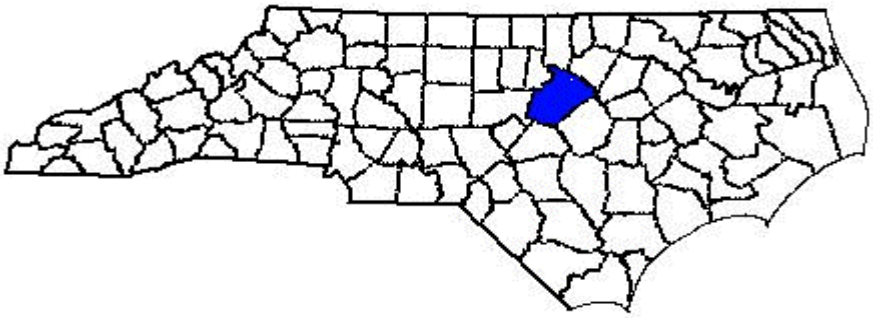
ANNUAL REPORT FOR 2003



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 2003

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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 2003 represent the third year of hydrology monitoring and the second 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, nine 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 three of the seven monitoring gauges met the hydrology success criteria of 5.0% for the 2003-growing season. Several gauges were not downloaded or were downloaded for only portions of the growing season. The missing data is reflected in Table 1.

There are four vegetation-monitoring plots established throughout the site. During the 2003-year, an additional plot was established for shrub plantings. Based on the results of the second year of monitoring, an average tree density of 590 trees per acre was reported on the site. This is well above the minimum required by the success criteria.

In Fall 2003, NCDOT installed a fence with an access gate at the entrance of the site, off of Blaney Franks Road. The fence was installed to prevent trespassing on the mitigation site.

Based on the monitoring results from the 2003 growing season, NCDOT recommends that hydrologic and vegetation monitoring continue on the Dutchman's Creek Mitigation Site.

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

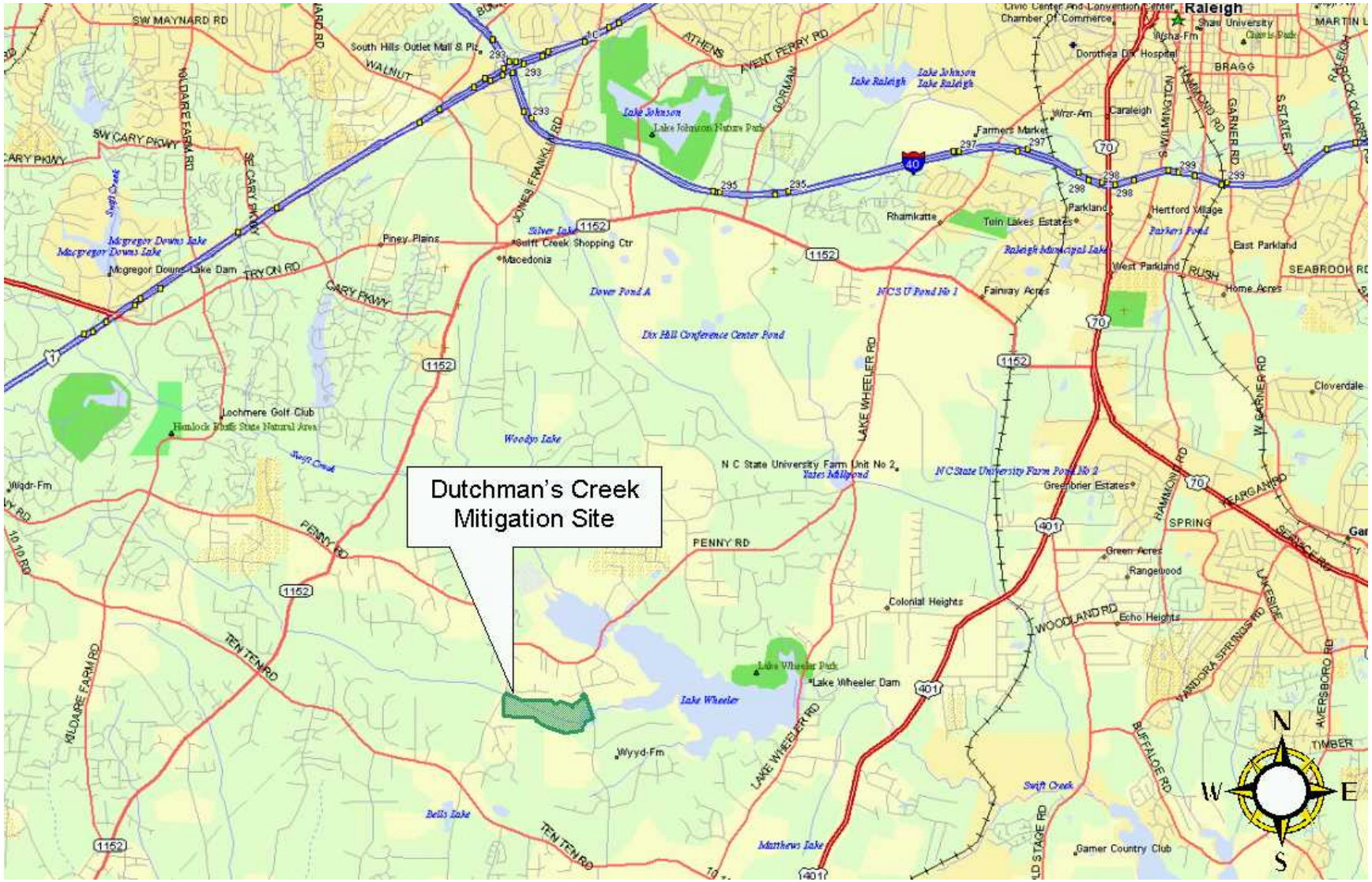
In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years or until the site is deemed successful. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic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

Activities in 2003 reflect the third year of hydrology monitoring and the second 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.)

Figure 1. Site Location Map



1.4 DEBIT LEDGER

The entire Dutchman's Creek Mitigation Site was used for projects R-2000D and R-2000CB to compensate for unavoidable wetland impacts related to roadway projects.

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 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.

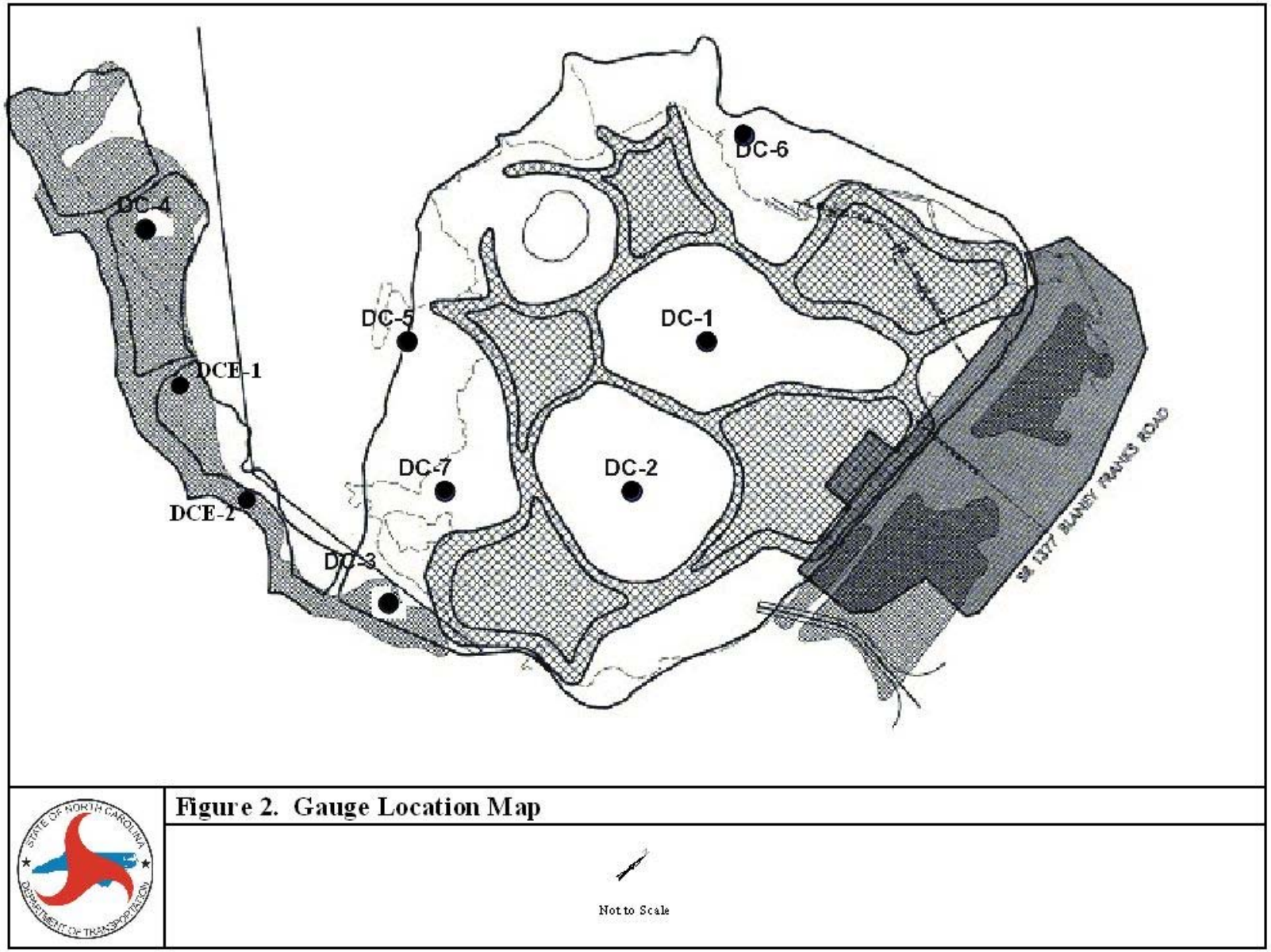
2.2 HYDROLOGIC DESCRIPTION

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. 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).

Table 1. Dutchman's Creek Hydrologic Monitoring Results

Monitoring Well	<5%	5-8%	8-12.5%	>12.5%	Actual %	Success Dates
DC-1+				×	20.0	March 26-May 10 October 9-Nov 10
DC-2+				×	21.7	March 26-June 26 Sept 19-Oct 24
DC-3	×				1.3	
DC-4*	×				3.0	
DC-5*	×				0.4	
DC-6+				×	100	March 26-Nov 10
DC-7	×				1.7	
DCE-1*					0	
DCE-2*					0	

+ Gauge met the success criterion during an average rainfall month (March, July, and October).
* Gauge was not downloaded for the entire growing season or only during portions of the growing season.

Specific Gauge Problems:

- Gauges DC-4 and DC-5 were not downloaded from July-November.
- Gauges DCE-1 and DCE-2 were installed in April 2003. These gauges experienced malfunctions after installation and were never downloaded.

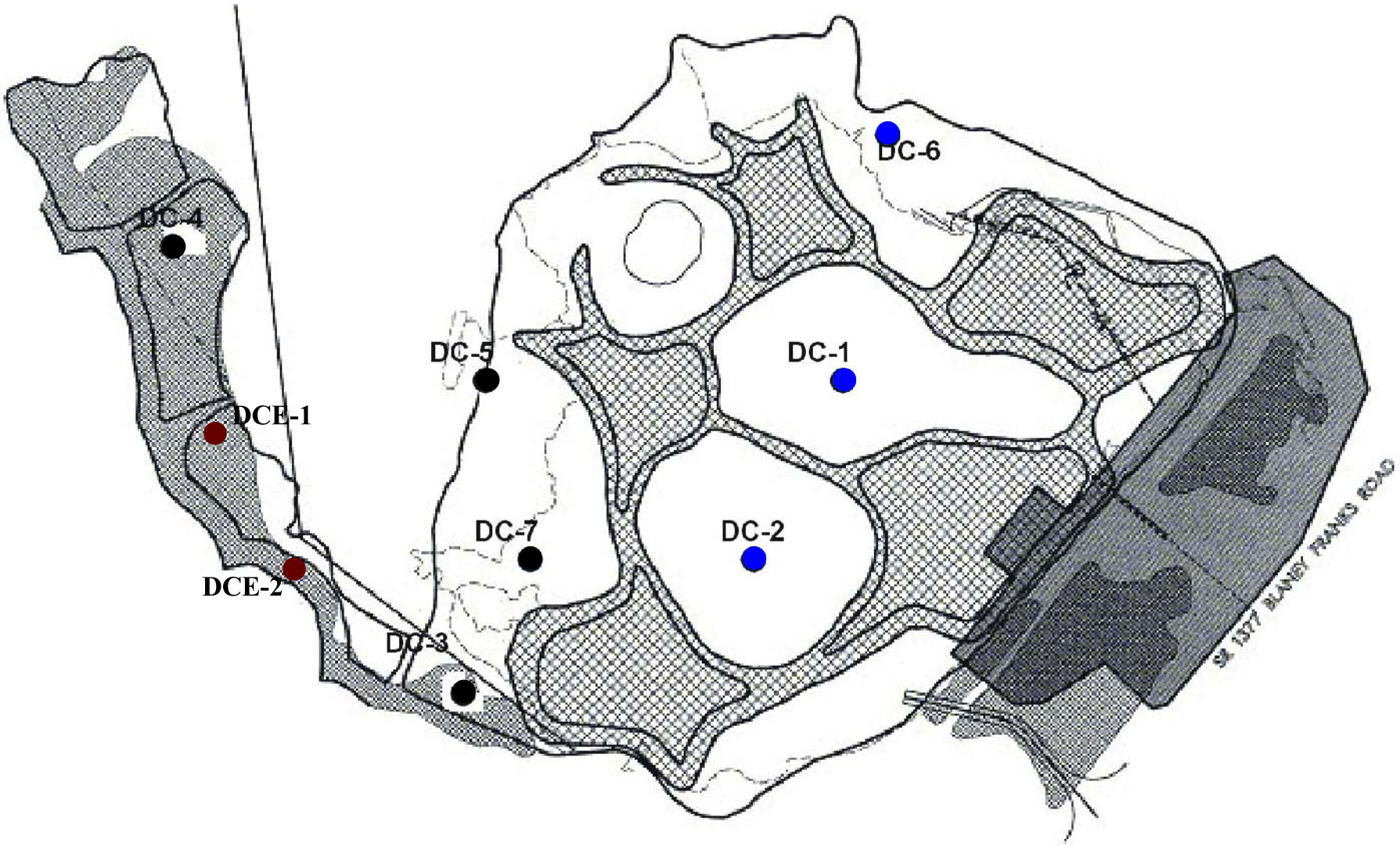


Figure 3. 2003 Hydrologic Monitoring Gauge Results

Hydrology Results

- < 5%
- 5 - 8%
- 8 - 12.5%
- > 12.5%

Rain Gauge

Surface Gauge

Not to Scale

2.3.2 Climatic Data

Figure 4 represents an evaluation of the local climate in comparison with historical data in order to determine whether 2003 was “average” in terms of climate conditions. The two lines represent the 30th and 70th percentiles of monthly precipitation for Raleigh. The bars are the monthly rainfall totals for November 2002 through November 2003. The NC State Climate Office provided historical data from the Raleigh/Durham weather station. The onsite rain gauge experienced malfunctions, therefore the Raleigh rain gauge data was used for the months of April 2003 - November 2003.

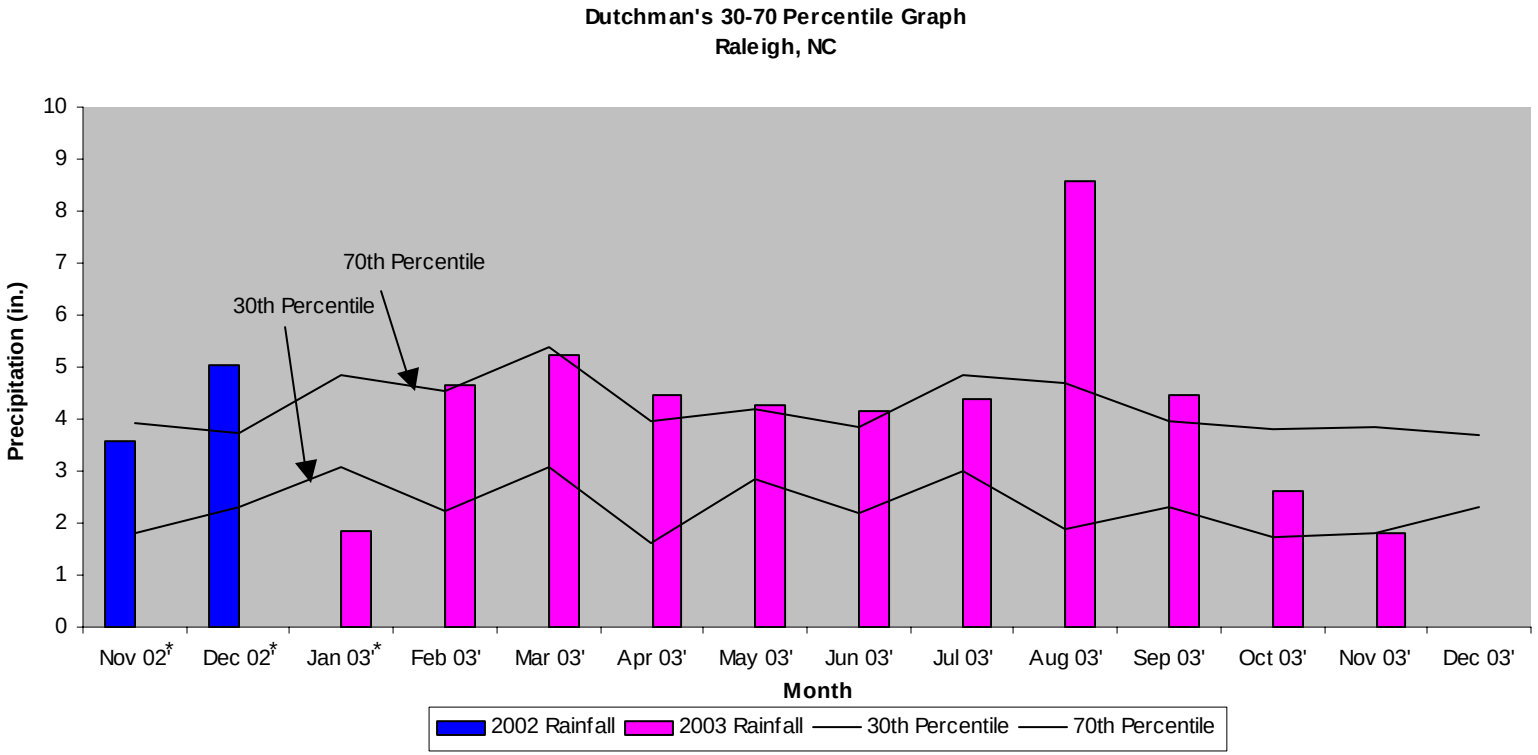
Months with below average rainfall include January and November. November (02’), February, March, July, and October experienced average rainfall. The months of December (02’), April, May, June, August, and September all experienced above average rainfall for the year. Overall the site experienced average to above average rainfall in 2003.

2.4 CONCLUSIONS

The 2003-year represents the third full growing season that the hydrologic data has been monitored on the Dutchman’s Creek Mitigation Site. Three of the seven gauges indicated saturation within 12” of the surface for greater than 5% of the growing season. Several gauges were not downloaded or were downloaded for only portions of the growing season. The missing data is reflected in Table 1.

NCDOT will continue to monitor Dutchman’s Creek for hydrology.

FIGURE 4: 30-70 Percentile Graph



3.0 VEGETATION: DUTCHMANS CREEK MITIGATION SITE (YEAR 2 MONITORING)

3.1 Success Criteria

As stated in the July 1999 Mitigation Plan, the success criteria for vegetation within the shrub-scrub 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 (2 Year)	Total (at planting)	Density (Trees/Acre)
1	4	16	3	2		1						26	39	453
2	4	14	15	4		1	4					42	44	649
3(shrub)								25	5	10	16	56	66	577
4(shrub)								40	2	5	3	50	50	680
				AVERAGE TREE DENSITY										590

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

3.4 Conclusions

The shrub area has been planted with all of the species listed above and there was an additional plot set (plot 4). The 2003 vegetation monitoring of the site revealed an average density of 590 trees per acre, which is well above the minimum success criteria of 320 trees per acre.

NCDOT will continue vegetation monitoring at the Dutchman's Creek Mitigation Site.

4.0 Overall Conclusions/Recommendations

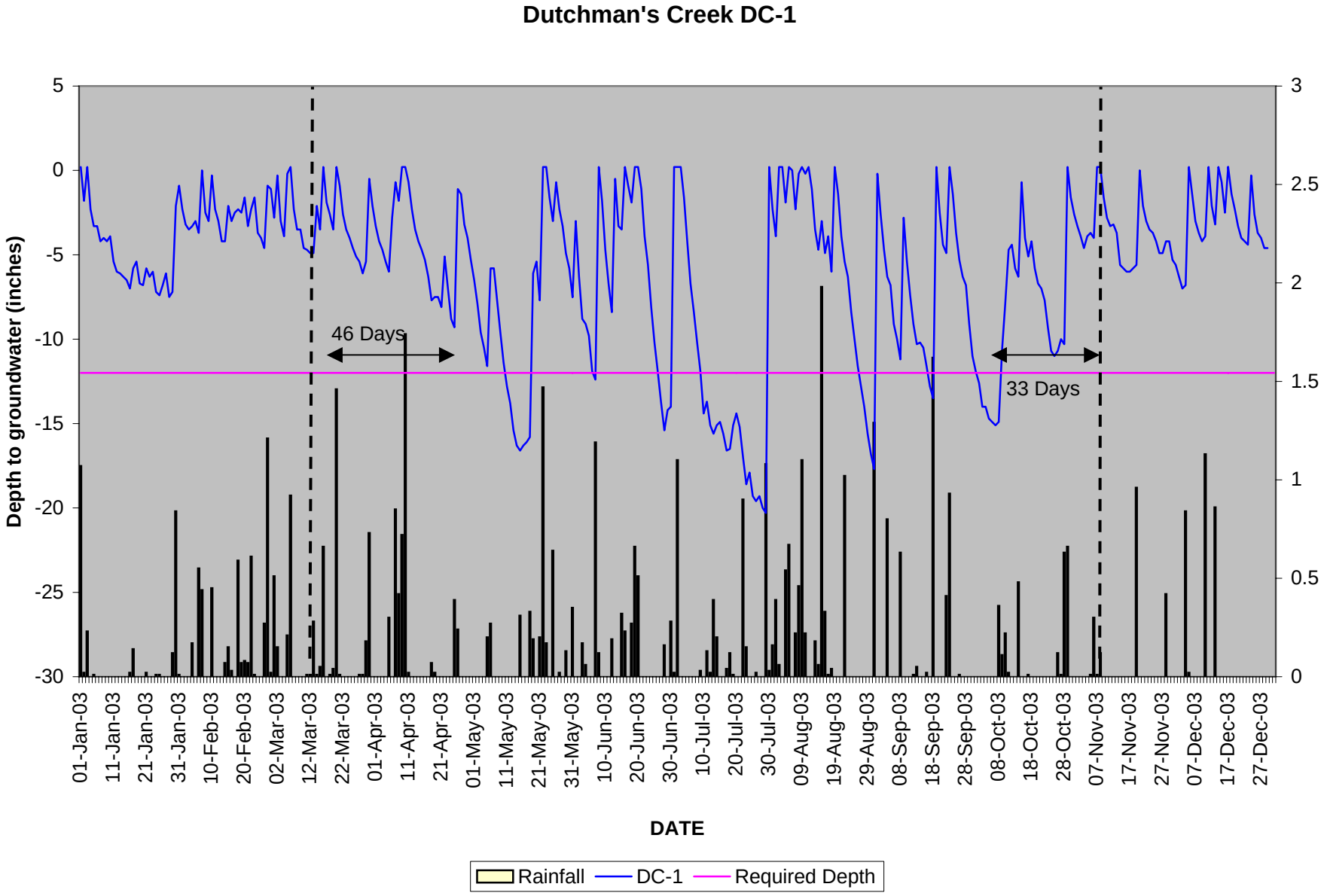
Three of the seven gauges indicated saturation within 12” of the surface for greater than 5% of the growing season during an average to above average rainfall year. Several gauges were not downloaded or were downloaded for only portions of the growing season. The missing data is reflected in Table 1.

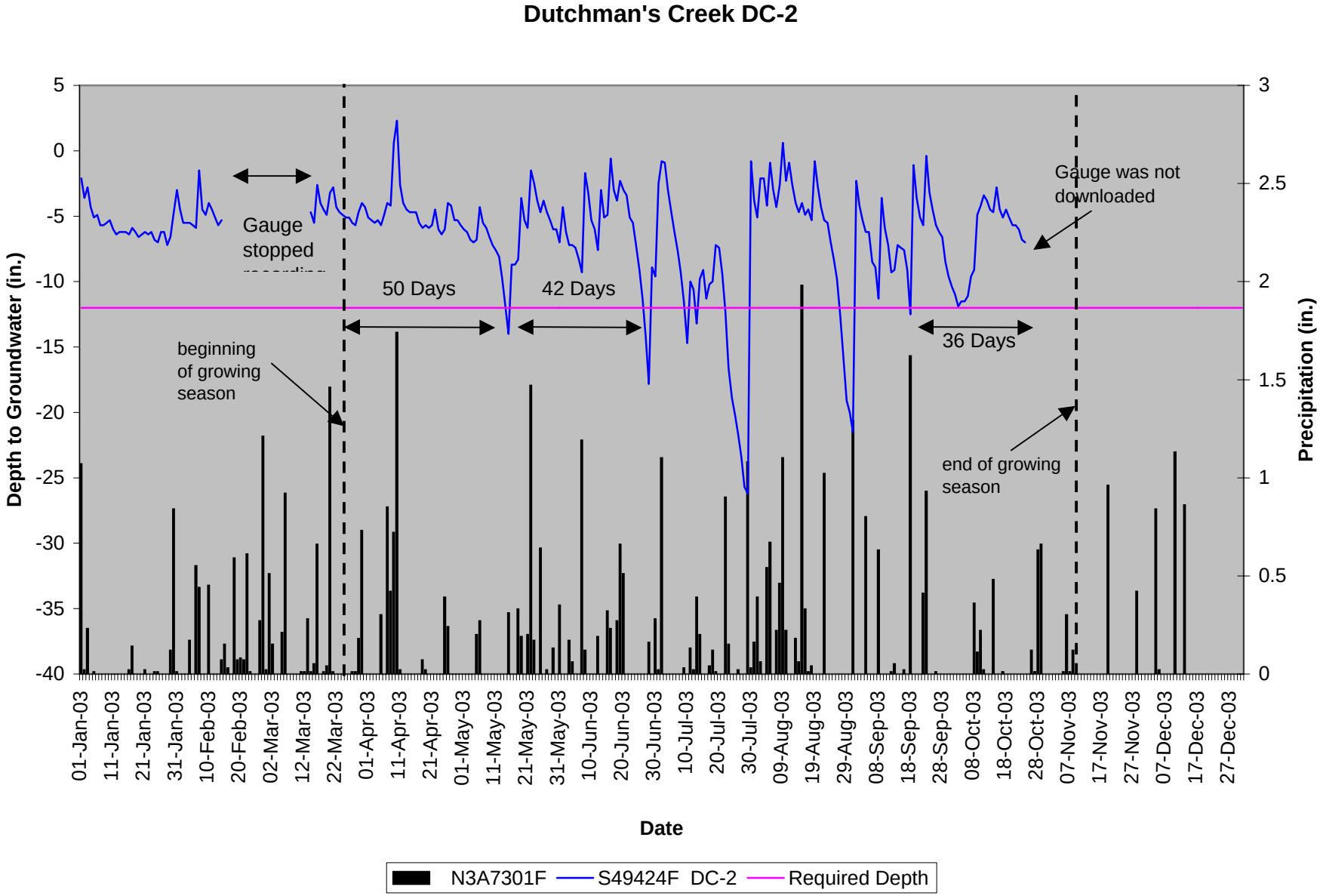
During the 2003-year an additional plot for shrub planting was established. The 2003 vegetation monitoring of the site revealed an average density of 590 trees per acre. This is well above the minimum required by the success criteria.

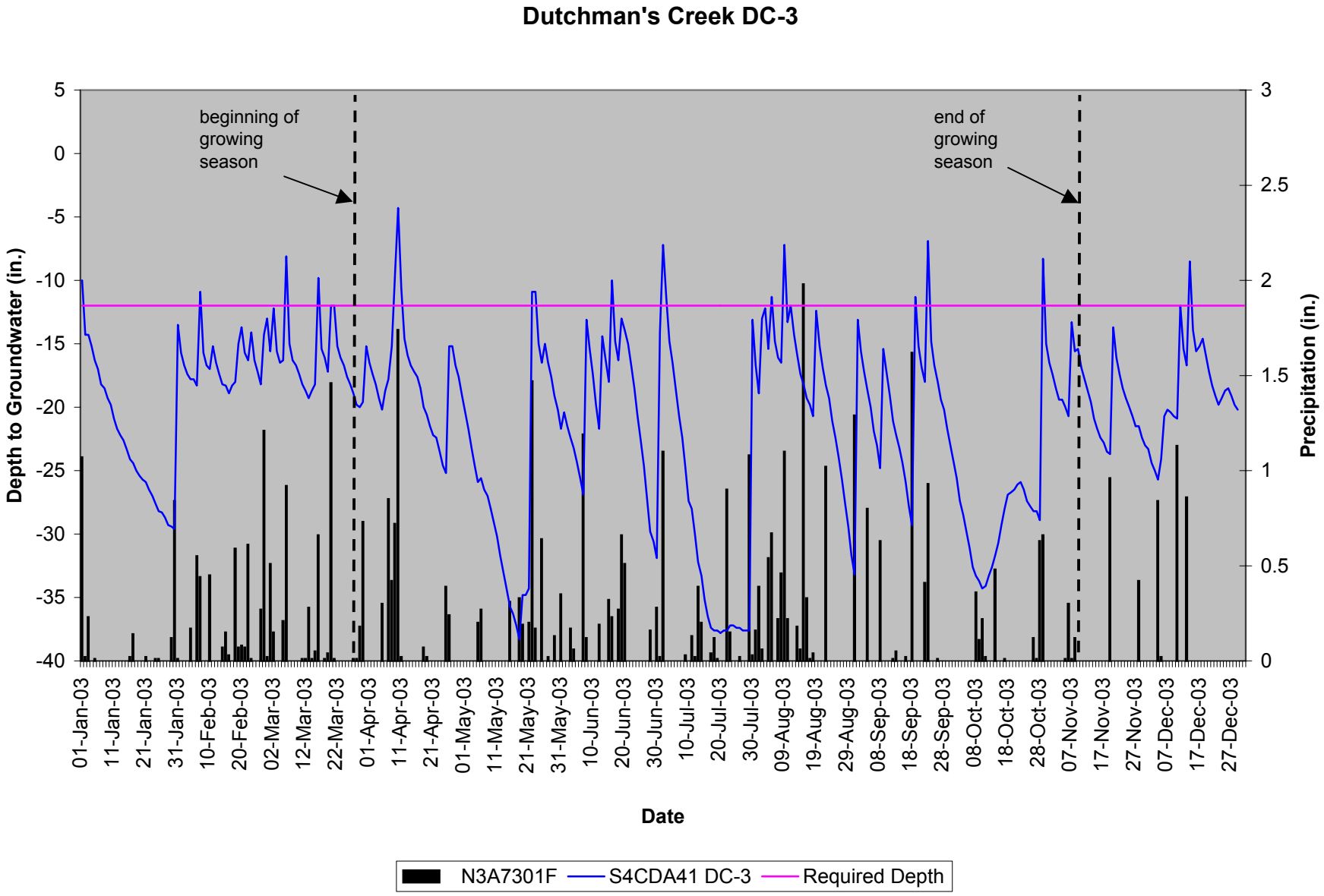
NCDOT will continue hydrologic and vegetation monitoring on the Dutchman’s Creek Mitigation Site.

APPENDIX A

GAUGE DATA GRAPHS


Dutchman's Creek DC-1
Depth to groundwater (inches)
5
0
-5
-10
-15
-20
-25
-30
3
2.5
2
1.5
1
0.5
0
46 Days
33 Days
01-Jan-03
11-Jan-03
21-Jan-03
31-Jan-03
10-Feb-03
20-Feb-03
02-Mar-03
12-Mar-03
22-Mar-03
01-Apr-03
11-Apr-03
21-Apr-03
01-May-03
11-May-03
21-May-03
31-May-03
10-Jun-03
20-Jun-03
30-Jun-03
10-Jul-03
20-Jul-03
30-Jul-03
09-Aug-03
19-Aug-03
29-Aug-03
08-Sep-03
18-Sep-03
28-Sep-03
08-Oct-03
18-Oct-03
28-Oct-03
07-Nov-03
17-Nov-03
27-Nov-03
07-Dec-03
17-Dec-03
27-Dec-03
DATE
Rainfall
DC-1
Required Depth


Dutchman's Creek DC-2
Depth to Groundwater (in.)
Precipitation (in.)
Date
Gauge stopped
50 Days
42 Days
36 Days
Gauge was not downloaded
beginning of growing season
end of growing season
N3A7301F
S49424F 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-03
11-Jan-03
21-Jan-03
31-Jan-03
10-Feb-03
20-Feb-03
02-Mar-03
12-Mar-03
22-Mar-03
01-Apr-03
11-Apr-03
21-Apr-03
01-May-03
11-May-03
21-May-03
31-May-03
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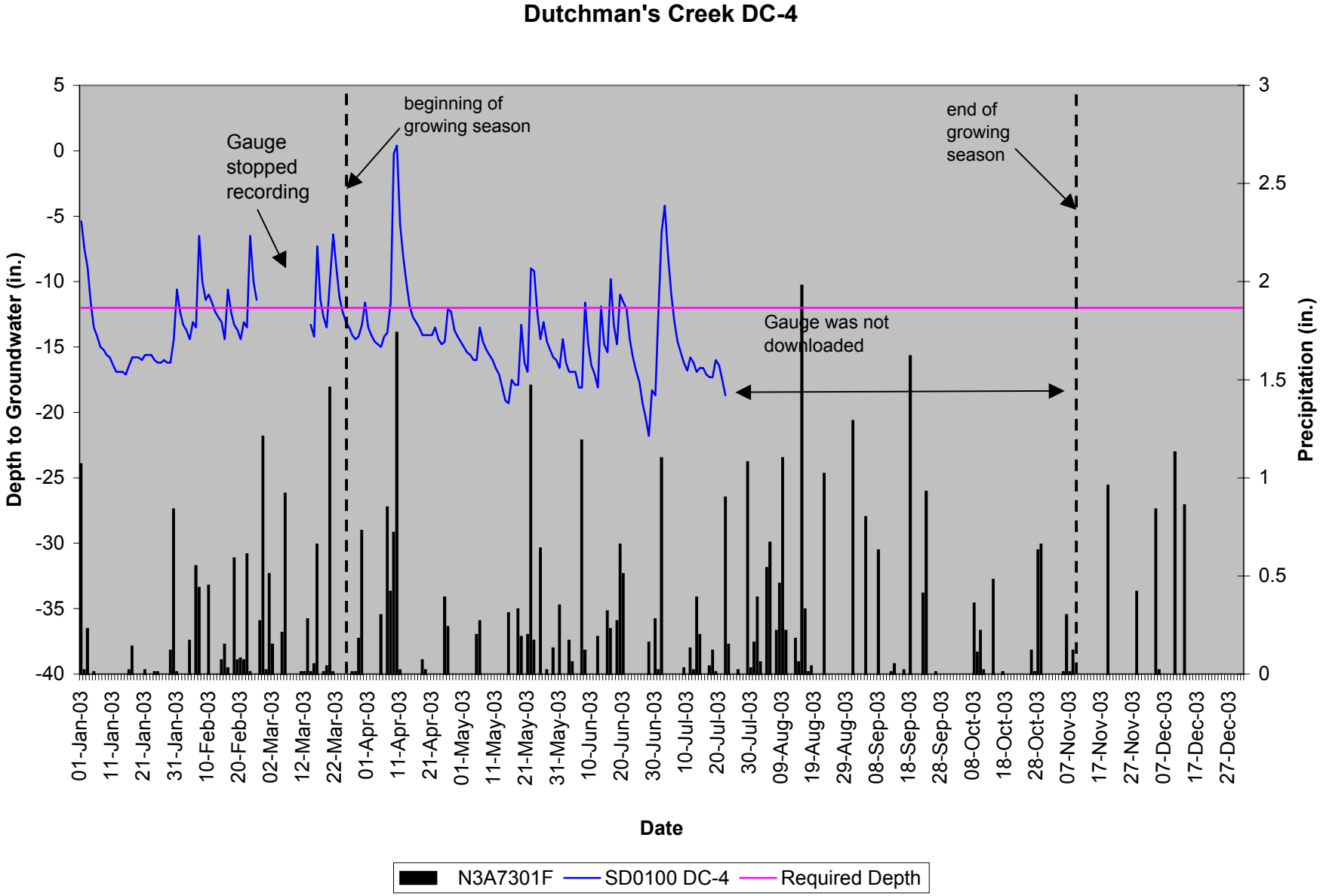
07-Nov-03
17-Nov-03
27-Nov-03
07-Dec-03
17-Dec-03
27-Dec-03
Date
N3A7301F
S4CDA41 DC-3
Required Depth


Dutchman's Creek DC-4
Depth to Groundwater (in.)
Precipitation (in.)
Date
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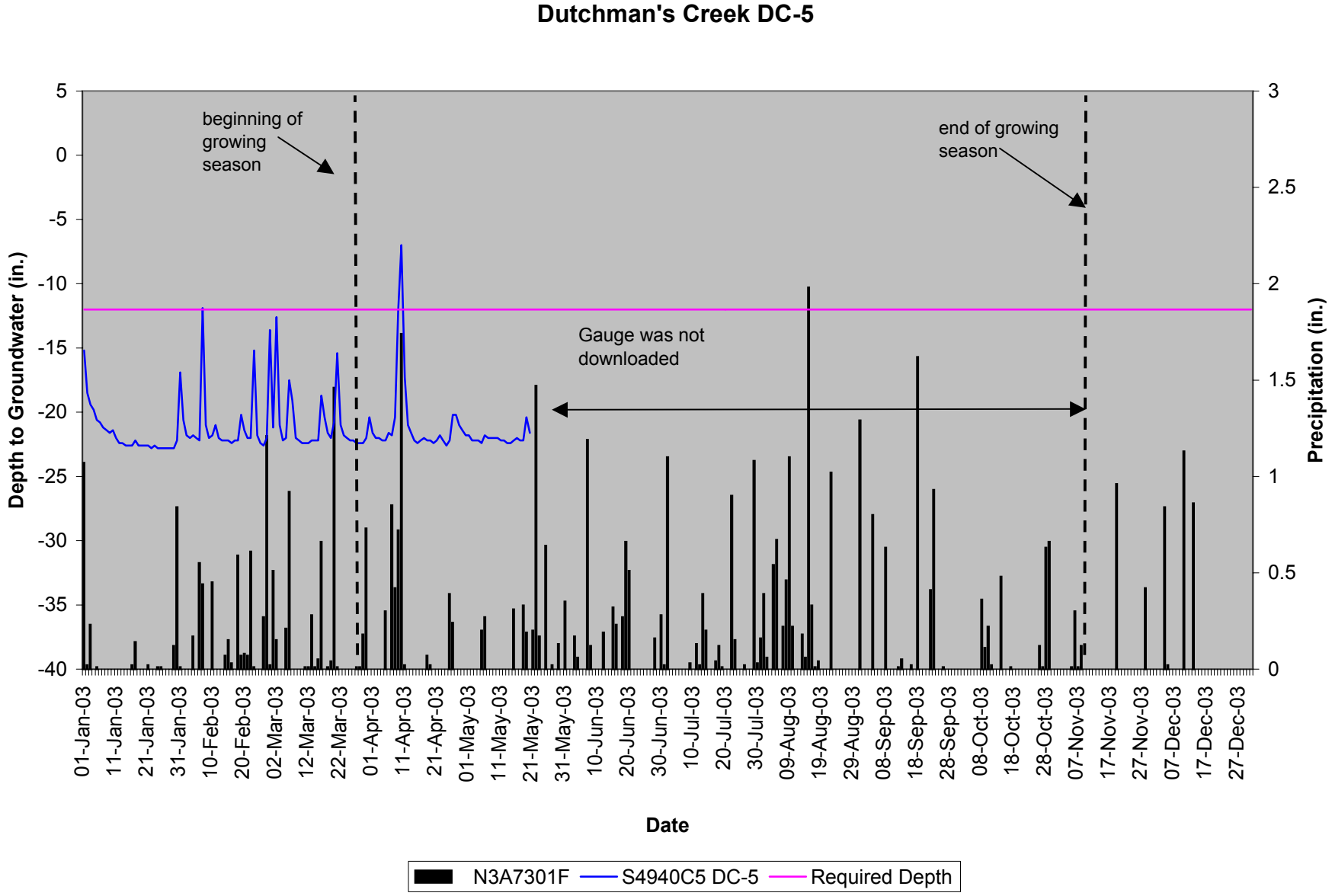
beginning of growing season
end of growing season
Gauge was not downloaded
N3A7301F
SD0100 DC-4
Required Depth


Dutchman's Creek DC-5
beginning of growing season
end of growing season
Gauge was not downloaded
Depth to Groundwater (in.)
Precipitation (in.)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
3
2.5
2
1.5
1
0.5
0
01-Jan-03
11-Jan-03
21-Jan-03
31-Jan-03
10-Feb-03
20-Feb-03
02-Mar-03
12-Mar-03
22-Mar-03
01-Apr-03
11-Apr-03
21-Apr-03
01-May-03
11-May-03
21-May-03
31-May-03
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20-Jun-03
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08-Sep-03
18-Sep-03
28-Sep-03
08-Oct-03
18-Oct-03
28-Oct-03
07-Nov-03
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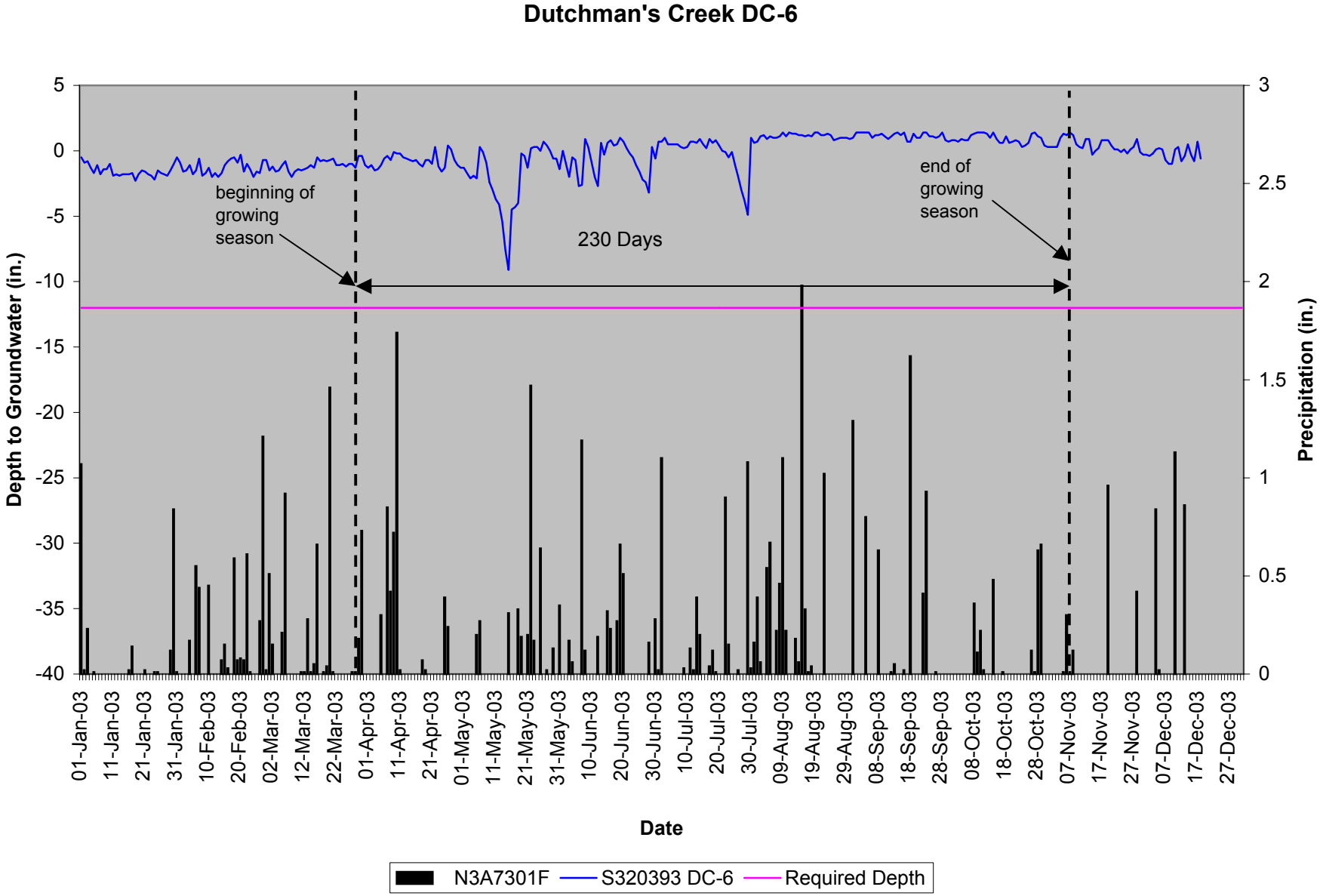
27-Dec-03
N3A7301F
S4940C5 DC-5
Required Depth


Dutchman's Creek DC-6
Depth to Groundwater (in.)
Precipitation (in.)
beginning of growing season
230 Days
end of growing season
5
0
-5
-10
-15
-20
-25
-30
-35
-40
3
2.5
2
1.5
1
0.5
0
01-Jan-03
11-Jan-03
21-Jan-03
31-Jan-03
10-Feb-03
20-Feb-03
02-Mar-03
12-Mar-03
22-Mar-03
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08-Sep-03
18-Sep-03
28-Sep-03
08-Oct-03
18-Oct-03
28-Oct-03
07-Nov-03
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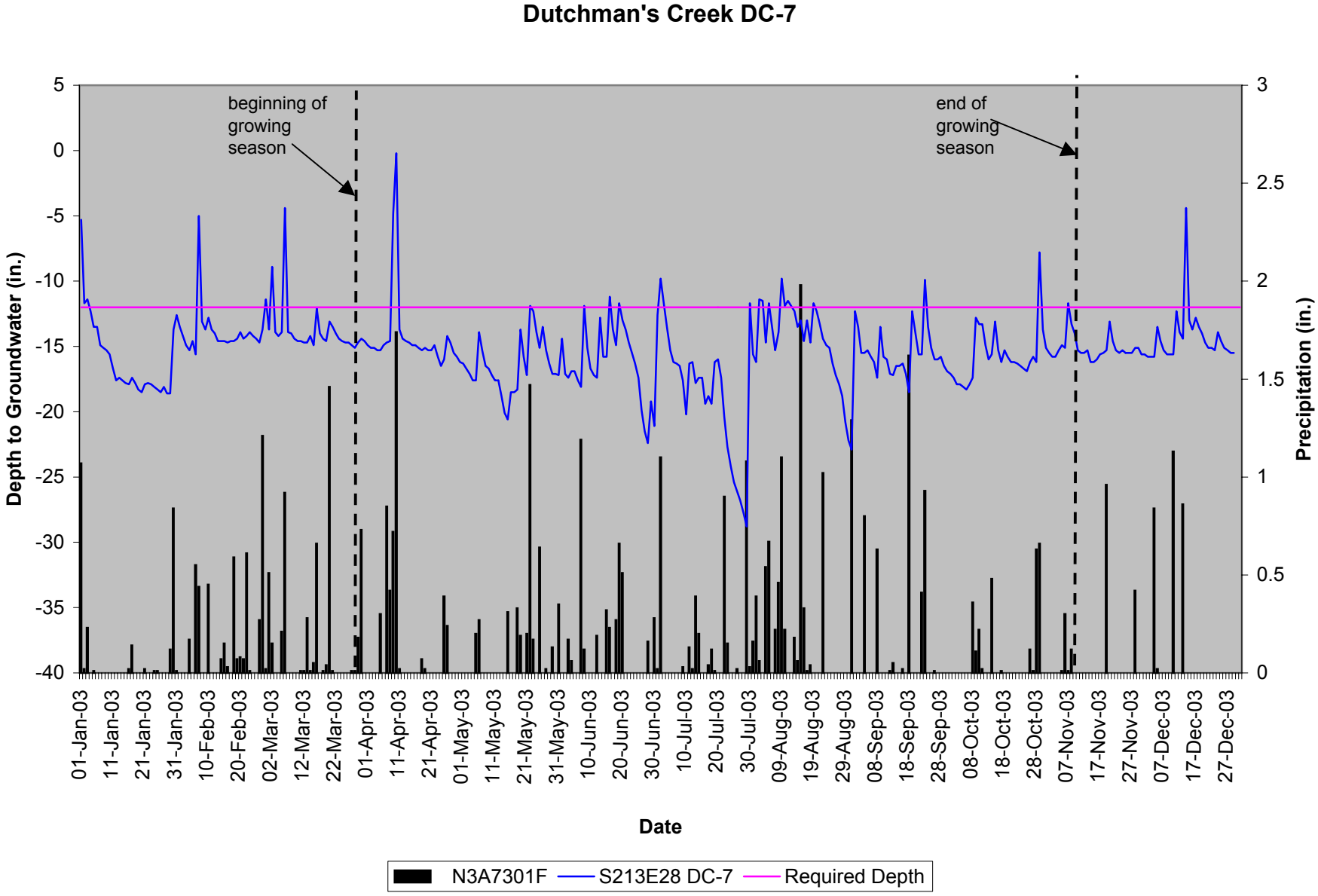
Date
N3A7301F
S320393 DC-6
Required Depth


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-03
11-Jan-03
21-Jan-03
31-Jan-03
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02-Mar-03
12-Mar-03
22-Mar-03
01-Apr-03
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20-Jun-03
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07-Nov-03
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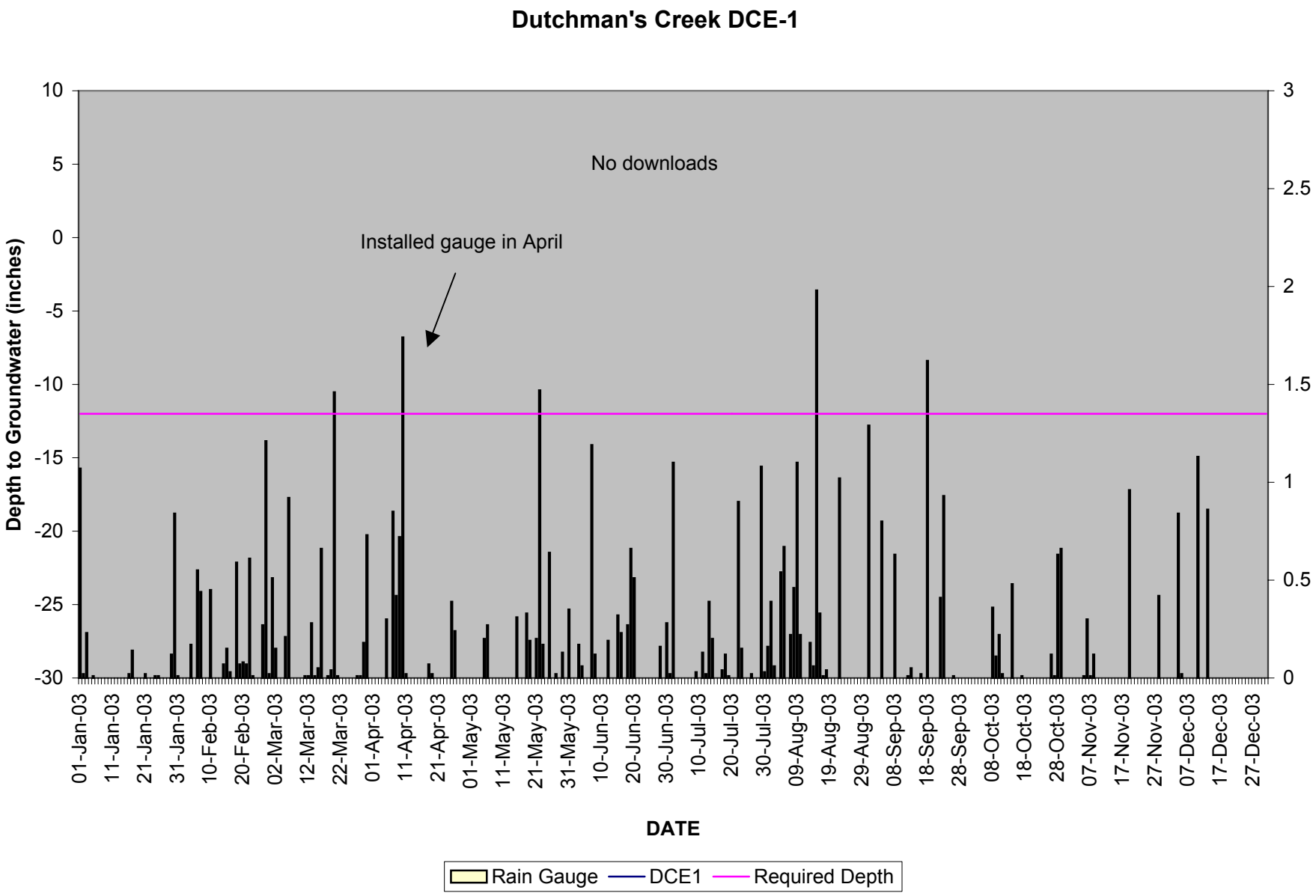
Date
N3A7301F
S213E28 DC-7
Required Depth


Dutchman's Creek DCE-1
No downloads
Installed gauge in April
Depth to Groundwater (inches)
10
5
0
-5
-10
-15
-20
-25
-30
3
2.5
2
1.5
1
0.5
0
01-Jan-03
11-Jan-03
21-Jan-03
31-Jan-03
10-Feb-03
20-Feb-03
02-Mar-03
12-Mar-03
22-Mar-03
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08-Oct-03
18-Oct-03
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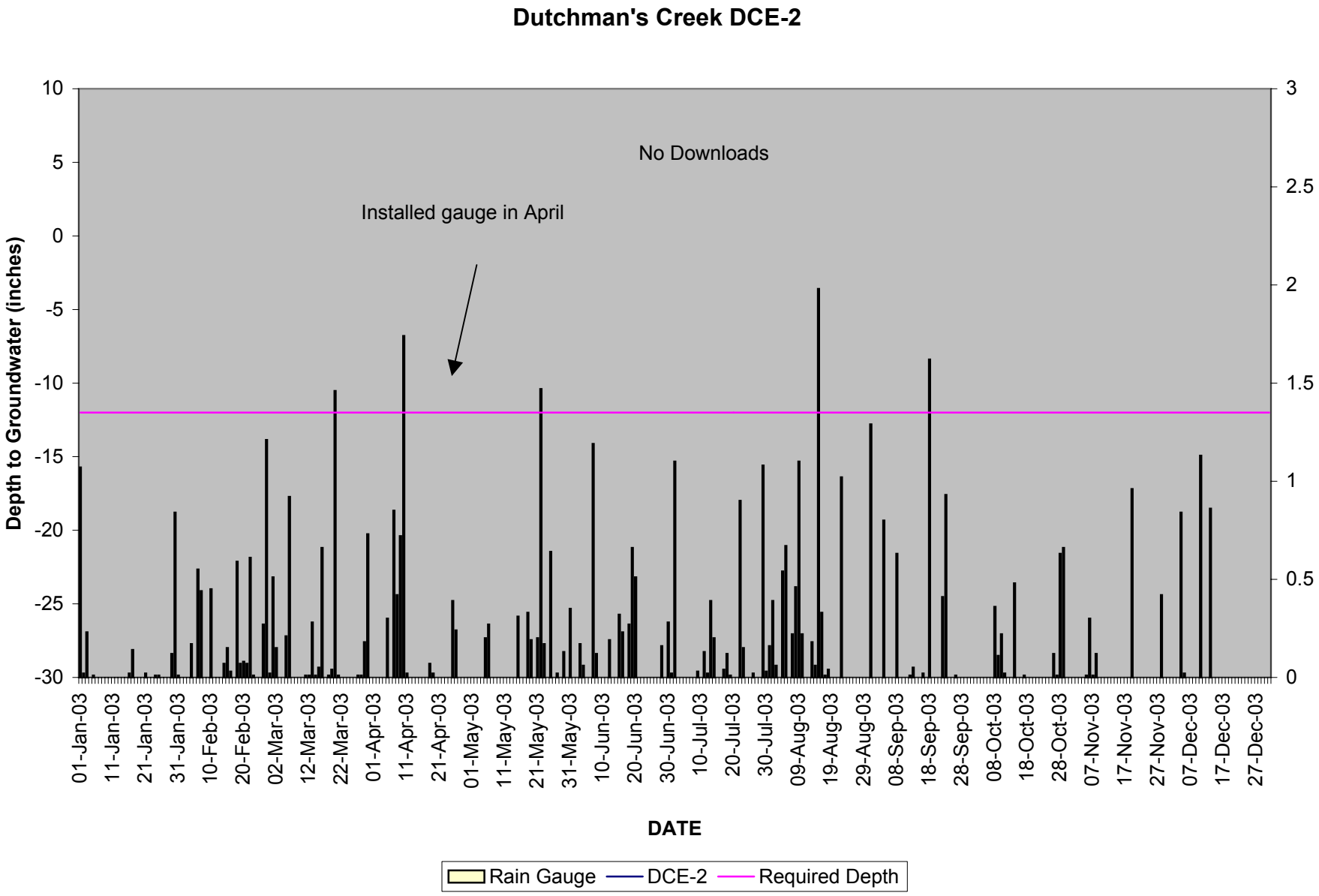
17-Dec-03
27-Dec-03
DATE
Rain Gauge
DCE1
Required Depth


Dutchman's Creek DCE-2
No Downloads
Installed gauge in April
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10
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0
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-10
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-25
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1.5
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18-Oct-03
28-Oct-03
07-Nov-03
17-Nov-03
27-Nov-03
07-Dec-03
17-Dec-03
27-Dec-03
DATE
Rain Gauge
DCE-2
Required Depth

APPENDIX B

SITE PHOTOS & PLANTING PLAN

Dutchman’s Creek

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

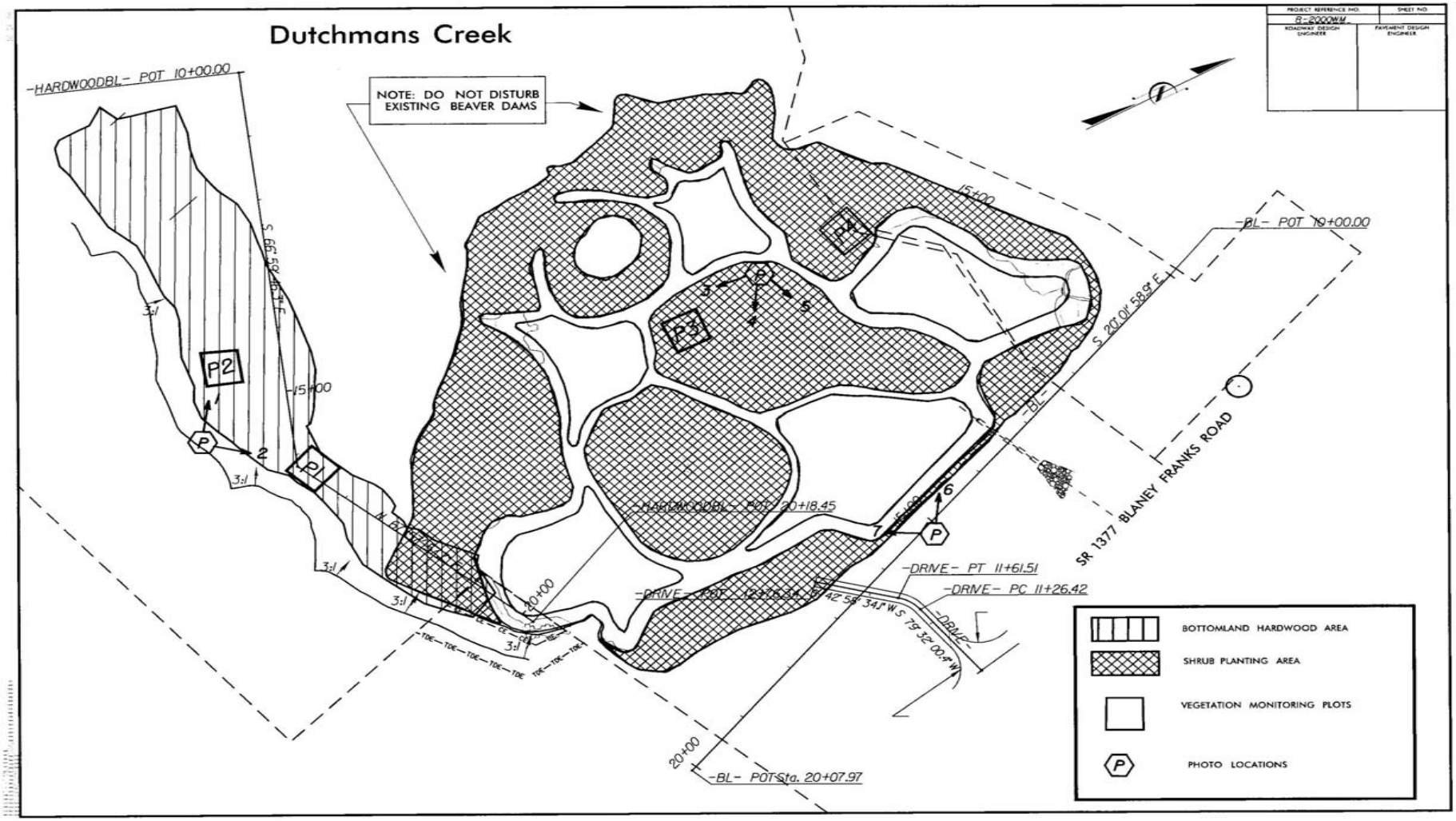
Photo 6

2003

Dutchman’s Creek

Photo 7

2003


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
P1
P2
P3
P4
P
1
2
3
4
5
6
7
15+00
20+00
-BL- POT 19+00.00
S 20° 01' 58" E
S 66° 58' 45" E
-HARDWOODBL- POT 20+18.45
-DRIVE- PT 11+61.51
-DRIVE- PC 11+26.42
-DRIVE- POT 12+15.34
S 42° 58' 34" W
S 79° 32' 00" W
-DRIVE-
-BL- POT Sta. 20+07.97
SR 1377 BLANEY FRANKS ROAD
3:1
TOE
BOTTOMLAND HARDWOOD AREA
SHRUB PLANTING AREA
VEGETATION MONITORING PLOTS
PHOTO LOCATIONS