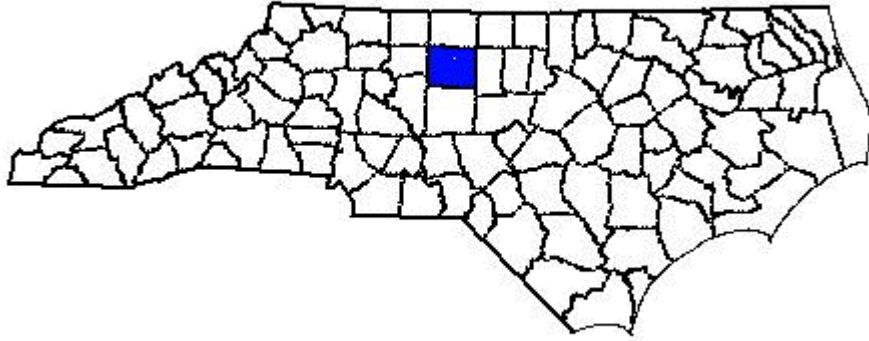


# ANNUAL REPORT FOR 2001



**South Buffalo Creek Mitigation Site  
Guilford County  
Project No. 8.U493501  
TIP No. I-2402 WM**



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December 2001

## TABLE OF CONTENTS

SUMMARY .....	1
1.0 Introduction .....	2
1.1 Project Description .....	2
1.2 Purpose .....	2
1.3 Project History .....	2
1.4 Debit Ledger .....	4
2.0 Hydrology .....	4
2.1 Success Criteria .....	4
2.2 Monitoring Methodology .....	4
2.3 Results of Hydrologic Monitoring .....	6
2.3.1 Site Hydrology.....	6
2.3.2 Climatic Data.....	8
2.4 Conclusions .....	8
3.0 Vegetation .....	10
3.1 Success Criteria.....	10
3.2 Description of Species .....	10
3.3 Results of Vegetation Monitoring.....	12
3.4 Conclusions .....	14
4.0 Overall Conclusions and Recommendations .....	15

### **TABLES**

Table 1 – Hydrologic Monitoring Results.....	6
Table 2 – Vegetation Monitoring Results.....	12
Table 3 – Randomly Selected Trees .....	13

### **FIGURES**

Figure 1 – Site Location Map .....	3
Figure 2 – Monitoring Gauge Location Map .....	5
Figure 3 – 2001 Hydrologic Monitoring Results.....	7
Figure 4 – 30 – 70 Percentile Graph .....	9
Figure 5 – Buffalo Creek Mitigation Photo Points and Plot Locations .....	12

### **APPENDICES**

Appendix A – Depth to Groundwater Plots.....	16
Appendix B – Site Photos.....	26

## **SUMMARY**

The following report summarizes the monitoring activities that have occurred in 2001 at the South Buffalo Creek Mitigation Site, representing the third year of hydrologic monitoring. Vegetation monitoring began in 1999 but was restarted with the additional requirement of monitoring the existing preservation area, therefore, 2001 represents the second year of vegetation monitoring.

The site is equipped with seven groundwater-monitoring gauges, 2 surface gauges, and 1 rain gauge that were installed in July 2000. For the 2001 monitoring period, data from the onsite (automatic recording tipping bucket) was used for the Groundwater plots. Rainfall data from the State Climatic Office was used for historical data in the 30-70 Percentile Graphs and onsite data was used for monthly precipitation.

Hydrologic monitoring resulted in five of the seven monitoring gauges recording the groundwater within 12 inches of the soil surface for more than 12.5 % of the growing season. Monitoring Gauges, G4 and G10, located in close proximity did not record sufficient hydrology to meet greater than the 12.5% hydrology requirement, however G10 was extremely close and met exactly 12.5% of the growing season but not greater than that amount.

Three vegetation-monitoring plots are located within the planted corridor, where the impervious subsurface wall was installed. These sites met the vegetation success criteria in 2001 with an average density of 524 trees per acre. In addition in 2001, monitoring of the existing forested area was conducted to demonstrate that wet-tolerant trees would show a lack of a negative impact from the increased water levels as a result of the impervious subsurface wall installed to increase hydrology.

Based on monitoring results of 2001, NCDOT recommends that hydrologic and vegetation monitoring continue.

## 1.0 INTRODUCTION

### 1.1 Project Description

The South Buffalo Creek Mitigation Site is located in Guilford County west of the NC 6 interchange with I-85 on the southeast side of Greensboro (Figure 1). Approximately 58 acres in size, the site serves as compensatory mitigation for several highway projects, including the eastern Greensboro Bypass (I-2402), the Northeastern Urban Loop (U-2525) and the widening of I-40 (I-2201 F/E). The Debit Ledger (Section 1.4) illustrates acreage used by projects as well as acreage remaining. Site construction involved the installation of a subsurface impervious wall to retard groundwater flow in support of swamp and bottomland hardwood forests communities.

### 1.2 Purpose

In order to demonstrate successful mitigation, the South Buffalo Creek mitigation site is monitored for both hydrologic and vegetation restoration success as established in the mitigation plan. The site was first monitored in 1999. The following list depicts the history of the South Buffalo Creek Mitigation Site since implementation.

### 1.3 Project History

August – December 1998	Site Construction
February 1999	Site Planted
March – November 1999	Hydrologic Monitoring (1 <sup>st</sup> year)
August 1999	Vegetation Monitoring – (1 <sup>st</sup> year)
March – November 2000	Hydrologic Monitoring (2 <sup>nd</sup> year)
July 19, 2000	Infinities Rain Gauge Installed
February 2000	2 - 40" Groundwater Gauges Installed
November 2000	Existing forested area monitored (1 <sup>st</sup> year)
November 2000	Vegetation Monitoring (1 <sup>st</sup> year - restarted)
March - November 2001	Hydrologic monitoring (3rd Year)
September 2001	Vegetation Monitoring (2 <sup>nd</sup> Year)



## 1.4 Debit Ledger

South Buffalo Creek Guilford Co.	Mit. Plan		TIP DEBIT	TIP DEBIT	TIP DEBIT	TIP DEBIT
<u>Habitat</u>	<u>Acres</u> <u>at Start:</u>	<u>Acres</u> <u>Remaining</u>	<u>U-2525A</u> <u>I-2402D</u>	<u>I-2201 F</u>	<u>I-2402D mod.</u>	<u>Mit Work</u>
BLH Restoration 2:1	15.53	4.98	9.1	0.96	0.35	0.14
BLH Preservation 7:1	16.2	2.21	9.4	3.36	1.23	
TOTAL	31.73	7.19	18.5	4.32	1.58	0.14

## **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 ground water for a consecutive 12.5% of the growing season. Areas inundated 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 hydrophytic vegetation and hydric soils.

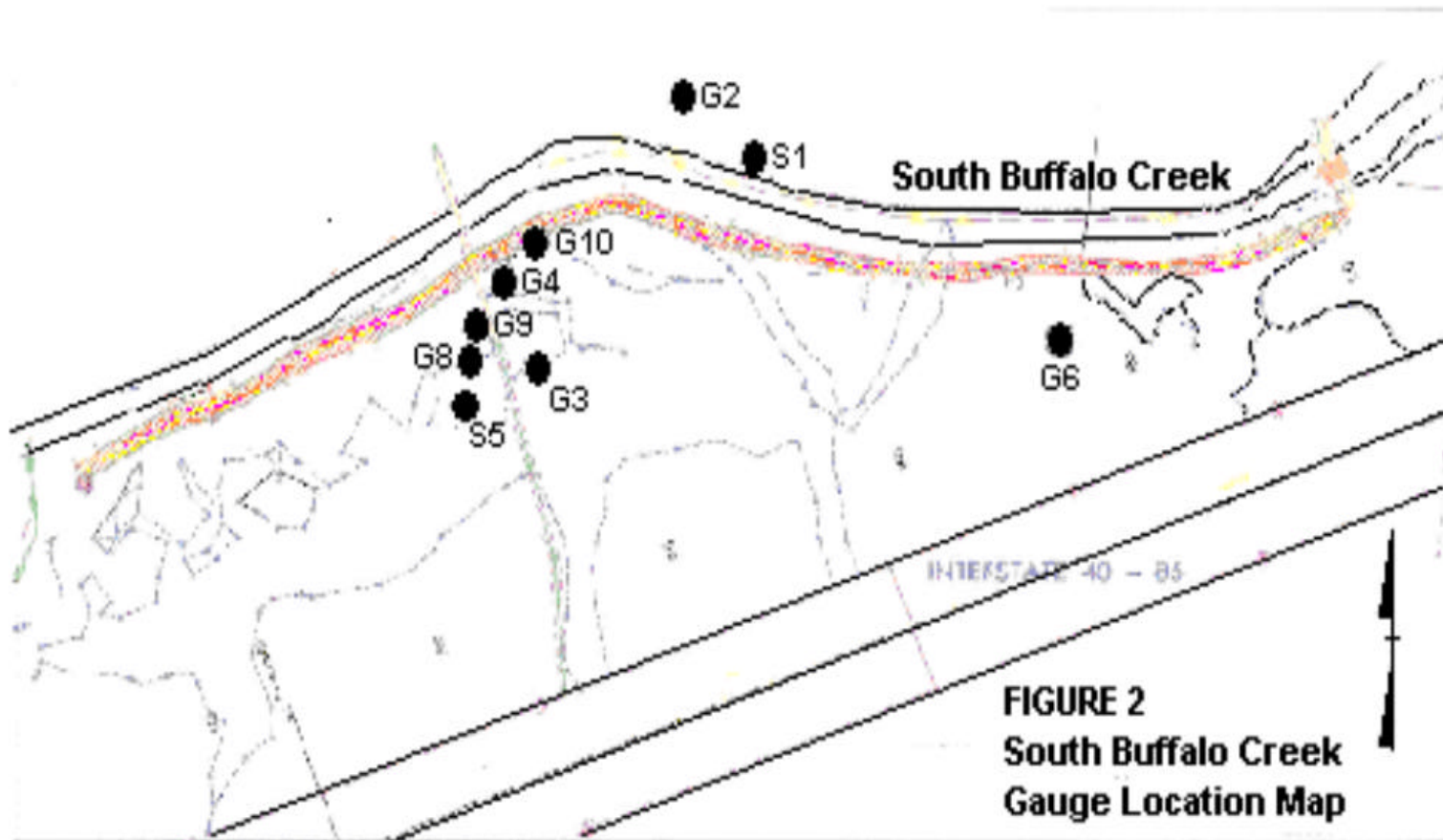
The growing season in Guilford County begins March 26 and lasts until November 6. These dates correspond to a 50% probability that air temperature will drop to 28° F lower after March 26 and before November 6.<sup>1</sup> Thus the growing season is 224 days; optimum hydrology requires 12.5% of this season, or 28 days. Local climate must represent average conditions for the area.

### **2.2 Monitoring Methodology**

Four groundwater monitoring gauges, two surface gauges, and one rain gauge were installed in winter 1998 after site construction (Figure 2). An additional groundwater gauge was installed in early May 1999 and two 40-inch groundwater gauges were installed in February 2000. An Infinity rain gauge replaced the original rain gauge in July 2000. Daily readings were taken throughout the growing season. Appendix A contains a plot of the water depth for each groundwater monitoring gauge and surface gauge. Monitoring results are shown from March 26 to November 6, 2001. Daily precipitation data from the onsite (Infinity rain gauge) is provided on each graph.

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<sup>1</sup> Soil Conservation Service, Soil Survey of New Hanover County, North Carolina, 1977.



## 2.3 Results of Hydrologic Monitoring

### 2.3.1 Site Hydrology

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 224-day growing season. Because it is uncertain if all wetlands impacted by NCDOT highway projects meet the 12.5% criteria, the monitoring gauge results are segmented into percentage ranges. Table 1 presents the monitoring results for the 2001 growing season as a range of percentages, actual percentages, and success dates of the longest hydroperiod on the site. Figure 3 depicts the location and hydrologic monitoring results of the groundwater gauges.

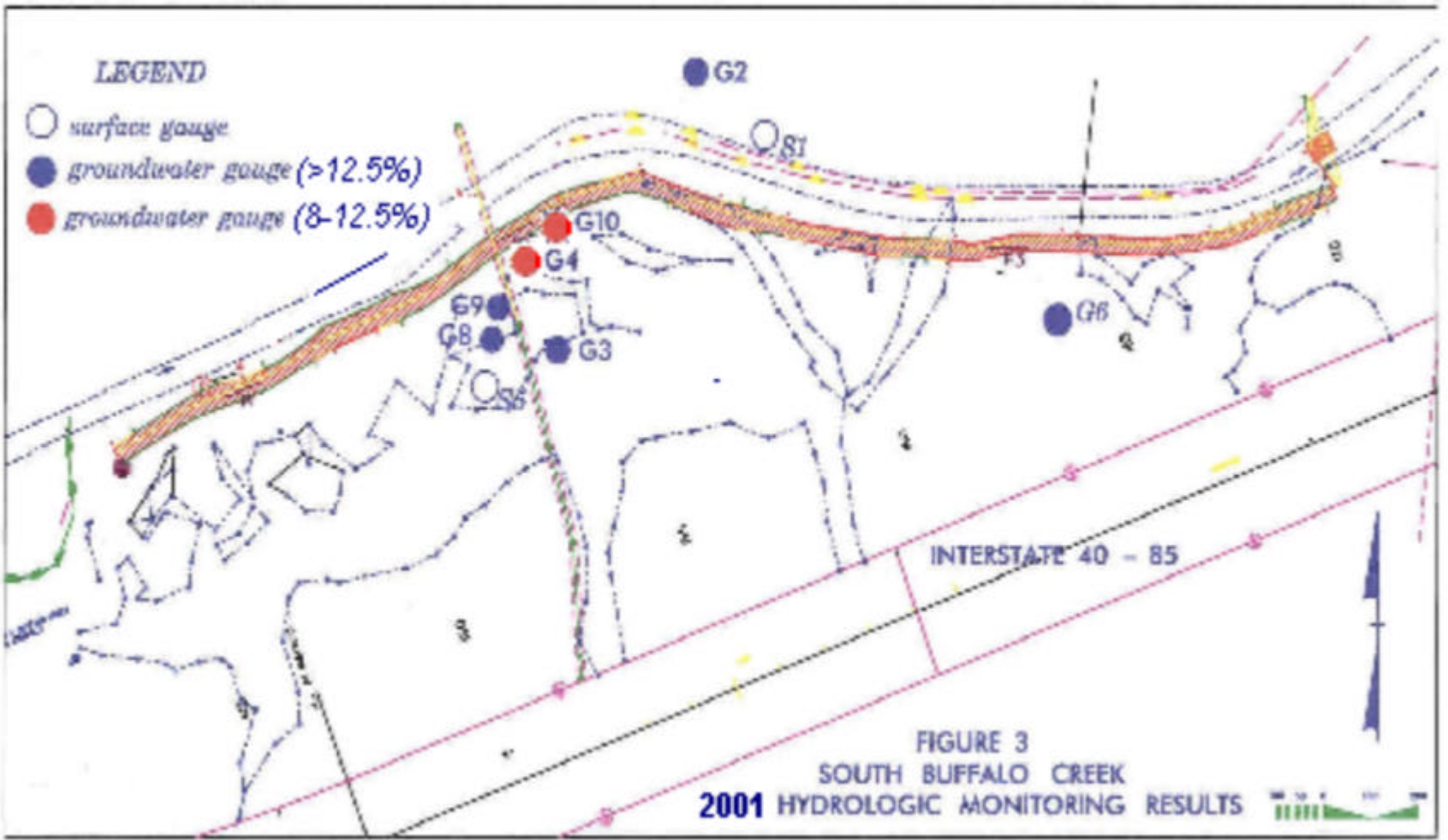
Table 1. HYDROLOGIC MONITORING RESULTS

Groundwater	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %	Dates
G2 (reference)				✓	34.3	Mar 26 - Jun 10
G3				✓	18.3	Mar 26-May 5
G4			✓		8.9	Mar 26 - Apr 14
G6				✓	17.4	Mar 26-May 3
G8				✓	16.9	Mar 26-May 2
G9				✓	16.5	Mar 26-May 6
G10			✓		12.5	Mar 26 - Apr 22

Precipitation for this area was slightly atypical (except for June rainfall) as rainfall for 2001 fluctuated between being drier than normal or wetter than normal. All data collected during the growing season were considered to determine hydrologic success of the site. Four of six gauges on the mitigation site recorded the water table within 12 inches of the surface for more than 12.5% of the growing season. In addition, the reference gauge, G2, recorded the water table within 12 inches of the surface for much more than 12.5% of the growing season. Groundwater gauges, G2 (reference), G3, G6 G8, G9 and G10 retained water for at least 12.5% of the time in early spring, in spite of the dry month of April.

Variation in microtopography is present throughout the wetland mitigation site and some areas such as that represented by G4 appear to be on a hummock. G4 did not retain water for any length of time after rainfall events. G8 was installed to represent the lower elevations in this area.

Surface water gauges indicated a consistent presence of surface water through mid-July with surface water frequently present throughout the growing season. The surface gauge, S5, contained an even pool of water until a drop in August, while the reference gauge, S1, had a prolonged period of inundation through early July followed by subsequent periods of drying and inundation.



### 2.3.2 Climatic Data

Figure 4 represents an examination of the onsite rainfall in comparison with local historical data to determine if 2001 rainfall occurs within the average rainfall range of the area. The historical data was provided by the National Climatic Data Center; the recent rainfall data was provided using the onsite Infinities rain gauge.

Precipitation on the South Buffalo Creek site began with a dry late winter/early spring (with the exception of an exceptionally wet March) and a wet summer during the months of July, August and September. Peaks and dips in rainfall did follow historic trends with March and July peaking in precipitation and autumn exhibiting the driest conditions.

## 2.4 Conclusions

Overall rainfall was uncharacteristic when compared with specific months, however, wet and dry periods generally correspond to historical trends. Four of six gauges as well as the reference gauge met hydrologic success criteria. During field inspection, G4 appeared to be located on a slight hummock, which might explain why it did not meet hydrological requirements. Gauge G10 appeared to be in a low wetland area, near the subsurface wall and it almost met requirements, recording 28 days of inundation. Climatic data showed a wetter than normal March followed by a drier than normal April, and the gauges that met the success criteria did so during this time period. A site visit is warranted to reexamine the locations of Gauges G4 and G10.

2001 South Buffalo Creek 30 - 70 Percentile Graph  
Greensboro, NC

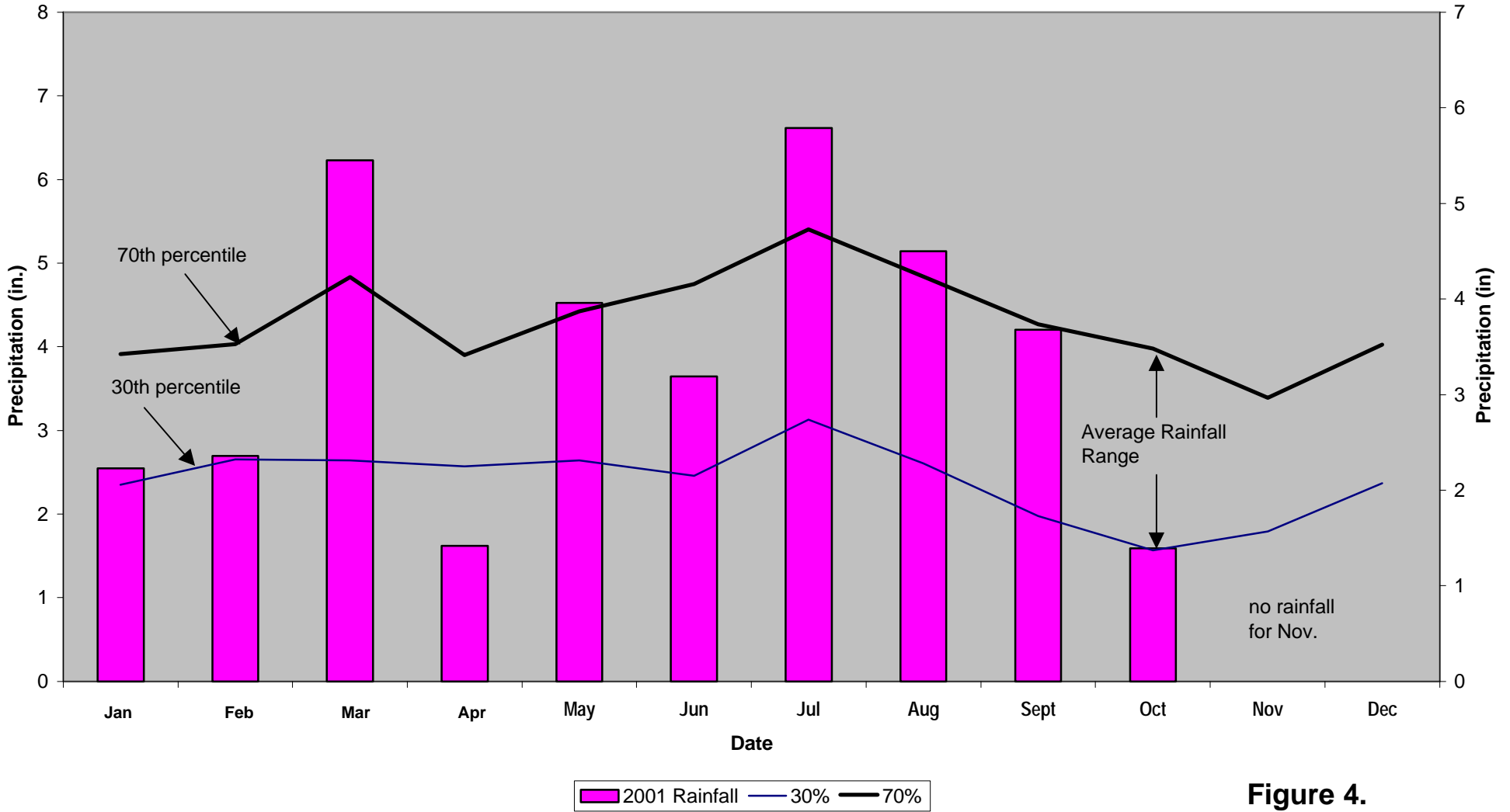


Figure 4.

### **3.0 VEGETATION: SOUTH BUFFALO CREEK MITIGATION SITE (YEAR 2 MONITORING)**

#### **3.1 Success Criteria**

Success Criteria states that within the poly-wall corridor there must be a minimum mean density of 320 trees per acre of approved target species surviving 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).

Success Criteria for the existing forested areas of the mitigation site will depend on the lack of a negative effect to the randomly selected trees in the restoration and preservation areas of the site. The existing forested sections of the site will be successful if 75% of the monitored wet-tolerant trees show a lack of a negative impact from the increased water levels.

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

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

*Fraxinus pennsylvanica*, Green Ash  
*Platanus occidentalis*, American Sycamore  
*Quercus lyrata*, Overcup Oak  
*Quercus michauxii*, Swamp Chestnut Oak  
*Quercus phellos*, Willow Oak  
*Quercus falcata* var. *pagodaefolia*, Cherrybark Oak

The following trees were marked in the existing forested Wetland Preservation and Restoration Areas of the site:

*Liriodendron tulipifera*, Tulip Poplar  
*Fraxinus occidentalis*, Green Ash  
*Ulmus americana*, American Elm  
*Quercus phellos*, Willow Oak  
*Acer rubrum*, Red Maple  
*Quercus michauxii*, Swamp Chestnut Oak  
*Carya ovata*, Shagbark Hickory  
*Liquidambar styraciflua*, Sweetgum  
*Acer saccharum*, Sugar Maple  
*Fagus grandifolia*, Beech  
*Ulmus alata*, Winged Elm

*Diospyros virginiana*, Persimmon  
*Quercus lyrata*, Overcup Oak  
*Quercus stellata*, Post Oak

The following trees were marked in the existing forested Wetland Reference Area of the site:

*Fraxinus pennsylvanica*, Green Ash  
*Betula nigra*, River Birch  
*Platanus occidentalis*, Sycamore  
*Ulmus americana*, American Elm  
*Salix nigra*, Black Willow  
*Carpinus caroliniana*, Iron Wood

### 3.3 Results of Vegetation Monitoring

Plot #	Green Ash	Sycamore	Overcup Oak	Swp Chestnut Oak	Willow Oak	Cherrybark Oak	Total (2 year)	Total (at planting)	Density (Tree/Acre)
1	13	2	10			11	36	41	597
2	12	17	2	1		1	33	45	499
3	16	9	2		1	5	33	36	623
<b>AVERAGE DENSITY</b>									<b>573</b>

**Site Notes:** Other species noted: Boxelder, cardinal flower, *Juncus* sp., smartweed, Japanese grass, fescue, jewelweed, cattail, woolgrass, *Sesbania* sp., *Bidens* sp., pokeweed, *Carex* sp., green briars, pawpaw, and volunteer sweet gum, green ash, sycamore, black willow, and hickory.

Randomly selected trees in the restoration and preservation area.

#	Species	2000 DBH	2001 DBH	#	Species	2000 DBH	2001 DBH
1	Green Ash	4.2	4.2	26	Sugar Maple	8.7	8.9
2	Green Ash	2.4	2.6	27	American Elm	8.7	8.8
3	River Birch	6.2	6.2	28	American Elm	14.7	15.1
4	Sycamore	8.7	8.8	29	Green Ash	8.4	8.4
5	American Elm	11.1	11.1	30	American Elm	11.2	11.4
6	Sycamore	12.2	12.5	31	Green Ash	14	14.1
7	Black Willow	7.2	7.7	32	Green Ash	7.6	7.8
8	American Elm	14.6	15	33	Beech	10.8	10.9
9	American Elm	7.5	7.5	34	Beech	5.2	5.3
10	Iron Wood	5.6	5.8	35	Swamp Chestnut Oak	6	6.4
11	Tulip Poplar	4.3	5	36	Beech	7.3	7.4
12	Green Ash	6.5	6.5	37	Winged Elm	10.3	10.5
13	American Elm	7.8	8	38	Persimmon	11.5	11.6
14	Willow Oak	11	11.2	39	Overcup Oak	7.9	8.1
15	Green Ash	12	12.3	40	Overcup Oak	3.2	3.3
16	Red Maple	9.2	9.1	41	Green Ash	7.4	7.5
17	Green Ash	10.5	10.5	42	Overcup Oak	8.1	8.4
18	Swamp Chestnut Oak	9.3	9.3	43	Swamp Chestnut Oak	4	4.3
19	Shagbark Hickory	9.3	9.4	44	Beech	2.7	2.9
20	Willow Oak	13.6	13.7	45	Swamp Chestnut Oak	5.9	6.3
21	Sweetgum	8.8	8.9	46	Winged Elm	3	3
22	Swamp Chestnut Oak	4.5	4.5	47	Winged Elm	4.3	4.3
23	Red Maple	13.1	13.1	48	Winged Elm	4.6	4.8
24	Green Ash	12.5	12.6	49	Post Oak	2.7	3.1
25	American Elm	8.8	9.2	50	Post Oak	6.9	6.9

Numbers 1-10 are in the reference area. Numbers 11-50 are in the preservation area.  
All trees measured at diameter at breast height (DBH, 4.5 feet above ground)

### 3.4 Conclusions

This site involved the planting of approximately 5 acres of bottomland hardwood forest. There were three plots established throughout the planting area, encompassing all plant communities. The vegetation monitoring revealed an average density of 524 trees per acre, which is well above the minimum 320 trees per acre required by the success criteria.

Fifty trees in the existing Reference, Preservation, and Restoration Areas have been tagged and identified for monitoring to ensure that increased hydrology is not detrimental to these trees. Yearly observations will be made for signs of stress.

NCDOT requests that the USACE modify the special conditions regarding vegetation monitoring and success in the following USACE Individual Permits.

Projects Mitigated for at South Buffalo Creek Mitigation Site		
USACE Action ID	TIP No.	Special Conditions
199300243	I-2402D/U-2525A	(j)
199820490	I-2201F	(j)
199820490	I-2201E	(k)

These special conditions should reflect the monitoring strategies and vegetation success described in this report and in the December 3, 1999 letter to USACE regarding South Buffalo Creek Mitigation Site.

## **4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS**

Hydrologic monitoring will continue for the fourth year in 2002 and vegetation monitoring will continue for the third year at the South Buffalo Creek Mitigation Site. NCDOT plans to continue monitoring existing, mature trees in the restoration and preservation areas of the site in 2002.

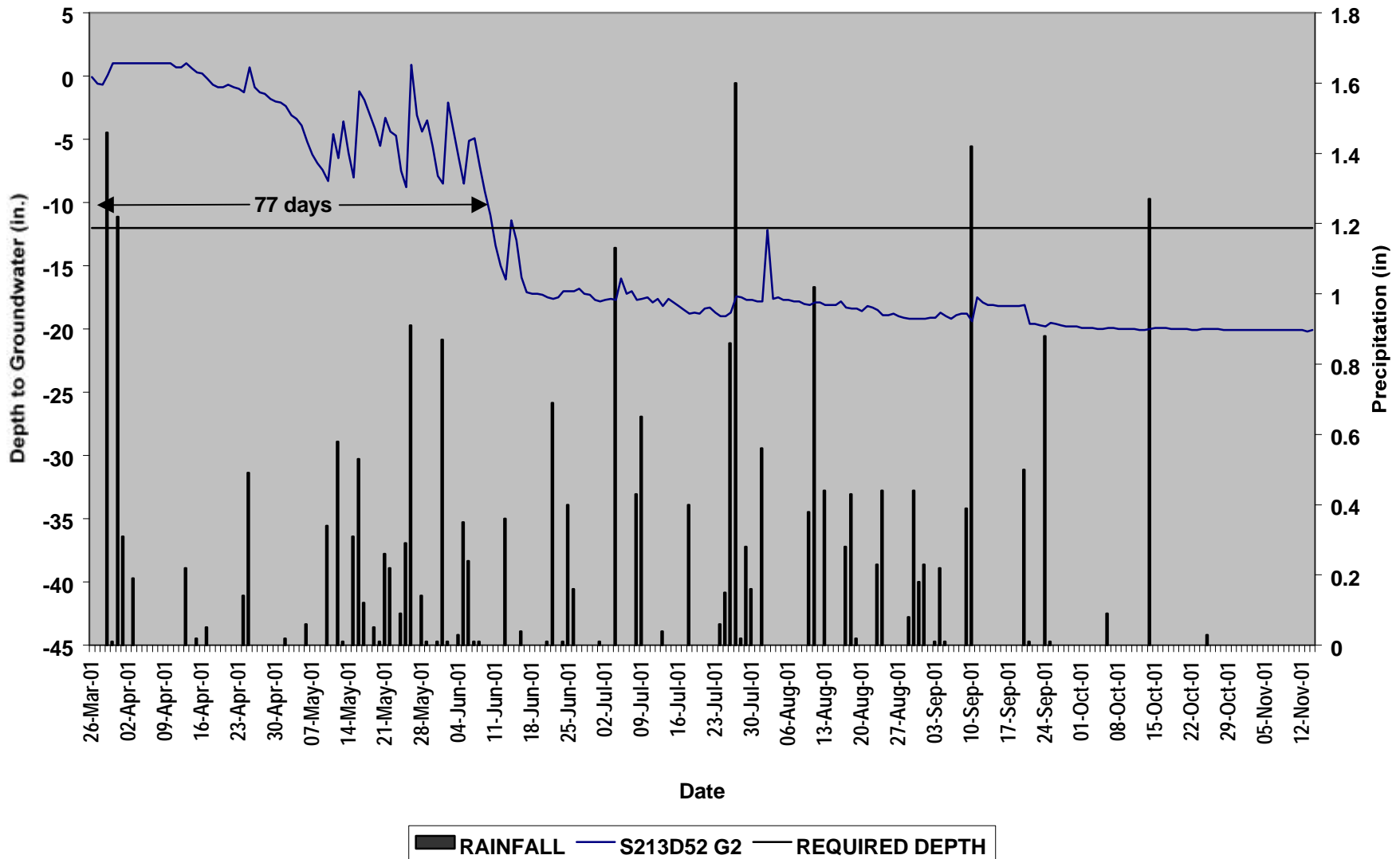
NCDOT requests that the United States Army Corps of Engineers modify the special conditions regarding vegetation monitoring and success for specific Individual Permits as mentioned in section 3.4 of this report.

Downloaded data from G4 and G10 will be examined, and if deemed necessary, additional gauges may be installed in the area to replace these gauges.

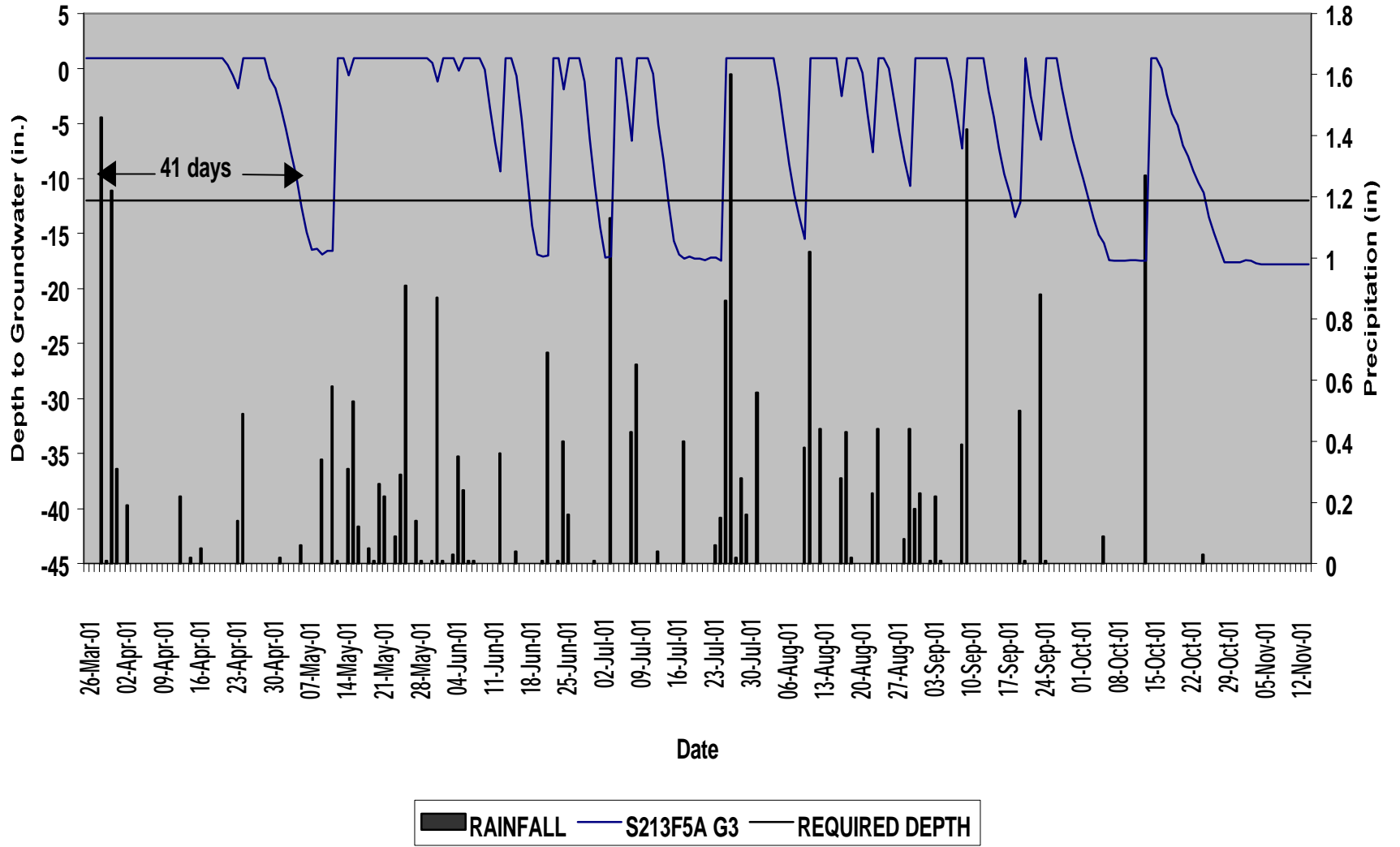
**APPENDIX A**

**DEPTH TO GROUNDWATER PLOTS**

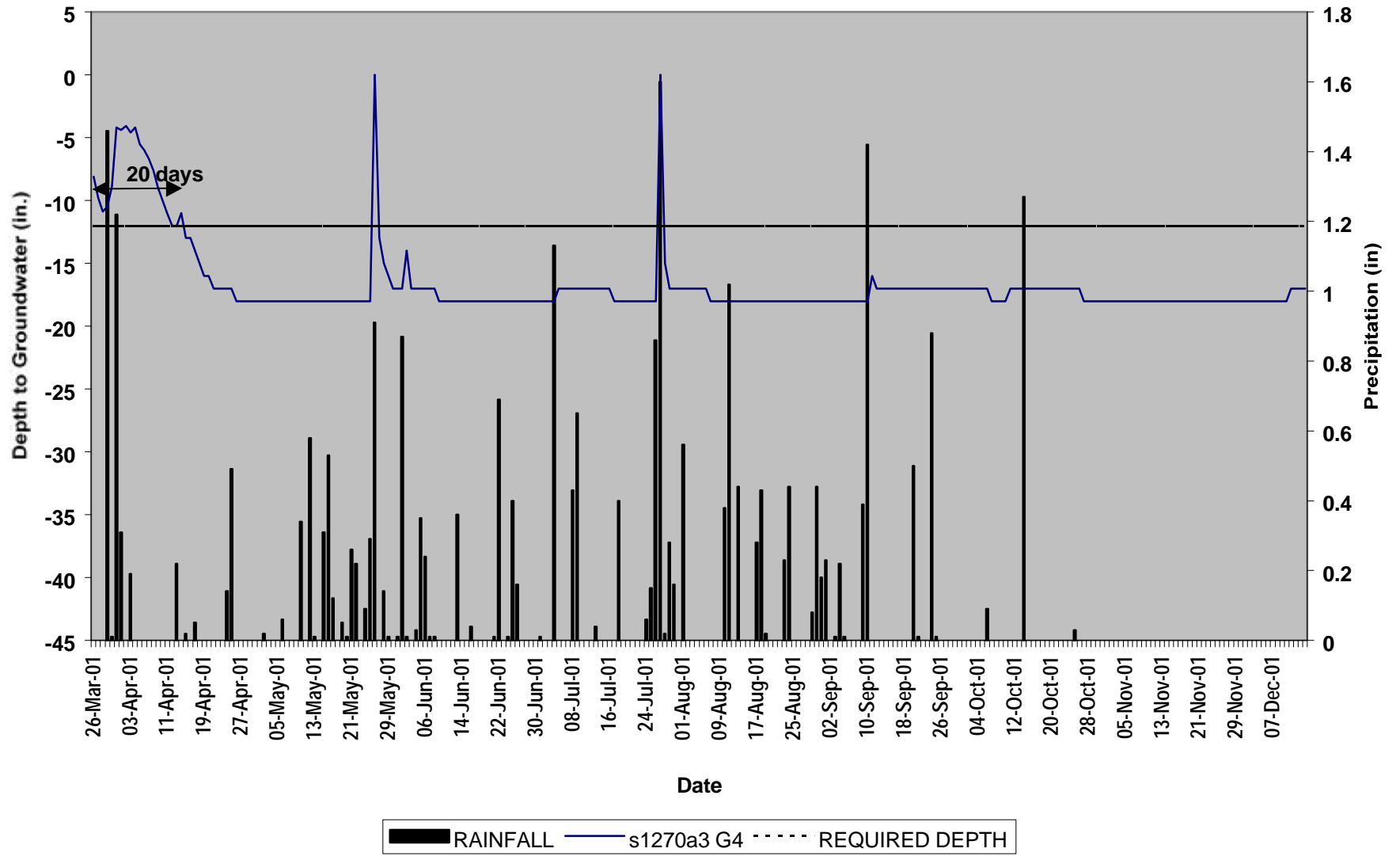
### South Buffalo Creek G2



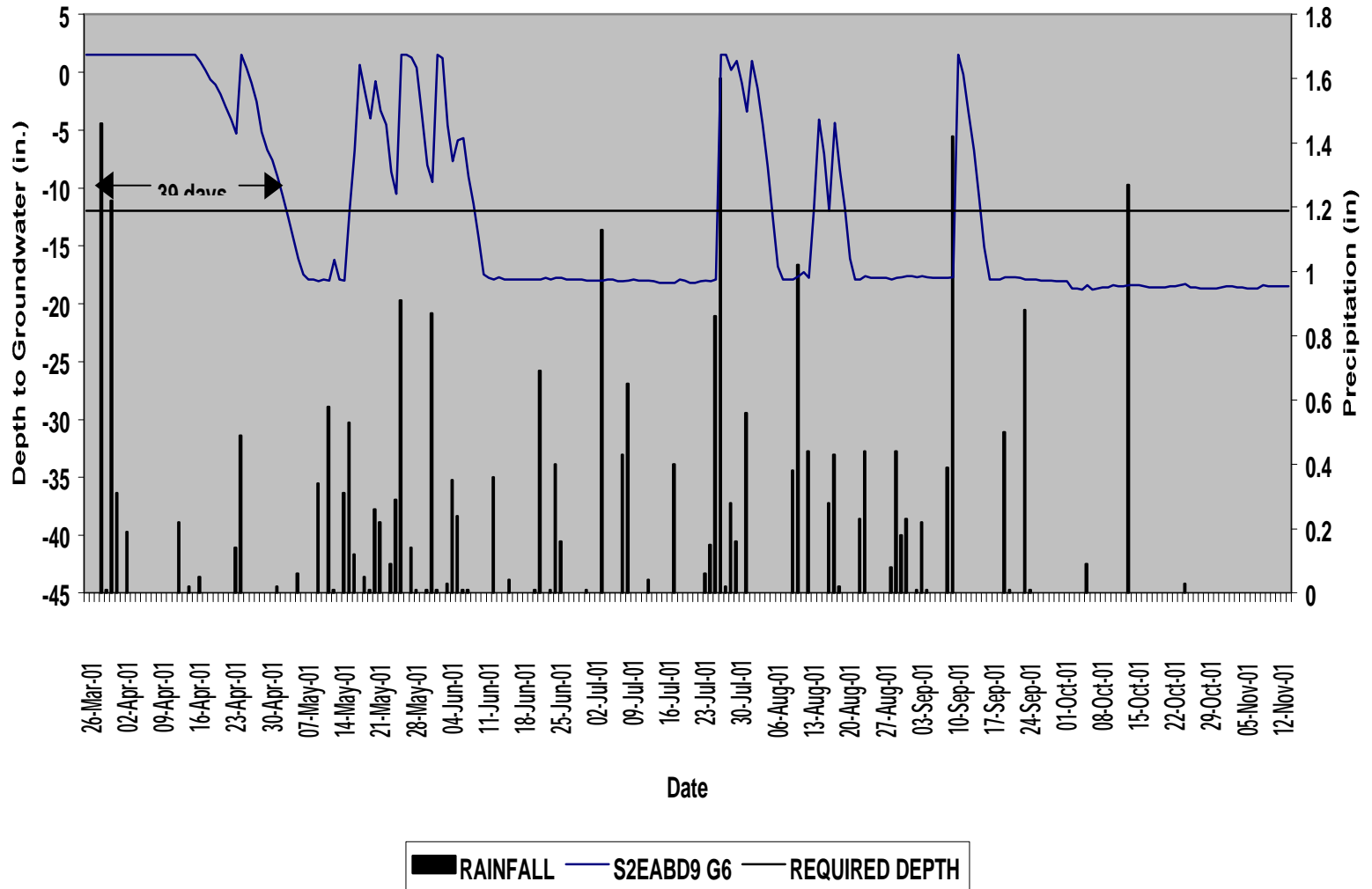
### South Buffalo Creek G3



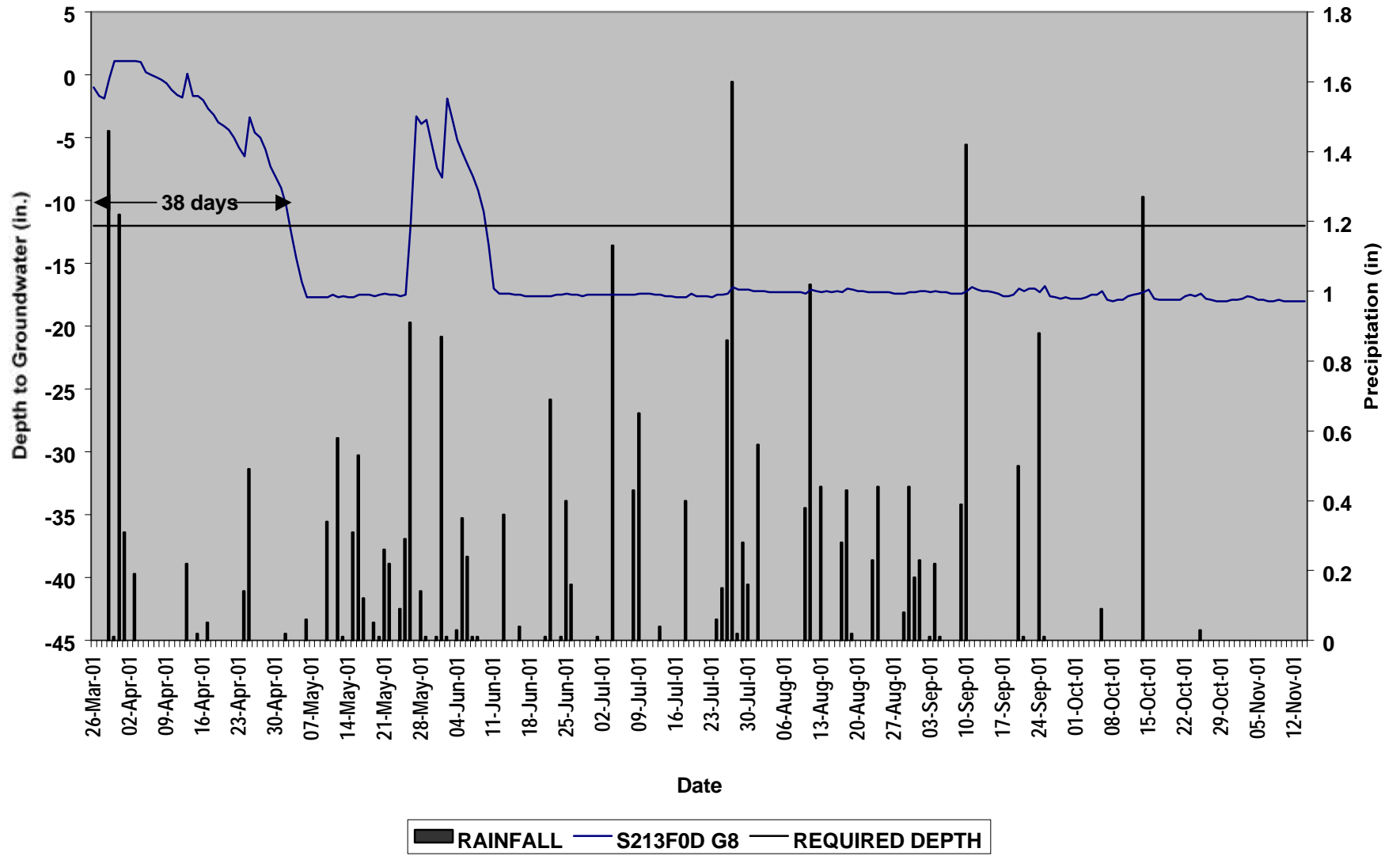
# 2001 Buffalo Creek G4



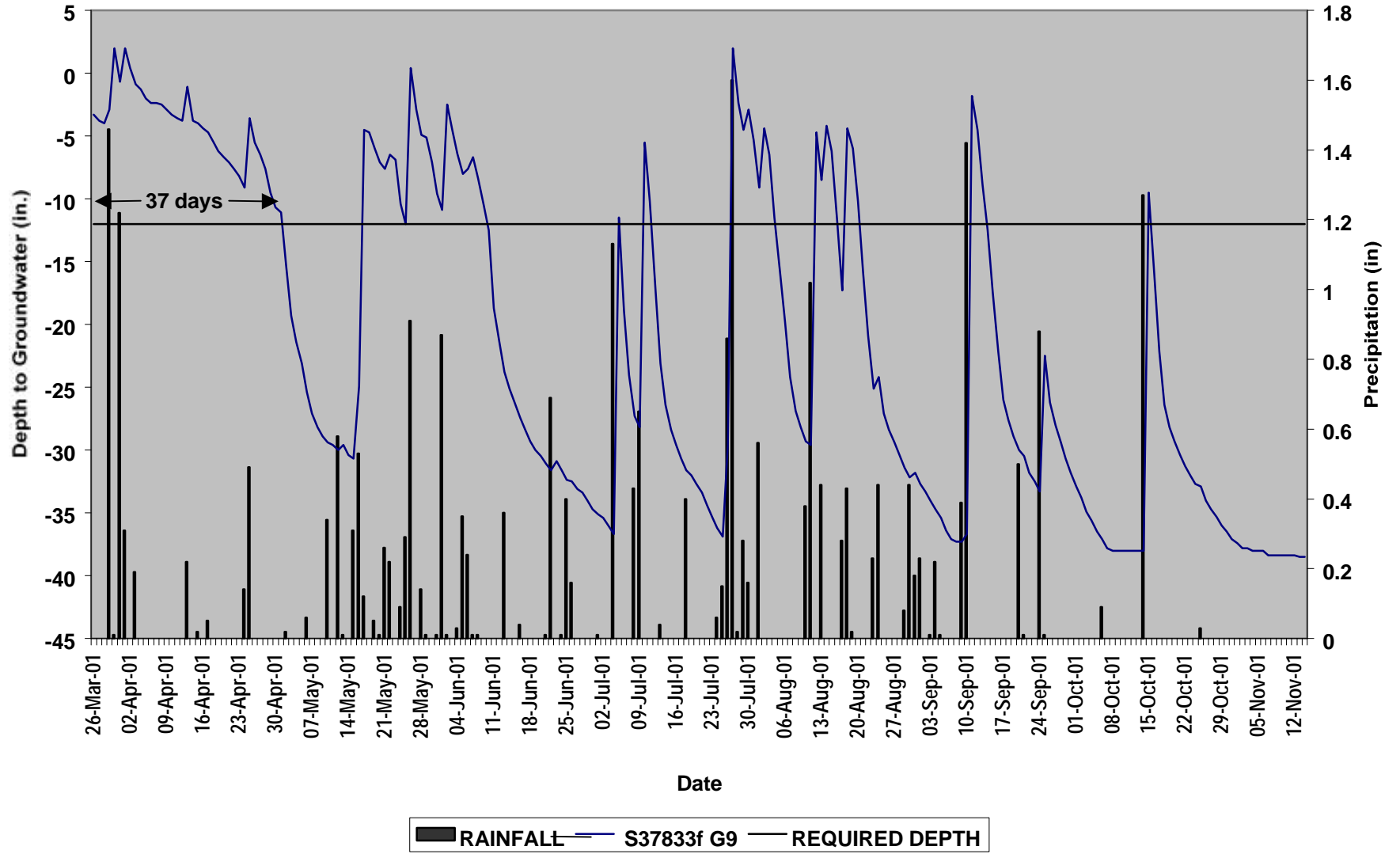
### South Buffalo Creek G6



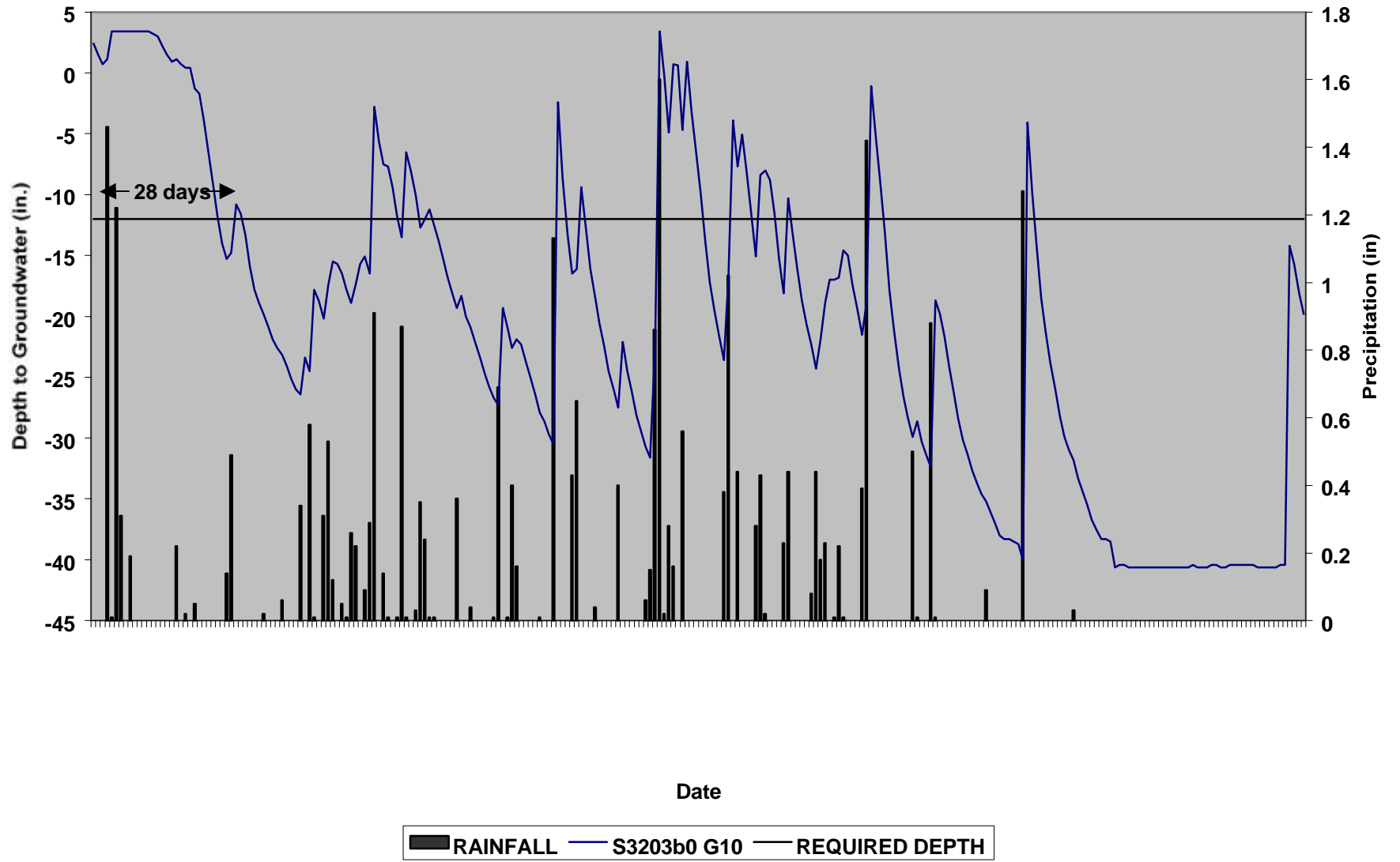
### South Buffalo Creek G8



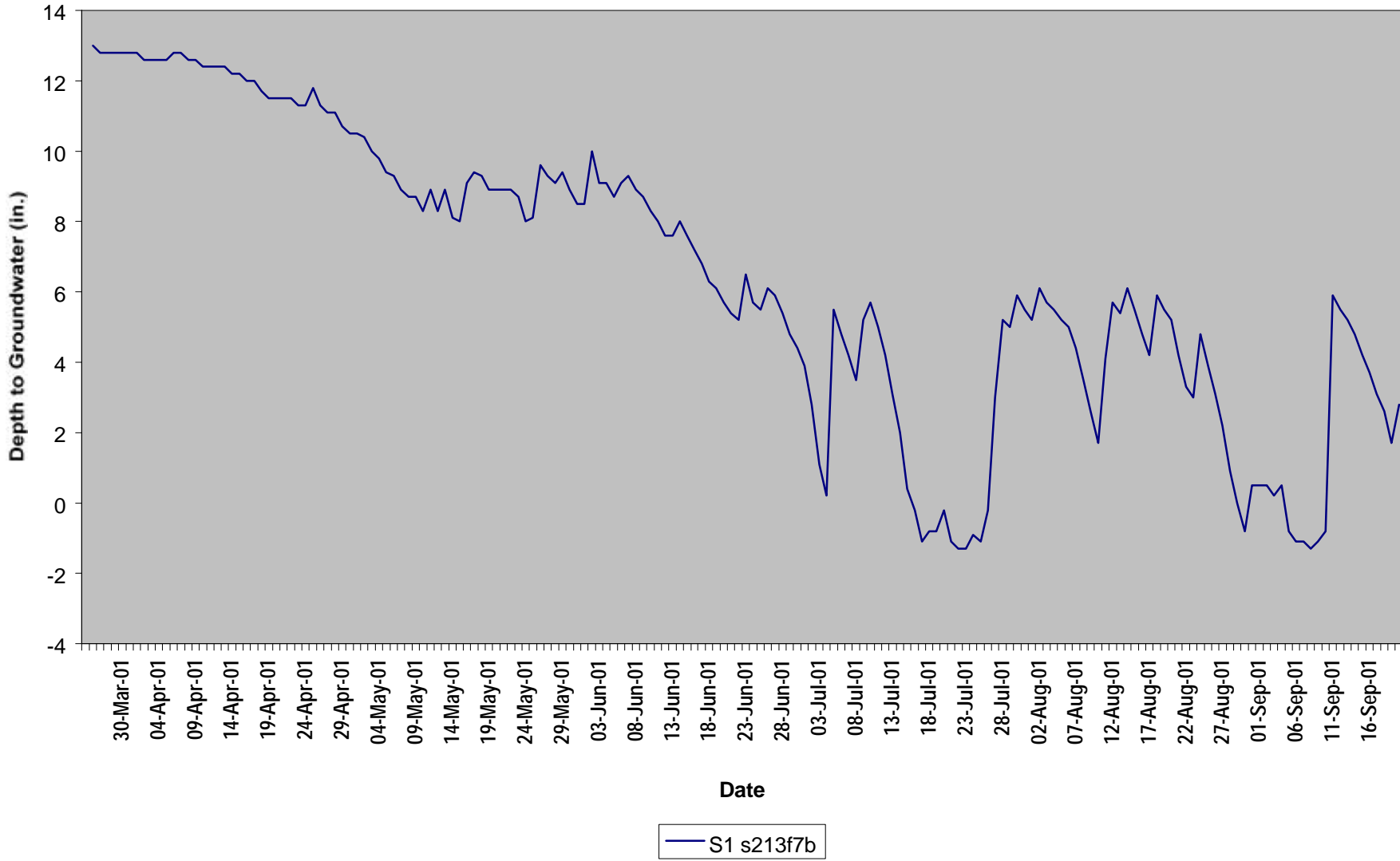
# South Buffalo Creek G9



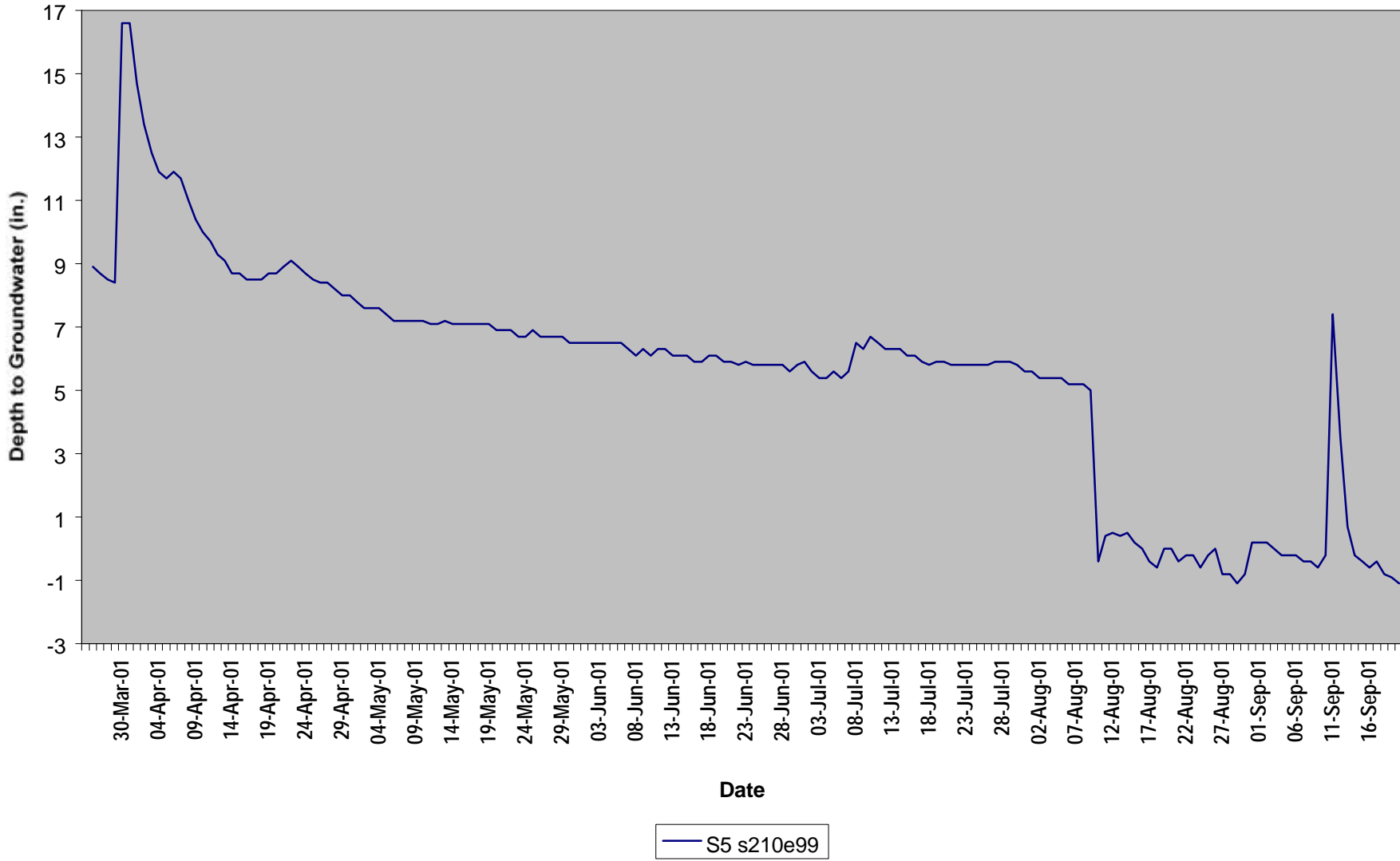
# South Buffalo Creek G10



# South Buffalo Creek S1



### 2001 South Buffalo Creek S5



**APPENDIX B**

**SITE PHOTOS**

# South Buffalo Creek



Photo 1



Photo 2



Photo 3



Photo 4

