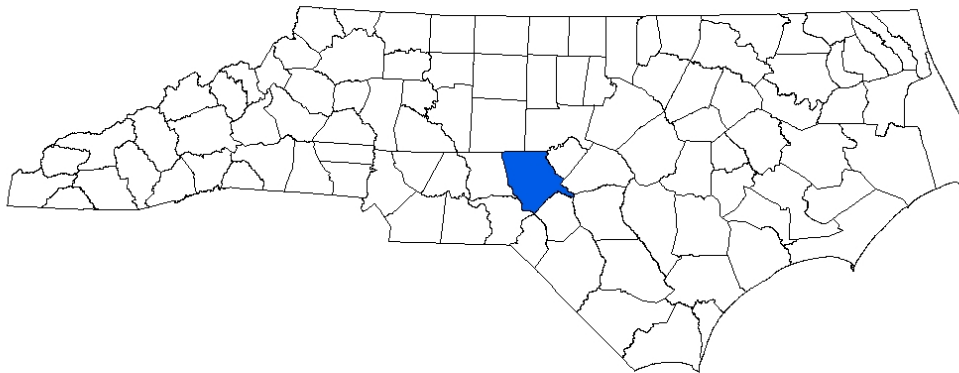


# ANNUAL REPORT FOR 2007

## Monitoring Year 2



### **SALT Mitigation Site**

Cape Fear River Basin,  
Moore County, North Carolina

**Submitted to:**

North Carolina Department of Environment and Natural Resources  
Ecosystem Enhancement Program  
Raleigh, North Carolina



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## **SUMMARY**

The 327 acre Sandhills Area Land Trust (SALT) Wetland Mitigation Site in Moore County, North Carolina serves as mitigation for the R-210 (US Bypass). This mitigation site was acquired by NCDOT in 1998 and put into permanent conservation status at that time. The following report summarizes the monitoring activities conducted in 2007 at the (SALT) site. Monitoring Year 1 data were collected in 2006 by NCDOT – Roadside Environmental Unit. Monitoring Year 2 (2007) represents the first year of hydrologic and vegetation monitoring conducted by The Louis Berger Group, Inc.

To be considered successful the SALT site must demonstrate hydrologic and vegetation success for a minimum of five years. Hydrologic success criteria are based on the approved mitigation plan (NCDOT 2000) and require that the site show saturation or inundation within one foot of the soil surface for at least 12.5% of the growing season. In 2007, 12 of the 13 gauges recorded data that demonstrated the presence of wetland hydrology for greater than 12.5% of the growing season.

Of the 24.5 acres of planting on this site, approximately 15.9 acres involved bottomland hardwood tree planting. Approximately 8.6 acres of upland buffer were planted with longleaf pine. Four vegetation-monitoring plots were established by DOT throughout the bottomland hardwood planting area. The 2007 vegetation monitoring of the site revealed an average tree density of 527 trees per acre. This average is above the minimum success criteria of 320 trees per acre.

## 1.0 INTRODUCTION

### 1.1 Project Description

The Sandhills Area Land Trust (SALT) Mitigation Site serves as mitigation for the R-210 (US-Bypass). The 327-acre site is located in southern Moore County, along the Little River, near the town of Lobelia (Figure 1). The 327-acre site includes 48 acres of wetland restoration and 169 acres of wetland enhancement.

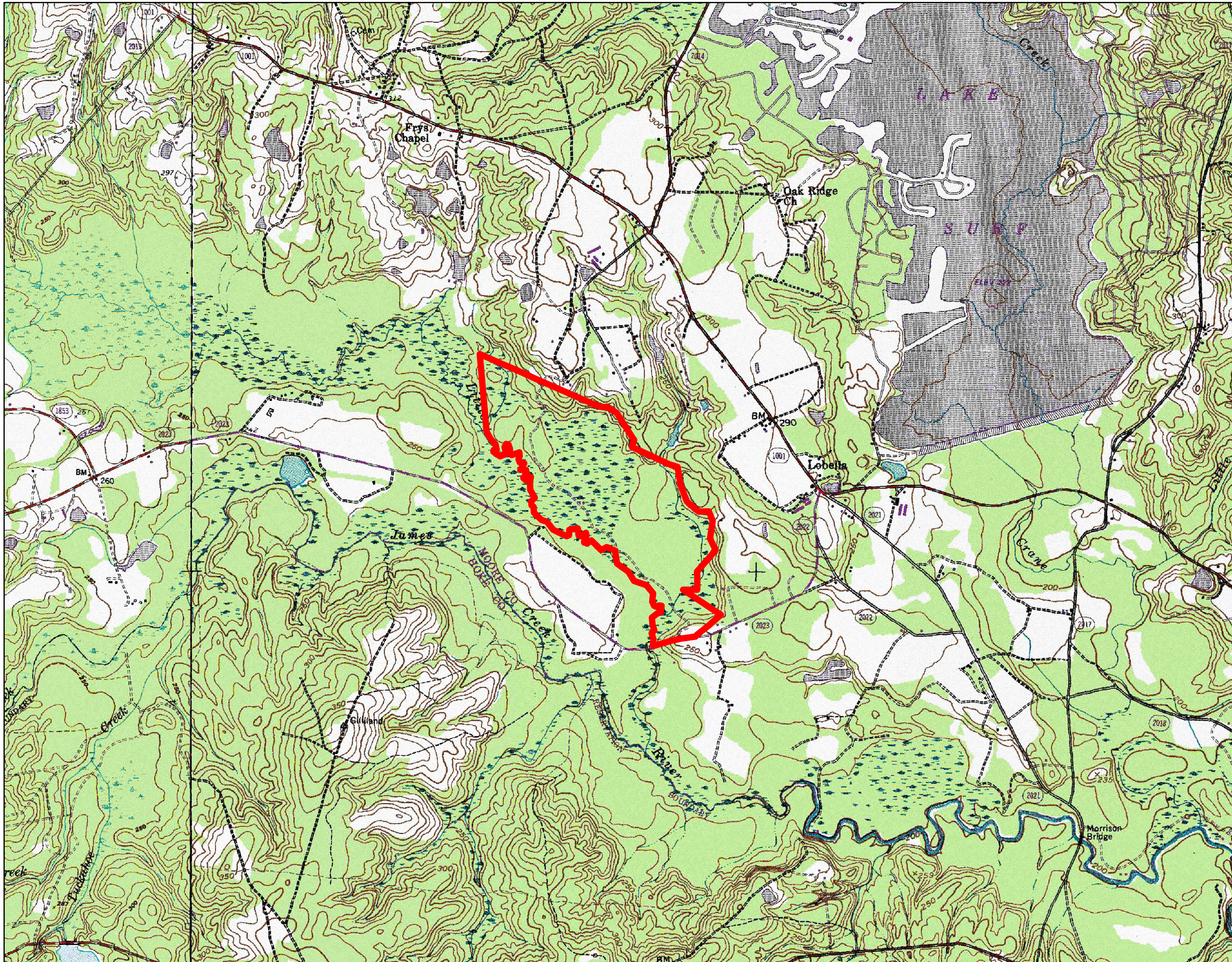
### 1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetation monitoring must be conducted for a minimum of five years or until the site is deemed successful. Success criteria are based on federal guidelines for wetland mitigation and as stipulated in the approved mitigation plan. Criteria for hydrologic conditions and vegetation survival are included in this document. Also included in this report are analyses of hydrologic and vegetation-monitoring results, discussions of local climate conditions throughout the growing season and site photographs.

### 1.3 Project History

December 2001	Site KG Sheared and Drum Chopped
July 2002	Site Sprayed
February 2003	Site Planted
January 2006	Ditches Plugged
January 2006	Monitoring Gauges reprogrammed
March-November 2006	Hydrologic Monitoring (Year 1)
February 2007	Vegetation Monitoring (Year 1)
April – October 2007	Hydrologic Monitoring (Year 2)
August 2007	Vegetation Monitoring (Year 2)





SALT Tract Mitigation Site  
Moore County, North Carolina

**Figure 1**

SALT Wetland Mitigation Site Location


**Legend**

 Site Boundary

Site directions: From Raleigh, take US 1 South to Vass, exit S.R. 690 turn left. Driving east travel approximately 7 miles to Lobelia, you will see a BP gas station on your left. Continue east for .5 miles then turn right on Lakebay Road. Follow for 1.5 miles and site entrance is on the right.

5

0 0.25 0.5 Miles



Louis Berger 2/2008  
Data sources:  
USGS 7.5' quadrangle: Lobelia (1980),  
NCDOT (2000, 2006), Berger (2007)



## **2.0 HYDROLOGY**

### **2.1 Success Criteria**

The hydrologic success criteria established for the SALT Mitigation Site require that saturated or inundated conditions be present within the upper 12 inches of soil for at least 12.5% of the growing season. Alternatively, hydrology success criteria may be established through comparison of well data between the wetland restoration area and the reference wetland (i.e. depth to groundwater). The reference hydroperiod will be compared to the restoration areas which must exceed 75 percent of the hydroperiod exhibited by the reference gauges, located within the same physiographic landscape area.

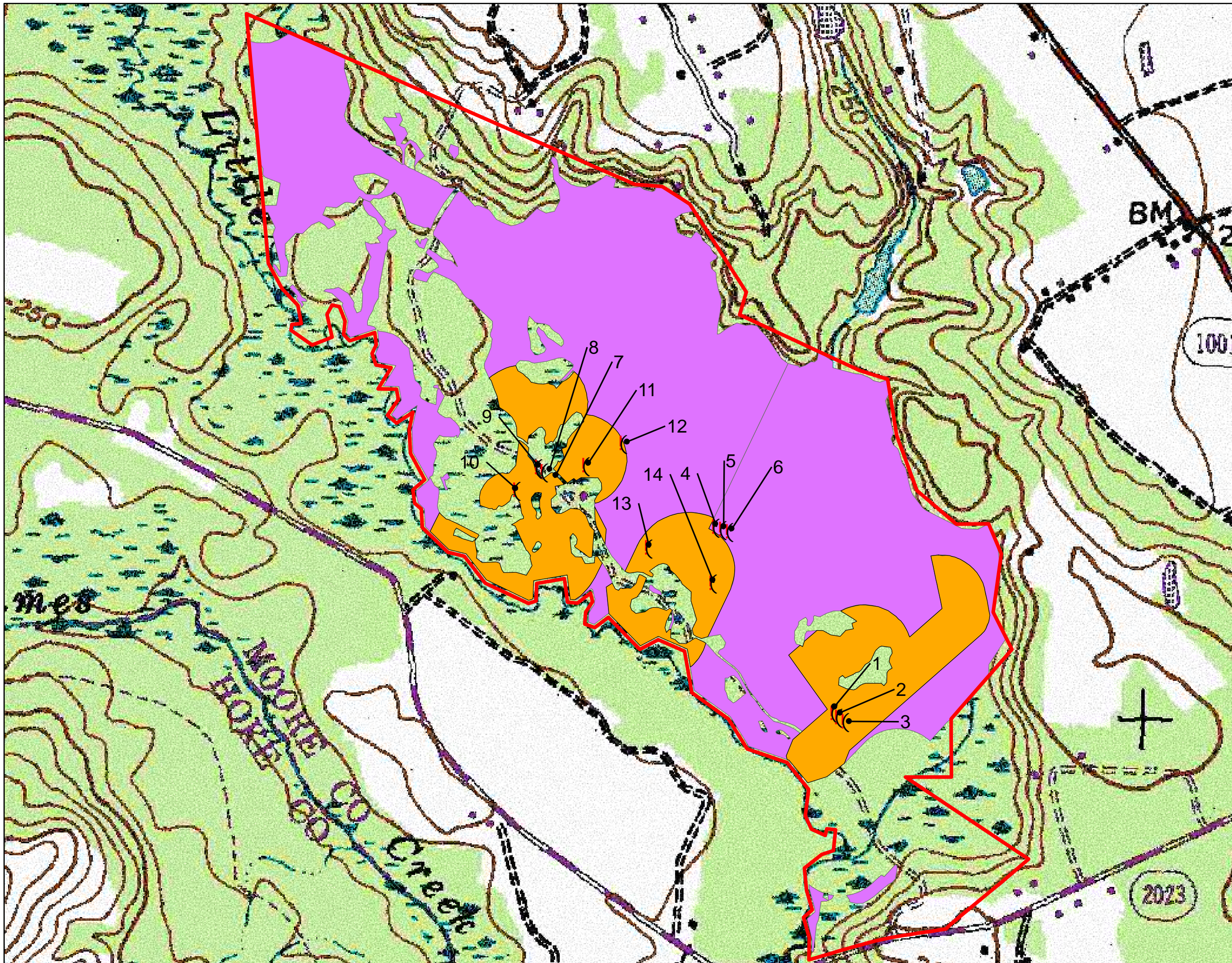
The growing season of Moore County begins on April 9 and ends October 26. The dates correspond to a 50% probability that surface air temperature will be above 28° between April 9 and October 26<sup>1</sup>; thus, the growing season is 201 days. Local climate must represent normal conditions for the area.

### **2.2 Hydrologic Description**

Monitoring data for 2007 represents the second year of hydrologic monitoring for the site. The groundwater gauges are set to record ground water levels three times daily. Figure 2 is a graphical representation of gauge locations throughout the SALT site.

Rain gauge data were not available from the site during the 2007 monitoring period. Precipitation data was gathered from the National Climatic Data Center affiliated with NOAA<sup>2</sup>. The official weather station from which the precipitation data was collected from is located approximately 8 miles from the site at Ft. Bragg's water treatment plant in Spring Lake, North Carolina.





SALT Tract Mitigation Site  
Moore County, North Carolina

**Figure 2**

Monitoring Gauge Location Map

**Legend**

- Site Boundary - 327.11 acres
- Wetland Restoration - 48.26 acres
- Wetland Enhancement/  
Preservation - 169.06 acres

**Monitoring Station Locations**

- Monitoring gauge

5

0 250 500 1,000  
Feet

Louis Berger 2/2008  
Data sources:  
USGS 7.5' quadrangle: Lobelia (1980),  
NCDOT (2000, 2006), Berger (2007)



## Results of Hydrologic Monitoring

### 2.2.1 Site Data

The SALT site experienced extreme drought conditions throughout the 2007 growing season. When compared to the average rainfall amounts from historical data covering the period of 1964-2006, rainfall amounts at the SALT site were generally below average (Figure 4).

The maximum number of consecutive days that saturation occurred within 12-inches of the ground surface was determined for each groundwater monitoring gauge. This number was converted into a percentage of the 201-day growing season (April 9 – October 26). Table 1 provides the 2007 hydrologic results; Figure 3 provides a graphical representation of these results. Appendix A includes graphs of the data recorded at each groundwater gauge.

**Table 1. 2007 Hydrologic Monitoring Results**

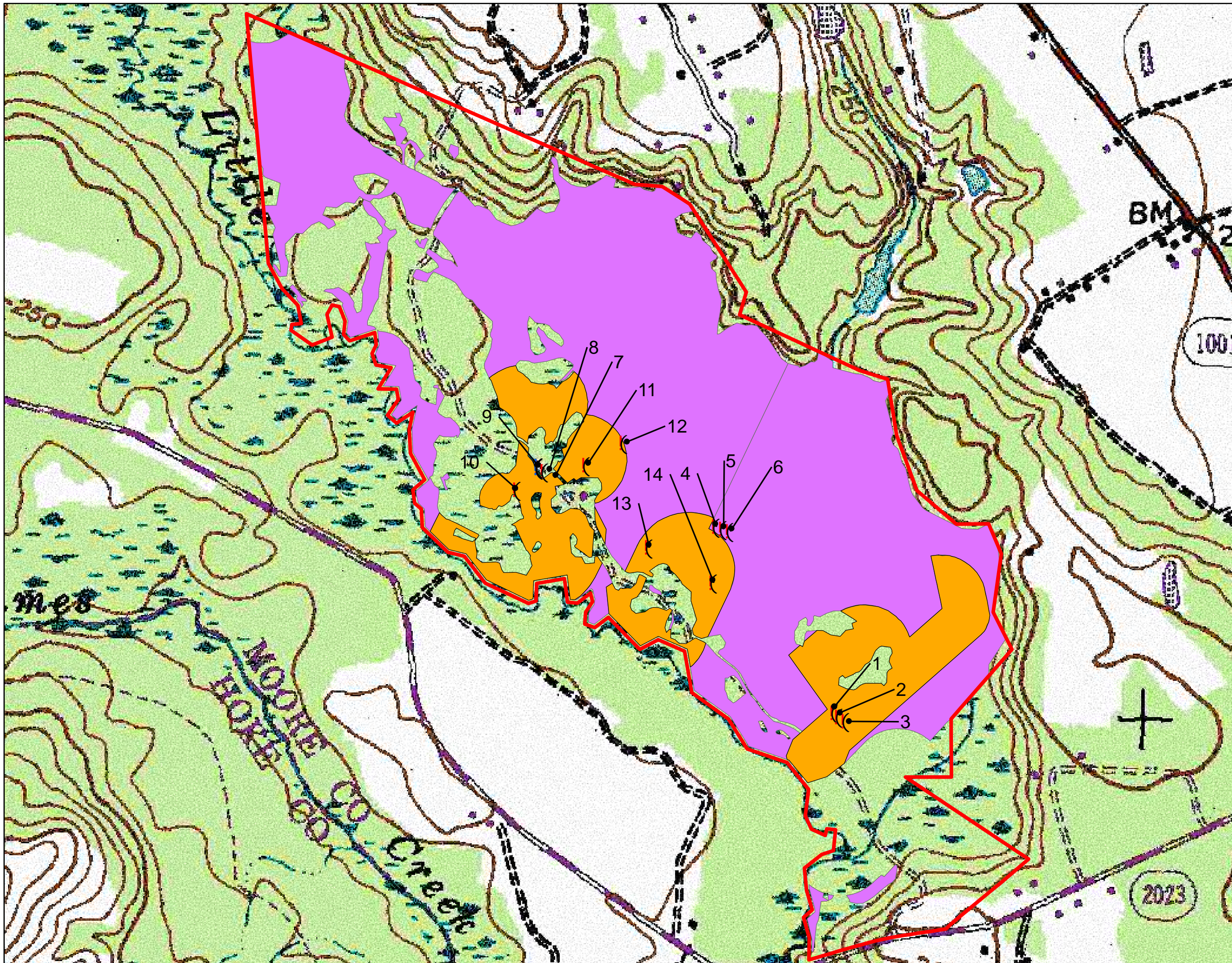
Monitoring Gauge	>12.5%	Actual %	Success Dates
STGW1	×	100	April 9-October 26
STGW2	×	100	April 9-October 26
STGW3	×	100	April 9-October 26
STGW4	×	53.7	April 9-July 25
STGW5	×	53.7	April 9-July 25
STGW6	×	60.2	April 9-August 7
STGW8	×	14.4	April 9-May 7
STGW9		4.4	April 12-April 20
STGW10	×	15.9	April 9-May 10
STGW11	×	22.9	April 9-May 29
STGW12	×	30.0	April 9-May 24
STGW13	×	26.4	April 9-May 31
STGW14	×	23.9	April 9-May 26

A summary table comparing Hydrologic Monitoring Results for Monitoring Year 1 and Monitoring Year 2 is provided below.

A summary table comparing Hydrologic Monitoring Results for Monitoring Year 1 and Monitoring Year 2 is provided below.

Monitoring Gauge	Monitoring Year 1			Monitoring Year 2		
	>12.5%	Actual %	Success Dates	>12.5%	Actual %	Success Dates
STGW1	no data	no data	no data	✗	100	April 9 - Oct 26
STGW2	✗	94.3	March 23 - Nov 7	✗	100	April 9 - Oct 26
STGW3	✗	94.3	March 23 - Nov 7	✗	100	April 9 - Oct 26
STGW4	no data	no data	no data	✗	53.7	April 9 - Jul 25
STGW5	✗	50.4	March 23 - Nov 7	✗	53.7	April 9 - Jul 25
STGW6	✗	100	March 23 - Nov 7	✗	60.2	April 9 - Aug 7
STGW8	✗	17.4	April 18 - May 27	✗	14.4	April 9 - May 7
STGW9		2.2	no data		4.4	April 12 - Apr 20
STGW10	✗	29.1	March 23 - May 28	✗	15.9	April 9 - May 10
STGW11	✗	30	Aug 31 - Nov 7	✗	22.9	April 9 - May 29
STGW12	✗	30	Aug 31 - Nov 7	✗	30	April 9 - May 24
STGW13	✗	33.5	Aug 31 - Nov 7	✗	26.4	April 9 - May 31
STGW14	✗	30	Aug 31 - Nov 7	✗	23.9	April 9 - May 26





SALT Tract Mitigation Site  
Moore County, North Carolina

**Figure 3**

2007 Hydrologic Monitoring Results

**Legend**

- Site Boundary - 327.11 acres
- Wetland Restoration - 48.26 acres
- Wetland Enhancement/  
Preservation - 169.06 acres

**Monitoring Gauges**

- Monitoring gauge met wetland  
criteria (>12.5% of growing season)
- Gauge did not meet wetland  
criteria (>12.5% of growing season)

5

0 250 500 1,000  
Feet

Louis Berger 2/2008  
Data sources:  
USGS 7.5' quadrangle: Lobelia (1980),  
NCDOT (2000, 2006), Berger (2007)

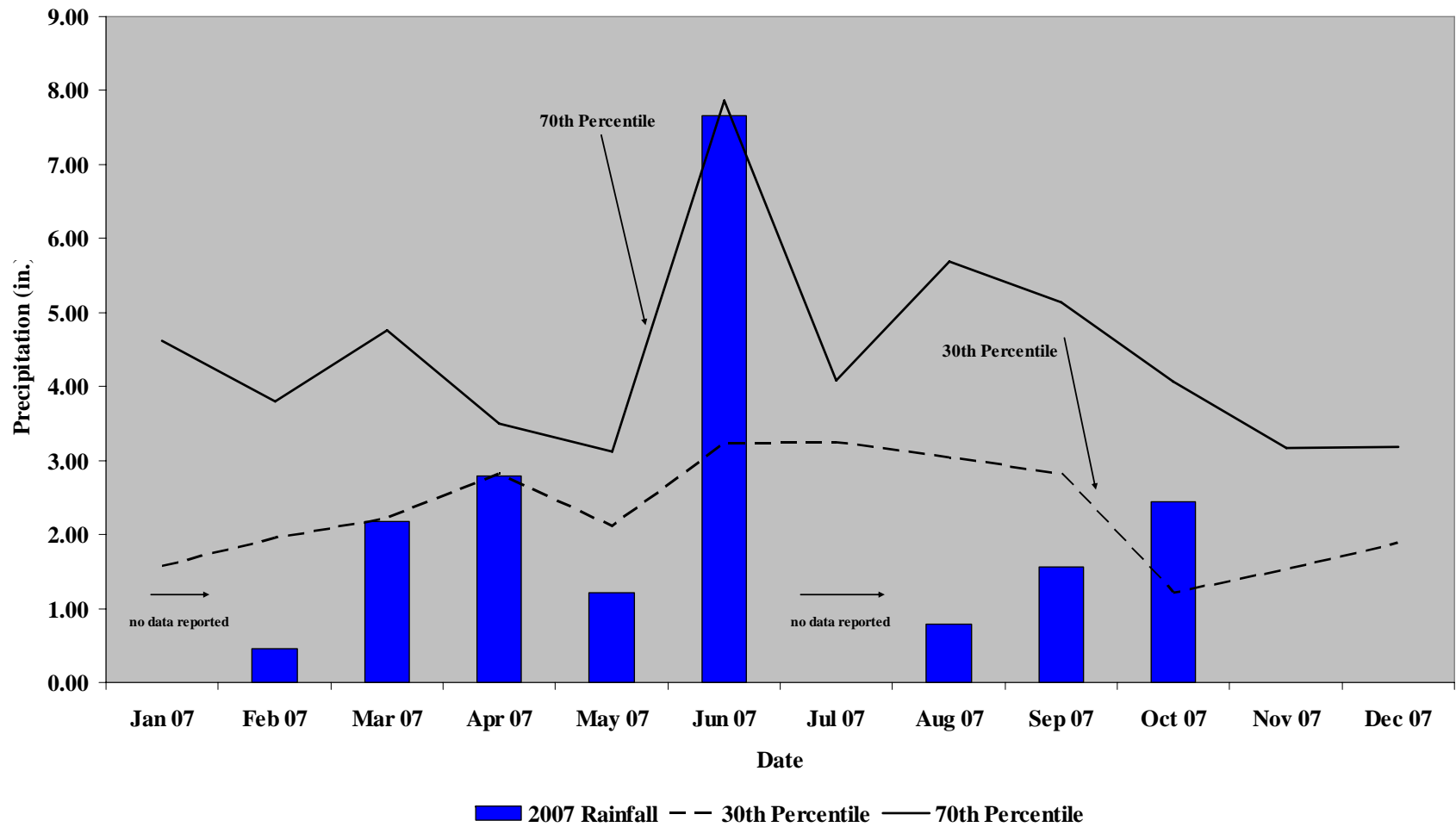


### **2.2.2 Climatic Data**

Figure 4 is a comparison of 2007 monthly rainfall to historical precipitation for the area. This comparison indicates whether 2007 was “average” in terms of climate conditions by comparing the 2007 monthly rainfall to that of historical monthly rainfall. The figure averages all rainfall data collected between 1964 and 2006 and compares two historical rainfall values per month the 30<sup>th</sup> percentile and 70<sup>th</sup> percentile values, (the values below which 30 percent and 70 percent of all observations may be found) with the actual 2007 monthly rainfall amount. The NOAA National Data Office provided all historical rainfall data<sup>iii</sup>.

This graph depicts the general precipitation conditions for the surrounding area. Consistent with the Palmer drought index review, 2007 was a below average rainfall year for the Ft. Bragg area and the SALT site<sup>iv</sup>. During February, March, May, August, September, and October rainfall amounts were below historic averages. Rainfall amounts during April and June were normal.

**SALT 30-70 Percentile Graph  
Lobelia, North Carolina**



**Figure 4: 2007**

### **3.0 VEGETATION: SALT MITIGATION SITE**

#### **3.1 Success Criteria**

Vegetation success criteria established for the SALT Mitigation Site requires survival of 320 planted seedling stems per acre at the conclusion of the first three years of monitoring. This survival criterion will decrease by 10% per year after the third year of vegetation monitoring (i.e., for an expected 290 stems per acre for Year 4, and 260 stems per acre for Year 5). The number of plants of one species is not to exceed 20% of the total number of plants of all species planted. Vegetation will be inventoried by counting planted woody stems rooted within established sample plots (Appendix B) and recording the quantity per species. For each of the four vegetation plots, the sampling methodology followed DOT Stem Counting Protocol.

#### **3.2 Description of Species**

The following species were planted in the Wetland Restoration Area:

*Chamaecyparis thyoides*, Atlantic White Cedar

*Taxodium distichum*, Baldcypress

*Quercus laurifolia*, Laurel Oak

*Nyssa sylvatica* var. *biflora*, Swamp Blackgum

*Quercus nigra*, Water Oak

*Quercus phellos*, Willow Oak

### 3.3 Results of Vegetation Monitoring

Plots	Atlantic white cedar	Bald cypress	Laurel oak	Swamp blackgum	Water oak	Willow oak	Total (Year 2)	Total (at planting)	Density (Trees/acre)
1	5		1		7	8	21	27	365.90
2	5			3		5	13	39	226.51
3	5	4	2	10	10	2	33	46	574.99
4	18	4	7	3	19	3	54	50	940.90
<b>TOTAL</b>	<b>33</b>	<b>8</b>	<b>10</b>	<b>16</b>	<b>36</b>	<b>18</b>	<b>121</b>	<b>162</b>	<b>2108.3</b>
<b>Average Tree Density: 527.08</b>									

Approximately 15.9 acres of the SALT Mitigation Site were planted as a bottomland hardwood forest community. There were four vegetation monitoring plots established within this area. The 2007 vegetation monitoring data indicated an average density at 527 stems/acre, an increase from 2006 average density at 440 stems/acre. This average is above the minimum success criteria of 320 trees per acre.

A summary table of the vegetation monitoring results in both monitoring years 1 and 2 is provided below.

Plots	Atlantic white		Bald cypress		Laurel oak		Swamp		Water Oak		Willow oak		Total		Total (at Planting)	Density (Trees/acre)	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2			
1	7	5	0	0	0	1	0	0	7	7	8	8	22	21	27	554	365.9
2	6	5	0	0	2	0	0	3	0	0	3	5	11	13	39	192	226.51
3	5	5	4	4	2	2	6	10	7	10	4	2	28	33	46	414	574.99
4	17	18	7	4	5	7	4	3	6	19	6	3	44	54	50	578	940.9
<b>TOTAL</b>	<b>35</b>	<b>33</b>	<b>11</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>10</b>	<b>16</b>	<b>20</b>	<b>36</b>	<b>21</b>	<b>18</b>	<b>105</b>	<b>121</b>	<b>162</b>	<b>1738</b>	<b>2108.3</b>
<b>Average Tree Density Year 1: 440, Year 2: 527</b>																	

### 4.0 Overall Conclusions/Recommendations

2007 represents the second year of monitoring for the SALT Mitigation Site. During 2007, twelve of the thirteen hydrologic gauges met the jurisdictional wetland hydrology criteria for greater than 12.5% of the growing season. Groundwater Monitoring Gauge 9 is the only monitoring gauge that did not meet the success criteria. During monitoring activities, Berger personnel observed that beaver activity had raised water levels in the vicinity of monitoring gauges 1, 2, and 3. These wells were completely submerged until August and again in October. Data in Appendix A reflect these conditions. NCEEP reported that successful beaver trapping had been carried out in November 2007.

Three of the four vegetation monitoring plots yielded stem densities above the success criteria. In both Monitoring Year 1 (2006) and Monitoring Year 2 (2007) the average densities for Plot 2 did not meet the success criteria of 320 stems/acre; the 2006 average density was reported at 192 stems/acre and the 2007 average density at 226 stems/acre. The monitoring report for Year 1 indicated evidence of Plot 2 having been mowed by the landowner. Observations during Year 2 monitoring indicated that the area was not mowed in 2007, yet the plot did appear to be in a clearing at the end of a road.

EEP will continue monitoring the hydrology at the SALT Mitigation Site for the 2008 monitoring year.

## 5.0 References

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<sup>1</sup> Soil Conservation Service, Soil Survey of Moore County, North Carolina, 1989.

<sup>2</sup> National Climatic Data Center and NOAA Satellite and Information Service, Record of Climatological Observations. Last updated 5 2007, <http://hurricane.ncdc.noaa.gov/DLY>

<sup>iii</sup> National Climatic Data Center and NOAA Satellite and Information Service, Record of Climatological Observations. Last updated 5 2007, <http://hurricane.ncdc.noaa.gov/DLY>

<sup>iv</sup> National Oceanic and Atmospheric Administration's Drought Information Center, The Palmer Drought Severity Index, <http://www.drought.noaa.gov/palmer.html>

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## **APPENDICES**

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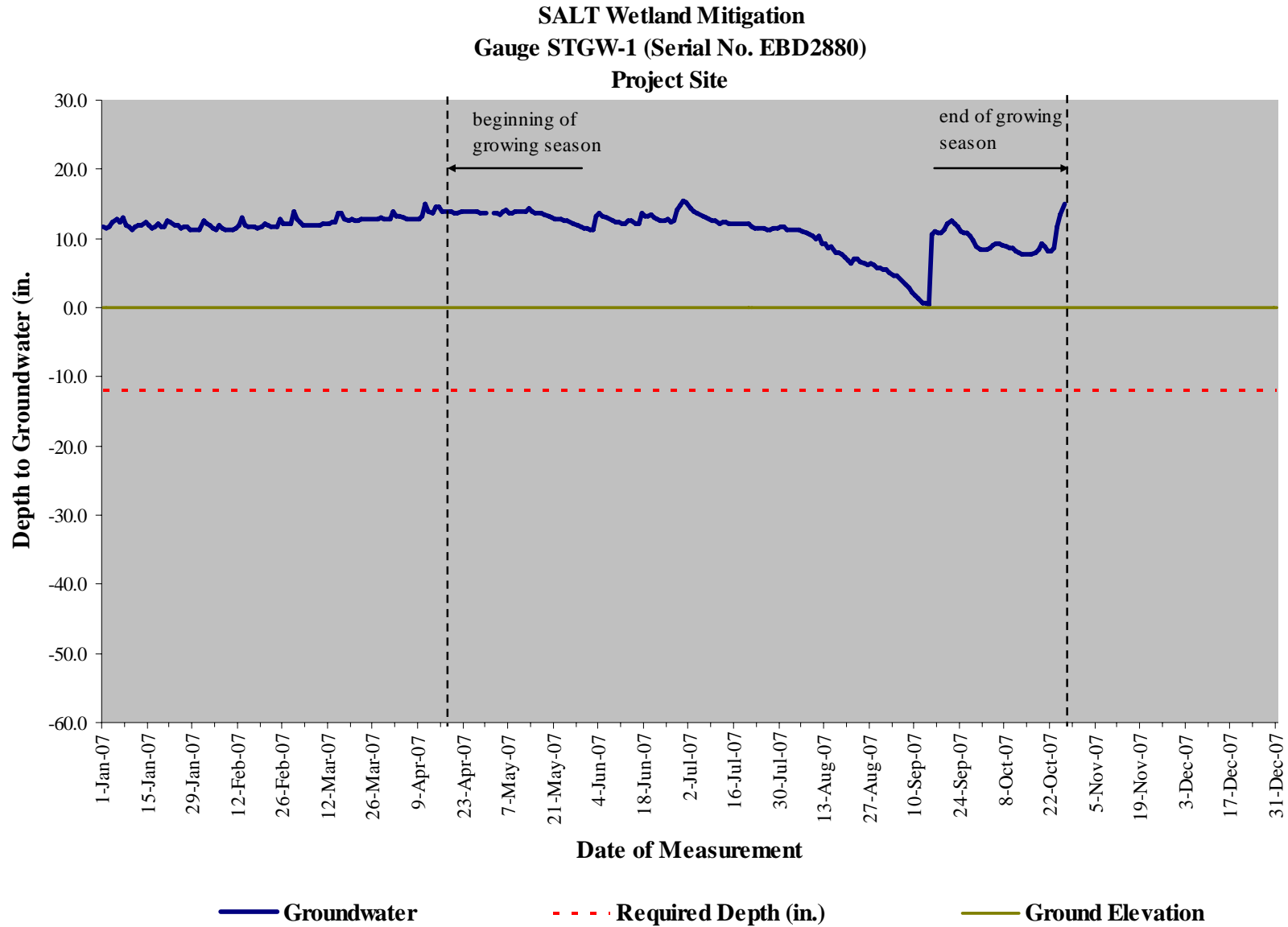


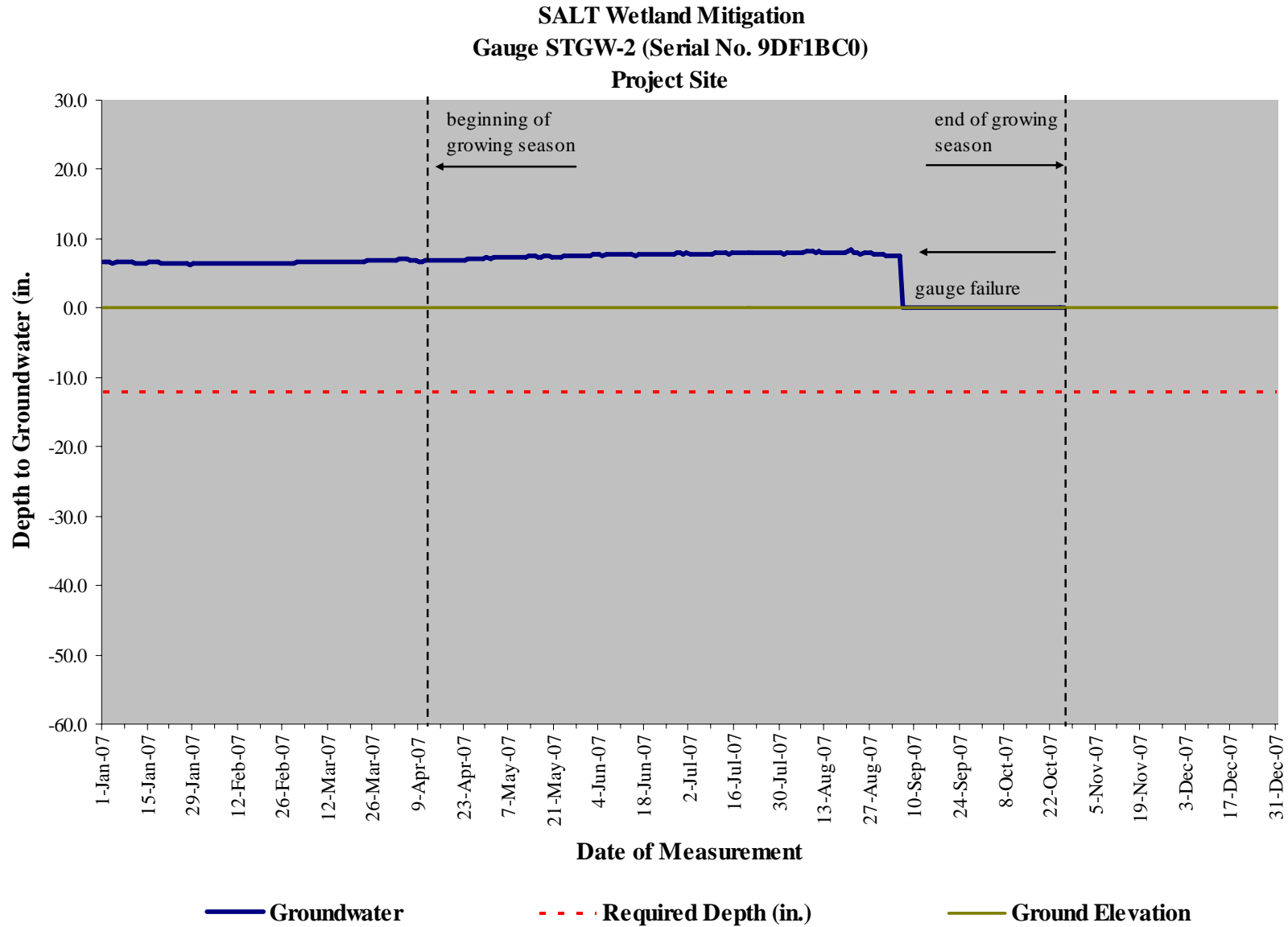
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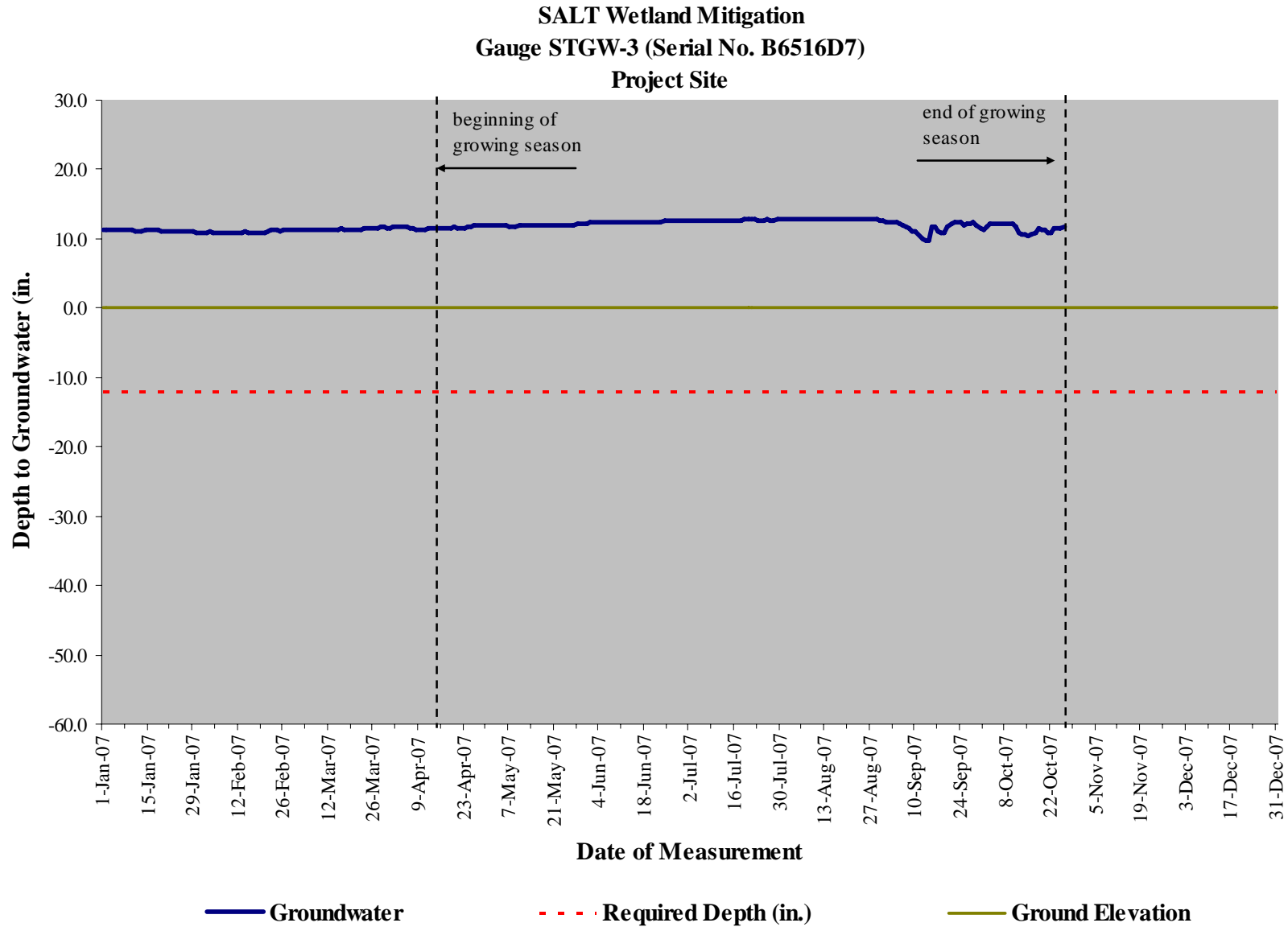
## **APPENDIX A**

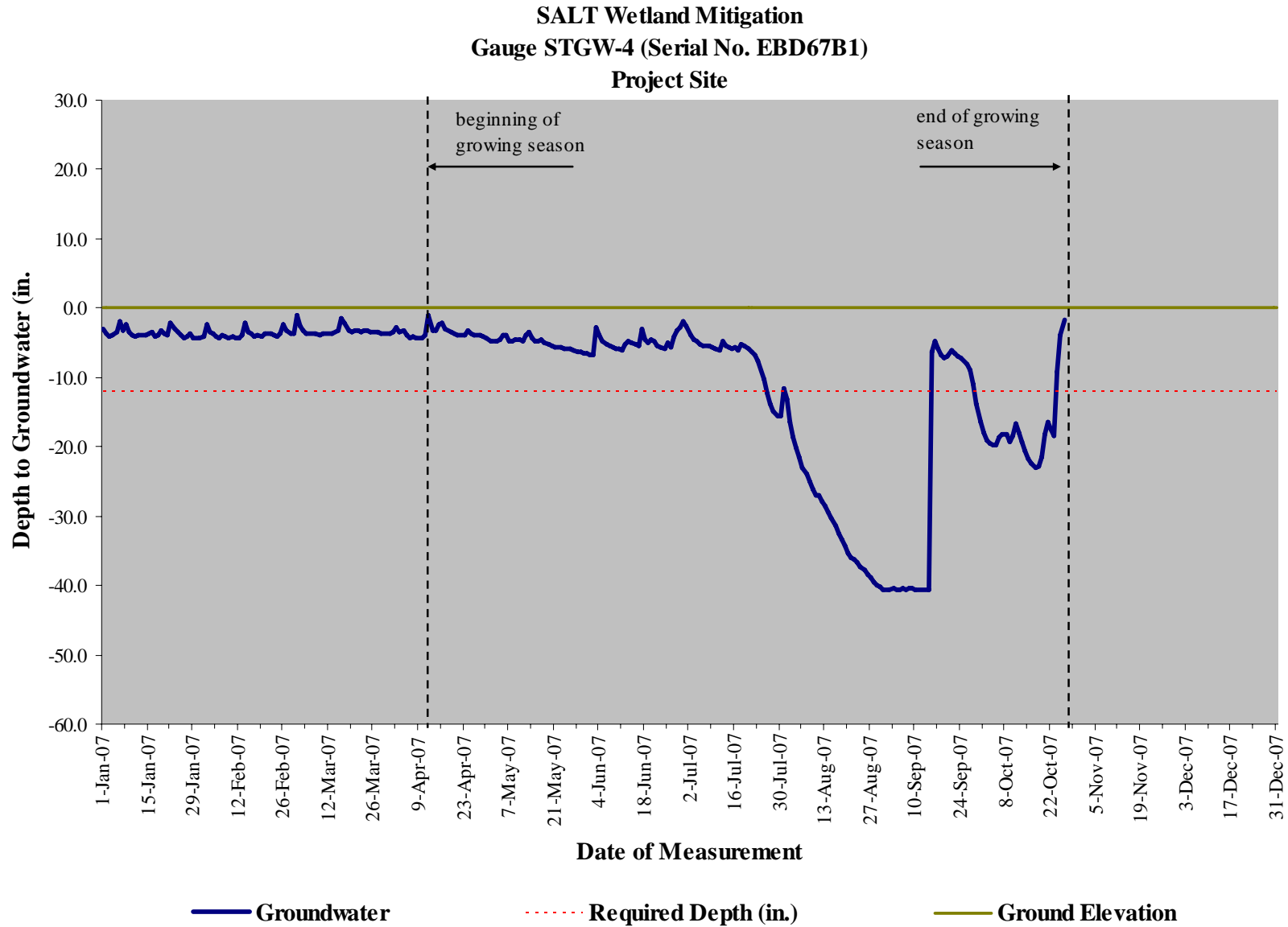
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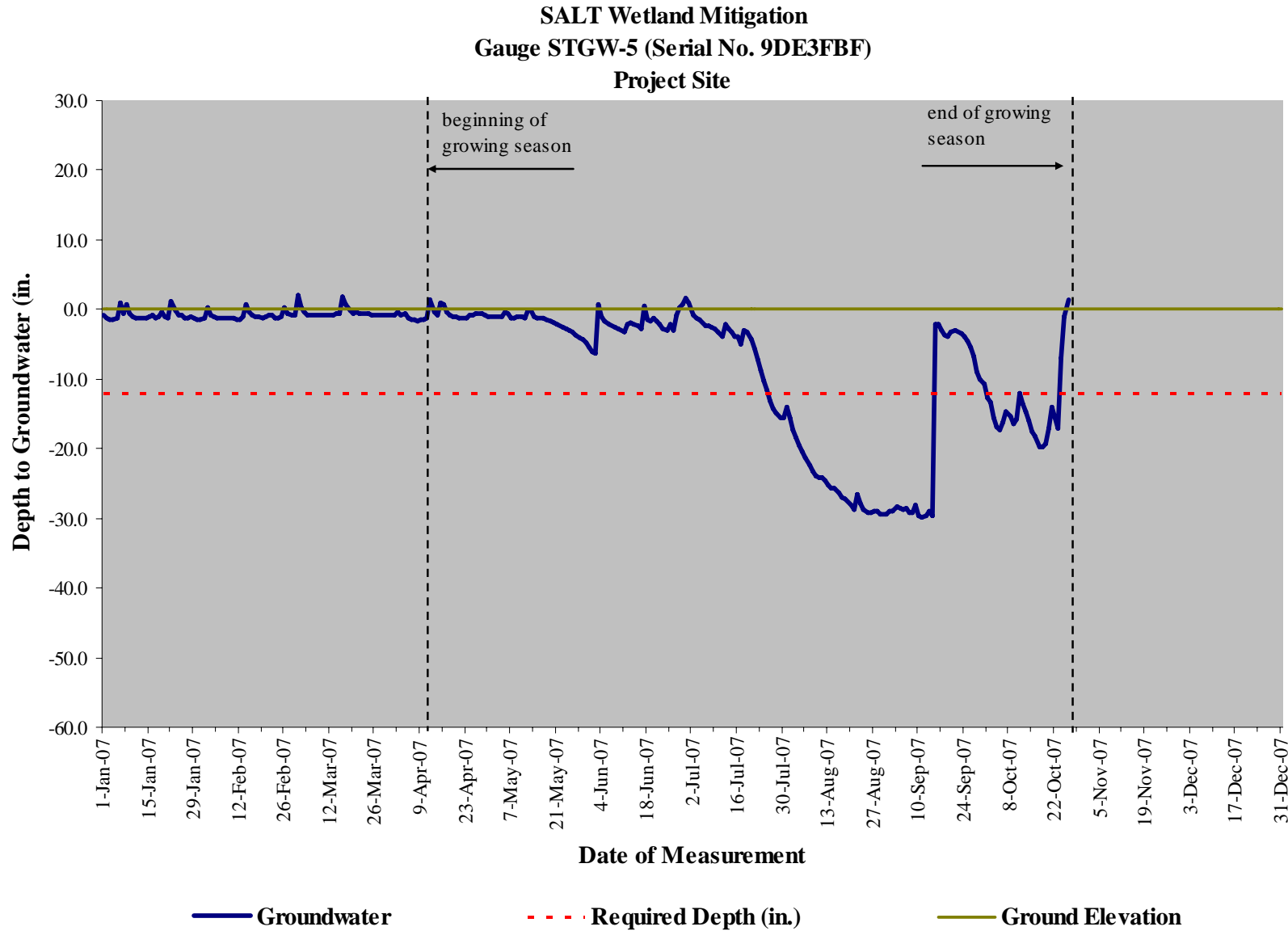
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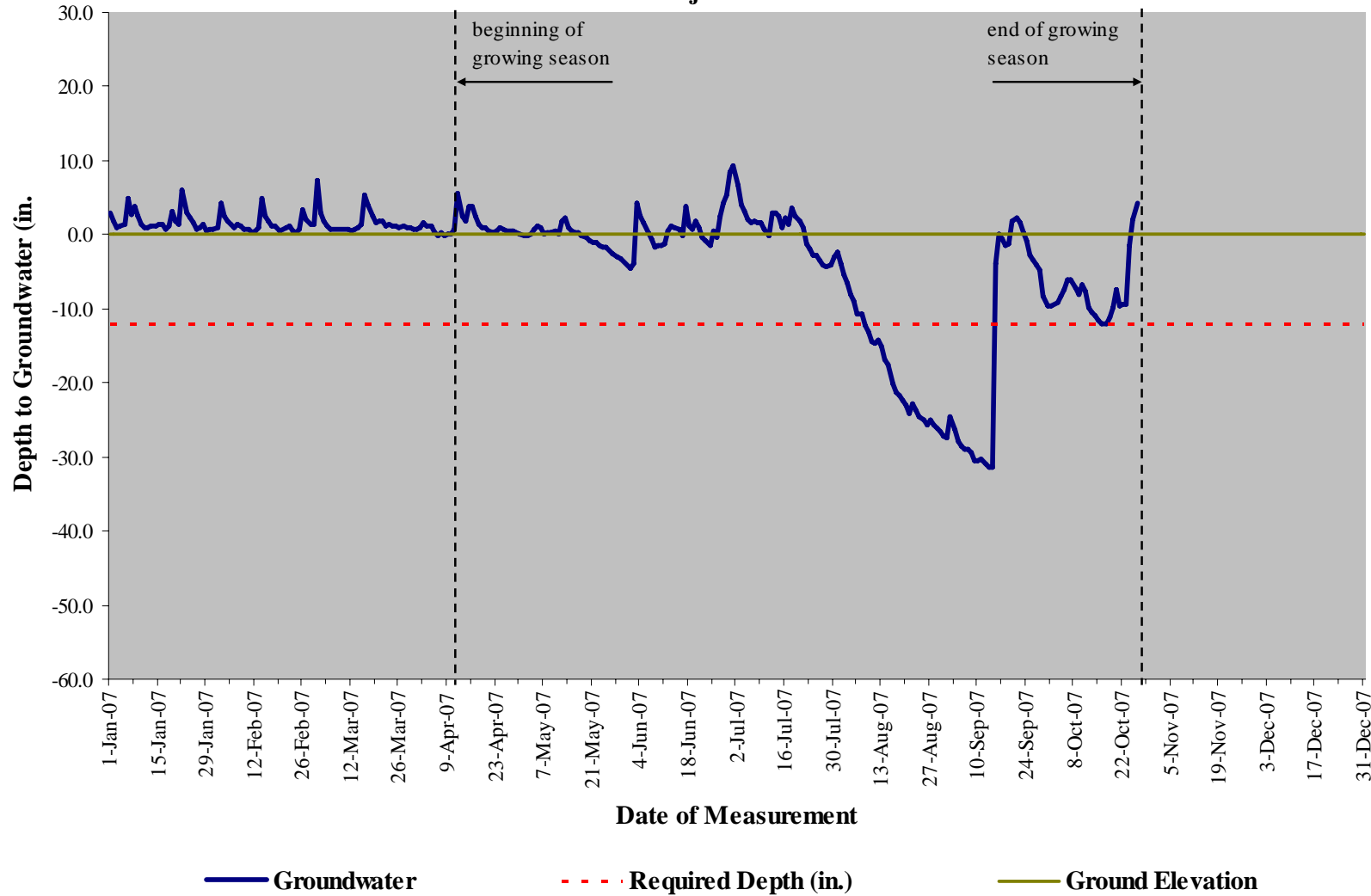


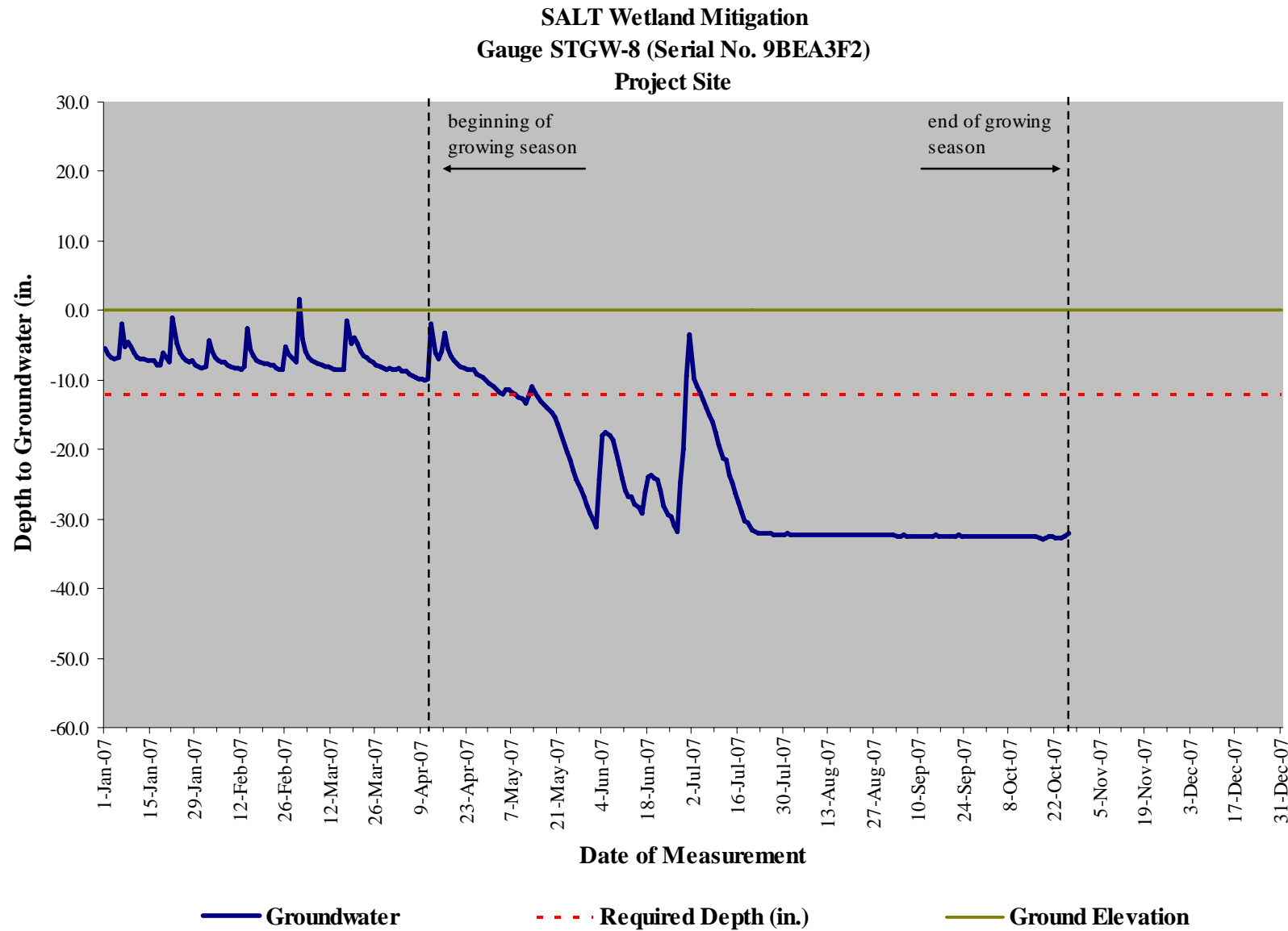




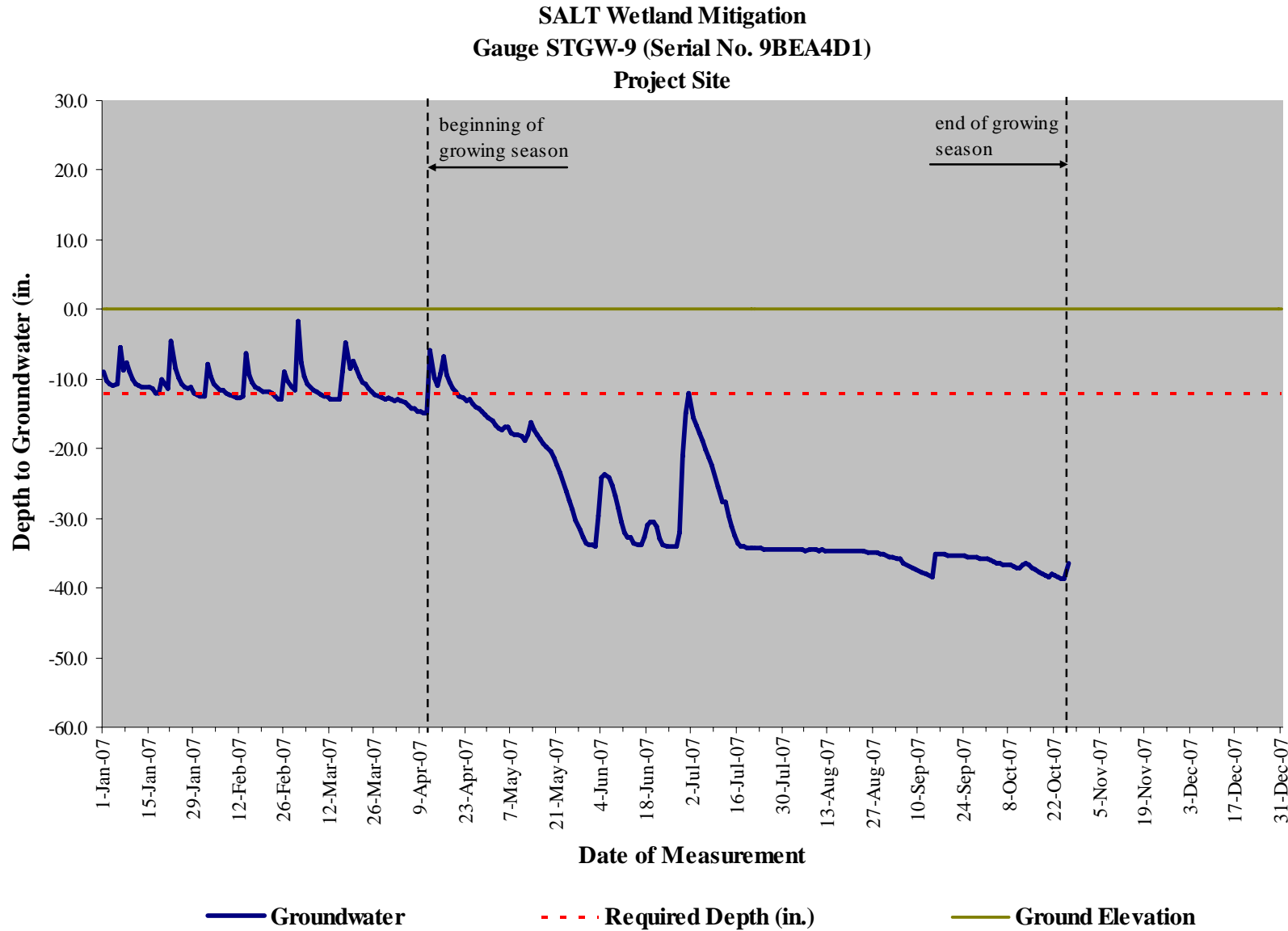


**SALT Wetland Mitigation  
Gauge STGW-6 (Serial No. 9BEA426)  
Project Site**

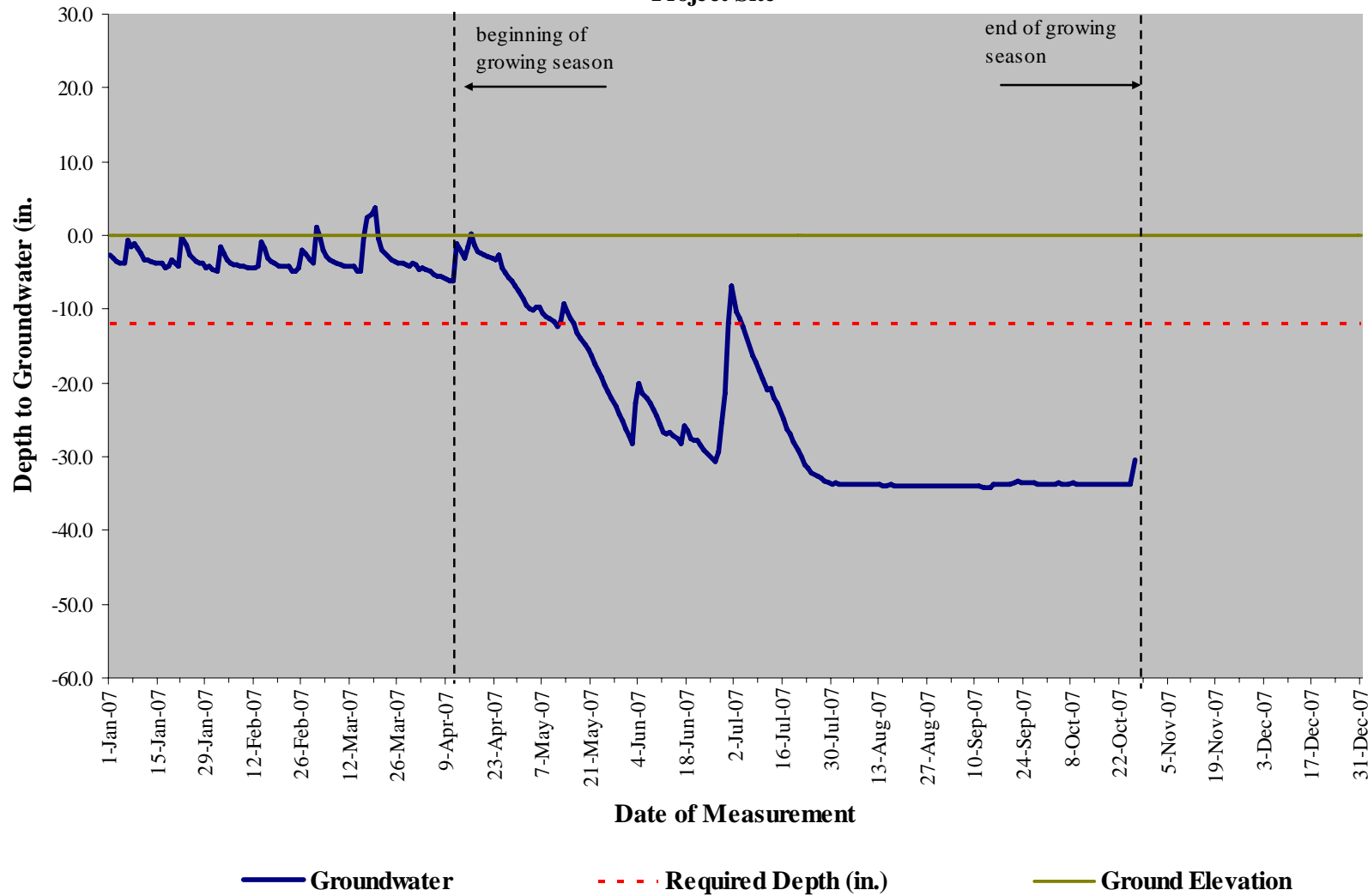




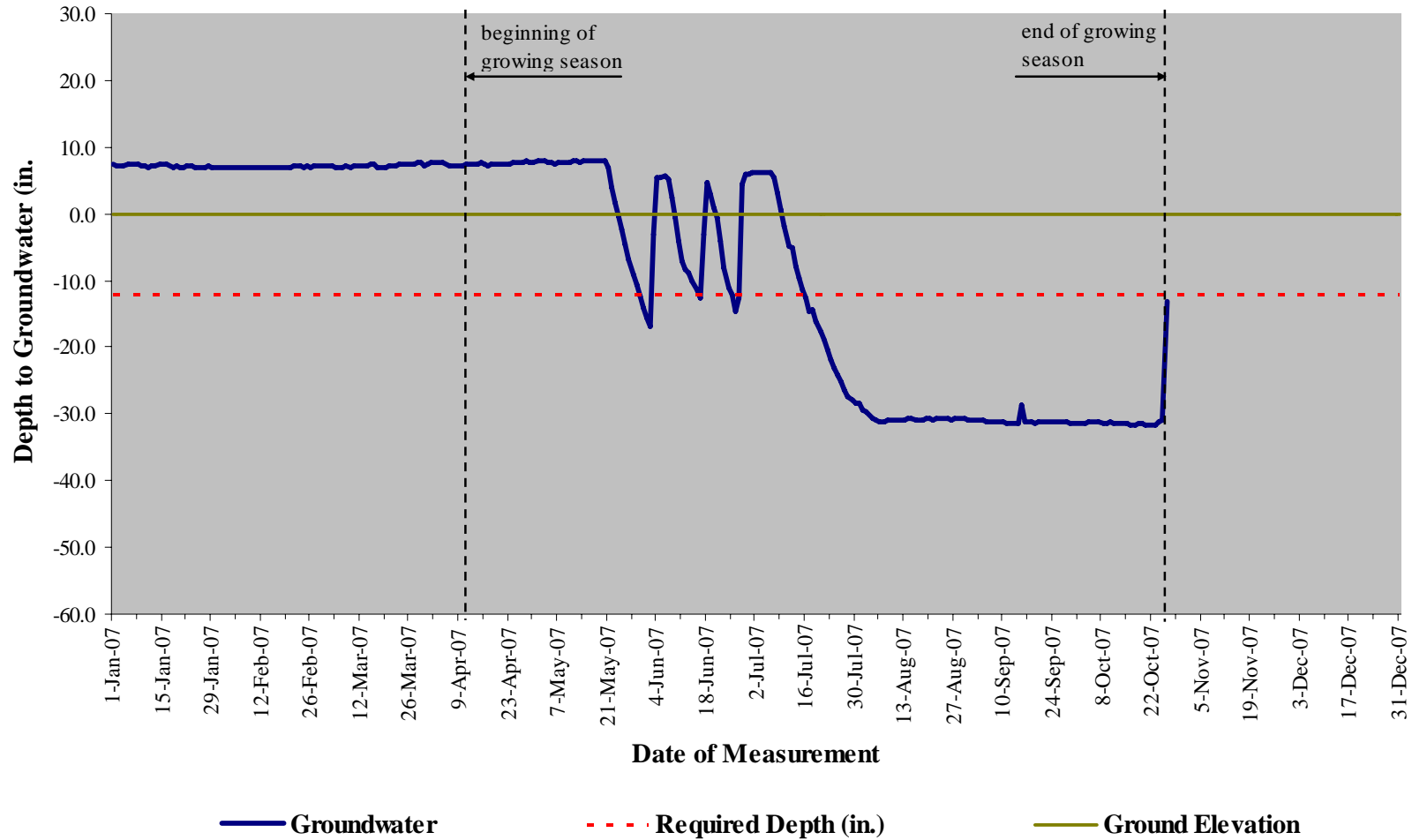




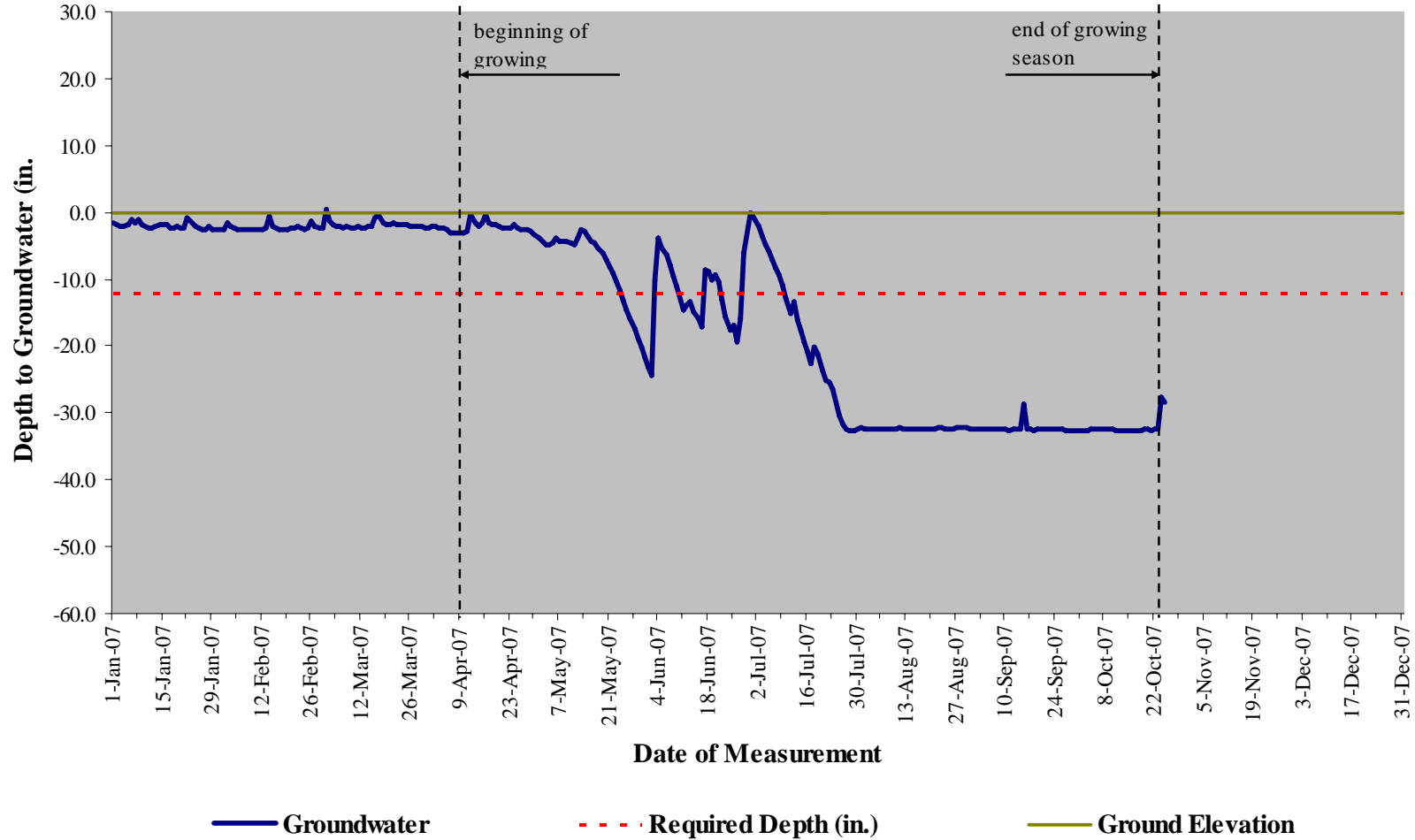
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Project Site**



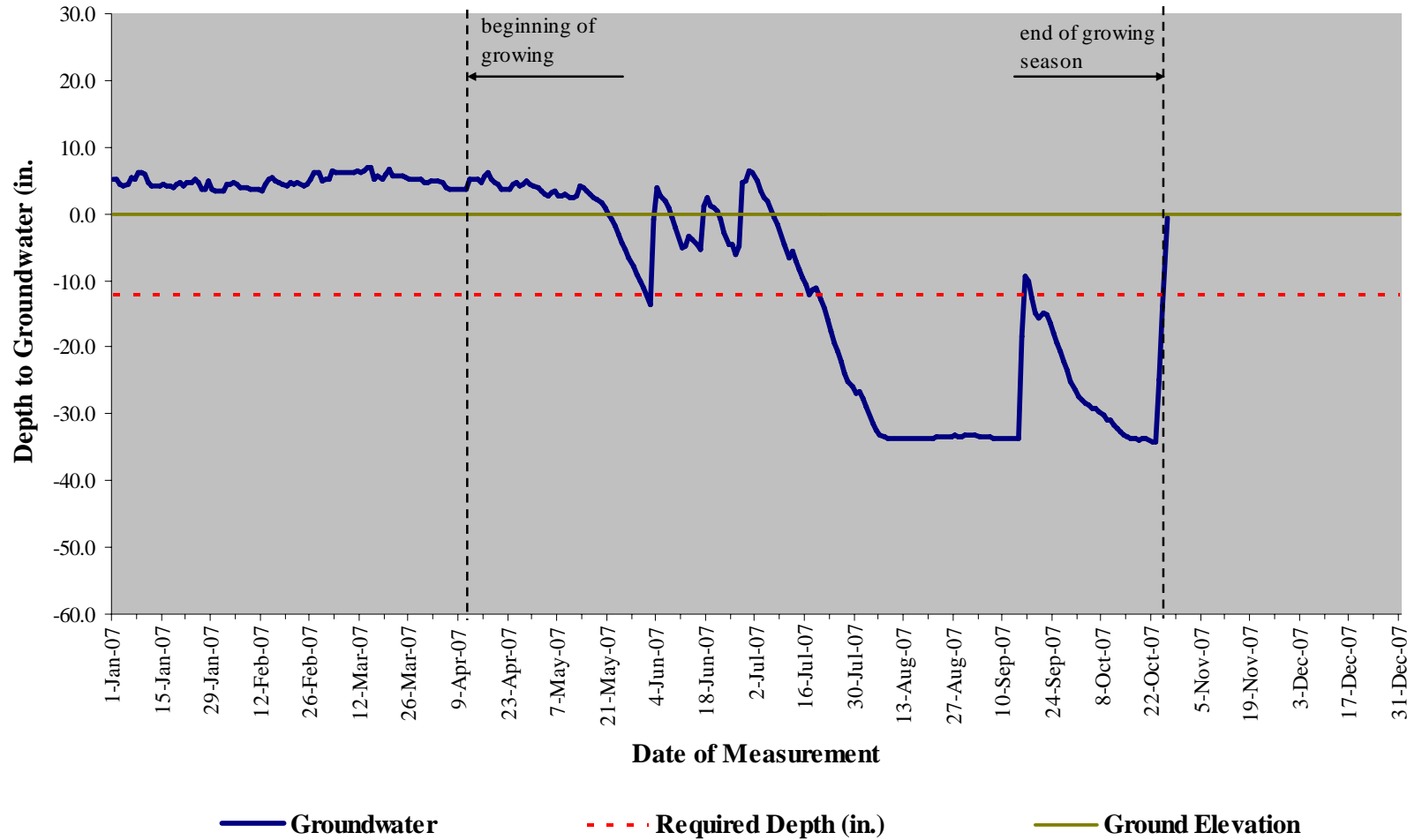
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Project Site**



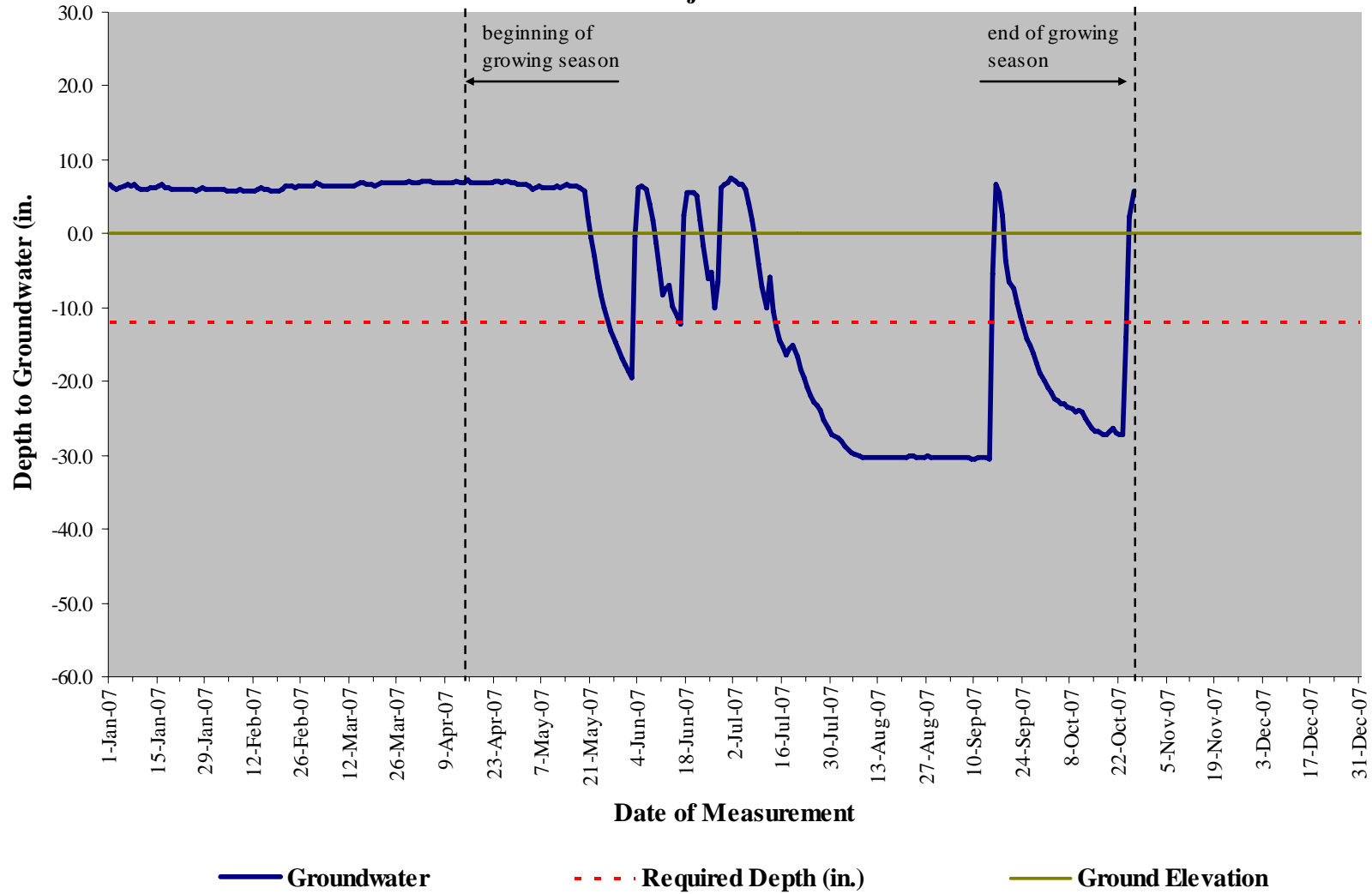
**SALT Wetland Mitigation  
Gauge G-12 (Serial No. 9DE5E9D)  
Project Site**



**SALT Wetland Mitigation  
Gauge STGW-13 (Serial No. 9BEA44D)  
Project Site**



**SALT Wetland Mitigation  
Gauge STGW-14 (Serial No. 9BE9009)  
Project Site**



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## **APPENDIX B**

### **1. VEGETATION MONITORING PLOT PHOTOS**

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**Vegetation Plot 1 – 10/17/2007**



**Vegetation Plot 2 – 10/17/2007**





**Vegetation Plot 3 – 10/17/2007**



**Vegetation Plot 4 – 10/17/2007**

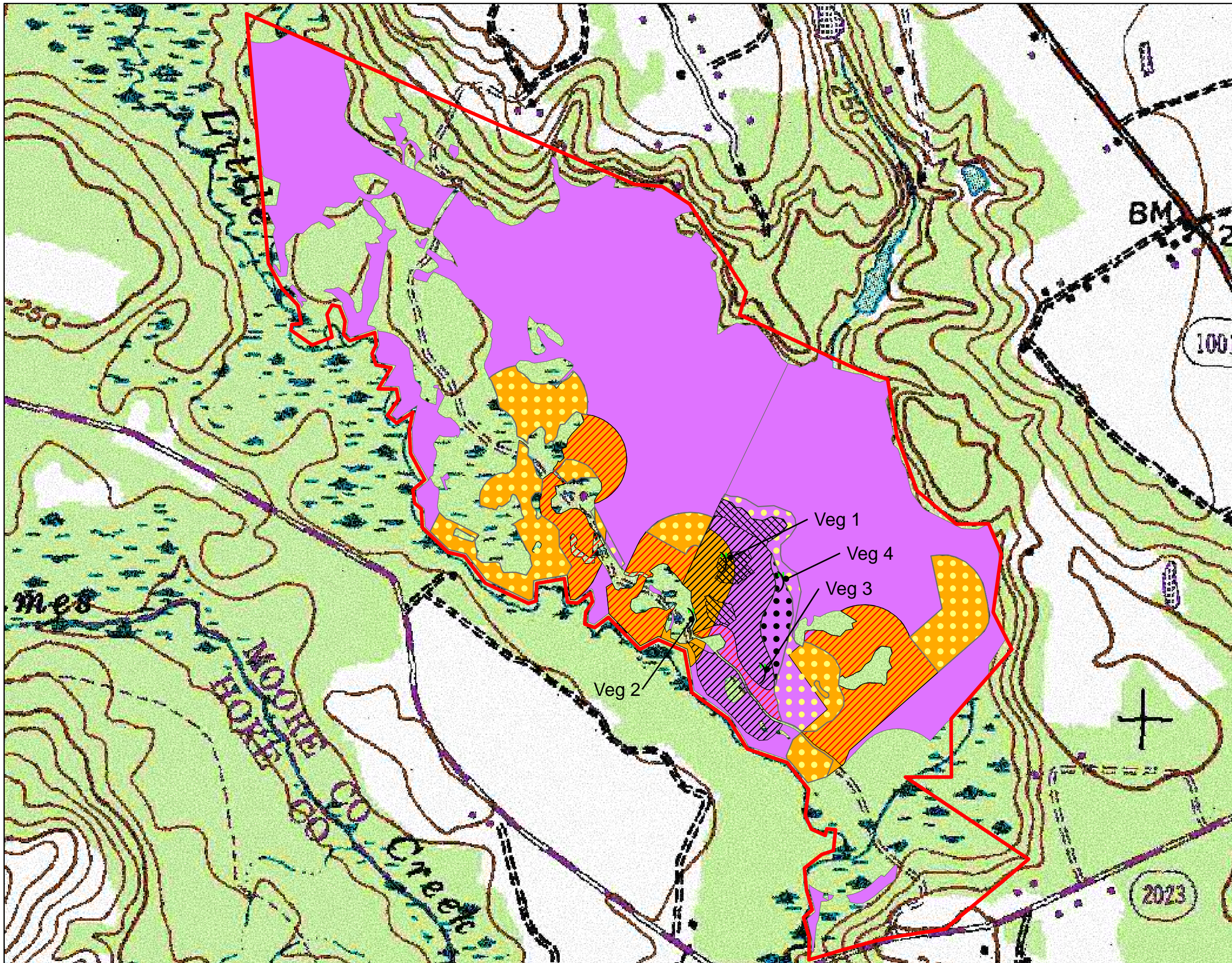
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## **APPENDIX B**

### **2. VEGETATION PLOT LOCATIONS**

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SALT Tract Mitigation Site  
Moore County, North Carolina

**Figure 4**

Vegetation Plots Location Map

**Legend**

- Site Boundary - 327.11 acres
- Wetland Restoration - 48.26 acres
- Wetland Enhancement/ Preservation - 169.06 acres
- Vegetation Plot

**Full Planting Areas**

- Bottomland Hardwood
- Pine Flatwood
- Cypress-Gum Swamp

**Supplemental Planting Areas**

- Cypress-Gum Swamp
- Bottomland Hardwood

5



Louis Berger 2/2008  
Data sources:  
USGS 7.5' quadrangle: Lobelia (1980),  
NCDOT (2000, 2006), Berger (2007)



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## **APPENDIX B**

### **3. SITE PHOTOS**

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**Looking east from gauge 14 – 10/17/2007**



**Looking northwest from southwest corner of vegetation plot 2 – 10/17/2007**





**Looking south from southwest corner of vegetation plot 2 – 10/17/2007**



**Looking southeast from southwest corner of vegetation plot 4 – 10/17/2007**





**Looking east from gauge 6 – 10/17/2007**