

ANNUAL REPORT FOR 1999



Mallard Creek Mitigation Site
Mecklenburg County
Project # 8.U670123
TIP # R-211



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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Mallard Creek Mitigation Site. This site was originally constructed in 1994 and underwent remediation in 1997. Monitoring activities in 1999 represent the second year of monitoring following the remediation. The site must demonstrate both hydrologic and vegetation success for a minimum of three years.

The Mallard Creek site is divided into two smaller sites. Site 1 is the smaller of the two, containing three monitoring wells, one surface gauge, and two vegetation plots.

The second site contains six monitoring wells and four vegetation plots. This portion, located across Mallard Creek Church Road from Site 1, is at a slightly higher elevation than its counterpart.

One major change in the hydrologic monitoring process is the use of local weather station rainfall data for the site analysis. The daily rainfall on the well data graphs is recorded at a Charlotte rain gauge, maintained by the NC State Climate Office. This data is being used because past the existing on-site rainfall gauges have proven unreliable. These site gauges will be replaced with more reliable equipment prior to the start of the 2000 growing season.

Hydrologic monitoring indicated that site 1 has met success criteria; the site was completely inundated for most of the growing season. Site 2 only showed saturation for over 12.5% of the growing season at 2 of the 6 wells, due largely to a large storm in mid-October that dumped 4.3 inches of rain in Charlotte in two days. Vegetation monitoring yielded a successful stem count in 5 of 6 planting transects.

Based on the monitoring results from the 1999 growing season, NCDOT recommends that monitoring continue.

1.0 INTRODUCTION

1.1 Project Description

The Mallard Creek Mitigation Site, located in Mecklenburg County, consists of two separate wetland sites. Both are situated along SR 2833 (Mallard Creek Church Road), just east of US 29 (Figure 1). The two sites mitigate for wetland impacts associated with the Charlotte Outer Loop (R-211 DA).

Both sites, totaling 10 acres in size, consist of the creation and restoration of a bottomland hardwood forest. The sites were initially constructed and planted in 1994; however, hydrologic and vegetation problems forced remediation in 1997. Remediation activities involved grading both sites to more accurately reflect groundwater profiles.

The site was developed in cooperation with Mecklenburg County. As a result of this partnership, the county will incorporate the mitigation sites into a greenway plan for the area. A boardwalk has been constructed on Site 2 as part of the Mecklenburg County Parks and Recreation system. An additional section of boardwalk will be constructed adjacent to Site 1 when Mallard Creek Church Road is widened; this project is slated for 2001.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of three 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 1999 at the Mallard Creek Mitigation Site.

Activities in 1999 reflect the second year of monitoring following the remediation efforts in 1997. The site did not meet jurisdictional hydrologic success in 1998; however, vegetation monitoring revealed an average tree density well above the minimum requirement. Included in this report are analyses of both hydrologic and vegetative monitoring results as well as local climate conditions throughout the growing season.



FIGURE 1
SITE LOCATION MAP

1.3 Project History

| | |
|----------------------|---|
| October 1994 | Site 1&2: Grading Construction |
| February 1995 | Site 2: Planted; Site 1: No planting |
| September 1995 | Vegetation Monitoring (1yr) |
| March- November 1996 | Hydrologic Monitoring |
| September 1996 | Vegetation Monitoring (2 yr) |
| October 1997 | Site 1&2: Remediation, Grading Construction |
| February 1998 | Site 2: Boardwalk Construction |
| March 1998 | Tree Planting: Site 1&2 |
| May 1998 | Monitoring Wells Installed |
| May- November 1998 | Hydrologic Monitoring |
| September 1998 | Vegetation Monitoring (1 yr) |
| May- November 1999 | Hydrologic Monitoring |
| September 1999 | Vegetation 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 Mecklenburg County begins March 22 and ends November 11. These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after March 22 and before November 11.¹ The growing season is 235 days; therefore, optimum hydrology requires 12.5% of this season, or at least 29 consecutive days. Local climate must also represent average conditions for the area.

2.2 Hydrologic Description

In May of 1998, nine monitoring wells, one rain gauge, and one surface water gauge were installed (Figure 2). The automatic monitoring wells record daily readings of groundwater depth. Even though 1999 is the second year of monitoring, it is the first full growing season that the monitoring wells have been in place.

The Mallard Creek site was designed to receive hydrologic input from both rainfall and runoff from Mallard Creek Church Road. 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 well. This number was converted into a percentage of the 235 day growing season. The results are presented in Table 1. Appendix A contains a plot of the groundwater depth for each monitoring well and the surface water depth recorded by the surface gauge. The maximum number of consecutive days is noted on each graph.

¹ Natural Resources Conservation Service, Soil Survey of Mecklenburg County, North Carolina, p.61.

Mallard Creek Mitigation Site
Monitoring Well Location Map

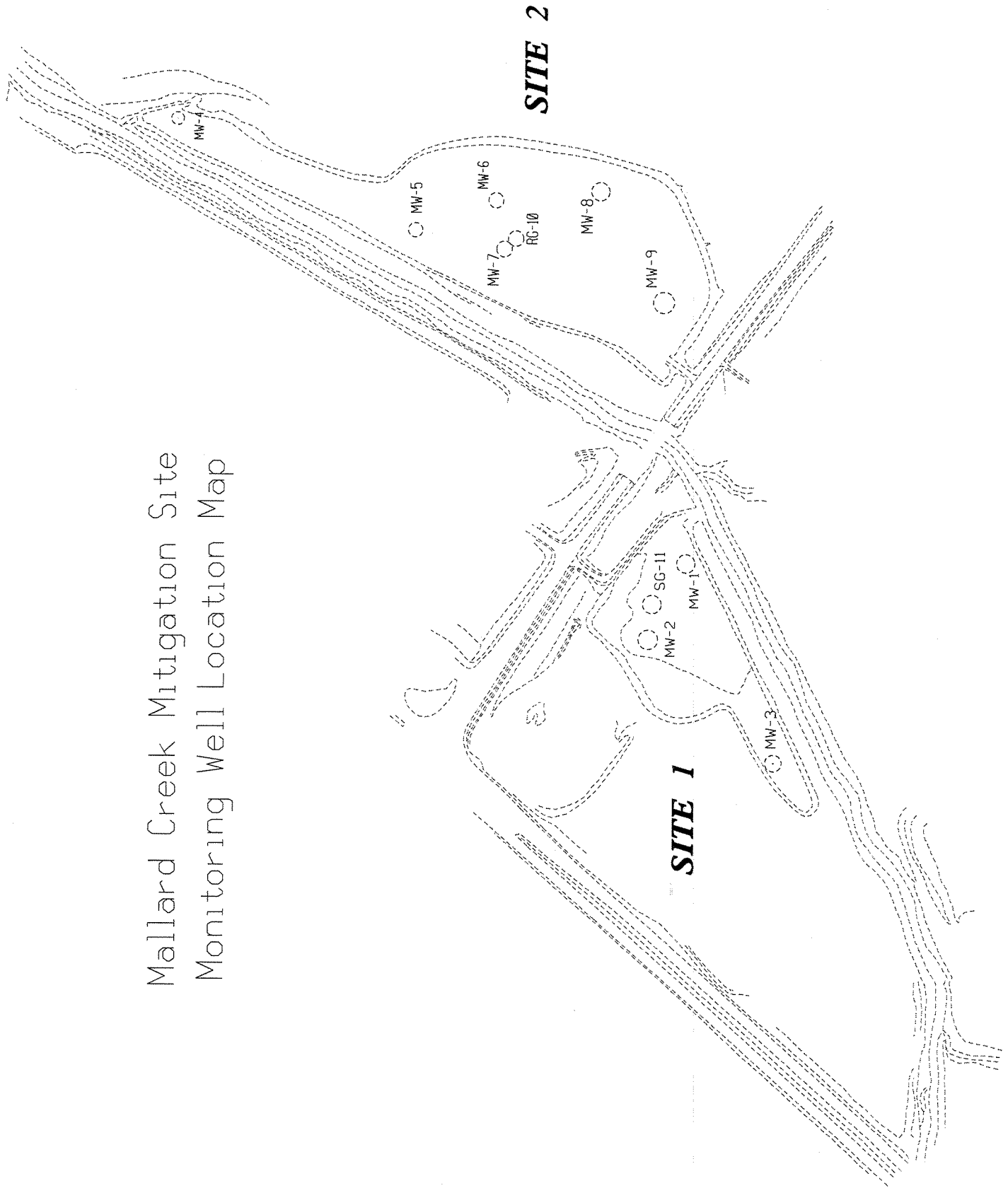


FIGURE 2
WELL LOCATION MAP

The individual precipitation events, shown on the monitoring well graphs as bars, represent data collected from a Charlotte weather station. This data was provided by the NC State Climate Office. The rain gauge that is currently located on the site will be replaced with a more accurate measuring device prior to the beginning of the 2000 monitoring season, thus eliminating the need to use official rainfall information on the monitoring well graphs.

Table 1
HYDROLOGIC MONITORING RESULTS

| Monitoring Well | < 5% | 5% - 8% | 8% - 12.5% | > 12.5% | Actual % | Success Dates |
|-----------------|------|---------|------------|---------|----------|------------------|
| <i>Site 1</i> | | | | | | |
| MW-1 | | | | ✓ | 62.1 | Mar. 22- Aug. 14 |
| MW-2 | | | | ✓ | 100 | Mar. 22- Nov. 11 |
| MW-3 | | | | ✓ | 27 | Mar. 22- May 23 |
| <i>Site 2</i> | | | | | | |
| MW-4 | ✓ | | | | 2.1 | Apr. 30- May 4 |
| MW-5 | ✓ | | | | 2.6 | Oct. 12- Oct. 17 |
| MW-6 | | | | ✓ | 13.3 | Oct. 12- Nov. 11 |
| MW-7 | | | | ✓ | 13.7 | Oct. 11- Nov. 11 |
| MW-8 | | ✓ | | | 5.2 | Apr. 28- May 9 |
| MW-9 | | ✓ | | | 7.3 | Oct. 11- Oct. 27 |

Figure 3 is a graphical representation of the hydrologic monitoring results.

Site 1 continues to meet jurisdictional hydrologic success by showing saturation for more than a consecutive 12.5% of the growing season. The surface gauge, which is located on this section, has shown consistent surface water throughout the growing season.

Site 2 has not shown the same success. Wells 6 and 7 showed saturation for over 30 days only after large rainfall events in early October saturated the Charlotte area. All of the wells on this site indicate that the groundwater levels drop quickly after rainfall.

Specific problems: The battery in monitoring well 4 had problems in the latter part of the growing season; this battery replaced in October of 1999, but not before one month's data for that location was lost. The battery in well 5 was replaced at the end of the growing season due to consistent problems.

2.3.2 Climatic Data

Figure 4 represents an examination of the local climate in comparison with historical data in order to determine whether 1999 was "average" in terms of

Mallard Creek Mitigation Site 1999 Hydrologic Monitoring Results

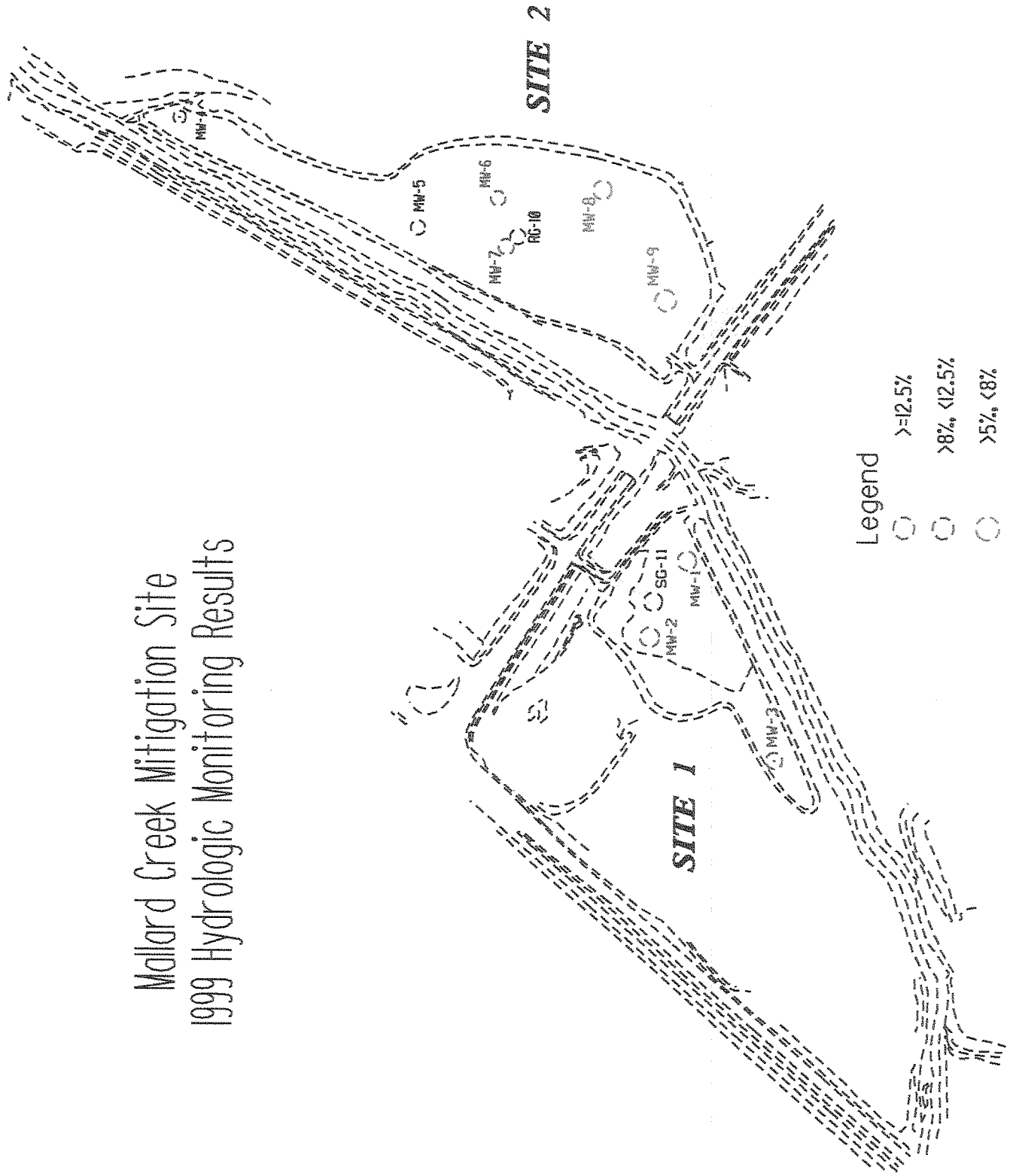
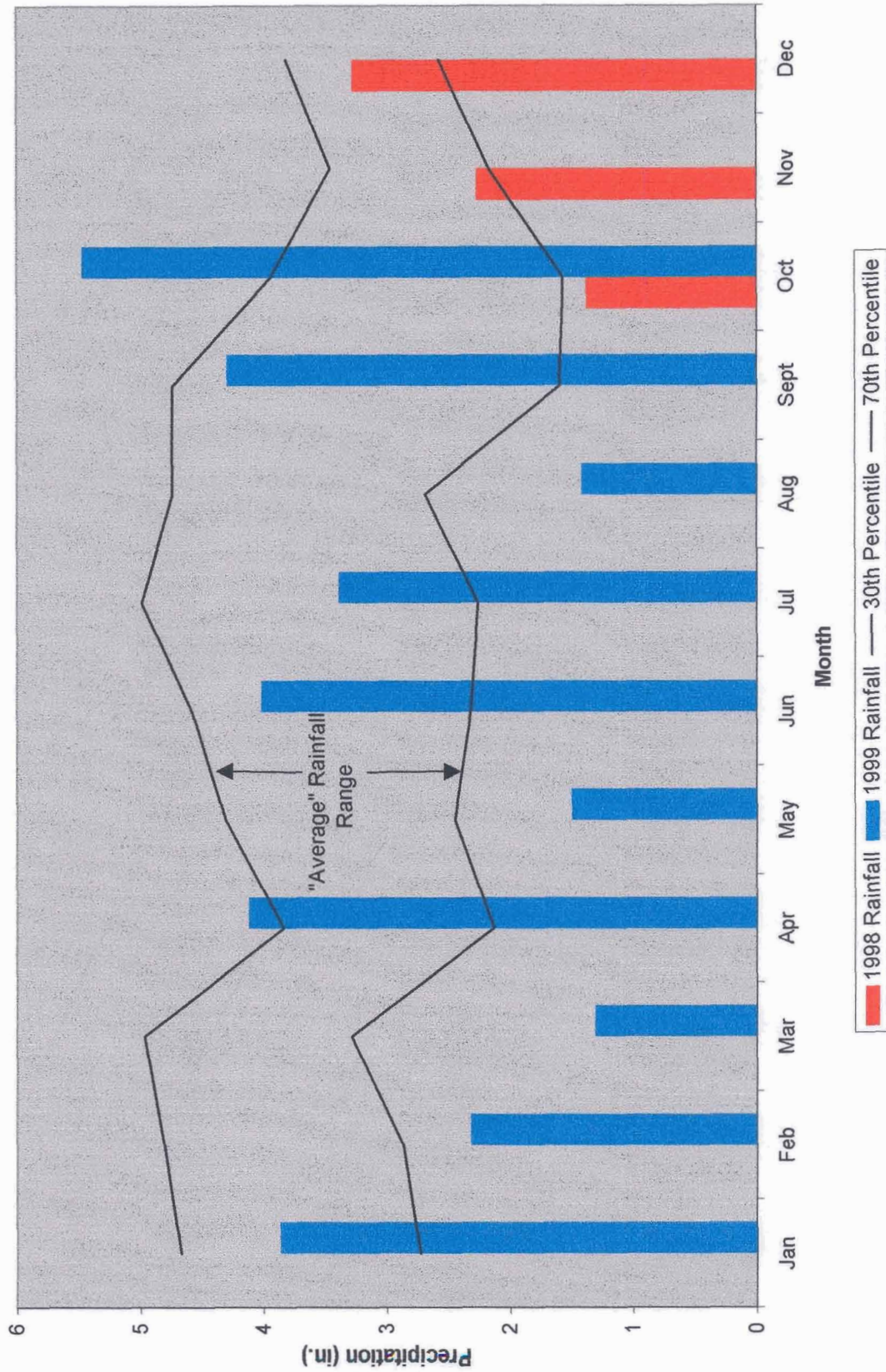


FIGURE 3
1999 HYDROLOGIC RESULTS

**Mallard Creek 30-70 Percentile Graph
Charlotte, NC**



**FIGURE 4
30-70 PERCENTILE GRAPH**

climate conditions. The figure compares the rainfall from 1998 and 1999 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 1999 rainfall totals through October 1999. Rainfall data for November and December 1999 will be presented in the 2000 Annual Monitoring Report.

Charlotte was not adversely affected by Hurricanes Floyd and Dennis, which hit the state in September 1999. Rainfall for September was within average limits for that month. However, a large storm (4.3 inches in two days) in October pushed that month's total rainfall well above average. February, March, May, and August were especially dry months.

2.4 Conclusions

1999 represents the first full growing season that the hydrologic data has been examined following remediation. Site 1 has exceeded success criteria; the majority of this site shows surface water for the majority of the growing season. Site 2 has not shown wetland hydrology; most of the wells indicate rapid decreases in the groundwater level following rainfall events. Part of this lack of success could be due to the lack of rainfall in February and March, which is normally the wettest part of the growing season.

The large rainfall in October enabled part of site 2 to be successful in the last part of the growing season. However, wells in the back of the site indicated that despite the extra rain, the water was still draining rapidly, presumably into Mallard Creek. It should be noted that the wells on site 2 which showed success (wells 6 and 7) are the same wells that in 1998 indicated the longest saturation period (> 8% of the growing season).

As was indicated in the 1998 Annual Report, the monitoring of a complete growing season indicated a higher success rate with the mitigation site. However, a portion of site 2 is still showing problems.

3.0 VEGETATION

3.1 Success Criteria

The Mallard Creek site was replanted in March 1998. The site is monitored in September/ October of each year for vegetation success. Success criteria states that there must be a minimum of 320 trees per acre surviving for three consecutive years.

3.2 Description of Species

The following tree species were replanted in the Wetland Creation Area:

Fraxinus pennsylvanica, Green Ash
Nyssa sylvatica, Blackgum
Quercus liras, Overcup Oak
Quercus nigra, Water Oak

3.3 Results of Vegetation Monitoring (2 year)

| Plot # (Type) | Green Ash | Blackgum | Overcup Oak | Water Oak | Total (2 year) | Total (at planting) | Density (Tree/Acre) |
|------------------------|-----------|----------|-------------|-----------|----------------|---------------------|---------------------|
| 1(BLH) | 11 | 1 | 4 | 3 | 19 | 31 | 417 |
| 2(BLH) | 4 | 2 | 10 | 10 | 26 | 27 | 655 |
| 3(BLH) | 9 | 0 | 12 | 1 | 22 | 35 | 427 |
| 4(BLH) | 8 | 11 | 8 | 3 | 30 | 31 | 658 |
| 5(BLH) | 5 | 1 | 11 | 4 | 21 | 38 | 376 |
| 6(BLH) | 13 | 0 | 2 | 0 | 15 | 36 | 283 |
| AVERAGE DENSITY | | | | | | | 469 |

The average tree density for each plot is calculated by the following formula:

$$\text{Density (trees/acre)} = \frac{\# \text{ Stems Counted}}{\# \text{ Stems Planted}} \times 680 \text{ (stems per acre)}$$

Notes from report: Plot 1 – Volunteer green ash, black willow, cottonwood; Plot 2 – Lespedeza and bidens present, some bare soil areas; Plots 3-4 – various grasses present, lespedeza and bidens, some deer browse, 4” standing water in Plot 6. General notes: volunteer cottonwoods throughout, standing water between Plots 5 and 6; Heavy grass and sedge competition mitigation area #1; rushes present also some juncus and volunteer cottonwood.

3.4 Conclusions

Approximately 10 acres of this site was re-graded in Fall, 1997. The total site is made up of two wetland mitigation areas. Wetland Mitigation Area #1 is a 2.80 acre site located in the southwest quadrant of the intersection of SR 2833 and Mallard Creek, while the remaining 7.20 acres is located directly across SR 2833 in the northwest quadrant. Six vegetation monitoring plots were established throughout the planting areas: 2 plots in mitigation area #1 and 4 plots in mitigation area #2. Based on the results of the stem counts for the two year monitoring period, we obtained an average tree density of 469 trees per acre. This average for the site as a whole is above the minimum success criteria of 320 trees/ acre; however, plot six yielded a density of only 283 trees per acre.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

Site 1 has shown excellent hydrologic results. There are several reasons for the possible success, including its lower elevation and its easier susceptibility to runoff from Mallard Creek Church Road.

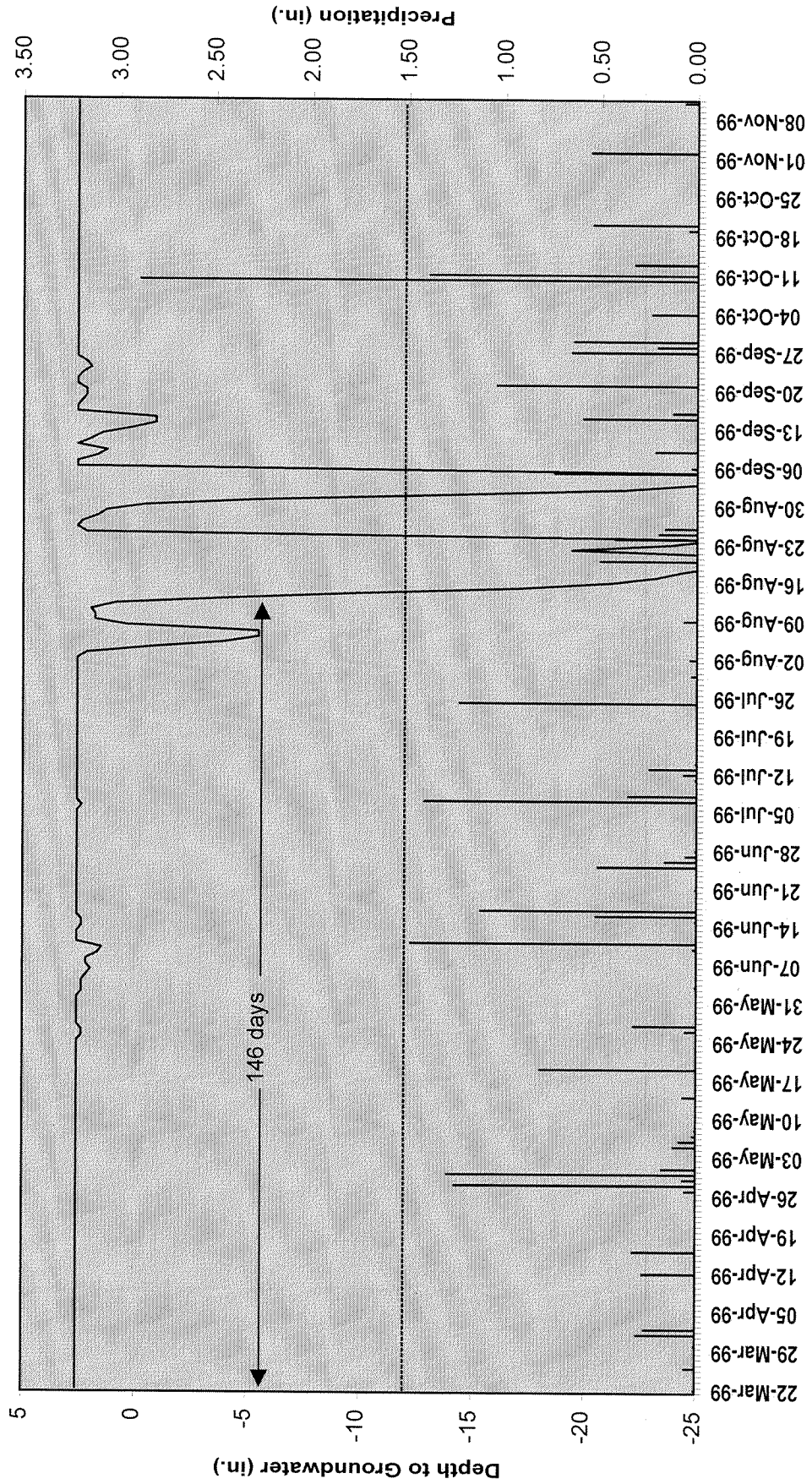
Site 2 has been less than successful, despite the fact that several months during the growing season had total rainfalls above the average range. Many of the wells on site 2 indicate that the groundwater level rises and falls rapidly after rainfall events.

All but one of the vegetation monitoring plots has indicated an average tree density of over 320 trees per acre. It is anticipated that vegetation success will be met after an additional year of monitoring.

NCDOT will continue to monitor the site for both hydrologic and vegetation success.

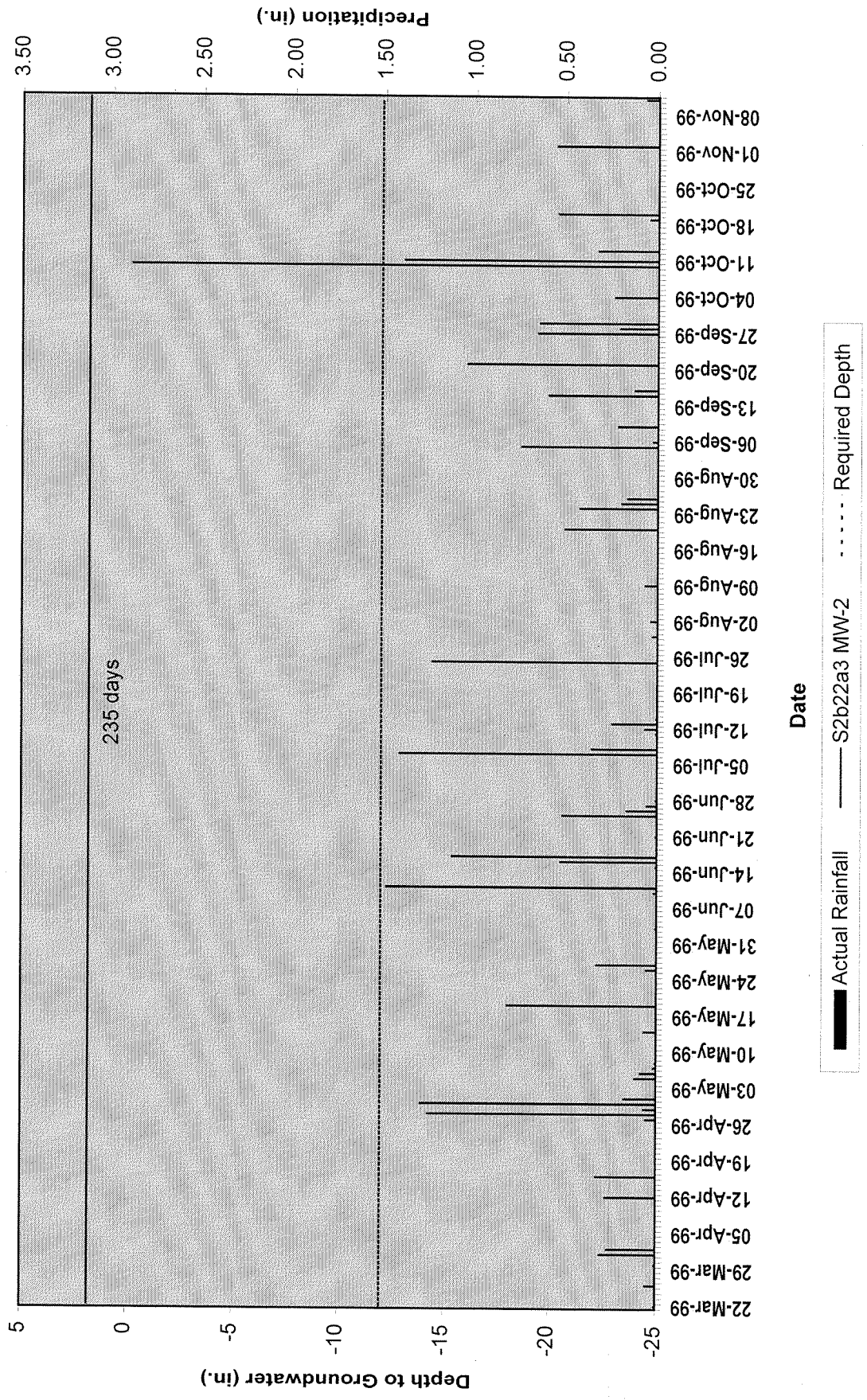
APPENDIX A
DEPTH TO GROUNDWATER PLOTS

Mallard Creek MW-1

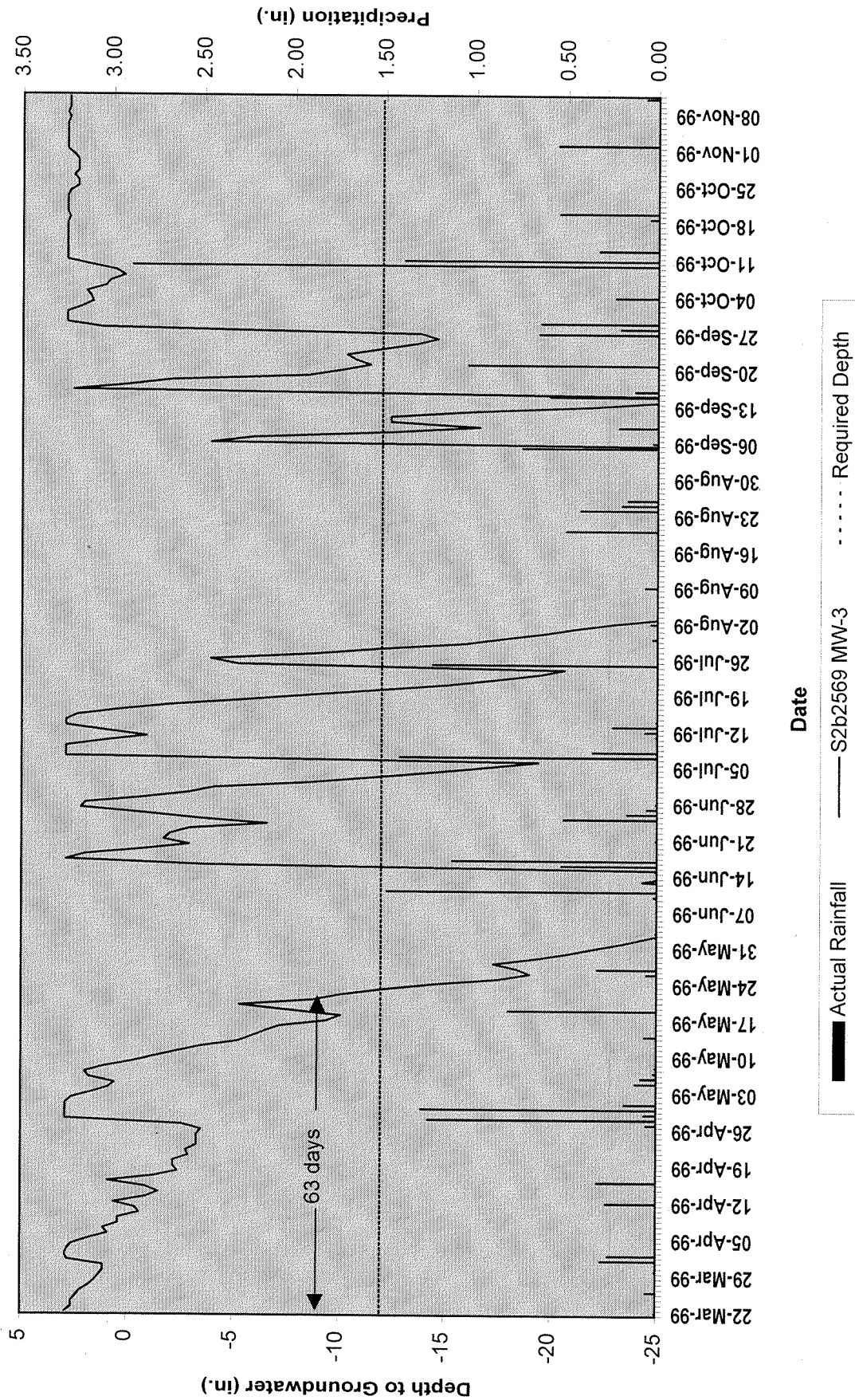


Actual Rainfall
 S2b2596 MW-1
 Required Depth

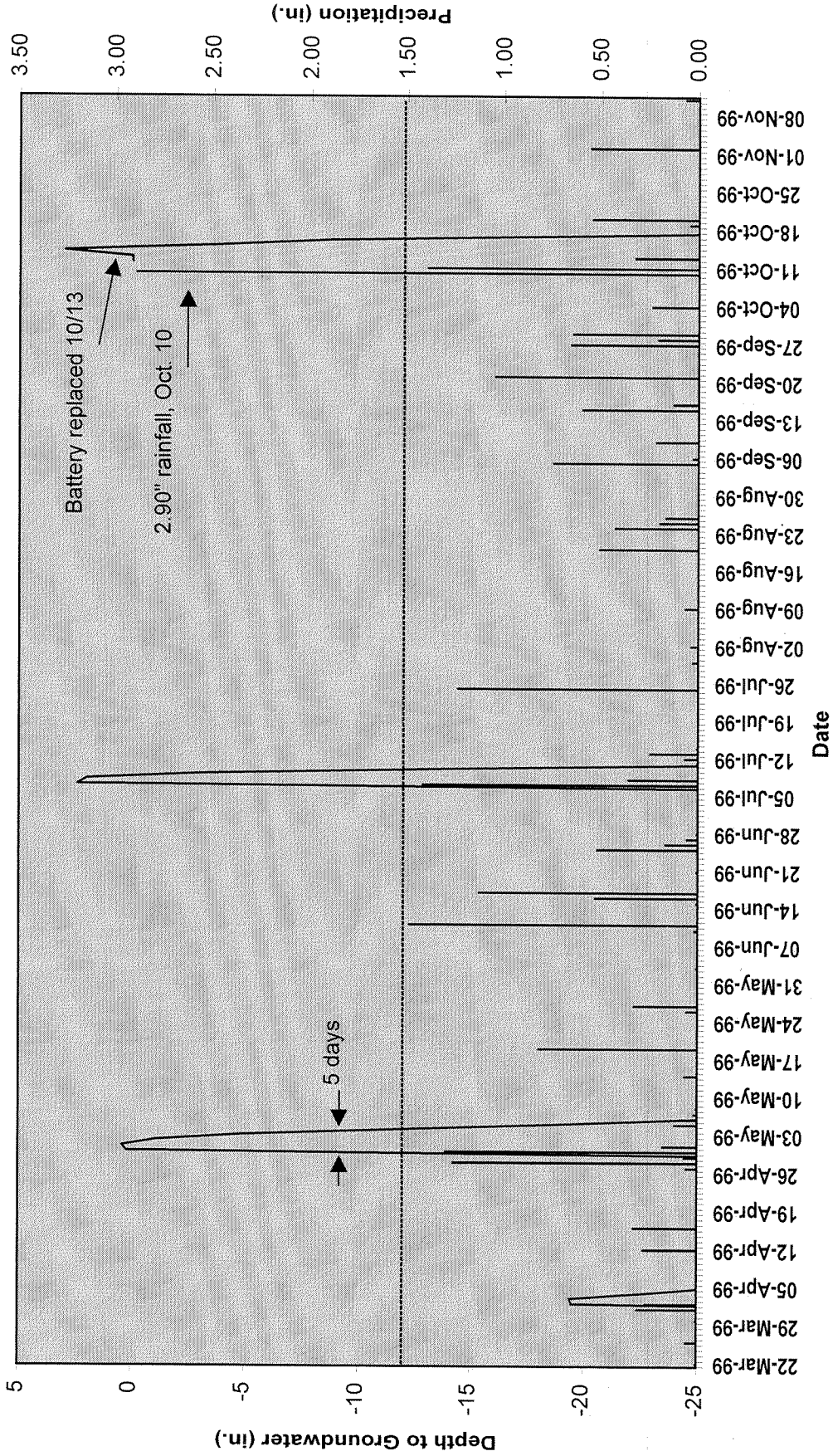
Mallard Creek MW-2



Mallard Creek MW-3

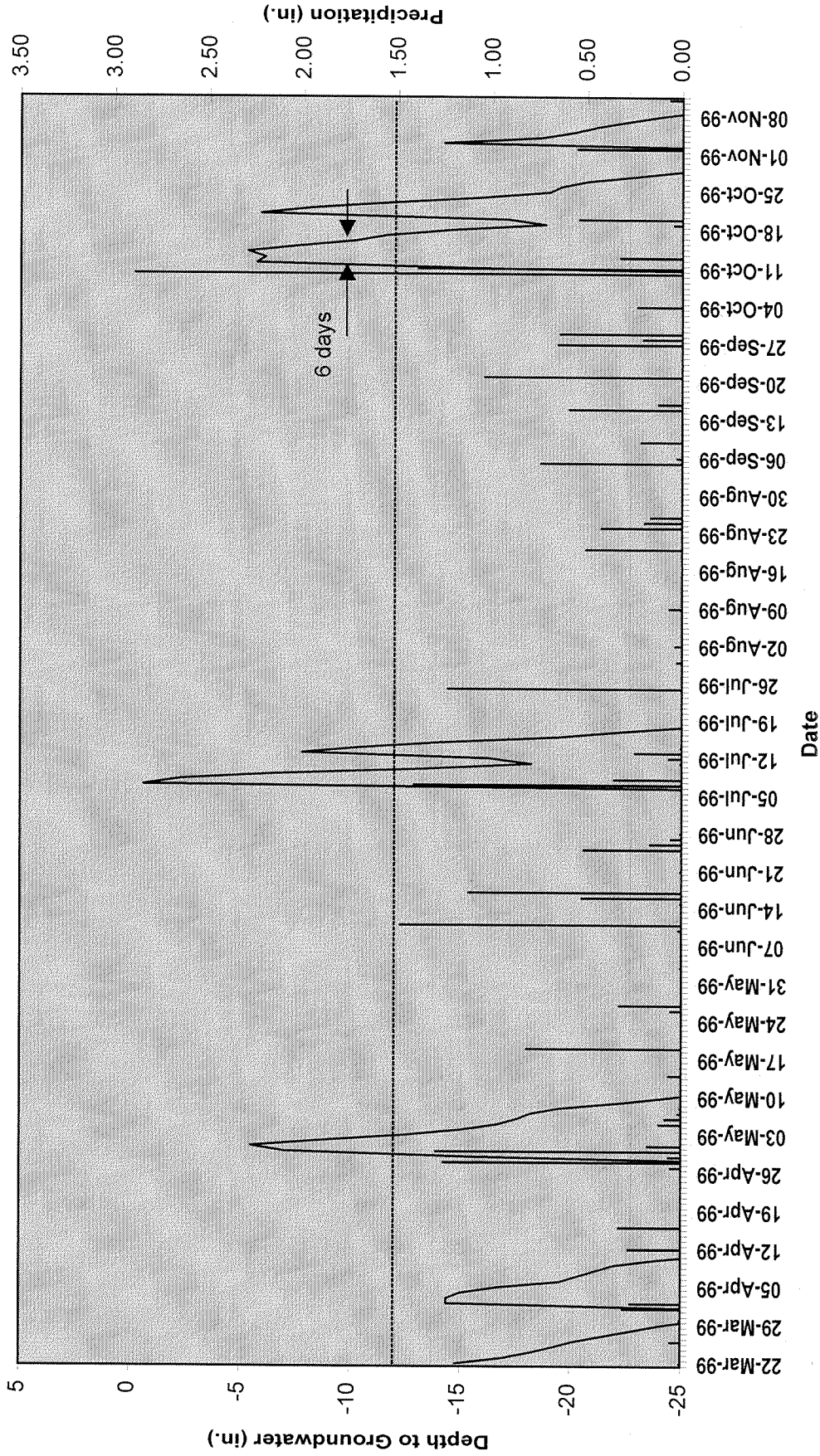


Mallard Creek MW-4



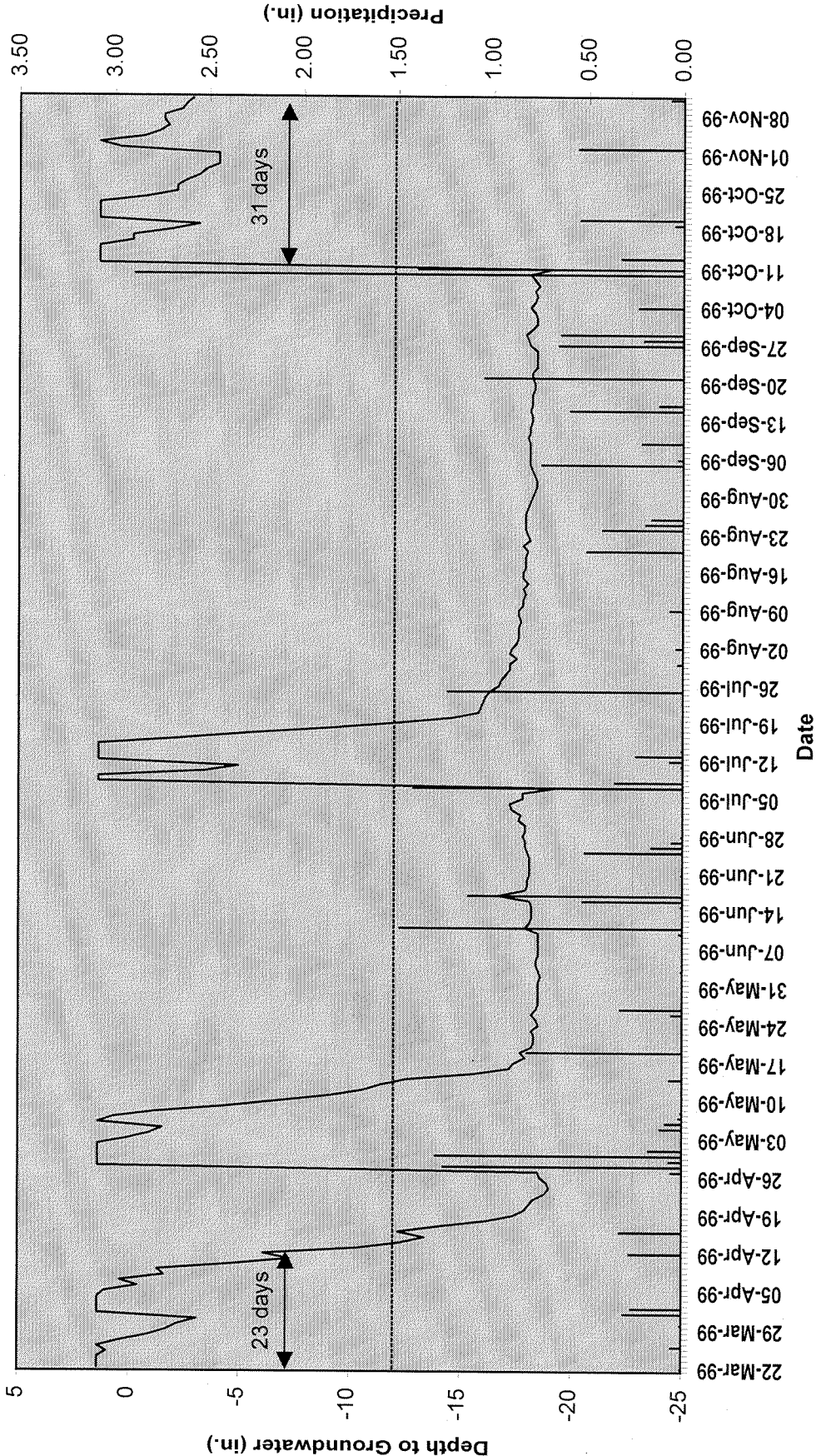
Actual Rainfall
 S2B23F7 MW-4
 Required Depth

Mallard Creek MW-5



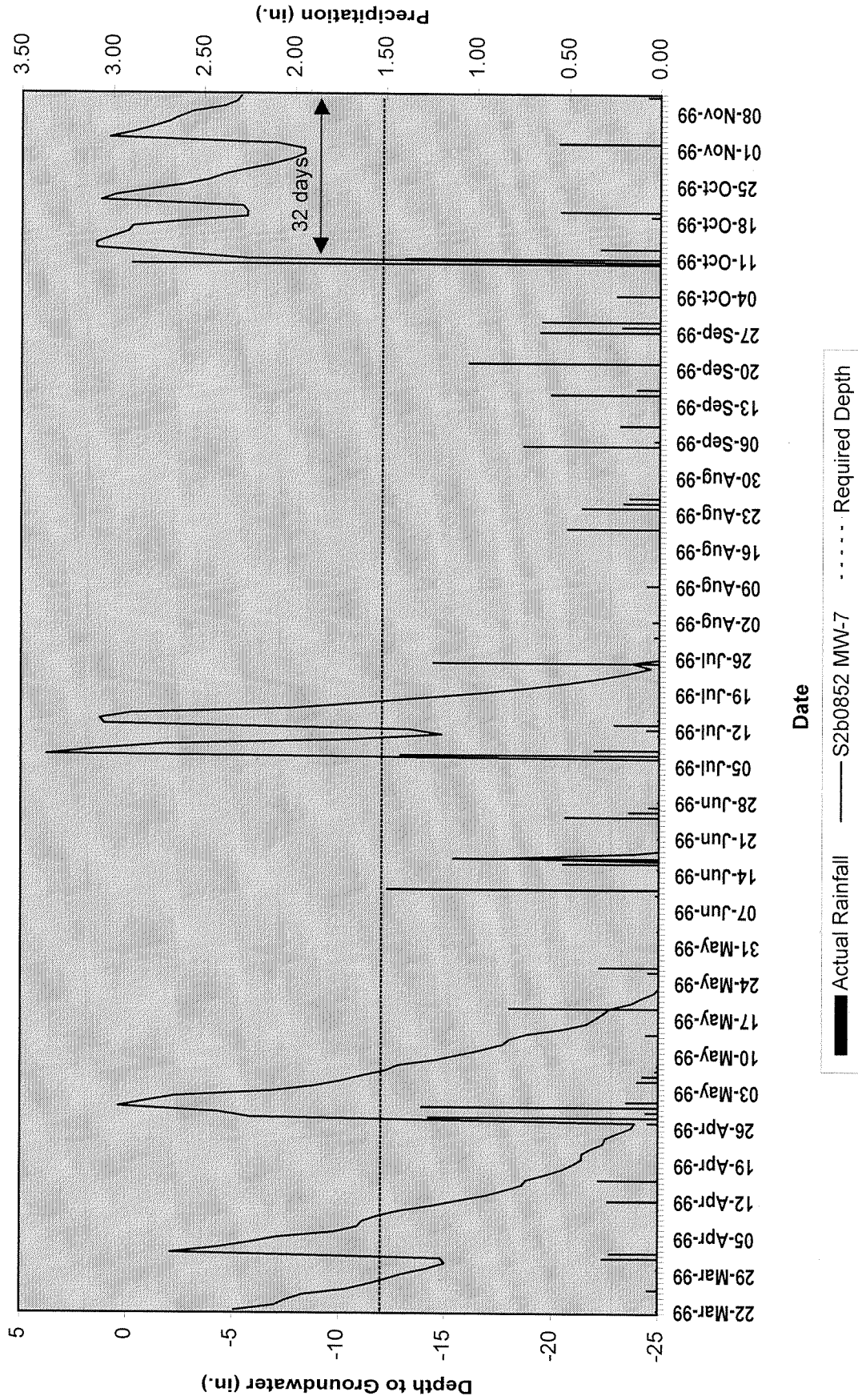
Actual Rainfall
 S2b082a MW-5
 Required Depth

Mallard Creek MW-6

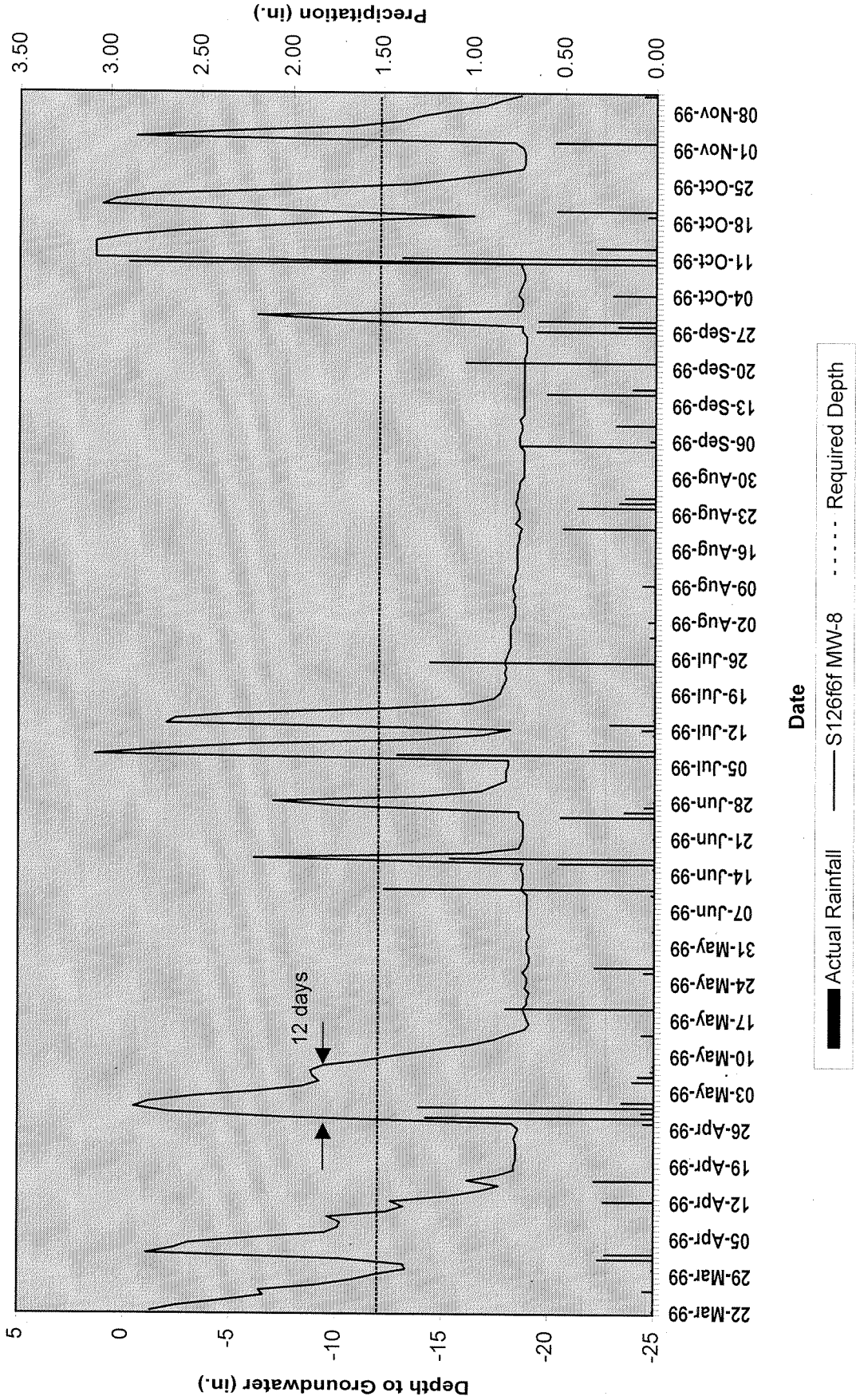


Actual Rainfall — S126401 MW-6 - - - - Required Depth

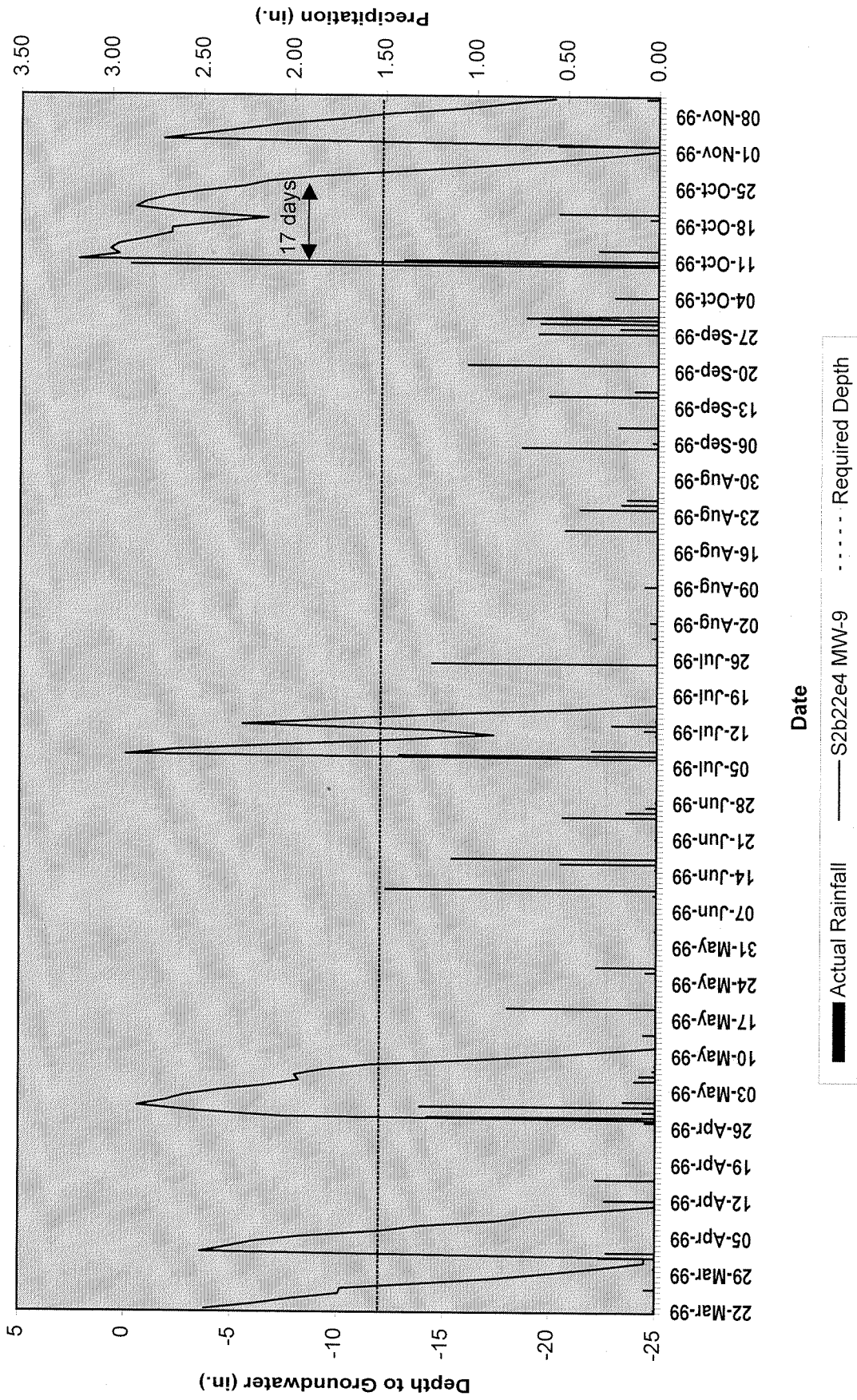
Mallard Creek MW-7



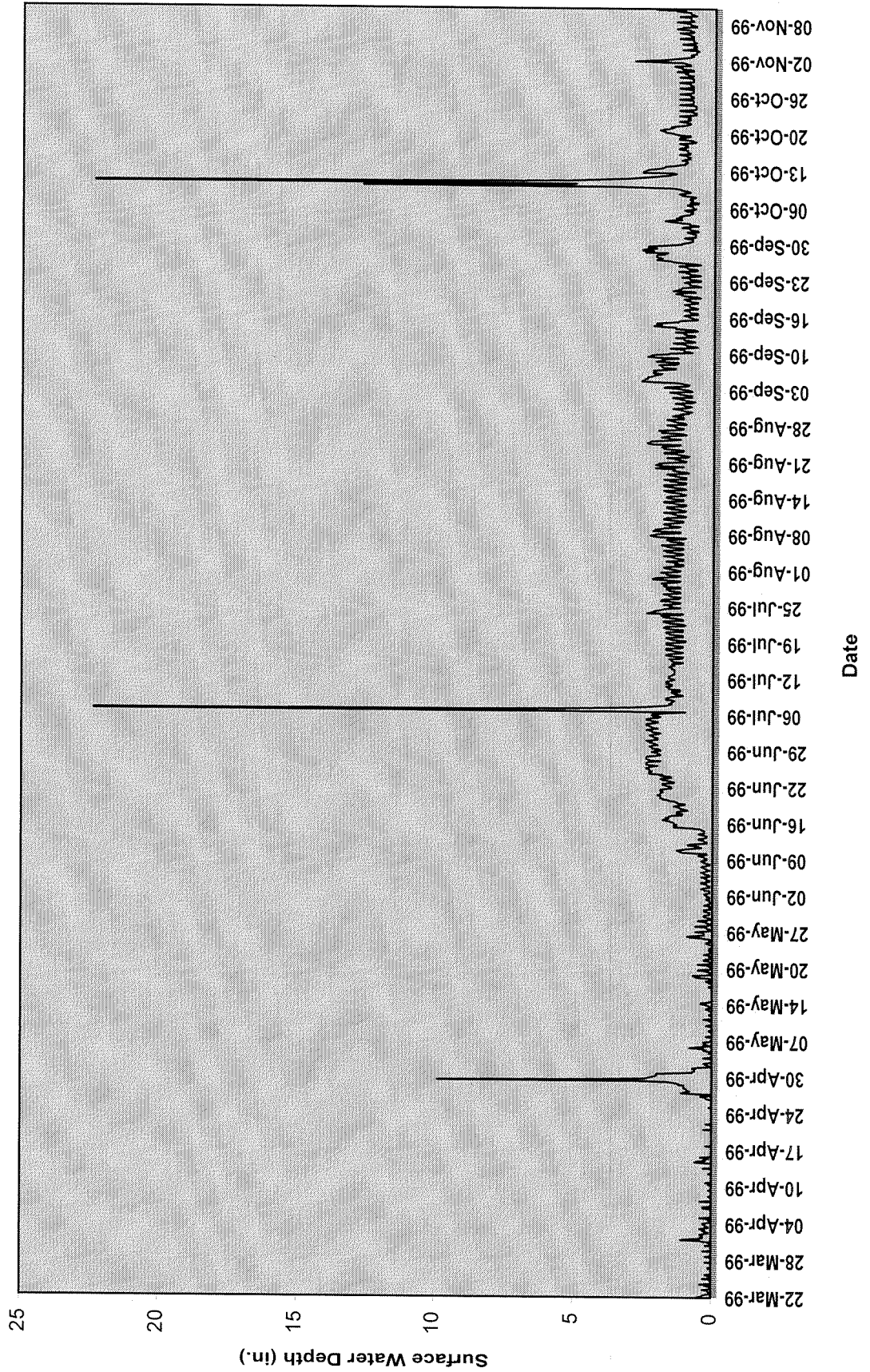
Mallard Creek MW-8



Mallard Creek MW-9



Mallard Creek SG-11



APPENDIX B
SITE PHOTOS

Mallard Creek



Photo 1: From SR 2833 looking Northeast



Photo 2: At P2 looking North



Photo 3: At P3 looking South



Photo 4: At P4 looking Southwest



Photo 5: At P5 looking Southwest



Photo 6: At P6 looking Northeast