ANNUAL REPORT FOR 2000

Mallard Creek Mitigation Site
Mecklenburg County
Project No. 8.1999974 (M-316)
TIP No. R-211 WM

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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 2000 represent the third 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 sites. Site 1 is the smaller of the two, containing three monitoring wells, one surface gauge, and two vegetation plots. Site 2 contains six monitoring wells, a rain gauge, and four vegetation plots. This site, located across Mallard Creek Church Road from Site 1, is at a slightly higher elevation than its counterpart.

Hydrologic data indicated that Site 1 has met the hydrologic success criteria for the second full year of monitoring. There was, however, additional hydrologic input stemming from a 12" water main leak located adjacent to the mitigation site. The amount of hydrology provided by the leak is unknown at this time, but the leak was repaired on December 2, 2000 by the Charlotte-Mecklenberg Utility District (CMUD). Site 2 hydrologic data showed saturation $\geq$12.5% of the growing season in 3 of the 6 gauges. This is one gauge more than the 1999 growing season. Additionally, the frequency and duration of higher groundwater levels increased in those gauges located at this site.

The daily rainfall data depicted on the well data graphs is recorded from an on-site rain gauge that was installed on May 4, 2000. Additional rainfall data used for the 30-70 graph was provided by the NC State Climate Office.

Vegetation monitoring yielded a successful stem count in 6 of 6 vegetation plots with an average density of 492 trees per acre.

Based on the monitoring results from the 2000 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, USACE Action I.D. 199200013).

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.

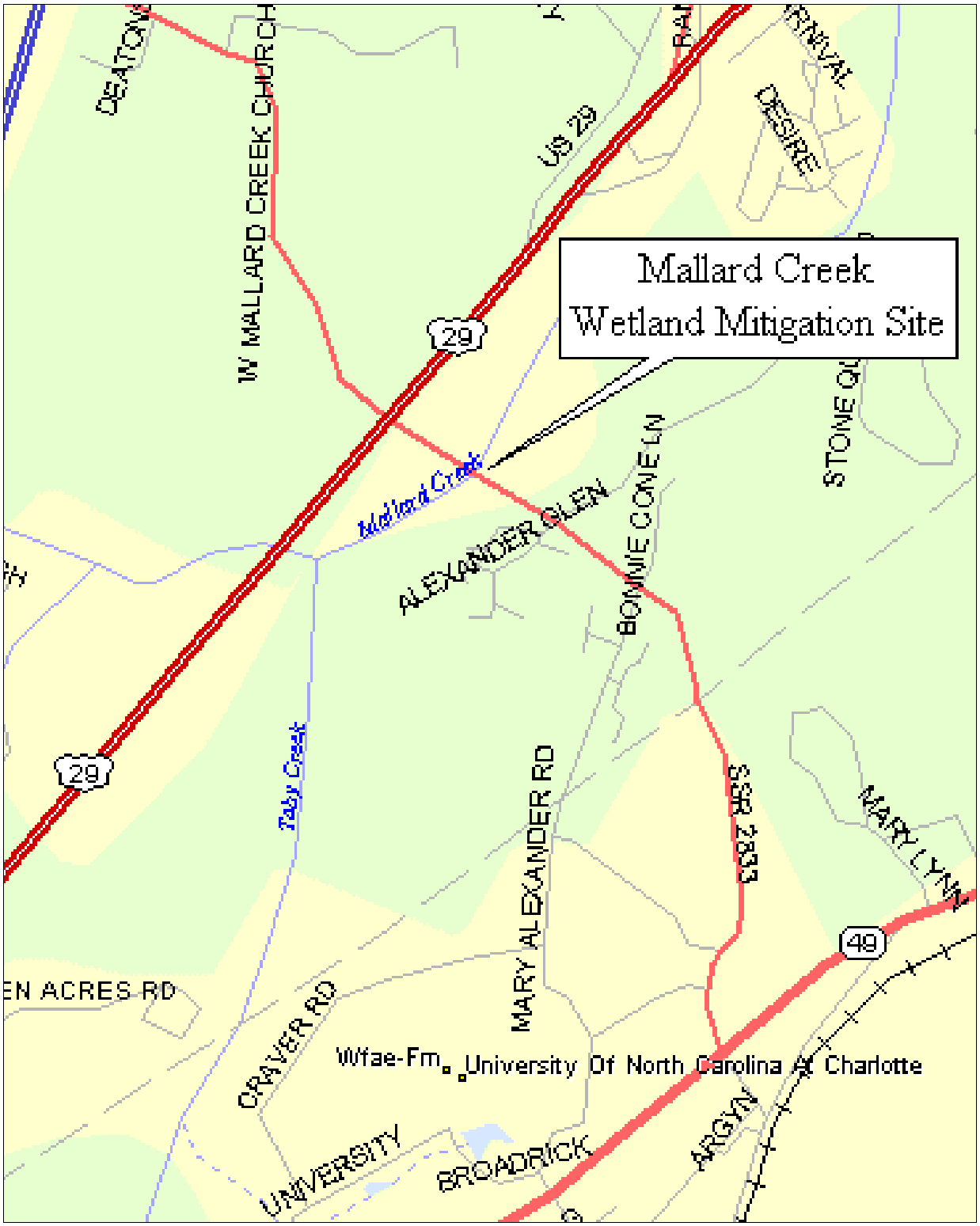
The site was developed in cooperation with Mecklenburg County. As a result of this partnership, the county will incorporate the mitigation sites into a greenway plan for the area. A boardwalk has been constructed on Site 2 as part of the Mecklenburg County Parks and Recreation system. An additional section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

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative criteria must be met 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 the year 2000 at the Mallard Creek Mitigation Site.

Activities in 2000 reflect the third year of monitoring following the remediation efforts in 1997. Site 2 did not meet hydrologic success in 1999; however, vegetation monitoring revealed an average tree density well above the minimum requirement for both sites. Included in this report are analyses of both hydrologic and vegetative monitoring results as well as onsite and local climate conditions throughout the growing season.

Figure 1. Vicinity 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
January-February 1998	Tree Planting: Site 1&2
May 1998	Monitoring Wells Installed
May - November 1998	Hydrologic Monitoring (1 yr.)
September 1998	Vegetation Monitoring (1 yr.)
May - November 1999	Hydrologic Monitoring (2 yr.)
September 1999	Vegetation Monitoring (2 yr.)
March - November 2000	Hydrologic Monitoring (3 yr.)
September 2000	Vegetation Monitoring (3 yr.)
December 2000	Water Main Fixed Adjacent to Site 1

2.0 HYDROLOGY

2.1 Success Criteria

In accordance with 404 Permit issued May 19, 1992 (Action I.D. 199200013), the success criteria for hydrology states that wetland hydrology will be established when the mitigation areas exceed the 1987 Wetland Manual criterion for hydrology (i.e. be saturated within 10 inches of the surface, ponded, or flooded for at least 26 consecutive days of the growing season). These site specific criteria are more stringent than the current federal guidelines that require a site to be inundated or saturated (within 12" of the surface) by surface or groundwater for a consecutive 5-12.5% of the growing season.

The growing season in Mecklenburg County begins March 22 and ends November 11 (235 days). These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after March 22 and before November 11.[1] Based on the current guidelines, the 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 groundwater gauges, one rain gauge, and one surfacewater gauge were installed at the Mallard Creek Mitigation Sites (Figure 2). The original rain gauge installed at this time was replaced on May 4, 2000 with a new rain gauge. The automatic groundwater gauges record daily readings of groundwater depth.

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.

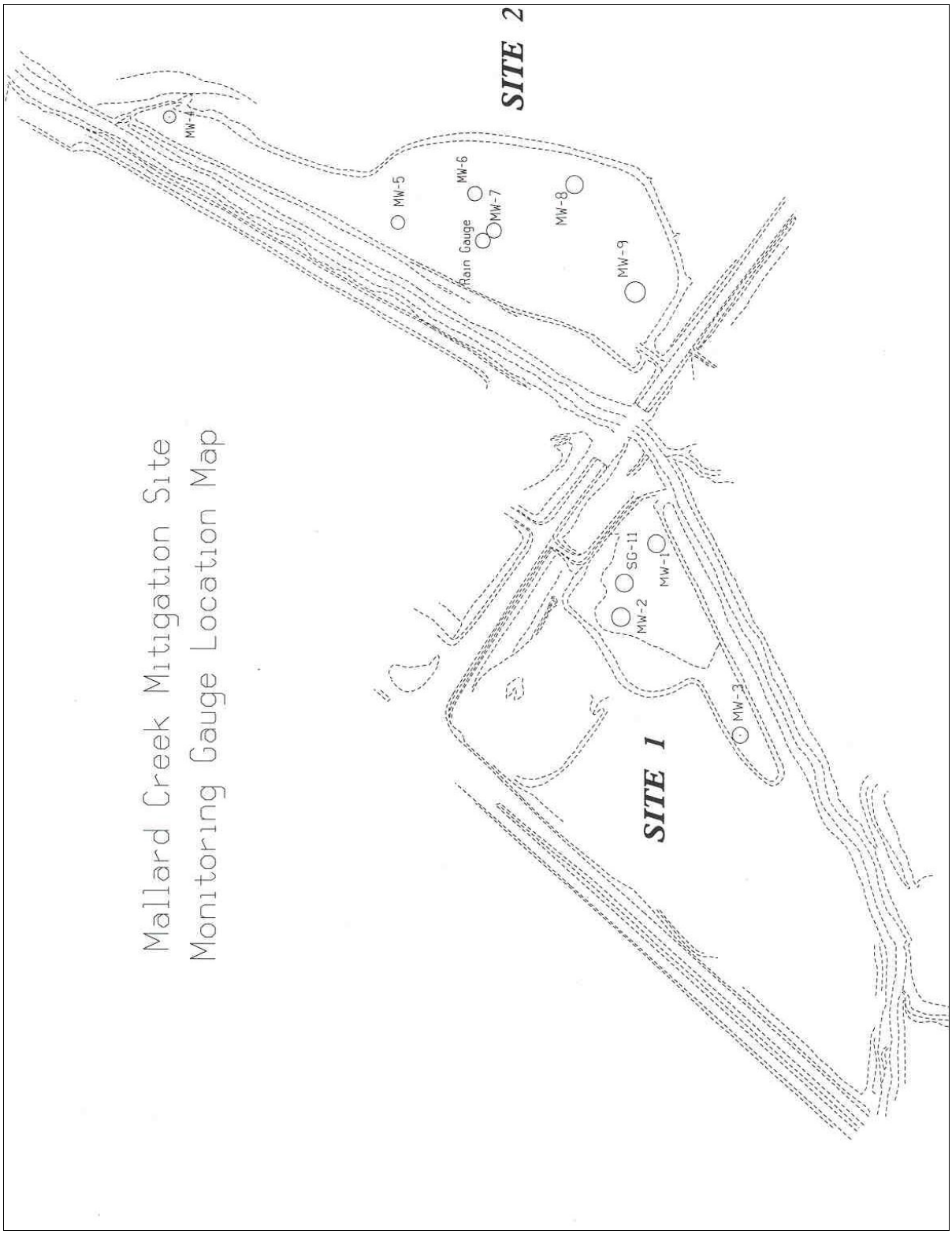
2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within ten inches of the surface was determined for each gauge. This

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

Figure 2. Monitoring Gauge Location Map.



number was then converted into a percentage of the 235 day growing season. The results are presented in Table 1. Additionally, Appendix A contains a plot of the groundwater depth for each groundwater gauge and 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 the on-site rain gauge. Additionally, precipitation data obtained from a Charlotte weather station was used to generate the 30-70 percentile graph. This data was provided by the NC State Climate Office.

Table 1. Hydrologic Monitoring: Mallard Creek Mitigation Site.

Monitoring Gauge	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %	Success Dates
Site 1						
MW-1				✔	22.9	Sep. 19 - Nov. 11
MW-2				✔	100	Mar. 22 - Nov. 11
MW-3				✔	47.2	Jul. 24 - Nov. 11
Site 2						
MW-4	✔				3.4	Apr. 14 - Apr. 21
MW-5		✔			6.0	Apr. 9 - Apr. 22
MW-6				✔	19.6	Mar. 22 - May 6
MW-7				✔	14.0	Mar. 22 – Apr. 23
MW-8		✔			5.5	Apr. 25 – May 7
MW-9				✔	19.5	Mar. 22 - May 6

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

Site 1 hydrologic data indicates that the site meets the hydrologic success criteria established by the USACE permit. The site was saturated or inundated for more than 26 days of the growing season. The surface gauge located on Site 1 also showed consistent inundation throughout the growing season. A 12” water main leak adjacent to his site has effected the hydrology at this location. The extent of the effect is unknown at this time.

Site 2 hydrologic data indicates that only three of six gauges met the hydrologic success criteria established for the site. Only gauges 6, 7, and 9 showed saturation or inundation greater than 26 days of the growing season. Gauges 4, 5, and 8 failed to meet the hydrologic success criteria. The data for Site 2, as in 1999, still indicates that the groundwater levels drop quickly after rainfall.

Specific problems:

MW 1: Data was lost due to battery failure from March 22 to May 3, 2000.
MW 5: Data was lost due to battery failure from June 19 to August3, 2000.
MW 6: Data was lost due to battery failure from September 11 to October 3, 2000.

2.3.2 Climatic Data

Figure 4 represents an examination of the local climate in comparison with historical data in order to determine whether 1999-2000 was "average" in terms of climate conditions. The figure compares the rainfall from 1999-2000 with that of historical rainfall (data collected between 1948 and 1996). All rainfall data was collected from the NC State Climate Office.

Figure 4 shows the monthly rainfall totals for the period of December 1999 through November 2000. The data for this period shows above average rainfall for three months (April, September, and November) and below average rainfall for five months of the monitoring period (February, May, July, October, and December). The observed cumulative rainfall of 36.53 inches is below the twenty nine year average rainfall range of 44 to 46 inches (1961-1990).

2.4 Conclusions

The year 2000 is only the second full growing season that the monitoring gauges have been in place since installing them three years ago. Site 1 has exceeded success criteria for the year 2000; however, the hydrology was altered by a 12" water main leak located adjacent to the site. The leak was repaired by the City of Charlotte on December 2, 2000 (Appendix C). The extent of the hydrology contributed by the leak cannot be evaluated until next year's monitoring report.

Wetland hydrology was observed in 3 of 6 groundwater gauges for Site 2. This is in increase by one gauge from the 1999 monitoring season. Despite lower overall average rainfall for the Charlotte area, the duration and frequency of saturation or inundation has also increased since the 1999 monitoring season. Based on these observations, NCDOT recommends the continued monitoring of the two sites.

Figure 3. Hydrologic Monitoring Results.

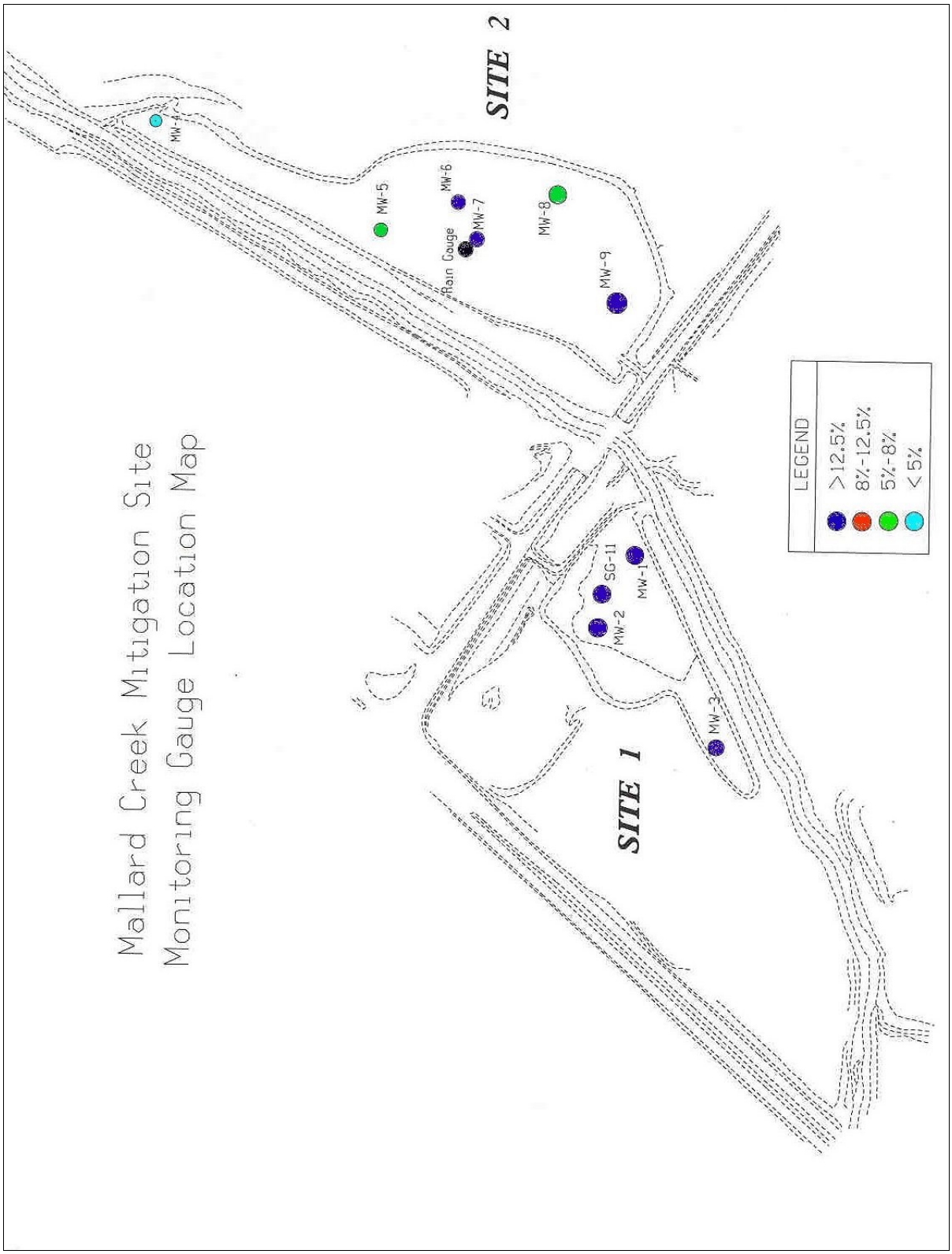
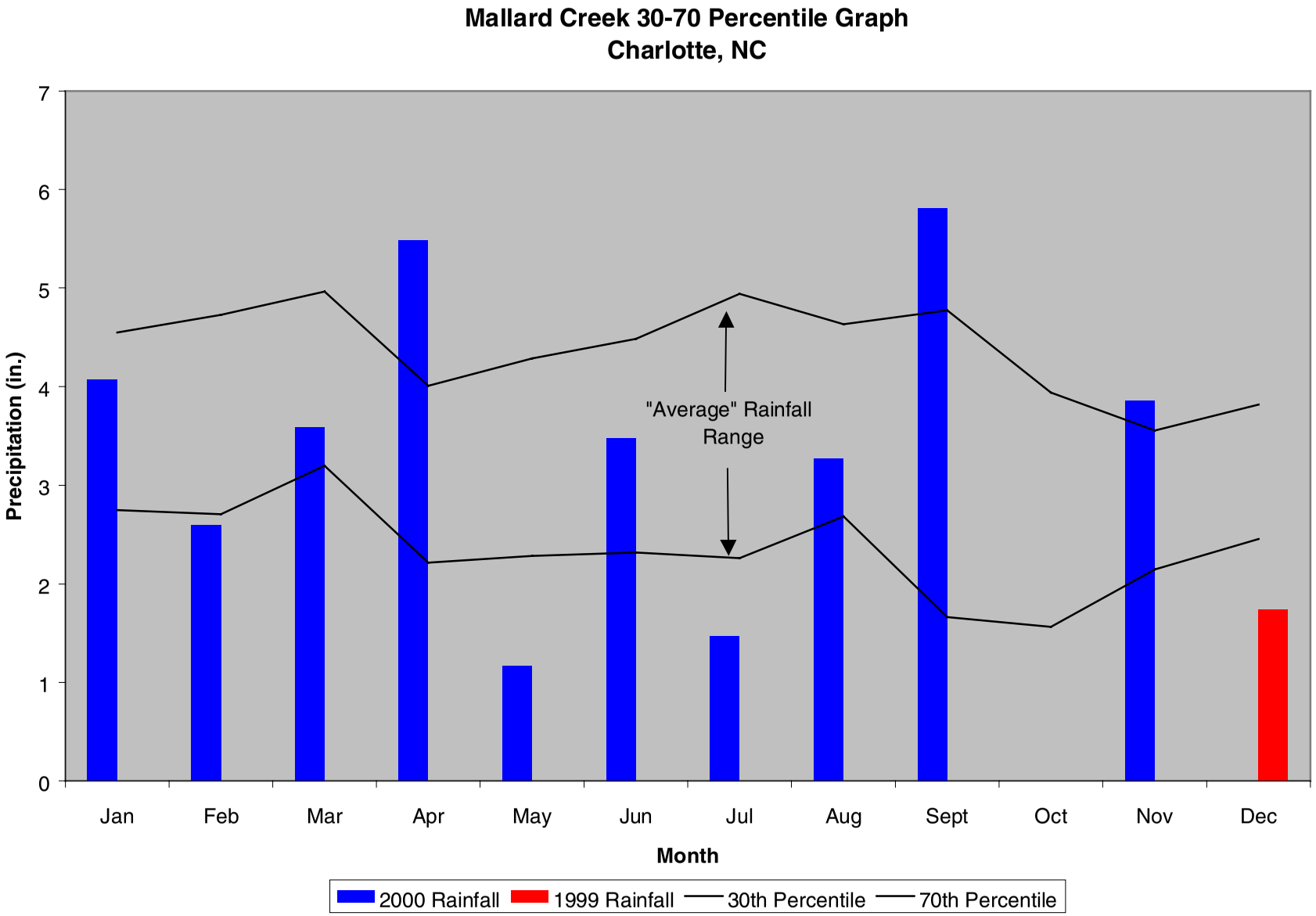

Mallard Creek Mitigation Site
Monitoring Gauge Location Map
SITE 2
SITE 1
MW-4
MW-5
MW-6
MW-7
Rain Gauge
MW-8
MW-9
SG-11
MW-1
MW-2
MW-3
LEGEND
>12.5%
8%-12.5%
5%-8%
<5%

Figure 4. 30-70 Percentile Graph.



3.0 VEGETATION

3.1 Success Criteria

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 lyrata, Overcup Oak

Quercus nigra, Water Oak

3.3 Results of Vegetation Monitoring

Plot # (Type)	Green Ash	Blackgum	Overcup Oak	Water Oak	Willow Oak	Swamp Chestnut Oak	Total	Total (at planting)	Density (Tree/Acre)
1(BLH)	13	1	3	1	1	1	20	31	439
2(BLH)	6		14	1			21	27	529
3(BLH)	14		13				27	35	525
4(BLH)	10	8	7	4			29	31	636
5(BLH)	18		4	3			25	38	447
6(BLH)	18		1	1			20	36	378
		AVERAGE DENSITY							492

To determine tree density, 50’ x 50’ plots were installed immediately following planting. The actual numbers of planted trees that occur within the plot were counted. This number is equated to the number within each plot, which represents 680 trees per acre (average). The survival monitoring number was compared to the planted number to obtain survival percentage. This percentage was 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: Other species included cottonwood, bidens, foxtails, various grasses, bermuda grass, red maple, black willow, lespedeza, sycamore, aster, goldenrod, juncus, cattail, cyperus, and volunteer green ash. Plot 1 had 2-4 inches of water. Plot 2 was wet and there was evidence of a recent 1 foot water level. Plot 3 had 3-4 inches of water. Plot 4 was wet. Plot 5 had 1-2 inches of water. Plot 6 had 4-6 inches of water.

3.4 Conclusions

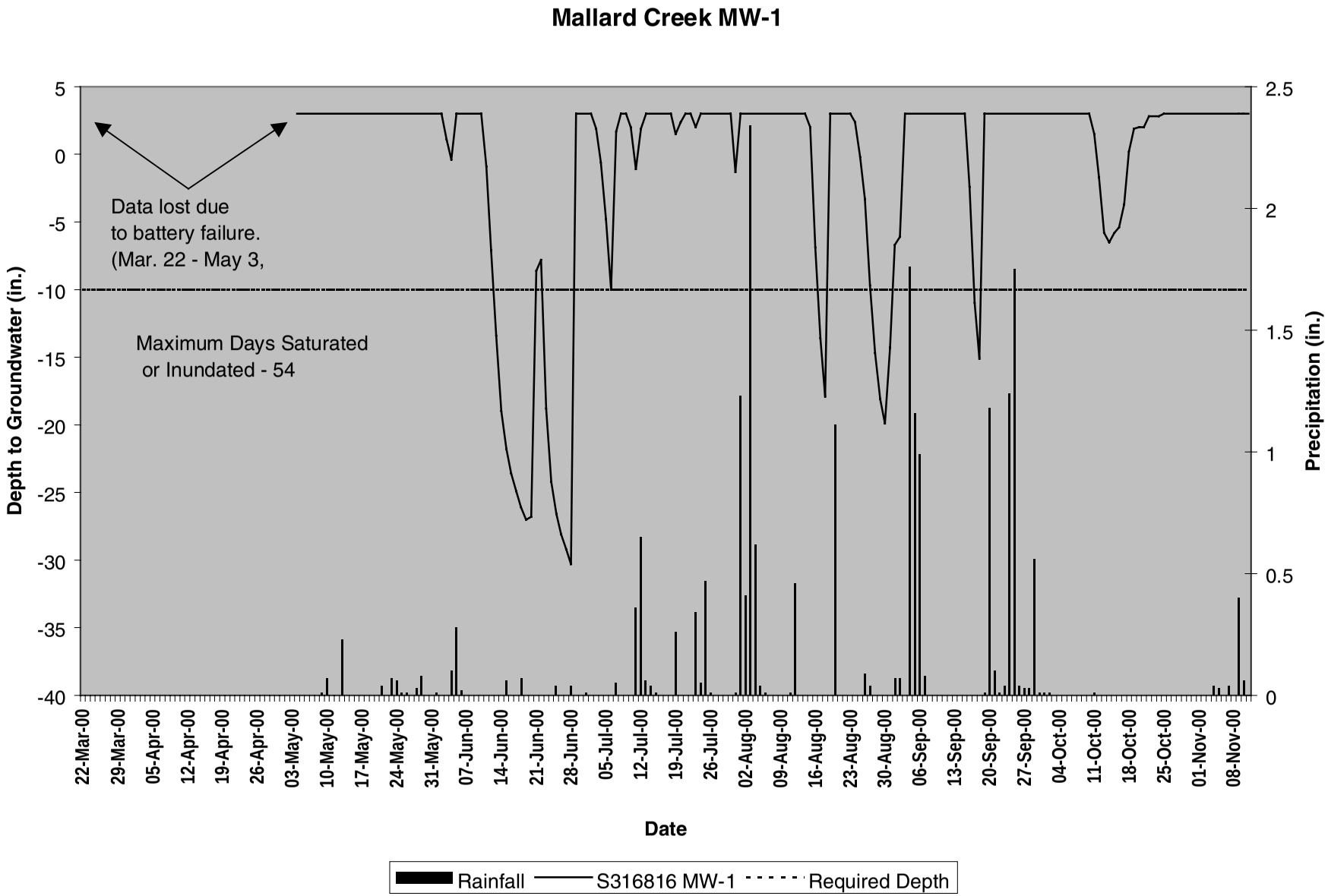
Approximately 10 acres of this site was re-graded in the fall of 1997. The total site is made up of two wetland mitigation areas. Wetland Mitigation Area #1 is a 2.80 acre site located in the southwest quadrant of the intersection of SR 2833 and Mallard Creek, while the remaining 7.20 acres is located directly across SR 2833 in the northwest quadrant. There were 6 vegetation monitoring plots established throughout the planting areas, 2 plots in mitigation area #1 and 4 plots in mitigation are #2. Based on the results of the stem counts for the monitoring period, we obtained an average tree density of 492 trees per acre. This average is above the minimum success criteria of 320 trees/ acre.

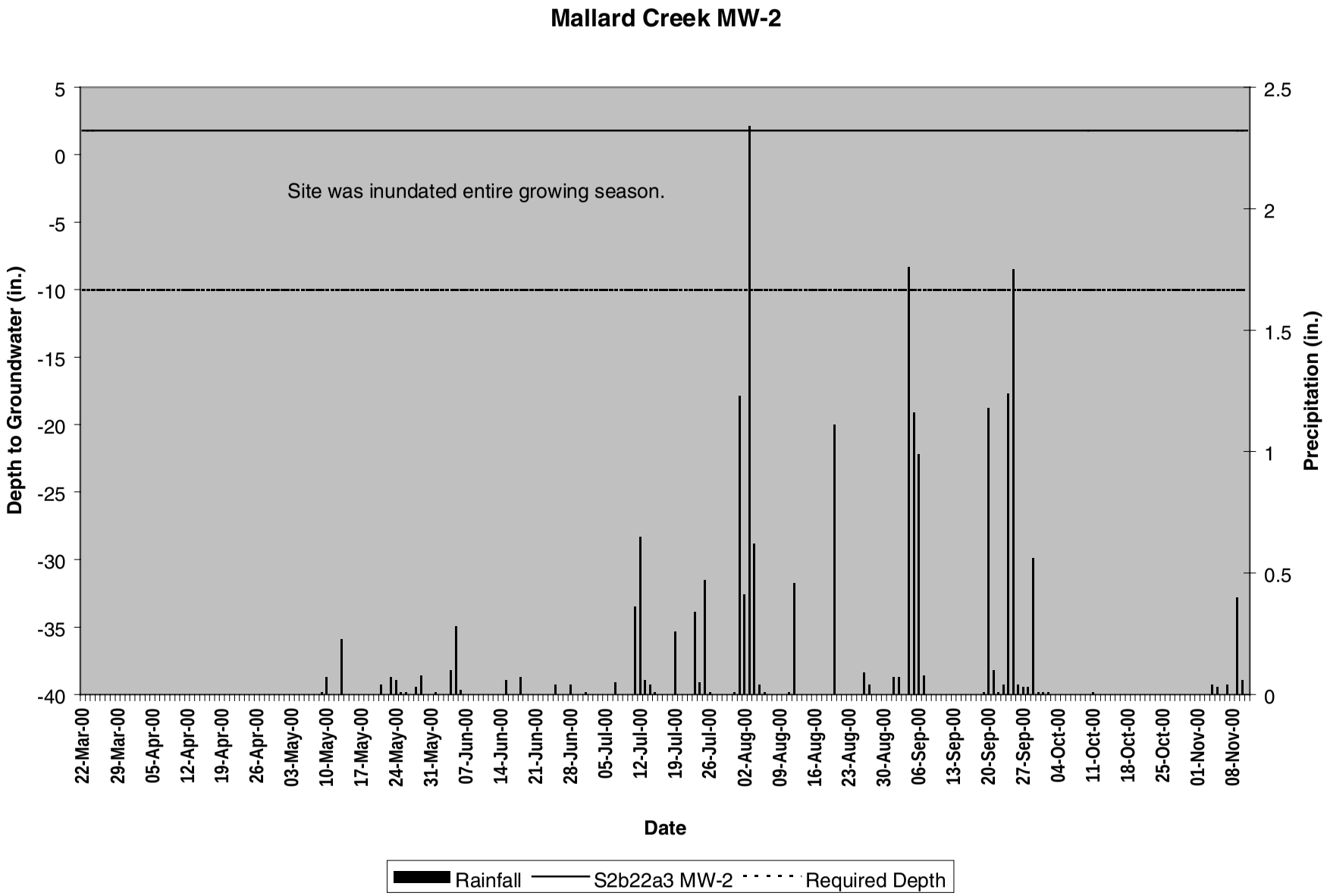
4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

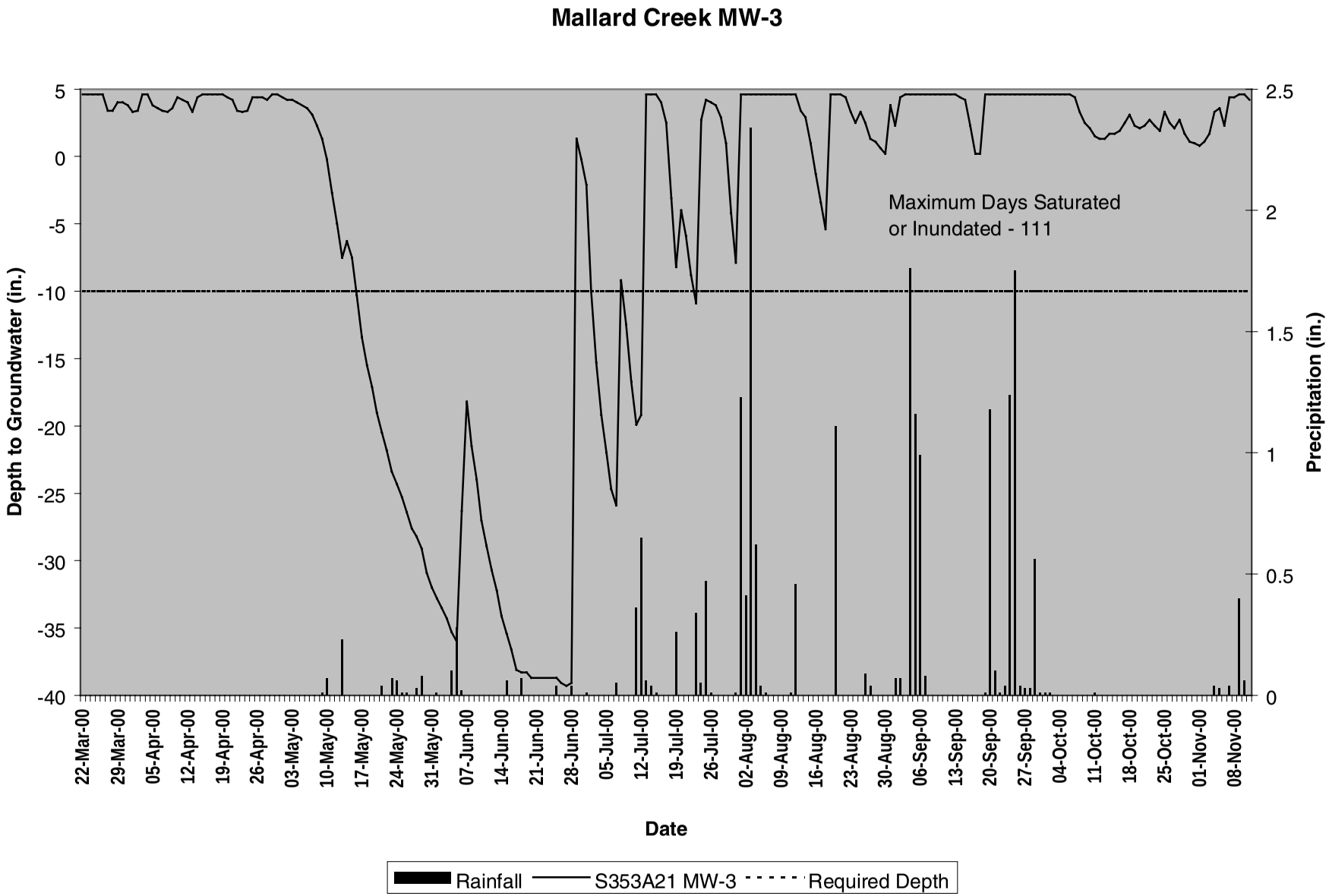
- All groundwater and surfacewater gauges located on Site 1 met the hydrologic success criteria as stated in the May 19, 1992 USACE permit. These results have been effected by a broken 12” water main located adjacent to the mitigation site. The water main was repaired on December 2, 2000. NCDOT will continue to monitor the hydrology at Site 1.
- Three of six gauges showed hydrologic success on Site 2. This is an increase in one gauge from the 1999 monitoring season despite the lower than normal rainfall in the Charlotte, North Carolina area. Additionally, the duration and frequency of saturation or inundation has increased since 1999.
- Six of six vegetation monitoring plots have 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.

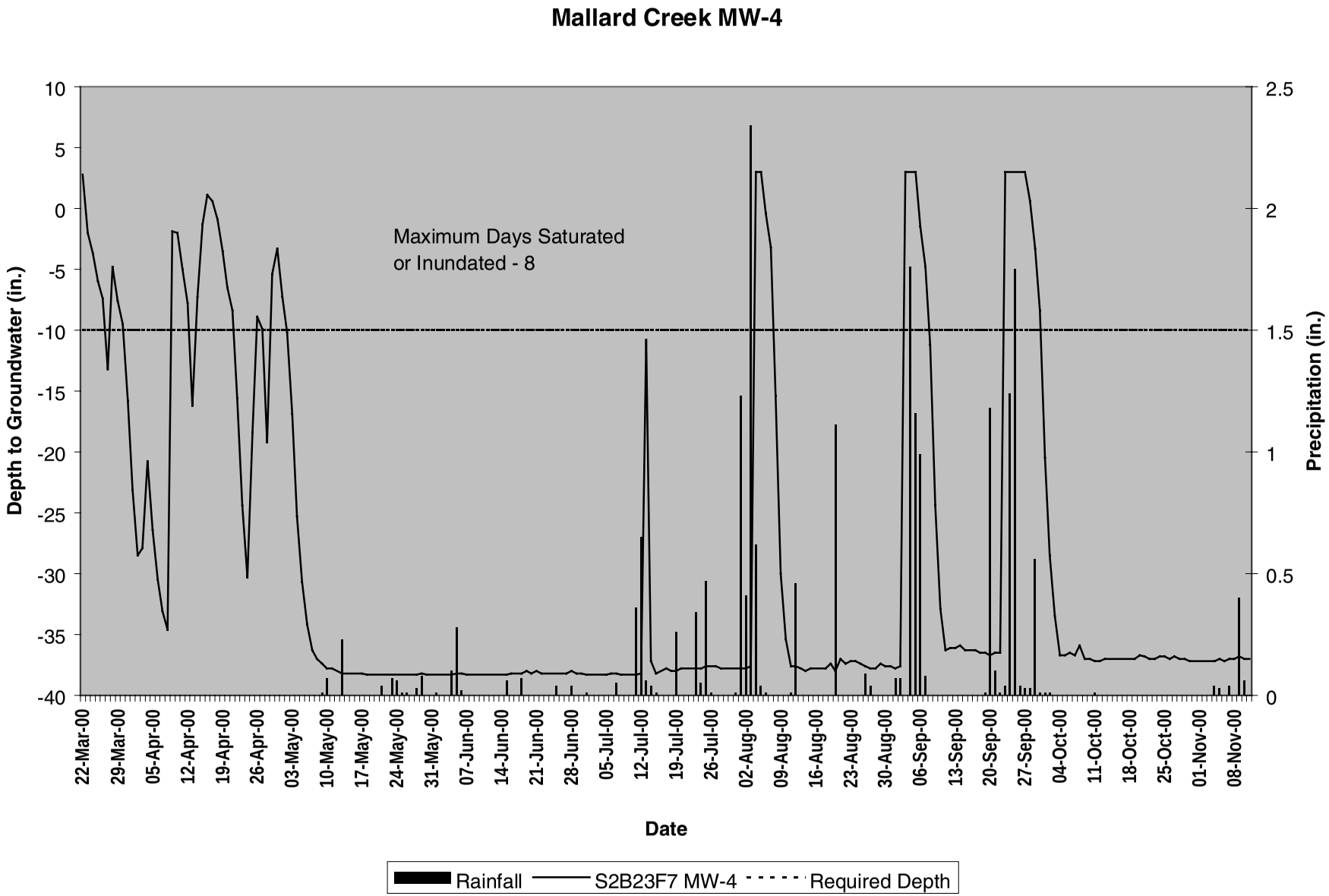
APPENDIX A

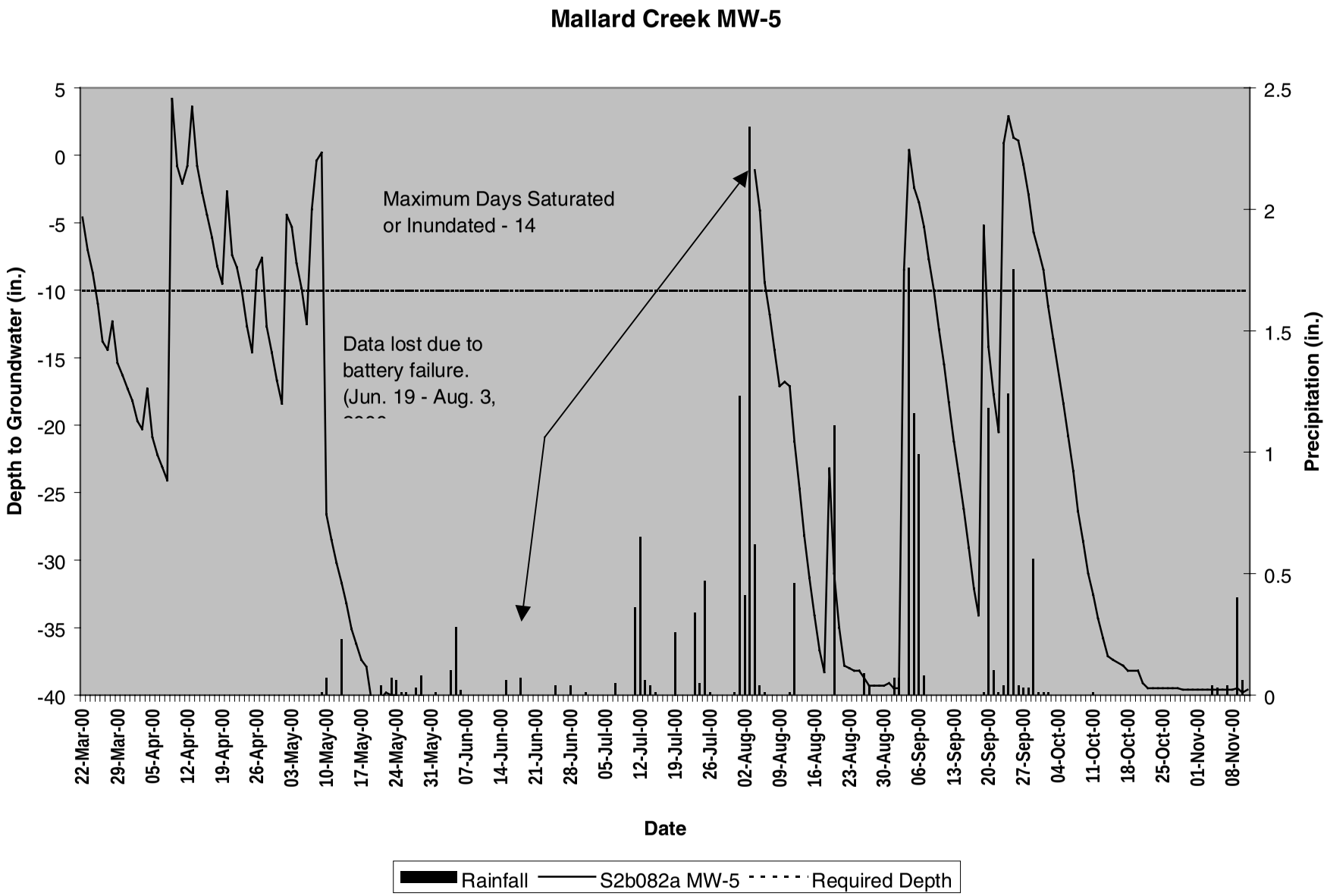
DEPTH TO GROUNDWATER PLOTS

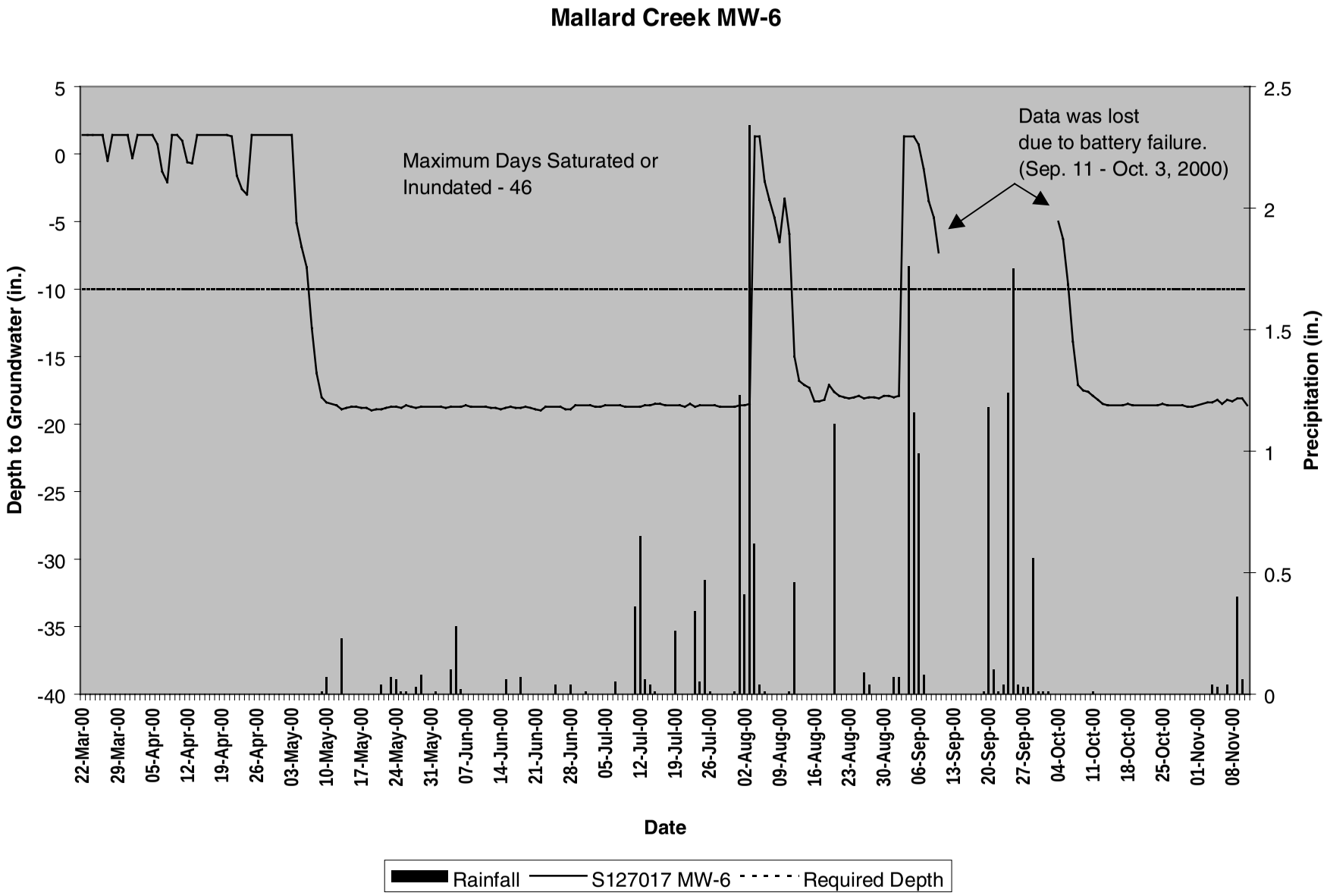

Mallard Creek MW-1
Data lost due
to battery failure.
(Mar. 22 - May 3,
Maximum Days Saturated
or Inundated - 54
Depth to Groundwater (in.)
Precipitation (in.)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
22-Mar-00
29-Mar-00
05-Apr-00
12-Apr-00
19-Apr-00
26-Apr-00
03-May-00
10-May-00
17-May-00
24-May-00
31-May-00
07-Jun-00
14-Jun-00
21-Jun-00
28-Jun-00
05-Jul-00
12-Jul-00
19-Jul-00
26-Jul-00
02-Aug-00
09-Aug-00
16-Aug-00
23-Aug-00
30-Aug-00
06-Sep-00
13-Sep-00
20-Sep-00
27-Sep-00
04-Oct-00
11-Oct-00
18-Oct-00
25-Oct-00
01-Nov-00
08-Nov-00
Rainfall
S316816 MW-1
Required Depth

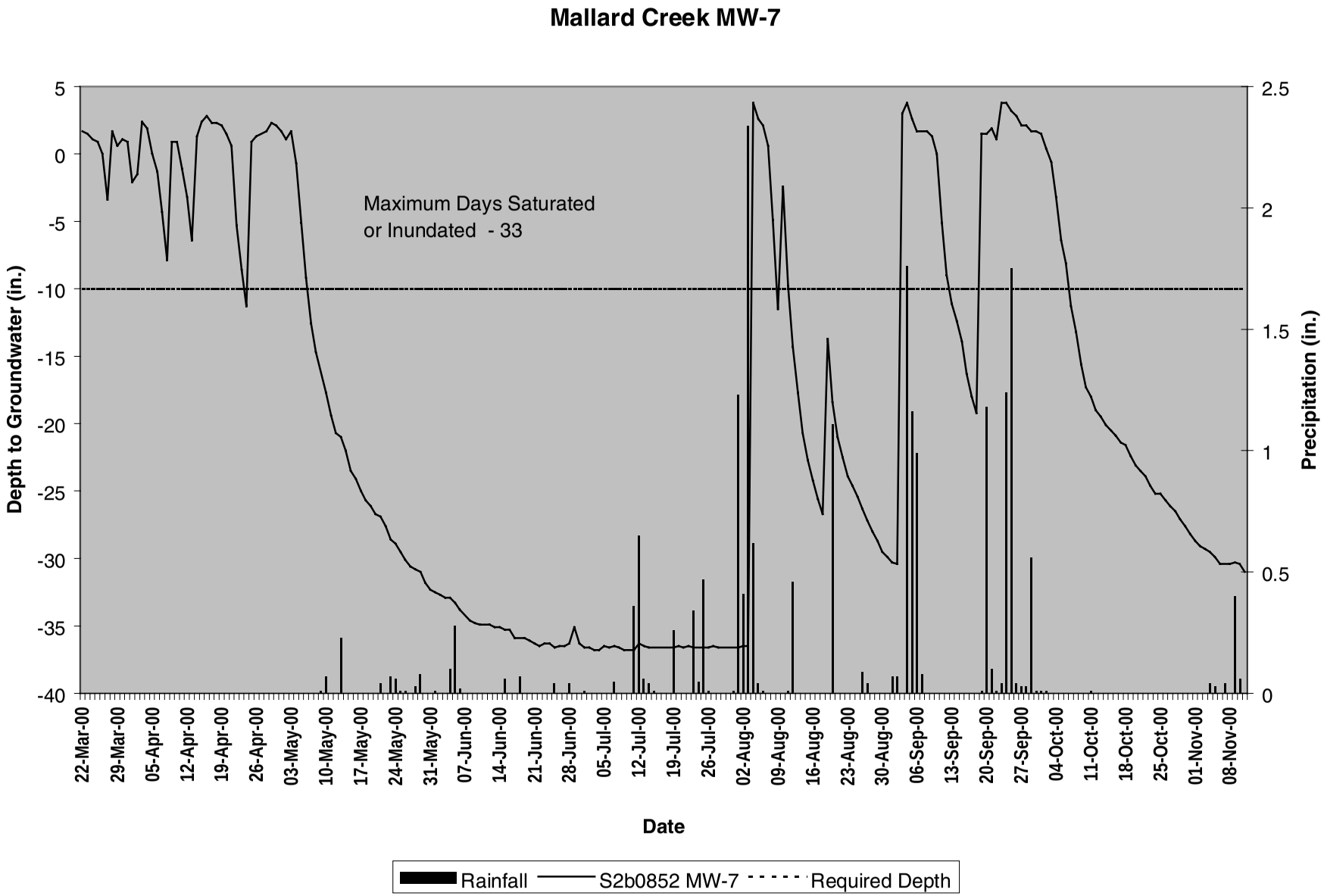

Mallard Creek MW-2
Site was inundated entire growing season.
Depth to Groundwater (in.)
Precipitation (in.)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
22-Mar-00
29-Mar-00
05-Apr-00
12-Apr-00
19-Apr-00
26-Apr-00
03-May-00
10-May-00
17-May-00
24-May-00
31-May-00
07-Jun-00
14-Jun-00
21-Jun-00
28-Jun-00
05-Jul-00
12-Jul-00
19-Jul-00
26-Jul-00
02-Aug-00
09-Aug-00
16-Aug-00
23-Aug-00
30-Aug-00
06-Sep-00
13-Sep-00
20-Sep-00
27-Sep-00
04-Oct-00
11-Oct-00
18-Oct-00
25-Oct-00
01-Nov-00
08-Nov-00
Rainfall
S2b22a3 MW-2
Required Depth

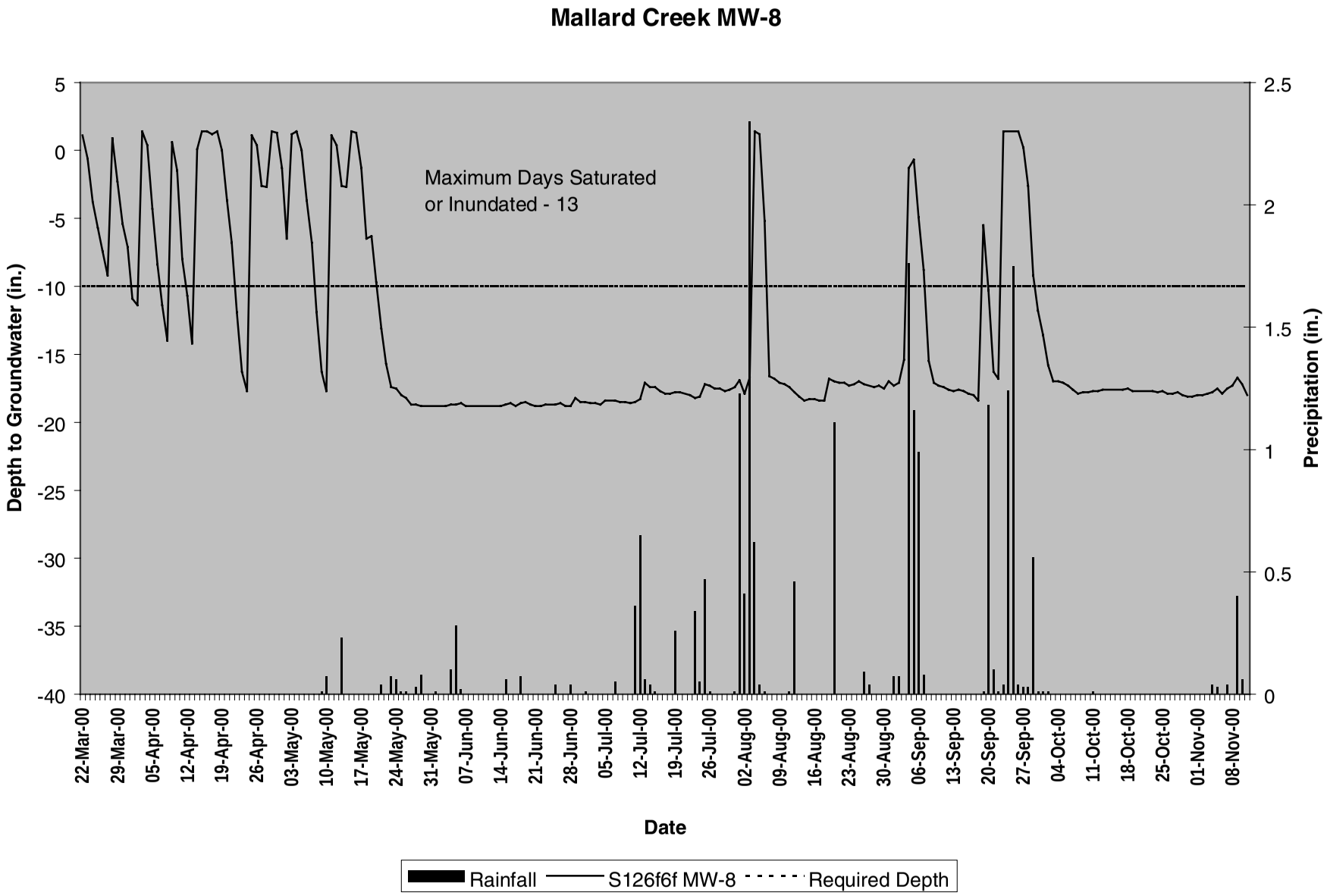

Mallard Creek MW-3
Depth to Groundwater (in.)
Precipitation (in.)
Maximum Days Saturated
or Inundated - 111
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
22-Mar-00
29-Mar-00
05-Apr-00
12-Apr-00
19-Apr-00
26-Apr-00
03-May-00
10-May-00
17-May-00
24-May-00
31-May-00
07-Jun-00
14-Jun-00
21-Jun-00
28-Jun-00
05-Jul-00
12-Jul-00
19-Jul-00
26-Jul-00
02-Aug-00
09-Aug-00
16-Aug-00
23-Aug-00
30-Aug-00
06-Sep-00
13-Sep-00
20-Sep-00
27-Sep-00
04-Oct-00
11-Oct-00
18-Oct-00
25-Oct-00
01-Nov-00
08-Nov-00
Date
Rainfall
S353A21 MW-3
Required Depth

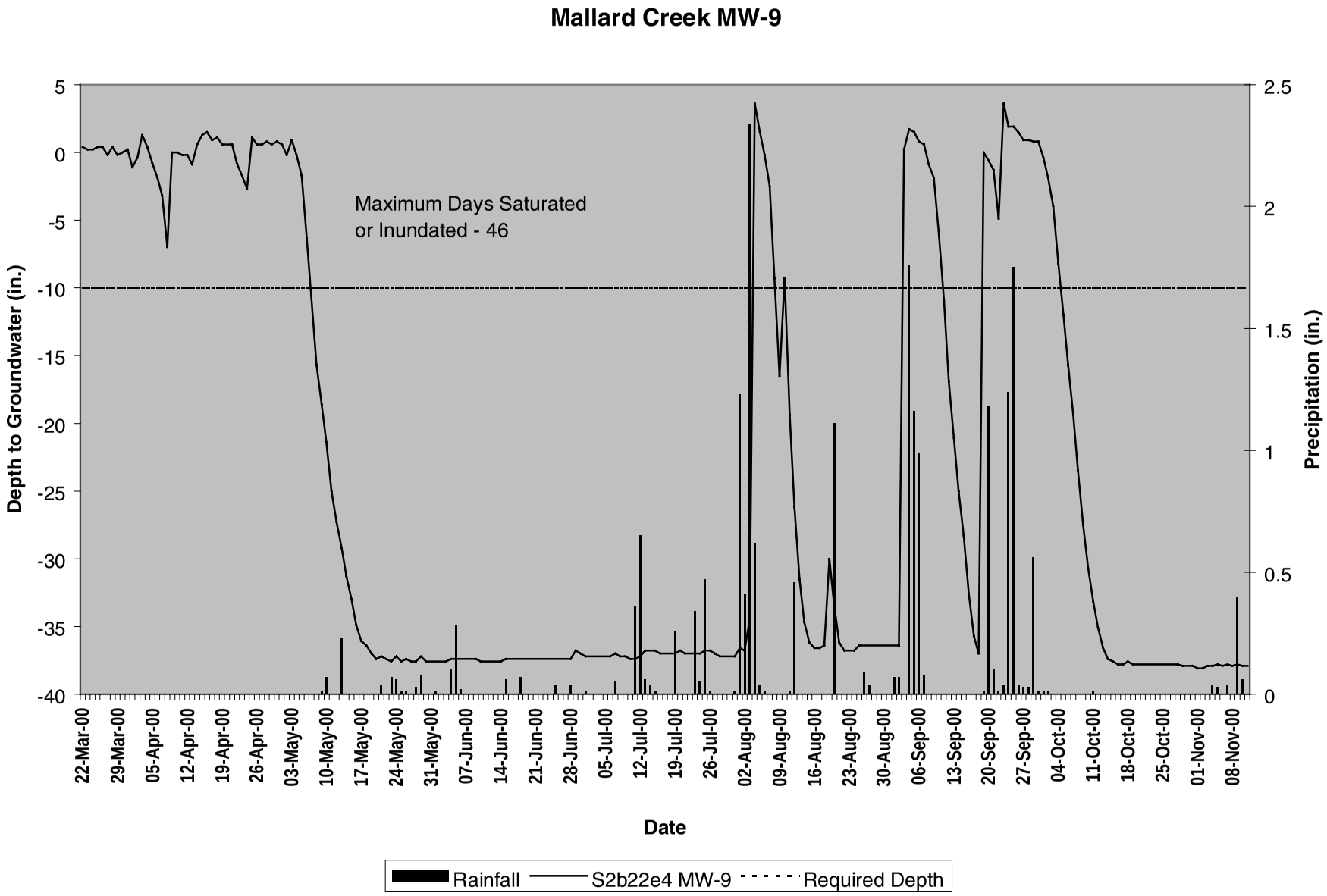

Mallard Creek MW-4
Maximum Days Saturated
or Inundated - 8
Depth to Groundwater (in.)
Precipitation (in.)
Date
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
22-Mar-00
29-Mar-00
05-Apr-00
12-Apr-00
19-Apr-00
26-Apr-00
03-May-00
10-May-00
17-May-00
24-May-00
31-May-00
07-Jun-00
14-Jun-00
21-Jun-00
28-Jun-00
05-Jul-00
12-Jul-00
19-Jul-00
26-Jul-00
02-Aug-00
09-Aug-00
16-Aug-00
23-Aug-00
30-Aug-00
06-Sep-00
13-Sep-00
20-Sep-00
27-Sep-00
04-Oct-00
11-Oct-00
18-Oct-00
25-Oct-00
01-Nov-00
08-Nov-00
Rainfall
S2B23F7 MW-4
Required Depth

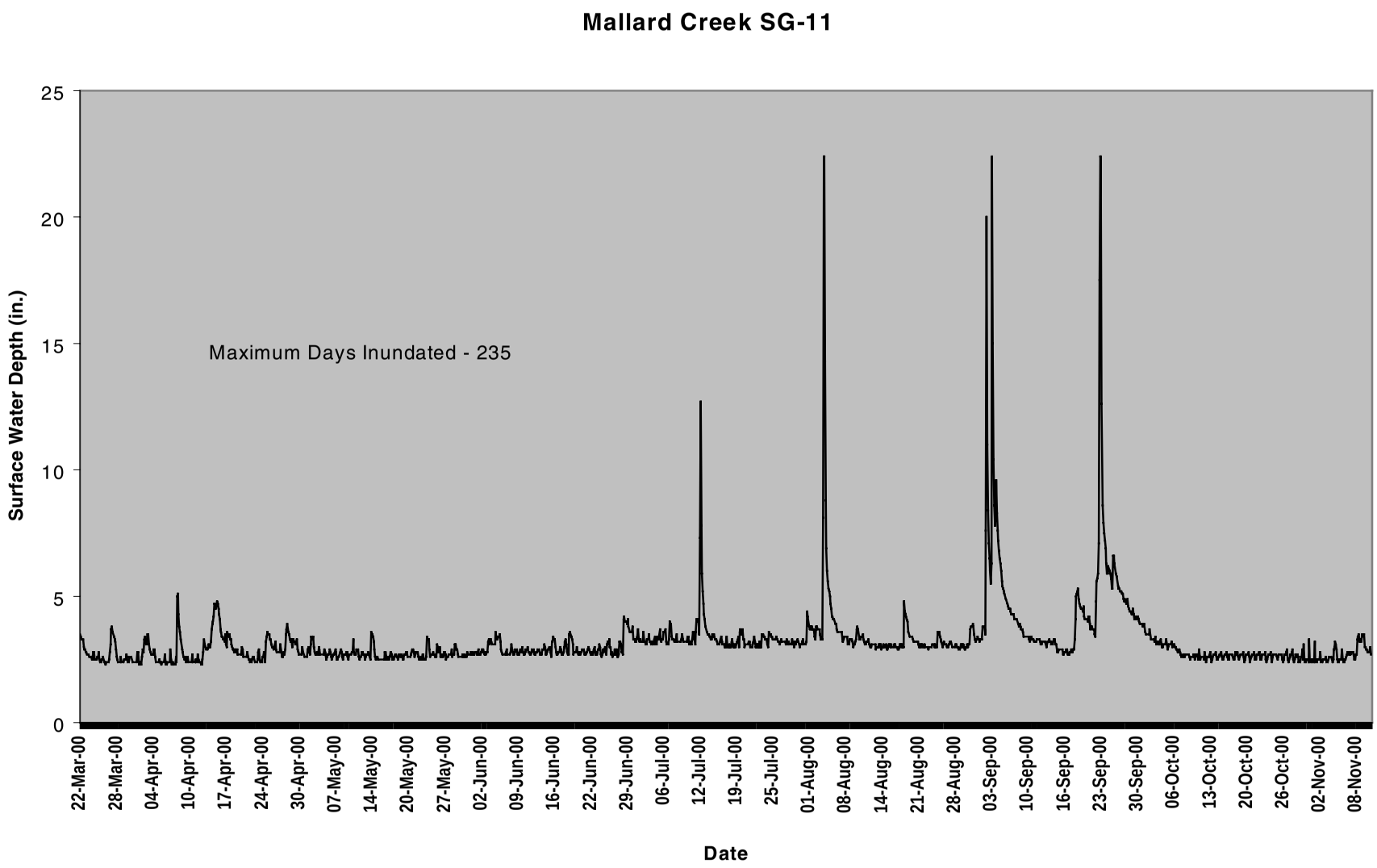

Mallard Creek MW-5
Maximum Days Saturated or Inundated - 14
Data lost due to battery failure. (Jun. 19 - Aug. 3,
Depth to Groundwater (in.)
Precipitation (in.)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
22-Mar-00
29-Mar-00
05-Apr-00
12-Apr-00
19-Apr-00
26-Apr-00
03-May-00
10-May-00
17-May-00
24-May-00
31-May-00
07-Jun-00
14-Jun-00
21-Jun-00
28-Jun-00
05-Jul-00
12-Jul-00
19-Jul-00
26-Jul-00
02-Aug-00
09-Aug-00
16-Aug-00
23-Aug-00
30-Aug-00
06-Sep-00
13-Sep-00
20-Sep-00
27-Sep-00
04-Oct-00
11-Oct-00
18-Oct-00
25-Oct-00
01-Nov-00
08-Nov-00
Rainfall
S2b082a MW-5
Required Depth


Mallard Creek MW-6
Maximum Days Saturated or Inundated - 46
Data was lost due to battery failure. (Sep. 11 - Oct. 3, 2000)
Depth to Groundwater (in.)
Precipitation (in.)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
22-Mar-00
29-Mar-00
05-Apr-00
12-Apr-00
19-Apr-00
26-Apr-00
03-May-00
10-May-00
17-May-00
24-May-00
31-May-00
07-Jun-00
14-Jun-00
21-Jun-00
28-Jun-00
05-Jul-00
12-Jul-00
19-Jul-00
26-Jul-00
02-Aug-00
09-Aug-00
16-Aug-00
23-Aug-00
30-Aug-00
06-Sep-00
13-Sep-00
20-Sep-00
27-Sep-00
04-Oct-00
11-Oct-00
18-Oct-00
25-Oct-00
01-Nov-00
08-Nov-00
Rainfall
S127017 MW-6
Required Depth


Mallard Creek MW-7
Maximum Days Saturated
or Inundated - 33
Depth to Groundwater (in.)
Precipitation (in.)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
22-Mar-00
29-Mar-00
05-Apr-00
12-Apr-00
19-Apr-00
26-Apr-00
03-May-00
10-May-00
17-May-00
24-May-00
31-May-00
07-Jun-00
14-Jun-00
21-Jun-00
28-Jun-00
05-Jul-00
12-Jul-00
19-Jul-00
26-Jul-00
02-Aug-00
09-Aug-00
16-Aug-00
23-Aug-00
30-Aug-00
06-Sep-00
13-Sep-00
20-Sep-00
27-Sep-00
04-Oct-00
11-Oct-00
18-Oct-00
25-Oct-00
01-Nov-00
08-Nov-00
Rainfall
S2b0852 MW-7
Required Depth


Mallard Creek MW-8
Maximum Days Saturated
or Inundated - 13
Depth to Groundwater (in.)
Precipitation (in.)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
22-Mar-00
29-Mar-00
05-Apr-00
12-Apr-00
19-Apr-00
26-Apr-00
03-May-00
10-May-00
17-May-00
24-May-00
31-May-00
07-Jun-00
14-Jun-00
21-Jun-00
28-Jun-00
05-Jul-00
12-Jul-00
19-Jul-00
26-Jul-00
02-Aug-00
09-Aug-00
16-Aug-00
23-Aug-00
30-Aug-00
06-Sep-00
13-Sep-00
20-Sep-00
27-Sep-00
04-Oct-00
11-Oct-00
18-Oct-00
25-Oct-00
01-Nov-00
08-Nov-00
Rainfall
S126f6f MW-8
Required Depth


Mallard Creek MW-9
Maximum Days Saturated
or Inundated - 46
Depth to Groundwater (in.)
Precipitation (in.)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
22-Mar-00
29-Mar-00
05-Apr-00
12-Apr-00
19-Apr-00
26-Apr-00
03-May-00
10-May-00
17-May-00
24-May-00
31-May-00
07-Jun-00
14-Jun-00
21-Jun-00
28-Jun-00
05-Jul-00
12-Jul-00
19-Jul-00
26-Jul-00
02-Aug-00
09-Aug-00
16-Aug-00
23-Aug-00
30-Aug-00
06-Sep-00
13-Sep-00
20-Sep-00
27-Sep-00
04-Oct-00
11-Oct-00
18-Oct-00
25-Oct-00
01-Nov-00
08-Nov-00
Rainfall
S2b22e4 MW-9
Required Depth


Mallard Creek SG-11
Maximum Days Inundated - 235
Surface Water Depth (in.)
25
20
15
10
5
0
22-Mar-00
28-Mar-00
04-Apr-00
10-Apr-00
17-Apr-00
24-Apr-00
30-Apr-00
07-May-00
14-May-00
20-May-00
27-May-00
02-Jun-00
09-Jun-00
16-Jun-00
22-Jun-00
29-Jun-00
06-Jul-00
12-Jul-00
19-Jul-00
25-Jul-00
01-Aug-00
08-Aug-00
14-Aug-00
21-Aug-00
28-Aug-00
03-Sep-00
10-Sep-00
16-Sep-00
23-Sep-00
30-Sep-00
06-Oct-00
13-Oct-00
20-Oct-00
26-Oct-00
02-Nov-00
08-Nov-00
Date

APPENDIX B

SITE PHOTOS

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

APPENDIX C

CHARLOTTE- MECKLINBURG UTILITY DISTRICT LETTER

CHARLOTTE

November 30, 2000

TO: Larry Thompson
Divisional Officer
NCDOT
716 West Main Street
Albemarle, NC 28001

Angela C. Lee

FROM: Angela C. Lee
Water Distribution Superintendent
Charlotte Mecklenburg Utilities

SUBJECT: Water Leak on Mallard Creek Road (9900 North Tryon Street)

The above location has a water leak that is on the repair list for a water distribution work crew. We believe that the leak is on a 12" ductile iron water main. Our field staff considered the leak to be minor because it is not doing property damage nor did they consider the leakage to be excessive. Due to your request, I have asked our field staff to expedite the repair. Call me (704–336-2564), if I can be of any further assistance.

Water Distribution Division 5730 General Commerce Drive Charlotte, NC 28213 Phone: 704/336-2564
Charlotte-Mecklenburg Utilities