

ANNUAL REPORT FOR 2003



**Ballance Farm Mitigation Site
Currituck County
Project No. 6.049008T
TIP No. R-2228WM**



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December 2003

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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Ballance Farm Mitigation Site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years or until the site is deemed successful.

The Ballance Farm site contains twenty-eight groundwater-monitoring gauges and twelve surface gauges. The original seventeen gauges were placed subsequent to the site construction. The site was extremely wet and the gauges were installed in the drier, and therefore higher locations across the site. NCDOT installed an additional eleven groundwater gauges across the site at elevation-representative locations.

Success criteria are based on federal guidelines for wetland mitigation (as well as a comparison to the hydrology of an undisturbed coastal marsh reference ecosystem located along Tull Creek and an undisturbed forested wetland reference ecosystem referred to as the Richard's property). These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. Gauges were not installed on the Richard's property for the first two years of monitoring.

Hydrologic monitoring in the restored-forested wetland revealed that twenty-seven of the twenty-eight groundwater gauges indicated saturation within 12" of the surface for more than 12.5% of the growing season. Only one gauge indicated less than 5%. The surface water gauges located in the existing and created coastal marshes showed continuous inundation throughout the growing season. The 2003-year experienced an average to above average rainfall year.

There were twenty-one tree-planting plots (50' x 50') established within the 223 acres planted in trees on the site. 500 random plots were also established within the 48 acres of marsh grass planting. The vegetation monitoring of the planted area revealed an average density of 439 trees per acre, which is above the 260 trees per acre required by the minimum success criteria for the fifth year of monitoring. For the marsh area, the percent frequency of target species is 92.1%, while the scale value is 3.89 for year 4.

Based on the hydrologic and vegetation monitoring, the Ballance Farm Mitigation Site met success criteria across the majority of the site during the 2003-growing season. NCDOT will continue to monitor the Ballance Farm Mitigation Site for marsh vegetation, however NCDOT proposes to discontinue hardwood vegetation monitoring and hydrology monitoring in the restored forested wetland area (based on the consistent success).

1.0 INTRODUCTION

1.1 Project Description

The Ballance Farm Mitigation Site is located in Currituck County (Figure 1). The property was originally a 469-acre site from which NCDOT purchased 430 acres. The mitigation site consisted of 297 acres of agricultural fields, 50 acres of tidal freshwater marsh, 51 acres of forested wetland, 5.3 acres of forested uplands, and 26 acres of roads and ditches. It was designed to mitigate for the widening of NC 168 (TIP Project R-2228); the project includes the creation of coastal marsh wetland and the preservation of forested wetlands and forested upland areas. According to the Ballance Farm Mitigation Plan, implementation of the site was to provide 61 acres of marsh creation, 236 acres of forested wetland restoration, 51 acres of forested wetland preservation, 50 acres of coastal marsh preservation, and 5.3 acres of upland habitat preservation. However, based on recent GPS data and ground observation, approximately 13 acres of the zone C1 marsh creation area appears to have been graded incorrectly. NCDOT obtained controlled aerial photography of the mitigation site to determine the as-built condition of the site.

The Final Mitigation Plan for this site was issued on April 1, 1996. Initial construction was completed in late 1998. The site was planted and monitoring gauges were installed in early 1999.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria are based on federal guidelines for wetland mitigation (as well as a comparison to the hydrology of an undisturbed coastal marsh reference ecosystem and an undisturbed-forested wetland reference ecosystem). These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetative monitoring during the 2003-year, as well as local climate conditions throughout the growing season at the Ballance Farm Mitigation Site.

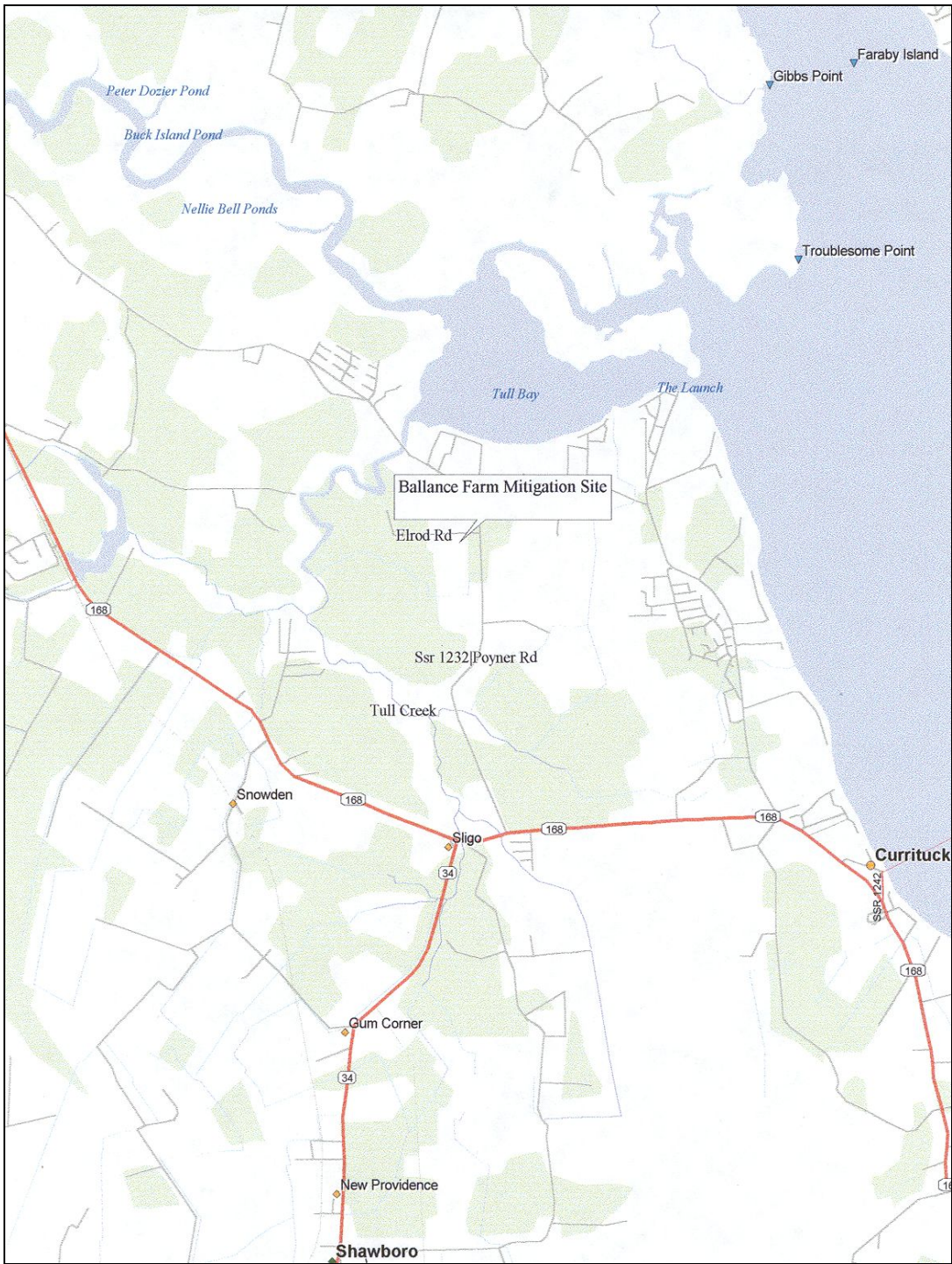


FIGURE 1: SITE LOCATION MAP

1.3 Project History

Fall 1998	Site Constructed
Spring 1999	Site Planted
March-November 1999	Hydrology Monitoring (YEAR 1)
November 1999	Vegetation Monitoring (YEAR 1)
March-November 2000	Hydrology Monitoring (YEAR 2)
March 2000	Hardwood Herbicide Treatment
June 2000	Marsh Re-planted
October 2000	Hardwood Vegetation Monitoring (YEAR 2)
October-November 2000	Marsh Vegetation Monitoring (YEAR 1)
March-November 2001	Hydrology Monitoring (YEAR 3)
July 2001	Hardwood Vegetation Monitoring (YEAR 3)
July 2001	Marsh Vegetation Monitoring (YEAR 2)
October-November 2002	Hydrology Monitoring (YEAR 4)
July 2002	Hardwood Vegetation Monitoring (YEAR 4)
July 2002	Marsh Vegetation Monitoring (YEAR 3)
October-November 2003	Hydrology Monitoring (YEAR 5)
October 2003	Hardwood Vegetation Monitoring (YEAR 5)
October 2003	Marsh Vegetation Monitoring (YEAR 4)

1.4 Debit Ledger

Table 1: Balance Farm Debit Ledger

Balance Farm	Mit. Plan			Ratios	TIP DEBIT	TIP DEBIT	TIP DEBIT	TIP DEBIT	TIP DEBIT
Currituck Co.									
Habitat	Acres at Start:	Acres Remaining	Percent Remaining		R-2228BA & A	R-2228 mod.	Div. 1	Div. 1; SR 1205	B-3445
FWM Creation	39	28.25	72.4			10.65			0.1
FWM (High) Creation	12	12	100.0						
FWM Preservation	50	50	100.0						
BLH Restoration	225	196.27	87.2		17.5	10.6	0.27	0.36	
BLH Preservation	51	49.65	97.4				1.35		
Upland Mgmt.	5.3	5.3	100.00						
TOTAL	382.3	341.47	89.3		17.5	21.25	1.62	0.36	0.1

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. Areas inundated or saturated for less than 5% of the growing season are always classified as non-wetlands. Areas inundated or saturated 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 Currituck County begins March 20 and ends November 13. These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after March 20 and before November 13.¹ The growing season is 239 days; therefore, optimum hydrology requires 12.5% of this season, or at least 30 consecutive days. Local climate must also represent average conditions for the area.

Based on the Ballance Farm Mitigation Plan, hydrologic success of the created coastal marsh is dependent on the groundwater levels occurring at depths concluded in the water budget analysis and similar to those in the adjoining reference coastal marsh. Success will also be determined by comparison of hydrology with the reference coastal marsh.

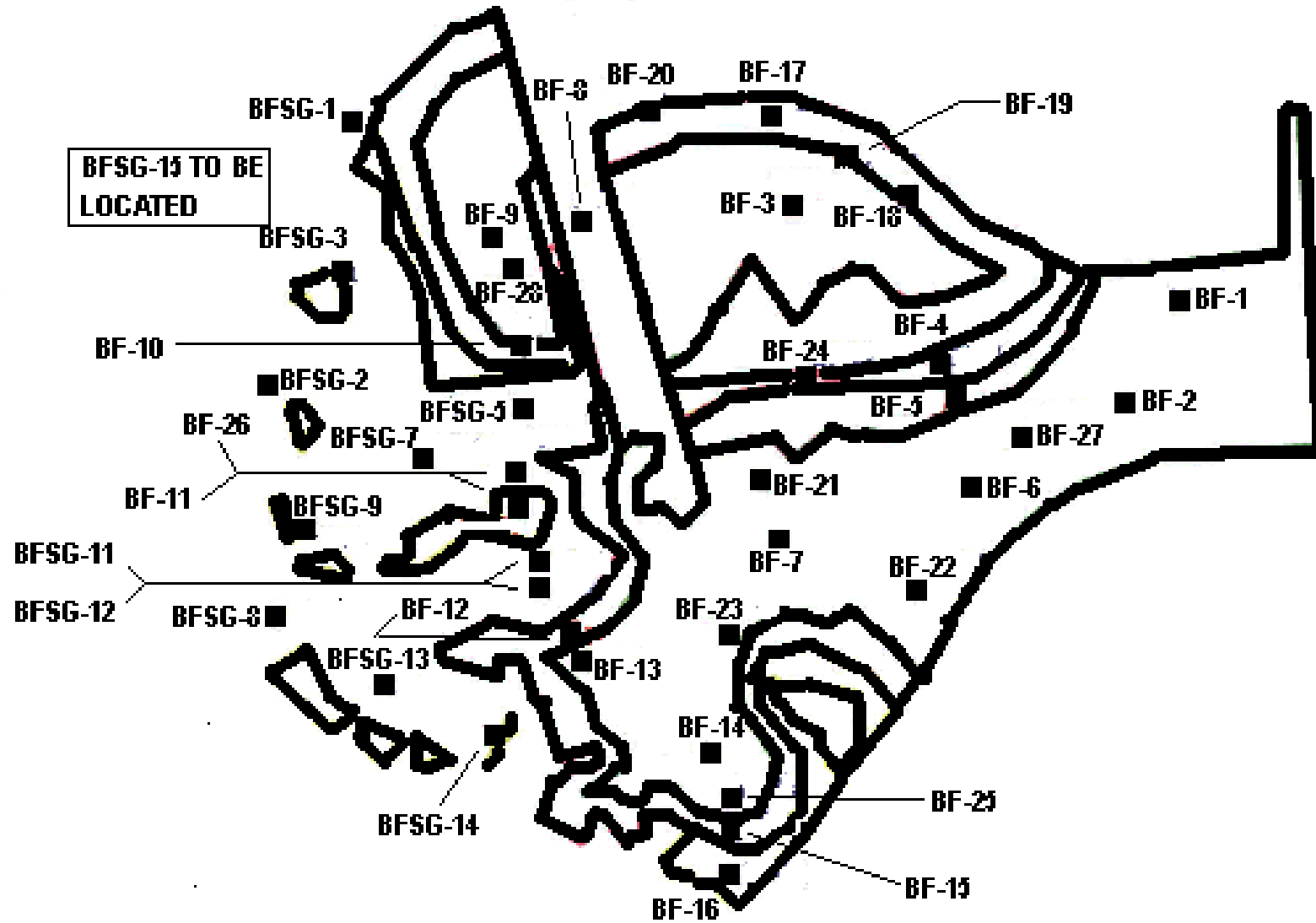
Based on coordination with the Corps of Engineers following the completion of the Ballance Farm Mitigation Plan, the restored forested wetland will be considered successful if hydrology onsite is consistent with the reference ecosystem referred to as the Richards' property. The plan also states that hydrologic success of the restored-forested wetland is dependent on the groundwater levels occurring at depths included in the water budget analysis.

2.2 Hydrologic Description

In early 1999, seventeen monitoring gauges, one rain gauge, and fourteen surface water gauges were installed. In early 2000, eleven additional groundwater-monitoring gauges were installed, and seven surface water gauges were either removed or relocated to more adequately monitor the marsh area. There are twelve surface water gauges onsite (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth and the surface gauges record daily readings of surface water depth.

¹ Natural Resources Conservation Service, Soil Survey of Currituck County, North Carolina, p.71.

Figure 2: 2003 Ballance Farm Gauge Locations



The Ballance Farm site involved the construction and planting of a tidal marsh system by grading the site to match the topography of the existing system located along Tull Creek and by constructing large channels connecting Roland Creek, Tull Creek, and a tributary to Tull Creek. This connectivity will allow for tidal flushing of the constructed coastal marsh. This work created a 400-foot wide band of coastal marsh area that resulted in approximately 61 acres of coastal marsh created. In the existing agricultural fields, the field crowns were graded down, the field ditches were filled and plugged, and this area was planted resulting in the restoration of approximately 236 acres of forested wetlands.

Rainfall and surface water from the adjacent creeks should provide adequate inputs to sustain the necessary hydrology on this site. The hydrologic monitoring should show the reaction of the groundwater level to specific tidal and 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 gauge. This number was converted into a percentage of the 239-day growing season. The results are presented in Table 2. Appendix A contains a plot of the groundwater depth for each monitoring gauge and the surface water depth recorded by the surface gauges. The maximum number of consecutive days is noted on each graph. The Infinities rain gauge that is currently located on the site was utilized for the 2003-monitoring season, thus eliminating the need to use official rainfall information on the monitoring gauge graphs. Historical rainfall data was obtained from the North Carolina State Climate Office. Figure 3 is a graphical representation of the hydrologic monitoring results.

Table 2. 2003 Hydrologic Monitoring Results

Monitoring Gauge	<5%	5%-8%	8%-12.5%	>12.5%	Actual %	Success Dates
BF-1+				×	37.7	March 20-April 30 Aug 16-Nov 13
BF-2				×	22.6	March 20-May 12 May 19-June 27 Sept 12-Oct 24
BF-3				×	23.0	March 20-May 13 May 19-June 25
BF-4+				×	100	March 20-Nov 13
BF-5				×	22.6	March 20-May 12 May 19-June 25 Sept 12- Oct 18
BF-6				×	20.1	May 19-July 5
BF-7				×	23.4	March 20-May 14 May 19-June 27
BF-8				×	23.4	March 20-May 14 May 19-June 25
BF-9+				×	18.0	March 20-April 24 May 19-June 30 August 8-Sept 5
BF-10				×	45.2	March 20-July 5
BF-11+				×	44.4	March 20-May 13 May 19-July 5 July 8-Oct 21
BF-12				×	22.6	March 20-May 12
BF-13+				×	43.9	March 20-July 2 July 14-Aug 24
BF-14+				×	52.3	March 20-July 8 July 12-Nov 13
BF-15+				×	100	March 20-Nov 13
BF-16*	×				2.9	
BF-17+				×	24.3	March 20-May 16 May 19-June 27 Sept 13-Oct 18
BF-18+				×	100	March 20-Nov 13
BF-19+				×	23.8	March 20-May 15 May 19-June 27 Sept 12-Oct 18
BF-20+				×	45.6	March 20-July 6 Sept 12-Oct 19
BF-21+				×	46.4	March 20-July 8 Sept 1-Oct 22
BF-22+				×	61.9	March 20-Aug 14

BF-23+				×	100	March 20-Nov 13
BF-24+				×	47.3	March 20-July 10 July 14-Aug 30 Sept 1-Nov 13
BF-25+				×	52.3	March 20-July 8 July 12-Nov 13
BF-26+				×	76.6	May 15-Nov 13
BF-27				×	46.4	March 20-July 8
BF-28+				×	52.3	March 20-July 8 July 12-Nov 13
BF-REF1+				×	100	March 20-Nov 13
BF-REF 2+				×	100	March 20-Nov 13
BF-REF 3+				×	100	March 20-Nov 13

+ Gauge met the success criterion during an average rainfall month (July, August, and October)

* Gauge (BF-16) is located near the ditch on the property line, which is at a slightly higher elevation.

As noted previously, the reference-forested wetland (Richards' Property) had gauges installed prior to the 2001-monitoring season. These three gauges indicated hydrology within 12" of the surface for 100% of the 2003-growing season during an average to above average rainfall year.

Table 3. Hydrologic Monitoring Results (1999- 2002)

Monitoring Gauge	1999 Results	2000 Results	2001 Results	2002 Results
BF-1	27.9	93.7	18.8	32.2
BF-2	14.6	32.6	11.7	25.5
BF-3	2.5	9.6	8.8	17.9
BF-4	31.0	94.6	67	40.2
BF-5	6.7	10	13.4	24.7
BF-6	6.7	17.2	33.9	25.5
BF-7	2.9	9.2	2.1	24.7
BF-8	16.3	22.2	14.6	24.3
BF-9	4.2	9.6	27.6	23.9
BF-10	2.5	0	0	15.9
BF-11	2.5	9.6	5.9	25.1

BF-12	1.3	10	4.6	10
BF-13	4.6	30.2	36.4	27.2
BF-14	8.0	30.2	29.7	29.7
BF-15	7.1	100	49.3	31.4
BF-16	0	17.2	0	1.3
BF-17	13.9	32.6	17.6	26
BF-18	Not Installed	21.3	5.9	32.6
BF-19	Not Installed	33.9	2.5	13.8
BF-20	Not Installed	34.3	31.8	28.5
BF-21	Not Installed	17.2	30.1	28
BF-22	Not Installed	32.6	35.9	27.2
BF-23	Not Installed	Battery Problems	36	32.2
BF-24	Not Installed	35.6	36.4	30.1
BF-25	Not Installed	32.2	23	28
BF-26	Not Installed	96.2	98.7	100
BF-27	Not Installed	32.6	34.4	28.9
BF-28	Not Installed	36.8	31.8	30.1
BF-REF1	Not Installed	Not Installed	Not Installed	100
BF-REF 2	Not Installed	Not Installed	Not Installed	100
BF-REF 3	Not Installed	Not Installed	Not Installed	100
	Average to Below Average Rainfall	Average Rainfall	Average to Below Average Rainfall	Average Rainfall

Table 3 represents hydrologic data in percentages from previous years (1999-2002).

2.3.2 Climatic Data

Figure 4 is a comparison of monthly rainfall for the period of November 2002 through November 2003 to historical precipitation (collected between 1972 and 2003) for Elizabeth City, North Carolina. This comparison gives an indication of how 2003 relates to historical data in terms of climate conditions. The NC State Climate Office provided all offsite data.

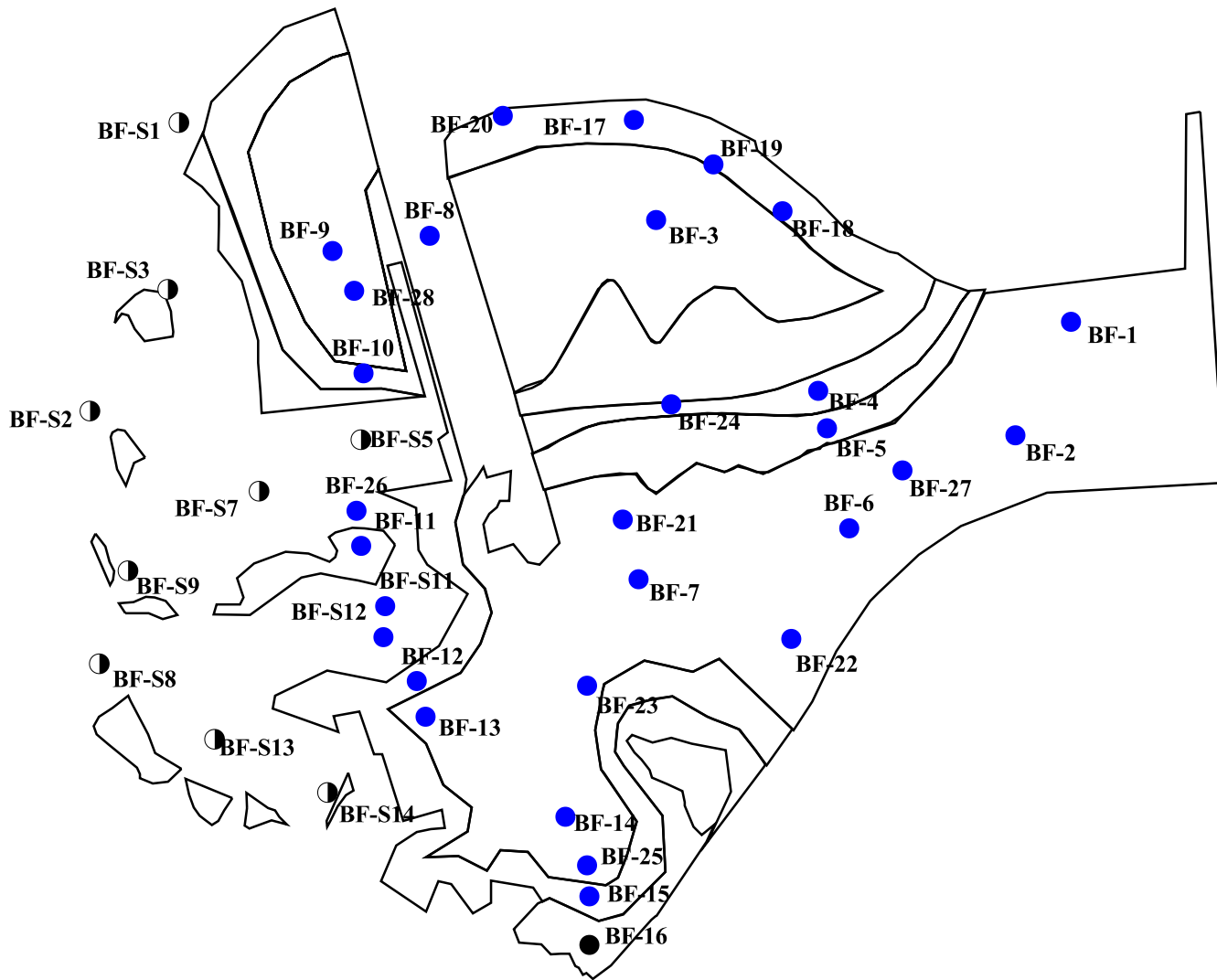


Figure 3. 2003 Hydrologic Monitoring Gauge Results



Hydrology Results

- < 5%
- 5 - 8%
- 8 - 12.5%
- > 12.5%
- ⊕ Rain Gauge
- ⊖ Surface Gauge

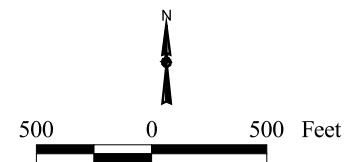
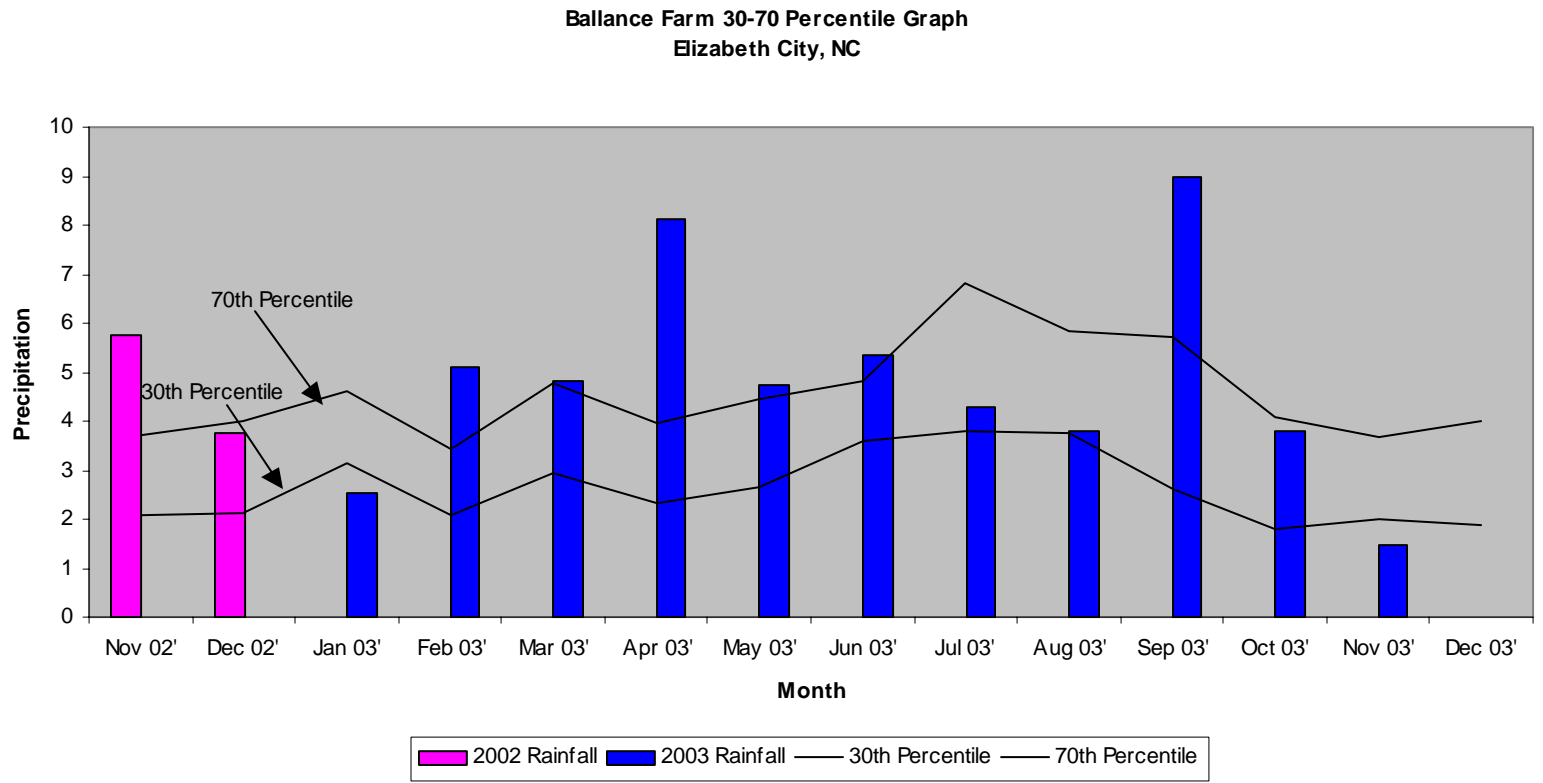


FIGURE 4: Elizabeth City 30-70 Graph



For the 2003-year, November (02'), February, March, April, May, June, and September experienced above average rainfall. The months of January and November recorded below average rainfall for the site. December (02'), July, August, and October experienced average rainfall. Overall, 2003 experienced an average to above average rainfall year.

2.4 Conclusions

The 2003-year represents the fifth growing season that the hydrologic data has been examined. Hydrologic monitoring in the restored-forested wetland reveals that twenty-seven of the twenty-eight groundwater gauges indicated saturation within 12" of the surface for more than 12.5% of the growing season. Only one gauge indicated less than 5%. The surface water gauges that are located in the existing and created coastal marshes showed continuous inundation throughout the growing season. The 2003-year experienced an average to above average rainfall year.

NCDOT proposes to discontinue hydrology monitoring at the restored-forested wetland area, based on the consistent hydrologic success.

3.0 VEGETATION: BALLANCE FARM MITIGATION SITE HARDWOOD (YEAR 5 MONITORING) MARSH (YEAR 4 MONITORING)

3.1A Success Criteria (Bottomland Hardwood Area)

NCDOT will monitor the site for five years. A 320 stems per acre survival criterion for planted seedlings will be used to determine success 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). The number of plants of one species will not exceed 20% of the total number of plants of all species planted.

3.1B Success Criteria (Marsh Grass Area)

The vegetative marsh success of the wetland site will be determined in accordance with NMFS Guidelines. Monitoring plots found to be located within the open water channel will not be evaluated, and will not count toward the final count of plots. The vegetation component of the wetland site will be deemed successful if the following criteria are met:

1. At year five, the average of all plots should have a scale value of 5 (75% vegetative cover) consisting of wetland herbaceous species, not including any invasive species.
2. A minimum of 70% of the plots shall contain the target (planted) species.

3.2A Description of Planted Areas

The following plant communities were planted in the Bottomland Hardwood Area:

Zone 1: Approximately 44 acres

Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Fraxinus pennsylvanica, Green Ash
Quercus lyrata, Overcup Oak
Quercus michauxii, Swamp Chestnut Oak
Quercus nigra, Water Oak
Quercus phellos, Willow Oak

Zone 2: Approximately 67 acres

Fraxinus pennsylvanica, Green Ash
Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Quercus michauxii, Swamp Chestnut Oak
Quercus phellos, Willow Oak
Quercus nigra, Water Oak
Quercus laurifolia, Laurel Oak
Quercus lyrata, Overcup Oak

Zone 3: Approximately 27 acres

Taxodium distichum, Baldcypress
Fraxinus pennsylvanica, Green Ash
Quercus lyrata, Overcup Oak
Nyssa aquatica, Water Tupelo

3.2B Description of Planted Areas

The following plant communities were planted in the Marsh Grass Area:

Zone 1: Approximately 44 acres in Zone 1 and 2

Scirpus cyperinus, Woolgrass
Juncus effusus, Soft rush

Zone 2:

Cladium jamaicense, Sawgrass
Juncus roemerianus, Black Needle Rush
Scirpus americanus, Swordgrass
Scirpus atrovirens, Green Bulrush
Carex lurida, Shallow Sedge
Carex vulpinoidea, Fox Sedge
Scirpus robustus, Saltmarsh Bulrush
Scirpus pungens, Three-square Bulrush
Juncus gerardii, Blackgrass
Distichlis spicata, Spikegrass

Zone 3: Approximately 4 acres

Spartina cynosuroides, Big Cordgrass

3.3A Results of Vegetation Monitoring (Year 5)

Table 4: Vegetation Monitoring Statistics (Bottomland Hardwood Area)

ZONE	Plot #	Overcup Oak	Water Tupelo	Green Ash	Baldcypress	Willow Oak	Laurel Oak	Cherrybark Oak	Swp. Chestnut Oak	Water Oak	Total (5 year)	Total (at planting)	Density (Trees/Acre)
1	4	8		9		4		7	4	2	34	39	593
	5	8		3		3		5		5	24	40	408
	8			13					3		16	44	247
	9	17		3		1		3	1		25	39	436
	11	5				2		7	7		21	38	376
	12	3		1		2		10	6	5	27	42	437
	15	2		3		6	1	9	9		30	37	551
	16	3		1		10		5	13	1	33	41	547
	17	11				9		8	9	1	38	41	630
	20	6		2				1			9	45	136
	21	5		3				2	5		15	39	262
ZONE 1 AVG.													420

2	3	15		1		4	2		2	1	25	39	436
	6			6		4				1	11	38	197
	10	1		6		2	2	1	16		28	36	529
	13	1				11	4	3	5	1	25	41	415
	14					8	3	1	6	1	19	37	349
	18	1		11		3		1	11		27	39	471
ZONE 2 AVG.													400

3	1		5	1	20						26	40	442
	2	1	8	12	14						35	36	661
	7	4		26		7					37	37	680
	19	12		2							14	23	414
ZONE 3 AVG.													549

TOTAL AVG.													439
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Site Notes:

Zone 1: Other species noted: sedges, broomsedge, various grasses, cattails, *Juncus* sp., trumpet creeper, fennel, briars, *Baccharis halimifolia*, Queen-Anne's-lace, ragweed, *Aster* sp., *Sesbania* sp., horse-nettle, redbay, red maple, hickory, and sweetgum.

Zone 2: Other species noted: sedges, *Baccharis halimifolia*, goldenrod, various grasses, hickory, pine, red maple, sweetgum, trumpet creeper, panic grass, broomsedge, *Juncus* sp., briars, *Sesbania* sp., fennel, Queen-Anne's-lace, redbay, ragweed, tulip poplar, horse-nettle, and *Aster* sp.

Zone 3: Other species noted: broomsedge, various grasses and sedges, cattails, *Juncus* sp., *Baccharis halimifolia*, switch grass, Queen-Anne's-lace, black willow, pine, fennel, wax myrtle, and few red maple.

3.3B Results of Vegetation Monitoring (Year 4)

Table 5: Vegetation Monitoring Statistics (Marsh Grass Area)

Plot #	Scale Factor	<i>Juncus effusus</i>	<i>Scirpus cyperinus</i>	<i>Juncus roemerianus</i>	<i>Scirpus robustus</i>	<i>Scirpus mangens</i>	<i>Scirpus americanus</i>	<i>Cladiumatrovirens</i>	<i>Juncus lamprocarpus</i>	<i>Distichlis spicata</i>	<i>Carex lupida</i>	<i>Carex vulpinoidea</i>	<i>Spartina cynosuroides</i>	Frequency
1	3.0	■												■
2	5.0	■												■
3	0.0													BG
4	5.0							■						■
5	0.0													BG
6	0.0													BG
7	0.0													BG
8	0.0													BG
9	3.0								■					■
10														OW
11	2.0			■										■
12	4.0	■			■									■
13	2.0								■					■
14	5.0								■					■
15	5.0	■	■											■
16	5.0								■					■
17	2.0					■								■
18	5.0							■						■
19	3.0	■					■							■
20	4.0						■		■					■
21	5.0								■					■
22	5.0	■							■					■
23	5.0							■						■
24	5.0	■						■	■					■
25	5.0				■									■
26	0.0													BG
27	5.0		■						■					■
28	5.0	■												■
29	5.0													■
30	5.0	■	■											■
31	5.0		■											■
32	5.0								■					■
33	5.0							■						■
34	4.0	■												■
35	4.0					■			■					■
36	0.0													BG
37	2.0			■										■
38	2.0			■										■
39	3.0								■					■
40														OW
41														OW
42	3.0								■					■
43	5.0								■					■
44	3.0			■					■					■
45	2.0			■					■					■
46	3.0			■										■
47	5.0	■	■											■
48	4.0	■												■
49	5.0				■									■
50	4.0			■										■
51	5.0								■					■
52	5.0			■					■					■
53	5.0	■												■
54														OW
55	4.0	■												■
56	5.0	■												■
57	4.0	■						■						■
58	5.0			■					■					■
59	4.0		■											■
60	3.0							■						■

Plot #	Scale Factor	<i>Juncus effusus</i>	<i>Scirpus cyperinus</i>	<i>Juncus roemerianus</i>	<i>Scirpus roebastus</i>	<i>Scirpus pungens</i>	<i>Scirpus americanus</i>	<i>Scirpus atrovirens</i>	<i>Cladium jamaicense</i>	<i>Juncus gerardii</i>	<i>Distichlis spicata</i>	<i>Carex lupida</i>	<i>Carex vulpinoidea</i>	<i>Spartina cynosuroides</i>	Frequency
61	5.0	■													■
62	5.0														
63															OW
64	0.0														BG
65	5.0	■							■	■					■
66	3.0														■
67	4.0	■	■												■
68	5.0									■					■
69	0.0														BG
70															OW
71	5.0	■					■								■
72	5.0				■										■
73	4.0	■							■						■
74	3.0	■													■
75	5.0	■													■
76	5.0								■						■
77	5.0													■	■
78	5.0		■						■						■
79															OW
80	5.0		■						■						■
81	2.0									■					■
82	3.0								■						■
83	3.0				■										■
84	3.0													■	■
85	3.0				■										■
86	5.0								■						■
87	3.0								■						■
88	3.0				■	■									■
89	4.0				■									■	■
90	5.0														
91	5.0				■				■		■				■
92	5.0										■			■	■
93	2.0								■						■
94	3.0				■										■
95	4.0													■	■
96	2.0				■				■						■
97	2.0				■				■						■
98	2.0				■					■					■
99	5.0														
100	5.0								■		■				■
101	5.0													■	■
102	3.0	■													■
103	2.0								■						■
104	2.0								■					■	■
105	2.0								■						■
106	2.0								■						■
107	2.0														
108	3.0				■					■					■
109	2.0													■	■
110	3.0				■										■
111	4.0	■	■												■
112	3.0								■						■
113															OW
114	5.0		■	■											■
115	4.0			■			■								■
116	5.0				■										■
117	5.0				■				■						■
118															OW
119	3.0								■						■
120															OW

Plot #	Scale Factor	<i>Juncus effusus</i>	<i>Scirpus cyperinus</i>	<i>Juncus roemerianus</i>	<i>Scirpus robustus</i>	<i>Scirpus pungens</i>	<i>Scirpus americanus</i>	<i>Scirpus atrovirens</i>	<i>Cladium lamatense</i>	<i>Juncus gerardii</i>	<i>Distichlis spicata</i>	<i>Carex lupida</i>	<i>Carex vulpinoidea</i>	<i>Spartina cynosuroides</i>	Frequency
121	3.0	■													■
122	2.0								■						■
123	4.0	■													■
124															OW
125	4.0			■											■
126	5.0			■											■
127	2.0					■									■
128	5.0	■	■												■
129	5.0			■			■		■						■
130															OW
131	3.0									■					■
132	3.0	■													■
133	5.0								■				■		■
134	3.0	■													■
135	5.0	■													■
136	5.0	■													■
137	4.0			■											■
138	5.0			■											■
139	4.0	■													■
140	2.0														
141	5.0		■						■						■
142	5.0	■							■						■
143	5.0			■											■
144	5.0								■				■		■
145	4.0			■						■					■
146	5.0									■					■
147	3.0														
148	4.0												■		■
149	5.0								■						■
150	0.0														BG
151	4.0		■						■						■
152	2.0									■					■
153	4.0			■											■
154	3.0												■		■
155	2.0									■					■
156	5.0								■						■
157	4.0			■						■					■
158	4.0			■	■										■
159	3.0		■							■					■
160	5.0			■											■
161	3.0									■					■
162	3.0								■						■
163	4.0		■												■
164	5.0	■													■
165	5.0														
166	3.0				■				■						■
167	5.0			■											■
168	5.0					■									■
169	2.0			■			■		■						■
170	5.0	■								■					■
171	4.0			■											■
172	2.0														
173	4.0	■								■					■
174	5.0			■											■
175															OW
176	5.0												■		■
177															OW
178															OW
179	3.0			■											■
180	5.0	■							■						■

Plot #	Scale Factor	<i>Juncus effusus</i>	<i>Scirpus cyperinus</i>	<i>Juncus roemerianus</i>	<i>Scirpus robustus</i>	<i>Scirpus pungens</i>	<i>Scirpus americanus</i>	<i>Scirpus atrovirens</i>	<i>Cladium jamaicense</i>	<i>Juncus gerardi</i>	<i>Distichlis spicata</i>	<i>Carex lupida</i>	<i>Carex vulpinoidea</i>	<i>Spartina cynosuroides</i>	Frequency
181	5.0														
182	3.0														
183	2.0														
184	3.0														
185	5.0														
186	3.0														
187	3.0														
188															OW
189	2.0														
190	5.0														
191	5.0														
192	3.0														
193	5.0														
194	5.0														
195															OW
196	5.0														
197	2.0														
198	4.0														
199															OW
200	4.0														
201															OW
202	4.0														
203	5.0														
204	3.0														
205	5.0														
206															OW
207	3.0														
208	5.0														
209	5.0														
210															OW
211	2.0														
212	3.0														
213	5.0														
214	4.0														
215	4.0														
216	3.0														
217	5.0														
218															OW
219	3.0														
220	5.0														
221															OW
222	5.0														
223	5.0														
224	3.0														
225	2.0														
226	4.0														
227															OW
228	4.0														
229	5.0														
230	5.0														
231	4.0														
232	5.0														
233															OW
234	3.0														
235	3.0														
236	2.0														
237															OW
238	4.0														
239															OW
240	3.0														

Plot #	Scale Factor	<i>Juncus effusus</i>	<i>Scirpus cyperinus</i>	<i>Juncus roemerianus</i>	<i>Scirpus robusus</i>	<i>Scirpus pungens</i>	<i>Scirpus americanus</i>	<i>Scirpus atrovirens</i>	<i>Cladium jamaicense</i>	<i>Juncus gerardii</i>	<i>Distichlis spicata</i>	<i>Carex lupida</i>	<i>Carex vulpinoidea</i>	<i>Spartina cynosuroides</i>	Frequency
241	5.0														
242	4.0														
243	5.0	■	■												■
244															OW
245	5.0			■											■
246	3.0			■											■
247	5.0			■											■
248	3.0									■					■
249	5.0		■						■						■
250	5.0									■					■
251	5.0						■			■					■
252	5.0			■											■
253	3.0			■											■
254	2.0									■					■
255	3.0						■			■					■
256	3.0														■
257	3.0								■						■
258															OW
259	3.0								■						■
260	3.0				■				■						■
261	5.0			■											■
262	2.0									■					■
263	3.0		■							■					■
264	5.0			■											■
265	4.0	■	■												■
266	2.0														■
267	5.0			■	■										■
268	2.0			■											■
269	3.0				■										■
270	5.0			■											■
271	3.0			■					■						■
272	5.0	■													■
273															OW
274	5.0				■										■
275	5.0	■													■
276	4.0			■	■										■
277	4.0	■													■
278	3.0	■								■					■
279															OW
280															OW
281															OW
282	5.0						■		■	■					■
283	3.0	■								■					■
284	2.0														■
285	4.0	■													■
286	4.0	■	■												■
287	5.0			■							■				■
288	5.0			■											■
289	4.0								■						■
290	5.0			■											■
291															OW
292															OW
293	3.0			■											■
294	5.0		■	■											■
295	4.0			■						■					■
296	2.0			■											■
297	4.0			■											■
298	5.0			■											■
299	3.0										■				■
300															OW

Plot #	Scale Factor	<i>Juncus effusus</i>	<i>Scirpus</i>	<i>Juncus</i>	<i>roemerianus</i>	<i>Scirpus</i>	<i>robustus</i>	<i>Scirpus</i>	<i>puberulus</i>	<i>Scirpus</i>	<i>americanus</i>	<i>Scirpus</i>	<i>atrovirens</i>	<i>Cladium</i>	<i>jamaicense</i>	<i>Juncus</i>	<i>gerrardii</i>	<i>Distichlis</i>	<i>spicata</i>	<i>Carex lupida</i>	<i>Carex</i>	<i> vulpinoidea</i>	<i>Spartina</i>	<i>cynosuroides</i>	Frequency
301	3.0	■																							■
302	3.0							■																	■
303	5.0									■					■		■								■
304	4.0			■																					■
305	3.0	■																							■
306																									OW
307	4.0			■	■										■										■
308	4.0														■										■
309	5.0	■																							■
310	5.0			■											■										■
311	2.0																								
312	5.0		■	■						■						■									■
313	2.0																								■
314	4.0			■											■										■
315	5.0	■																							■
316	3.0		■														■								■
317																									OW
318	4.0	■																							■
319	3.0			■																					■
320																									OW
321	5.0			■																					■
322	4.0			■																					■
323	5.0			■																			■		■
324	5.0	■													■										■
325	4.0			■						■															■
326	5.0	■	■																						■
327	5.0	■																							■
328	4.0	■		■	■																				■
329	4.0		■	■	■																				■
330																									OW
331	5.0														■										■
332	3.0																								
333																									OW
334	2.0	■																							■
335	5.0	■																							■
336																									OW
337	3.0											■					■								■
338	3.0	■																							■
339	5.0	■													■										■
340																									OW
341	3.0			■																					■
342	4.0		■	■																					■
343																									OW
344	5.0						■																		■
345	5.0	■													■										■
346	5.0	■																							■
347																									OW
348	4.0			■	■																				■
349	5.0	■															■								■
350	3.0			■																					■
351	5.0														■										■
352	3.0														■										■
353	3.0														■										■
354	5.0			■																					■
355	5.0			■																					■
356	5.0			■																					■
357	5.0			■																					■
358																									OW
359																									OW
360	3.0	■																							■

Plot #	Scale Factor	<i>Juncus effusus</i>	<i>Scirpus cyperinus</i>	<i>Juncus roemerianus</i>	<i>Scirpus robustus</i>	<i>Scirpus pungens</i>	<i>Scirpus americanus</i>	<i>Scirpus atrovirens</i>	<i>Cladium jamaicense</i>	<i>Juncus gerardii</i>	<i>Distichlis spicata</i>	<i>Carex lupida</i>	<i>Carex vulpinoidea</i>	<i>Spartina cynosuroides</i>	Frequency
361	5.0	■	■	■											■
362															OW
363	3.0										■				
364															OW
365	2.0	■					■								■
366	5.0	■							■						■
367															OB
368															OW
369	5.0							■		■					■
370	4.0		■												■
371	4.0														
372	4.0			■	■										■
373	5.0							■		■					■
374	5.0	■													■
375	4.0								■						■
376	5.0			■											■
377	5.0								■						■
378	2.0								■	■					■
379	4.0						■								■
380															OW
381	5.0		■						■						■
382															OW
383															OW
384	5.0			■											■
385															OW
386															OW
387	4.0			■					■						■
388	2.0									■					■
389	5.0	■							■						■
390	5.0			■											■
391	5.0	■								■					■
392	3.0			■											■
393	4.0			■					■						■
394	5.0			■											■
395	2.0				■										■
396	5.0						■		■	■					■
397	5.0								■						■
398															OW
399	3.0									■					■
400	4.0		■			■			■						■
401	5.0			■										■	■
402	4.0	■							■						■
403									■						OW
404	4.0								■						■
405	5.0			■											■
406	5.0			■	■										■
407															OW
408	5.0			■						■					■
409	0.0														BG
410	4.0					■									■
411	5.0			■	■										■
412	5.0			■											■
413	4.0					■									■
414															OW
415															OW
416	5.0										■				■
417	5.0						■								■
418	5.0	■													■
419	4.0			■					■						■
420	3.0								■						■

Plot #	Scale Factor	<i>Juncus effusus</i>	<i>Scirpus cyperinus</i>	<i>Juncus roemerianus</i>	<i>Scirpus robustus</i>	<i>Scirpus pungens</i>	<i>americanus</i>	<i>Scirpus atrovirens</i>	<i>Cladium jamaicense</i>	<i>Juncus gerardii</i>	<i>Distichlis spicata</i>	<i>Carex lupida</i>	<i>Carex vulpinoidea</i>	<i>Spartina cynosuroides</i>	Frequency
421	3.0	■								■					■
422	5.0	■													■
423	5.0			■			■								■
424	3.0					■									■
425	5.0								■						■
426	2.0		■												■
427															OW
428	5.0	■													■
429															OW
430	5.0			■											■
431	4.0	■													■
432															OW
433	5.0						■		■						■
434	5.0			■											■
435	4.0	■								■					■
436	4.0								■						■
437	4.0						■								■
438	2.0			■			■								■
439	5.0	■													■
440	5.0			■											■
441	5.0	■		■											■
442	4.0								■						■
443	4.0	■								■					■
444	2.0			■											■
445	5.0			■											■
446															OW
447	5.0			■											■
448	3.0	■							■						■
449	5.0			■											■
450	5.0								■						■
451	2.0					■									■
452															OW
453															OW
454	5.0			■					■	■					■
455	2.0							■	■						■
456	3.0			■						■					■
457	3.0								■						■
458	3.0				■				■						■
459	5.0			■											■
460	5.0								■		■				■
461	3.0								■						■
462	5.0		■	■											■
463	5.0								■				■		■
464	4.0	■	■												■
465	5.0			■											■
466	5.0			■											■
467															OW
468	5.0			■					■						■
469	5.0								■	■					■
470	3.0														
471	2.0														
472	3.0			■		■									■
473	4.0								■						■
474	5.0			■	■										■
475	5.0			■					■						■
476	5.0		■	■											■
477	5.0	■													■
478															OW
479	5.0														
480	3.0								■						■

Plot #	Scale Factor	<i>Juncus effusus</i>	<i>Scirpus cyperinus</i>	<i>Juncus roemerianus</i>	<i>Scirpus robustus</i>	<i>Scirpus pungens</i>	<i>Scirpus americanus</i>	<i>Scirpus atrovirens</i>	<i>Cladium jamaicense</i>	<i>Juncus gerardii</i>	<i>Distichlis spicata</i>	<i>Carex lupida</i>	<i>Carex</i>	<i>vulpinoidea</i>	<i>Spartina cynosuroides</i>	Frequency
481																OW
482	5.0	■							■							■
483	5.0	■							■							■
484	5.0	■		■												■
485	4.0		■													■
486	5.0		■													■
487	3.0	■		■												■
488	5.0			■												■
489	5.0															■
490	4.0			■						■						■
491	2.0			■												■
492	2.0	■														■
493	5.0	■														■
494	4.0			■												■
495																OW
496	5.0	■														■
497	3.0			■					■							■
498	3.0								■							■
499	4.0	■														■
500																OW
Frequency/Percentage Plots with Desired Species		24.8	9.3	31.5	6.8	3.3	6.1	0.9	25.9	19.2	1.9	0.0	0.0	4.0		92.1
Sum Scale Value																1666
Total Number of Plots																428
Vegetative Cover (Scale Value)																3.89

Note: OW=Open Water

Site Notes: The following species were also noted in the monitoring plots. The number of plots the species was found in is documented in parentheses (i.e. goldenrod was noted in 212 plots):

Goldenrod (212), *Baccharis halimifolia* (30), *Aster* sp. (13), *Juncus acuminatus* (47), smartweed (86), *Pluchea* sp. (13), lizard tail (2), *Panicum* sp. (29), broomsedge (44), *Scirpus* sp. (34), barnyard grass (2), pennywort (24), *Cyperus* sp. (64), cattail (26), baldcypress (37), phragmites (20), foxtail (7), water grass (5), pine (4), *Sagittaria* sp. (37), nutsedge (1).

3.4A Conclusions

Of the 430 acres on this site, approximately 223 involved tree planting. There were 21 plots established throughout the planting areas, encompassing all plant communities. The 2003 vegetation monitoring of the planted area revealed an average density of 439 trees per acre, which is above the 260 trees per acre required by the minimum success criteria.

NCDOT proposes to discontinue tree monitoring at the Ballance Farm Mitigation Site.

3.4B Conclusions

- Percent Frequency of Target Species (planted species) **92.1%**
Frequency of 70% required.
- Vegetative Cover Scale Value **3.89**
Scale Value of 5 required for year 5.

Of the 430 acres on this site, approximately 48 acres involved marsh grass planting. There were 500 random plots established throughout the planting areas, encompassing all plant communities. These plots were located with GPS. The marsh was replanted in June of 2000. The plantings are continuing to increase in cover.

NCDOT will continue marsh grass monitoring at the Ballance Farm Mitigation Site.

4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

The 2003-year represents the fifth growing season that the hydrologic data has been examined. The majority of the monitoring gauges on the site have shown saturation and inundation for extended periods. Hydrologic monitoring in the restored-forested wetland indicates twenty-seven of the twenty-eight groundwater gauges showed saturation within 12" of the surface for more than 12.5% of the growing season. Only one gauge indicated less than 5%. The groundwater gauges installed in the forested wetland reference ecosystem, located on the Richards' Property, showed saturation in the upper 12" for 100% of the growing season during an average to above average rainfall year. The surface gauges that are located in the existing and created coastal marsh, indicate continuous inundation throughout the growing season.

There are twenty-one vegetation plots established in the 223 acres that were planted in trees. The plots revealed an average density of 439 trees per acre, which is above the 260 trees per acre. NCDOT has been monitoring the tree plots for five consecutive successful years; therefore, NCDOT proposes to discontinue tree monitoring at Ballance Farm Mitigation Site.

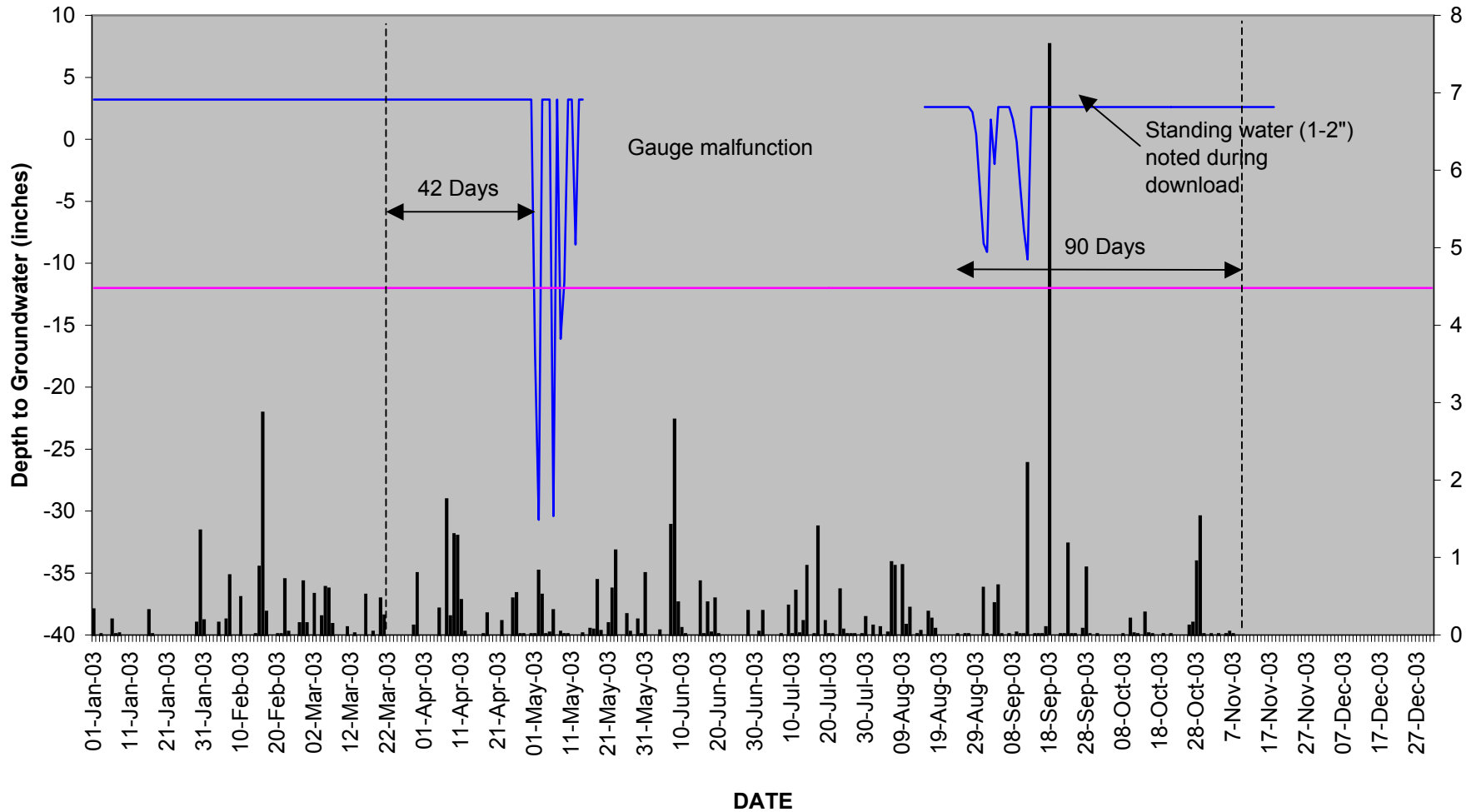
There were 500 random plots established in the 48 acres planted with marsh grasses. For the 2003 monitoring year, the plots increased in cover with a vegetative cover scale value of 3.89.

The hydrologic and vegetation monitoring indicate that the Ballance Farm Mitigation Site met the success criteria across the majority of the site during the 2003-growing season. NCDOT will continue to monitor the Ballance Farm Mitigation Site for marsh vegetation, however NCDOT proposes to discontinue hardwood vegetation monitoring and hydrology monitoring in the restored-forested wetland area (based on the consistent success).

APPENDIX A
GAUGE DATA GRAPHS

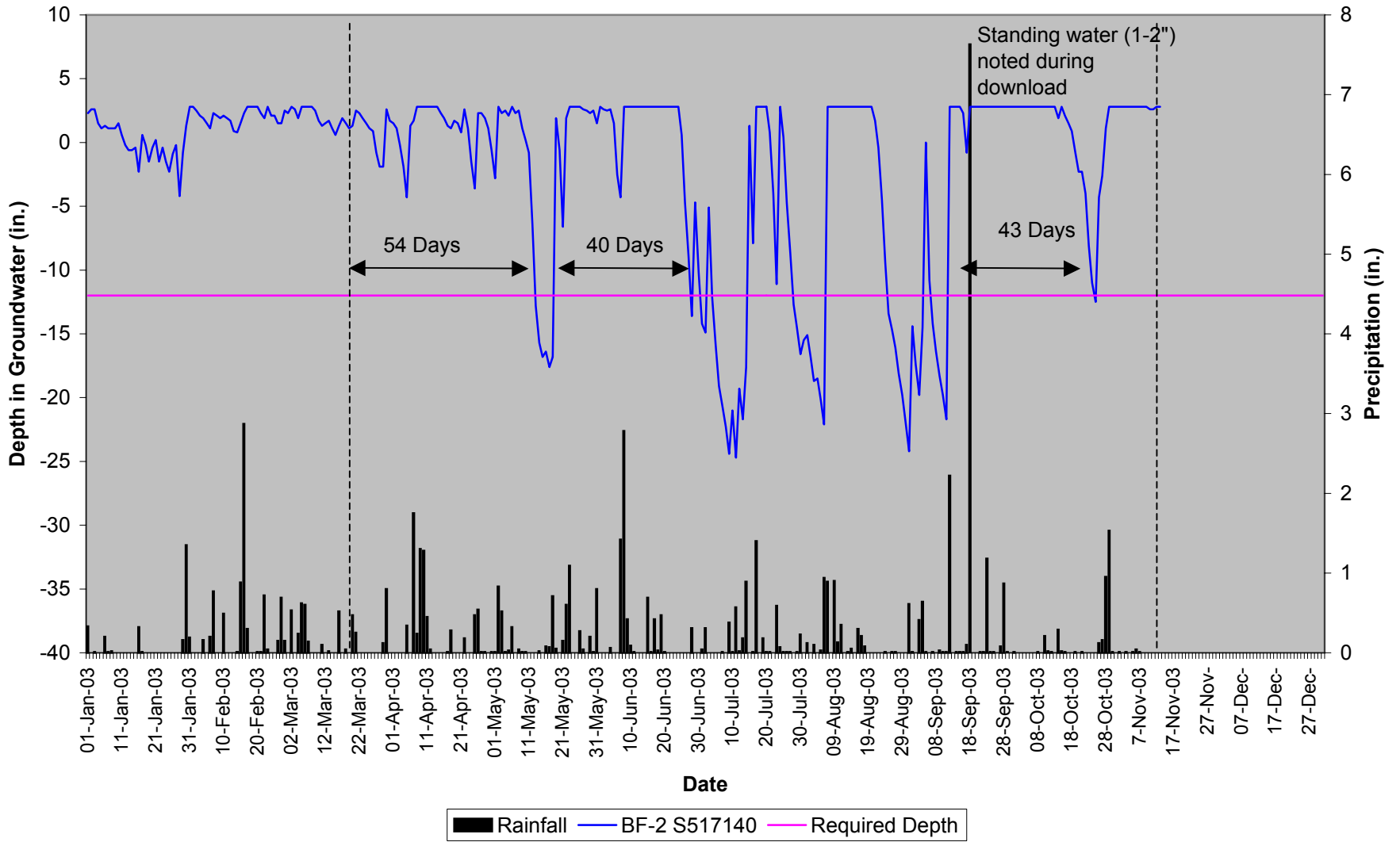
GROUNDWATER GAUGE GRAPHS

Ballance Farm BF-1 40" Groundwater

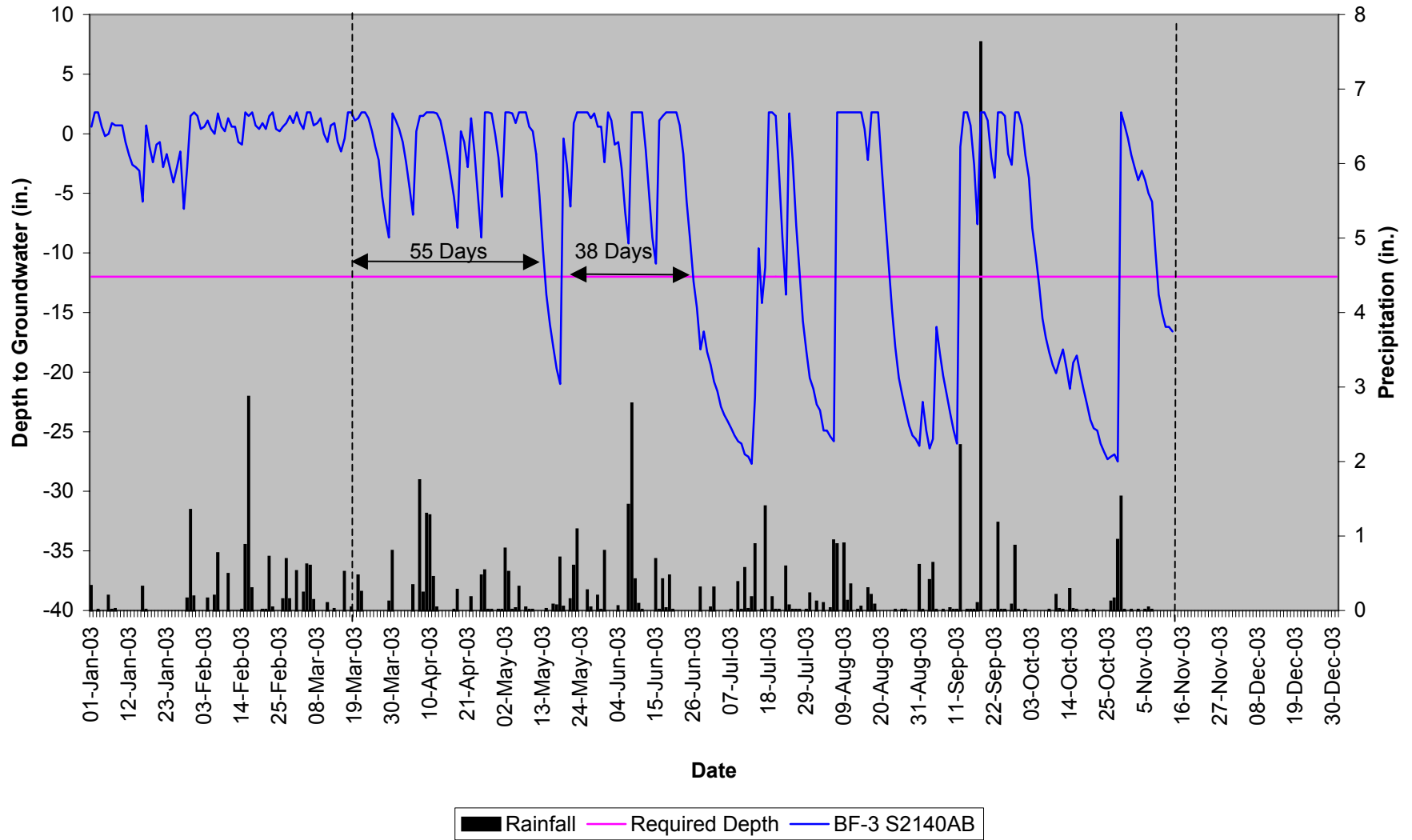


■ Rain Gauge — BF-1 S31F7F3 — Required Depth

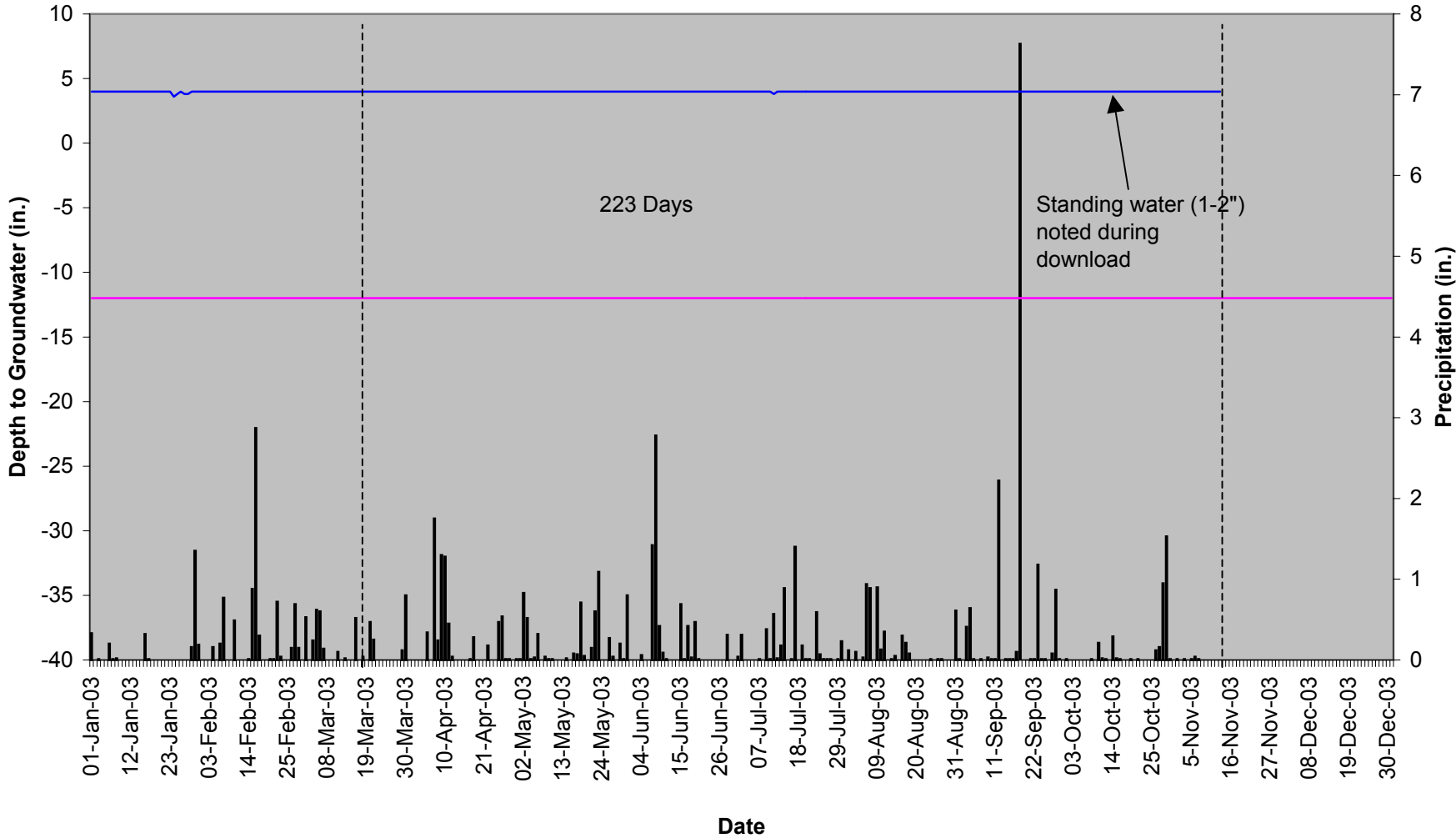
Ballance Farm BF-2 40" Groundwater



Ballance Farm BF-3 40" Groundwater

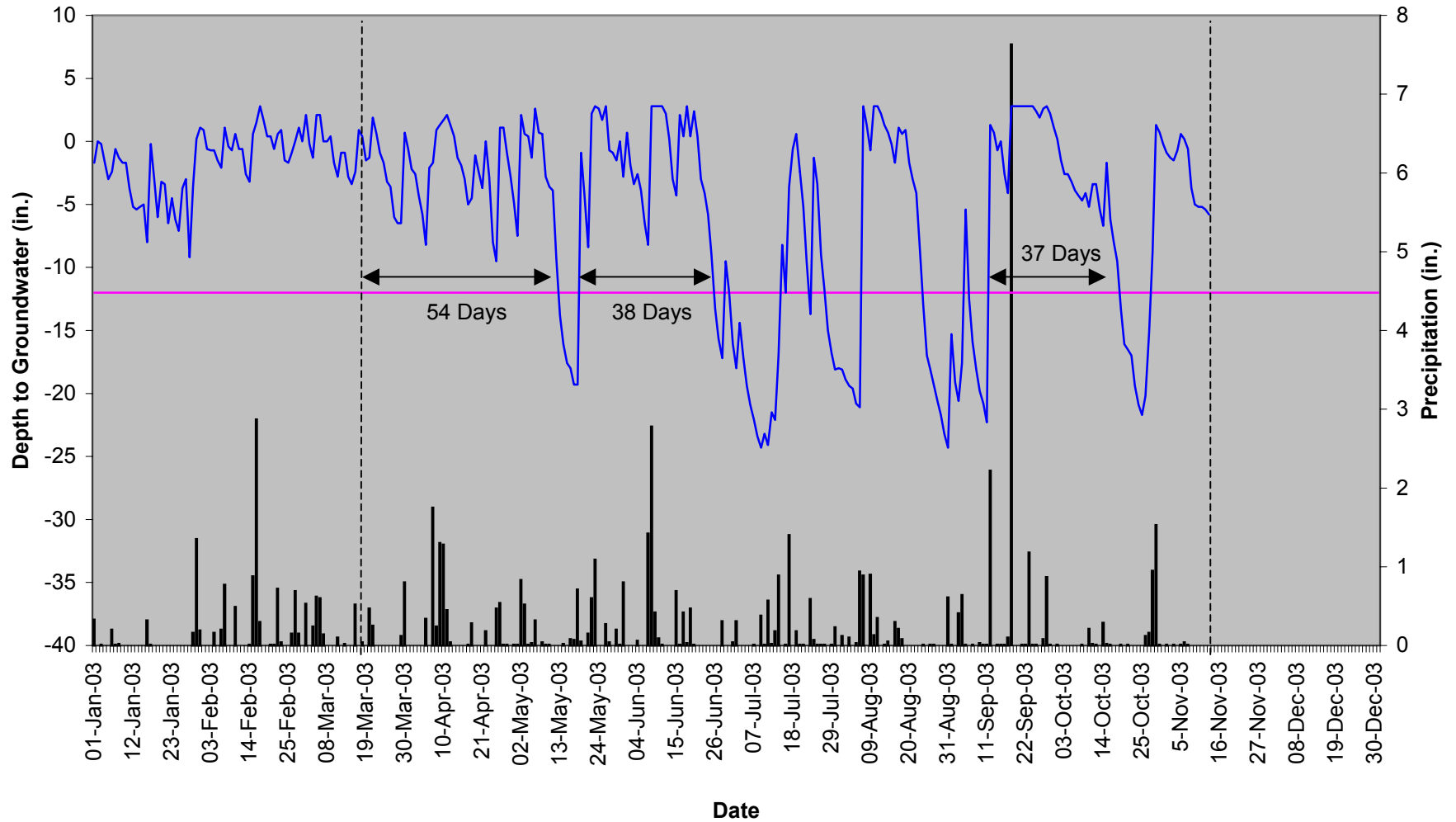


Ballance Farm BF-4 40" Groundwater



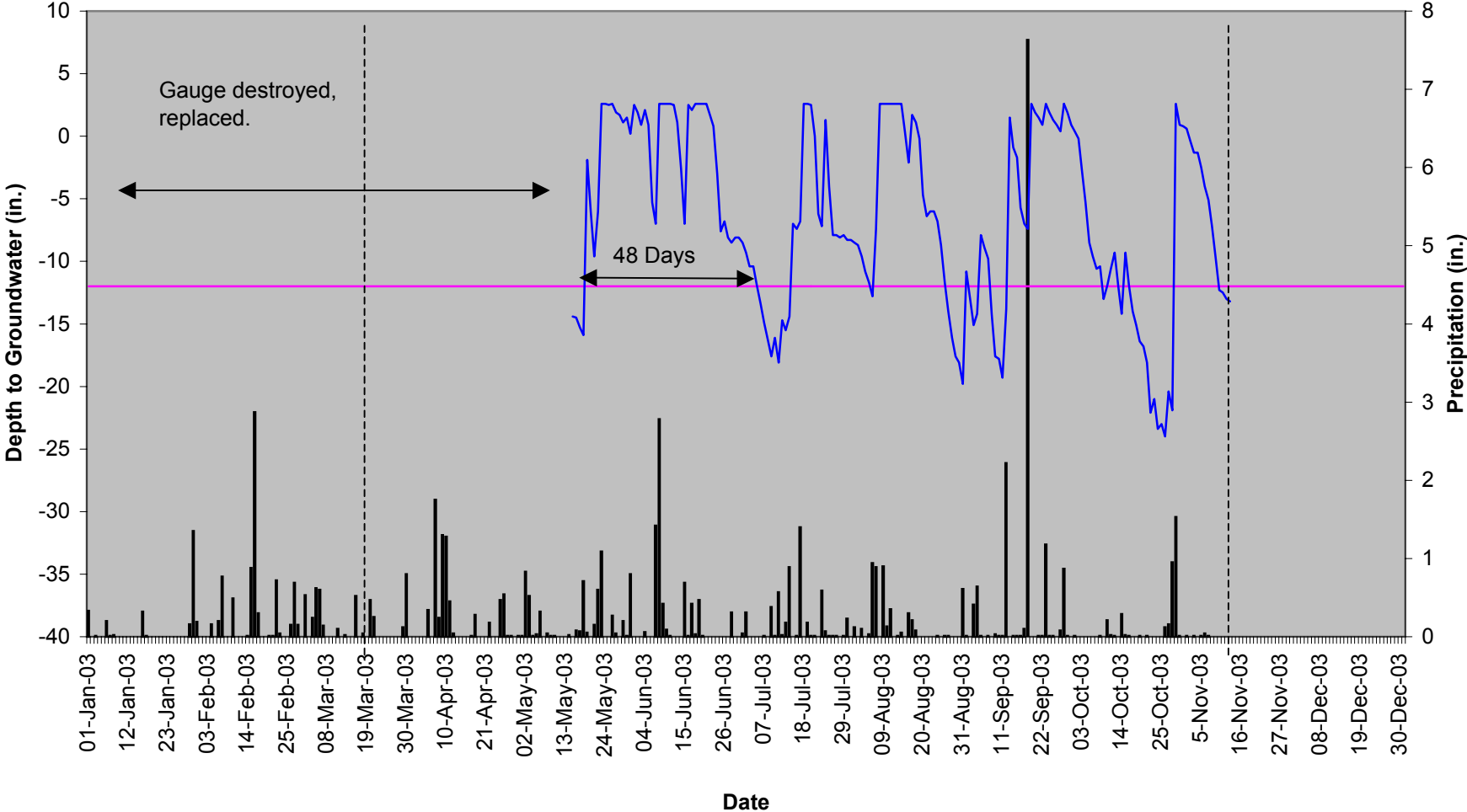
Rainfall
 Required Depth
 BF-4 S31F804

Ballance Farm BF-5 40" Groundwater

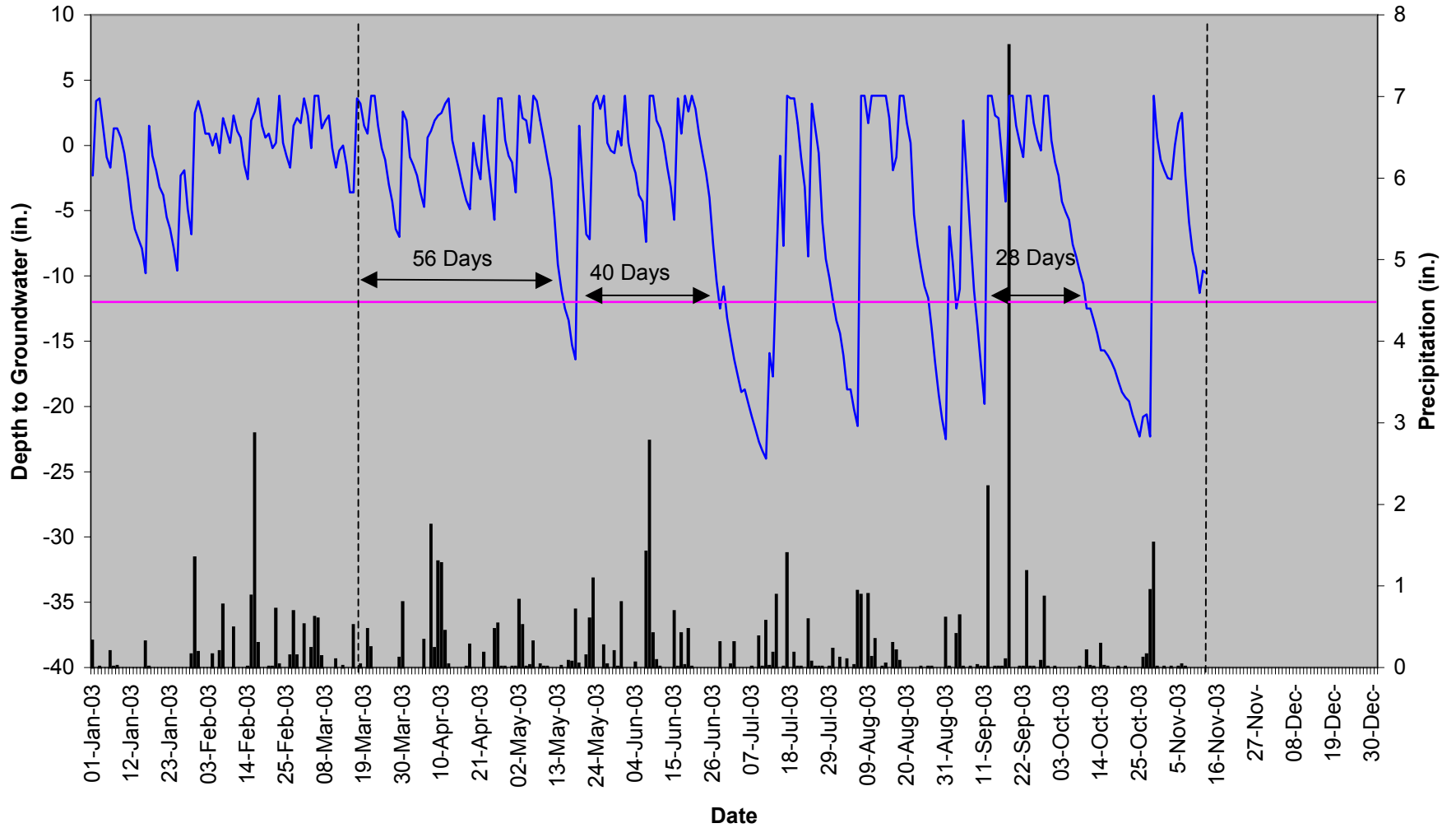


■ Rainfall — Required Depth — BF-5 S213D96

Ballance Farm BF-6 40" Groundwater

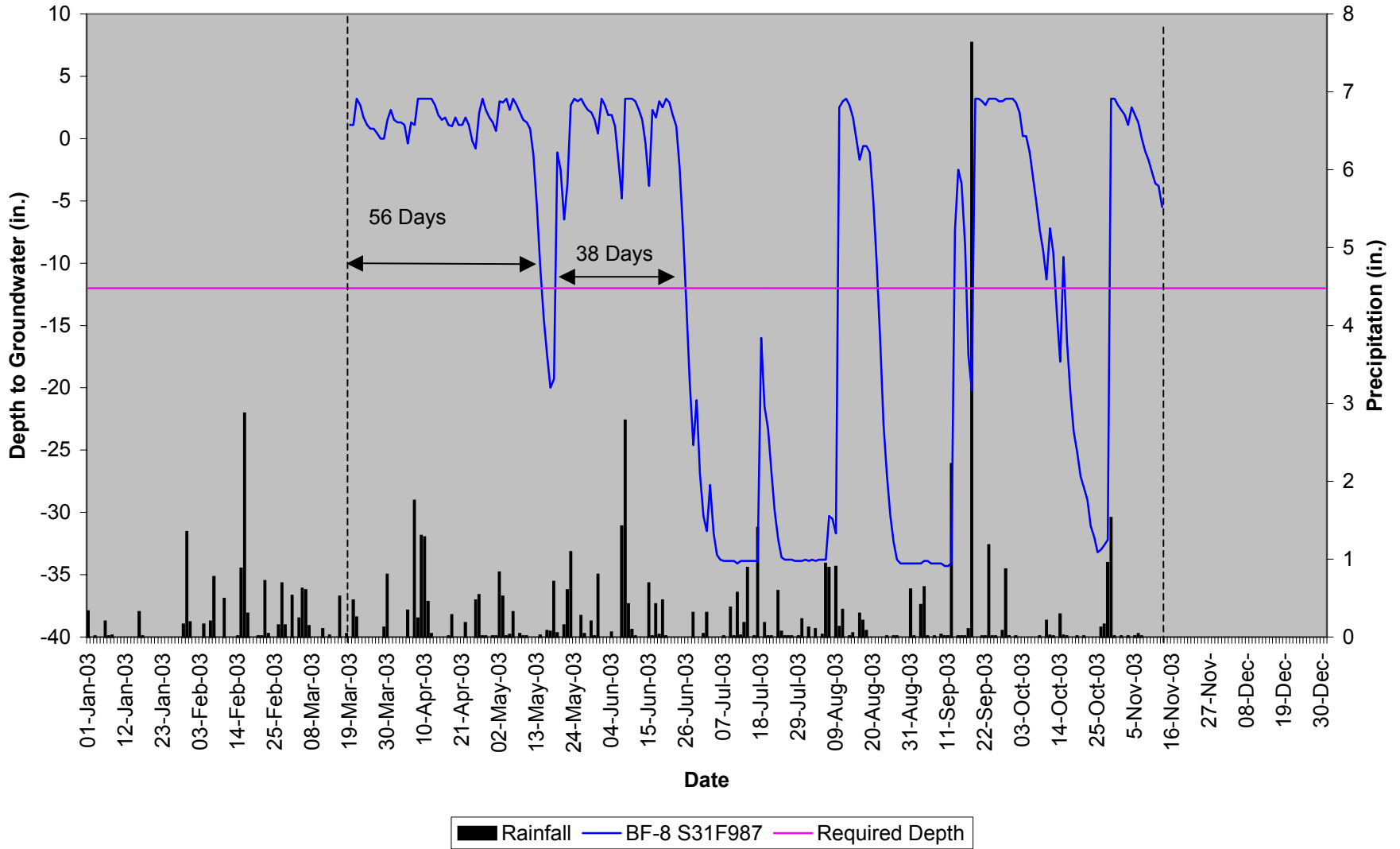


Ballance Farm BF-7 40" Groundwater

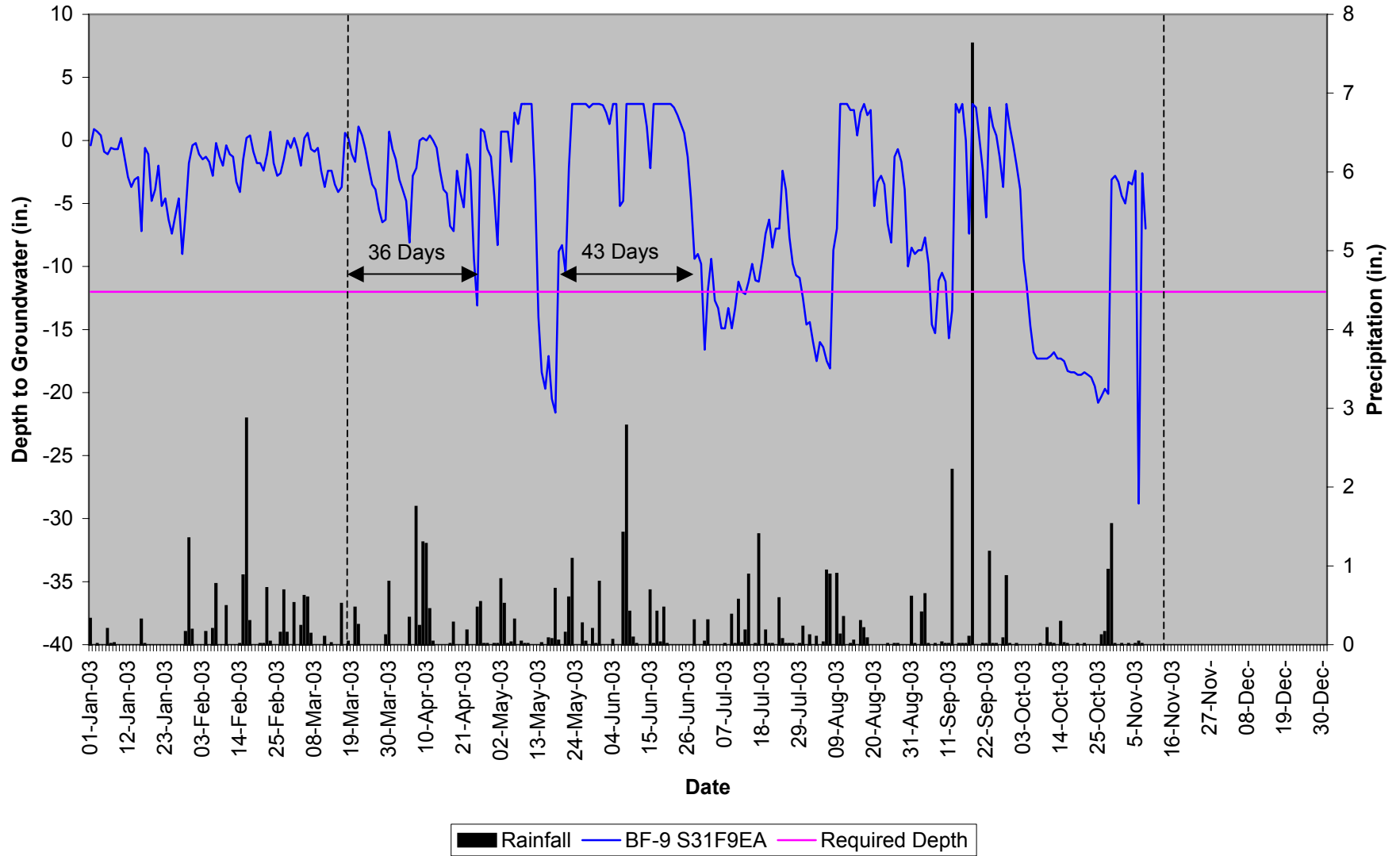


Rainfall
 BF-7 S3175EA
 Required Depth

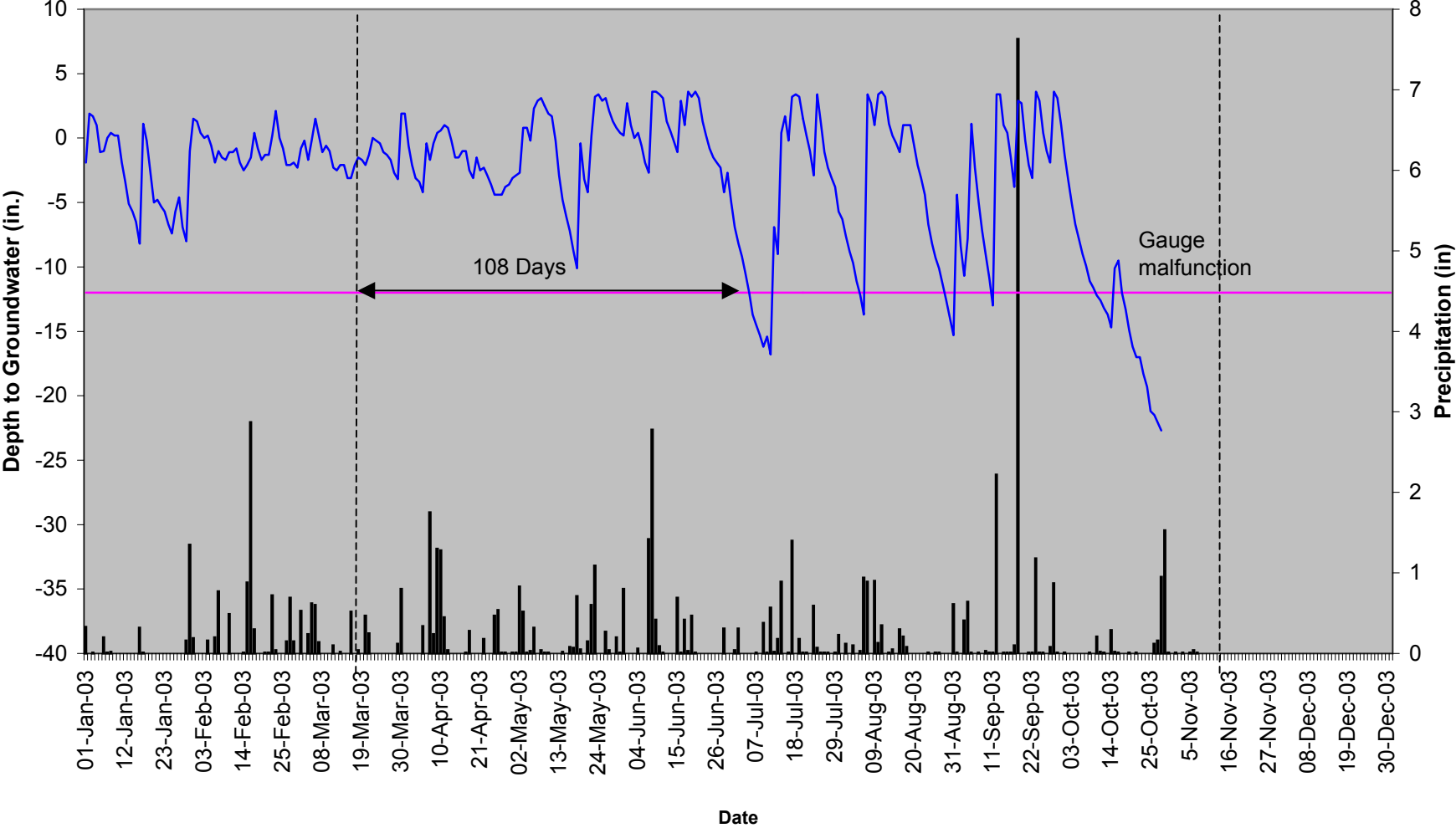
Ballance Farm BF-8 40" Groundwater



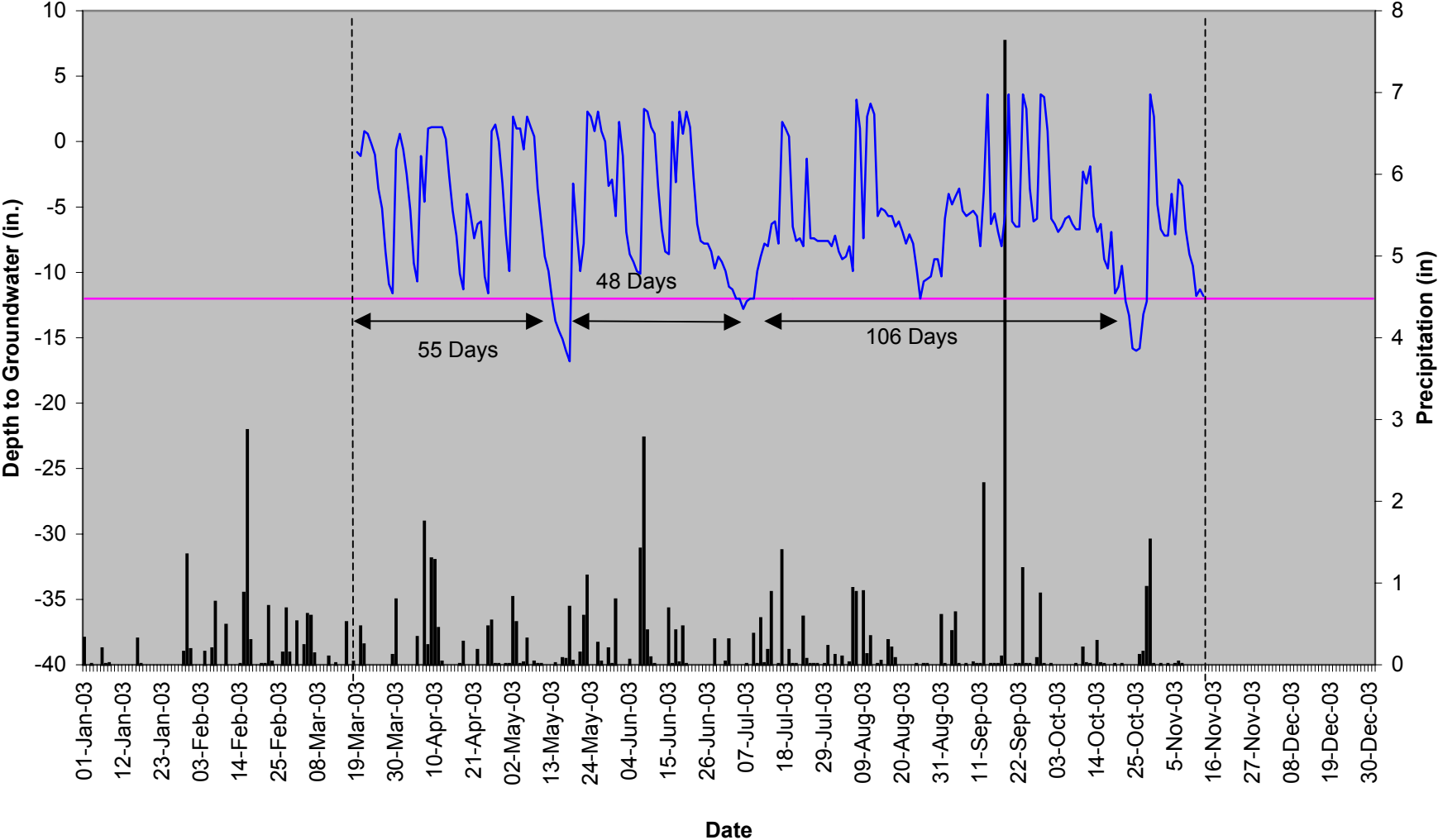
Ballance Farm BF-9 40" Groundwater



Ballance Farm BF-10 40" Groundwater

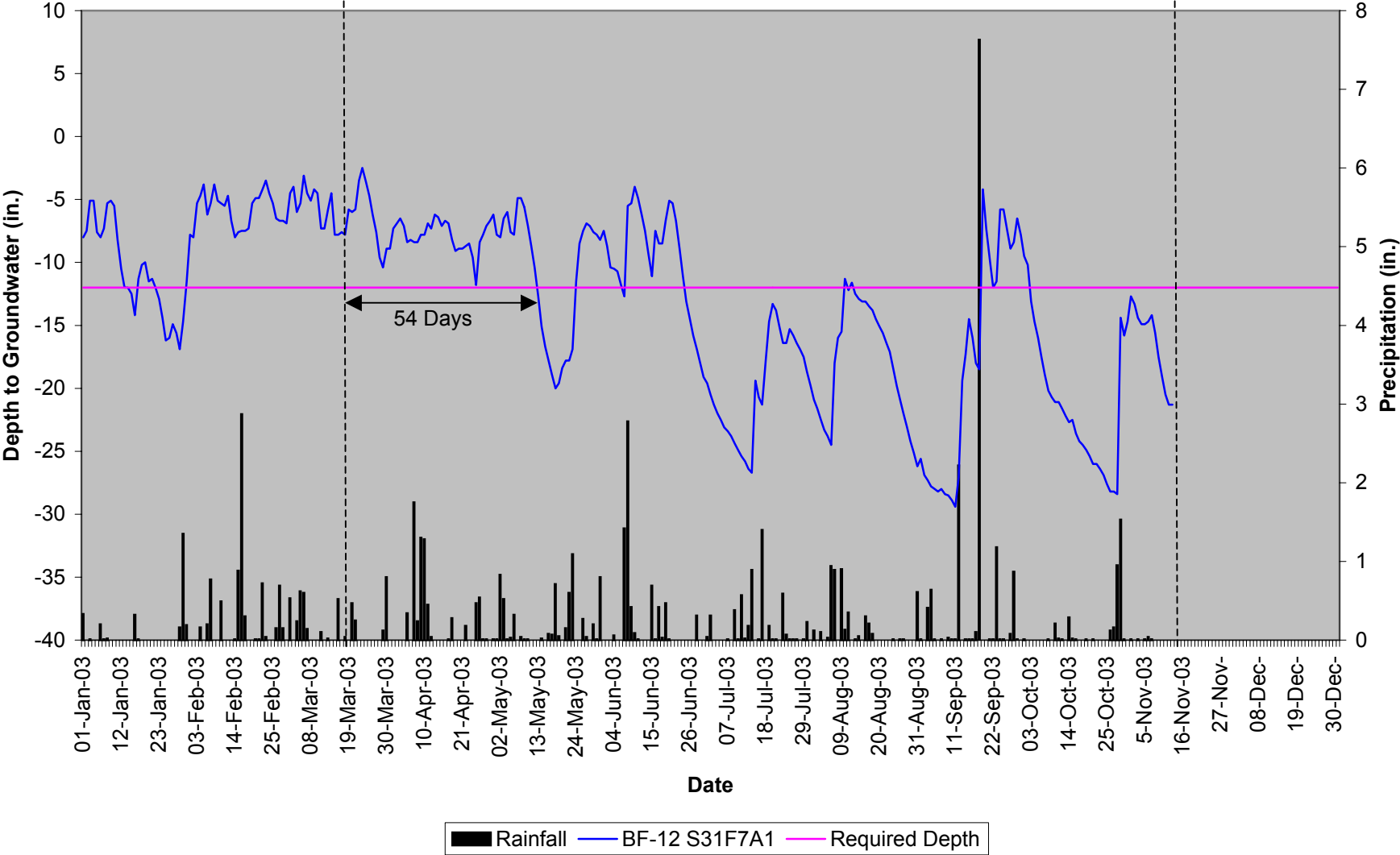


**Ballance Farm BF-11
40" Groundwater**

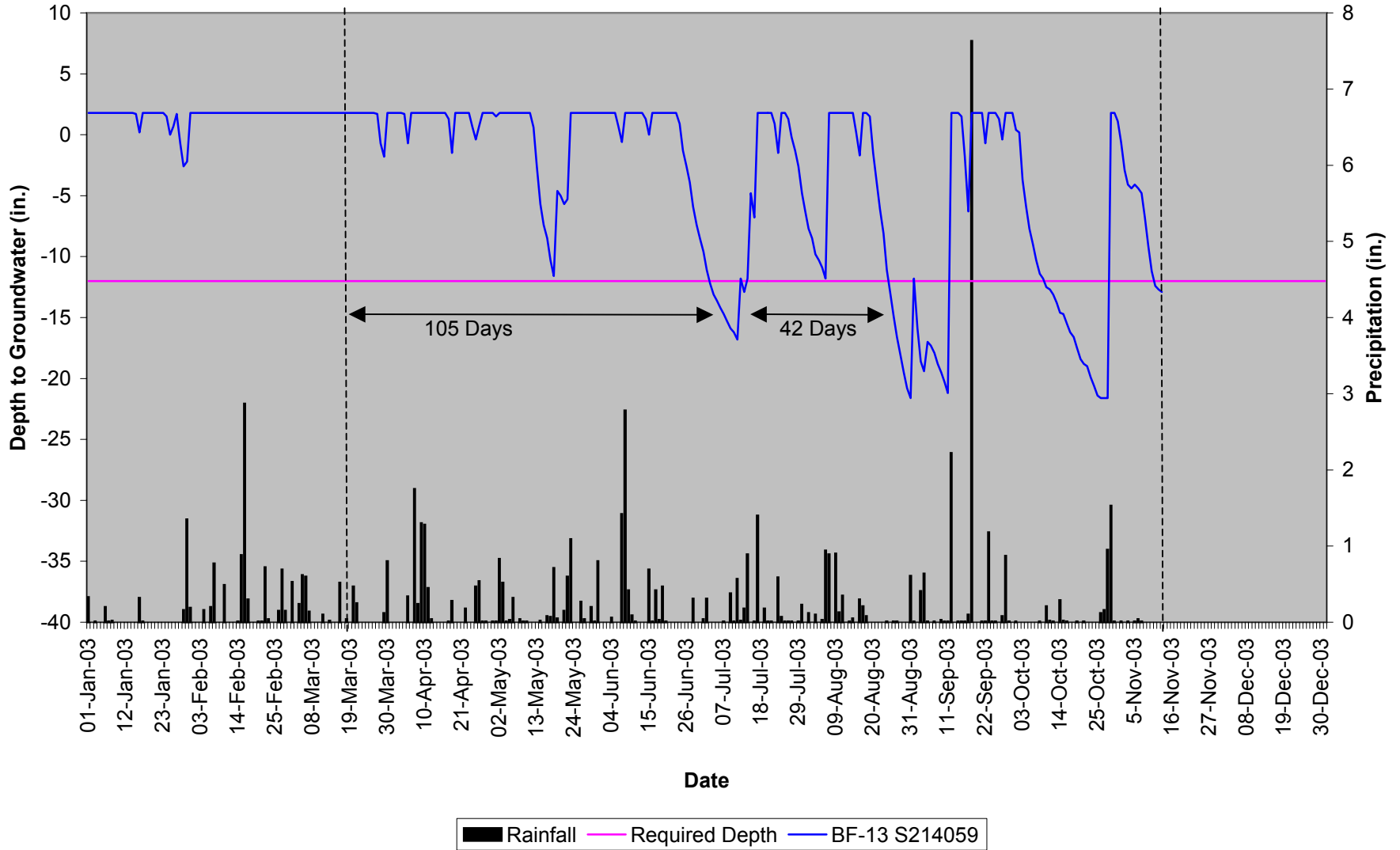


Rainfall
 Required Depth
 BF-11 S31F8BE

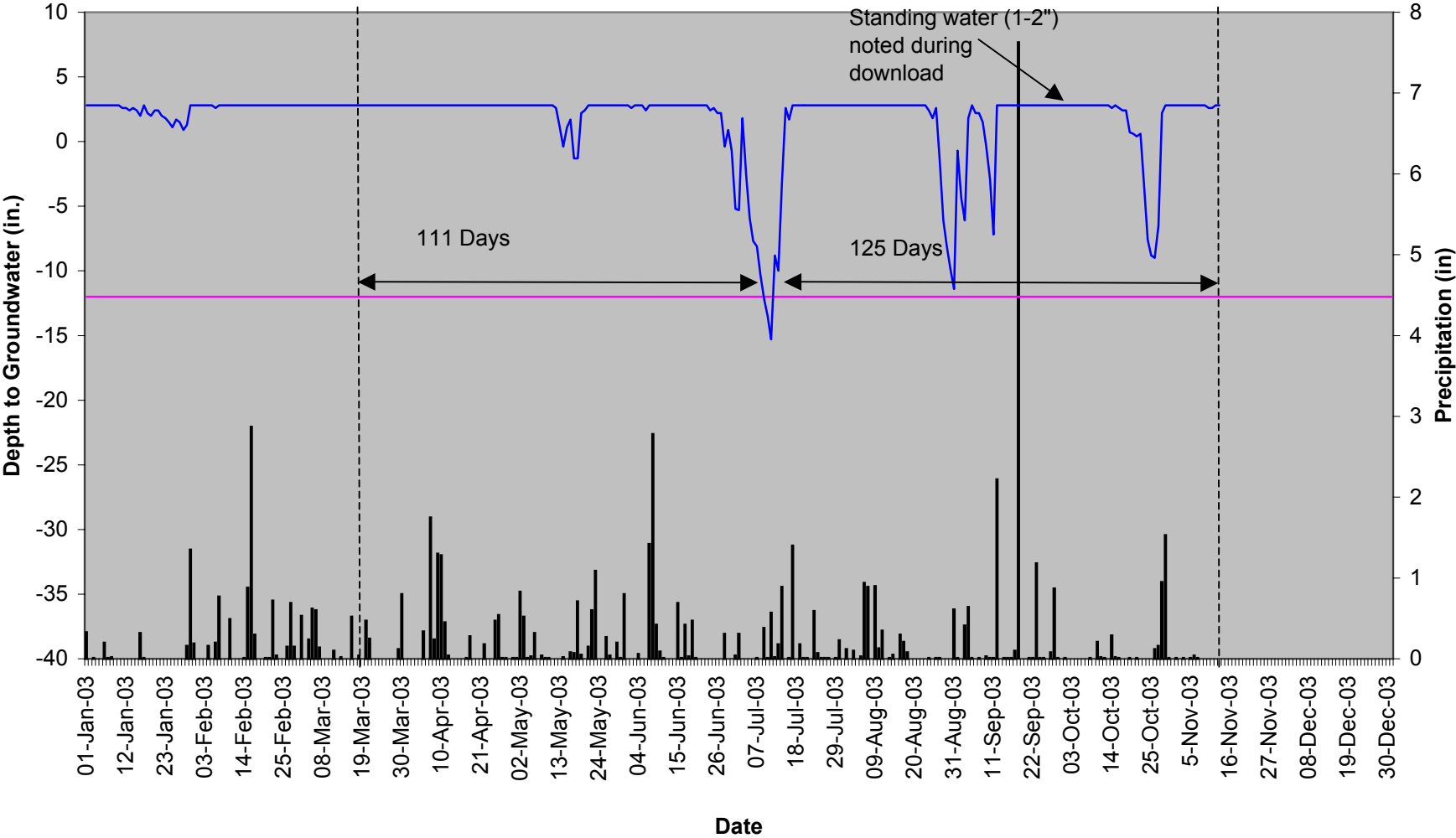
Ballance Farm BF-12 40" Groundwater



Ballance Farm BF-13 40" Groundwater

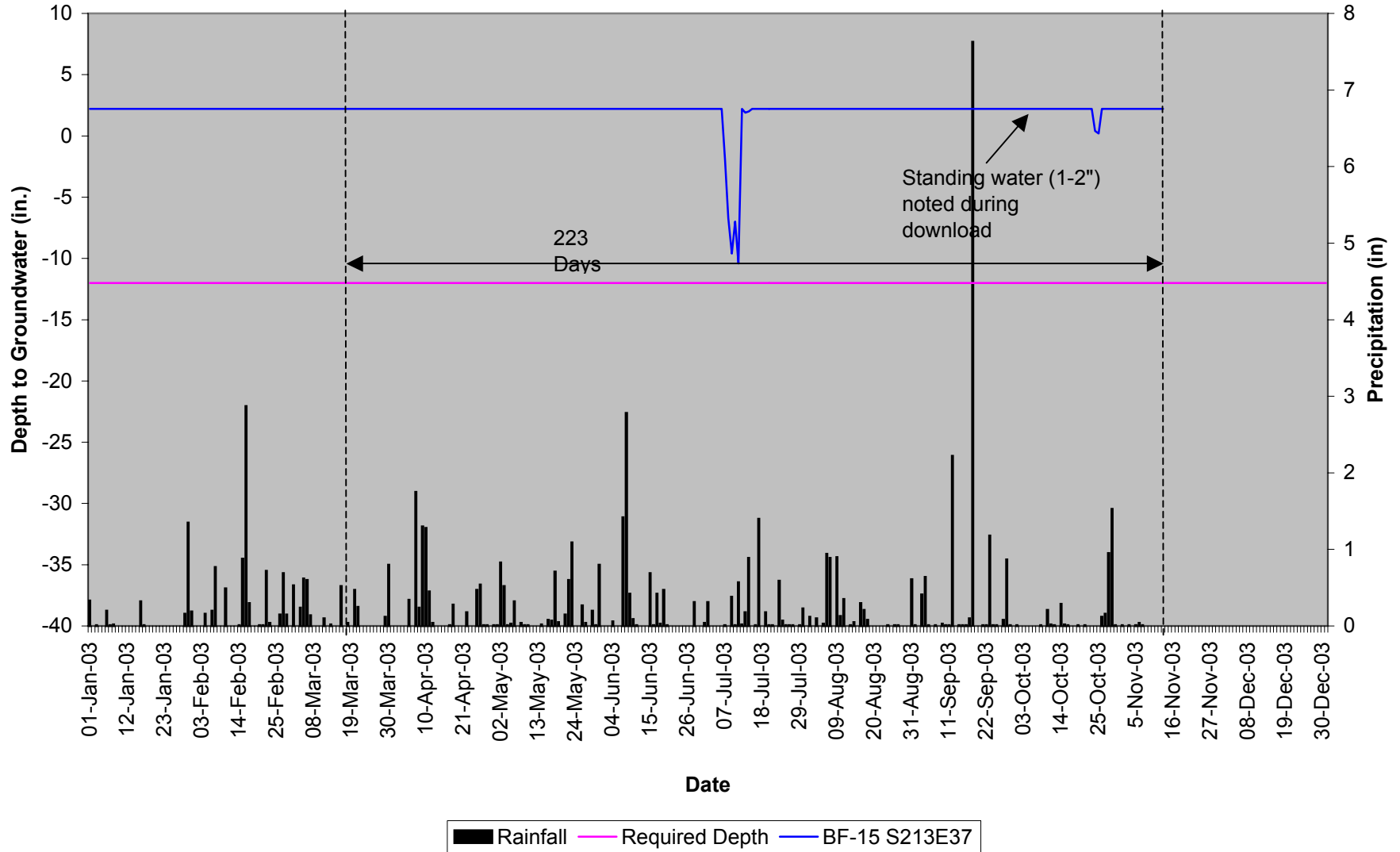


**Ballance Farm BF-14
40" Groundwater**

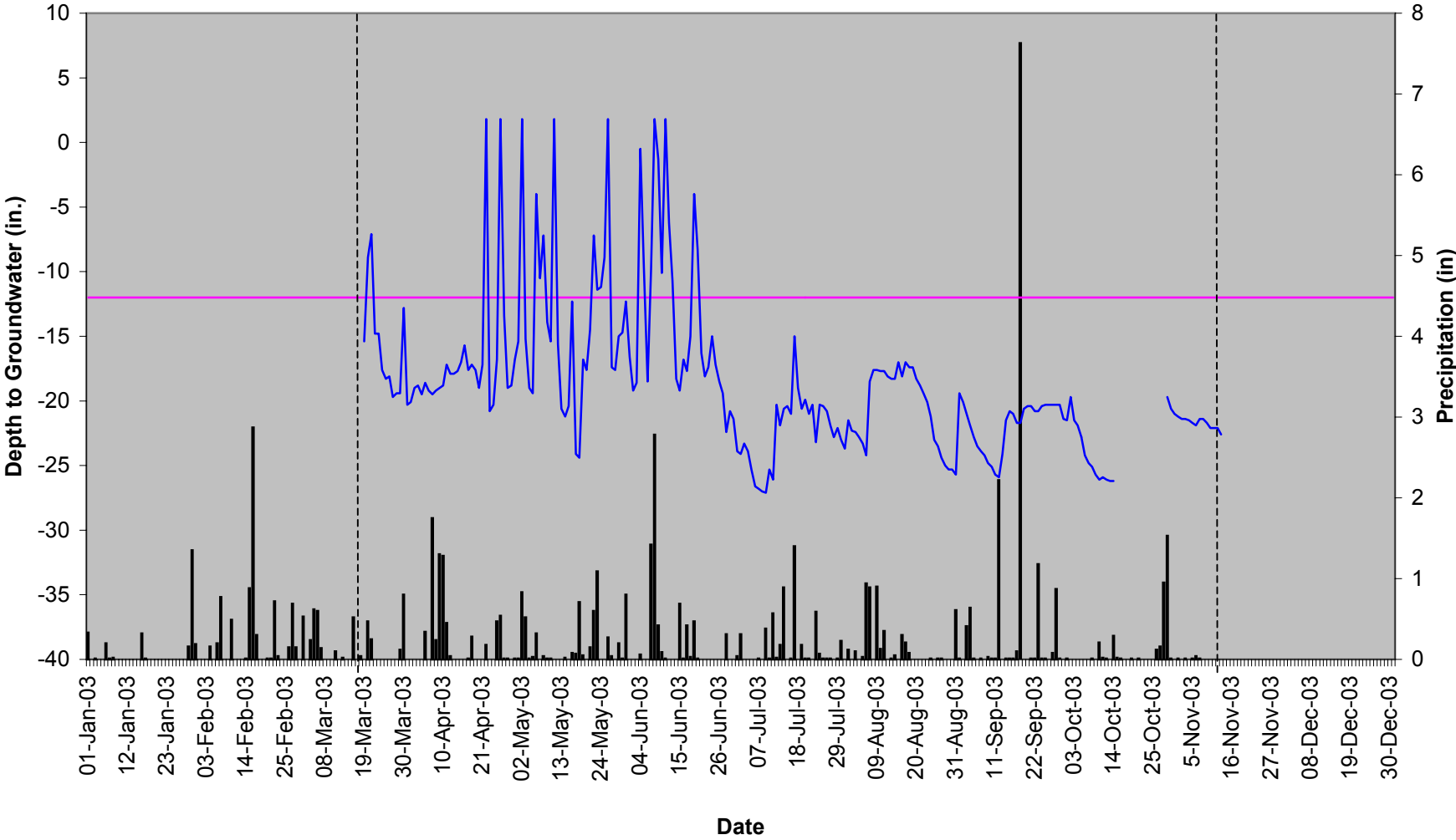


Rainfall
 Required Depth
 BF-14 S2B2369

Ballance Farm BF-15 40" Groundwater

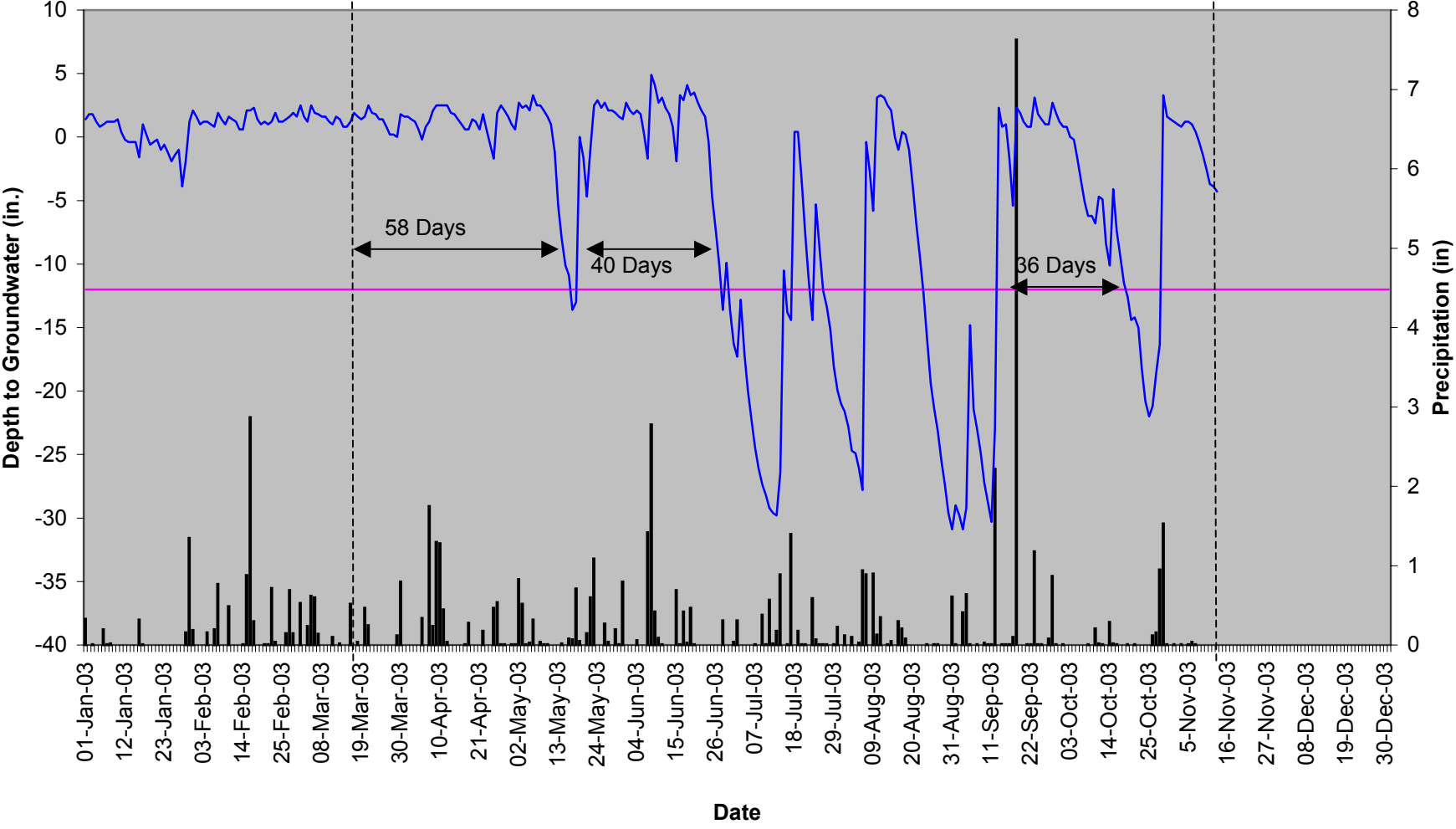


Ballance Farm BF-16 40" Groundwater



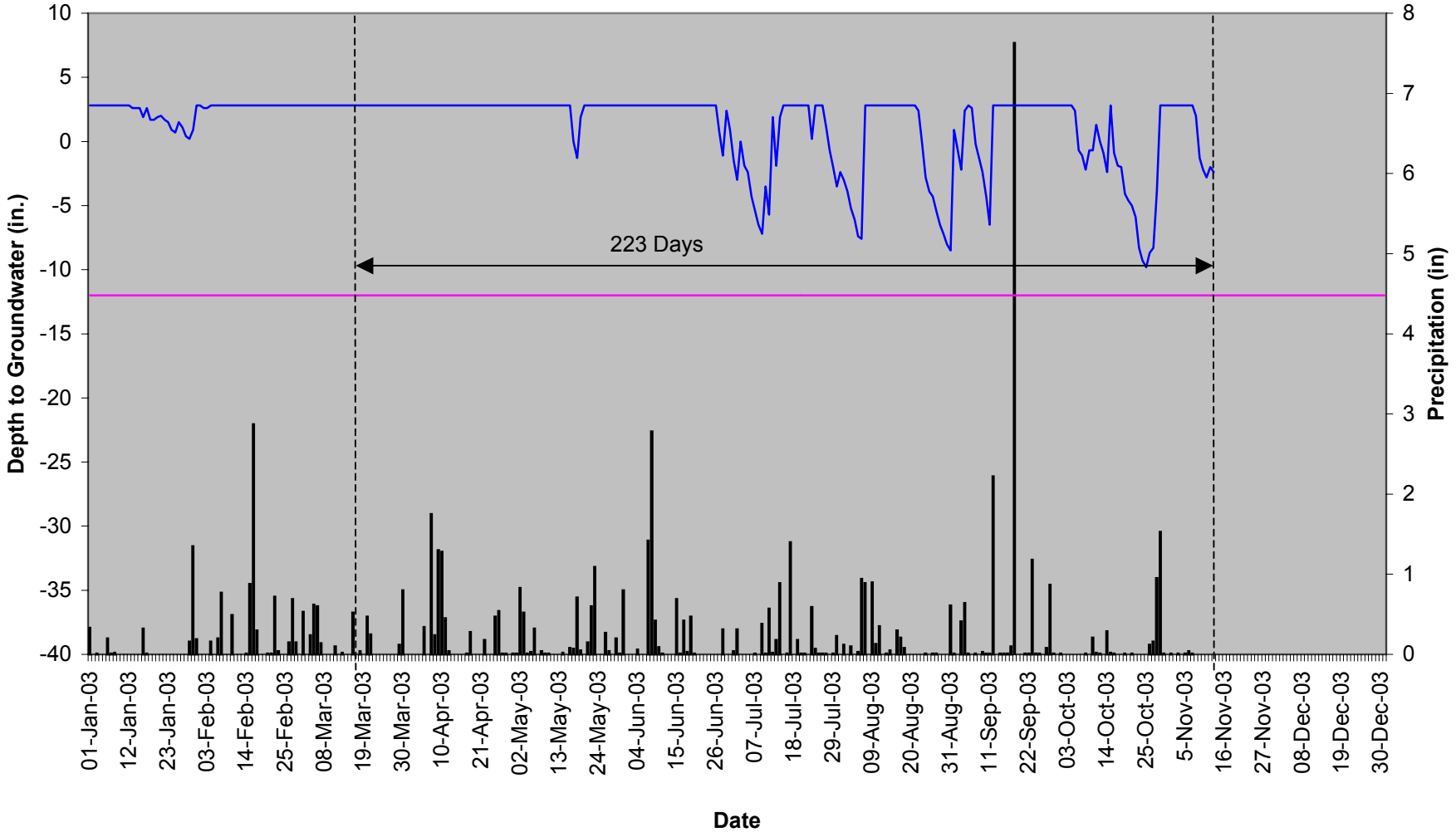
■ Rainfall — Required Depth — BF-16 S2B2402

**Ballance Farm BF-17
40" Groundwater**



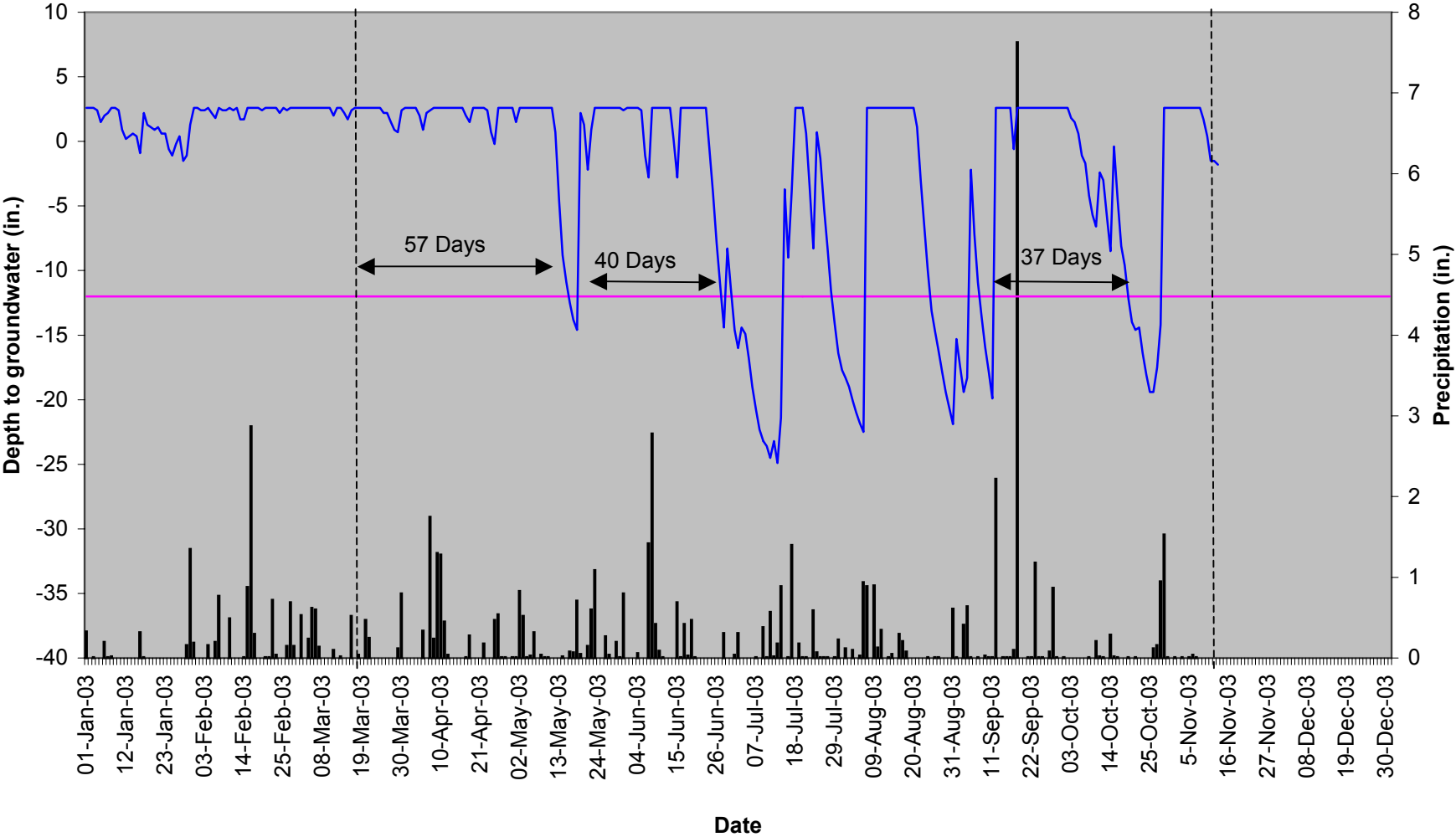
Rainfall
 Required Depth
 BF-17 S2B25A2

**Ballance Farm BF-18
40" Groundwater**



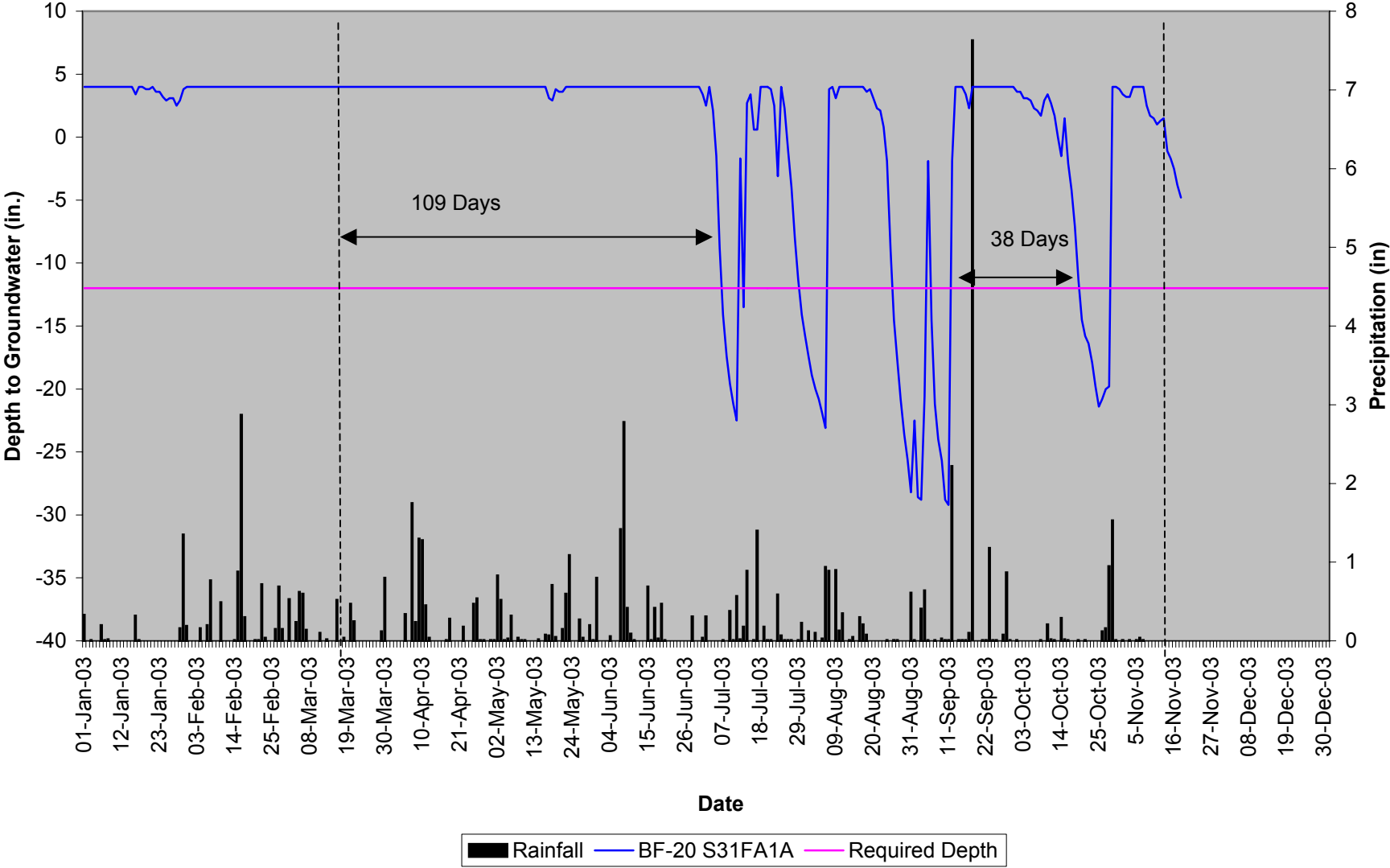
■ Rainfall — Required Depth — BF-18 S317595

**Ballance Farm BF-19
40" Groundwater**

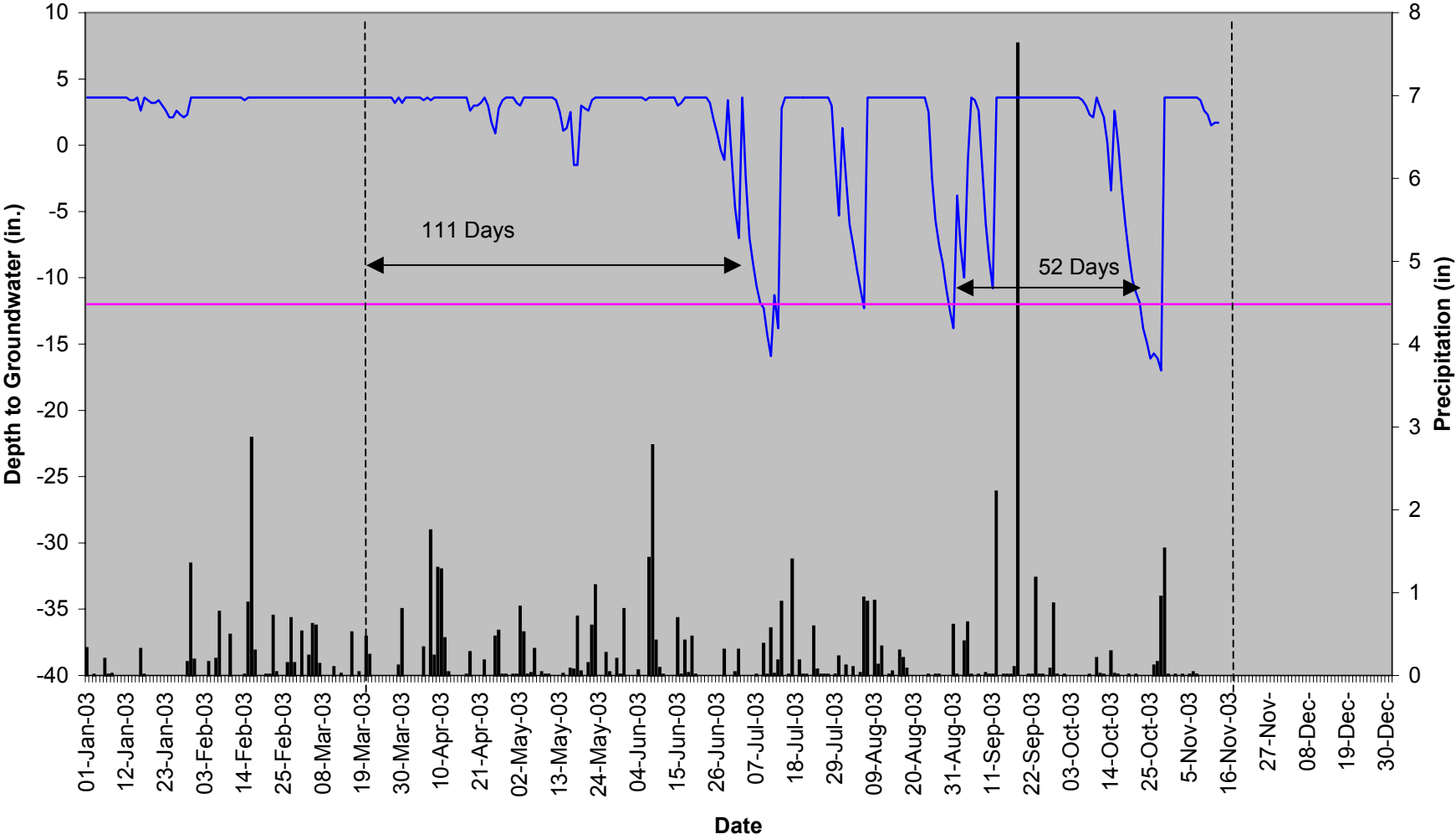


Rainfall
 Required Depth
 BF-19 S417BA7

Ballance Farm BF-20 40" Groundwater

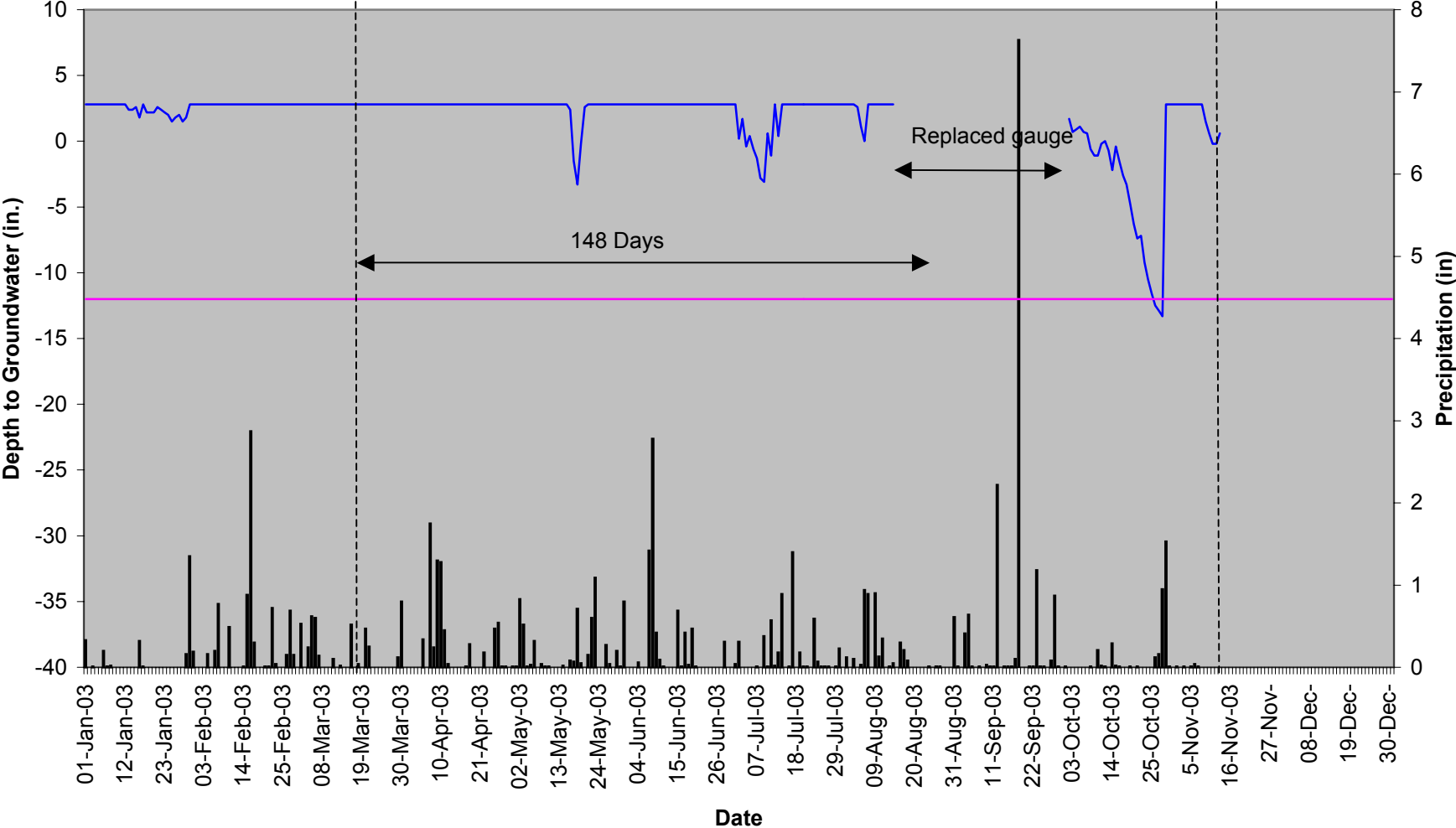


**Ballance Farm BF-21
40" Groundwater**



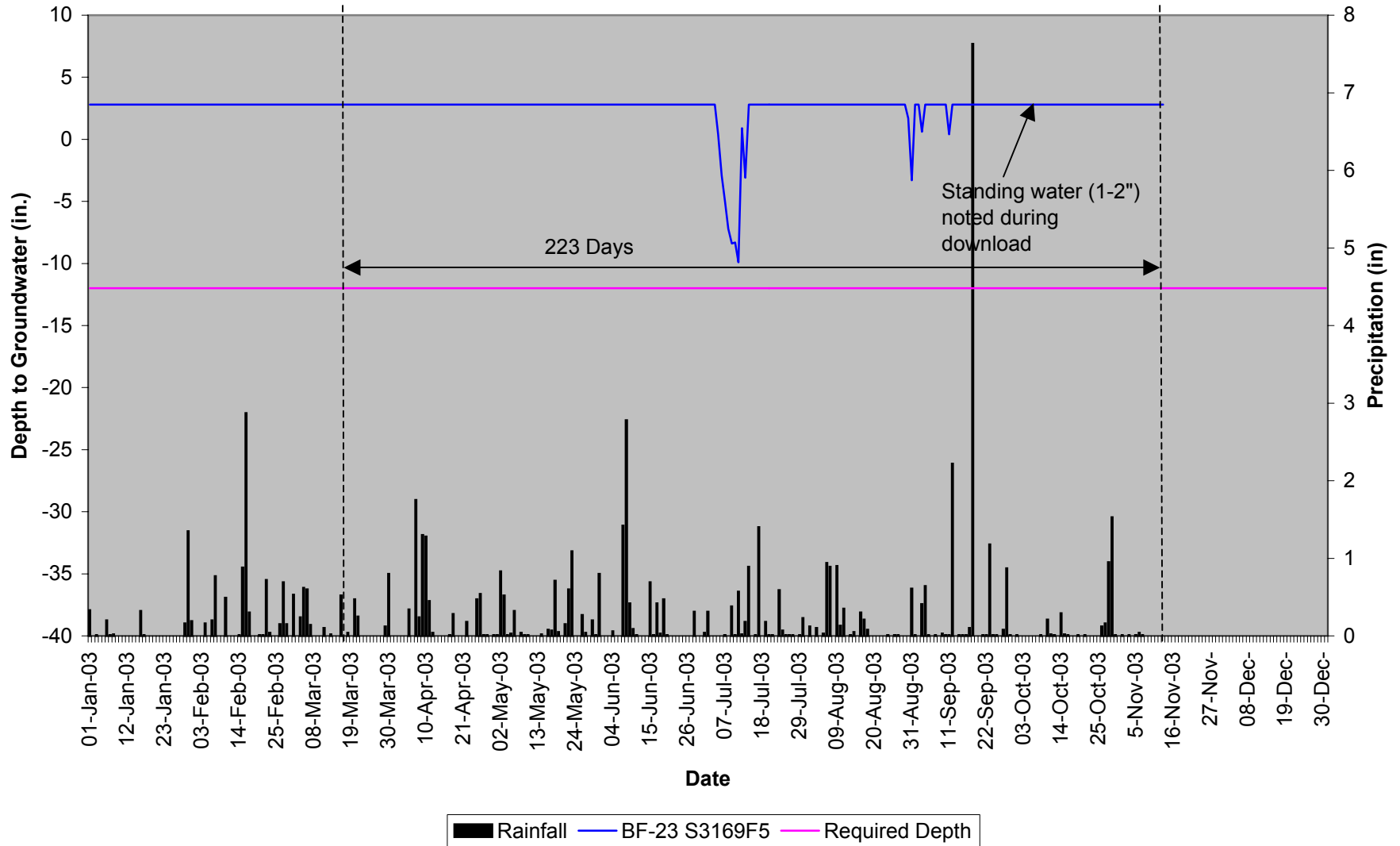
■ Rainfall — BF-21 S31F8A9 — Required Depth

**Ballance Farm BF-22
40" Groundwater**

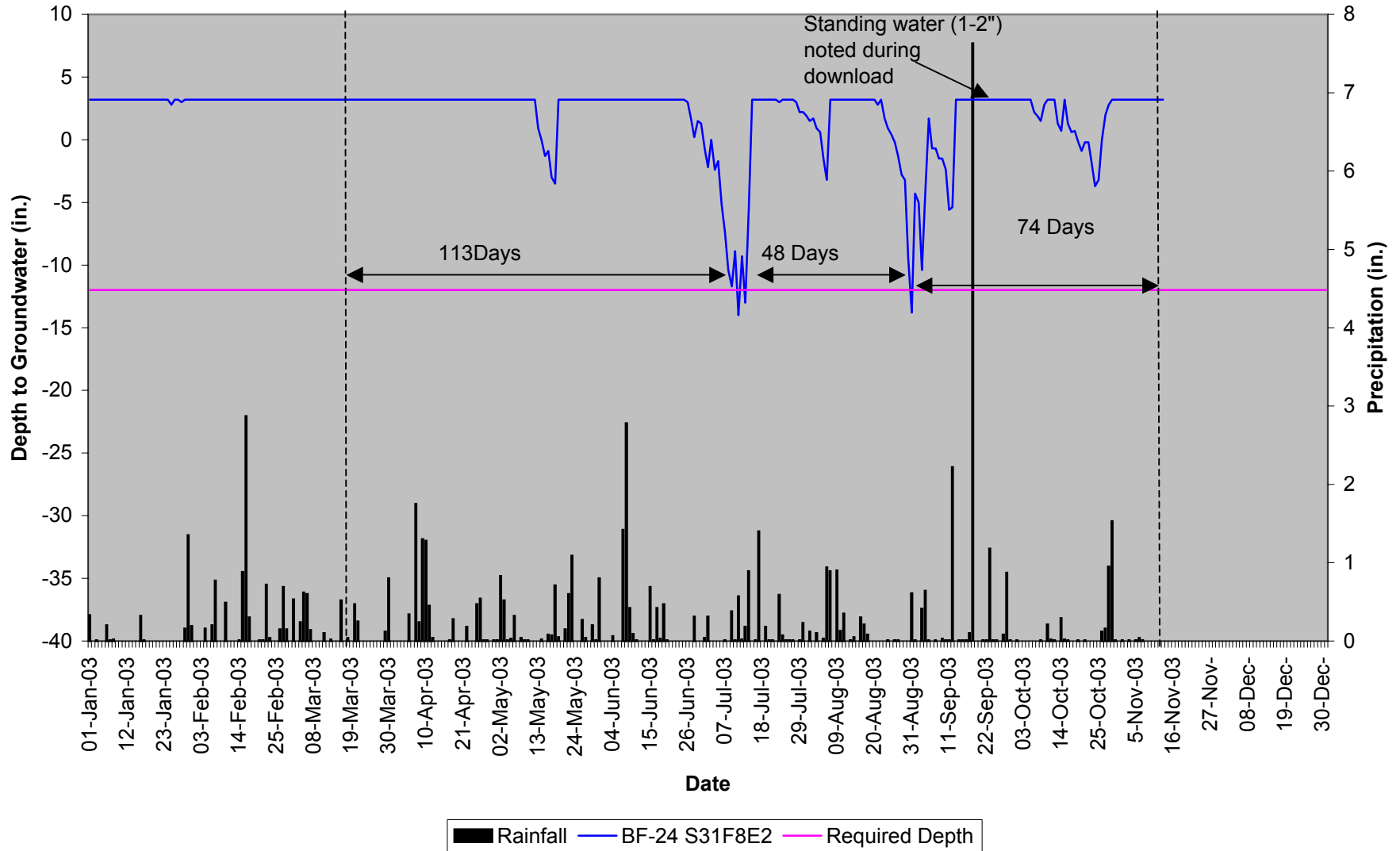


■ Rainfall — BF-22 S31F777 — Required Depth

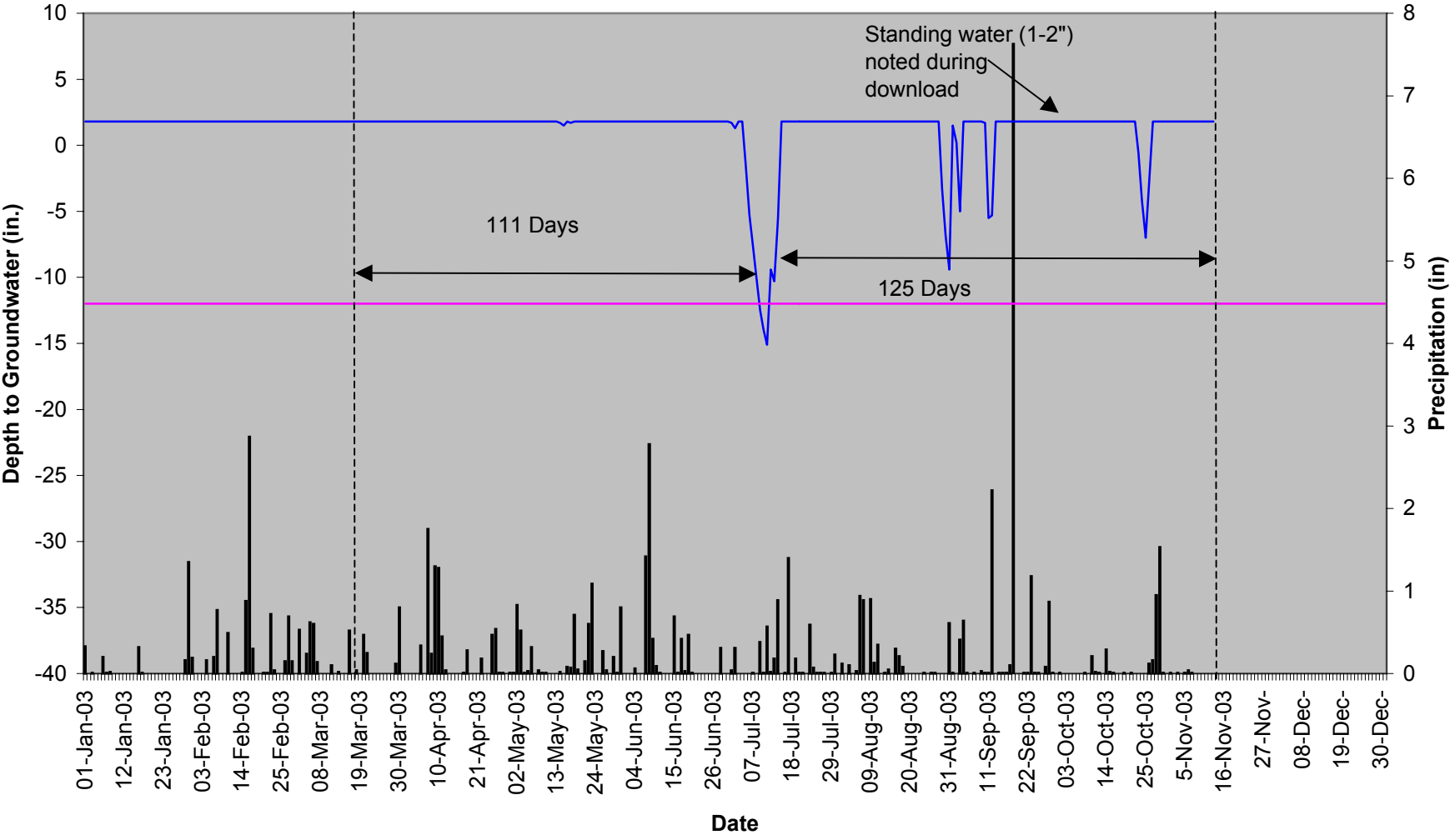
Ballance Farm BF-23 40" Groundwater



Ballance Farm BF-24 40" Groundwater

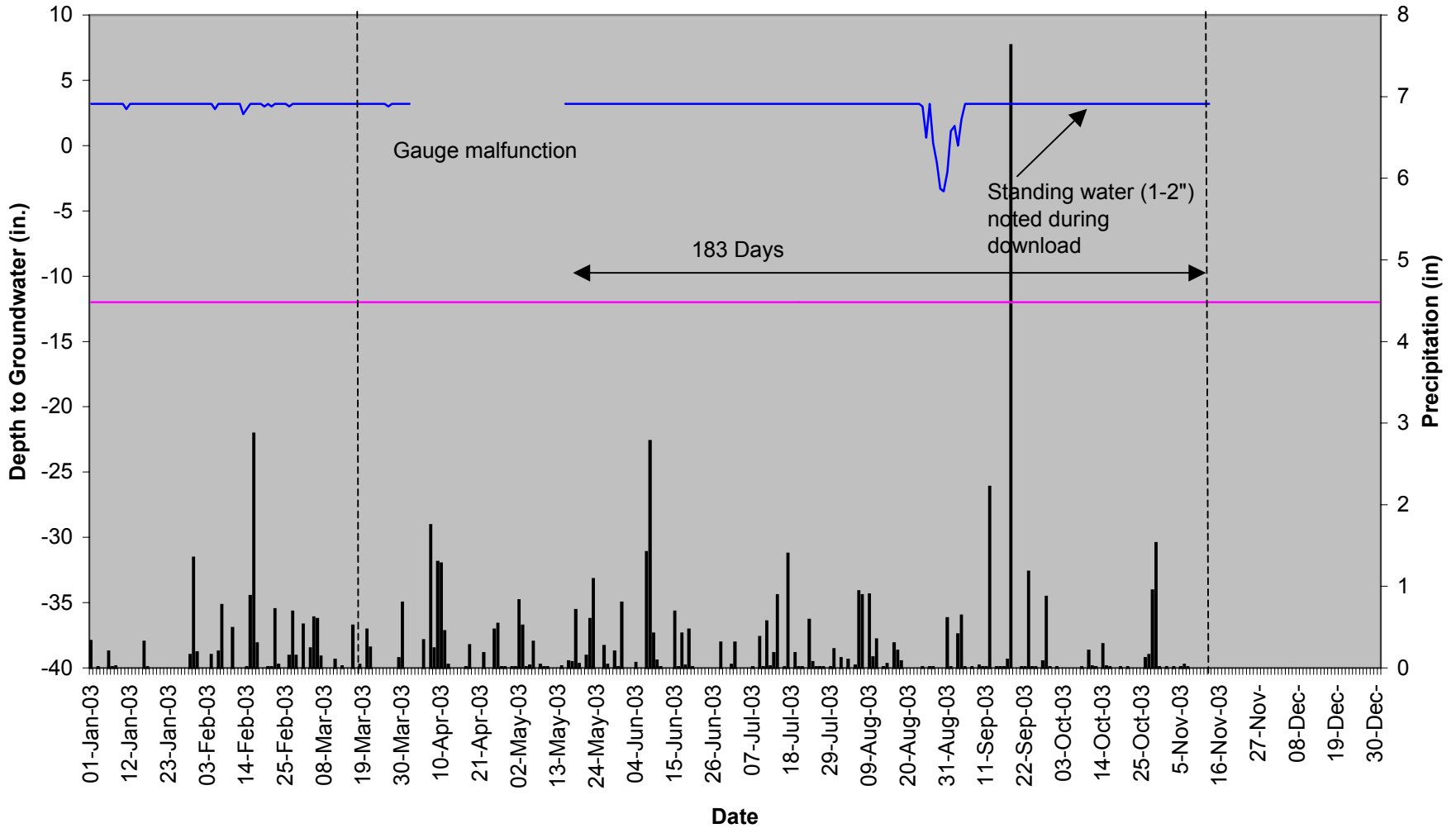


Ballance Farm BF-25 40" Groundwater



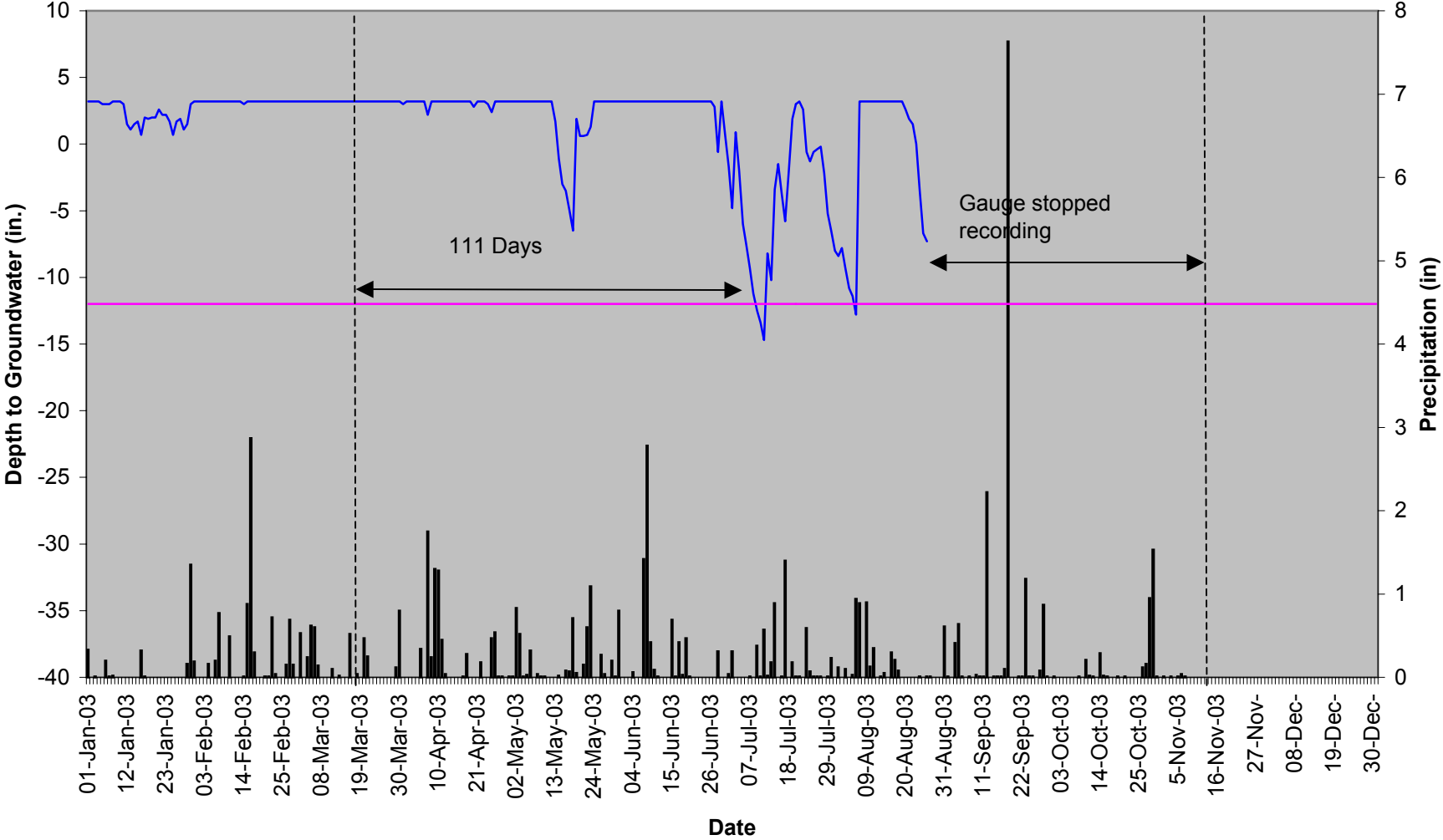
Rainfall
 BF-25 S31F917
 Required Depth

Ballance Farm BF-26 40" Groundwater



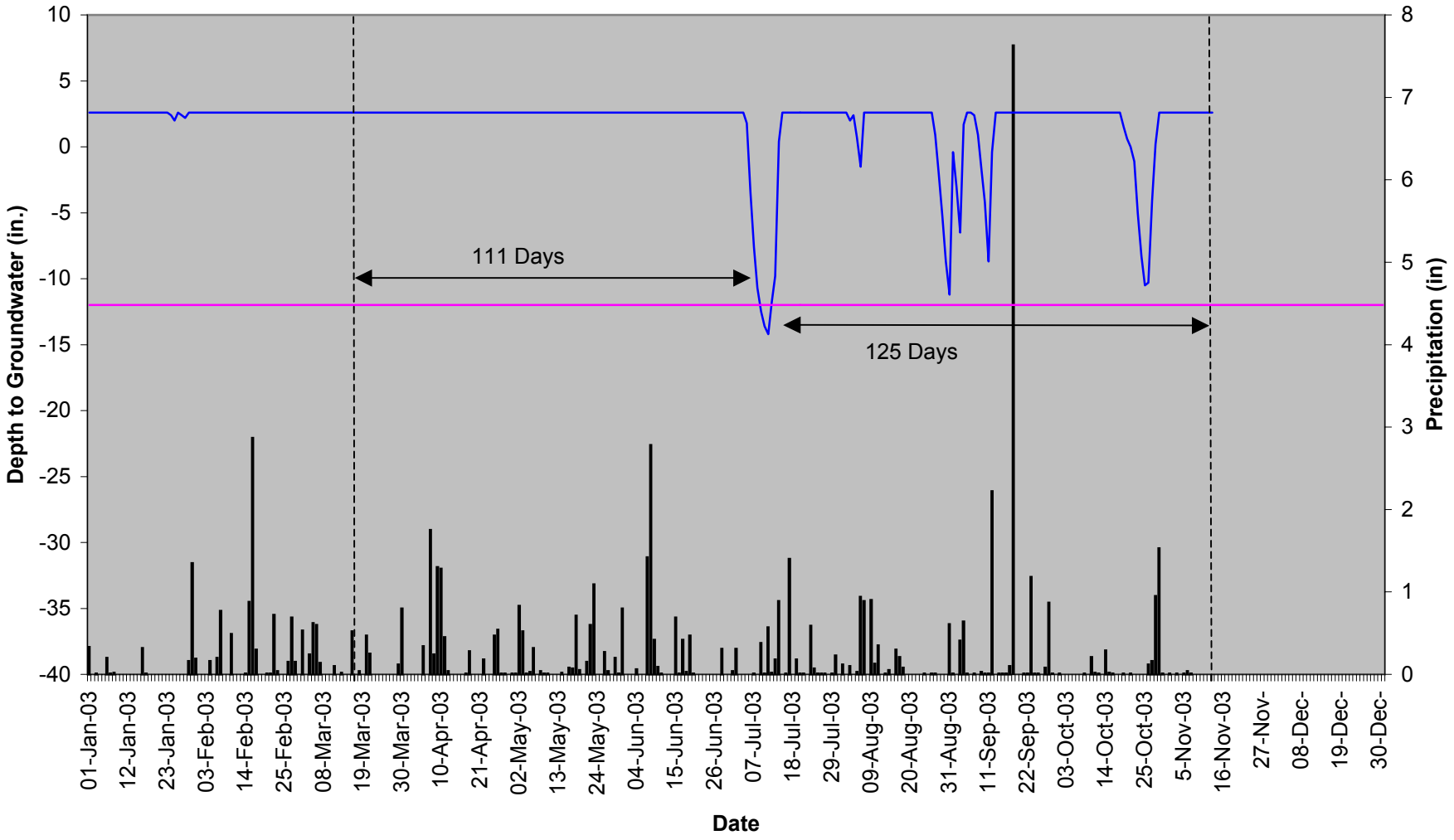
■ Rainfall — BF-26 S31F72D — Required Depth

Ballance Farm BF-27 40" Groundwater



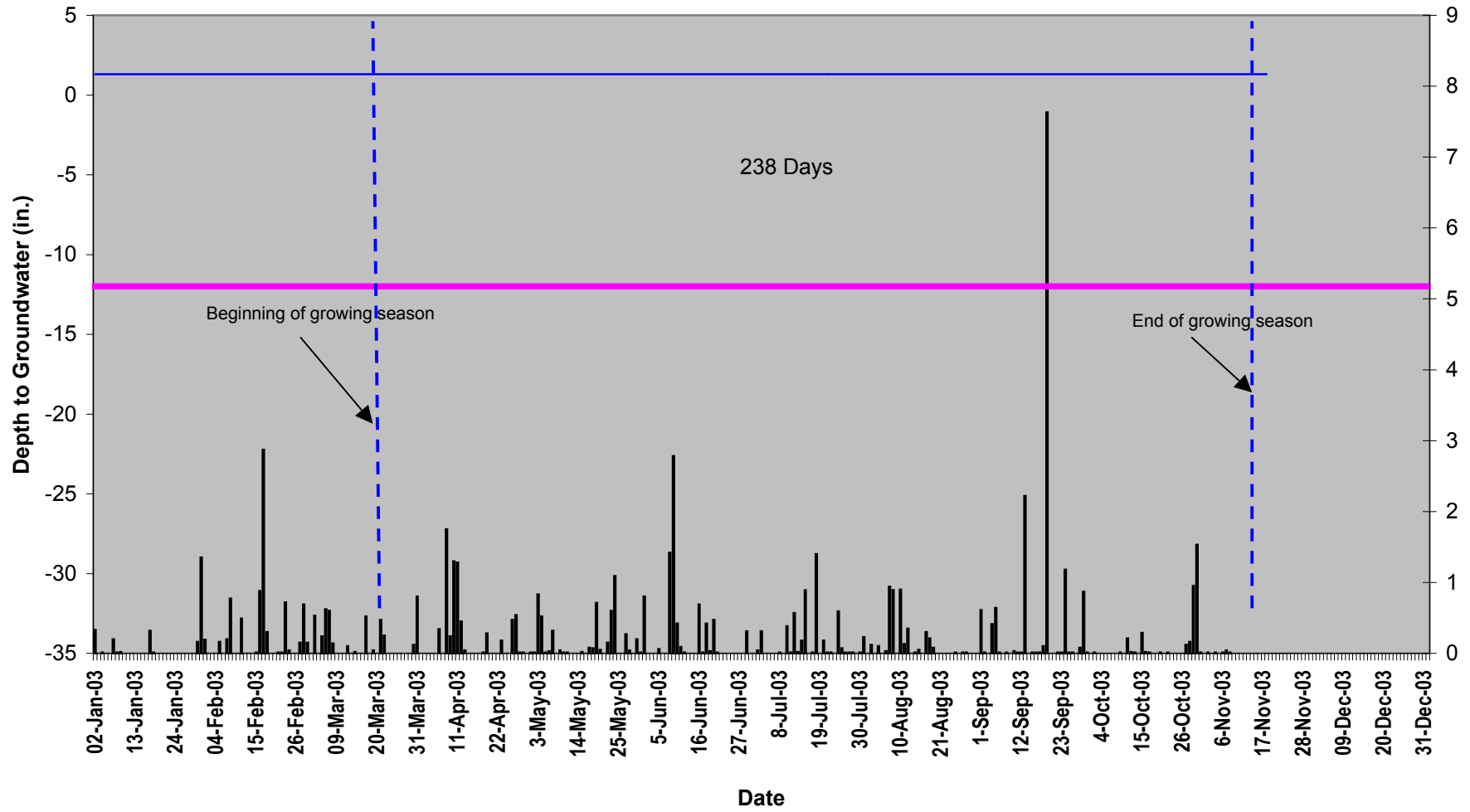
■ Rainfall — BF-27 S31FA18 — Required Depth

Ballance Farm BF-28 40" Groundwater



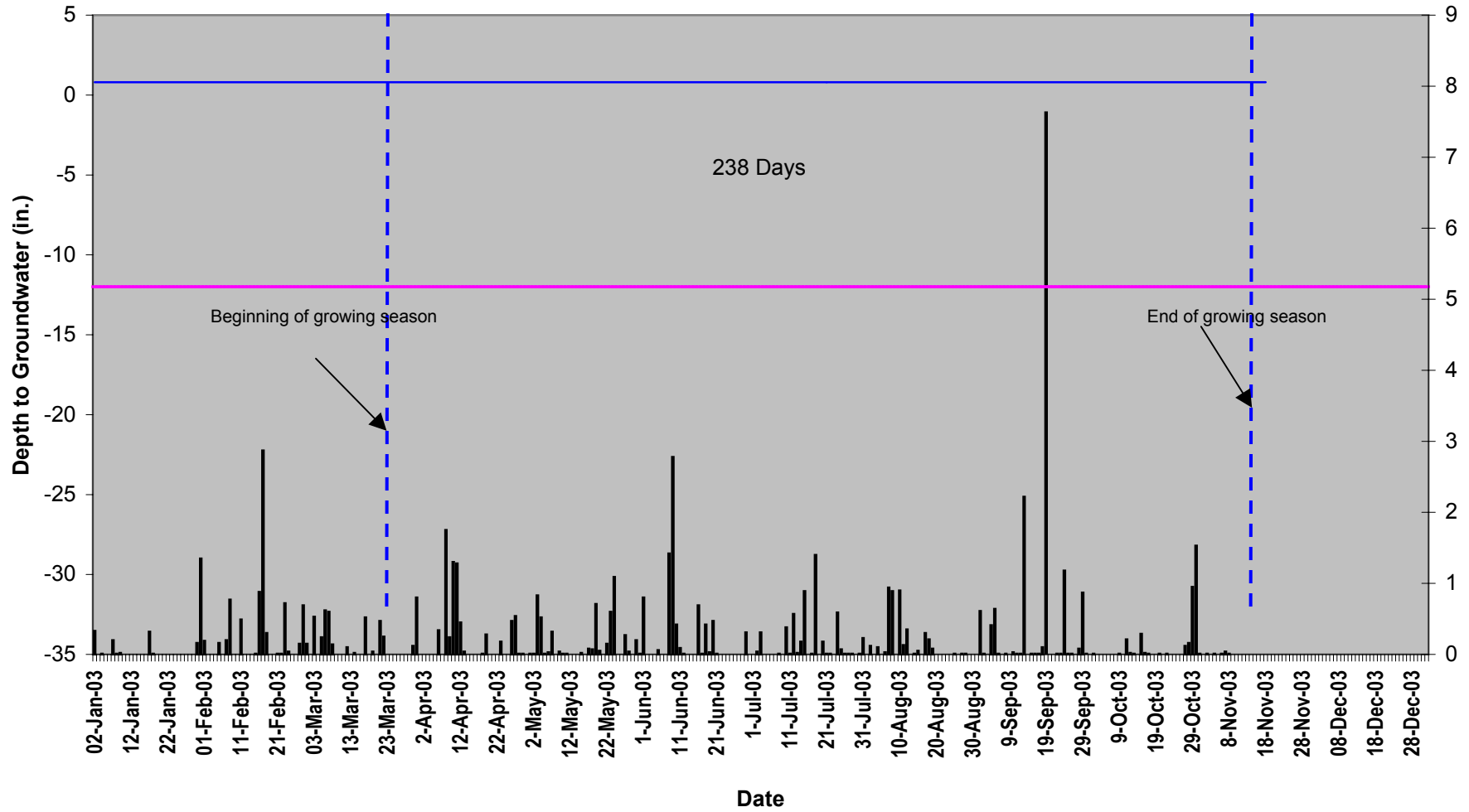
■ Rainfall — BF-28 S213E3C — Required Depth

Balance Reference BF-REF1

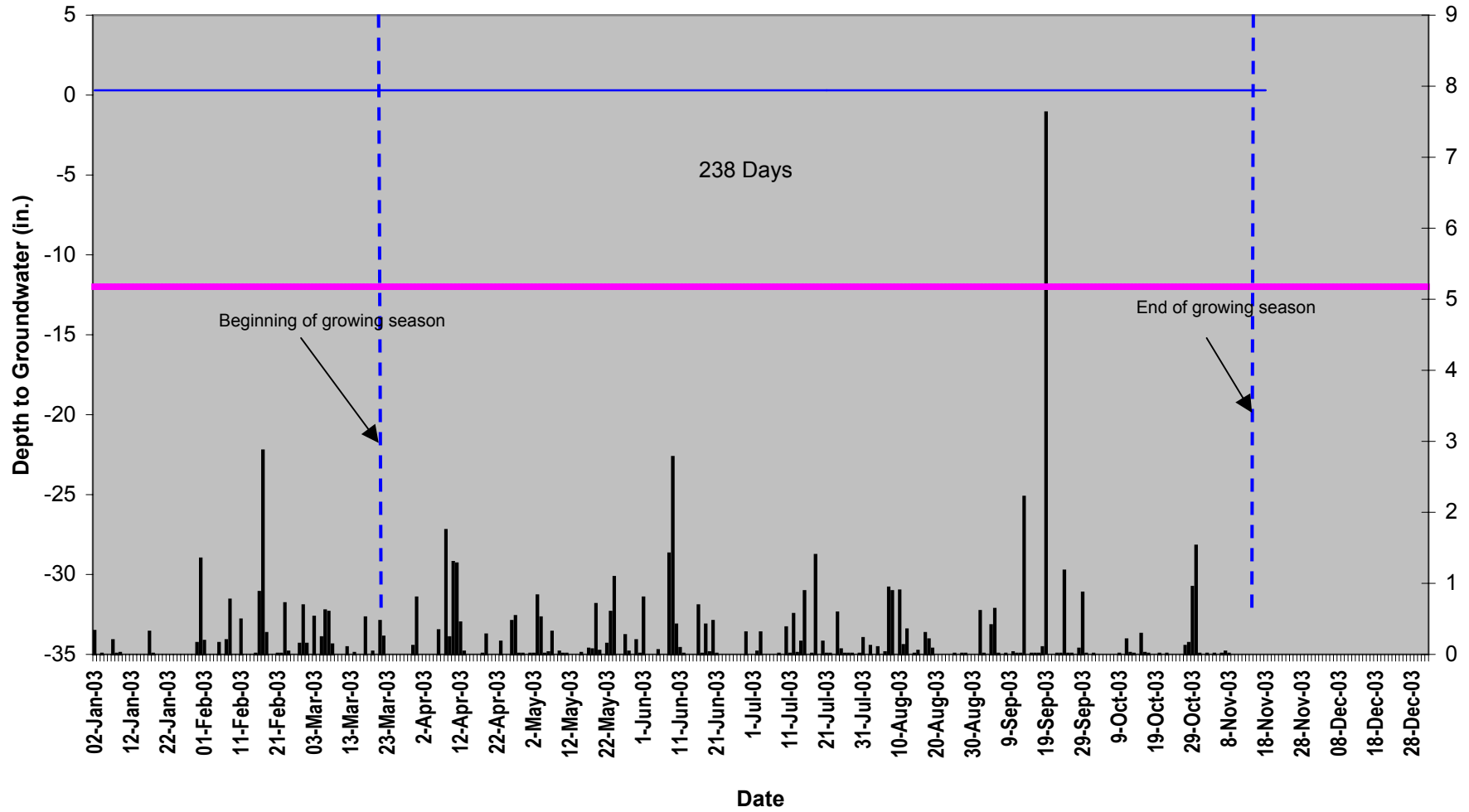


RAINFALL BF-REF1 REQUIRED DEPTH

Balance Reference BF-REF2

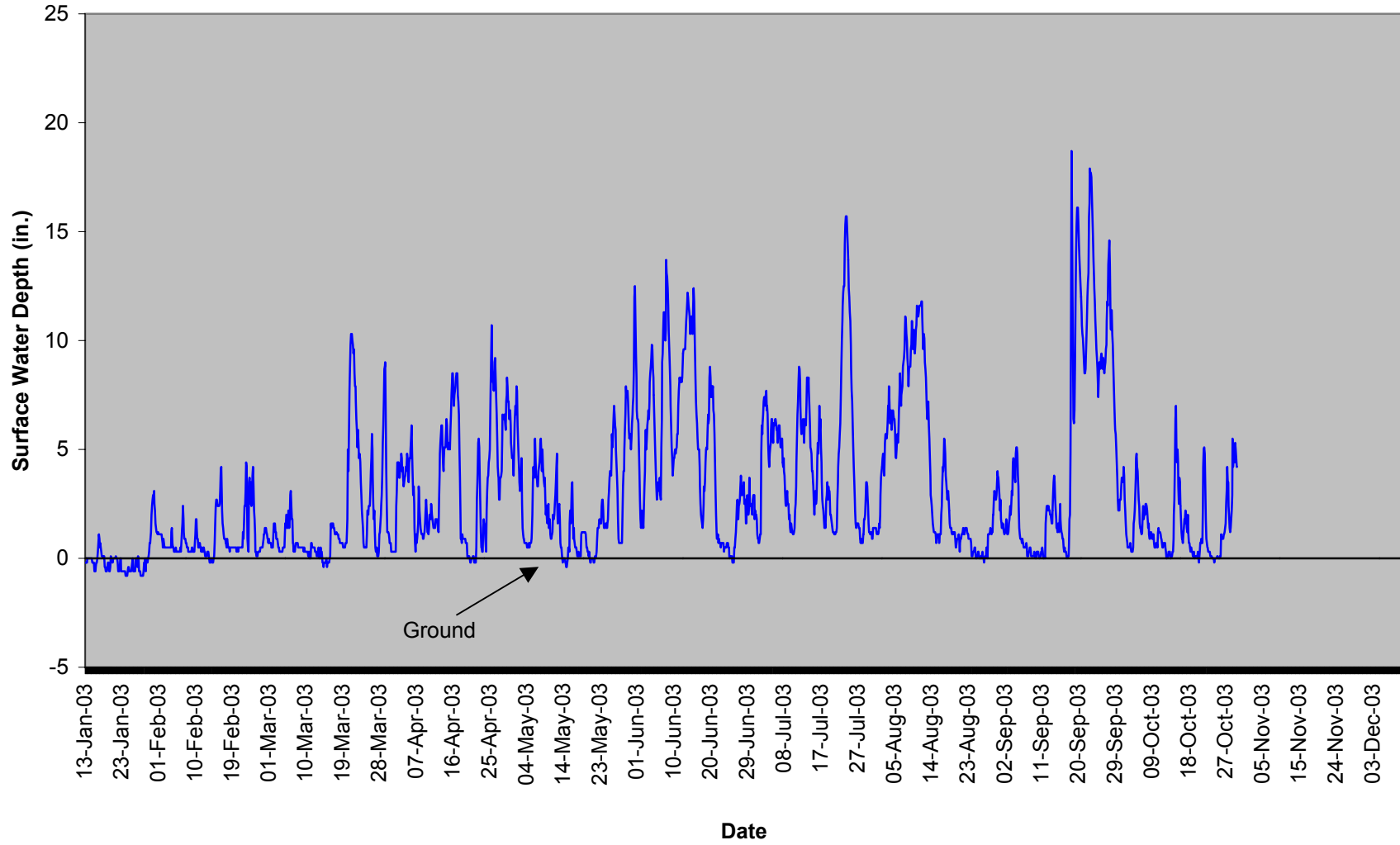


Balance Reference BF-REF3

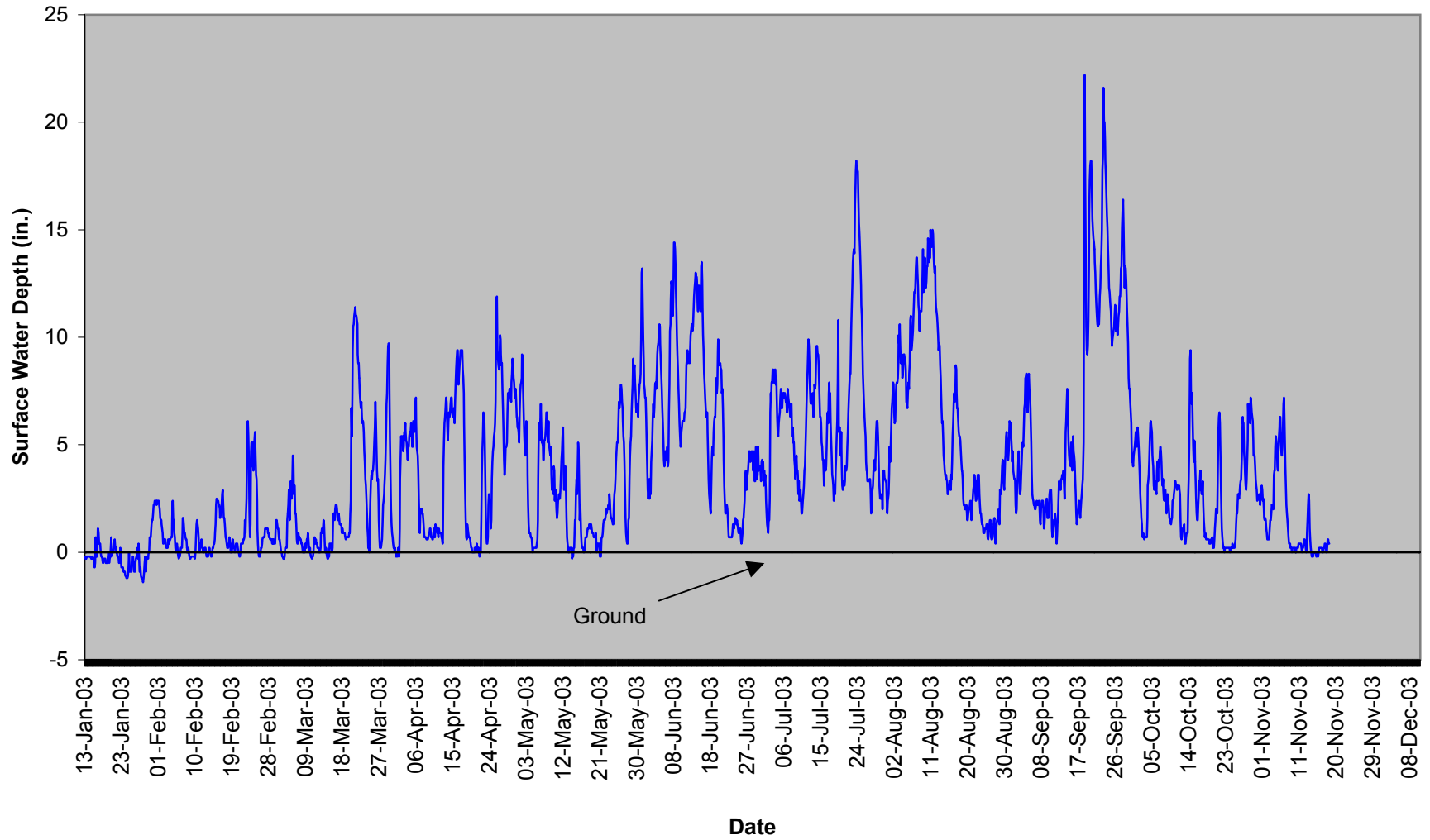


SURFACE WATER GAUGE GRAPHS

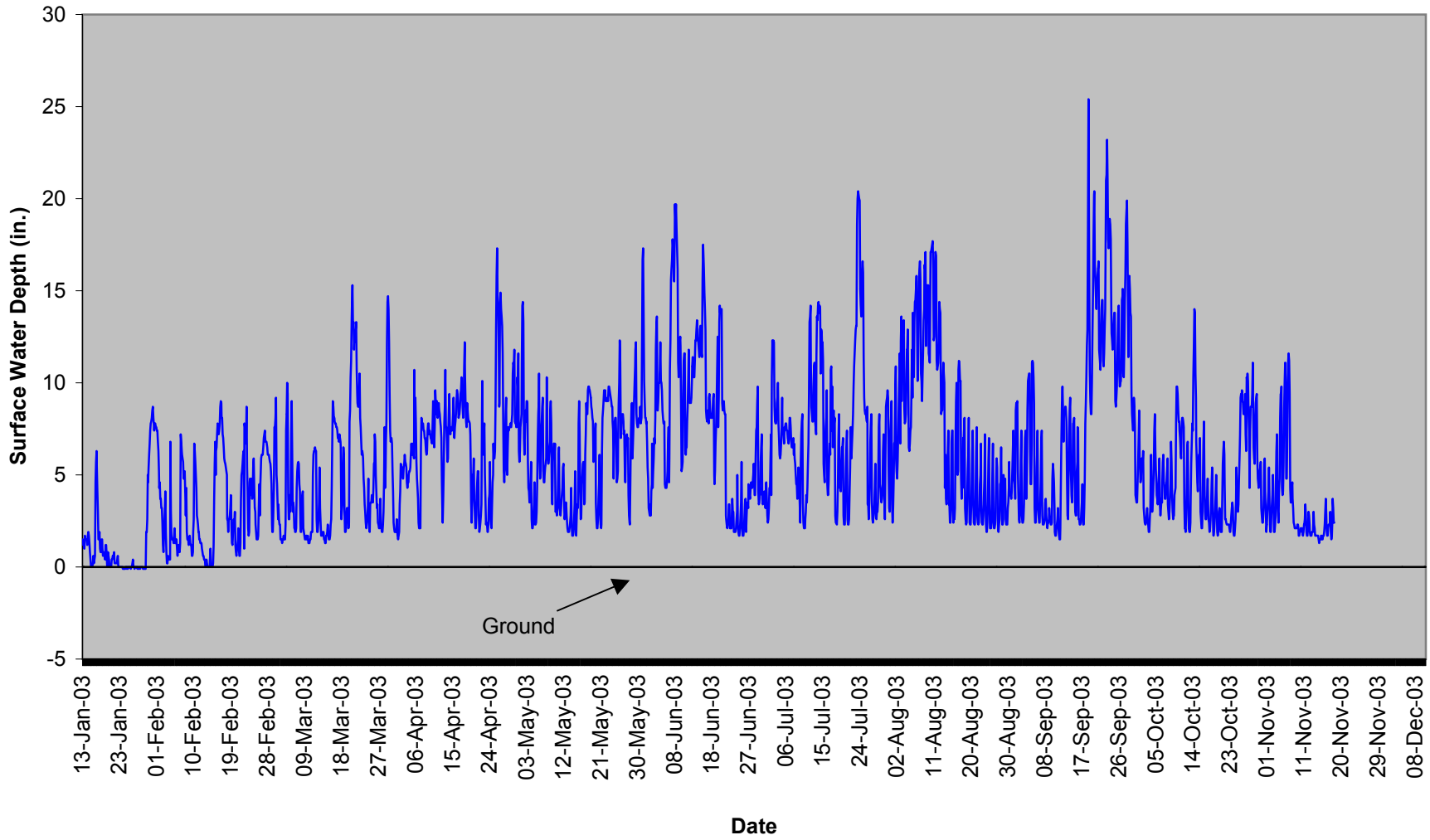
**Ballance Farm BFSG-1
40" Surface Gauge**



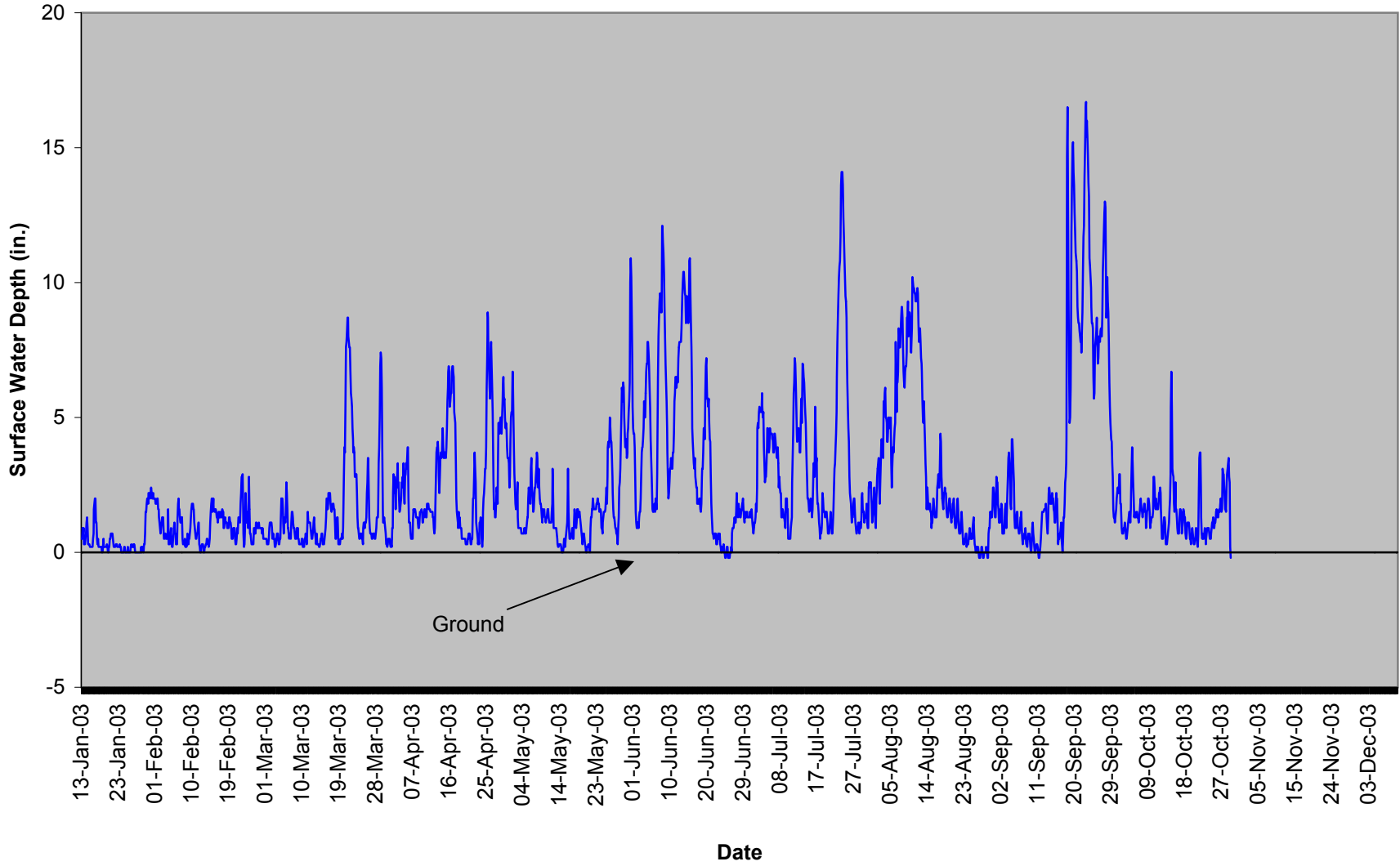
Ballance Farm BFSG-2 40" Surface Gauge



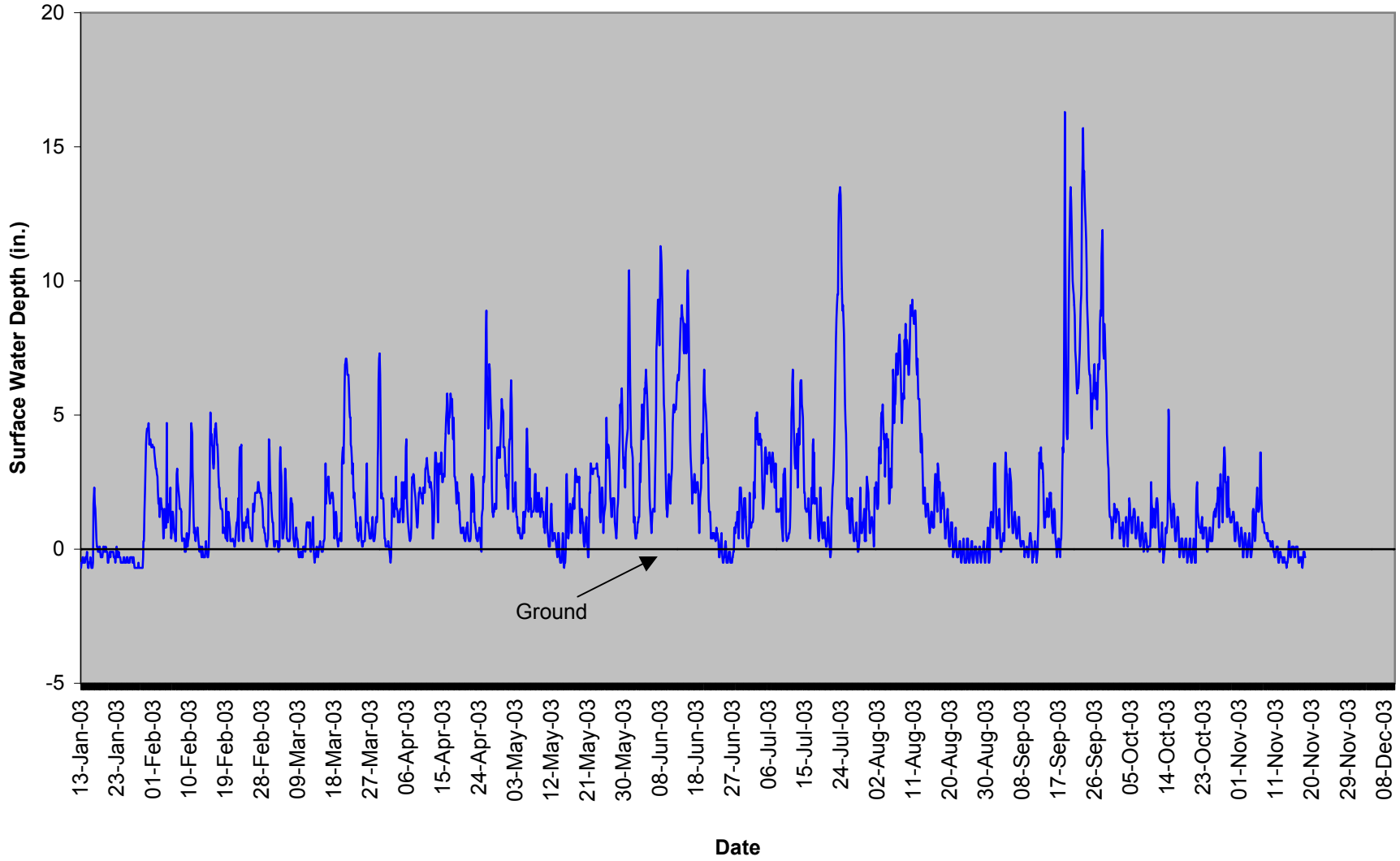
Ballance Farm BFSG-3 40" Surface Gauge



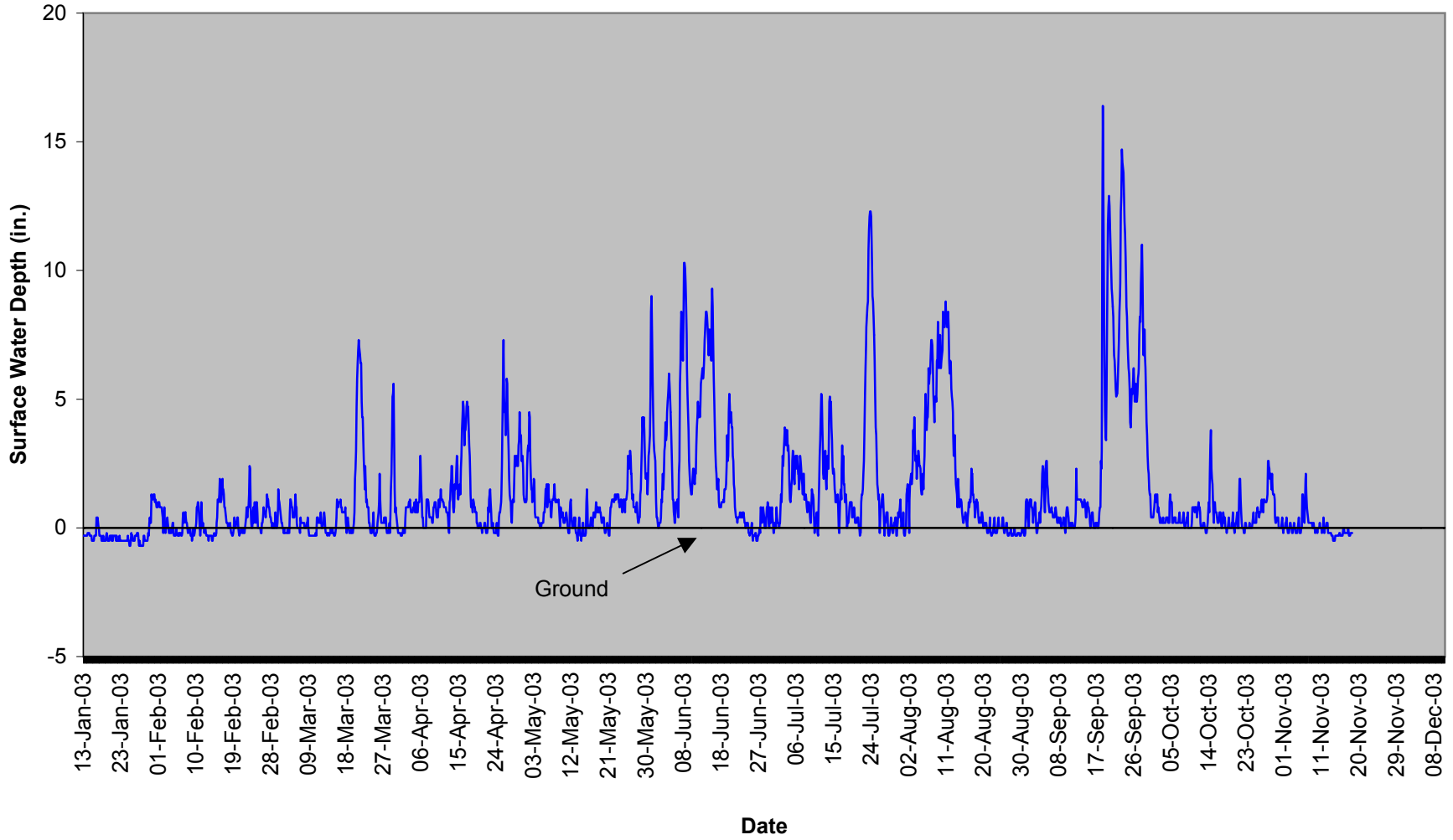
**Ballance Farm BFSG-5
40" Surface Gauge**



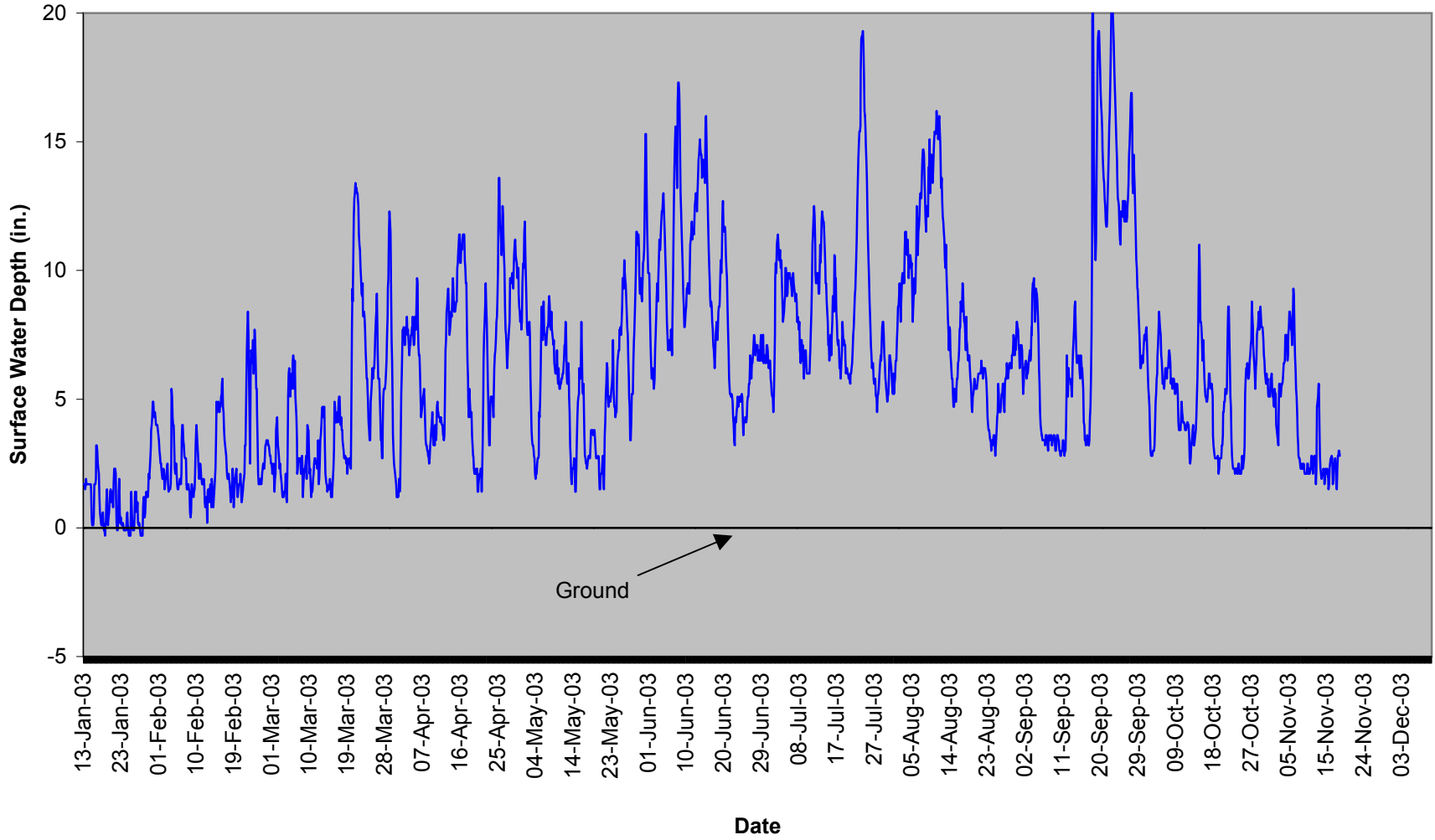
**Ballance Farm BFSG-7
40" Surface Gauge**



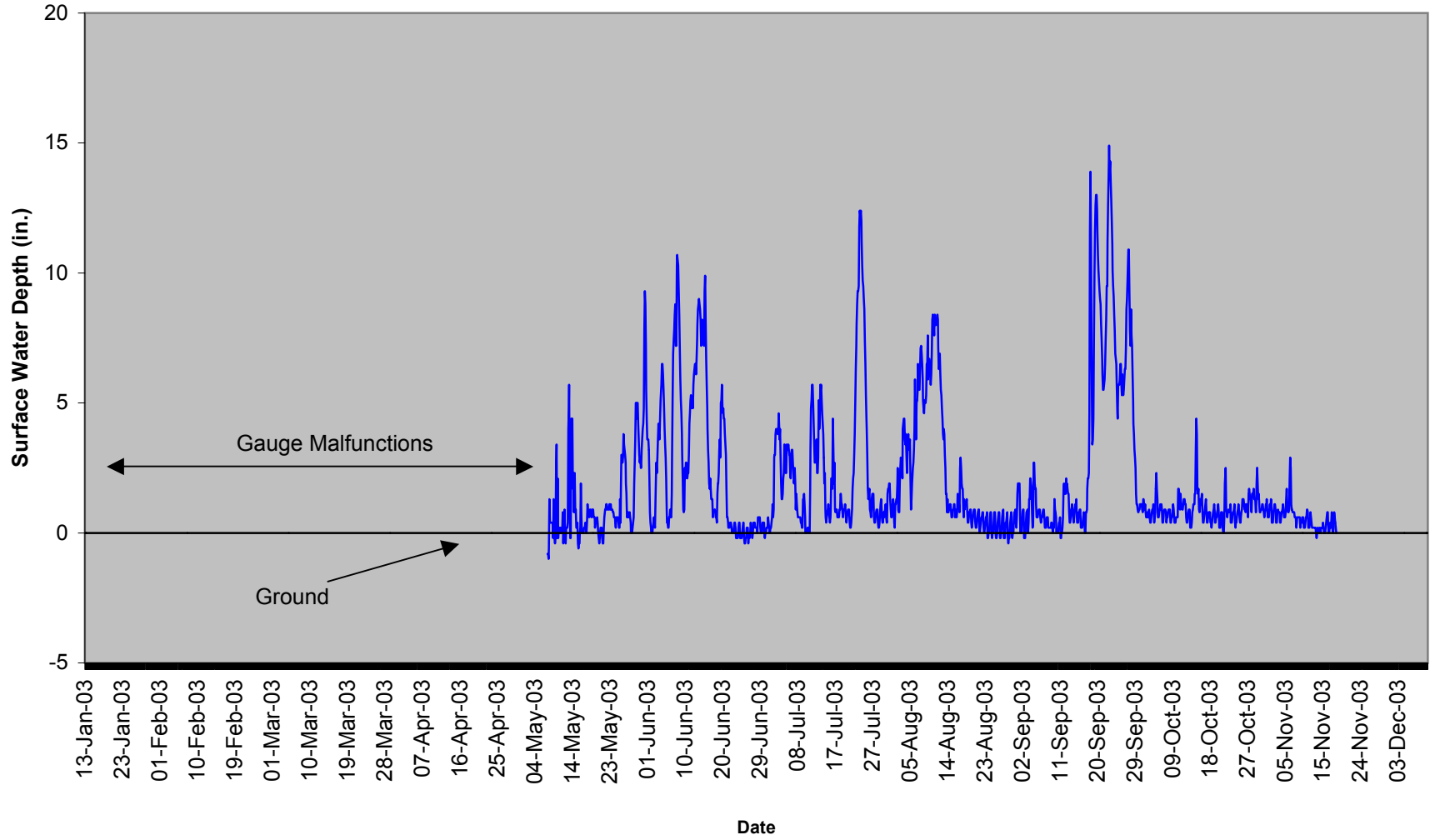
**Ballance Farm BFSG-8
40" Surface Gauge**



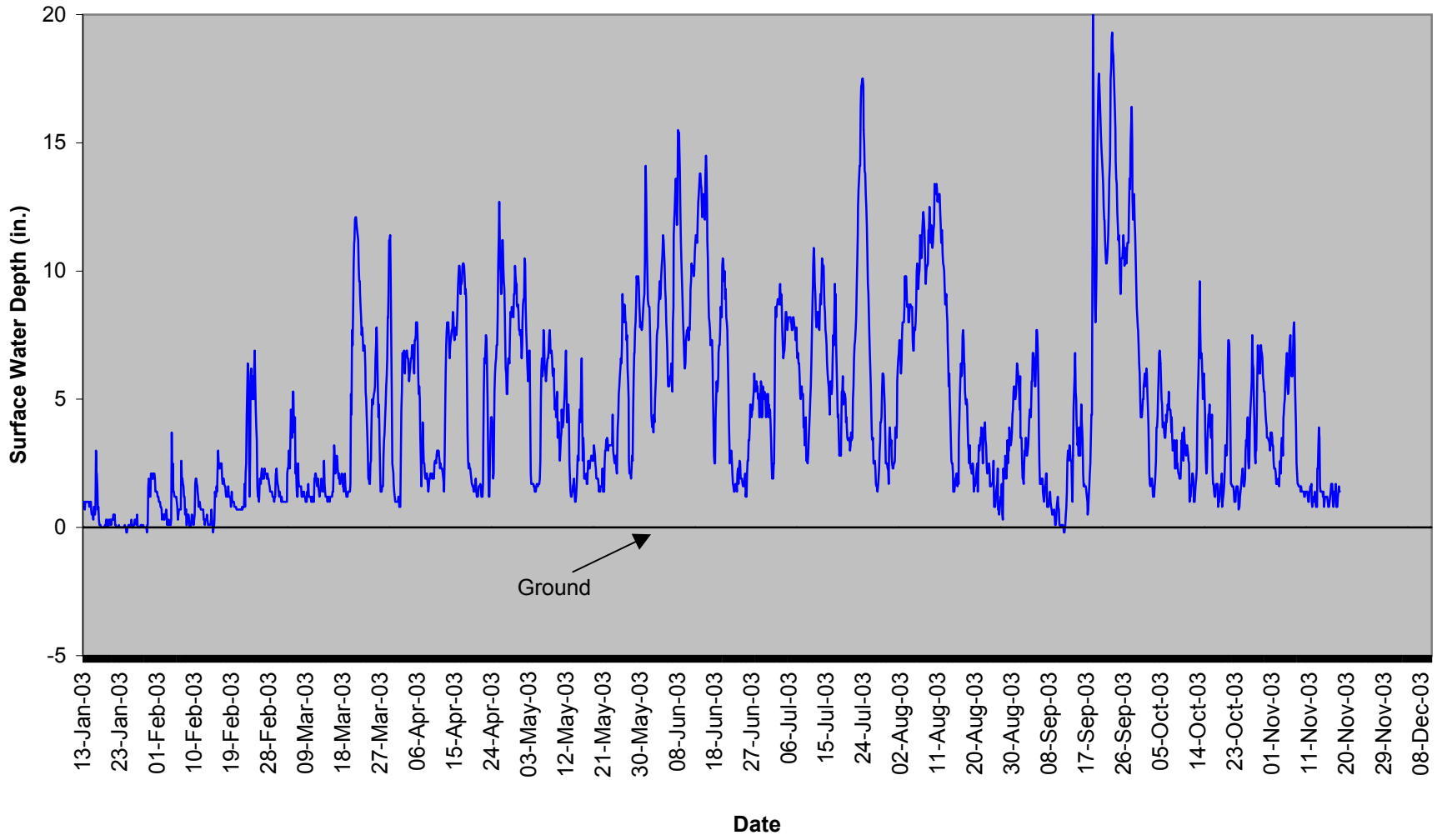
**Ballance Farm BFSG-9
40" Surface Gauge**



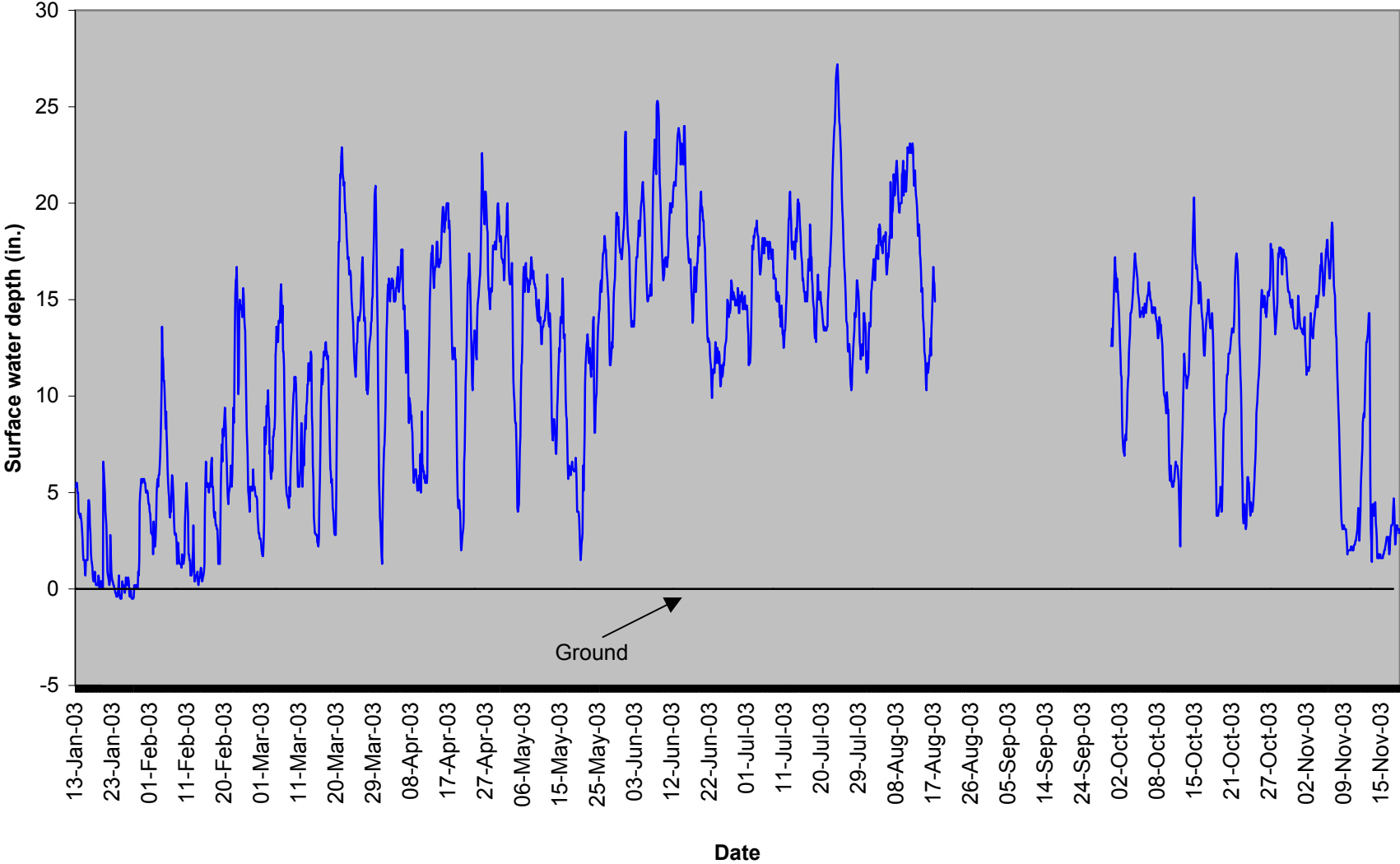
**Ballance Farm BFSG-11
40" Surface Gauge**



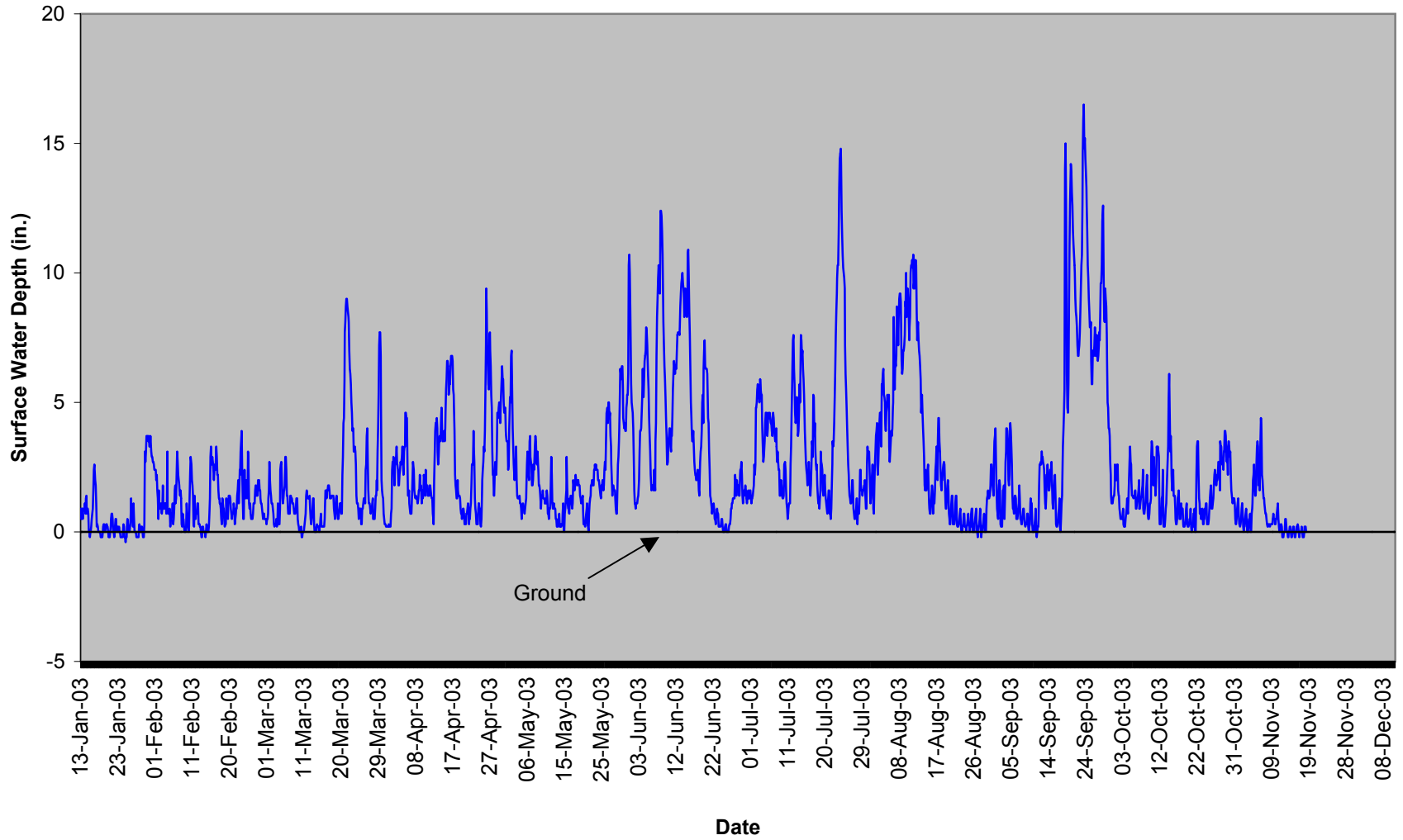
**Ballance Farm BFSG-12
40" Surface Gauge**



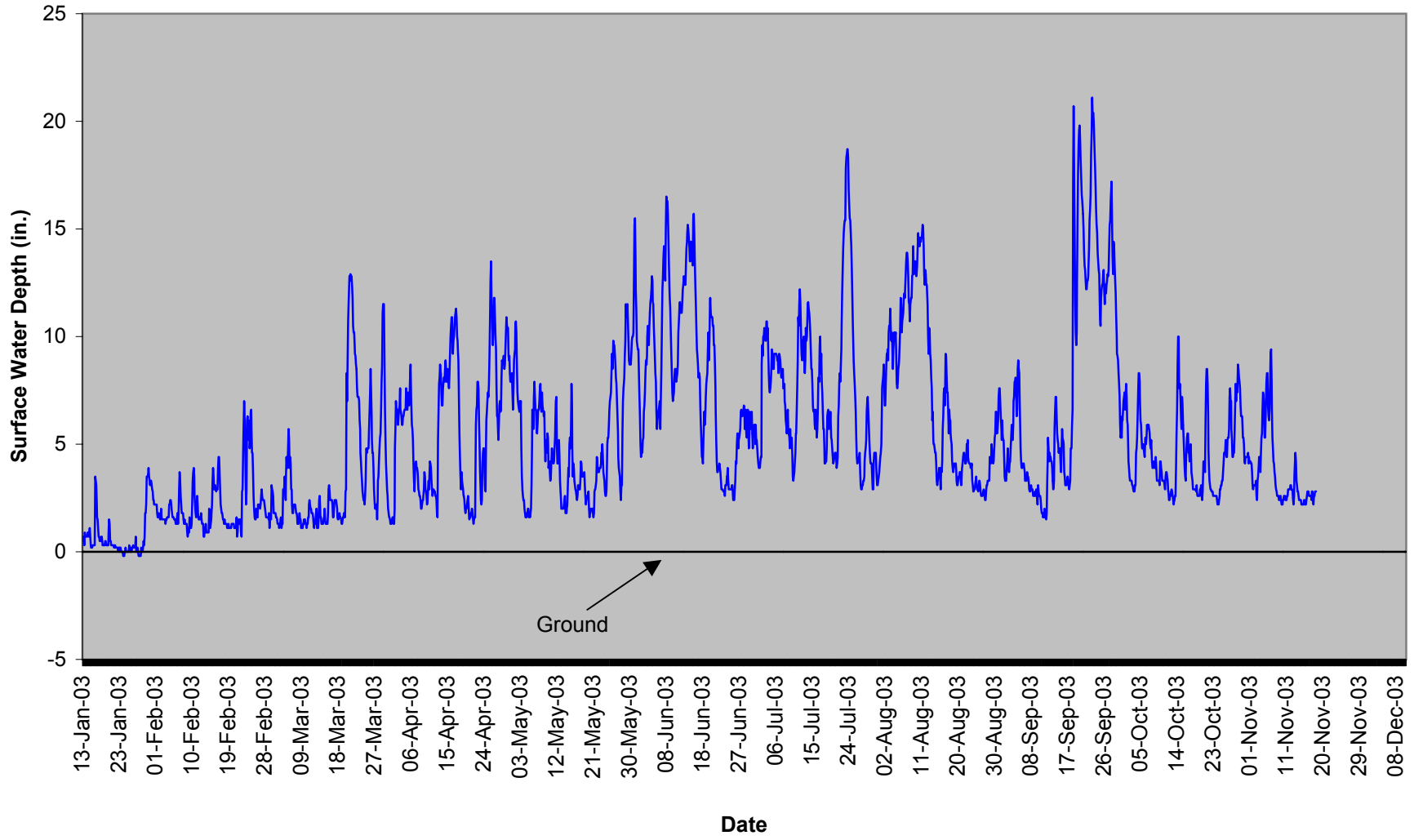
**Ballance Farm BFSG-13
40" Surface Gauge**



**Ballance Farm BFSG-14
40" Surface Gauge**



Ballance Farm BFSG-15 40" Surface Gauge



APPENDIX B
SITE PHOTOS

Ballance Farm



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8



Photo 9



Photo 10



Photo 11



Photo 12

APPENDIX C

PHOTO AND PLOT LOCATIONS

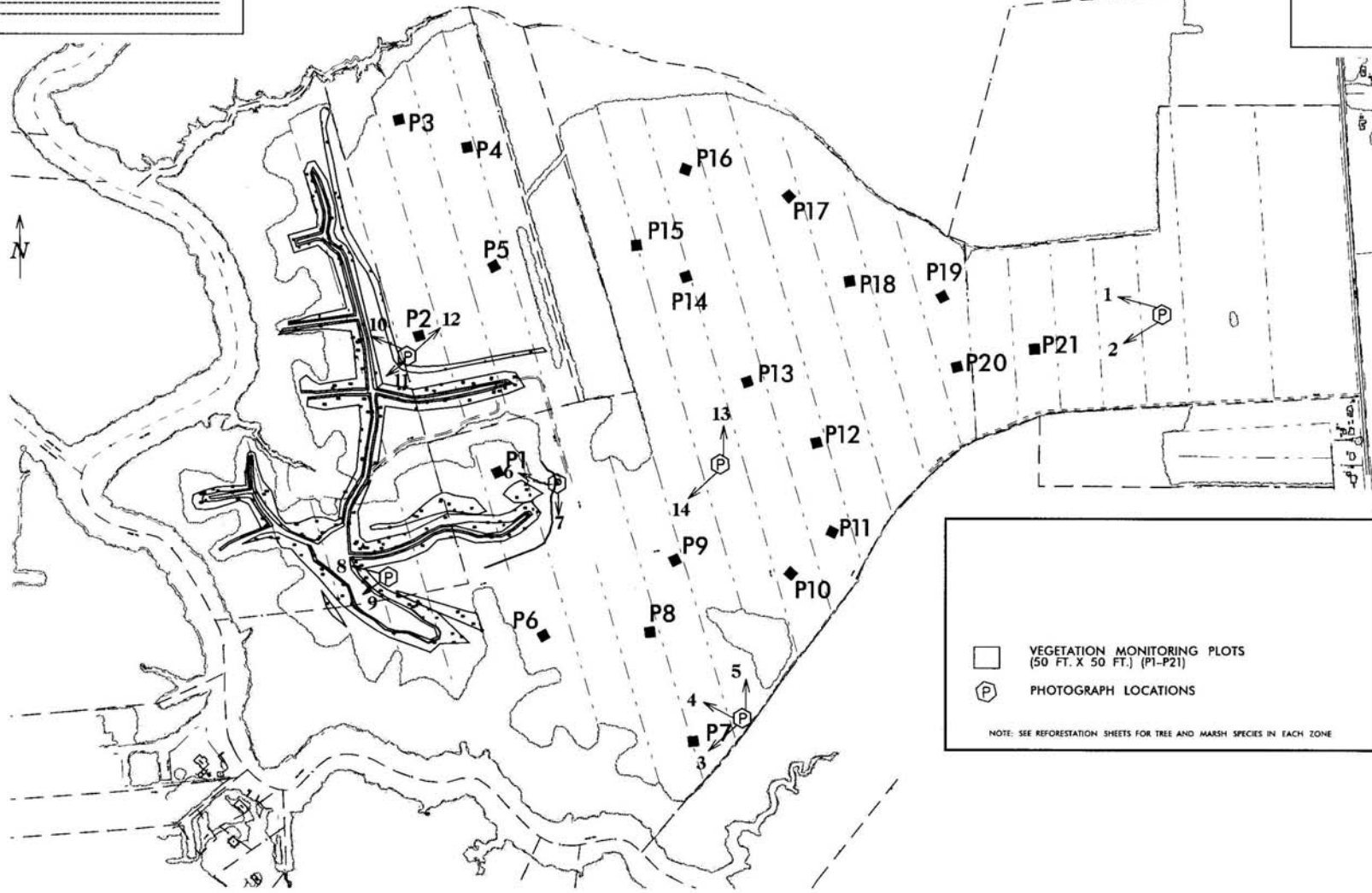
MARSH GRASS RANDOM PLOT LOCATIONS

PLANTING PLAN

REVISIONS

BALLANCE FARM MITIGATION SITE
PHOTO AND PLOT LOCATIONS

PROJECT REFERENCE NO. R-2228MM	SHEET NO. MAP 1
R/W SHEET NO.	HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER	

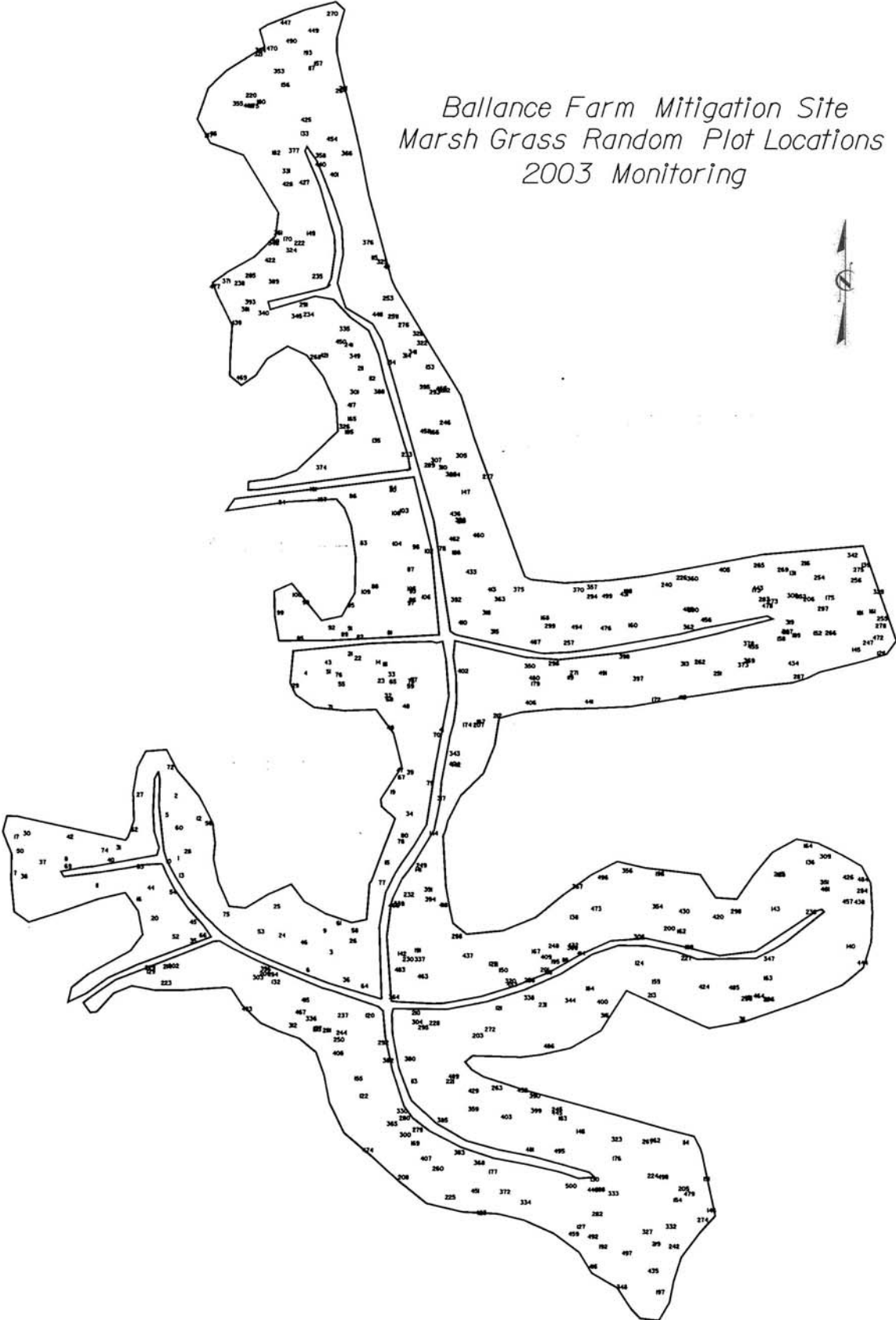


VEGETATION MONITORING PLOTS
 (50 FT. X 50 FT.) (P1-P21)

P PHOTOGRAPH LOCATIONS

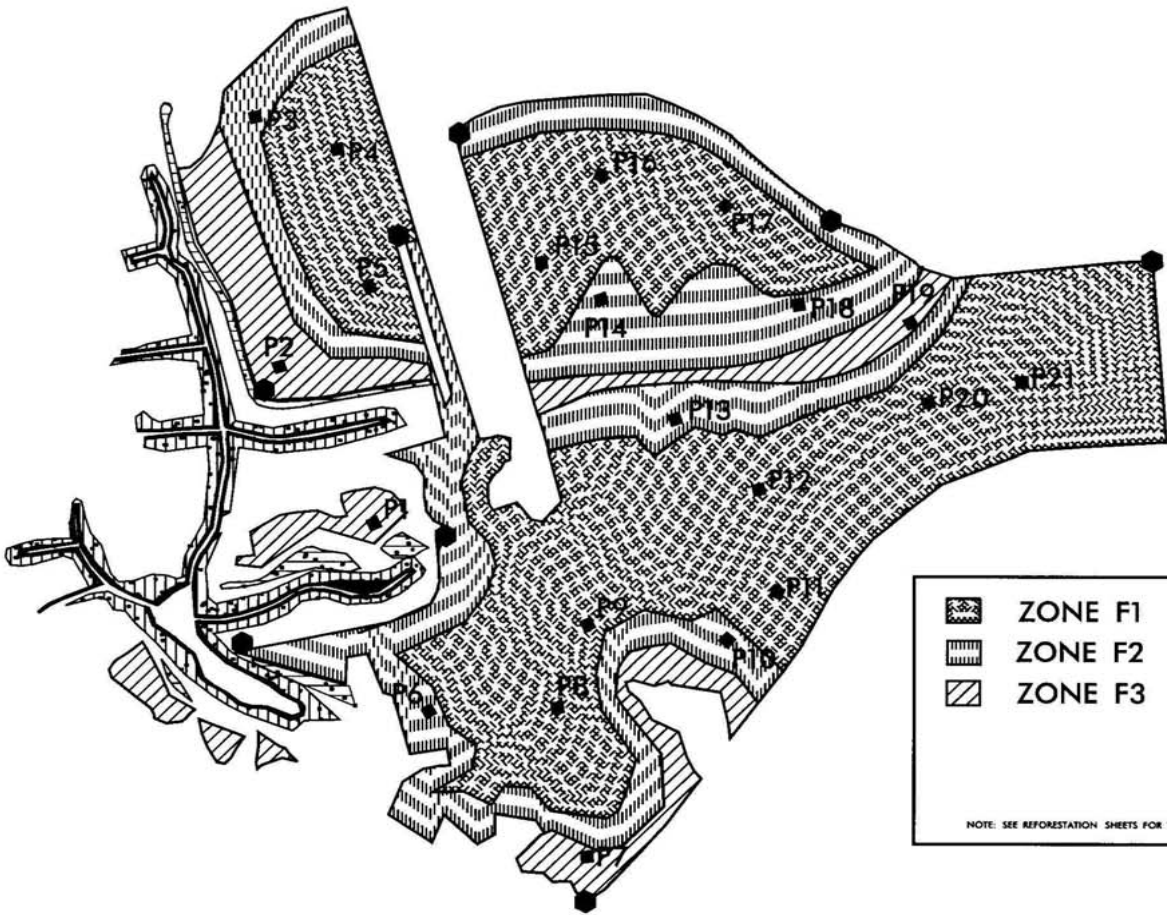
NOTE: SEE REFORESTATION SHEETS FOR TREE AND MARSH SPECIES IN EACH ZONE

*Ballance Farm Mitigation Site
Marsh Grass Random Plot Locations
2003 Monitoring*



CURRITUCK COUNTY, NORTH CAROLINA
 BALLANCE FARM MITIGATION PLANTING PLAN

PROJECT REFERENCE NO. R-2228WM	SHEET NO. WM-1
ROW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



	ZONE F1		ZONE M1
	ZONE F2		ZONE M2
	ZONE F3		ZONE M3

NOTE: SEE REFORESTATION SHEETS FOR TREE AND MARSH SPECIES IN EACH ZONE