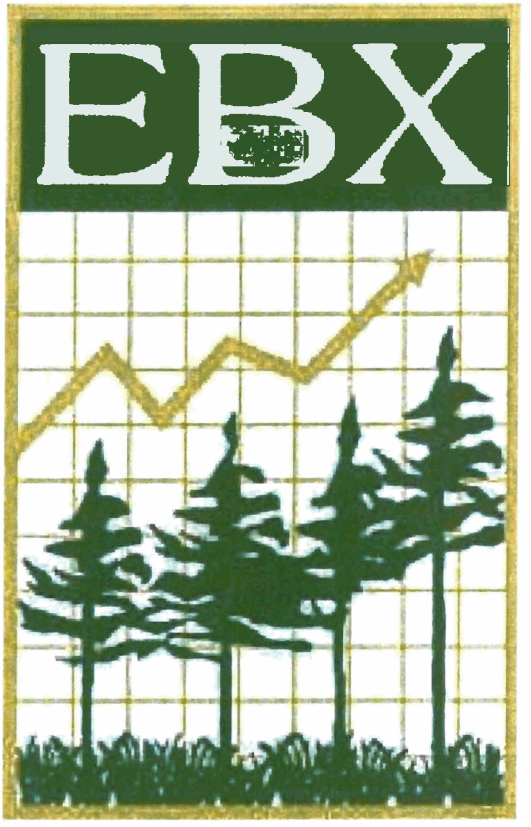
Neu-Con Umbrella Wetland and Stream Mitigation Bank

Casey/King Wetland Mitigation Site
Annual Monitoring Report For 2003 (Year 2)



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ANNUAL MONITORING REPORT FOR 2003 (YEAR 2)

Casey/King Wetland Mitigation Site

November 2003

SUMMARY

This Annual Report documents vegetation survivability, during the second growing season, based on five vegetation monitoring plots. Five monitoring plots 1/10th of an acre in size were used to predict survivability of the woody vegetation planted on site. The original approved mitigation plan specified only three vegetation monitoring plots were necessary for the anticipated restoration of a 28 acre wetland system. After construction, it was determined that up to 37.3 acres of wetland hydrology was restored. The additional 9.3 acres were planted as nonriverine forest. Two additional vegetation monitoring plots, located outside of the original projected mitigation boundary were installed to monitor the vegetation on the additional 9.3 acres.

This Annual Report presents data from five wetland-monitoring stations. Each station is equipped with a manual groundwater gauge and four stations are equipped with an automated gauge. Each gauge is located at the corner of a 0.1acre vegetation-monitoring plot. Additionally, the gauges are points from which photographs are taken or are referenced. The approved Mitigation Plan specified three monitoring plots. This Annual Report presents data for two additional monitoring plots with groundwater gauges. One plot (Plot #1) was added outside of the approved boundary because early observations indicated that the area was wetting more than was expected based on design models. The second monitoring plot (Plot #4) was added along the southeastern boundary of the project to document hydrology in one of the higher elevation areas.

The target wetland system for the restored site was primarily a "nonriverine wet hardwood forest" with a small component of "Coastal Plain small stream swamp", as described by Schafale and Weakley, 1990. After construction, it was estimated that up to 37.3 acres of wetland hydrology was restored. In 2003, all five wetland-monitoring plots have met the hydrologic success criteria based on field observations and data collected. During this period, higher than normal rainfall amounts were documented.

The vegetation monitoring, for the second growing season, indicated an average survivability of over 430 stems per acre, which should put the site on track for meeting the initial vegetation survival criteria of 320 stems per acre surviving after the third growing season.

INTRODUCTION

1.1 PROJECT DESCRIPTION

Located in Lenoir County, North Carolina, the Casey/King Wetland Mitigation Site encompasses a total restored area of approximately 37.3 acres. It is situated off of British Road (State Road 1803) several miles east of Kinston (Figure 1). This project provides compensatory mitigation for wetland impacts associated with NC Department of Transportation projects within the resident hydrologic unit. The Casey/King Site was designed to restore nonriverine wet hardwood forest and Coastal Plain small stream swamp ecosystems. It was constructed between December 2001 and February 2002, with 37.3 acres of planting completed on March 19, 2002. Groundwater and rain gauges became functional on March 20, 2002. The site is now in its second year of monitoring.

1.2 PURPOSE

Monitoring of the Casey/King Site is required to demonstrate successful mitigation based on the criteria described in the Site Specific Mitigation Plan and the Neu-Con Umbrella Stream and Wetland Mitigation Bank Instrument, and through a comparison to reference site conditions. Both hydrologic and vegetation monitoring are conducted throughout the growing season. Success criteria must be met for five consecutive years. This Annual Report details the results of the hydrologic and vegetation monitoring for 2003 (Year 2) at the Casey/King Wetland Mitigation Site.

1.3 PROJECT HISTORY AND SCHEDULE

May 2000	Pre-restoration Monitoring Gauges Installed
Fall 2001	Approved Mitigation Plan
December 17, 2001	Construction Began
March 7, 2002	Construction Completed
March 19, 2002	Planting Completed
March 19, 2002	Post Construction Monitoring Gauges Installed
April 2002	As-Built Report Submitted
October / November 2002	Supplemental Vegetative Monitoring
November 30, 2002	1st Annual Monitoring Report
November 2003	2nd Annual Monitoring Report
November 2004 (scheduled)	3rd Annual Monitoring Report
November 2005 (scheduled)	4th Annual Monitoring Report
November 2006 (scheduled)	5th Annual Monitoring Report

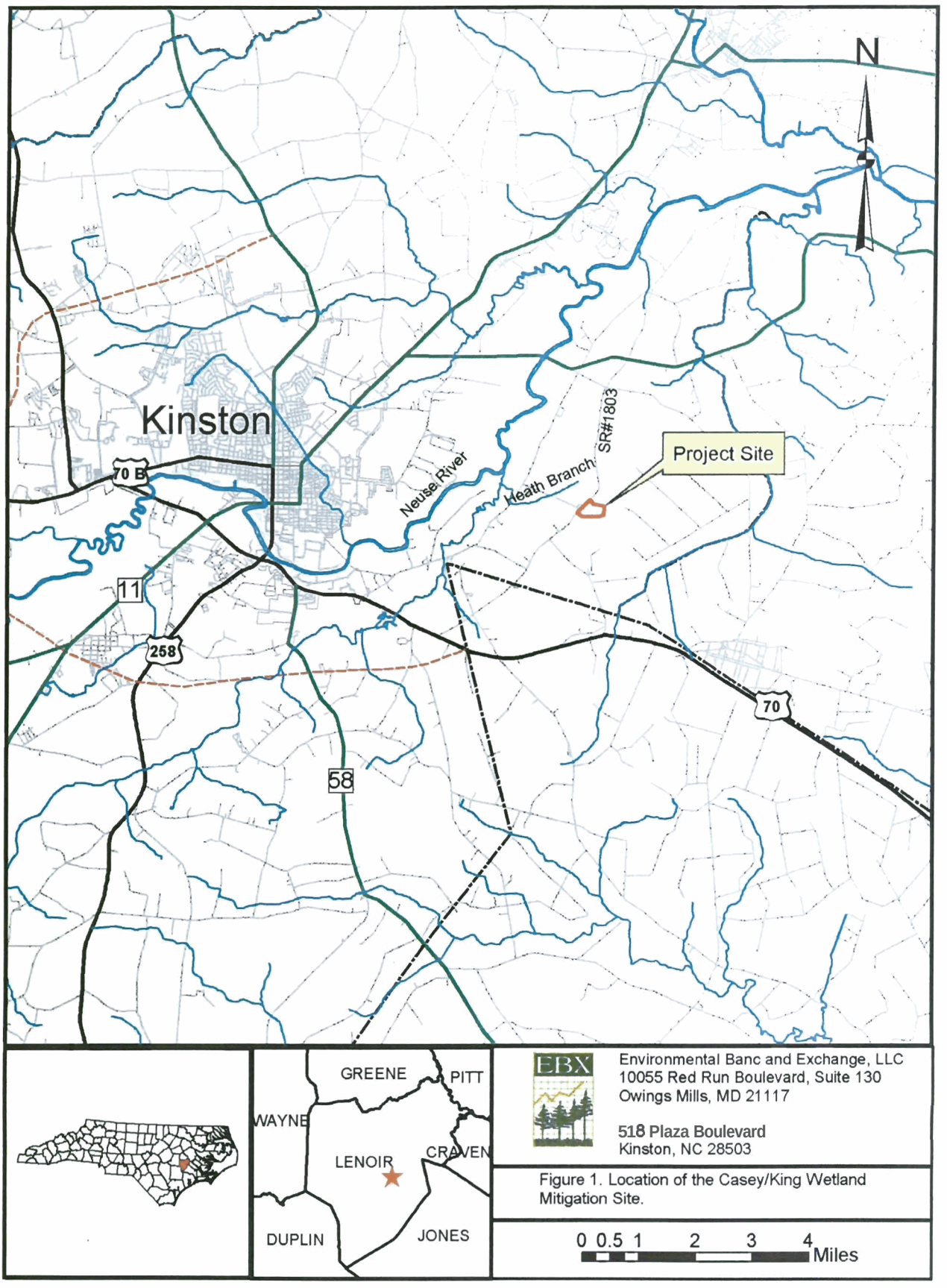

Figure 1. Location of the Casey/King Wetland Mitigation Site.

HYDROLOGIC MONITORING

2.1 SUCCESS CRITERIA

As stated in the approved Mitigation Plan, the hydrologic success criteria for the Site is restoration of the water table so that it will remain within 12 inches of the soil surface for at least 12.5% of the growing season cumulatively (approximately 30 days) or at least 5% of the growing season continuously (approximately 12 days). The day counts are based on the growing season for Lenoir County, which is 238 days long, beginning on March 20 and ending November 12, as determined from National Weather Service Wetlands Determination Tables (WETS) for Kinston NNE, NC4689. The Mitigation Plan specified that data would be collected from manual groundwater gauges.

The Mitigation Plan further specifies that in order for the hydrologic data to be considered successful, the data must demonstrate wetland conditions are present in normal or dryer than normal conditions. For comparison, we have included monitoring data from the reference system (the Webb reference site) identified in the Mitigation Plan because it demonstrates positive correlations between the restoration site and the natural hydrology of the target system.

2.2 DESCRIPTION OF HYDROLOGIC MONITORING EFFORTS

Five manual groundwater gauges, four automated groundwater gauges (Remote Data Systems model WL 40), and one manual rain gauge were installed in the first growing season (Figure 2). Groundwater gauges, both manual and automated, were installed to a minimum depth of at least 32 inches below the ground surface. The monitoring protocol for the site specifies that automated monitoring stations will be downloaded and checked for malfunctions on a monthly basis. During monthly site visits, manual groundwater gauges are read and rainfall totals are collected from the on-site rain gauge. Raw hydrograph data from the monitoring gauges are presented in Appendix A.

During the 2003 growing season, two of the RDS loggers (CK4 and CK5) failed and were replaced by loggers manufactured by Infinities USA, Inc. Based on past monitoring experience, the Infinities loggers have proved to be more reliable than those manufactured by RDS, and provide the same level of accuracy. Therefore, any RDS loggers that fail in the future will be replaced by Infinities loggers.

Each monitoring station is located to analyze the success of a particular wetness zone within the restoration site. Plots CK#1, CK#3, CK#4 and CK#5 contain both manual and automated groundwater gauges and are positioned to determine the success of restoring a nonriverine wet hardwood forest on the site. Plot CK#2 is accessed to determine the success of the small stream swamp, with the success being determined by a single manual gauging station. Automated and manual gauges within a plot are separated by no more than three feet.

CAUSEY ROAD
SR 1816

SR 1803 BRITISH ROAD 60' PUBLIC RIGHT-OF-WAY

WATER TABLE ELEVATIONS APRIL 15, 2002	
WELL #1	501.7' (0.5' BELOW GROUND ELEVATION)
WELL #2	499.5' (0.5' BELOW GROUND ELEVATION)
WELL #3	504.1' (0.1' BELOW GROUND ELEVATION)
WELL #4	504.9' (0.1' BELOW GROUND ELEVATION)
WELL #5	504.3' (0.2' BELOW GROUND ELEVATION)

NAD 83

LEGEND

- MAJOR CONTOUR
- MINOR CONTOUR
- RIGHT-OF-WAY
- TOP OF DITCH BANK
- APPROXIMATE TOP OF DITCH BANK
- PROPERTY LINE
- TREELINE
- EDGE OF PAVEMENT
- CROSS VANE
- PROPERTY CORNER
- POWER POLE
- MITIGATION PLAN PROPOSED RESTORATION AREA
- ACTUAL PROPOSED RESTORATION AREA
- CONSERVATION EASEMENT BOUNDARY
- VEGETATION ZONE PLANTING BOUNDRY

SUMMARY OF WETLAND MITIGATION ACREAGE	
WETLAND RESTORATION AREA AS PROPOSED IN MITIGATION PLAN	28 ACRES
PROPOSED ACTUAL RESTORATION AREA	37.28 ACRES

VEGETATION SELECTION	
ZONE A	ZONE B
BARE ROOT PLANTINGS	BARE ROOT PLANTINGS
WATER OAK *(QUERCUS NIGRA)*	BALD CYPRESS (TAXODIUM DISTICHUM)
SWAMP CHESTNUT OAK *(QUERCUS MICHAUXII)*	SWAMP CHESTNUT OAK (QUERCUS MICHAUXII)
LAUREL OAK *(QUERCUS LAURIFOLIA)*	LAUREL OAK (QUERCUS LAURIFOLIA)
BLACKGUM *(NYSSA SYLVATICA)*	OVERCUP OAK (QUERCUS LYRATA)
SYCAMORE *(PLATANUS OCCIDENTALIS)*	SWAMP BLACKGUM (NYSSA BIFLORA)

NO	SUBMITTALS / REVISIONS	DES	DRN	CHK	DATE
1	DRAFT AS-BUILT DRAWING	KLT	DCW	KLT	04-23-2002
2	FINAL AS-BUILT PLANS	KLT	DCW	KLT	05-09-2002
3	REVISED FINAL PLANS	KLT	DCW	KLT	08-8-2002

BUCK ENGINEERING
8000 Regency Parkway, Suite 200
Cary, North Carolina 27511
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AS-BUILT DRAWING

WETLAND RESTORATION PROJECT
EBX CASEY / KING
LENOIR COUNTY

DATE 8-8-2002
PROJECT NO 024
FILENAME DesignVAsbuiltCasey asb.asb
SCALE FULL SIZE 1"=100'
HALF SIZE 1"=200'
SHEET NO 2

2.3 RESULTS OF HYDROLOGIC MONITORING

2.3.1 Site Data

The following hydroperiod statistics were calculated for each monitoring station during the growing season: 1) most consecutive days that the water table was within twelve inches of the surface; 2) total number of days that the water table was within twelve inches of the soil surface; and 3) number of times that the water table rose to within twelve inches of the soil surface. The results of these calculations are presented in Table 1. Figure 3 provides a chart of the water depth for each of the monitoring gauges on the site. Precipitation is shown across the top of each graph. These graphs demonstrate the reaction at each monitoring location of the groundwater level to specific rainfall events.

Two of the automated gauges on the site experienced malfunctions during the 2003 growing season; specifically, stations CK#4 and CK#5. When it was determined that the malfunctions could not be corrected, the units were replaced by gauges manufactured by Infinities USA, Inc. Based on past monitoring experience, the Infinities loggers have proved to be more reliable than those manufactured by RDS, and provide the same level of accuracy. Therefore, any RDS loggers that fail in the future will be replaced by Infinities loggers. In addition, a small manual calibration well was installed in the same hole as the Infinity well in order to check accuracy and calibrate automated wells. The placement of the groundwater gauges is shown in Figure 2, and a graphical representation of the hydrologic monitoring data is provided in Figure 3.

The site was designed to function with rainfall as its primary hydrologic influence. Monitoring has thus far demonstrated the influence of rainfall on site hydrology. During most site visits in the 2003 monitoring season, evidence of surface inundation was observed across the monitored restoration area.

Table 1. Hydrologic Monitoring Results for 2003 (Year 2).
Percentage indicates percent of the growing season.

Monitoring Station	Most Consecutive Days Meeting Criteria[1]	Cumulative Days Meeting Criteria[2]	Number of Instances Meeting Criteria[3]
CK1	25 (11%)	87 (37%)	12
CK2 [4]	~ 49 (21%)	~ 165 (69%)	~ 7
CK3	57 (24%)	188 (79%)	5
CK4 [5]	49.5 (21%)	165.5 (70%)	7
CK5 [5]	49.5 (21%)	134.5 (57%)	8

[1] Indicates the most consecutive number of days within the monitored growing season with a water table less than 12 inches from the soil surface.

[2] Indicates the cumulative number of days within the monitored growing season with a water table less than 12 inches from the soil surface.

[3] Indicates the number of instances within the monitored growing season when the water table rose to less than 12 inches from the soil surface.

[4] Groundwater gauge CK2 is a manual gauge. Hydrologic parameters are estimated based on data from gauge CK4, which most closely matches the data from CK2.

[5] Monitoring station experienced some brief periods of missing data.

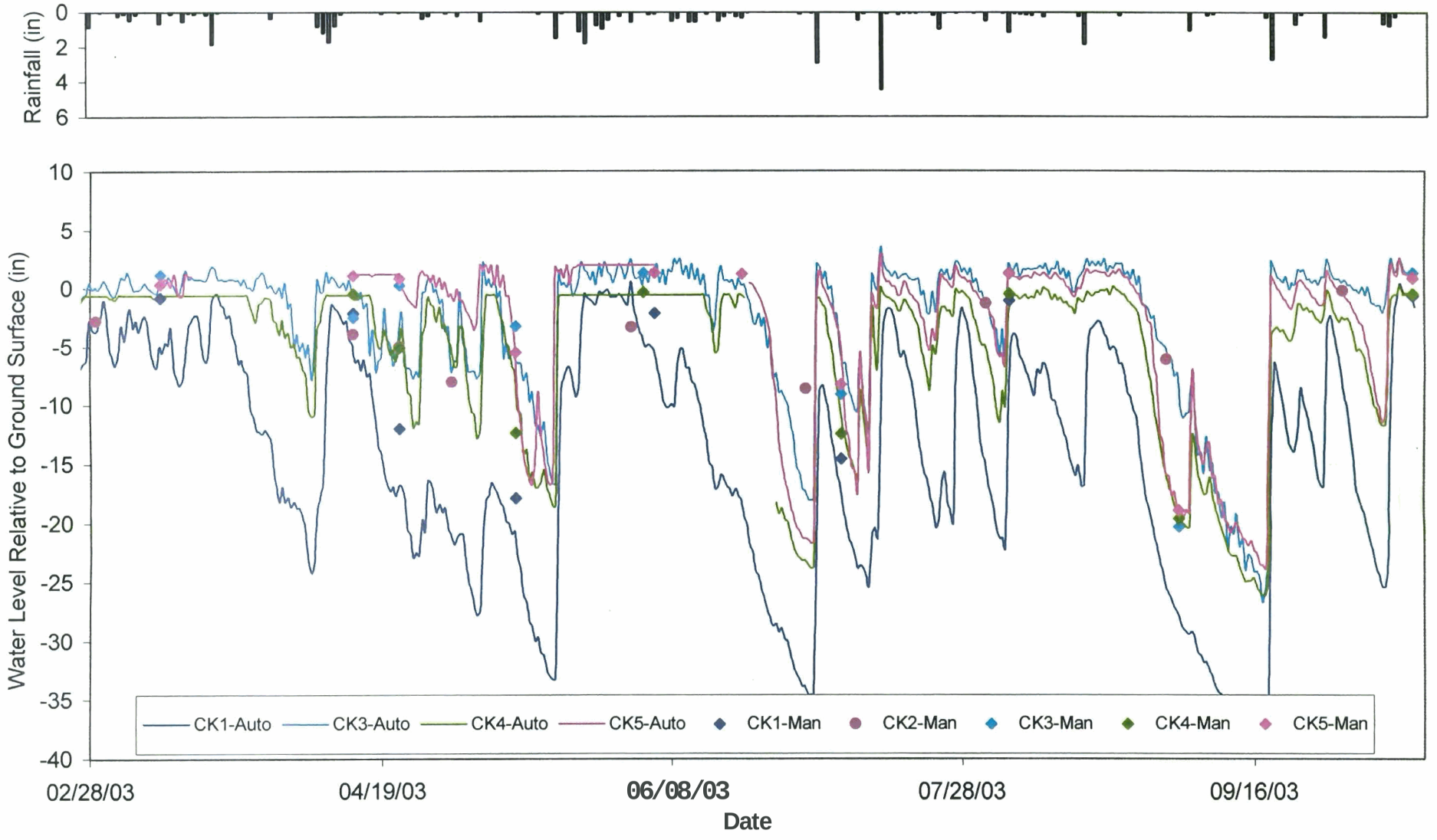

Figure 3. 2003 Groundwater Gauge Data Graph.

2.3.2 Climatic Data

Table 2 is a comparison of the 2003 monthly rainfall to historical precipitation (collected between 1948 and 2002) for the Lenoir County area. Historic data presented were collected from an automated weather station in Kinston. For the period of record in which rainfall measurements were collected on-site (March 12 through October 13), the rainfall total from the Kinston gauge (44.54 inches) correlates well with data collected from the onsite manual rain gauge (42.41 inches). In general, monthly rainfall amounts for the area were higher than normal for the 2003 monitoring season, with the exceptions of the months of January, June, and August. This comparison gives an indication of how 2003 compares to historical data in terms of average rainfall. For the 2003 period of record shown, total rainfall was approximately eleven inches greater than the long-term average. Monthly rainfall for October, November, and December 2003 were not available at the time this report was compiled.

Table 2. Comparison of Historic Average Rainfall to Observed Rainfall (Inches).

Month	Average	30%	70%	Observed 2003 Precipitation
January	4.05	3.08	4.71	**1.58**
February	3.73	2.41	4.49	**5.54**
March	3.97	2.71	4.74	**4.84**
April	3.16	1.95	3.82	**5.48**
May	4.26	2.79	5.12	**7.66**
June	4.04	2.76	4.82	**4.28**
July	5.29	3.78	6.26	**9.39**
August	5.48	3.73	6.55	**4.49**
September	4.29	2.30	5.24	**6.58**
October	2.96	1.77	3.66	**N/A**
November	2.83	1.86	3.40	**N/A**
December	3.54	2.11	4.29	**N/A**

2.4 HYDROLOGIC CONCLUSIONS

Data collected from all the groundwater monitoring gauges on the Casey/King Wetland Mitigation Site indicate that hydrologic success criteria have been met during the 2003 growing season. All gauges demonstrated saturated conditions on consecutive days for greater than five percent of the growing season, and cumulative saturated conditions for greater than 12.5% of the growing season. Although wetter than average conditions were experienced during 2003, data collected over the past two years indicate that under normal rainfall conditions, the site would meet wetland hydrologic success criteria.

VEGETATION

3.1 SUCCESS CRITERIA

The interim measure of vegetative success identified in the Casey/King Mitigation Plan will be the survival of at least 320 3-year old trees per acre at the end of year 3 of the monitoring period. The final vegetative success criteria will be the survival of 260 5-year old trees per acre at the end of the monitoring period. In addition, for the five year monitoring period, the presence of volunteer facultative softwood species such as red maple, sweet gum, and loblolly pine will be limited to less than 10% each of the total number of trees utilized to determine success. These trees may contribute more than 10% of the total trees on the site, but they will not constitute more than 10% each of the 260 trees per acre.

Construction was completed on March 7, 2002. Planting of bare root trees and spreading of the permanent seed mixture was completed on March 19, 2002. Approximately 21,900 trees were planted over 37.3 acres. Supplemental planning occurred in the spring on selected areas of the site consistent with the 2002 monitoring report.

3.2 DESCRIPTION OF SPECIES

The following tree species were planted in the Wetland Restoration Area:

Table 3. Tree Species Planted in the Casey/King Wetland Restoration Area.

ID	Common Name	Scientific Name	FAC Status	Year planted
1	*Celtis laevigata*	Sugarberry	FACW	2003
2	*Nyssa biflora*	Swamp Tupelo	OBL	2003
3	*Nyssa sylvatica*	Blackgum	FAC	2002 & 2003
4	*Platanus occidentalis*	Sycamore	FACW-	2002
5	*Quercus laurifolia*	Laurel Oak	FACW	2002 & 2003
6	*Quercus lyrata*	Swamp White Oak	OBL	2003
7	*Quercus michauxii*	Swamp Chestnut Oak	FACW-	2002 & 2003
8	*Quercus nigra*	Water Oak	FACW-	2003
9	*Quercus pagoda*	Cherrybark Oak	FAC	2002 & 2003
10	*Quercus phellos*	Coastal Willow Oak	FACW-	2002 & 2003
11	*Quercus shumardii*	Shumard Oak	FACW-	2003
12	*Taxodium distichum*	Bald Cypress	OBL	2002 & 2003

3.3 RESULTS OF VEGETATION MONITORING

The following table present stem counts for each of the monitoring stations. Each planted tree species is identified across the top row and each plot is identified down the left column. The numbers on the top row correlate to the ID column of the above table. Trees are flagged in the field on a quarterly basis before the flags degrade. Flags are utilized because they will not interfere with the growth of the tree. Volunteers are also flagged during this process.

Table 4. 2003 Vegetation Monitoring Statistics, by Plot.

Plot	1	2	3	4	5	6	7	8	9	10	11	12	Total	Stem/ac
CK1	0	0	5	3	0	0	4	2	14	15	0	4	47	470
CK2	0	0	2	2	0	0	0	3	9	13	0	7	36	360
CK3	0	0	13	3	0	2	6	0	9	1	0	1	35	350
CK4	0	0	3	2	0	0	3	0	5	1	16	0	30	300
CK5	0	0	0	13	2	0	2	0	1	4	0	0	32	320

Average Planted Stems/Acre: 360

The following table present volunteer tree species and stem counts for each of the monitoring stations. Each volunteer tree species is identified across the top row and each plot is identified down the left column. The numbers on the top row correlate to the ID column of the above table. First year volunteer species typically lack the distinguishing characteristics that allow for positive identification.

The following tree species were identified as volunteers within the Wetland Restoration Area:

Table 5. Tree Species Identified as Volunteers Within the Casey/King Wetland Restoration Area.

ID	Species	Common Name	FAC Status
A	*Acer rubrum*	Red Maple	FAC
B	*Liquidambar styraciflua*	Sweetgum	FAC+
C	*Nyssa sylvatica*	Blackgum	FAC
D	*Platanus occidentalis*	Sycamore	FACW-
E	*Salix nigra*	Black Willow	OBL
F	*Taxodium distichum*	Bald Cypress	OBL
G	*Carya* sp. *	Hickory	
H	*Fraxinus* sp. *	Ash	

* First year sapling; positive ID not possible

The following table provides an accounting of the total stems per acre based on planted and observed volunteers. The average coverage is on a trajectory for success.

Table 6. 2003 Volunteer Species, by Plot.

Plot	A	B	C	D	E	F	G	H	Volunteer	Planted	Total	Stem/ac
CK1	0	0	1	0	4	1	0	0	6	47	53	530
CK2	0	0	0	0	0	0	0	2	2	36	38	380
CK3	0	0	0	0	0	0	0	0	0	35	35	350
CK4	1	4	0	20	1	0	0	0	26	30	56	560
CK5	0	0	0	0	0	0	4	2	6	32	38	380

Average Stems/Acre (including volunteers): 440

3.4 VEGETATION CONCLUSIONS

Approximately 37.3 acres of this site was planted in nonriverine hardwoods and coastal plain swamp species. There were five $1/10^{th}$ acre vegetation monitoring plots established throughout the planting areas. The 2003 vegetation monitoring revealed an average tree density greater than 430 stems per acre, for the second growing season. We feel that this site is easily on trajectory for meeting the minimum success interim criteria of 320 trees per acre by year three (next year) and the final success criteria of 260 trees per acre by year five.

The supplemental planting efforts, which took place this spring, have improved stems per acre across the entire site. The results are most evident in Plot 3, which now has more than double the 157 stems per acre that it had at the end of the growing season last year. Based on these increases, the supplemental planting is considered a success.

REFERENCE SITE CONDITIONS

The approved Mitigation Plan provides that if the rainfall data for any given year during the monitoring period is not normal the reference wetland data can be accessed to determine if there is a positive correlation between the performance of the restoration site and the natural hydrology of the reference site.

Although appropriate hydrology was observed at the site during the 2003 monitoring season, data fiom the reference site are compared to restoration site data in Figure 4, due to the above average rainfall. Data from the reference wetland groundwater gauge show a positive correlation with the groundwater gauge located in monitoring plot CK#1. The automated gauges from both CK#1 and the reference wetland demonstrate the similarity of the natural hydrology of the reference site and the restored hydrology of the Casey/King Mitigation Site. One period of missing data was experienced for the reference site gauge (August 5 through September 3), due to a gauge malfunction. Rainfall amounts during the monitoring period were less on the Webb reference site (40.68 inches) than the mitigation site (42.41), which may explain the drier conditions on the reference site during certain times of the year.

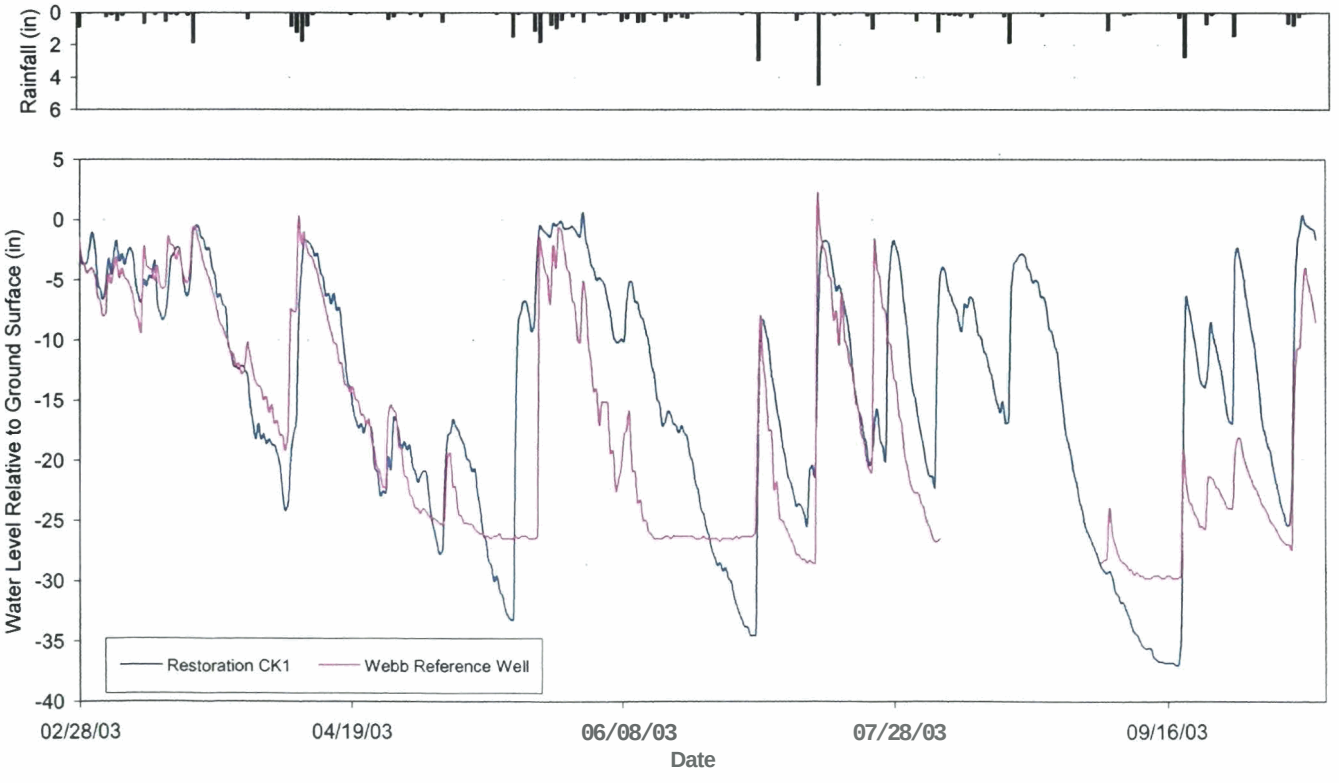

Figure 4. Comparison of Reference Site Data to Station CK#1.

OVERALL CONCLUSIONS AND RECCOMENDATIONS

- Second year hydrologic monitoring has shown that wetland hydrologic success criteria have been met and that the site is performing as designed.
- Vegetation monitoring efforts have calculated the average number of stems per acre on site to be 432, which is an annual survival rate of almost 95%, based on last years count of 459 stems per acre. With a stem per acre count of 432, and a high survivability going into the third growing season, we should easily meet the 320 stems per acre criteria necessary at the end of next growing season, with very little if any anticipated maintenance or replanting.
- Monitoring of vegetation and hydrology will continue in 2004.

WILDLIFE OBSERVATIONS

Deer and raccoon tracks are common observations during site visits. Rabbit tracks and skat are also common. Leopard can be found in the areas of the site that exhibit surface ponding for extensive periods. Tree frogs have also been observed from time to time on tall vegetation. Mosquito fish can be observed in all open and flowing water areas.

VEGETATION OBSERVATIONS

Hydrophytic herbaceous vegetation can be found across the entire site. Rush (*Juncus effusus*), spike-rush (*Eleocharis obtusa*), Boxseed (*Ludwigia* sp.), and sedge (*Carex* sp.), all hydrophytic herbaceous plants, are frequently observed across the site particularly in areas of inundation. Cat-tail (*Typha latifolia*) and knotweed (*Polygonum persicaria*) are also found on site. The presence of these herbaceous wetland plants helps to confirm the presence of wetland hydrology on the site.

Weedy vegetation is also present on the entire site and very thick in some areas. The majority of the weedy species are annuals and believed to pose very little threat to survivability in site. There are tall thickets of partridge pea (*Cassia fasciculata*) and fennel (*Foeniculum vulgare*), but these don't seem to be affecting the survivability of the planted vegetation. Other weedy vegetation including ragweed (*Ambrosia artemisiifolia*) and morning-glory (*Ipomoea coccinea*) is present on site. Some rows of Johnson grass were noted in scattered portions of the site particularly adjacent to ditches. Control measures could be deemed necessary to prevent extensive invasion of this species. This grass, plus possibly other species of grass and/or weeds may impact the establishment of this stand. It is our recommendation that OUST herbicide should be broadcast at a 3 oz per acre rate over the entire site to inhibit germination of these weeds for the upcoming growing season.