ANNUAL REPORT FOR 2008

Indian Creek Mitigation Site
Lincoln County
TIP No. R-0617BA

Prepared By:
Natural Environment Unit & Roadside Environmental Unit
North Carolina Department of Transportation
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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Indian Creek Mitigation Site. Site construction began in February 2005 and was completed within the same month. Monitoring activities in 2008 represent the fourth year of monitoring for the site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years or until the site is deemed successful.
The site is monitored with four groundwater gauges, one rain gauge, and one vegetation plot.

The daily rainfall data depicted on the monitoring gauge graphs was recorded from an onsite rain gauge. An offsite rain gauge, maintained by the NC State Climate Office in Lincolnton, contributed to the daily rainfall data and historical rainfall data used for the 30th – 70th percentile analysis.

The 2008 vegetation monitoring of the site revealed an average density of 310 trees per acre, which is above the minimum success criteria of 290 trees per acre needed for Year 4. NCDOT will continue to monitor the Indian Creek Mitigation Site for vegetation.

Hydrologic success criteria are based on the approved mitigation plan and require that the site demonstrate saturation or inundation within 12 inches of the soil surface for a consecutive 10% of the growing season during years of normal rainfall.

2008 represents the fourth year for hydrology monitoring. One of the two groundwater gauges located in the wetland preservation area exceeded the success criteria with saturation within 12” of the soil surface for greater than 10% of the growing season. The two gauges located in the wetland creation area did not meet the success criteria.

NCDOT recommends discontinuing monitoring of the wetland creation on the Indian Creek Mitigation Site. The wetland creation has failed to meet the hydraulic monitoring requirements during the four years of monitoring. The elevations on the site have been verified and are either at the adjacent wetland elevation or lower. It has been determined by NCDOT NEU staff that the incision of Indian Creek is creating a drawdown of the groundwater in the creation area.

NCDOT had 0.64 acres of wetland impacts associated with R-0617BA. The Indian Creek mitigation as-built indicates the following:

0.6 Acres of Wetland Creation
1.7 Acres of Wetland Enhancement
4.5 Acres of Wetland Preservation
480 LF of Stream Enhancement
2,080 LF of Stream Preservation
6.5 Acres of Upland Enhancement

5.2 Acres of Upland Preservation Based on the as-built, NCDOT would like to use the 1.7 acres of Wetland Enhancement and 4.5 acres of Wetland Preservation to offset the 0.64 acres of wetland impacts associated with R-0617BA. The table below illustrates that by utilizing the wetland enhancement and wetland preservation credits; NCDOT has sufficient credit to offset the 0.64 acres of wetland impacts.

Mitigation Type	Acres Available	Credit Ratio	Acres of Wetland Credit
Wetland Enhancement	1.7	5:1	0.34
Wetland Preservation	4.5	10:1	0.45
Total Credit			**0.79**

1.0 INTRODUCTION

1.1 Project Description

The Indian Creek Mitigation Site is located on Pleasant Union Church Road, south of Lincolnton and just north of the town of Crouse. The site is adjacent to Indian Creek in Lincoln County (Figure 1). NCDOT is using onsite mitigation at the Indian Creek Site to offset impacts to existing wetlands and streams from the construction of NC 150 in Lincoln County.

The Indian Creek Site consists of approximately 20.0 acres of wetland creation, enhancement, and preservation; stream enhancement (with riparian buffer restoration and enhancement), and uplands enhancement and preservation.

Headwater wetlands were created through minor grading of deforested uplands (0.6 acre). Wetland enhancement consisted of planting approximately 0.9 acre of existing emergent wetland and wetland preservation included protecting approximately 6.2 acres of headwater and scrub-shrub wetlands. Stream enhancement was performed on approximately 1,280 feet of channel and included 480 feet of buffer restoration and 800 feet of buffer preservation (3.0 acres total). An upland area (6.4 acres) was enhanced through planting while another 4.4 acres of upland were preserved.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria for hydrology and vegetation are based on the approved mitigation plan dated August 2002. The following report details the results of hydrologic and vegetative monitoring activities that were performed during the 2008 growing season at the Indian Creek Mitigation Site.

1.3 Project History

February 2005	Site Planted
March-November 2005	Hydrology Monitoring (Year 1)
July 2005	Vegetation Monitoring (Year 1)
March-November 2006	Hydrology Monitoring (Year 2)
July 2006	Vegetation Monitoring (Year 2)
March-November 2007	Hydrology Monitoring (Year 3)
August 2007	Vegetation Monitoring (Year 3)
March-November 2008	Hydrology Monitoring (Year 4)
August 2008	Vegetation Monitoring (Year 4)

Figure 1. Site Location Map

2.0 HYDROLOGY

2.1 Success Criteria

Per the approved mitigation plan dated August 2002, groundwater hydrology on the Indian Creek Mitigation Site shall be monitored for five years following the completion of all implementation activities, or until hydrologic success criteria are met. As stated in the mitigation plan, hydrologic success is defined as inundated or saturated soil conditions within a major portion of the root zone (within 12 inches of the soil surface) for greater than or equal to 10% of the growing season in normal years.

The growing season in Lincoln County begins March 28 and ends November 4. These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after March 28 or before November 4.[1] The growing season is 222 days; therefore, hydrologic success requires 10% continuous saturation during this period, or at least 22 consecutive days.

2.2 Hydrologic Description

In March 2005, four groundwater gauges were installed across the site (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth. The 2008 year represents the fourth growing season that the monitoring gauges have been in place since construction of the site.

[1] Soil Conservation Service, Soil Survey of Lincoln County, North Carolina.

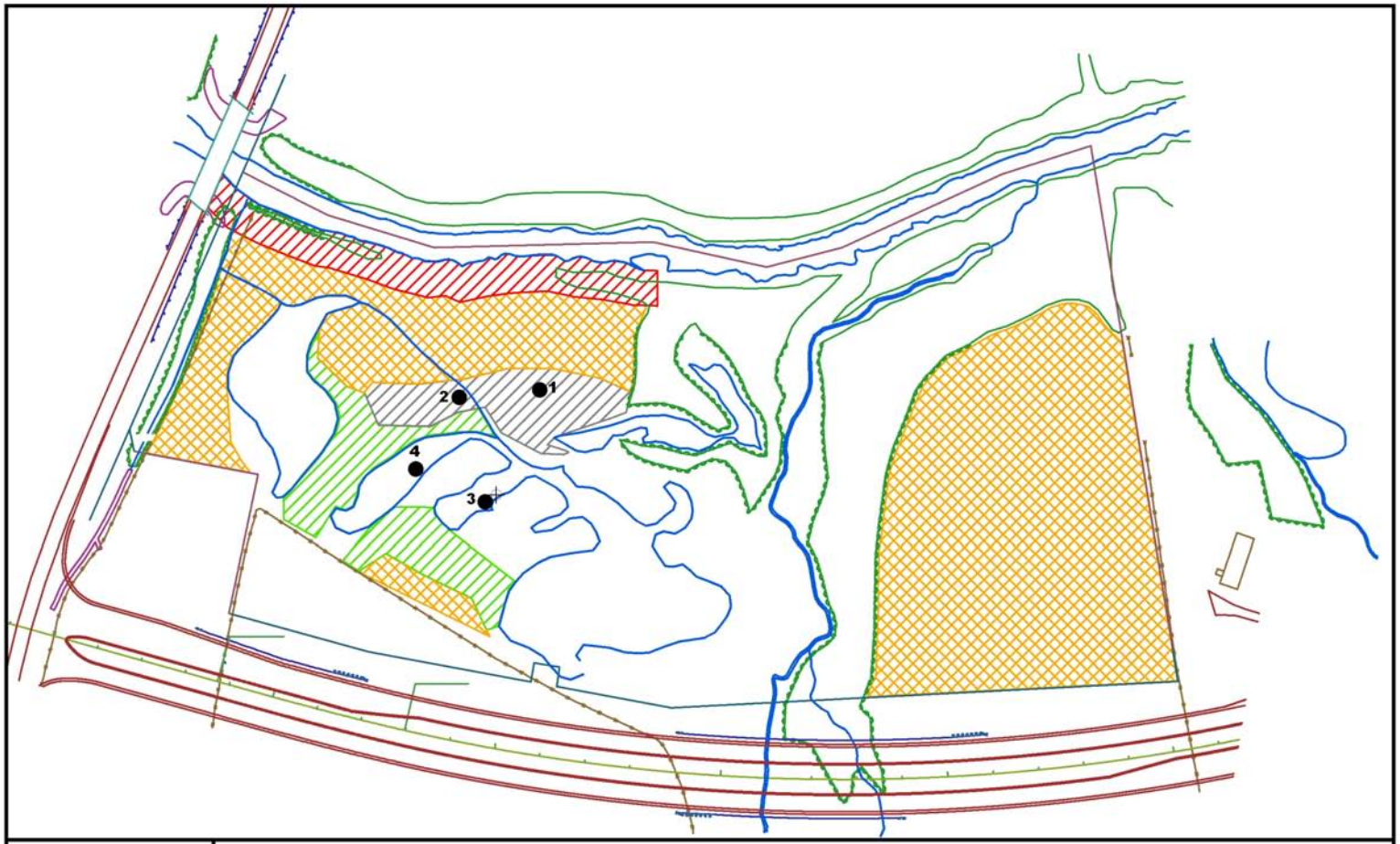


Figure 2. Gauge Location Map

Groundwater Gauge
Rain Gauge
Wetland Creation
Wetland Enhancement
Riparian Buffer Restoration
Upland Buffer Enhancement

0 50 100 200 Feet

N

2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that groundwater was within twelve inches of the surface was determined for each gauge. This number was converted into a percentage of the 222-day growing season. The results are presented in Table 1. Figure 3 also provides a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 10% of the growing season. Gauges highlighted in red show hydrology between 5% and 10% of the growing season. Those gauges highlighted in black indicate no wetland hydrology (< 5% of the growing season).

Appendix A contains a plot of the groundwater depth for each monitoring gauge. The maximum number of consecutive days is noted on each graph. An onsite rain gauge was used to obtain rainfall data from the site. It has been compared with rainfall data acquired from the State Climate Office Local Weather Station in Lincolnton.

Table 1. Hydrologic Monitoring Results

Monitoring Gauge	**<5%**	**5%-10%**	**>10.0%**	**Actual %**	Success Dates
GW-1 (Creation)		**X**		**5.0**	April 4-April 14
GW-2 (Creation)	**X**			**3.6**	
+GW-3			**X**	**26.1**	April 8-June 4 Oct 9- Oct 31
GW-4		**X**		**9.5**	March 28-April 17

Shaded gauges are gauges located in the preservation area.
+Gauge met success during average rainfall months (March, May, October and November).

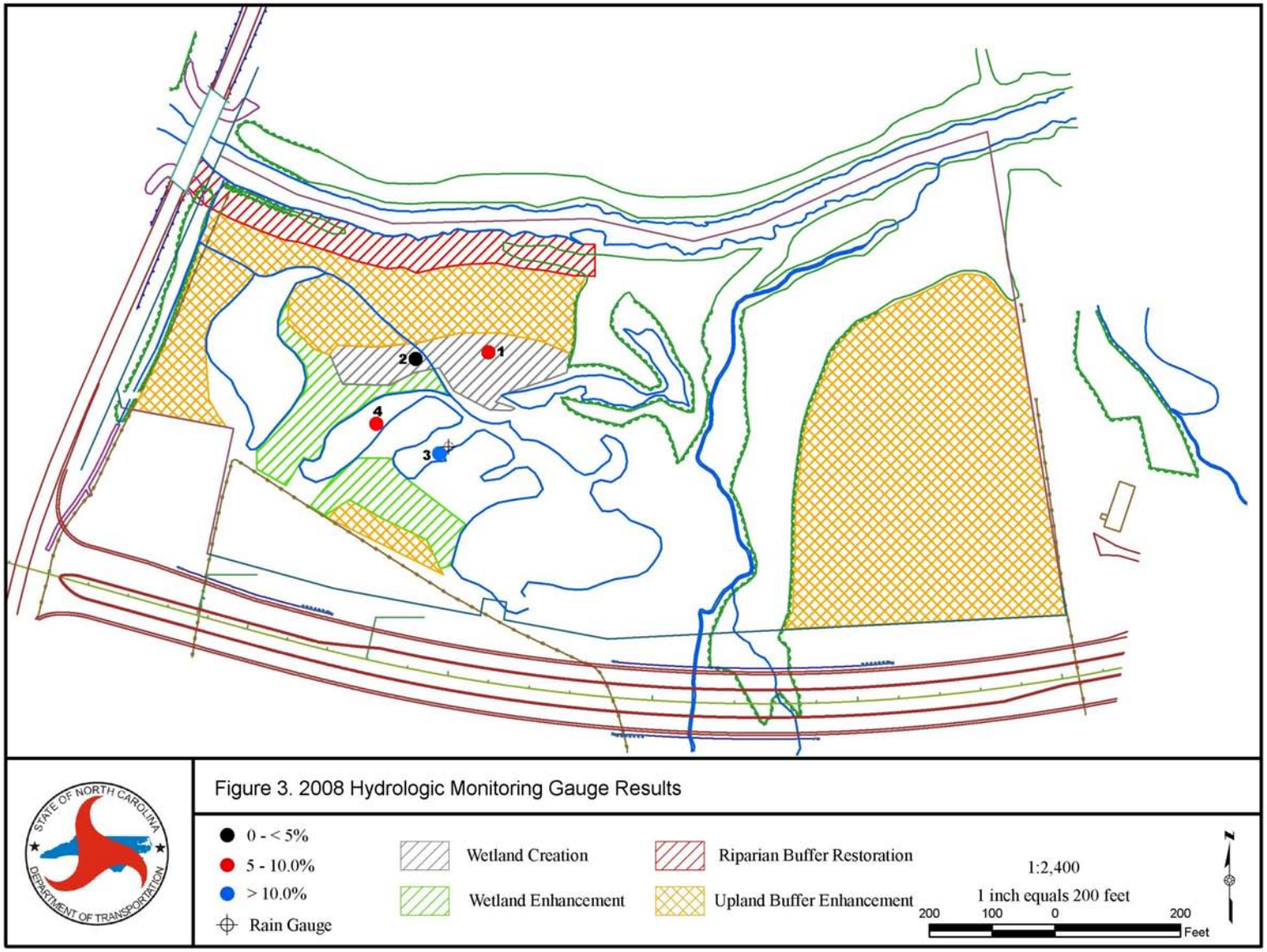


Figure 3. 2008 Hydrologic Monitoring Gauge Results

2.3.2 Climatic Data

Figure 4 is a comparison of the 2008 monthly rainfall to the historical precipitation (collected between 1977 and 2008) for Lincolnton, North Carolina. This comparison gives an indication of how 2008 relates to historical data in terms of climate conditions. The NC State Climate Office provided all historical rainfall information.

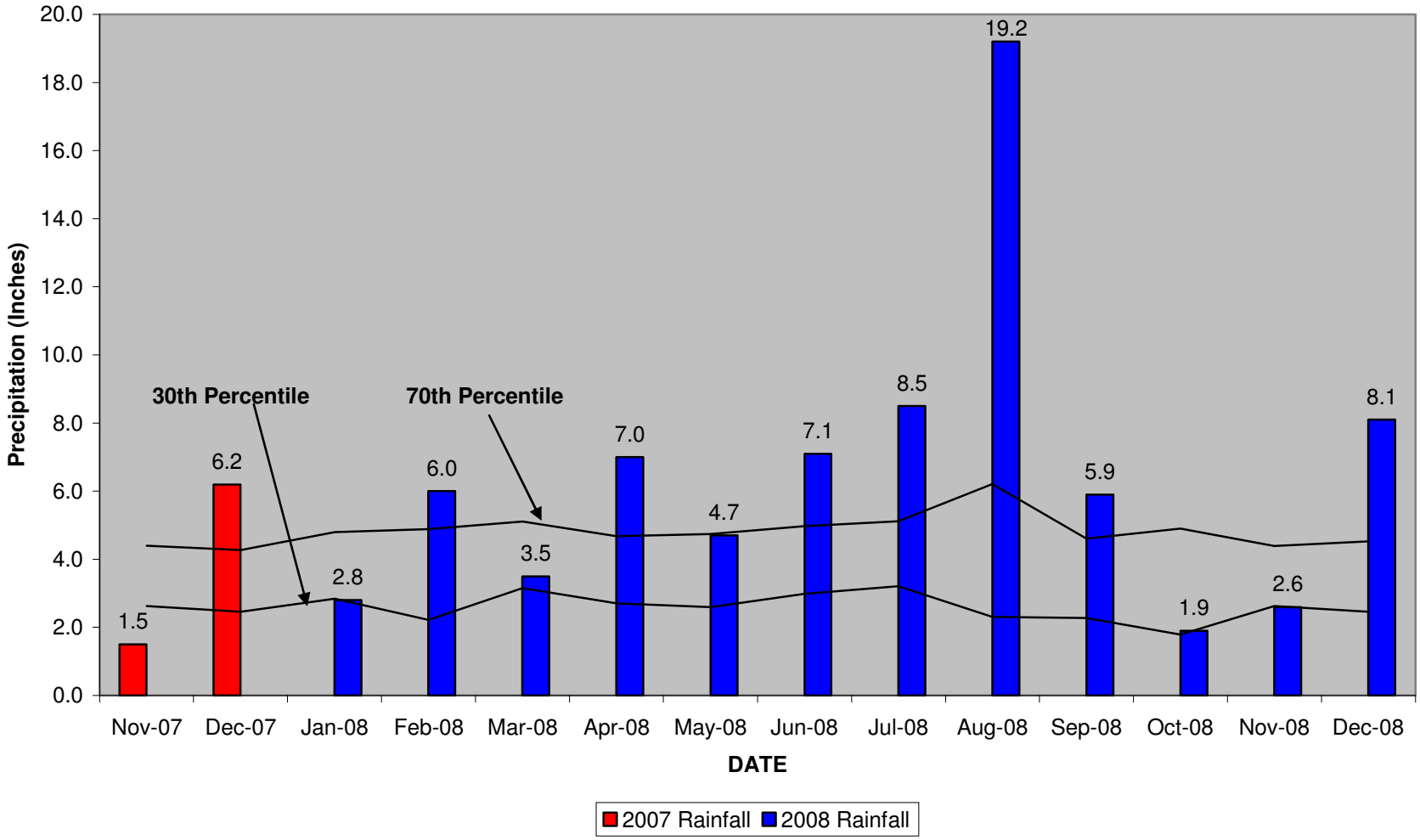
Based on the historical data, January, March, May, October, and November recorded average rainfall for the site in 2008. The months of February, April, June, July, August, September, and December recorded above average rainfall. Overall, the 2008 monitoring year was an average to above average rainfall year.

2.4 Conclusions

2008 was the fourth year of hydrology monitoring. One of the two groundwater gauges located in the wetland preservation area exceeded the success criteria of saturation within 12" of the soil surface for greater than a continuous 10% of the growing season. The other gauge located in the preservation area as well as the two gauges in the wetland creation area did not meet the success criteria.

NCDOT proposes to discontinue hydrology monitoring at the Indian Creek Mitigation Site. The wetland creation has failed to meet the hydraulic monitoring requirements during the four years of monitoring.

Indian Creek
Figure 4 (30-70 Percentile Graph)
Lincolnton, NC



3.0 VEGETATION: INDIAN CREEK MITIGATION SITE (YEAR 4 MONITORING)

3.1 Success Criteria

Success criteria have been established to verify that wetland creation areas support the vegetation necessary for a jurisdictional determination. Additional success criteria are dependent upon the density and growth of characteristic forest species. For the forested wetlands, a minimum count of 320 trees per acre must be achieved within three years of the initial planting with a minimum count of 260 trees per acre within five years of initial planting.

3.2 Description of Species

The following tree species were planted in the Buffer, Creation, and Enhancement Areas:

Betula nigra, River Birch

Fraxinus pennsylvanica, Green Ash

Quercus nigra, Water Oak

Quercus phellos, Willow Oak

Platanus occidentalis, Sycamore

Quercus alba, White Oak

The following tree species were planted in the Upland Area:

Quercus alba, White Oak

Quercus phellos, Willow Oak

Liriodendron tulipifera, Tulip Poplar

Juglans nigra, Black Walnut

Prunus serotina, Black Cherry

3.3 Results of Vegetation Monitoring

Table 2. Vegetation Monitoring Results

Plot #	River Birch	Green Ash	Water Oak	Willow Oak	Sycamore	White Oak	Total (Year 4)	Total (at planting)	Density (Trees/Acre)
1	5		5	8	8		26	57	310
Average Density Trees/Acre									310

Site Notes: Other vegetation noted: goldenrod, fennel, poison ivy, sweetgum, woolgrass, red maple, *Juncus* sp., horse nettle, black willow, blackgum, *Scirpus* sp., walnut, and various grasses. Green ash was noted in the creation area, even though none were counted in the plot. There was some ATV and vehicle activity noted on site during the 2007 monitoring evaluation in the upland buffer enhancement area (photos 4 and 5). Steps were taken to stop the vehicular trespass in the upland buffer enhancement area. The 2008 evaluation noted a decrease in the amount of ATV and vehicle activity.

3.4 Conclusions

There was one vegetation monitoring plot established in the 1.5-acre creation area. The 2008 vegetation monitoring of the site revealed an average tree density of 310 trees per acre. This average is above the minimum success criteria of 290 trees per acre needed for Year 4.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

One of the four groundwater monitoring gauges met the hydrology success criteria at the Indian Creek Mitigation Site in 2008. The gauge located in the preservation area had continuous saturation for 9.5% of the growing season. The two gauges that are located in the wetland creation area recorded hydrology equal to or less than 5% (consecutive) of the growing season. NCDOT will investigate the areas that failed to meet the success criteria during the 2008 monitoring year.

The site had an average density of 310 trees per acre, which is above the minimum success criteria of 290 trees per acre needed for Year 4. NCDOT will continue to monitor the Indian Creek Mitigation site for vegetation.

NCDOT recommends discontinuing monitoring of the wetland creation on the Indian Creek Mitigation Site. The wetland creation has failed to meet the hydraulic monitoring requirements during the four years of monitoring. The elevations on the site have been verified and are either at the adjacent wetland elevation or lower. It has been

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Total Credit			**0.79**

APPENDIX A

GAUGE DATA GRAPHS

APPENDIX B

SITE PHOTOGRAPHS AND

PHOTO AND MONITORING PLOT LOCATIONS

Indian Creek

Photo 1

Photo 2

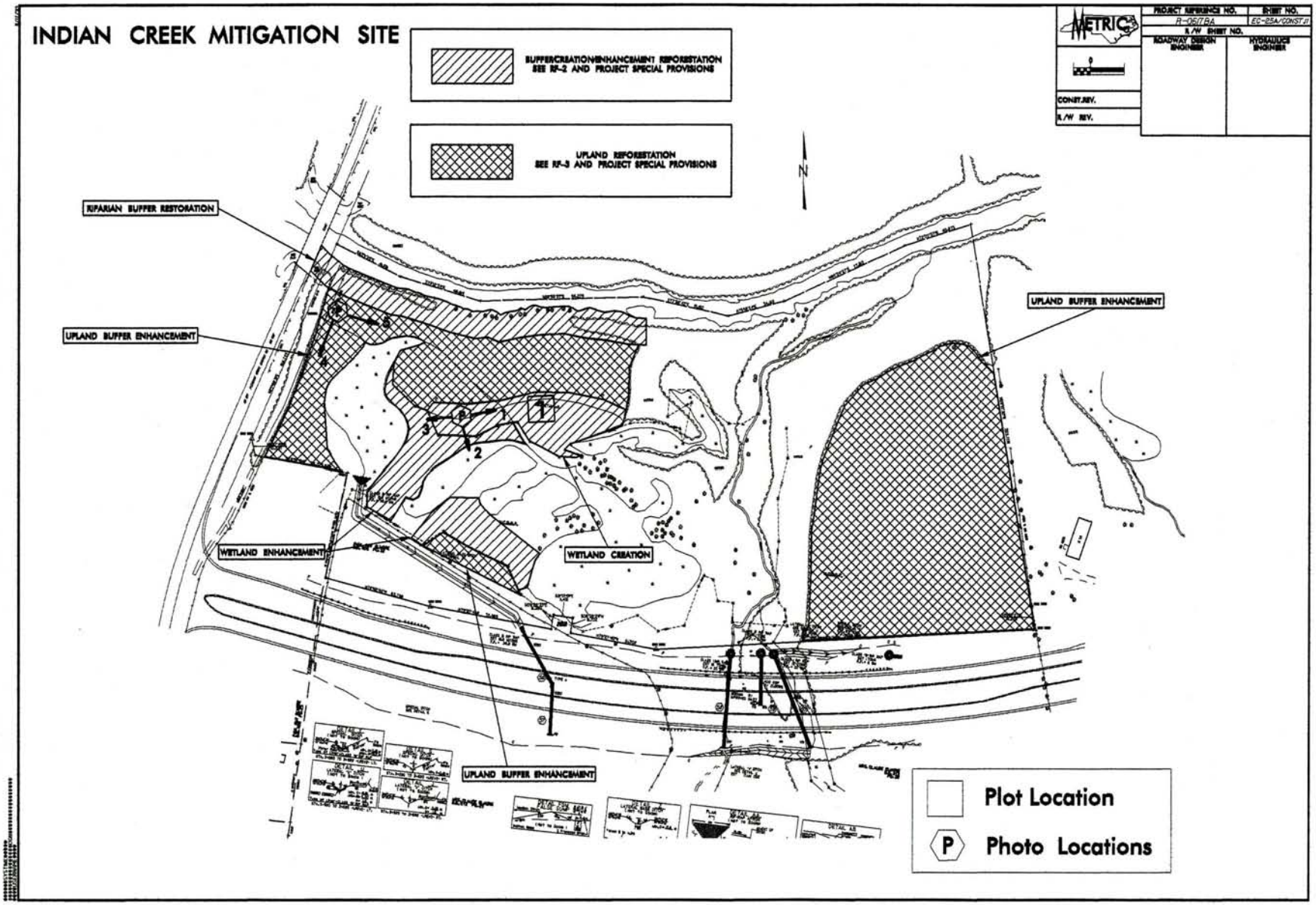
Photo 3

Photo 4

Photo 5

August 2008

INDIAN CREEK MITIGATION SITE



METRIC	PROJECT REFERENCE NO.	SHEET NO.
	R-0617BA	EC-25A/CONST.II
	R/W SHEET NO.	
	ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
CONST.REV.		
R/W REV.		