using the correlation between the site elevations and the USGS Lumber River gauge it was possible to directly examine the frequency of flood events at the site. This was accomplished by counting the number of times certain benchmark elevations were reached, within the six year span of time. Cross section profiles perpendicular to Meadowbranch Swamp have been surveyed throughout the site. Available onsite storage volume can be calculated using cross sectional profiles and a maximum elevation. An elevation, and corresponding storage volume which will supply the remaining necessary water to support wetland hydrology, will then be selected. Flood frequency to whole foot benchmarks can be seen in **Table 1**.

Table 1. Project Site Flooding Frequency

Average Number of Occurrences Per elevation-Since July 2000							Flooding Frequency		
7/00	2001	2002	2003	2004	2005	2006	Flooded site elevation (ft)	Total Number of Occurrences	Avg. / yr.
8	12	13	20	16	15	16	109	95	16
7	7	11	20	13	12	11	110	80	13
5	6	7	20	12	8	7	111	65	11
4	3	3	20	9	6	6	112	51	9
2	-	-	16	5	3	3	113	28	5
1	-	-	9	4	-	2	114	16	3
1	-	-	4	3	-	2	115	10	2
-	-	-	1	2	-	1	116	4	1
-	-	-	-	1	-	-	117	1	0
-	-	-	-	1	-	-	118	1	0
-	-	-	-	1	-	-	119	1	0

Secondary Methods

Another approach involved comparing total storm event precipitation depth return and return period and the corresponding rise in river elevation. Due to the backwater effects of the Lumber River, the entire 715 square mile Lumber River Basin had to be analyzed. The first step was to collect rainfall data. Daily rainfall quantities from seven rain gauges across the watershed were obtained from the State Climate Office. To calculate the weighted rainfall average for the Lumber River watershed, Thiessen’s Method was used. To use Thiessen’s method, the watershed must be divided into polygons. There is one polygon for each rain gauge. A weighted rainfall average can then be calculated using the area of these polygons, and the rainfall amounts from each rain gauge. The Thiessen average rainfall will be referred to simply as the “average rainfall” in this document. Average rainfall for the watershed was then compared to the estimated water surface elevation of Meadowbranch Swamp. For each rain event that resulted in a water surface elevation increase, the total rainfall, initial elevation and final elevation was recorded. Over six years, this generated 95 rain events, each of which resulted in a water surface elevation change. Initial elevation is recorded to correlate an elevation change with rainfall amounts. Rain events resulting in roughly the same elevation change **and** starting at approximately the same elevation were selected and compared, to find average rainfall values.

Further analysis was pursued, but site conditions and the available data made them invalid. The time period over which the Lumber River reacted to rain events was observed. For some events this time interval was over one week. This revealed that the time of concentration, which was calculated as 32 hours, was not accurate. This is because the watershed is very flat, and contains numerous wetlands, providing a high water storage capacity. These wetlands absorb storm events and release them over a greater period of time than the calculated time of concentration would

suggest. This causes the water levels to continue to rise sometimes over a week. If the time of concentration had been accurate, and the Lumber River had reacted in a clear and well defined manner to the rain events, elevation changes could have been linked directly to rainfall amounts. Twenty-four hour rain events could have then been compared to the return periods that they are known to have in this region. The return periods would have verified the frequency of the high flow events, but because of the large amount of wetlands present in the watershed, the exact reaction of the water surface elevation to the rainfall could not be identified. Another approach was to determine flood frequency using the Log-Pearson analysis. The flood frequency was calculated, this method is only accurate when used with 10 or more years of data, and because only six years of data was available, this calculation can not be made with acceptable accuracy. The average recurrence interval of all the high flow events recorded suggests the return intervals are inaccurate; because the Log-Pearson method is not being applied as it was designed, it can not be expected to give accurate results. Based on the challenges associated with the secondary methods, the results were limited to those produced from the primary method.

E. Results & Conclusion

The analysis shows how often the site floods to target elevations, measured in whole feet over the last six years. Over the last 6 years, Meadowbranch Swamp has flooded to an elevation of 114 ft. three times per year, on average. Elevations of 115 ft. and 116 ft. were flooded two times and one time, respectively.

Meadowbranch Swamp Wetland Restoration Project Memorandum of Agreement

Appendix 8.0



THE JOHN R. McADAMS
COMPANY, INC.

Meadowbranch Swamp Wetland Restoration Project
NC Ecosystem Enhancement Program
City of Lumberton
Lumber River Conservancy

MEMORANDUM OF AGREEMENT

A. Introduction

The mission of the North Carolina Department of Environment and Natural Resources (NCDENR) Ecosystem Enhancement Program (EEP) is to restore, enhance and preserve wetlands, streams and riparian buffer areas throughout North Carolina's seventeen (17) major river basins with the overall goal of improving water quality and instream and riparian habitats. EEP is planning to restore and enhance the functions of approximately 60 acres of riverine wetlands along Meadowbranch Swamp (the "Project Area") in Lumberton. The wetlands are adjacent to the waterway north of Carthage Road and west of I-95 on a parcel owned by the Lumber River Conservancy (LRC). Currently the City of Lumberton (hereafter "City") owns a Conservation Easement and a Water Rights Easement on the parcel.

Pursuant to this Memorandum of Agreement (MOA) between EEP, the City and LRC, the City will release its Water Rights Easement and Conservation Easement on the Project Area, copies of which are attached hereto as Appendix A. For the project area shown in Appendix B, LRC agrees to convey to EEP for recordation contemporaneous with the cancellation of the City's Conservation Easement, the standard Conservation Easement that is required by EEP for the permanent protection of stream and wetland mitigation projects (Appendix C). Both of these legal matters must be resolved prior to the restoration of the site. The Agreement will also delineate the roles of the City, LRC and of EEP throughout the course of the design, construction, monitoring and future of the Project.

B. Background

This potential project was brought to the attention of EEP by the LRC in January 2006. EEP staff members visited the site in February 2006, and after internal review and approval, proceeded to investigate the property. At this time, the existing Conservation Easement and Water Rights Easement owned by the City were identified. The EEP's interest in this site is for the restoration, enhancement and preservation of riverine wetlands, to be used for mitigation credits in the USGS 03040203 cataloguing unit of the Lumber River Basin.

EEP's goals on the property are to establish crossings within an existing maintenance road that will allow floodwaters from Meadowbranch Swamp to enter and exit the property, and to replant the site with native wetland vegetation. This will accomplish

several goals: re-connect the historical riverine wetland with stream floodwaters; restore a more natural hydrologic regime to the historical wetland; provide flood storage for waters in Meadowbranch Swamp; allow for retention and treatment of sediment, nutrients, and toxins to improve downstream water quality; and enhance the wildlife habitat present in the restored wetland. In addition, an existing timber road and adjacent canal will be removed to restore natural wetland hydrology

The access road will not be included in the Project area, except to act as a construction entrance and exit and monitoring access, and will not be subject to EEP's Conservation Easement. LRC will grant a permanent access easement along the access road to the City. The City has plans to make the access road part of a greenway system.

The City's existing sewer easement in the northeastern corner of the property will also remain under easement by the City. A Pumping Station on the site of the Project Area will be removed by Fall of 2006 by the City

C. Purpose

The purpose of this MOA is to set forth the terms of agreement reached by all parties relating to the planning, engineering, designing, construction, monitoring and maintenance required for the planned wetland restoration project within the City of Lumberton. The Project includes the ecological enhancement of approximately 60 acres of wetlands by re-connecting the wetlands to the waterway to restore natural hydrology and planting native plant species indigenous to similar wetlands in the area. The ecological restoration shall re-establish flood plain connectivity to Meadowbranch Swamp to provide for long term ecological integrity. The enhancement work will include installation of culverts and/or other crossings along the maintenance road to allow flow from the waterway to enter the wetlands.

The aforementioned crossings will accomplish the following: allow floodwaters to enter and exit the property; allow for pedestrian as well as maintenance vehicle access to the waterway (to include large machinery such as trackhoes); and be designed so as to avoid heavy maintenance requirements in the future

All costs associated with the planning, engineering, designing, construction, monitoring and maintenance of the Project will be funded by EEP through other contracts for a minimum of five years after construction.

This MOA establishes that the City will work in close coordination with EEP and the project design consultant regarding the design and construction phases of the restoration project. The City will be solicited for both comment and approval on the final design of the restoration project; the design must be mutually acceptable to the EEP and the City.

The designer shall investigate and provide hydrologic data indicating current and proposed flood levels in the Project Area

The property for the Project Area is identified in Attachment B.

EEP agrees to do the following:

1. EEP shall fund, plan, engineer and design the wetland restoration portion of the Project.
2. EEP will provide the City and LRC with two (2) opportunities to review and provide written comment on the design of the Project. EEP will forward to the designated contacts one (1) copy of the Project Area Draft Restoration Plan and one copy of the Project Area Draft Construction Plans
3. EEP will assume responsibility for the selection, oversight, and supervision of designated contractors and consultants to conduct this work
4. EEP will ensure that activities are carried out in accordance with the conditions of this agreement as well as with all applicable laws and regulations of the State of North Carolina and the United States of America
5. EEP will review and monitor each phase of the project during restoration and after its completion to ensure that all technical and ecological specifications as identified in the final approved plan have been met.
6. EEP will meet with City and LRC staff to review and assess the Project's progress.
7. EEP shall remove all unused material, excluding waste spoil material, at the completion of the project and will grade and seed the disturbed areas with temporary and permanent seeding.
8. EEP shall be responsible for maintenance of those portions of the Project lying within the Protected Property area, as described in the Permanent Conservation Easement, for a minimum of five years after project construction (until mitigation success criteria have been met.)
9. EEP shall monitor the wetland restoration portion of the Project for a minimum of five (5) years following project completion. Any repair or maintenance that must be performed on the project will be at EEP expense for a minimum of five (5) years
10. EEP shall be responsible for environmental compliance and regulatory requirements of the Project.

11. EEP and its contractors will be responsible for restoring property affected by the construction activities during the construction phase of the project, including but not limited to the City's roads, bridges, parking facilities, stream banks, underground utilities and vegetation. Access and staging areas will be restored to condition equivalent to or superior to the pre-construction condition.
12. EEP will allow the City to remove beaver dams or other debris jams within the Project area that cause flooding onto adjacent properties, resulting in hydrologic trespass. These clearing activities will not be done with large machinery, but by hand and with hand-held implements.

The City agrees to do the following:

1. The City will cancel its Conservation Easement and Water Rights Easement that exist on the property. The EEP's Permanent Conservation Easement (Attachment C) will govern future activities on the property due to current wetland mitigation regulations.
2. The City will review and comment on the Project Area Draft Restoration Plan and Draft Construction Plan within fifteen (15) working days of receipt of said plans. Comments will include but not be limited to schematic drawings of any infrastructure improvements planned for the project area. Comments provided by the City on the design, including but not limited to final vegetative cover, may be incorporated into the design and approved by the EEP if such comments are consistent with: the template Permanent Conservation Easement (Appendix C); wetland mitigation protocols endorsed by stream and wetland regulatory agencies; and the EEP Project budget. These reviews will ensure that both the EEP wetland restoration objectives and City infrastructure needs are properly planned for and integrated into the final design. Note that if no comments are received within this fifteen (15) day period, approval by the City is implied and EEP will proceed with the design as is.
3. City staff will meet with EEP staff at a frequency sufficient to review and assess the Project's progress.
4. The City will provide reasonable on-site assistance as needed or requested by EEP or its contractors during the Project as typically outlined in the City's standard specifications. This may include: diverting traffic around the project area during construction; coordination with maintenance crews to avoid the site during construction; assistance in complying with City and County regulations.
5. The City shall provide a map describing utilities in the Project Area to EEP within one (1) month of the City's authorization of this document.

6. The City will provide reasonable access for EEP, its consultants and contractors to all work sites during the Project's duration.
7. The City shall coordinate with EEP on its property to identify construction staging areas within or adjacent to the Project Area sufficient to stockpile construction materials and construction equipment during the construction period of the Project.

LRC agrees to do the following:

1. To execute and deliver a Conservation Easement Option Agreement in the form of Appendix D on the Project Area (Appendix B) for eventual purchase of a Conservation Easement at fair market value.
2. To give EEP a temporary access easement and the City a permanent easement across the maintenance road shown on Appendix B pursuant to the terms of written easement agreements to be mutually agreed upon after the date hereof
3. LRC will review and comment on the Project Area Draft Restoration Plan and Draft Construction Plan within fifteen (15) working days of receipt of said plans. Comments will include but not be limited to schematic drawings of any infrastructure improvements planned for the project area. Comments provided on the design, including but not limited to final vegetative cover, may be incorporated into the design and approved by the EEP if such comments are consistent with: the template Permanent Conservation Easement (Appendix C); wetland mitigation protocols endorsed by stream and wetland regulatory agencies; and the EEP Project budget. Note that if no comments are received within this fifteen (15) day period, approval by LRC is implied and EEP will proceed with the design as is.
4. LRC shall coordinate with EEP on its property to identify construction staging areas within or adjacent to the Project Area sufficient to stockpile construction materials and construction equipment during the construction period of the Project.

All parties to this MOA agree as follows:

1. EEP and the City shall coordinate regarding public outreach and environmental education opportunities for the Project.
2. EEP, LRC and the City will work cooperatively to develop and implement a restoration plan that is agreeable to all.

3. EEP, LRC and the City will work cooperatively to develop and implement a remedial action plan that is agreeable to all in the event that post-construction remedial activities are necessary within five years after construction.
4. EEP and the City will provide personnel as necessary to ensure proper supervision of construction activities and public safety during the construction phase of the project.
5. EEP will work cooperatively to develop and implement a Project Area Monitoring and Maintenance Plan that is agreeable to all parties.
6. The City, LRC and EEP shall abide by all covenants, conditions and restrictions set forth in the Permanent Conservation Easement.
7. The City and EEP shall provide training to maintenance staff regarding acceptable maintenance of vegetation within EEP's Permanent Conservation Easement Area.

D. Funding

The State, acting through the North Carolina Ecosystem Enhancement Program, agrees to provide one-hundred percent (100%) of the funds for design, construction and monitoring and maintenance of the restored wetland for a minimum of five (5) years after the completion of the Project.

E. Timeline and Duration of this Agreement

The Project guided by this MOA shall commence on the date that this agreement is signed by all parties and the agreement shall terminate upon the completion of the EEP wetland restoration project. Obligations of the State do not apply until the Permanent Conservation Easement have been granted and recorded for this project.

It is anticipated that the Project will commence construction on or before 12/01/2007.

F. Enforcement and Remedies

- a. In the event that EEP determines that the City or LRC has violated or is threatening to violate any of these terms, conditions or restrictions, EEP may institute a suit to enjoin such violation and if necessary, to require the restoration of the Protected Property to its prior condition at the responsible party's expense. Barring such violation, LRC shall have no liability for any maintenance or repairs related to the wetland restoration.

project. Neither the City nor LRC shall be responsible for damage or violation attributable to third parties

- b. No failure on the part of any party to enforce any covenant or provision hereof shall discharge or invalidate such covenant or any other covenant, condition or provision hereof or affect the right of either party to enforce the same in the event of a subsequent breach or default.

G. Miscellaneous

- a. If any party fails to comply with any condition of this agreement and such failure shall continue for more than 30 days after written notice from the other party, and if the non-compliant party should not within 30 days commence to cure with due diligence the failure, then the aggrieved party may terminate this MOA on written notice to the non-compliant party, termination to be effective not less than 15 days from the receipt of the written notice. If the project is Terminated before the restoration of the wetlands is completed, EEP will insure that all disturbed areas are stabilized with temporary and permanent seeding.
- b. No provision of this MOA shall be deemed amended or waived unless such amendment or waiver is set forth in a writing signed by EEP. No act or failure to act by EEP shall be deemed a waiver of its rights hereunder, and no waiver in any one circumstance or of any one provision shall be deemed a waiver in other circumstances or of other provisions.
- c. This MOA may be modified or terminated by mutual consent of the parties as long as such modifications or termination are made in writing and signed by authorized officers from both agencies.
- d. All notices required to be given under this agreement shall be deemed to have been given when reduced to writing and deposited, postage-paid, in the U.S. Mail or delivered by courier or in person to the addresses:

City of Lumberton
500 N. Cedar Street
P.O. Box 1388
Lumberton, N.C. 28359-1388
Attn: T. Wayne Horne, City Manager

NC Department of Environment and Natural Resources
Ecosystem Enhancement Program
1619 Mail Service Center
Raleigh, NC 27699-1619

Attn: Suzanne Klimek, Director of Operations

Lumber River Conservancy
P O. Box 1235
Pembroke, NC 28372-1235
Attn: Jeff McKay, President

IN TESTIMONY THEREOF, the parties have hereunto set their hands and seals, or if corporate have caused this instrument to be executed in their corporate names by their duly authorized representatives as of the dates indicated below.

City of Lumberton

By: _____
Raymond B. Pennington
Mayor, City of Lumberton

NORTH CAROLINA
COUNTY OF _____

I, _____, a Notary Public in and for the County and State aforesaid, do hereby certify that _____, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the _____ day of _____, 200_____.

Notary Public

My commission expires:

Ecosystem Enhancement Program

By: _____
Suzanne Klimek
EEP Director of Operations

NORTH CAROLINA
COUNTY OF _____

I, _____, a Notary Public in and for the County and State aforesaid, do hereby certify that Suzanne Klimek, Director of Operations for the Ecosystem Enhancement Program, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the _____ day of _____, 200__

Notary Public

My commission expires:

Lumber River Conservancy

By: Jeff McKay
Jeff McKay
President

NORTH CAROLINA
COUNTY OF Randolph

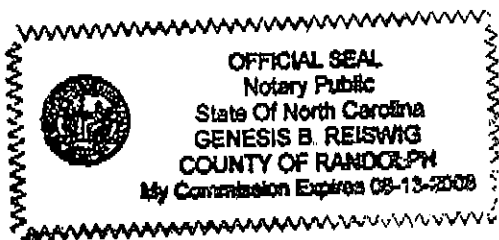
I, Genesis B. Reising, a Notary Public in and for the County and State aforesaid, do hereby certify that Jeff McKay, President of the Lumber River Conservancy personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have herunto set my hand and Notary Seal this the 2nd day of June, 2006.

Genesis B. Reising
Notary Public

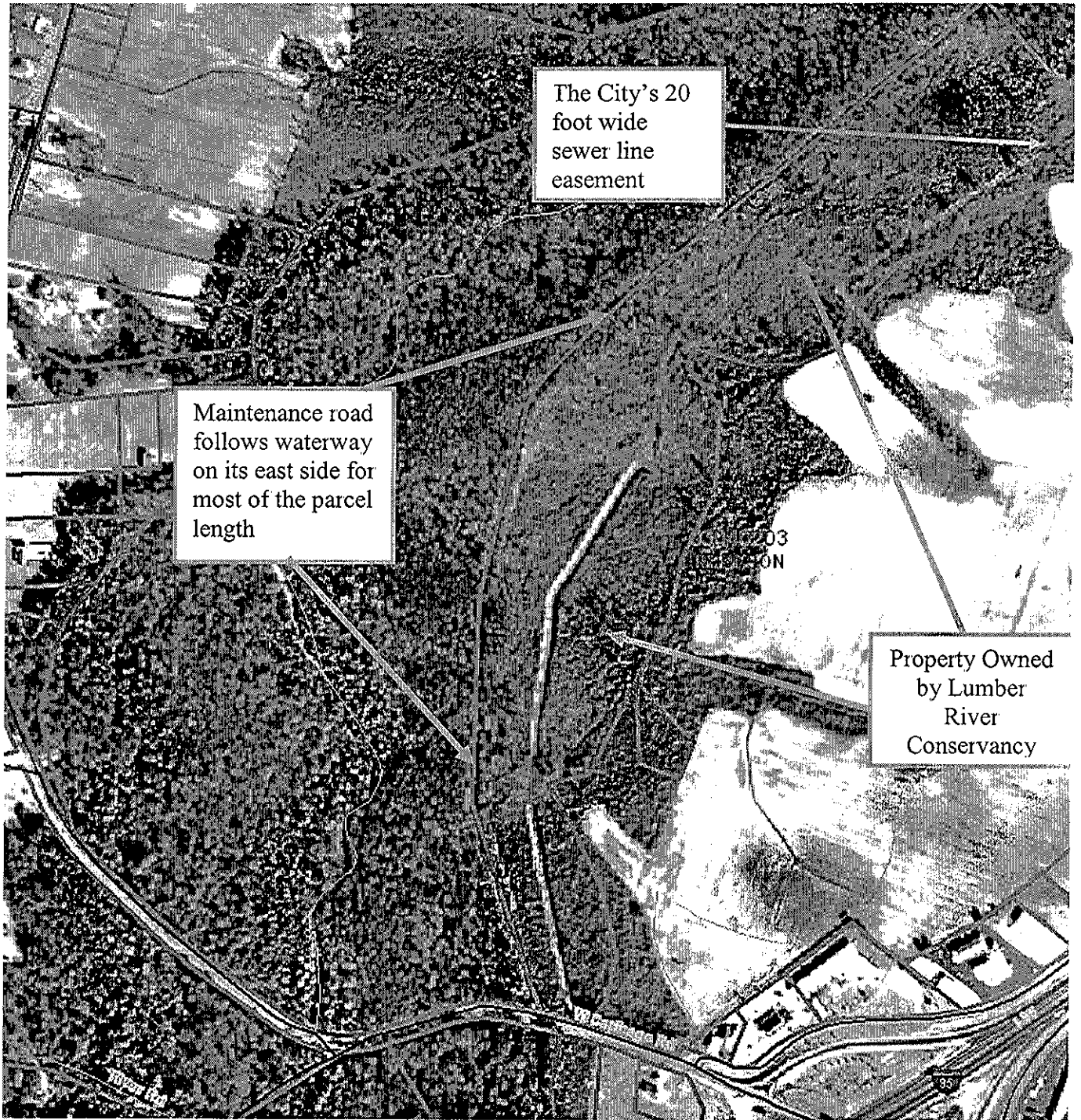
My commission expires:

08-13-08



APPENDIX A:
CITY'S CONSERVATION EASEMENT
CITY'S WATER RIGHTS EASEMENT

APPENDIX B- PROJECT AREA



The City's 20
foot wide
sewer line
easement

Maintenance road
follows waterway
on its east side for
most of the parcel
length

Property Owned
by Lumber
River
Conservancy

APPENDIX C
EEP CONSERVATION EASEMENT TEMPLATE

STATE OF NORTH CAROLINA

CONSERVATION EASEMENT

_____ COUNTY

SPO File Number

Prepared by: Office of the Attorney General

Property Control Section

Return to: NC Department of Administration

State Property Office

1321 Mail Service Center

Raleigh, NC 27699-1321

THIS CONSERVATION EASEMENT DEED, made this _____ day of _____, 2006, by _____, (“**Grantor**”), whose mailing _____ address _____ is _____, to the State of North Carolina, (“**Grantee**”), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 *et seq.*, the State of North Carolina has established the Ecosystem Enhancement Program (formerly known as the Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Ecosystem Enhancement Program in the Department of Environment and Natural Resources has approved acceptance of this instrument; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003. This MOA recognizes that the

Ecosystem Enhancement Program is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in _____ Township, _____ County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately _____ acres and being conveyed to the Grantor by deed as recorded in **Deed Book _____ at Page _____** of the _____ County Registry, North Carolina; and

WHEREAS, Grantor is willing to grant a Conservation Easement over the herein described areas of the Property, thereby restricting and limiting the use of the included areas of the Property to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept such Conservation Easement. This Conservation Easement shall be for the protection and benefit of the waters of ***if known, insert name of stream, branch, river or waterway here***

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement of the nature and character and to the extent hereinafter set forth, over a described area of the Property, referred to hereafter as the "**Easement Area**", for the benefit of the people of North Carolina, and being all of the tract of land as identified as Tract _____ as shown on a plat of survey entitled "**_____**" dated _____, certified by _____, and **recorded in Map Book _____, Page _____**, _____ County Registry. Tract _____ being more particularly described as follows:

[INSERT LEGAL DESCRIPTION OR REFERENCE ATTACHED EXHIBIT]

The purposes of this Conservation Easement are to maintain, restore, enhance, create and preserve wetland and/or riparian resources in the Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

DURATION OF EASEMENT

This Conservation Easement shall be perpetual. It is an easement in gross, runs with the land, and is enforceable by Grantee against Grantor, their personal representatives, heirs, successors, and assigns, lessees, agents, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. The following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Easement Area for the purposes thereof. Usage of motorized vehicles in the Easement Area is prohibited, except as they are used exclusively for management, maintenance, or stewardship purposes, and on existing trails, paths or roads.

B. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Easement Area not inconsistent with this Conservation Easement, and the right of access to the Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

C. Vegetative Cutting. Except as related to the removal of non-native plants, diseased or damaged trees, and vegetation that obstructs, destabilizes or renders unsafe the Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Easement Area is prohibited.

D. Industrial, Residential and Commercial Uses. All are prohibited in the Easement Area.

E. Agricultural Use. All agricultural uses within the Easement Area including any use for cropland, waste lagoons, or pastureland are prohibited.

F. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Easement Area.

G. Roads and Trails. There shall be no construction of roads, trails, walkways, or paving in the Easement Area. Existing roads or trails located in the Easement Area may be maintained by Grantor in order to minimize runoff, sedimentation and for access to the interior of the Property for management, maintenance, stewardship purposes, or undeveloped recreational and educational uses of the Easement Area. Existing roads, trails or paths may be maintained with loose gravel or permanent vegetation to stabilize or cover the surfaces.

H. Signs. No signs shall be permitted in the Easement Area except interpretive signs describing restoration activities and the conservation values of the Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Easement Area may be allowed.

I. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances or machinery, or other material in the Easement Area is prohibited.

J. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, or drilling; no removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

K. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water. No altering or tampering with water control structures or devices, or disruption or alteration

of the restored, enhanced, or created drainage patterns. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Easement Area may temporarily be used for good cause shown as needed for the survival of livestock and agricultural production.

L. Subdivision and Conveyance. No further subdivision, partitioning, or dividing of the Easement Area is allowed. Unless agreed to by the Grantee in writing, any future conveyance of the Easement Area and the rights as conveyed herein shall be as a single block of property. Any future transfer of the remaining fee simple rights shall be subject to this Conservation Easement. Any transfer is subject to the Grantee's right of ingress, egress, and regress over and across the Property to the Easement Area for the purposes set forth herein.

M. Development Rights. All development rights are removed from the Easement Area and shall not be transferred.

N. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is consistent with the purposes of this Conservation Easement. The Grantor shall not vary from the above restrictions without first obtaining written approval from the N.C. Ecosystem Enhancement Program, whose mailing address is 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. Ingress, Egress, Regress and Inspection. The Grantee, its employees and agents, successors and assigns, receive the perpetual right of general ingress, egress,

and regress to the Easement Area over the Property at reasonable times to undertake any activities to restore, manage, maintain, enhance, and monitor the wetland and riparian resources of the Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterranean water flow.

IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Easement Area that is inconsistent with the purposes of this Easement and to require the restoration of such areas or features of the Easement Area that may have been damaged by such activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, their successors or assigns, that comes to the attention of the Grantee, the Grantee shall, except as provided below, notify the Grantor, their successors or assigns in writing of such breach. The Grantor shall have ninety (90) days after receipt of such notice to correct the conditions constituting such breach. If the breach remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by appropriate legal proceedings including damages, injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief if the breach of the term of this Conservation Easement is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement. The Grantor and Grantee acknowledge that under such circumstances damage to the Grantee would be irreparable and remedies at law will be inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor, their successors or assigns are complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor, their

successors or assigns, for any injury or change in the Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life, damage to property or harm to the Property resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, their successors or assigns, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown above or to other address(es) as either party establishes in writing upon notification to the other.

C. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees to make any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed subject to the Conservation Easement herein created.

D. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

E. This Conservation Easement may be amended, but only in a writing signed by all parties hereto, and provided such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement.

F. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Easement Area, and the right of quiet enjoyment of the Easement Area.

TO HAVE AND TO HOLD the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes.

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same are free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

_____ (SEAL)

NORTH CAROLINA

COUNTY OF _____

I, _____, a Notary Public in and for the County and State aforesaid, do hereby certify that _____, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the
_____ day of _____, 200__

Notary Public

My commission expires:

APPENDIX D
CONSERVATION EASEMENT OPTION AGREEMENT

**STATE OF NORTH CAROLINA
COUNTY OF ROBESON**

Prepared by State Property Office
Return after recording to:
Blane Rice, State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

CONSERVATION EASEMENT Option Agreement

Ecosystem Enhancement Program

SPO File Number 78-AAF

THIS OPTION AGREEMENT, hereinafter referred to as Option, made and entered into this _____ day of _____, 2006 by and between **The Lumber River Conservancy**, a non-profit corporation organized and existing under the laws of the State of North Carolina hereinafter referred to as the **Seller**, and the **State of North Carolina**, and its successors and assigns, hereinafter referred to as the **State**.

WITNESSETH

In consideration of \$10.00 and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, and of the agreements contained in this Option, **Seller** hereby grants to the **State**, its successors and assigns, the exclusive right and option to receive a perpetual **Conservation Easement in the form of Appendix C attached hereto** over mutually agreed upon lands owned by the **Seller**, hereinafter referred to as the **Parent Tract**. The **Conservation Easement** shall perpetually protect those lands hereinafter referred to as the **Easement Area**. The **Parent Tract** is located in

Robeson County, North Carolina and contains 64 acres, more or less. The **Parent Tract** subject to the **Conservation Easement** is more particularly described as follows:

Located on both sides of the Carthage Road, located east of the Saddletree Swamp Canal on the North side of said road, and located west of the Saddletree Swamp Canal on the South side of said road, and containing 64 acres by survey. Being all of Lot Number Two (2) of the McMillan Mill Pond Division as shown on a map of the Division dated November 1953 and recorded in Book of Maps Number 20, at Page 67 in the office of the Register of Deeds for Robeson County, North Carolina, and also being the same property allotted to Mrs. Nora G. Caldwell, by decree confirming Report of Commissioners, recorded in Book 11-R at Page 194 in the office of the Register of Deeds for Robeson County, North Carolina.

Also being all that tract of land containing 64 acres, more or less, as particularly shown on a map of a survey by Johnny W. Nobles & Associates, Registered Land Surveyor, dated September, 1993, a copy of which map is attached hereto and made a part of this description.

Also being the same land described in deed from Harold J. Pait, et als to The Lumber River Conservancy dated March 24, 1997, recorded in Book 944, at page 475, Robeson County Registry.

The Property is subject to a right of way and easement of the Grantee for the sewer lift station and 20 foot wide sanitary sewer easement as shown on the attached map of a survey by Johnny W. Nobles & Associates, which easement and right of way is hereby ratified by the Grantor.

Being a perpetual **Conservation Easement** that will permanently protect the restoration, enhancement and/or preservation of the Meadowbranch Swamp, located on the north side of Carthage Road.

The following terms, provisions, and conditions are further agreed to:

1. **OPTION PERIOD.** This option shall remain in effect from the date that this Option has been executed by the **Grantor** until the **31st of December 2006**. This Option shall be exercised upon posting, by certified mail, a written notice to the **Grantor** at the following address: **Lumber River Conservancy, P.O. Drawer 1087, Lumberton, NC 28359**. Exercise shall be deemed timely if such written notice is mailed on or before the date first set forth in this paragraph.

2. **PURCHASE PRICE.** The total purchase price for the **Easement Area** per acre shall be the sum of **\$150.00 (ONE HUNDRED FIFTY Dollars)** per acre subject to final survey. (\$150.00 per acre).
3. **CLOSING** A closing of the sale of this **Conservation Easement** under this Option shall be held within **90 days** of the exercise of this Option; provided, however, in the event of objections to title or condition of land at closing, and diligent efforts on **Seller's** part to cure said objections, a closing shall be held within a reasonable time following the removal of said objections.
4. **EVIDENCE OF TITLE.** Upon receipt of this signed Option, the **State** will have title to the **Easement Area** examined, and if applicable, obtain a preliminary title insurance commitment. The title examination and/or commitment must evidence the **Seller's** ability to deliver title at closing as set forth below. All costs necessary to procure the title examination and, if applicable, the title commitment and final title insurance policy to be issued at closing, shall be the responsibility of the **State**.
5. **TITLE.** At closing, the **Seller** shall convey good, insurable and marketable title to the **Conservation Easement** together with all rights necessary to protect the **Easement Area** in perpetuity, including legal access, all mineral rights and all development rights, to the **State** free and clear of all liens, encumbrances, restrictions, rights, or exceptions except those of record that are acceptable to the **State**.
6. **TITLE DEFECTS.** If for any reason the **Seller** cannot deliver title at closing as required by Paragraph 5 of this Option, the **State** may elect to a) accept the **Conservation Easement** with title as is; b) refuse to accept the **Conservation Easement**; or c) allow the **Seller** additional time to pursue reasonable efforts to correct the problem, including bringing any necessary quiet title actions or other lawsuits.
7. **SUBJECT TO SURVEY AND DESIGN.** It is understood and intended that the final **Easement Area** and **Conservation Easement** under this option is subject to final design, approval and survey by the **Ecosystem Enhancement Program** with these costs paid by the **State**.
8. **DOCUMENTS FOR CLOSING.** The **Seller** shall execute and deliver at closing a **Conservation Easement**, any owner's affidavits or documents required by a title insurance company to remove the standard title policy exceptions, and any other documents necessary to close in accordance with the terms of this Option. These documents will be prepared at the expense of the **State**.
9. **PROPERTY TAXES.** Any delinquent real estate taxes and all levied assessments are the **Seller's** responsibility and should be satisfied of record by the **Seller** at or before closing. Any deferred taxes on the **Easement Area**, which become due as a result of this conveyance, shall be the responsibility of the **Seller**. Real estate taxes for the year in which the transaction is closed shall be the responsibility of the **Seller** and not prorated, as the **State** is not receiving fee simple title.

10. **MISCELLANEOUS CLOSING EXPENSES.** The **Seller** will pay any documentary stamp tax, real estate transfer fee or any similar charge due upon conveyance of title to the **State**. The **State** will pay recording fees.
11. **POSSESSION.** The **Seller** will deliver possession of the **Easement Area** to the **State** at closing subject to no leases, mortgages, liens or other reserved rights, and in the condition set forth below in Paragraph 12.
12. **CONDITION OF PROPERTY/ RISK OF LOSS.** The **Seller** shall not transfer or encumber any interests in the **Easement Area** prior to closing. The **Seller** shall keep the **Easement Area** in its current condition until closing and shall prevent and refrain from any use of the **Easement Area**, for any purpose or in any manner, that would diminish its value or adversely affect the **State's** intended uses.

In the event of any adverse change in the condition of the **Easement Area**, whether said change is caused by **Seller** or by forces beyond **Seller's** control, the **State** may elect to a) refuse to accept the property; b) accept the Property, or a portion thereof, in which case there may be an equitable adjustment of the purchase price based on a change in circumstances; or c) require restoration of the Property to its condition at the time this Option was granted.

13. **RIGHT OF ENTRY AND INSPECTION.** The **State** and its agents shall have the right to enter upon the Property at reasonable times for surveying, engineering, conducting environmental inspections and assessments to detect hazardous or toxic substances, and other reasonable purposes related to this transaction. Based upon the results of the environmental inspections and assessments, or upon other conditions revealed to be unsuitable to the **State**, the **State** may elect to refuse to accept the **Easement Area**.
14. **REMEDIES.** In addition to any other remedy specifically set forth in this Option, the **State** has the right to enforce the provisions of this Option through an action for specific performance, injunctive relief, damages, contribution or any other available proceedings in law or equity. The election of any one remedy available under this Option shall not constitute a waiver of any other available remedies.
15. **BINDING EFFECT.** This Option becomes effective when signed by the **Seller** and shall then apply to and bind the **Seller** and **Seller's** heirs, executors, administrators, successors, and assigns.
16. **COMPLETE AGREEMENT.** This Option constitutes the sole and complete agreement between the parties and cannot be changed except by written agreement. The **Ecosystem Enhancement Program** promotes the preservation, restoration and enhancement of streams and/or wetlands. Any representations, contracts or agreements created by or for the **Ecosystem Enhancement Program** are exclusive of this option unless specifically incorporated herein by exhibit.
17. **NO WAIVER.** No provision of the Option shall be deemed amended or waived unless such amendment or waiver is set forth in a writing signed by the **State**. No act

or failure to act by the **State** shall be deemed a waiver of its rights hereunder, and no waiver in any one circumstance or of any one provision shall be deemed a waiver in other circumstances or of other provisions

18. **ASSIGNMENT.** The **State** has the right to assign this Option. In the event of such assignment, the assignee will have all the rights, powers, privileges and duties held by the **State** pursuant to this Option.

IN TESTIMONY THEREOF, the parties have hereunto set their hands and seals, or if corporate have caused this instrument to be executed in their corporate names by their duly authorized representatives as of the dates indicated below

Seller: **The Lumber River Conservancy, a
Non-profit corporation**

By: _____
Jeffrey L. McKay, President

ATTEST

J. Dickson McLean, Secretary

[Corporate seal]

Ecosystem Enhancement Program FEMA Reporting Form

Appendix 9.0



THE JOHN R. McADAMS
COMPANY, INC.



EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. Edward Curtis), NC Floodplain Mapping Unit (attn. John Gerber) and NC Ecosystem Enhancement Program.

Project Location

Name of project:	Meadowbranch Swamp Wetland Restoration
Name if stream or feature:	Meadowbranch Swamp
County:	Robeson
Name of river basin:	Lumber
Is project urban or rural?	Urban
Name of Jurisdictional municipality/county:	Lumberton
DFIRM panel number for entire site:	3710939200J
Consultant name:	The John R. McAdams Company Inc.
Phone number:	919.361.5000
Address:	Post Office Box 14005 RTP, North Carolina 27709

Design Information

The primary actions to restore the site will include removal of the former logging road, and minor earthwork to modify the existing access road along the canal. Several road crossings, low areas built into the access road, will be designed to mimic the natural swale in the reference wetland. These road crossings will allow flood events onto the project parcel. The area located to the east of the former logging road is a prime example of an area partially isolated from overbank flooding. Soil excavated to create the former logging road will be returned to its original location. This will hydrologically reconnect the site east of the former logging road to the rest of the site, allowing water from overbank flood events to be distributed and stored over the entire site. Through these actions, it is expected that approximately 50 acres of riverine wetlands will be restored enhanced, and preserved.

See last page for a site map.

Proposed Project Goals Meadowbranch Swamp-EEP 06050

Restoration Type	Acres
Wetland Restoration	0.8
Wetland Enhancement	32.1
Wetland Preservation	17.9

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

Yes No

The land area covered by the floodwaters of the base flood is the Special Flood Hazard Area (SFHA) on NFIP maps. The SFHA is the area where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. The SFHA includes Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE, and V.

If project is located in a SFHA, check how it was determined:

- Redelineation
- Detailed Study
- Limited Detail Study
- Approximate Study
- Don't know

List flood zone designation:

Check if applies:

AE Zone

Floodway

Non-Encroachment

None

A Zone

Local Setbacks Required

No Local Setbacks Required

If local setbacks are required, list how many feet:

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

Yes

No

Land Acquisition (Check) - N/A Land not being acquired, already protected

State owned (fee simple)

Conservation easment (Design Bid Build)

Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)

Is community/county participating in the NFIP program?

Yes

No

Note: if community is not participating, then all requirements should be addressed to NFIP (attn: Edward Curtis, (919) 715-8000 x369)

Name of Local Floodplain Administrator: Brandon Love

Phone Number: 910.671.3976

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

No Action

No Rise

Letter of Map Revision

Conditional Letter of Map Revision

Other Requirements

List other requirements:

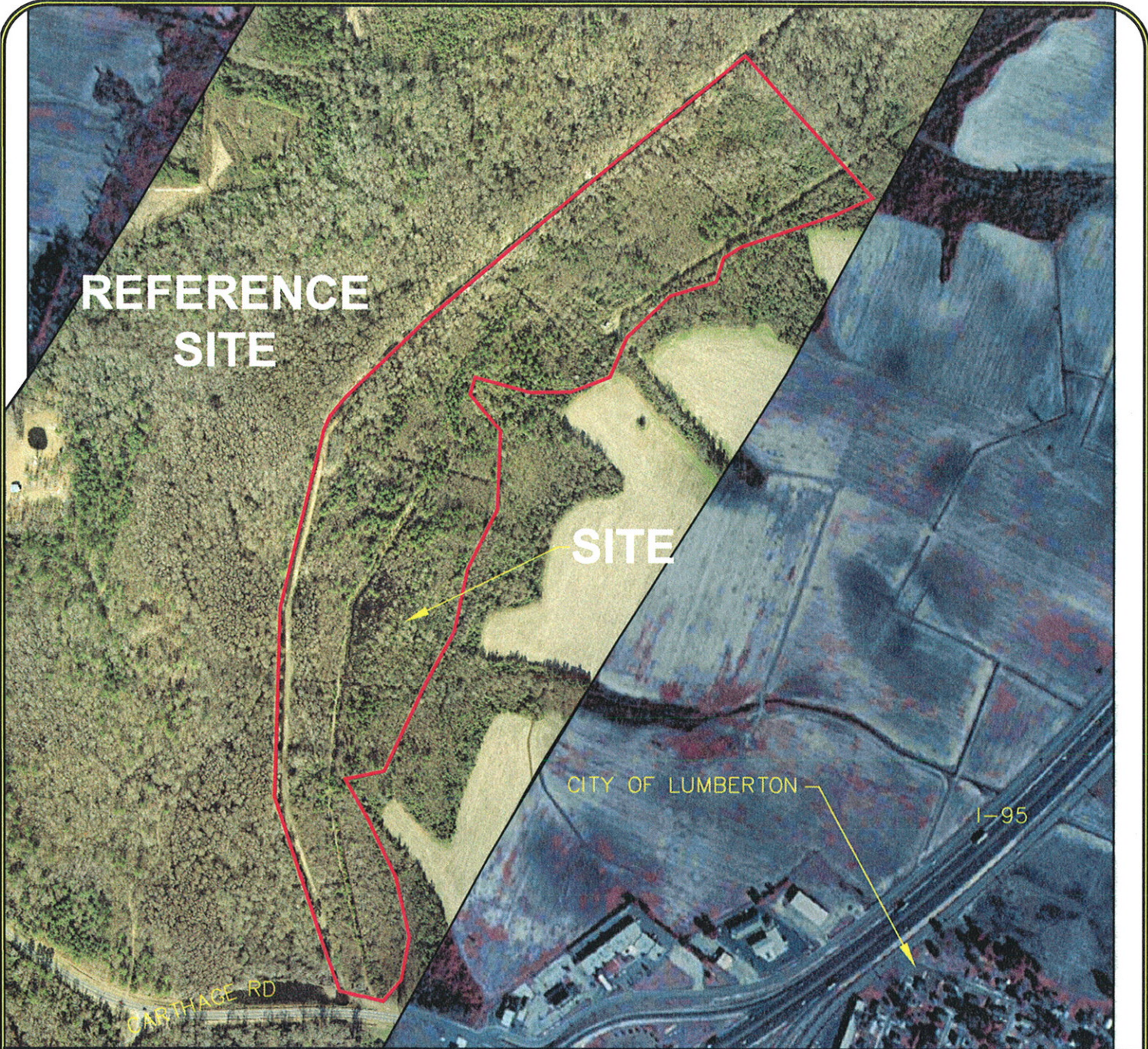
Comments:

Name: _____

Signature: _____

Title: _____

Date: _____



LEGEND

— APPROXIMATE PROPERTY BOUNDARY
1998 COLOR INFRARED PHOTOGRAPH

NOTES:

PROJECT: MEADOWBRANCH, DENR #D07017S
ROBESON COUNTY, NORTH CAROLINA



SCALE: 1" = 600'

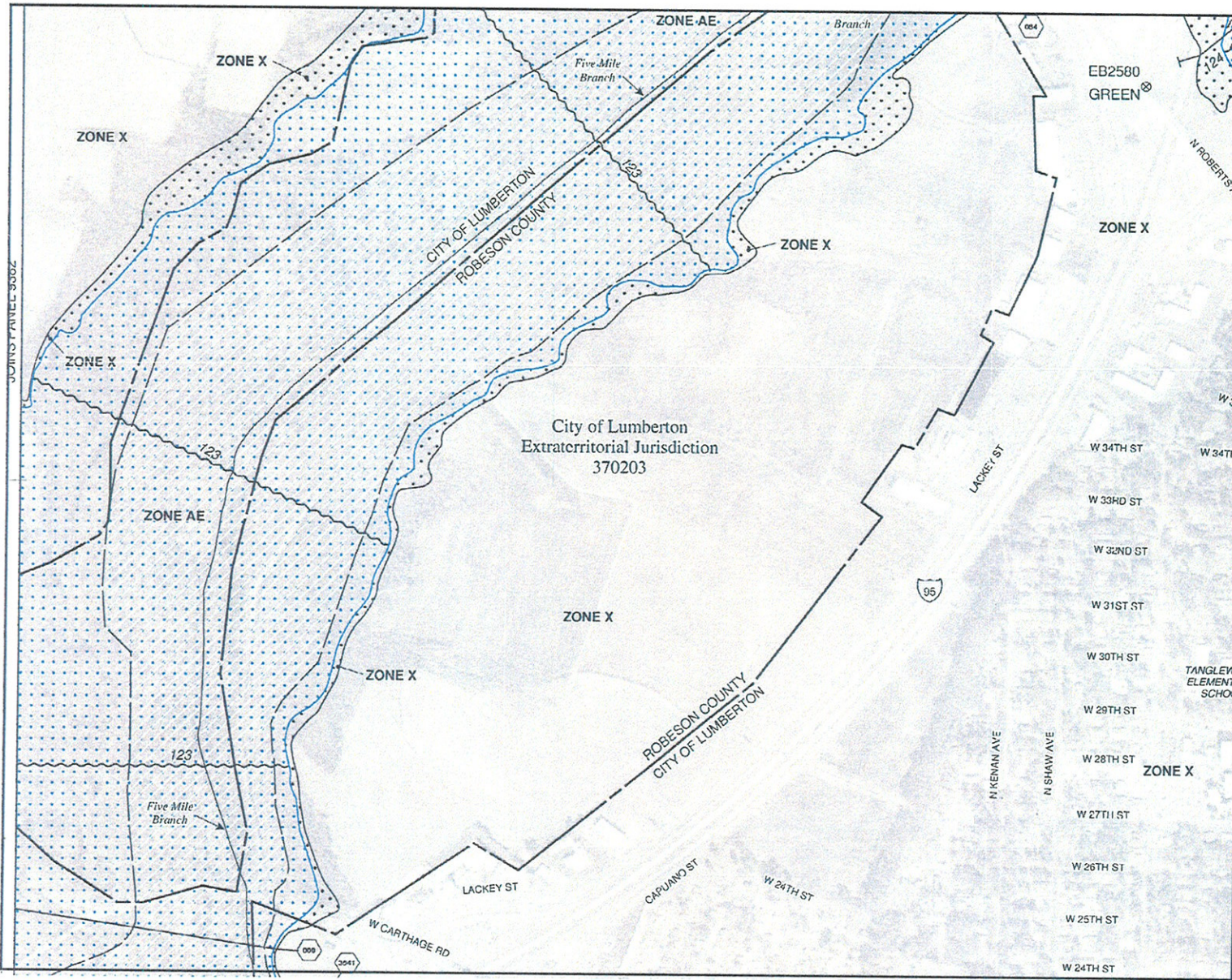
McADAMS


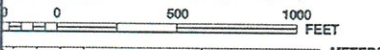
PROJECT NO. EEP-06050
FILENAME: EEP06050
SCALE: 1" = 600'
DATE: 3-26-07



SITE MAP

THE JOHN R. McADAMS COMPANY, INC.
ENGINEERS/PLANNERS/SURVEYORS
RESEARCH TRIANGLE PARK, NC
P.O. BOX 14005 ZIP 27709-4005
(919) 361-5000






GRID NORTH
MAP SCALE 1" = 500' (1 : 6,000)


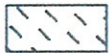
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 9392J
FIRM
FLOOD INSURANCE RATE MAP
NORTH CAROLINA
PANEL 9392
SEE LOCATION DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT
CONTAINS:

COMMUNITY	NUMBER	PANEL	SHEET
LUMBERTON, CITY OF ROBESON COUNTY	9392	9392	J

Refer to Item 1 on the Map Number stream below sheet to see sheet showing map options. The Community Number stream above should be used on insurance applications for the subject community.
EFFECTIVE DATE **MAP NUMBER**
JANUARY 19, 2005 **3710939200J**


 State of North Carolina
 Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.



1% annual chance floodplain boundary



0.2% annual chance floodplain boundary



Floodway boundary



Zone D Boundary



CBRS and OPA Boundary



Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.



Base Flood Elevation line and value; elevation in feet*

(EL 987)

Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988



Cross section line



Transect line

97 07'30", 32 22'30"

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

4276 ⁰⁰⁰M

1000-meter Universal Transverse Mercator grid ticks, zone 17

1 477 500 FEET

2500-foot grid values: North Carolina State Plane coordinate system (FIPZONE 3200, State Plane NAD 83 feet)

BM5510 X

North Carolina Geodetic Survey bench mark (see explanation in the Datum Information section of this FIRM panel).

BM5510 ⊗

National Geodetic Survey bench mark (see explanation in the Datum Information section of this FIRM panel).

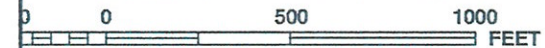
● M1.5

River Mile



GRID NORTH

MAP SCALE 1" = 500' (1 : 6,000)



METERS

LEGEND



SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A

No Base Flood Elevations determined.

ZONE AE

Base Flood Elevations determined.

ZONE AH

Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO

Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR

Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99

Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE VE

Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.



FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.



OTHER FLOOD AREAS

ZONE X

Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.



OTHER AREAS

ZONE X

Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D

Areas in which flood hazards are undetermined, but possible.



COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS



OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.



1% annual chance floodplain boundary



0.2% annual chance floodplain boundary



Floodway boundary



Zone D Boundary



CBRS and OPA Boundary

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov