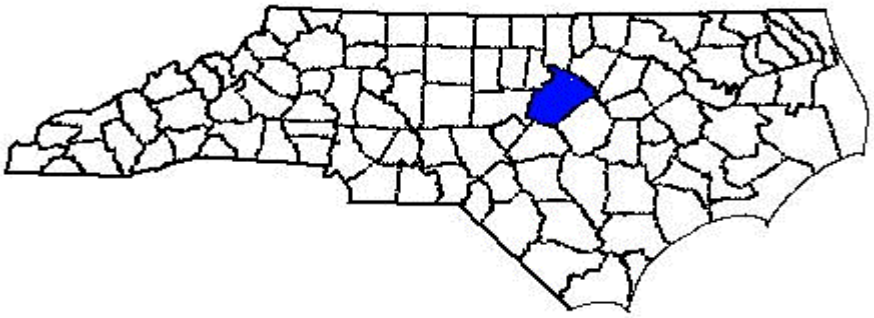
ANNUAL REPORT FOR 2004



Dutchman's Creek Mitigation Site
Wake County
Project No. 8.U401721
TIP No. R-2000 WM

Prepared By:
Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
December 2004

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Summary

The following report summarizes the monitoring activities that have occurred in the past year at the Dutchman's Creek Mitigation Site. This site was originally constructed in 2000. Monitoring activities in 2004 represent the fourth year of hydrology monitoring and the third year of vegetation monitoring for the site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years or until the site is deemed successful.

Upon agency request, two additional groundwater gauges were installed in April 2003 (between gauges DC-3 and DC-4). Currently, eight groundwater gauges and a rain gauge are used to monitor hydrology on the site.

This report utilizes rainfall data from both a local weather station and from an onsite rain gauge. The NC State Climate Office provided historical data from the Raleigh/Durham weather station.

Hydrologic monitoring indicated that four of the eight monitoring gauges met the hydrology success criteria of 5.0% for the 2004-growing season. Gauges DC-3 and DC-7 also failed to meet during the 2003 year. Gauges DCE-1 and DCE-2, which were installed in April 2003 between gauges DC-3 and DC-4, failed to meet the success criteria. NCDOT has approached the Ecosystem Enhancement Program (EEP) about accepting approximately five acres of deficit in the creation area. The resource agencies will be contacted as soon as more information is available.

During the 2004-year, an additional plot for shrub planting was established. There are currently four vegetation-monitoring plots established throughout the site. Based on the results of the third year of monitoring, an average tree density of 509 trees per acre was reported on the site. This is well above the minimum required by the success criteria.

Per the letter from the EEP to NCDOT dated August 25, 2004, the EEP has accepted the transfer of all offsite mitigation projects. The EEP will be responsible for fulfilling the remaining monitoring requirements and future remediation for this project.

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Dutchman's Creek Mitigation Site is located between SR 1386 (Graham Newton Road) and SR 1377 (Blaney Franks Road) immediately above the confluence with Lake Wheeler in Wake County. This site mitigates for wetland impacts associated with the Raleigh Outer Loop (R-2000).

The site, totaling 87 acres in size, consists of scrub-shrub wetland restoration, bottomland hardwood creation, marsh (littoral zone) and open water creation, and floodplain wetland preservation components. The site was constructed in 2000 and planted in 2001.

1.2 PURPOSE

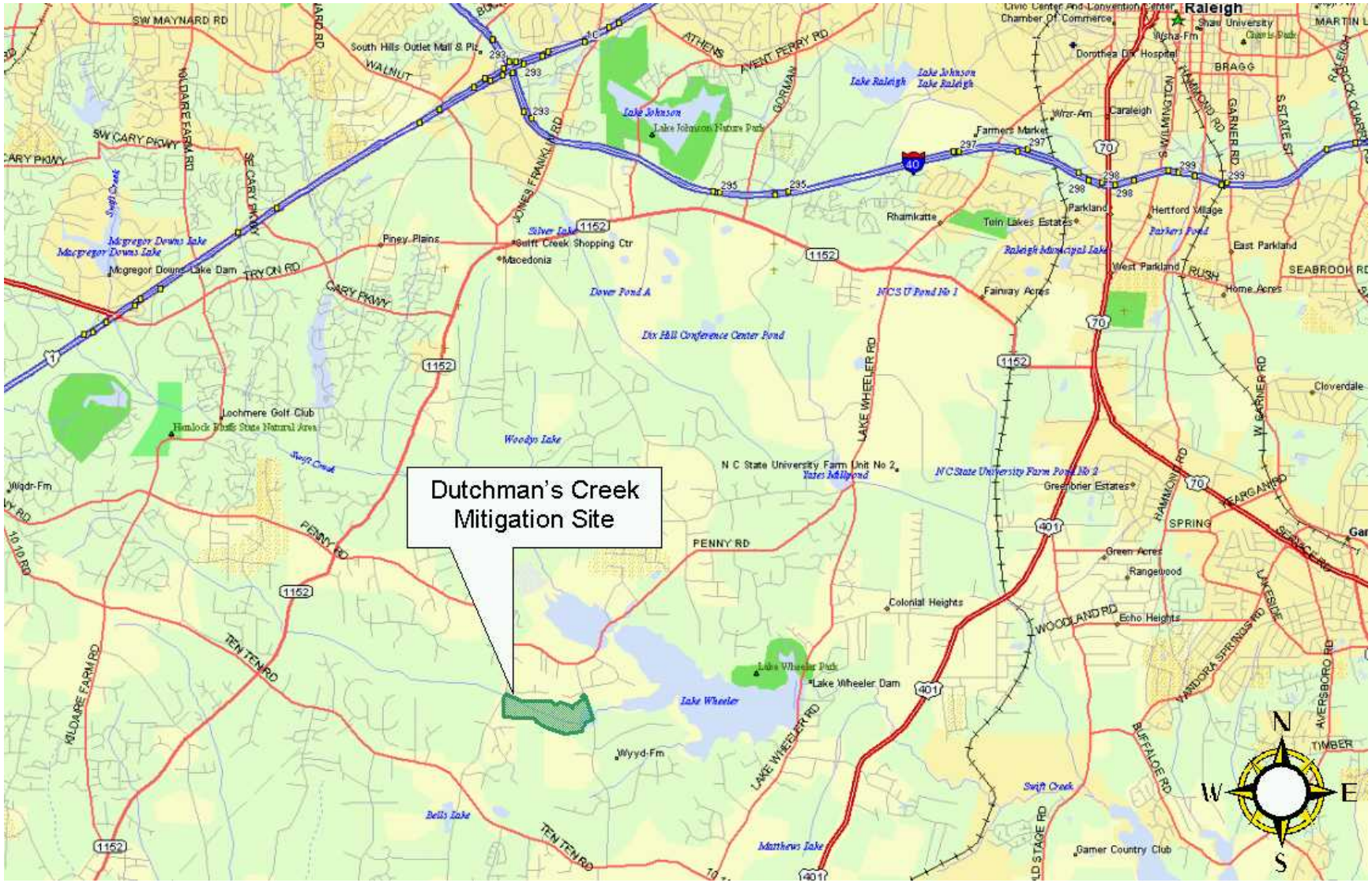
In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years or until the site is deemed successful. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival.

Activities in 2004 reflect the fourth year of hydrology monitoring and the third year of vegetation monitoring following the restoration efforts. Included in this report are analyses of both hydrologic and vegetative monitoring results, as well as local climate conditions throughout the growing season, and site photographs.

1.3 PROJECT HISTORY

December 2000	Construction Completed
Spring 2001	Site Planted
March 2001	Monitoring Gauges Installed
March- November 2001	Hydrologic Monitoring (1 yr.)
October 2001	Vegetation Monitoring (1 yr.)
March 2002	Replanted Plants and Shrubs
June 2002	Vegetation Monitoring (1 yr. Restart)
March-November 2002	Hydrologic Monitoring (2 yr.)
February 2003	Shrub Area Supplemental Planting
June 2003	Vegetation Monitoring (2 yr.)
March-November 2003	Hydrologic Monitoring (3yr.)
June 2004	Vegetation Monitoring (3 yr.)
March-November 2004	Hydrologic Monitoring (4 yr.)

Figure 1. Site Location Map



2.0 HYDROLOGY

2.1 SUCCESS CRITERIA

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology state that the area must be inundated or saturated (within 12" of the surface) by surface or groundwater for at least a consecutive 5% of the growing season during a normal precipitation year. Areas inundated for less than 5% of the growing season are always classified as non-wetlands.

A site may be found to meet the hydrology performance criteria on the basis of comparison of monitoring data taken from the site with monitoring data taken from an established reference site approved by the Corps. The Corps retains the discretion to find that the hydrology criteria are met if such monitoring data from the mitigation site and the reference site are substantially the same.

The growing season in Wake County begins March 26 and ends November 10. These dates correspond to a 50% probability that temperatures will not drop to 28°F or lower after March 26 and before November 10.[1] The growing season is 229 days; therefore, optimum hydrology requires 5% of this season, or at least 12 consecutive days. Local climate must also represent average conditions for the area.

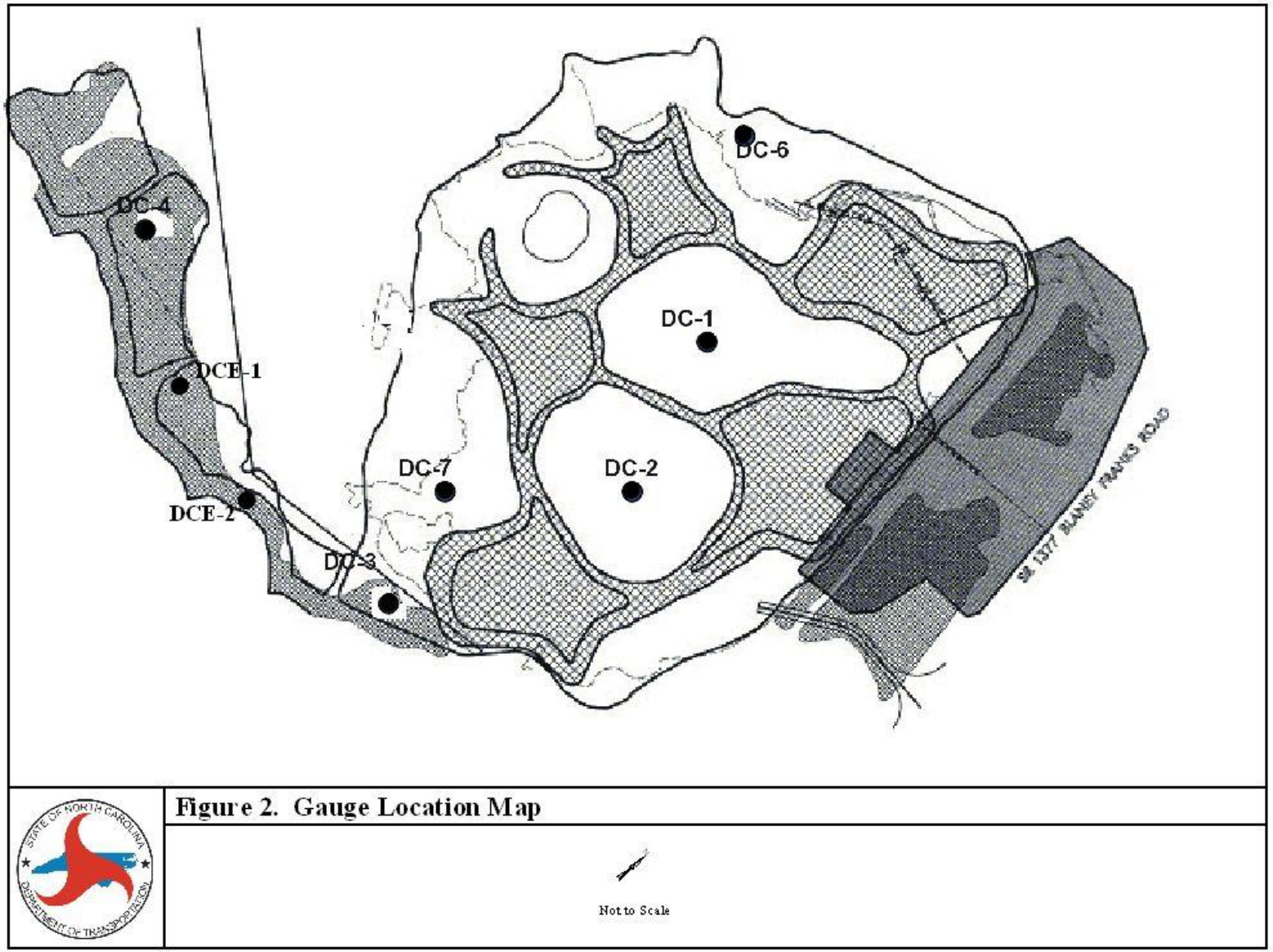
2.2 HYDROLOGIC DESCRIPTION

In March of 2001, six groundwater-monitoring gauges were installed across the site (Figure 2). An additional groundwater gauge was installed in March 2002 based on an onsite agency review meeting. In April of 2003, two additional groundwater gauges were installed between gauges DC-3 and DC-4. Currently, eight groundwater gauges and a rain gauge are used to monitor hydrology on the site. The automatic monitoring gauges record daily readings of groundwater depth.

The Dutchman's Creek site was designed to receive hydrologic input from rainfall and surface water accessing the floodplain. The hydrologic monitoring should show the reaction of the groundwater level to specific rainfall events.

[1] Natural Resources Conservation Service, Soil Survey of Wake County, North Carolina, p. 79.

Figure 2. Monitoring Gauge Location Map



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 229-day growing season (March 26 – November 10). The results are presented in Table 1.

Appendix A contains a plot of the groundwater depth for each monitoring well. If the gauge shows saturation for greater than 5% of the growing season, the maximum number of consecutive days is noted on each graph. The individual precipitation events are shown on the monitoring well graphs as bars.

Figure 3 provides a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 12.5% of the growing season. Gauges highlighted in red show hydrology between 8% and 12.5% of the growing season, while those in green indicate hydrology between 5% and 8%. Gauges highlighted in black indicate no wetland hydrology (less than 5% of the growing season).

2.3.2 Climatic Data

Figure 4 provides an evaluation of the local climate in comparison with historical data in order to determine whether 2004 was “average” in terms of climate conditions. The two lines represent the 30^{th} and 70^{th} percentiles of monthly precipitation for Raleigh. The bars are the monthly rainfall totals for November 2003 through November 2004. The NC State Climate Office provided historical data from the Raleigh/Durham weather station.

Months with below average rainfall include January and April. November (03’), December (03’), February, March, May, and October experienced average rainfall. The months of June, July, August, September, and October all experienced above average rainfall for the year. Overall, the site experienced average to above average rainfall in 2004.

Table 1. Dutchman's Creek Hydrologic Monitoring Results

Monitoring Well	<5%	5-8%	8-12.5%	>12.5%	Actual %	Success Dates
DC-1+				✕	39.1	March 26-May 11 Aug 13-Nov 10
DC-2+				✕	20.0	March 26-May 10 Oct 12-Nov 10
DC-3	✕				2.2	
DC-4+				✕	27.0	March 26-May 26
DC-6+				✕	27.0	March 31-May 26 July 18-Sept 17
DC-7	✕				.4	
DCE-1	✕				1.3	
DCE-2	✕				.4	

+ Gauge met the success criterion during an average rainfall month (February, March, May, and October experienced average rainfall).

Specific Gauge Problems:

- Gauge DCE-2 malfunctioned during the period from May 14 - September 17.

2.4 CONCLUSIONS

The 2004-year represents the fourth full growing season that the hydrologic data has been monitored on the Dutchman's Creek Mitigation Site. Four of the eight gauges indicated saturation within 12" of the surface for greater than 5% of the growing season. Gauges DC-3 and DC-7 also failed to meet during the 2003 year. Gauges DCE-1 and DCE-2, which were installed in April 2003 between gauges DC-3 and DC-4, failed to meet the success criteria.

The EEP will monitor the Dutchman's Creek Mitigation Site for hydrology in 2005.

Figure 3. Monitoring Gauge Results Map

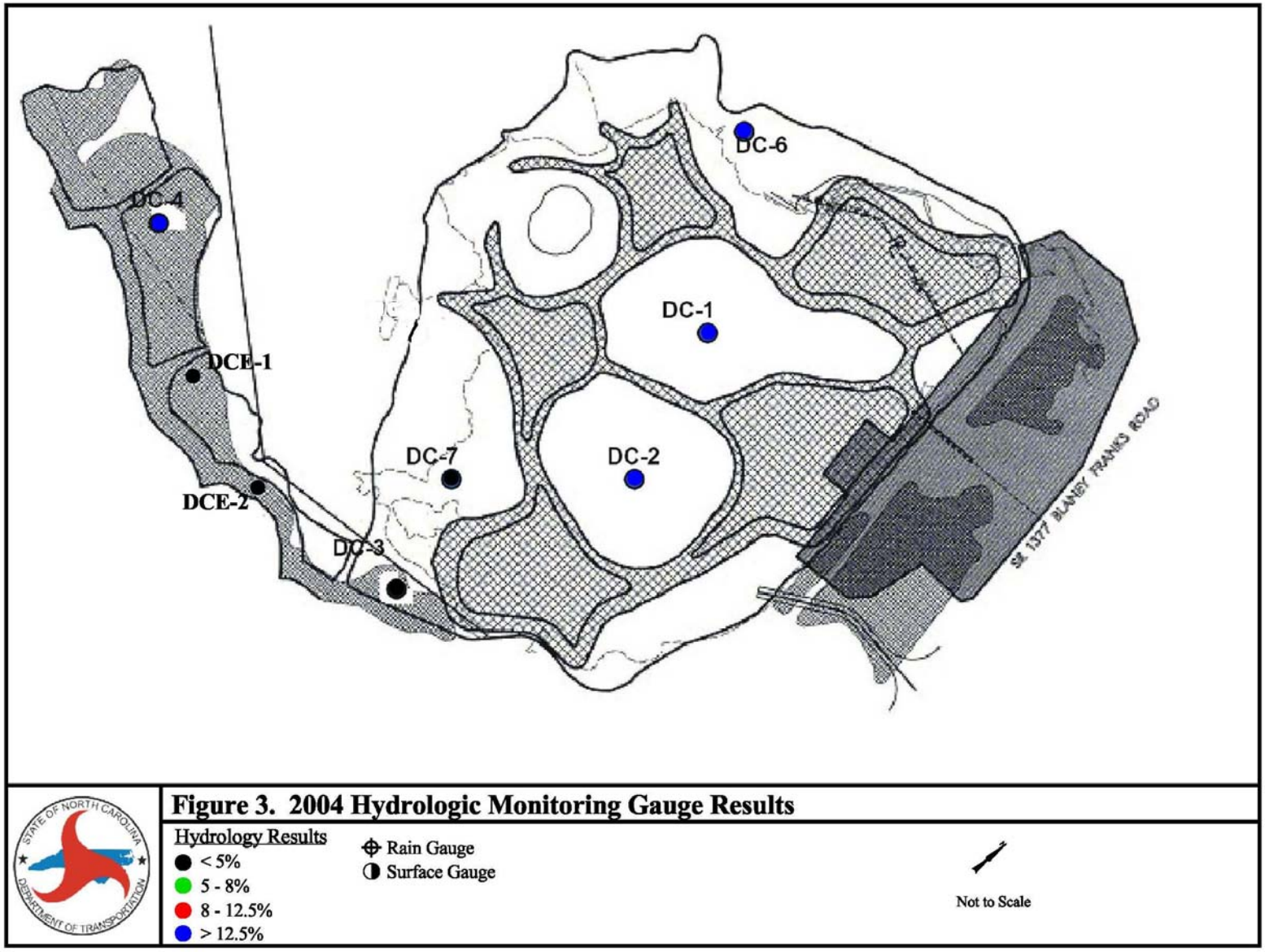
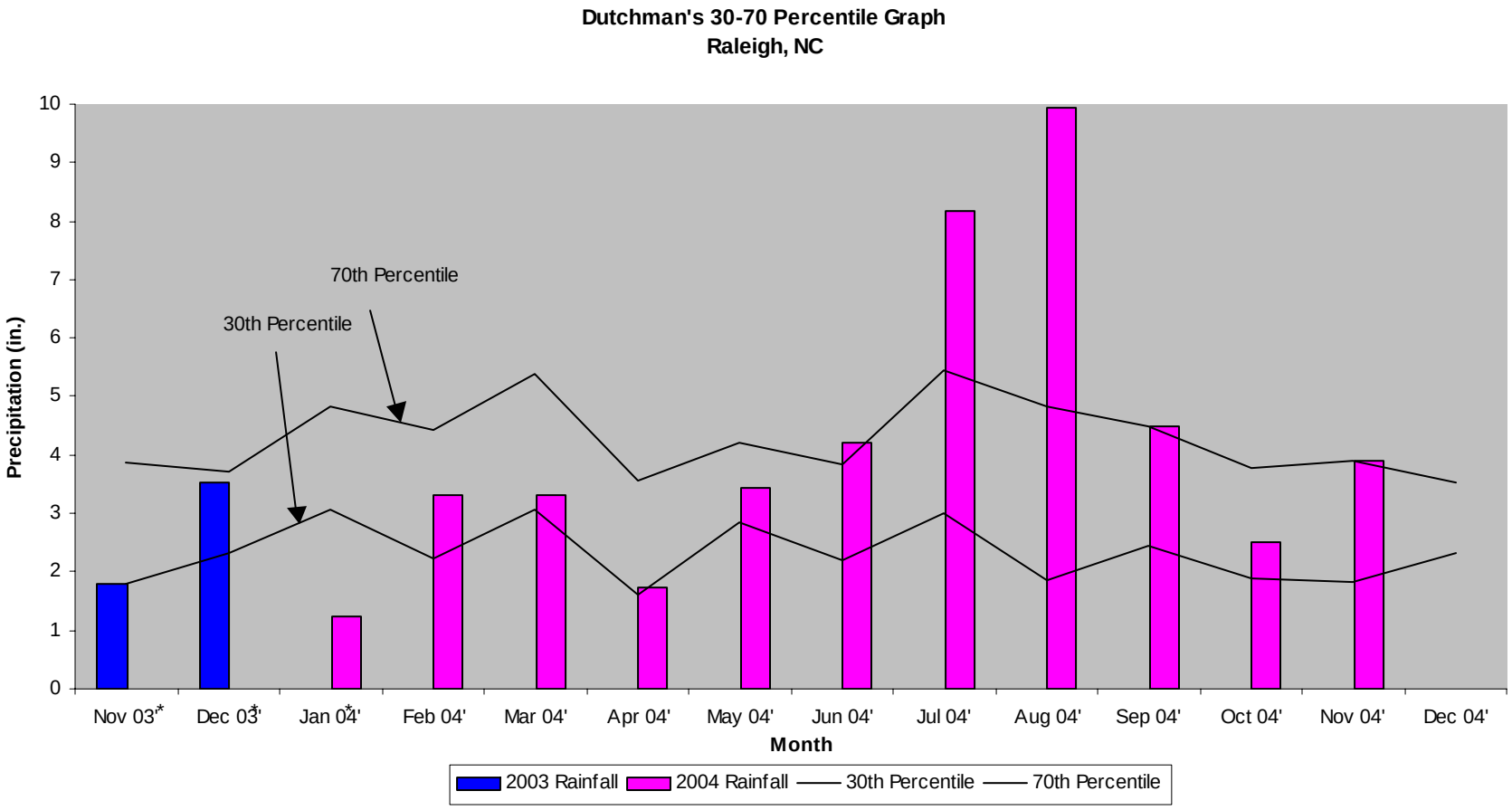


FIGURE 4: 30-70 Percentile Graph



3.0 VEGETATION: DUTCHMANS CREEK MITIGATION SITE (YEAR 3 MONITORING)

3.1 SUCCESS CRITERIA

As stated in the July 1999 Mitigation Plan, the success criteria for vegetation within the scrub-shrub areas and bottomland hardwood forest will be met if a minimum mean density of 320 characteristic species/acre are surviving after 3 years and a minimum mean density of 260 characteristic species/acre are surviving after 5 years from initial planting. Supplemental plantings will be performed as needed to achieve the vegetation success criteria.

3.2 DESCRIPTION OF SPECIES

The following tree species were planted in the Wetland Restoration Area: (Bottomland Hardwood Area)

Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Quercus falcata var. *falcata*, Southern Red Oak
Fraxinus pennsylvanica, Green Ash
Quercus phellos, Willow Oak
Nyssa sylvatica var. *sylvatica*, Blackgum
Quercus lyrata, Overcup Oak
Quercus nigra, Water Oak

The following shrub species were planted in the Wetland Restoration Area: (Shrub Area)

Cornus amomum, Silky Dogwood
Cornus stricta, Swamp Dogwood
Cornus sericea, Redosier Dogwood
Alnus serrulata, Tag Alder
Cephalanthus occidentalis, Buttonbush
Celtis laevigata, Sugarberry

3.3 RESULTS OF VEGETATION MONITORING

Table 2. Vegetation Monitoring Statistics

Plot #	Cherrybark Oak	Green Ash	Overcup Oak	Southern Red Oak	Water Oak	Willow Oak	Blackgum	Dogwood Species	Tag Alder	Buttonbush	Sugarberry	Total (3 Year)	Total (at planting)	Density (Trees/Acre
1	1	14										15	39	262
2	4	17	11	2		1	4					39	44	603
3(Shrub)								25	5	7	16	53	66	546
4(Shrub)								36	2	5	3	46	50	626
				AVERAGE TREE DENSITY										509

Site Notes: Species noted: alder, arrow-arum, elderberry, microstegium, *Juncus* sp., silky dogwood, switch grass, black willow, *Baccharis* sp., pokeberry, cattail, river birch, sedge, multi-flora rose, and fennel.

A few sweetgum and red maple were noted, but neither were considered an issue at this time.

3.4 CONCLUSIONS

The shrub and the bottomland hardwood areas have been planted with the species listed above. An additional shrub-monitoring plot (plot 4) was established in 2004. The 2004 vegetation monitoring of the site revealed an average density of 509 trees per acre, which is well above the minimum success criteria of 320 trees per acre.

The EEP will begin vegetation monitoring on the Dutchman's Creek Mitigation Site during the 2005 monitoring year.

4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

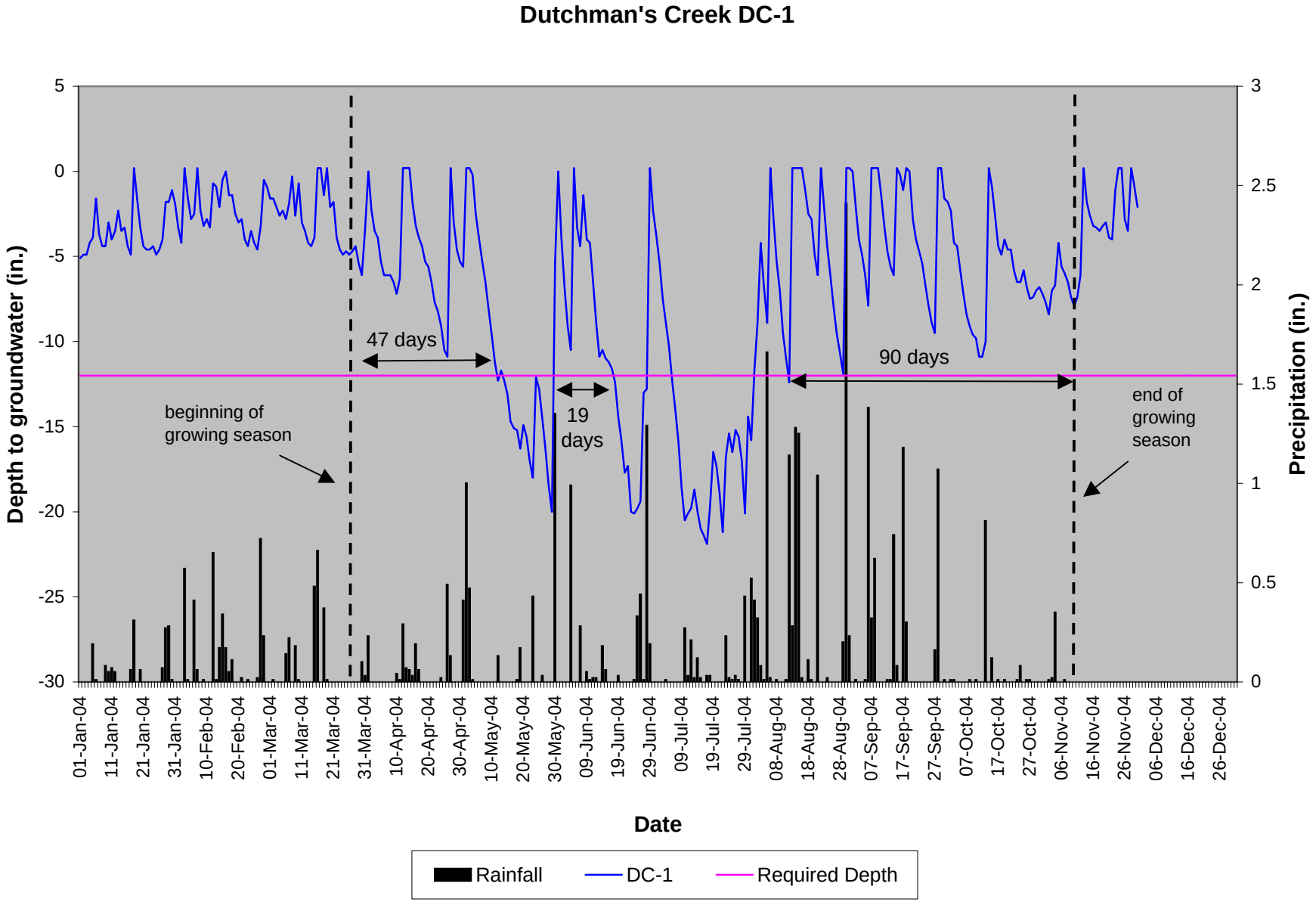
Four of the eight gauges indicated saturation within 12" of the surface for greater than 5% of the growing season during an average to above average rainfall year. Gauges DC-3 and DC-7 failed to meet during the 2003 year, as well. Gauges DCE-1 and DCE-2, which were installed in April 2003 between gauges DC-3 and DC-4, also failed to meet the success criteria. NCDOT has approached the Ecosystem Enhancement Program (EEP) about accepting approximately five acres of deficit in the creation area. The resource agencies will be contacted as soon as more information is available.

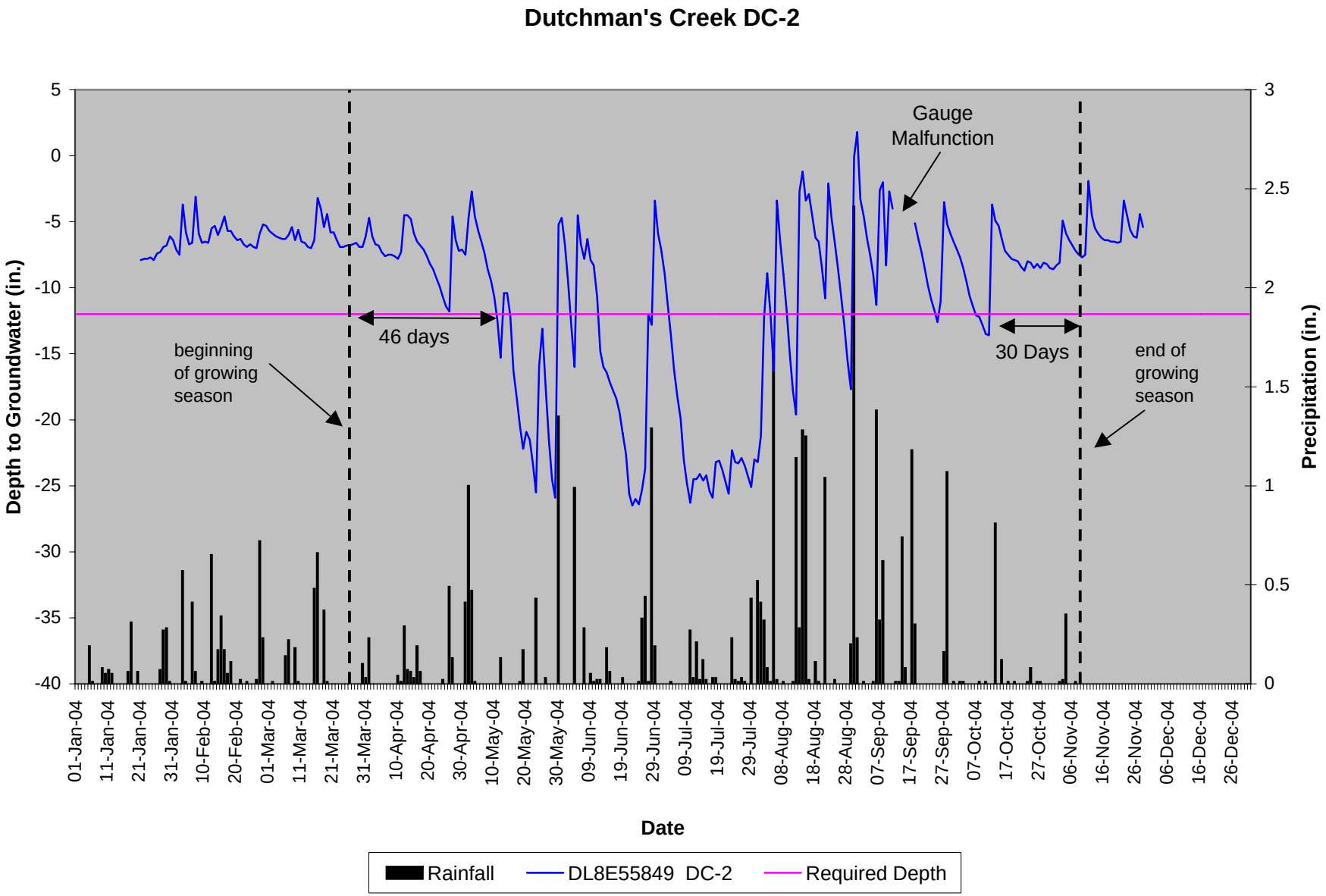
During the 2004-year, an additional plot for shrub planting was established. The 2004 vegetation monitoring of the site revealed an average density of 509 trees per acre. This is well above the minimum required by the success criteria.

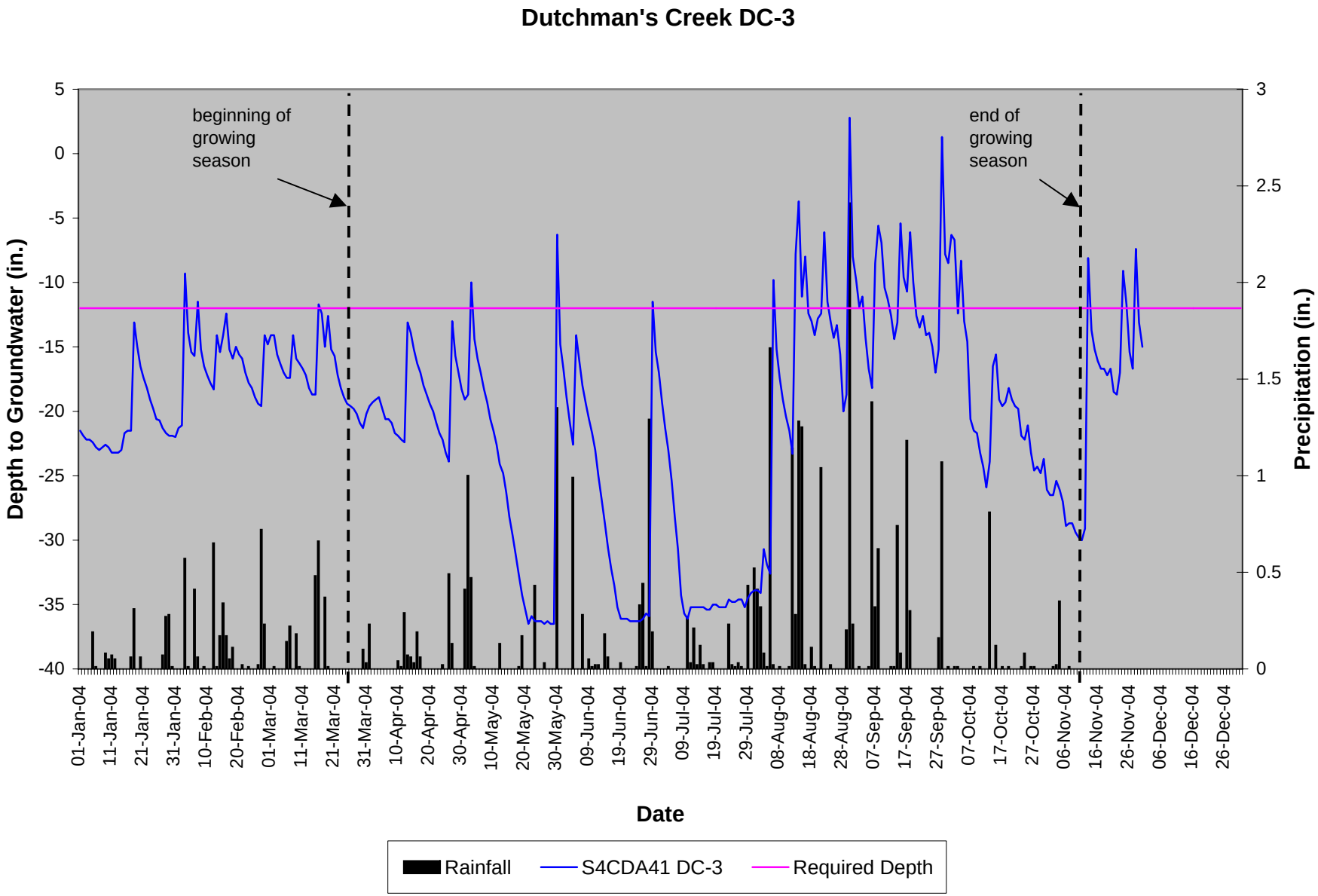
Per the letter from the EEP to NCDOT dated August 25, 2004, the EEP has accepted the transfer of all offsite mitigation projects. The EEP will be responsible for fulfilling the remaining monitoring requirements and future remediation for this project.

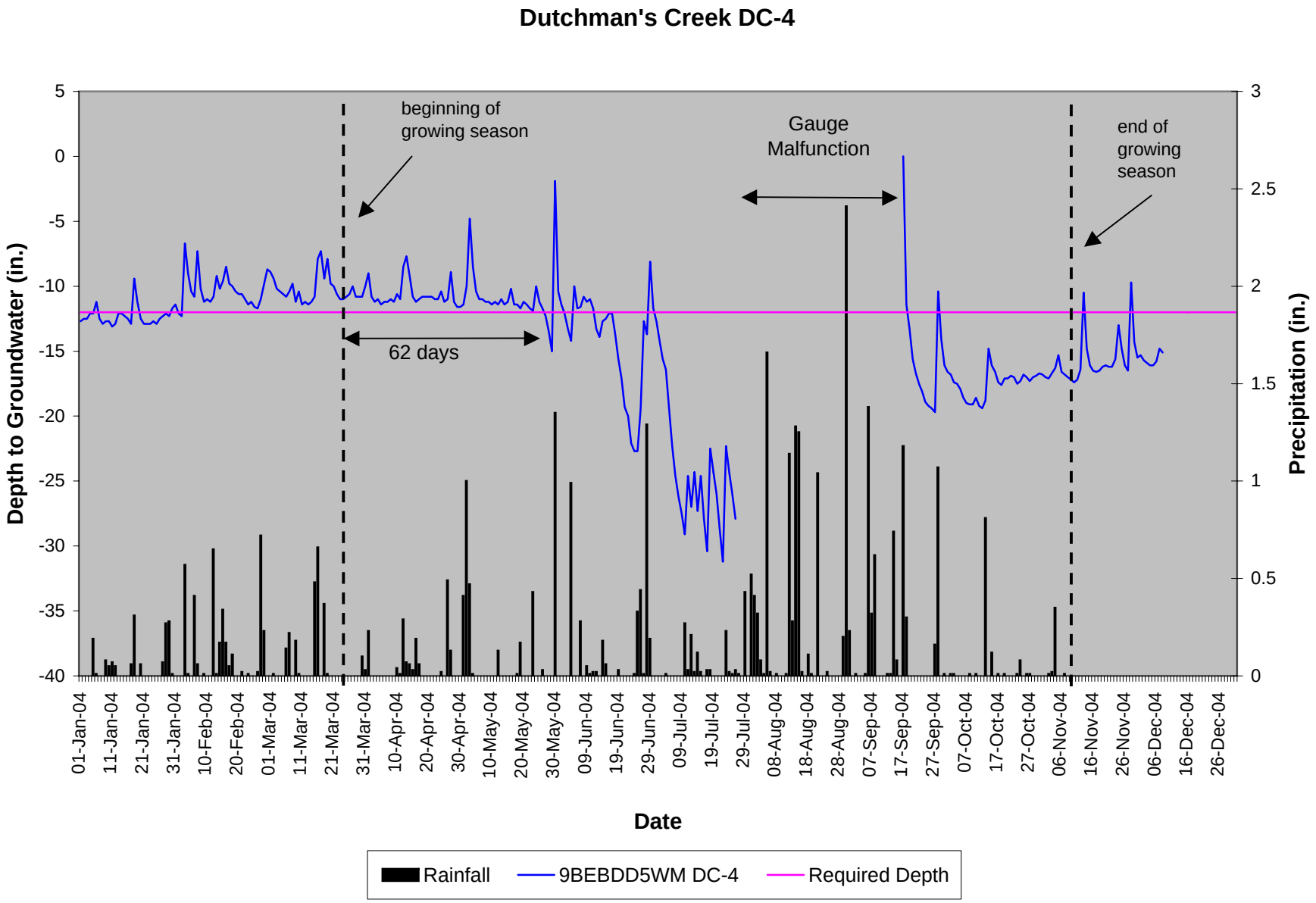
APPENDIX A

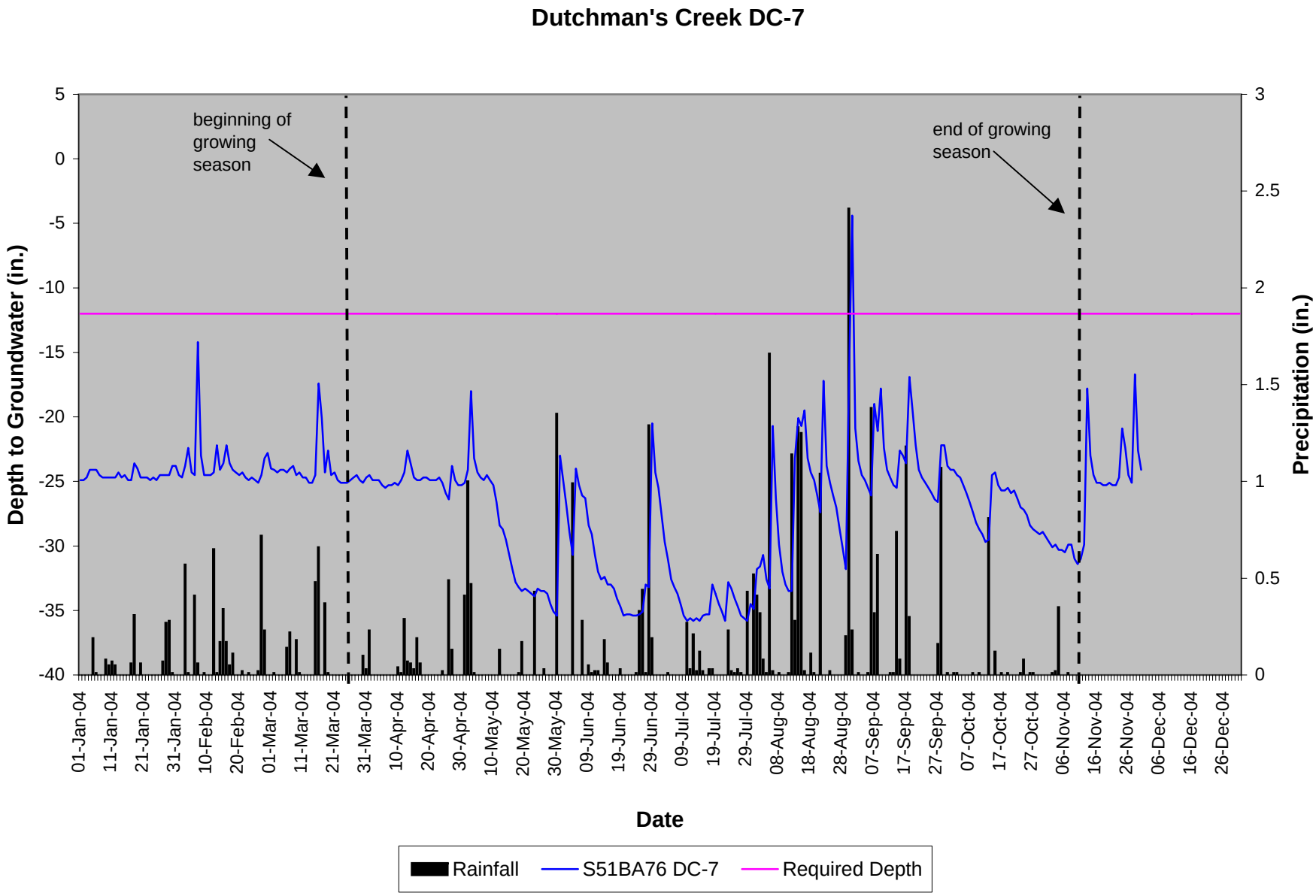
GAUGE DATA GRAPHS

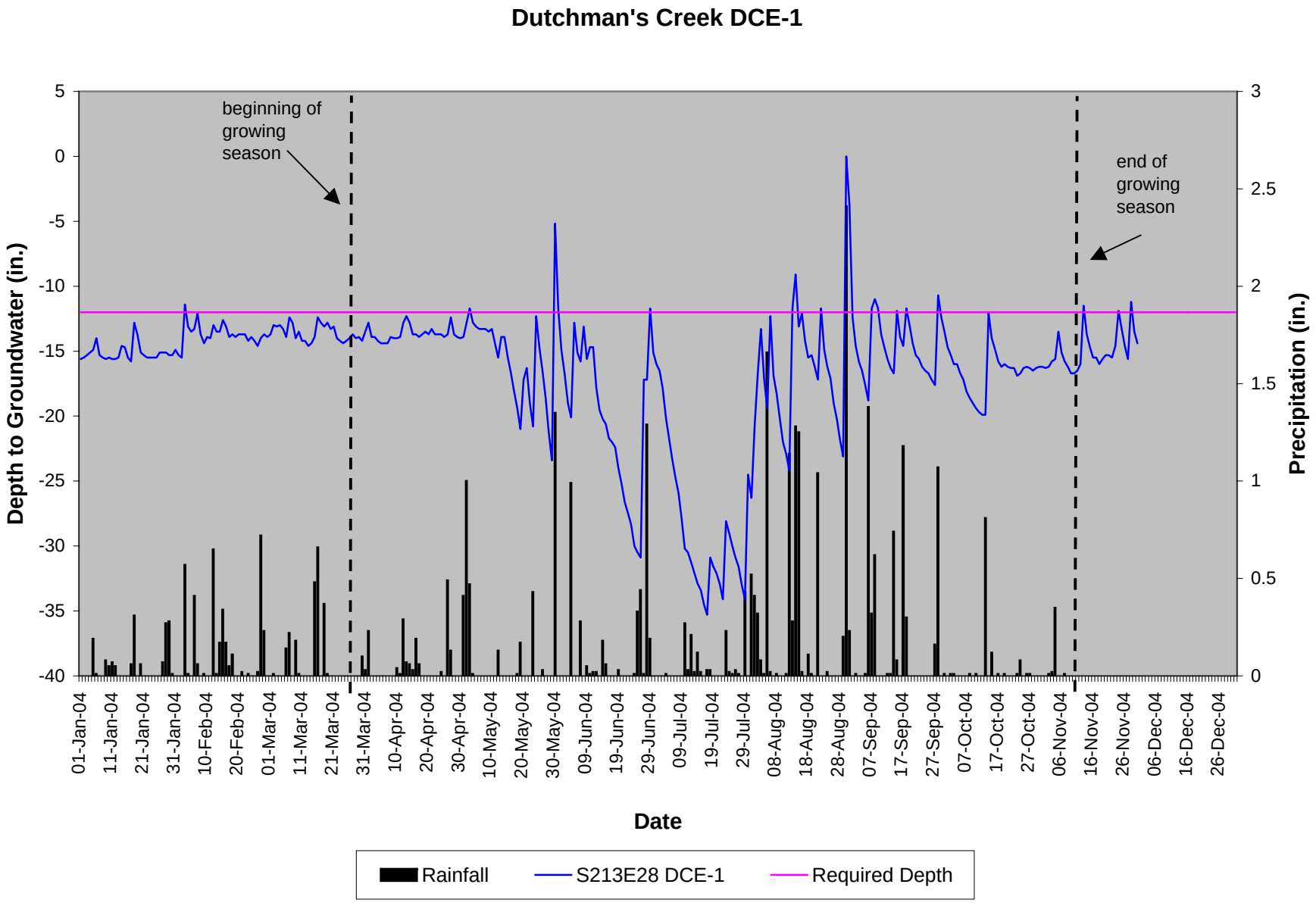

Dutchman's Creek DC-1
Depth to groundwater (in.)
Precipitation (in.)
Date
47 days
19 days
90 days
beginning of growing season
end of growing season
Rainfall
DC-1
Required Depth

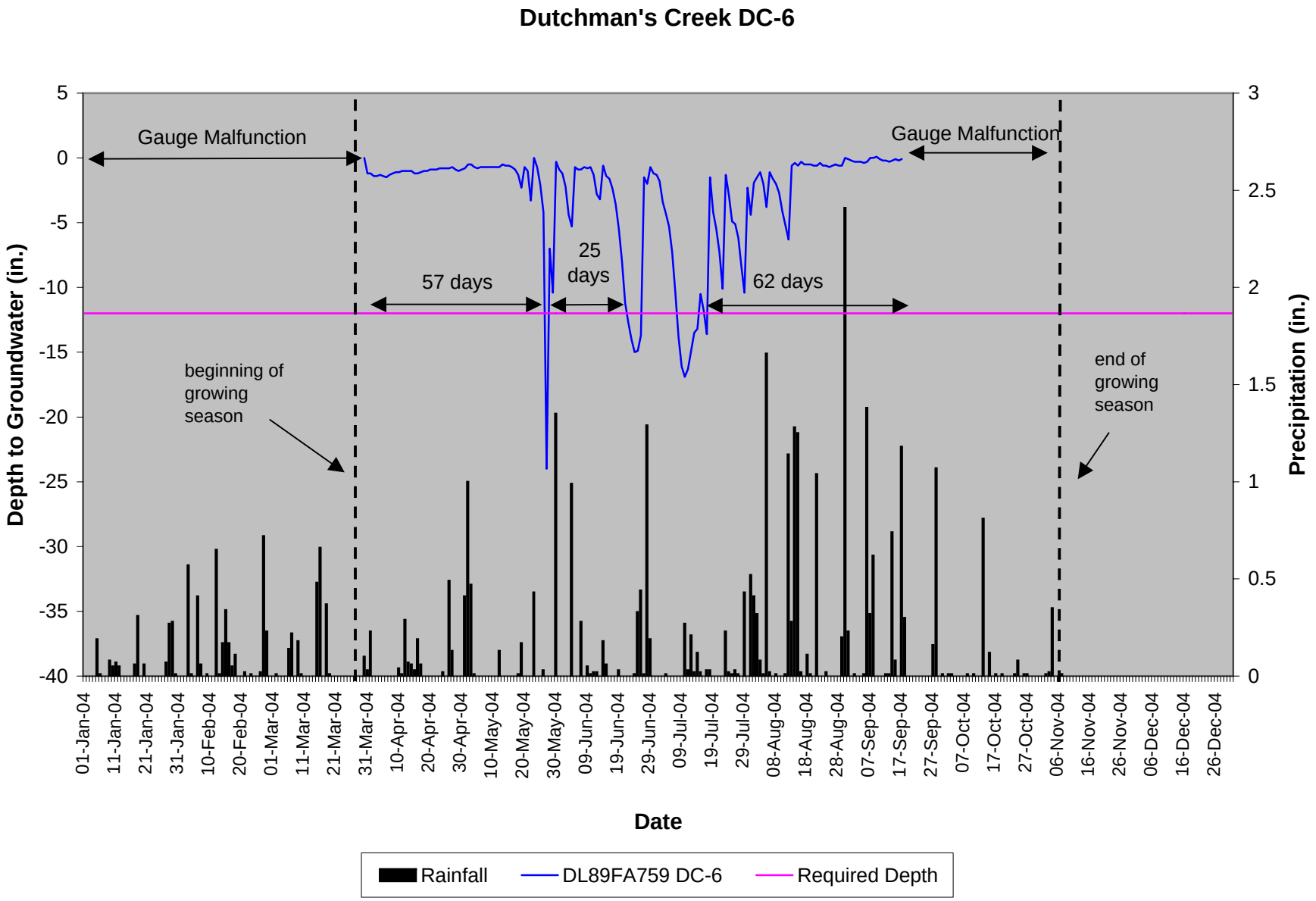

Dutchman's Creek DC-2
Depth to Groundwater (in.)
Precipitation (in.)
Date
Gauge Malfunction
beginning of growing season
46 days
30 Days
end of growing season
Rainfall
DL8E55849 DC-2
Required Depth

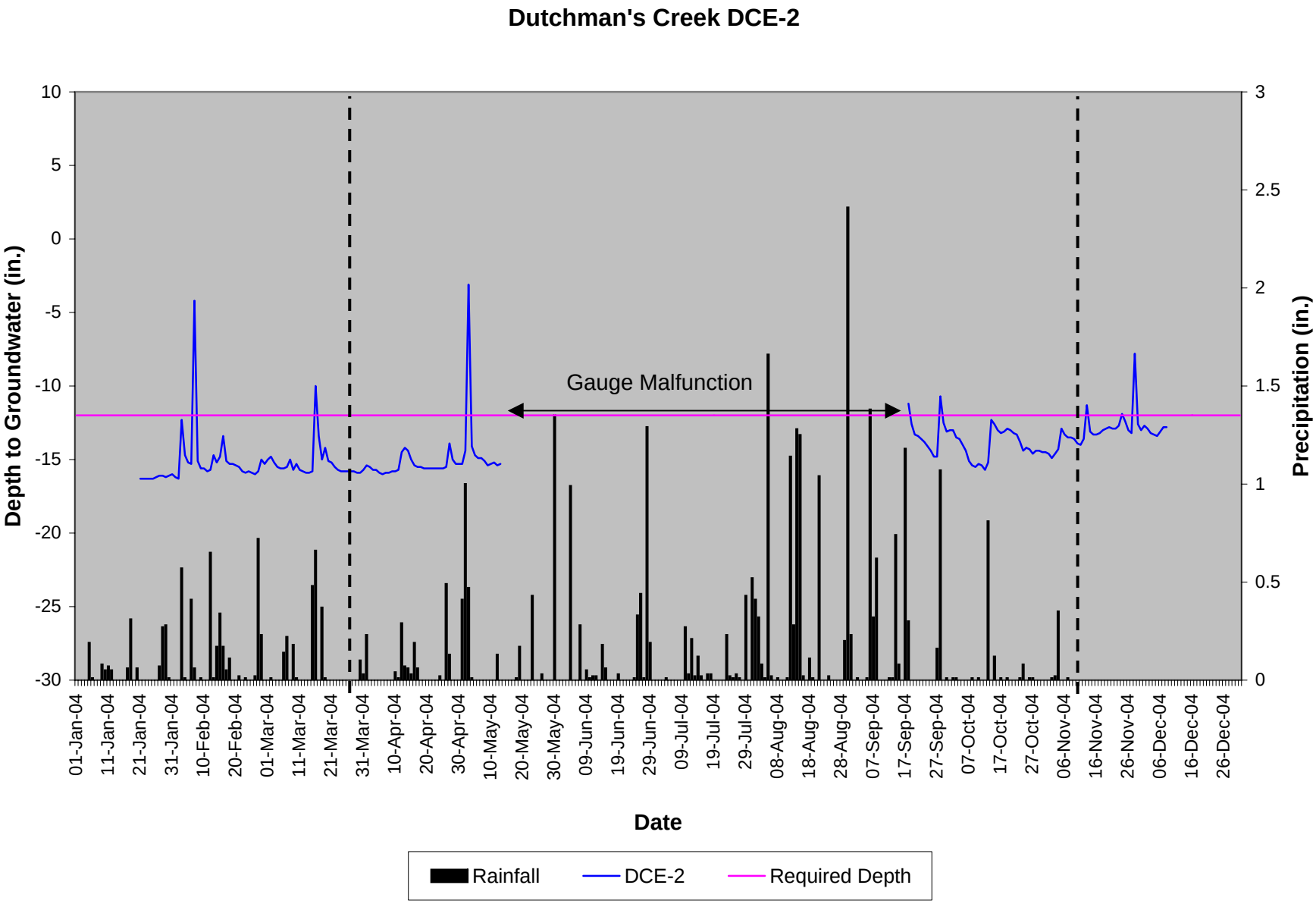

Dutchman's Creek DC-3
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
3
2.5
2
1.5
1
0.5
0
01-Jan-04
11-Jan-04
21-Jan-04
31-Jan-04
10-Feb-04
20-Feb-04
01-Mar-04
11-Mar-04
21-Mar-04
31-Mar-04
10-Apr-04
20-Apr-04
30-Apr-04
10-May-04
20-May-04
30-May-04
09-Jun-04
19-Jun-04
29-Jun-04
09-Jul-04
19-Jul-04
29-Jul-04
08-Aug-04
18-Aug-04
28-Aug-04
07-Sep-04
17-Sep-04
27-Sep-04
07-Oct-04
17-Oct-04
27-Oct-04
06-Nov-04
16-Nov-04
26-Nov-04
06-Dec-04
16-Dec-04
26-Dec-04
Date
Rainfall
S4CDA41 DC-3
Required Depth


Dutchman's Creek DC-4
beginning of growing season
Gauge Malfunction
end of growing season
62 days
Depth to Groundwater (in.)
Precipitation (in.)
Date
Rainfall
9BEBDD5WM DC-4
Required Depth


Dutchman's Creek DC-7
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
3
2.5
2
1.5
1
0.5
0
01-Jan-04
11-Jan-04
21-Jan-04
31-Jan-04
10-Feb-04
20-Feb-04
01-Mar-04
11-Mar-04
21-Mar-04
31-Mar-04
10-Apr-04
20-Apr-04
30-Apr-04
10-May-04
20-May-04
30-May-04
09-Jun-04
19-Jun-04
29-Jun-04
09-Jul-04
19-Jul-04
29-Jul-04
08-Aug-04
18-Aug-04
28-Aug-04
07-Sep-04
17-Sep-04
27-Sep-04
07-Oct-04
17-Oct-04
27-Oct-04
06-Nov-04
16-Nov-04
26-Nov-04
06-Dec-04
16-Dec-04
26-Dec-04
Date
Rainfall
S51BA76 DC-7
Required Depth


Dutchman's Creek DCE-1
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
3
2.5
2
1.5
1
0.5
0
01-Jan-04
11-Jan-04
21-Jan-04
31-Jan-04
10-Feb-04
20-Feb-04
01-Mar-04
11-Mar-04
21-Mar-04
31-Mar-04
10-Apr-04
20-Apr-04
30-Apr-04
10-May-04
20-May-04
30-May-04
09-Jun-04
19-Jun-04
29-Jun-04
09-Jul-04
19-Jul-04
29-Jul-04
08-Aug-04
18-Aug-04
28-Aug-04
07-Sep-04
17-Sep-04
27-Sep-04
07-Oct-04
17-Oct-04
27-Oct-04
06-Nov-04
16-Nov-04
26-Nov-04
06-Dec-04
16-Dec-04
26-Dec-04
Date
Rainfall
S213E28 DCE-1
Required Depth


Dutchman's Creek DC-6
Gauge Malfunction
Gauge Malfunction
57 days
25 days
62 days
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
Date
Rainfall
DL89FA759 DC-6
Required Depth


Dutchman's Creek DCE-2
Depth to Groundwater (in.)
Precipitation (in.)
Gauge Malfunction
Date
Rainfall
DCE-2
Required Depth
10
5
0
-5
-10
-15
-20
-25
-30
3
2.5
2
1.5
1
0.5
0
01-Jan-04
11-Jan-04
21-Jan-04
31-Jan-04
10-Feb-04
20-Feb-04
01-Mar-04
11-Mar-04
21-Mar-04
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30-Apr-04
10-May-04
20-May-04
30-May-04
09-Jun-04
19-Jun-04
29-Jun-04
09-Jul-04
19-Jul-04
29-Jul-04
08-Aug-04
18-Aug-04
28-Aug-04
07-Sep-04
17-Sep-04
27-Sep-04
07-Oct-04
17-Oct-04
27-Oct-04
06-Nov-04
16-Nov-04
26-Nov-04
06-Dec-04
16-Dec-04
26-Dec-04

APPENDIX B

SITE PHOTOS & PLANTING PLAN

Dutchman’s Creek

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

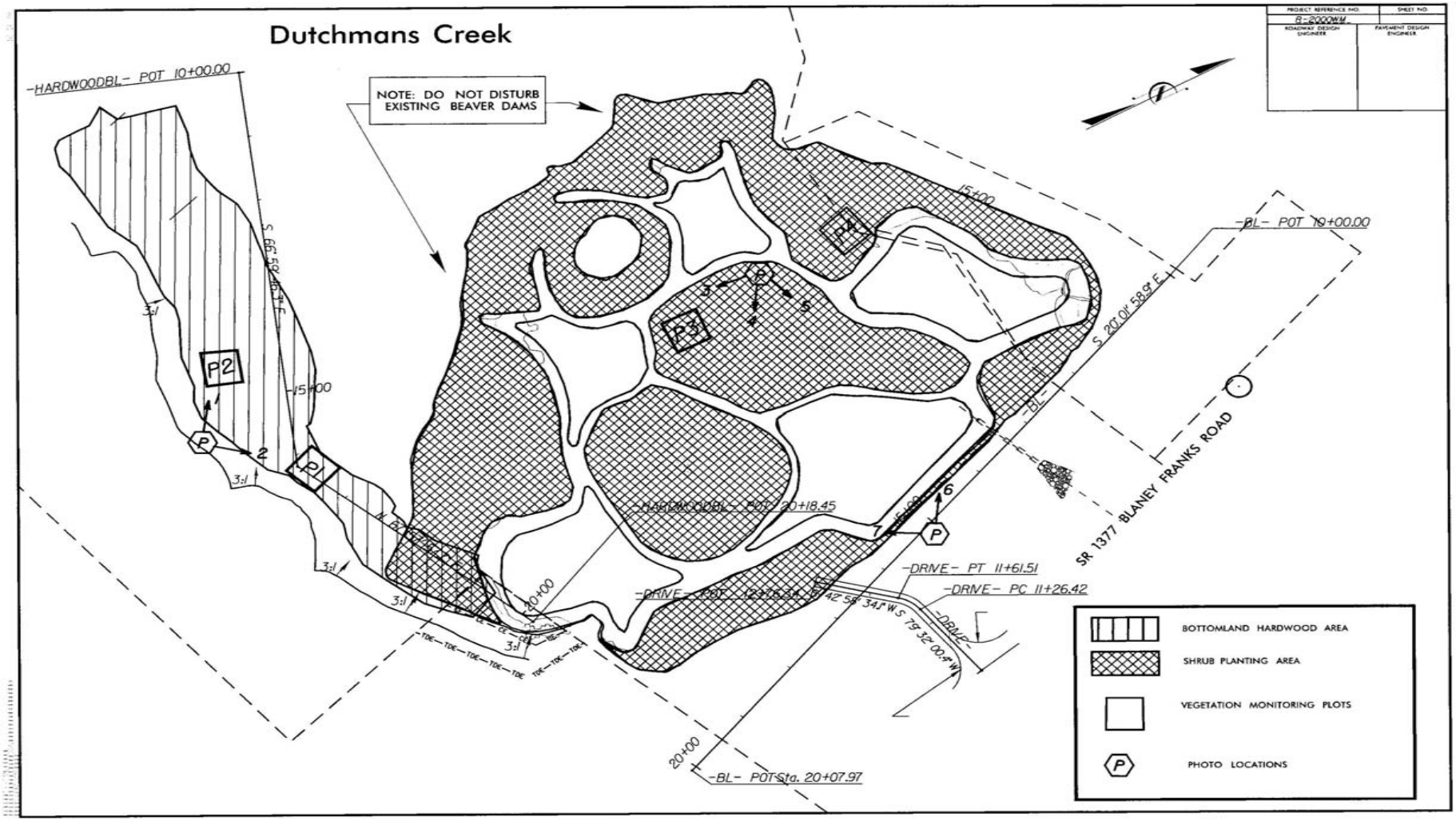
Photo 6

2004

Dutchman’s Creek

Photo 7

2004


Dutchmans Creek
PROJECT REFERENCE NO.
B-2000WM
SHEET NO.
ROADWAY DESIGN ENGINEER
PAVEMENT DESIGN ENGINEER
-HARDWOODBL- POT 10+00.00
NOTE: DO NOT DISTURB EXISTING BEAVER DAMS
-BL- POT 19+00.00
S 20° 01' 58.9" E
SR 1377 BLANEY FRANKS ROAD
-HARDWOODBL- POT 20+18.45
-DRIVE- PT 11+61.51
-DRIVE- PC 11+26.42
-DRIVE-
-BL- POTSta. 20+07.97
P1
P2
P3
P4
P
BOTTOMLAND HARDWOOD AREA
SHRUB PLANTING AREA
VEGETATION MONITORING PLOTS
PHOTO LOCATIONS