

# ANNUAL REPORT FOR 2000



**Tucker Mitigation Site  
Currituck County  
Project No. 6.049009T  
TIP No. R-2228WM**



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December 2000

## TABLE OF CONTENTS

SUMMARY.....	1
1.0 Introduction .....	2
1.1 Project Description .....	2
1.2 Purpose .....	2
1.3 Project History .....	2
2.0 Hydrology.....	4
2.1 Success Criteria .....	4
2.2 Hydrologic Description .....	4
2.3 Results of Hydrologic Monitoring.....	6
2.3.1 Site Data.....	6
2.3.2 Climatic Data.....	8
2.4 Conclusions.....	11
3.0 Vegetation.....	12
3.1 Success Criteria .....	12
3.2 Description of Species.....	12
3.3 Results of Vegetation Monitoring .....	13
3.4 Conclusions .....	15
4.0 Overall Conclusions and Recommendations .....	16

**TABLES**

Table 1 – Hydrologic Monitoring Results. . . . .6  
Table 2 – Vegetation Monitoring Results. . . . .13

**FIGURES**

Figure 1 – Site Location Map . . . . . 3  
Figure 2 – Monitoring Gauge Location Map. . . . . 5  
Figure 3 - 2000 Hydrologic Monitoring Results. . . . .9  
Figure 4 – 30 – 70 Percentile Graph . . . . .13

**APPENDICES**

Appendix A – Depth to Groundwater Plots . . . . .17  
Appendix B – Site Photos . . . . .18

## **SUMMARY**

The following report summarizes the monitoring activities that have occurred in the past year at the Tucker Tract Mitigation Site. This is the second year the site has been monitored for vegetation and hydrologic success. The site must demonstrate both hydrologic and vegetation success for a minimum of five years.

The Tucker Tract contains one surface gauge and ten groundwater monitoring gauges. The site also contains 12 vegetation monitoring plots.

In 1999 the local weather station rainfall data was used for the site analysis. The daily rainfall on was recorded at Elizabeth City as reported by the NC State Climate Office. This data was used because the on-site rainfall gauges installed in 1999 proved to be unreliable. An Infinities tipping bucket rain gauge was installed in August 2000 and it is expected to provide reliable data for all future monitoring reports

Hydrologic monitoring indicated that of the ten gauges on site, eight showed saturation for over 12.5% of the growing season, one gage (TT-6) showed saturation between 8 – 12.5% of the growing season (this gage, as noted last year, is situated in a local high area) and the remaining gage (TT-1) continually malfunctioned and will be replaced before the next growing season. Gage TT-1 is presented in the report for information purposes (it did show saturation between 5 – 8% of the growing season, and during vegetation monitoring this area was observed to be saturated). The second year vegetation monitoring of the planted areas revealed an average density to be 391 trees per acre, which is above the minimum requirement of 320 trees per acre.

Based on the hydrologic and vegetation monitoring, the Tucker Mitigation Site met success criteria across the majority of the site during the 2000 growing season. NCDOT recommends that monitoring continue.

## 1.0 INTRODUCTION

### 1.1 Project Description

The Tucker Tract Mitigation Site is located in Currituck County (Figure 1). This site is part of a large property consisting of 68.3 acres in total. Approximately 48.1 acres has been set aside for mitigation. Approximately 28.2 acres of the 48.1 acres was developed and constructed as the Tucker Tract Mitigation Site. The remaining 20.2 acres will be reserved for possible future mitigation projects. The site was built to mitigate for the widening of NC 168 (TIP Project R-2228). The project includes the restoration of 25.1 acres of PC agricultural fields on this property to forested wetland and the preservation of 2.8 acres of forested wetland and 8.7 acres of timbered wetland.

The Final Mitigation Plan for this site was issued on April 1, 1996. Initial construction was completed in late 1997. At that time it was determined that the site had been graded to an unacceptable level. A second contract was issued and the site was regraded in 1998 with completion in September 1998. The site was planted in early 1999. In March 1999, NCDOT installed monitoring gauges to be used for hydrologic monitoring. Twelve plots were established to monitor vegetation. This monitoring report presents the second year results of both hydrologic and vegetation monitoring.

### 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 are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetative monitoring during the year 2000 at the Tucker Tract Mitigation Site as well as local climate conditions throughout the growing season.

### 1.3 Project History

December 1997	Site Construction Completed (Contract 1)
September 1998	Site Construction Completed (Contract 2)
March 1999	Site Planted, Monitoring Gauges Installed
October 1999	Vegetation Monitoring (1 yr.)
March-November 1999	Hydrologic Monitoring (1 yr.)
August 2000	Vegetation Monitoring (2 yr.)
March-November 2000	Hydrologic Monitoring (2 yr.)



## **2.0 HYDROLOGY**

### **2.1 Success Criteria**

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology states that the area must be inundated or saturated (within 12" of the surface) by surface or groundwater for at least a consecutive 12.5% of the growing season. Area inundated for less than 5% of the growing season are always classified as non-wetlands. Areas inundated between 5% - 12.5% of the growing season can be classified as wetlands depending upon factors such as the presence of wetland vegetation and hydric soils.

The growing season in Currituck County begins March 20 and ends November 13. These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after March 20 and before November 13.<sup>1</sup> The growing season is 239 days; therefore, optimum hydrology requires 12.5% of this season, or at least 30 consecutive days. Local climate must also represent average conditions for the area. Based on the Mitigation Plan, hydrologic success is soil saturation for at least 12.5% of the growing season.

### **2.2 Hydrologic Description**

In March 1999, ten monitoring gauges and one rain gauge were installed (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth. This is the second year of hydrologic monitoring for the site.

The principal hydrologic source for this site is precipitation with some input from Buckskin Creek. The Tucker Tract site involved the grading of the field crowns and placing the excess into several drainage ditches to prohibit water from leaving the site. An additional seven to nine inches of fill was brought in to bring the site elevation to its final grade. Several earthen berms were constructed adjacent to the lower areas of the site and adjacent to the residential area. This design will restore wetland hydrology, restrict infiltration losses and surface runoffs, and avoid flooding the adjacent residential area. The hydrologic monitoring should show the reaction of the groundwater level to specific rainfall events.

### **2.3 Results of Hydrologic Monitoring**

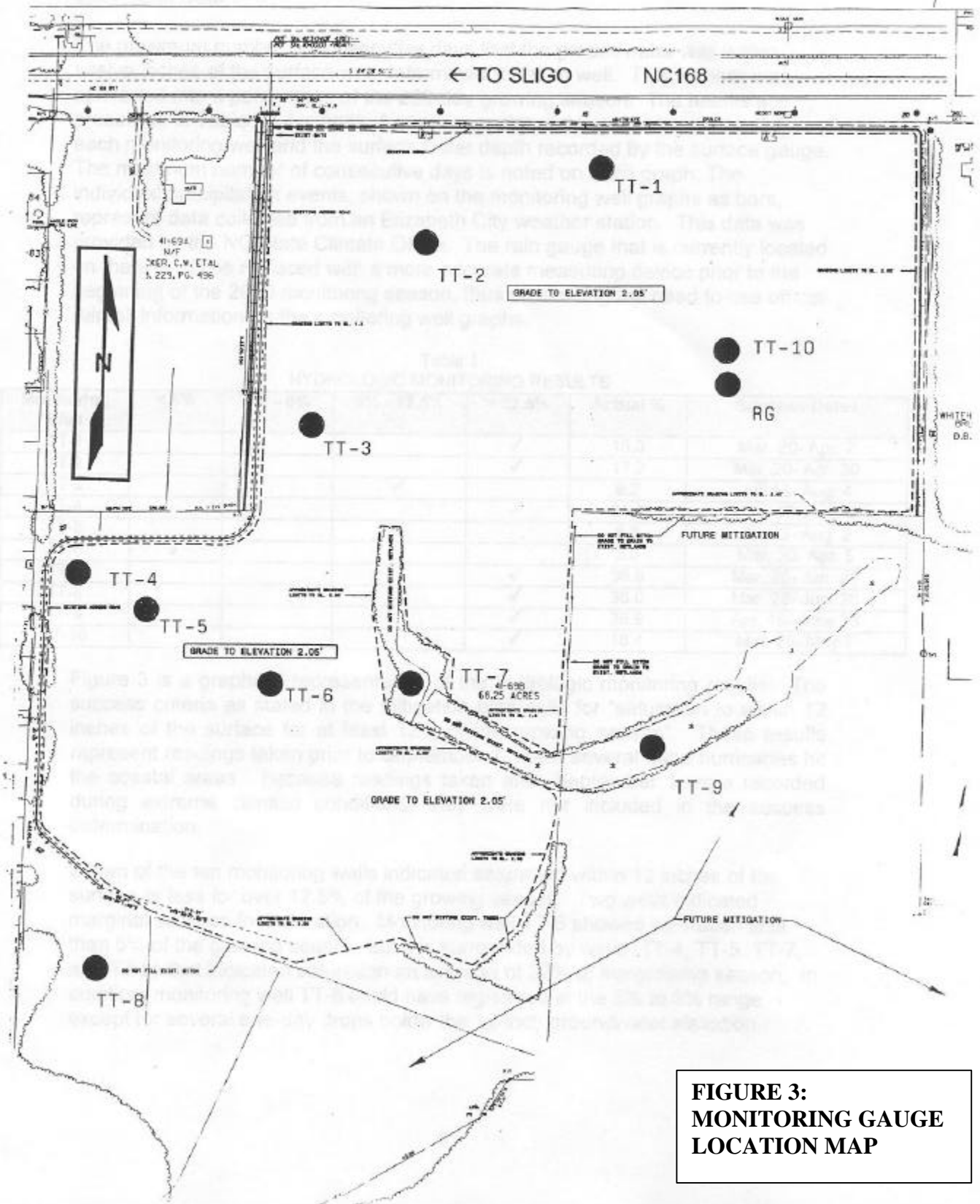
#### **2.3.1 Site Data**

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each gauge. This number was converted into a percentage of the 239 day growing season. The results are

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<sup>1</sup> Natural Resources Conservation Service, Soil Survey of Currituck County, North Carolina, p.71.

2.3 Results of Hydrologic Monitoring



**FIGURE 3:  
MONITORING GAUGE  
LOCATION MAP**

presented in Table 1. Appendix A contains a plot of the groundwater depth for each monitoring gauge and the surface water depth recorded by the surface gauge. The maximum number of consecutive days is noted on each graph. The individual precipitation events, shown on the monitoring gauge graphs as bars, represent data collected from an Elizabeth City weather station. The NC State Climate Office provided this data. A more accurate measuring device (Infinity Rain Gauge) was installed adjacent to gage TT-3 in August 2000. This data will be used for all subsequent monitoring reports.

Table 1  
HYDROLOGIC MONITORING RESULTS

Monitoring Gauge	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %	Success Dates
TT-1						malfunctioned
TT-2				✓	38	Jul 21 – Oct 21
TT-3				✓	25	May 28 – Jul 27
TT-4				✓	100	Mar 20 – Nov 13
TT-5				✓	33	Jul 24 – Oct 11
TT-6			✓		8	Apr 16 – May 5
TT-7				✓	100	Mar 20 – Nov 13
TT-8				✓	94	Mar 20 – Oct 29
TT-9				✓	100	Mar 20 – Nov 13
TT-10				✓	33	Jul 24 – Oct 10

Figure 3 is a graphical representation of the hydrologic monitoring results. The success criteria as stated in the mitigation plan calls for “saturation to within 12 inches of the surface for at least 12.5% of the growing season”.

This year (2000) the majority of the monitoring gauges on site have shown saturation for long periods of time. Monitoring gauge TT-1 was eliminated from the analysis because battery failure resulted in no data for most of the growing season (see graph of TT-1 in Appendix A). Gage TT-1 was checked, maintained, and reset three times during the growing season to no avail. Of the remaining nine gauges, eight exhibited saturation within 12 inches of the surface for over 12.5% of the growing season. This is an improvement over the 1999 results by 20 percent. In 2000, TT-6 showed saturation for 8% of the growing season, which is similar to the 1999 results. Monitoring gauge TT-6 is situated in a locally elevated part of the site. May and June exhibited greater than normal rainfall and July lower than normal rainfall (Figure 4), thus TT-3 data would be closer to saturation for 12.5% of the growing season.

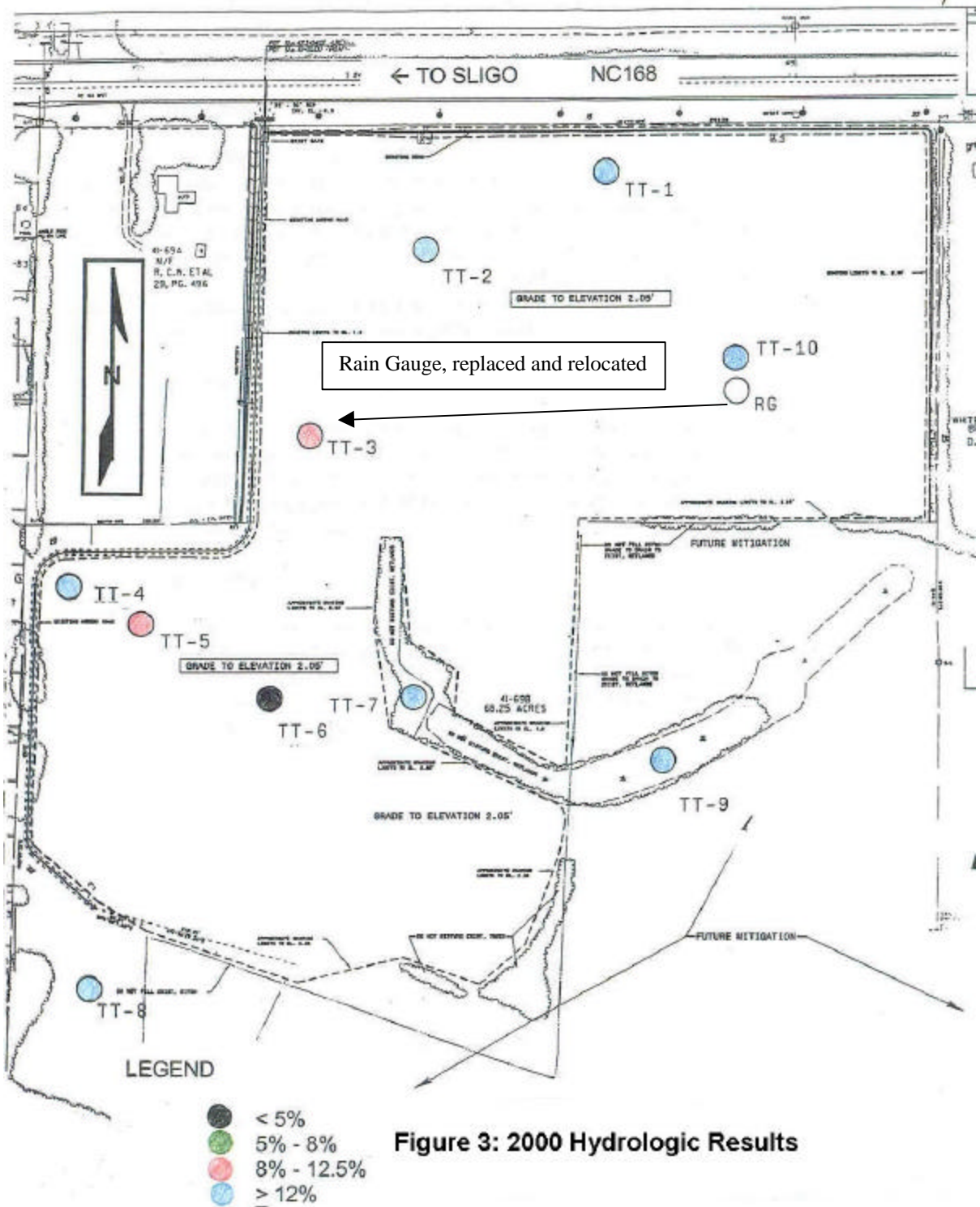
*Specific problems:* Dead batteries hampered the data acquisition process. Monitoring gauge TT-1 did not record groundwater elevations from May 1 to August 29, September 14 to October 6 and October 12 to November 15. Several attempts to repair and reset this gage proved unsuccessful. As previously mentioned this gauge was eliminated from the data analysis due to the data gaps. This gage will be replaced prior to the next growing season. Monitoring gauge TT-3 had dead batteries for the month of August.



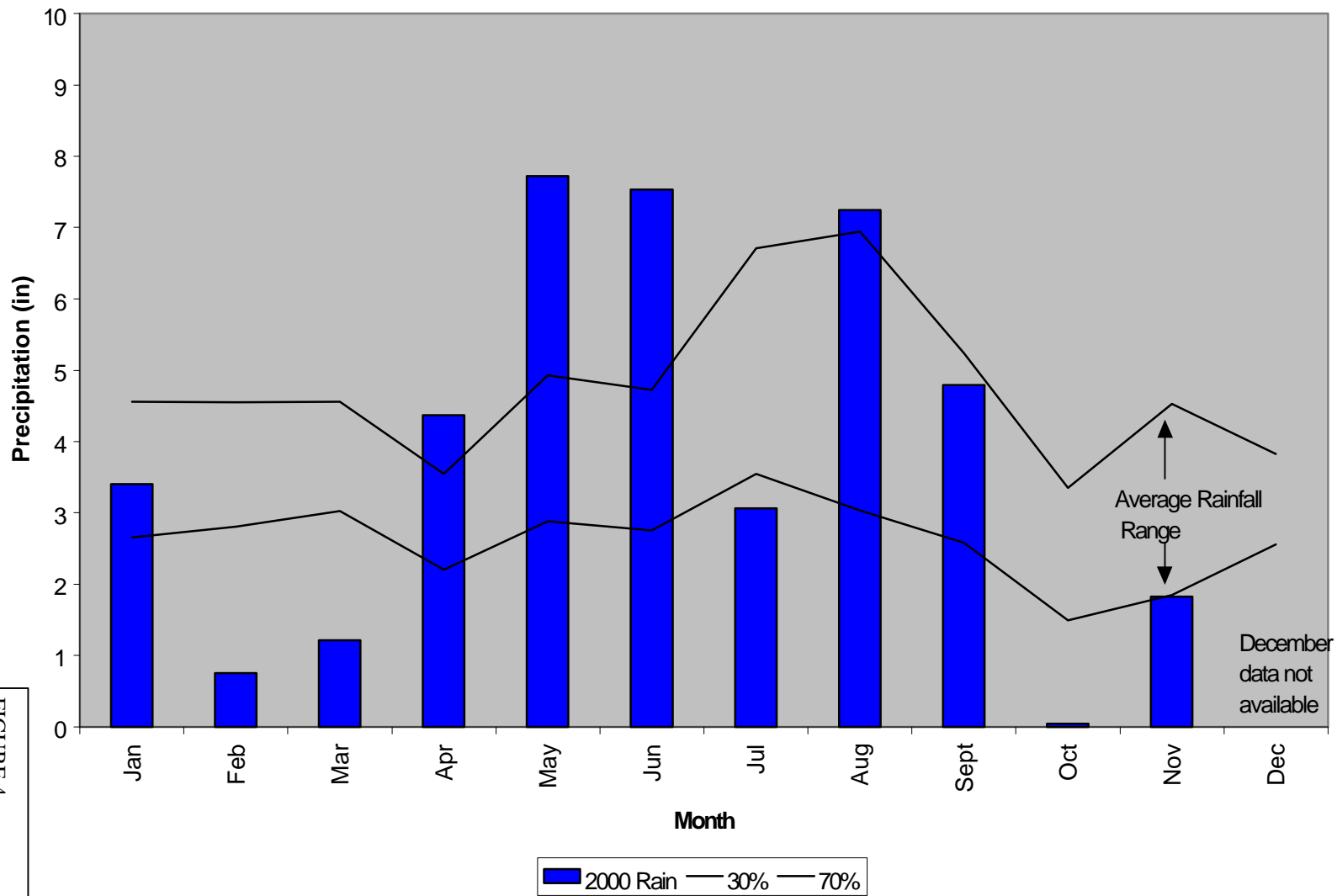
### **2.3.2 Climatic Data**

Figure 4 represents an examination of the local climate in comparison with historical data to determine whether 2000 was “normal” in terms of climate conditions. The figure compares the rainfall from 2000 with that of historical rainfall (data collected between 1948 and 1996). All rainfall data was collected from the NC State Climate Office. The graph shows 2000 rainfall totals from January 2000 through the end of November 2000 which includes the growing season for this site. In the year 2000, February, March, and October had extremely below normal rainfall; July and November were below normal. May and June, showed significantly above average rainfall.

As previously mentioned, in 1999 monitoring gauges TT-3, TT-5, and TT-6 showed saturation for less than 10% of the growing season. By comparison in 2000, TT-3 showed saturation for 25% of the growing season from May 29 to July 27; TT-5 for 33% of the growing season from July 24 to October 11; and TT-6 for less than 10% of the growing season. The months of April, August and September exhibited rainfall at or slightly above the normal range. There were high rainfall amounts through April, May, and June with the May and June data being substantially above normal. These results contributed to the longer periods of saturation exhibited by the gauges. However, groundwater levels were maintained through the more normal rainfall periods of July, August and September and even into the low rainfall periods during October and November.



Tucker 30 - 70 Percentile Graph  
Elizabeth City, NC



December data not available

FIGURE 4  
30-70 Percentile Graph

## **2.4 Conclusions**

The year 2000 represents the second growing season that the hydrologic data has been examined. The majority of the monitoring gauges on site have shown saturation for long periods of time.. Hydrologic monitoring data in 2000 met or exceeded the success criteria for jurisdictional wetland hydrology. Gauges will continue to be closely monitored during subsequent field trips.

### **3.0 VEGETATION: TUCKER TRACT MITIGATION SITE (YEAR 2 OF 5)**

#### **3.1 Success Criteria**

NCDOT will monitor the site for five years. A 320 stems per acre survival criterion for planted seedlings will be used to determine success for the first three years. The required 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 will not exceed 20% of the total number of plants of all species planted.

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

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

##### **Zone 1: Wetland Reforestation (14.05 Acres)**

*Fraxinus pennsylvanica*, green ash

*Quercus falcata* var. *pagodaefolia*, cherrybark oak

*Quercus michauxii*, swamp chestnut oak

*Quercus phellos*, willow oak

*Quercus nigra*, water oak

##### **Zone 2: Wetland Reforestation (9.04 Acres)**

*Taxodium distichum*, bald cypress

*Fraxinus pennsylvanica*, green ash

*Quercus falcata* var. *pagodaefolia*, cherrybark oak

*Quercus michauxii*, swamp chestnut oak

*Quercus phellos*, willow oak

##### **Zone 3: Wetland Reforestation (1.89 Acres)**

*Quercus phellos*, willow oak

*Quercus nigra*, water oak

*Fraxinus pennsylvanica*, green ash

*Taxodium distichum*, bald cypress

*Quercus lyrata*, overcup oak

*Nyssa aquatica*, tupelo gum

### 3.3 Results of Vegetation Monitoring

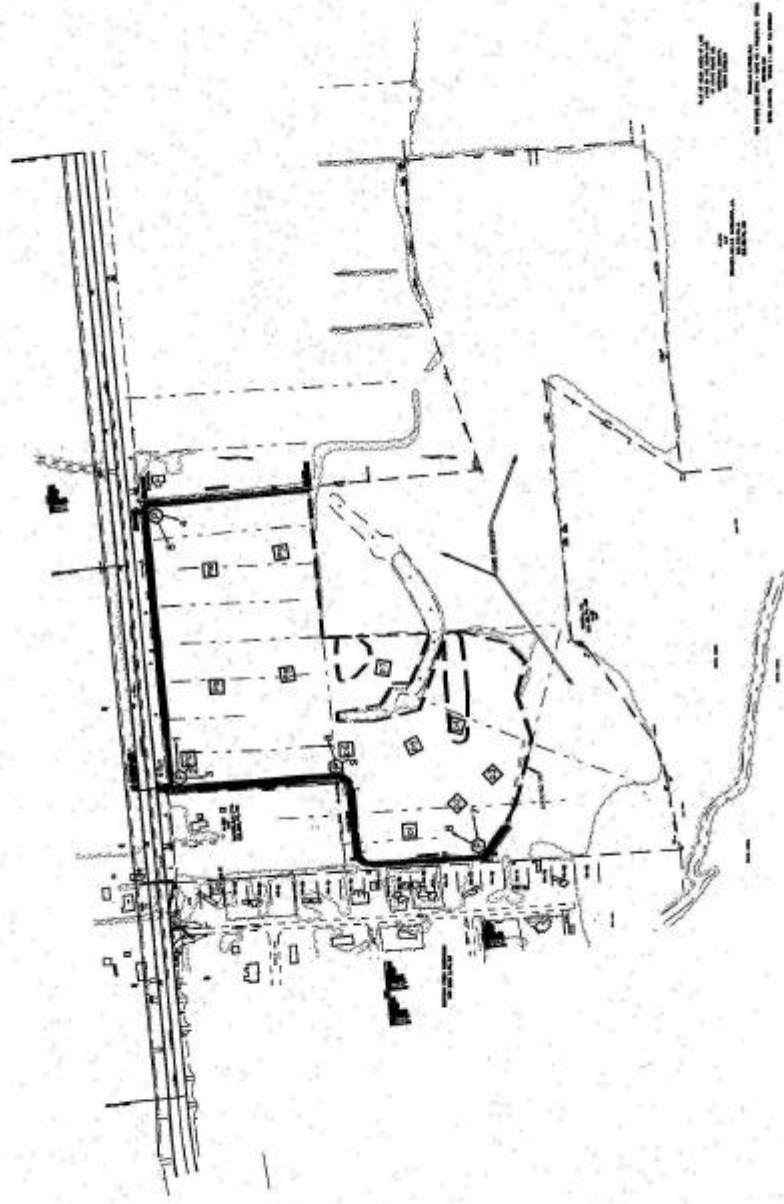
ZONE	Plot #	Overcup Oak	Tupelo Gum	Green Ash	Bald Cypress	Water Oak	Willow Oak	Sw. Chestnut Oak	Cherrybark Oak	Total (2 year)	Total (at planting)	Density (Tree/Acre)
1	4		1	11			12	7	7	38	55	470
	5			8			8	9	3	28	48	397
	8			17			8	4		29	52	379
	9			9			12	3	5	29	40	493
	10			8			5	1	1	15	39	262
	11			4			1	3	1	9	48	128
<b>ZONE 1 AVERAGE DENSITY</b>											<b>355</b>	
2	6	2			13		10	4	3	32	50	435
	7	4		1	10		4	2	8	29	62	318
	12	2		6	8		4		5	25	48	354
<b>ZONE 2 AVERAGE DENSITY</b>											<b>369</b>	
3	1	3	3	12	10		2		9	39	53	500
	2	3		1			2	8	13	27	51	360
	3	1	17	9	9		3		10	49	56	595
<b>ZONE 3 AVERAGE DENSITY</b>											<b>485</b>	
<b>TOTAL AVERAGE DENSITY</b>											<b>391</b>	

To determine tree density, 50' x 50' plots are installed immediately following planting. The actual number of planted trees which occur within the plot are counted. This number is equated to the number within each plot, which represents 680 trees per acre (average). The survival monitoring number is compared to the planted number to obtain survival percentage. This percentage is applied to the 680 trees per acre to obtain an estimated tree per acre for the site. (Density = monitoring count / planted trees x 680)

**Site Notes:** The site is well vegetated with various grasses including varieties of juncus and sedges. Surface water is present throughout the site. Other species noted: cardinal flower, water pennywort, duck potato, cattail and spike rushes.

**Tucker Farm Mitigation Site  
Photo and Plot Locations  
2000 Monitoring**

PROJECT IDENTIFICATION NO.	DATE
NO. OF SHEETS	PROJECT NO.
PROJECT NAME	PLANTING



### **3.4 Conclusions**

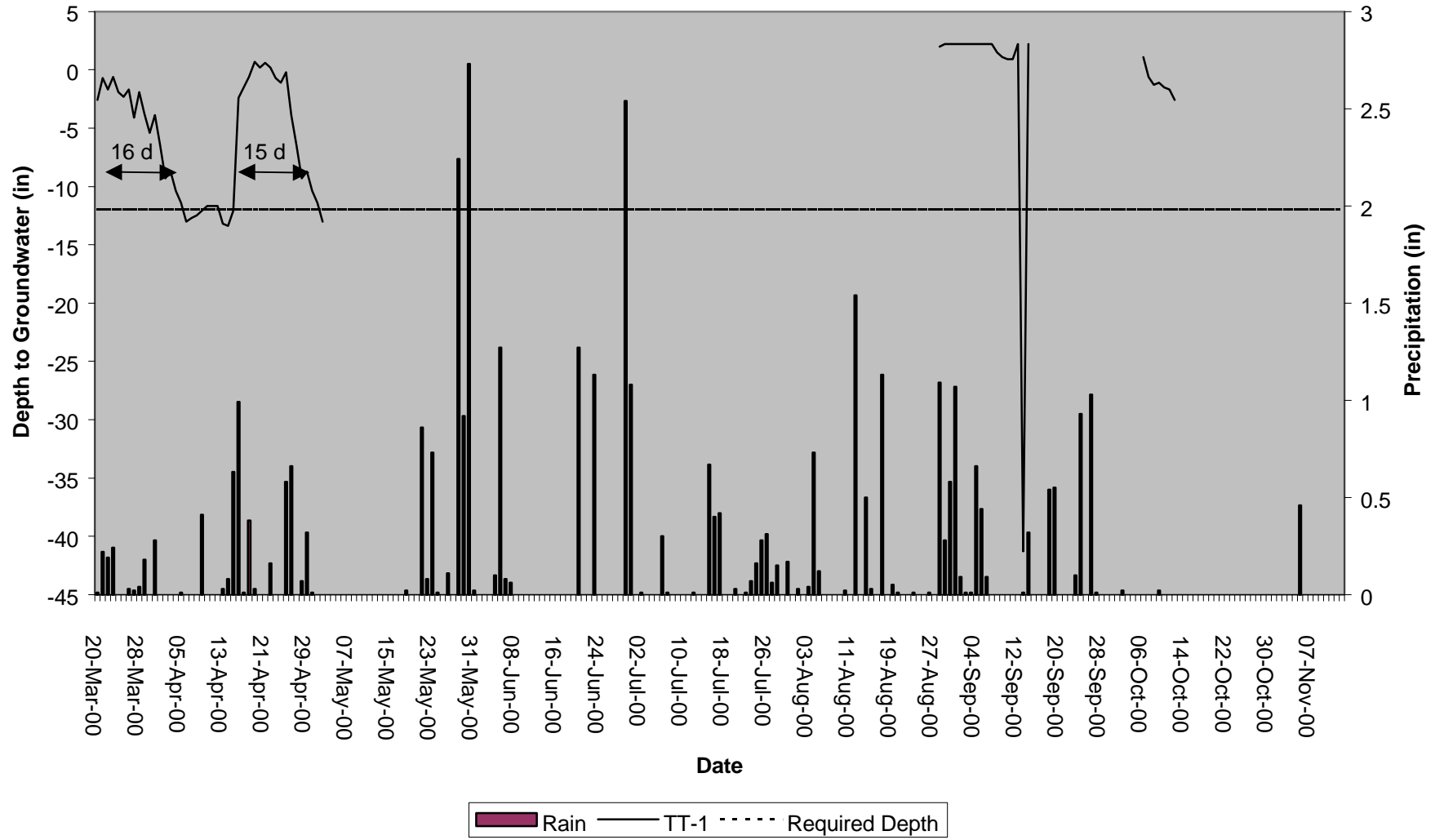
Of the 48 acres of this site, approximately 25 acres involved tree planting. There were 12 vegetation-monitoring plots established throughout the planting areas. The second year vegetation monitoring of the planted areas revealed an average density to be 391 trees per acre, which is above the minimum requirement of 320 trees per acre. Plots 10 and 11 did show density numbers of 262 and 128, and this can possibly be attributed to local elevated surface water and the presence of thick juncus. The average density in each planting zone remains above the minimum requirement of 320 trees per acre.

#### **4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS**

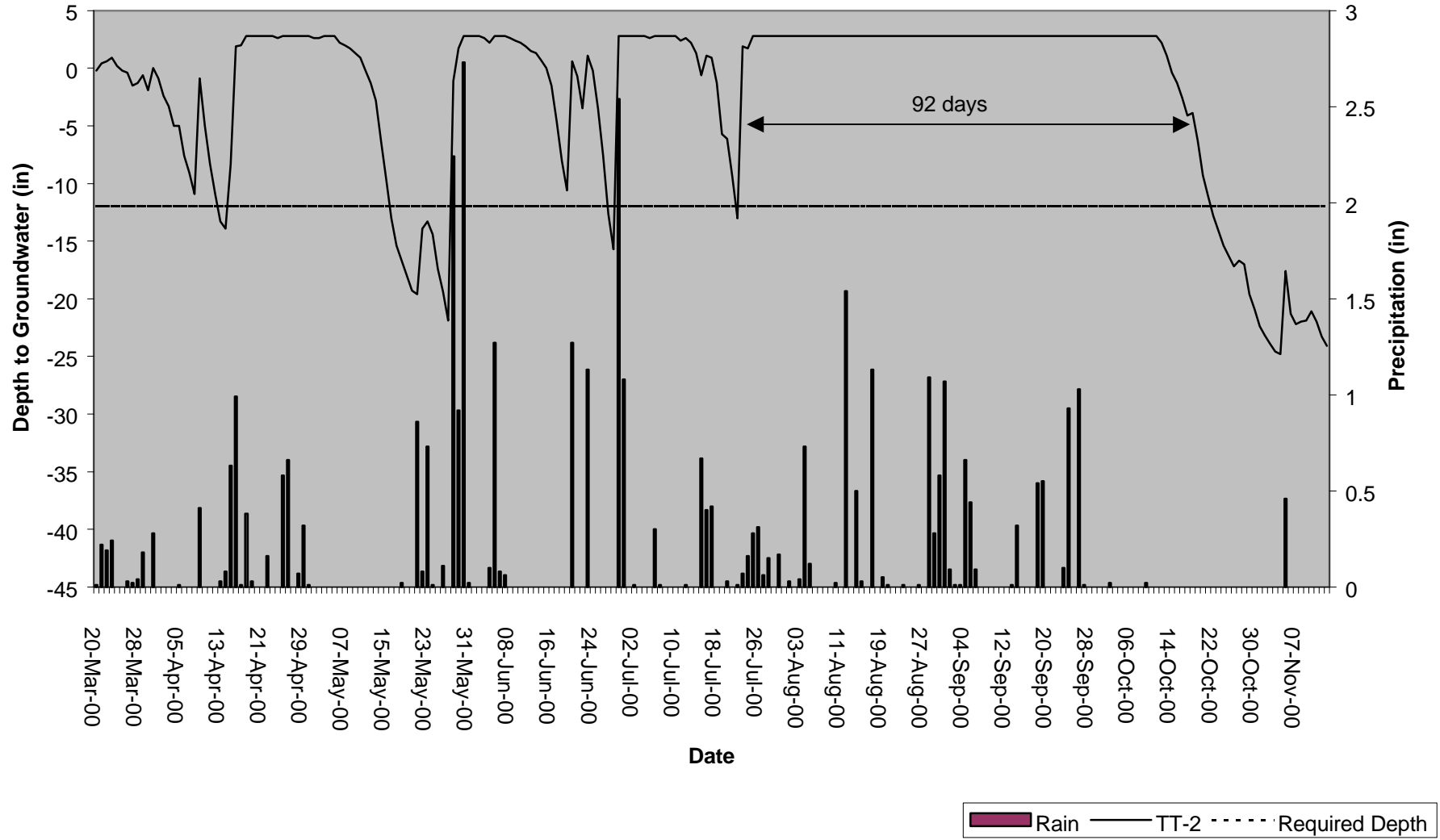
The results of the second year of monitoring indicate this site was successful. The majority of the groundwater gauges met the hydrologic success criteria. Gauge TT-1 malfunctioned multiple times during the year despite numerous maintenance efforts and will be replaced. Based upon a previous field investigation, gage TT-6 is situated in a locally high hummock rising approximately 8 inches above the surrounding area. Vegetation data also met success criteria. The average plot density was above the required 320 stems/acre, as well as densities within each zone. Vegetation and hydrologic monitoring will continue for a third year in 2001 at the Tucker Tract Mitigation Site.

**APPENDIX A**  
**DEPTH TO GROUNDWATER PLOTS**

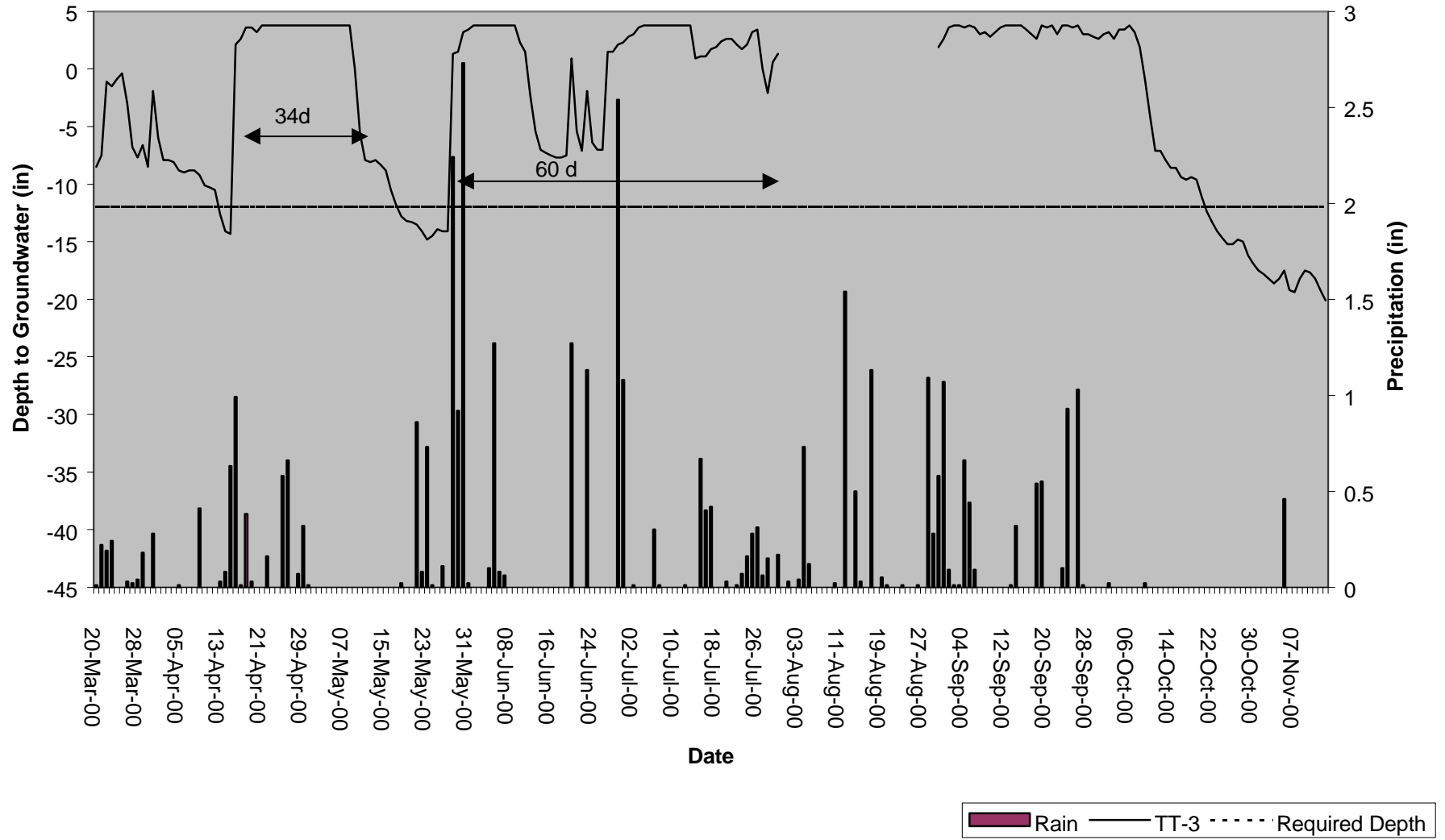
# TT-1



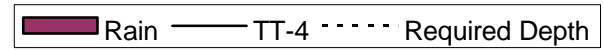
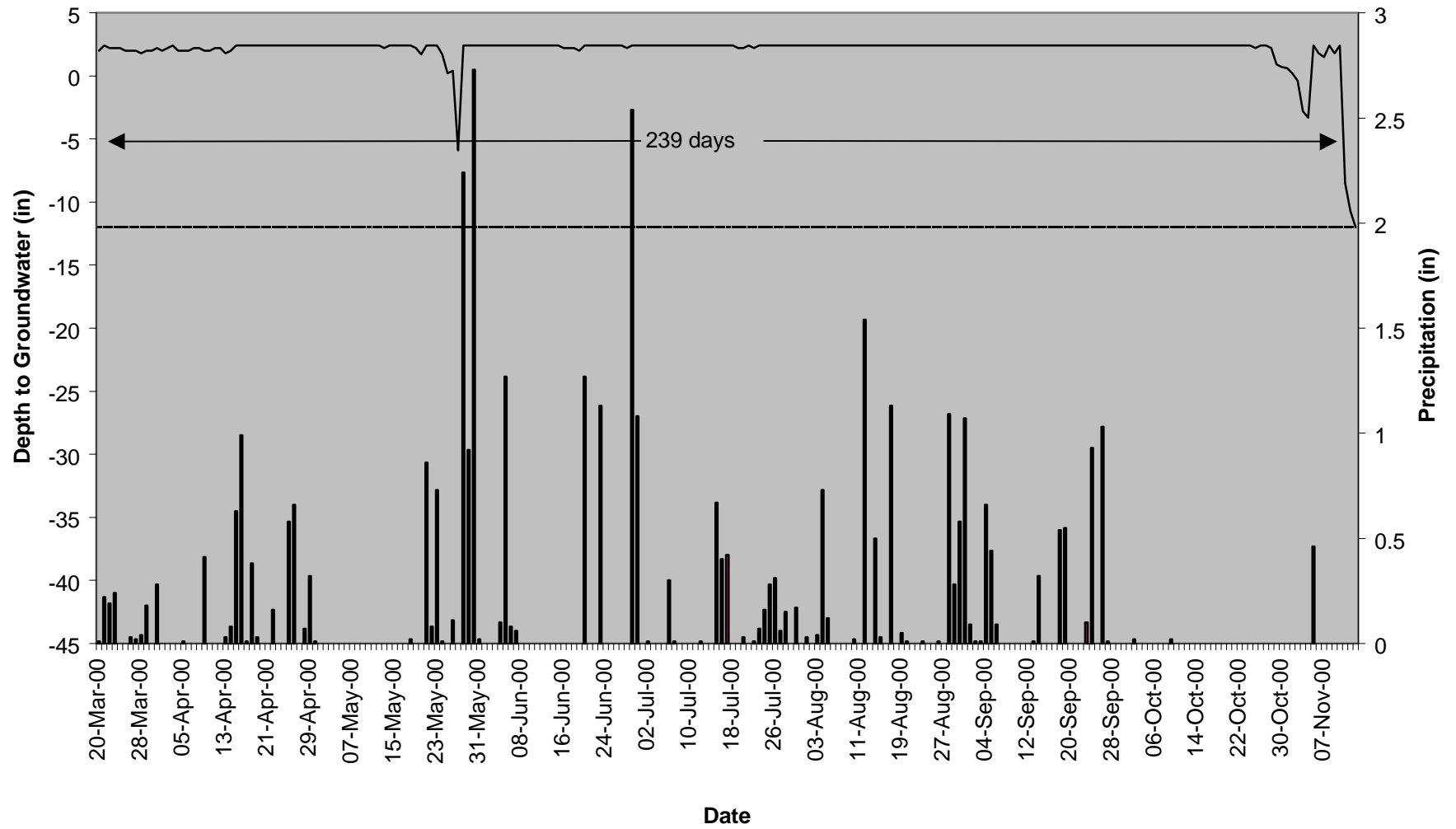
# TT-2



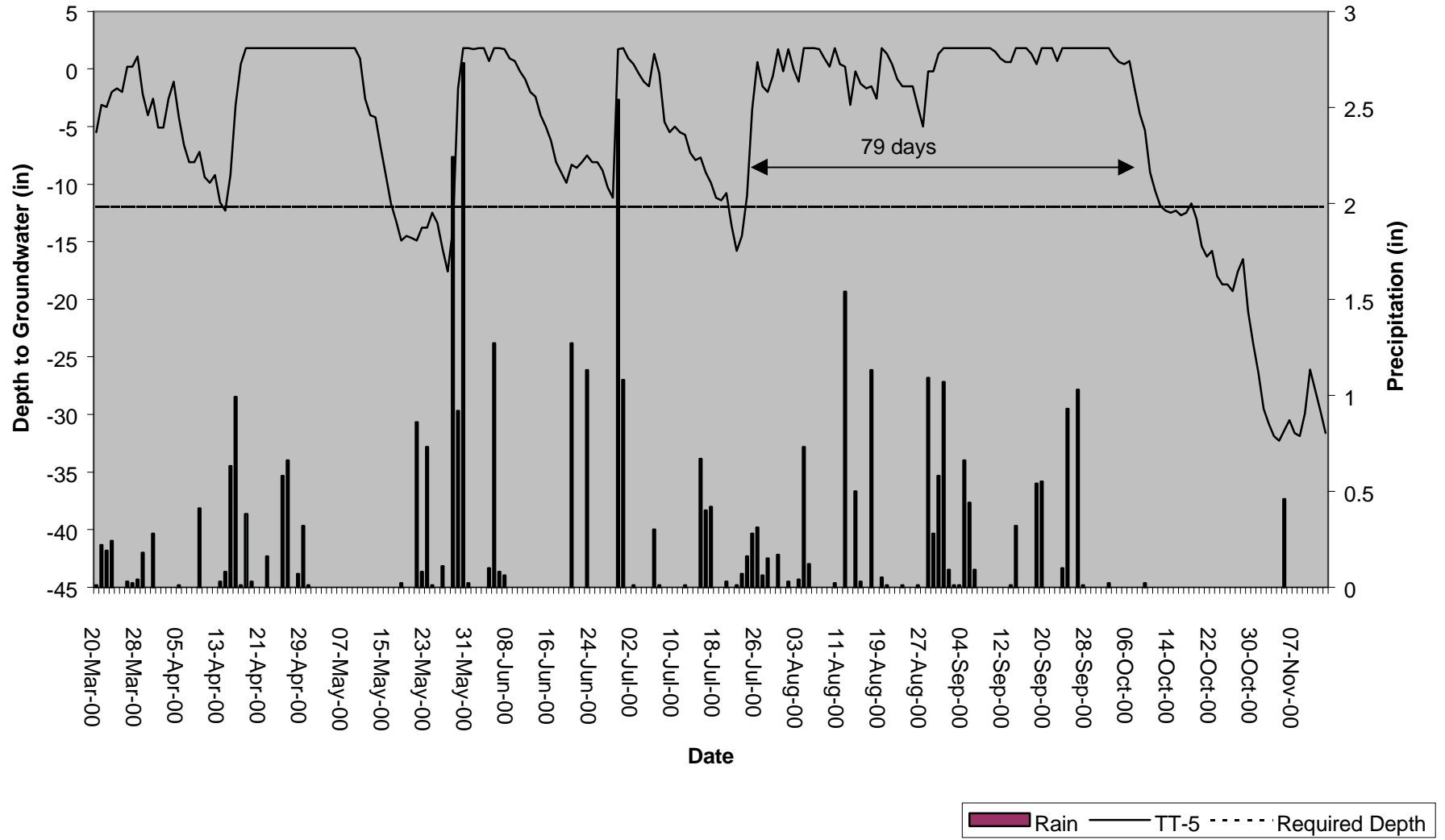
# TT-3



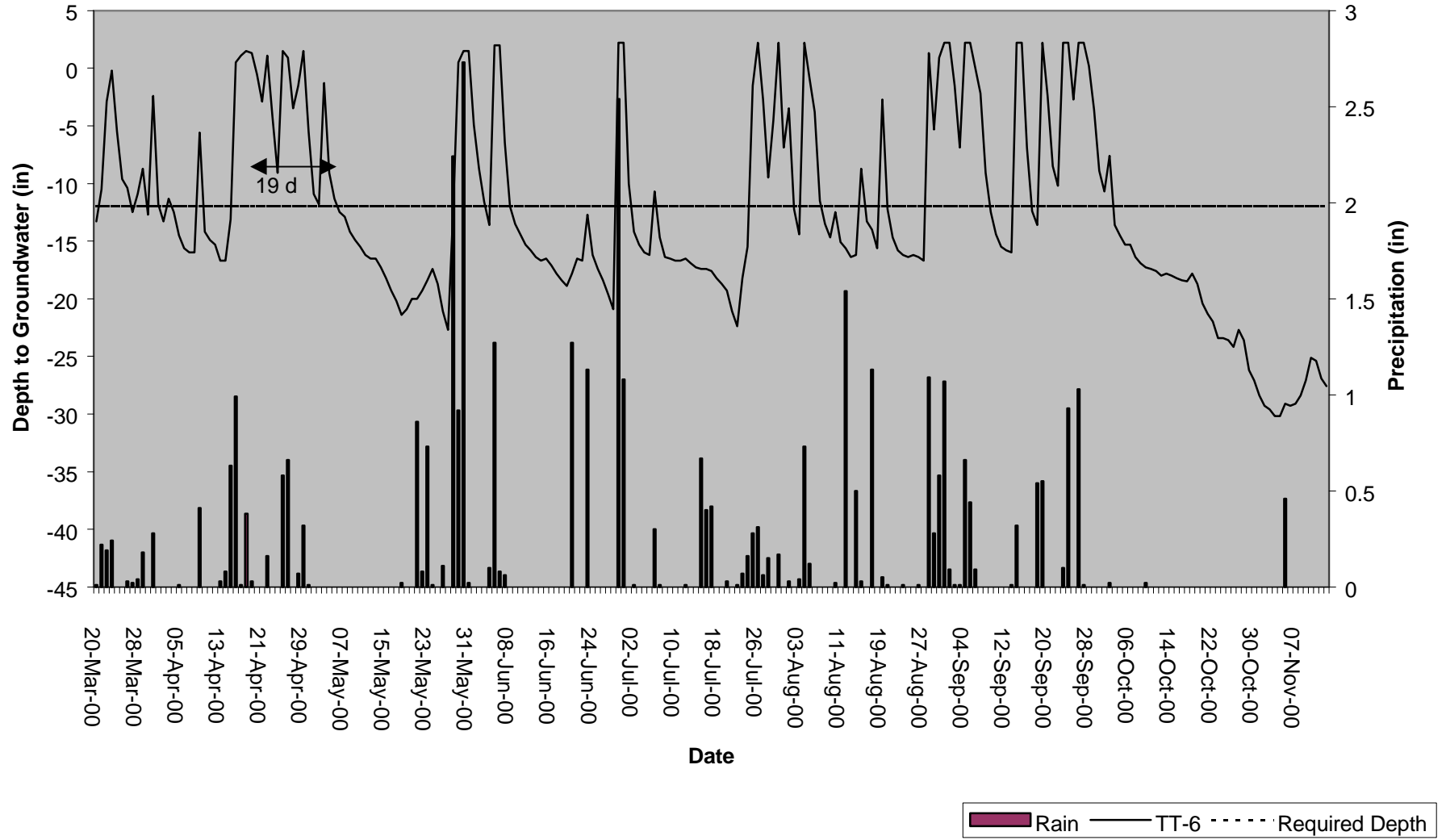
# TT-4



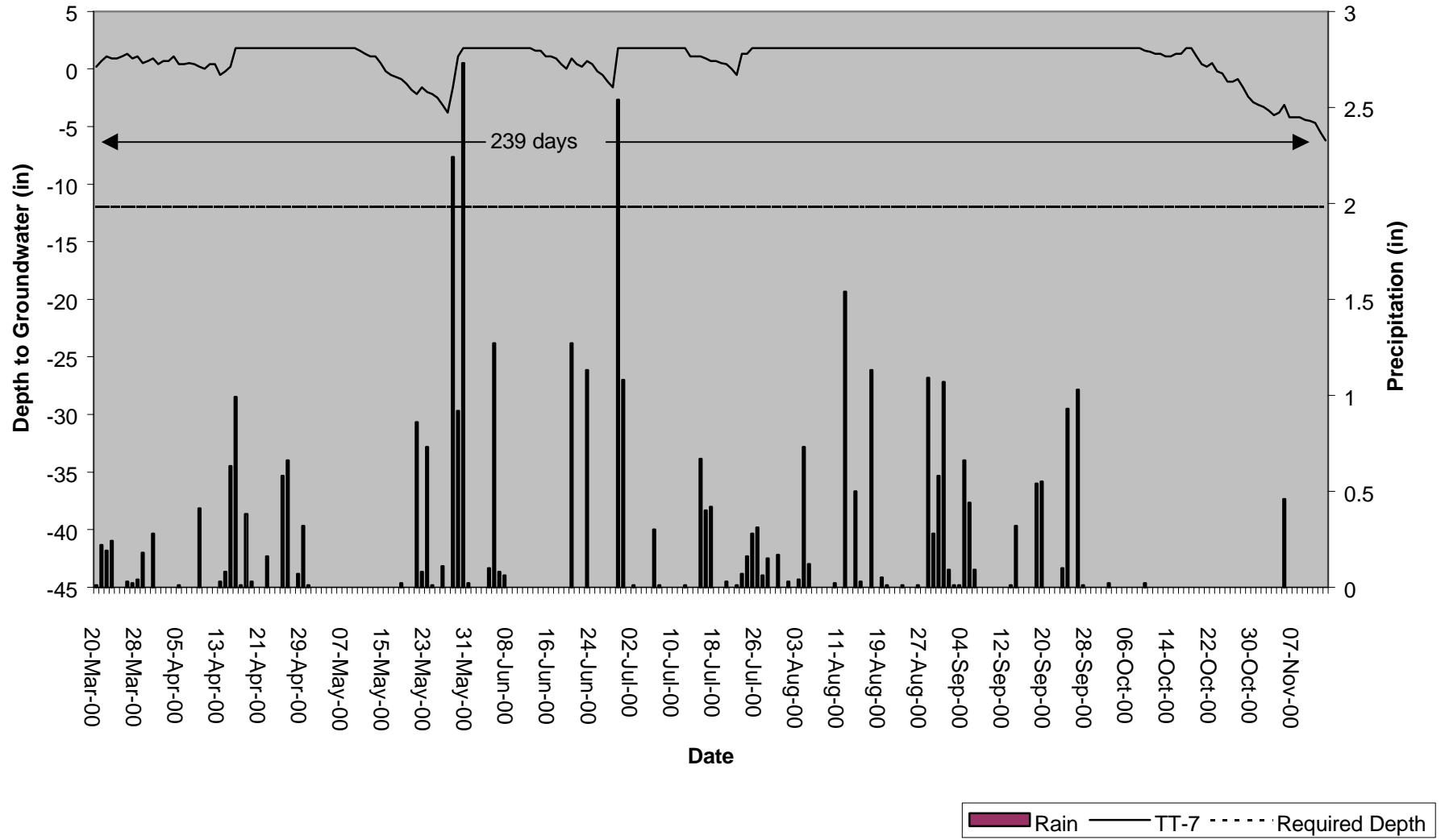
# TT-5



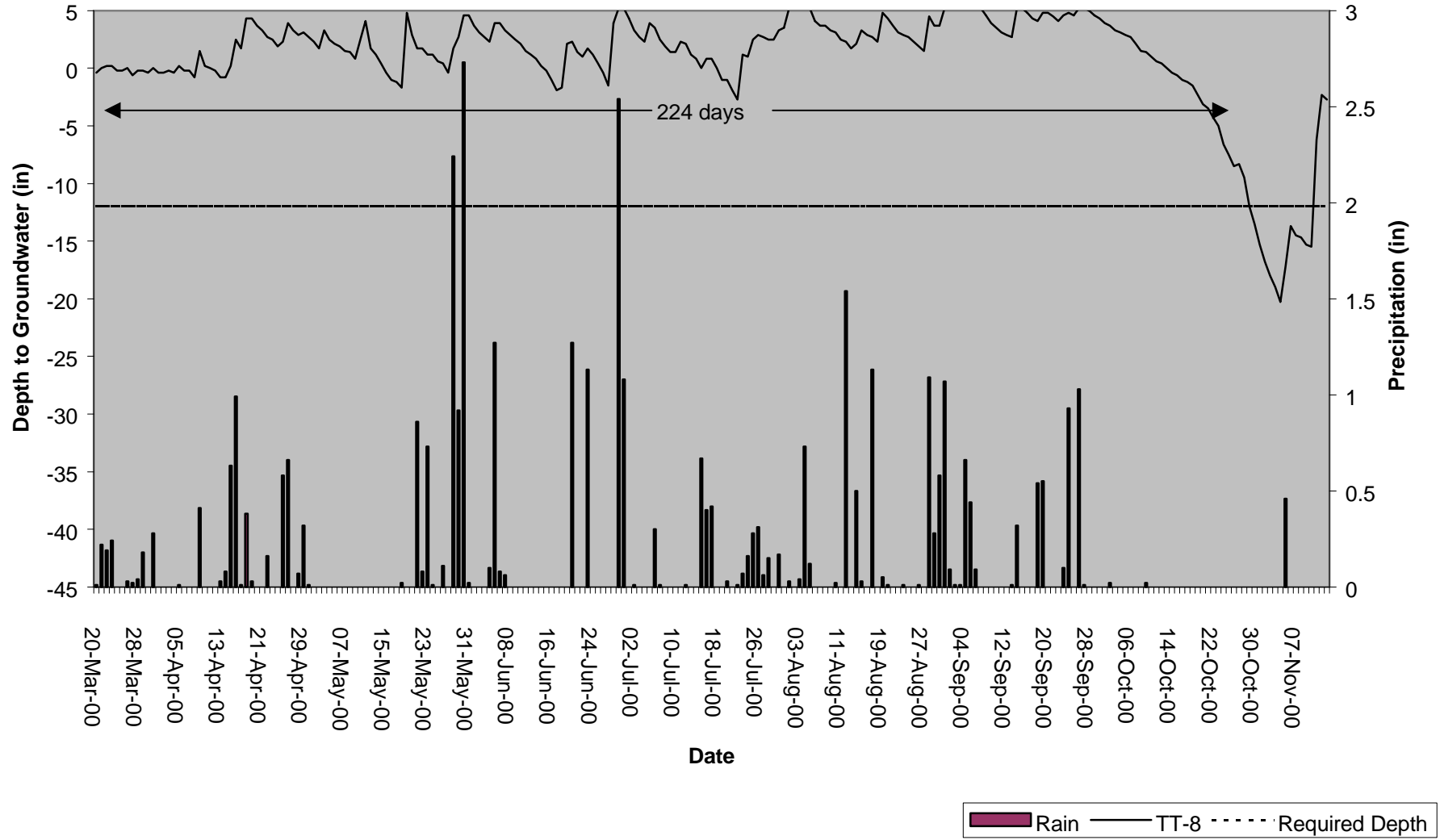
# TT-6



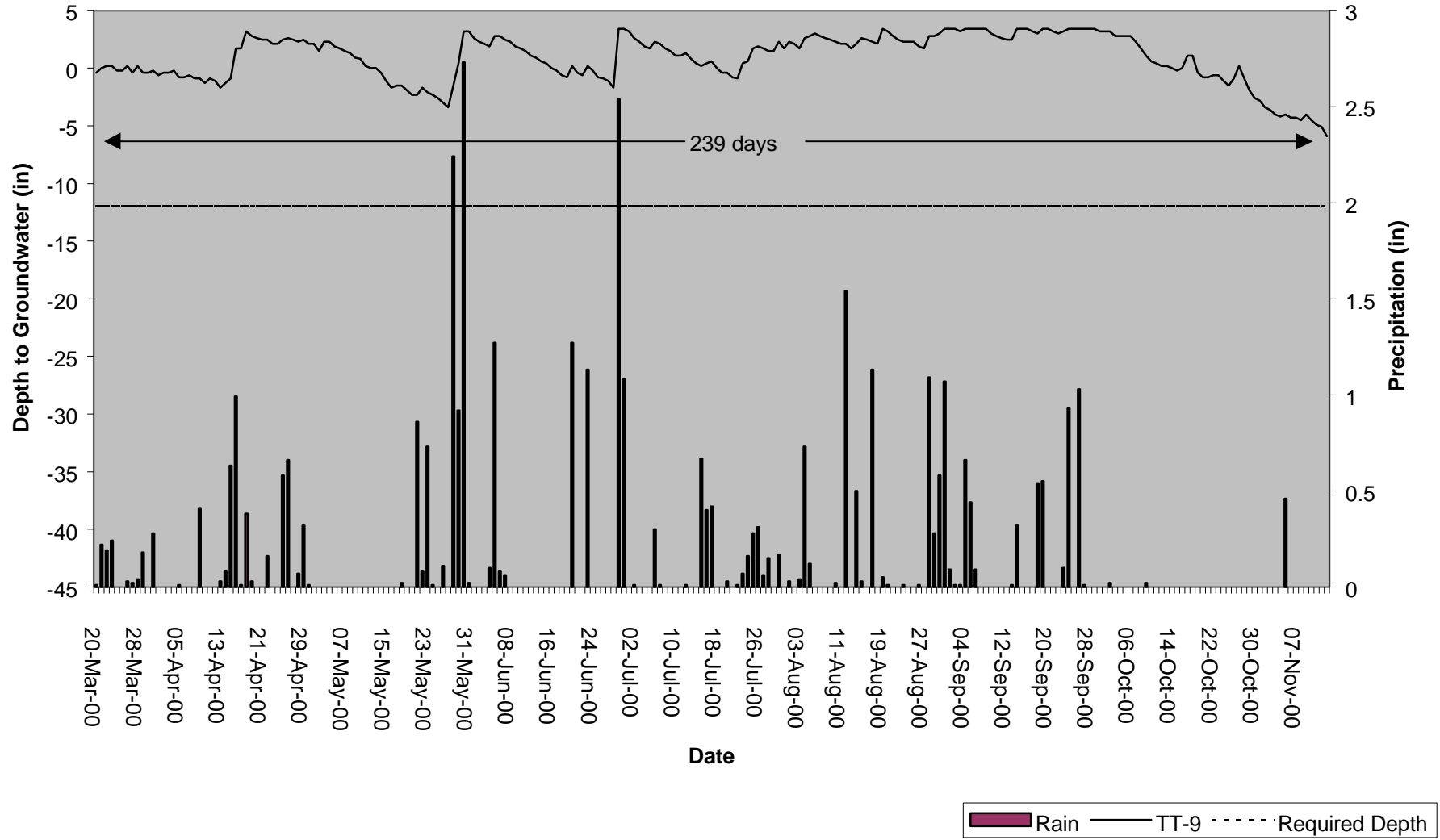
# TT-7



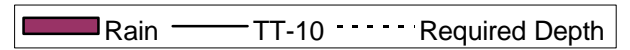
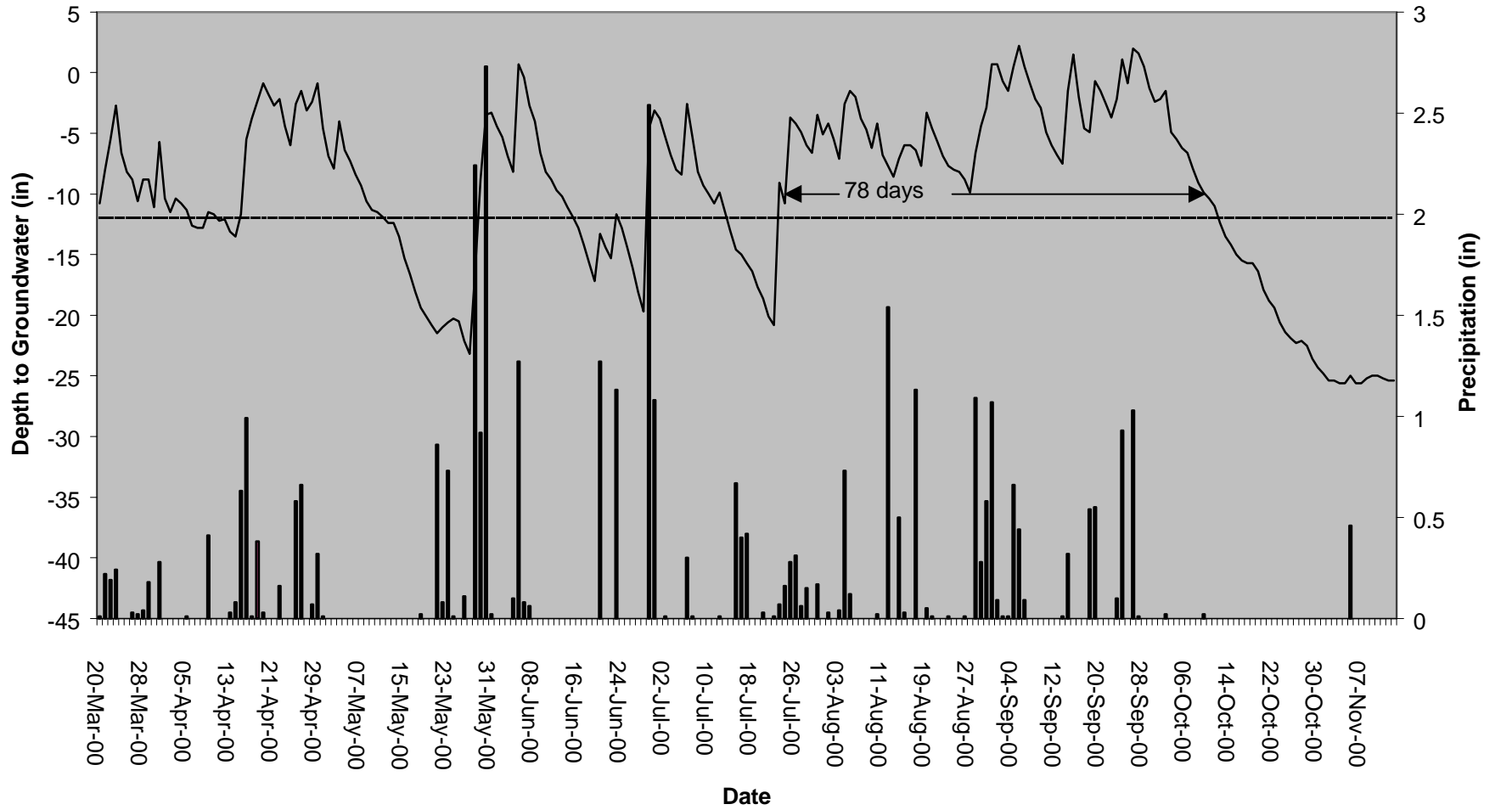
# TT-8



# TT-9



# TT-10



**APPENDIX B  
SITE PHOTOS**



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



**Photo 7**



**Photo 8**



**Photo 9**