Annual Monitoring Report for 2005

(Year 3 of 5)

Pott Creek Mitigation Bank

Lincoln County, North Carolina

Bank Sponsors:
Marsh Resources, Inc. and
Rummel, Klepper and Kahl, LLP

Prepared By:
Rummel, Klepper and Kahl, LLP

December 20, 2005

MARSH RESOURCES INC.

RK&K

POTT CREEK MITIGATION BANK
2005 MONITORING REPORT – EXECUTIVE SUMMARY

This report summarizes the monitoring activities for 2005 (Year 3) at the Pott Creek Mitigation Bank. The site was constructed in the spring of 2002. Drought during the growing season resulted in significant tree seedling mortality and the site was replanted in February of 2003. Steve Lund (USACE) commented during a September 2002 field MBRT site meeting that a meander pool needed repair, which was completed by North State Environmental, Inc. in March 2003.

The mitigation bank monitoring protocol states that the wetland component of the site must demonstrate vegetation and hydrological success for a minimum of five years. The site is monitored with twelve 0.1-acre vegetation plots, twenty-four onsite groundwater gauges, two stream gauges, and two gauges located offsite just upstream on the Wyant property. Precipitation data from the N.C. Climate Office was obtained from the weather station at the Lincolnton Airport to use in this monitoring report. The monitoring protocol for the stream restoration portion of the project requires the collection of dimension, pattern and profile data over five years with a minimum of two bankfull events required during the monitoring period. Eight permanent cross sections and a 3000' monitoring profile reach were established during the first year monitoring survey. Comparisons to the as-built survey and subsequent annual surveys will be made to determine channel stability. Two benthic macroinvertebrate sampling sites have been established for monitoring purposes.

Hydrologic monitoring indicates that twenty-one of the twenty-four groundwater gauges met success criteria during the 2005 monitoring year. These gauges exceeded the expected 12.5% jurisdictional wetland criteria for the growing season. The 30-70-percentile precipitation graph indicates below average rainfall for the 2005 growing season. Vegetation monitoring yielded a successful total average tree density of 469 targeted tree species per acre across the site, which is 46% above the success criteria of 320 trees per acre after three years of monitoring. Stream monitoring data includes the third year monitoring profile overlaid on the previous monitoring and as-built profiles, permanent cross sections overlaid on previous monitoring and as-built cross sections, stream bed analysis and photographic documentation of all permanent cross section, structures (root wads) and vegetation monitoring plots. Channel dimension, pattern and profile data comparisons can be found in the Monitoring Data Record in **Appendix A**. The riparian zone vegetation monitoring data generated an average of 420 trees per acre and a percent herbaceous cover of 90%.

RECEIVED

DEC 21 2005

NC ECOSYSTEM
ENHANCEMENT PROGRAM

TABLE OF CONTENTS

2005 REPORT – EXECUTIVE SUMMARY

1.0 INTRODUCTION **1**
1.1 Project Description 1
1.2 Purpose 1
1.3 Project History 1

2.0 WETLANDS
2.1 HYDROLOGY **2**
2.1.1 Success Criteria 2
2.1.2 Hydrologic Monitoring Description 4
2.1.3 Results of Hydrologic Monitoring 4
2.1.4 Specific Gauge Problems 8
2.1.5 Conclusions 8
2.2 VEGETATION **8**
2.2.1 Success Criteria 8
2.2 2 Description of Species 9
2.2.3 Results of Vegetation Monitoring 9
2.2.4 Discussion and Conclusions 9

3.0 STREAM
3.1 STREAM DATA **11**
3.1.1 Longitudinal Profile 11
3.1.2 Permanent Cross-Sections 11
3.1.3 Channel Substrate Composition at Permanent Cross-Sections 11
3.1.4 Bankfull Event Verification 11
3.1.5 Vegetation 12
3.1.6 Stream Vegetation Discussion and Conclusions 13
3.1.7 Benthic Macroinvertebrate Monitoring Data 13

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS **14**

FIGURES

Figure 1. SITE LOCATION MAP 3
Figure 2. SITE PRECIPITATION DATA 6
Figure 3. GROUNDWATER MONITORING GAUGE LOCATIONS 7

TABLES

Table 1. PROJECT HISTORY 1
Table 2. GROUNDWATER HYDROLOGY MONITORING RESULTS-2005 . . . 4
Table 3. SUMMARY OF WETLAND TREE SURVIVAL 10
Table 4. RESULTS OF RIPARIAN VEGETATION SURVEY 12

APPENDICES

APPENDIX A. MONITORING DATA RECORD.
APPENDIX B. GROUNDWATER MONITORING GAUGE GRAPHS
APPENDIX C. INDEX MAP AND SITE PHOTOS
APPENDIX D. STREAM AND VEGETATIVE MONITORING PLAN
APPENDIX E. STREAM PROFILES
APPENDIX F. STREAM CROSS SECTIONS AND BED ANALYSIS

1.0 INTRODUCTION

1.1 Project Description

The Pott Creek Mitigation Bank is located northwest of Lincolnton in Lincoln County on the south side of Pott Creek, west of Killian Road (S.R. 1008). Pott Creek flows east through the site and into the South Fork of the Catawba River approximately 0.4 mile to the east. The site is located north of Reepsville Road (S.R. 1113), east of Wyant Road (S.R. 1216), and south of Hoover Road (S.R. 1217). A site location map is included in **Figure 1**. The site is approximately 75 acres, with approximately 45 acres of cleared floodplain areas and approximately 30 acres of upland.

1.2 Purpose

To demonstrate successful wetland mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five years. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival.

Stream restoration also requires a five-year monitoring period. Stream monitoring data collected at the Pott Creek Mitigation Bank includes channel stability analysis, plant survival analysis, benthic macroinvertebrate qualitative sampling, and reference photos. The following report details the results of wetland and stream restoration monitoring during 2005 at the Pott Creek Mitigation Bank as well as local climate conditions throughout the growing season.

1.3 Project History

Table 1. Project History
Pott Creek Mitigation Bank

Date	Task Accomplished
2002	
January-April	Site grading, ditch filling and channel construction
April	Tree planting; Groundwater monitoring gauges installed
November	Vegetation monitoring reveals low tree survival
2003	
February	Trees replanted
March	Remedial channel construction at Sta. 19+00
April	Stream monitoring survey performed – Year 1
July	Remaining erosion control measures removed (including instream brush barrier at downstream end of project); Final MBI/Mitigation Plan submitted to agencies
October	Vegetation, benthic macroinvertebrate, and

Table 1. Project History Pott Creek Mitigation Bank	
Date	**Task Accomplished**
	groundwater hydrology monitoring completed for first year
2004	
April	Stream channel monitoring survey preformed – Year 2
November	Vegetation, benthic macroinvertebrate, and groundwater hydrology monitoring completed – Year 2
2005	
March	Stream channel monitoring survey preformed – Year 3
November	Vegetation, benthic macroinvertebrate, and groundwater hydrology monitoring completed – Year 3

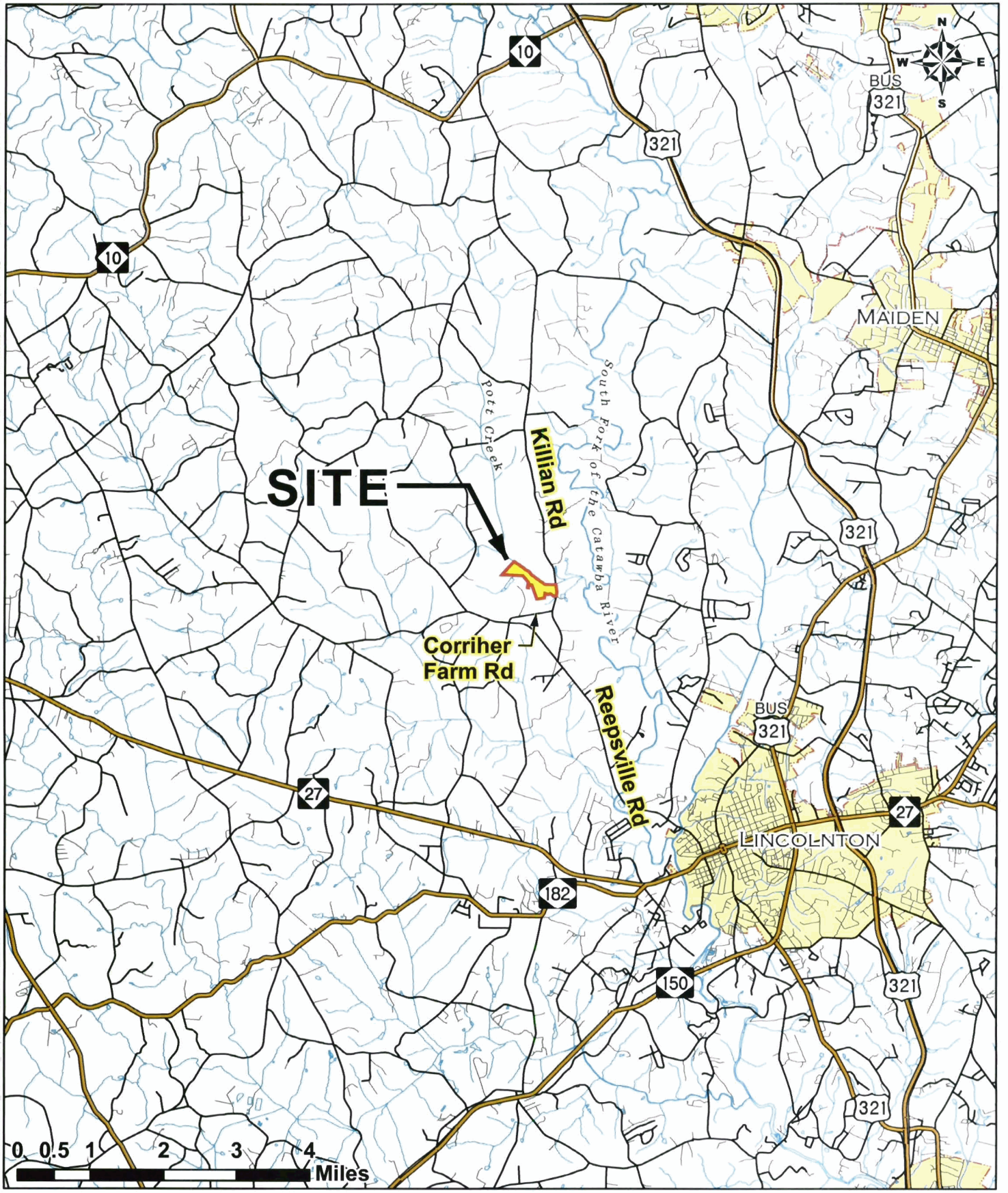
2.0 WETLANDS

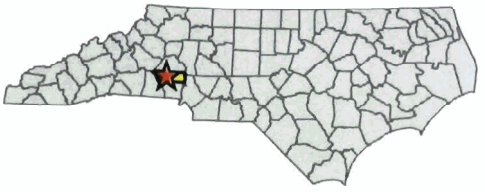
2.1 Hydrology

2.1.1 Success Criteria

Target hydrological characteristics are saturation or inundation within 12 inches of the surface for at least 12.5% of the growing season. However, if the period of saturation or inundation within 12 inches of the surface is less than 12.5% of the growing season, durations of 5%-12% will be considered.

The WETS meteorological data for Lincolnton, N.C. indicates that the growing season in Lincoln County begins March 28 and ends November 4. The dates correspond to a 50% probability that temperatures will drop to 28° F or lower. The growing season is 222 days, therefore 12.5% of the growing season is approximately 28 days. Five percent of the growing season is approximately 11 days. 2005 precipitation data and the WETS monthly precipitation averages for the Lincolnton area are presented in **Figure 2.**





Pott Creek Mitigation Site

Location Map

Lincoln County

Figure 1

2.1.2 Hydrologic Monitoring Description

Previously the site had been monitored with twenty-one Remote Data Systems (RDS) WL40 groundwater-monitoring gauges. This year, three additional RDS WM40 gauges were installed to monitor additional areas. There are now twenty-four groundwater monitoring gauges total. Two RDS WL40 units are installed just upstream in an undisturbed forested floodplain area adjacent to the site (Wyant 1 and 2). These gauges are used to monitor the reference wetland hydrology. See **Figure 3** for gauge locations. Additionally, two RDS WL40 units were installed to measure stream stage at upstream and downstream locations. Graphical and tabular groundwater elevation data for each gauge, recorded during the growing season, are located in **Appendix B**.

Some gaps in the data occurred during well malfunctions. When malfunctions were detected, the wells were replaced or repaired as soon as possible.

2.1.3 Results of Hydrologic Monitoring

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 222-day growing season. **Table 2** shows the groundwater hydrology results for the 2005 growing season.

Table 2. Groundwater Hydrology Monitoring Results-2005 Pott Creek Mitigation Bank

Gauge #	Gauge Serial #	# Consecutive Days Saturated	Dates	Percentage of Growing Season That Gauges Recorded Saturation (Consecutive)
1	S369A04	32	3/28-4/28	14.4
2	S3697DF	54	7/23-9/14	24.3
3	S517063	40	6/28-8/6	18.0
4	S369932	222	3/28-11/4	100
5	S51BCBF	222	3/28-11/4	100
6	S369802	222	3/28-11/4	100
7	S21403E	44	7/3-8/15	19.8
8	S369771	25	6/28-7/22	11.3
9	S369A86	222	3/28-11/04	100
10	S3699C5	157	3/28-8/31	70.7
11*	B65136F	65	3/28-5/31	29.3
12	S4CD9F9	87	6/2-8/27	39.2
13	S4778EC	12	6/27-7/8	5.4
14	S3697B2	42	3/28-5/8	18.9
15	S369949	37	3/28-5/3	16.7
16	S4CDA8F	177	3/28-9/20	79.7
17	S369884	31	3/28-4/27	14.0
18	S369A6D	51	3/28-5/17	23.0
19	S4CD827	13	3/28-4/9	5.9
20	S4CD981	43	3/28-5/9	19.4
21	S3698B8	155	3/28-8/29	69.8

Table 2. Groundwater Hydrology Monitoring Results-2005 Pott Creek Mitigation Bank				
22	B6522FB	112	4/7-7/27	50.5
23	B651392	28	4/7-5/4	12.6
24	B652284	212	4/7-11/4	95.5
Wyant 1	S4CDA31	222	3/28-11/4	100
Wyant 2	S55FB3C	222	3/28-11/4	100

*These gauges malfunctioned at some point in the growing season, resulting in lost data-see Appendix A

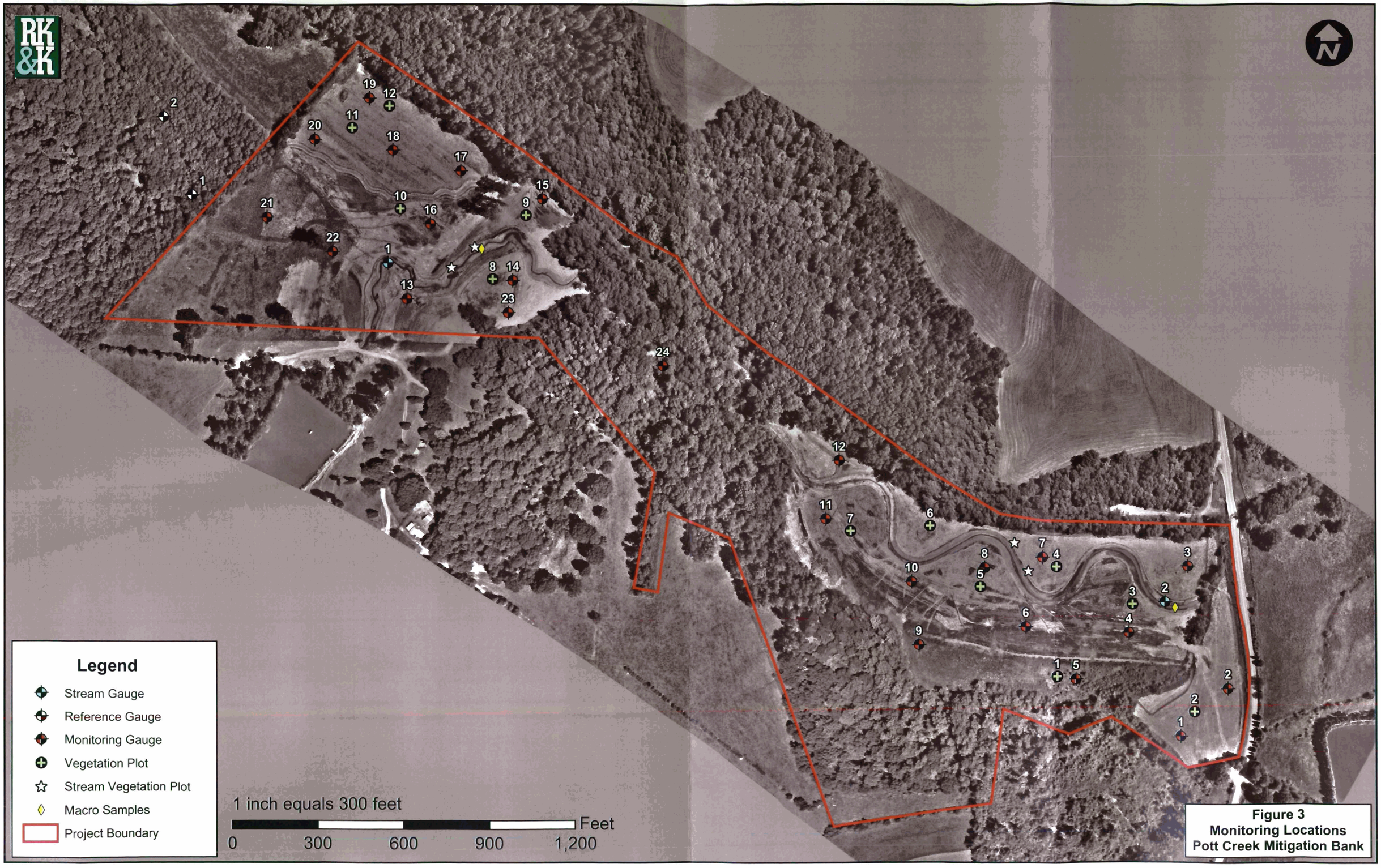
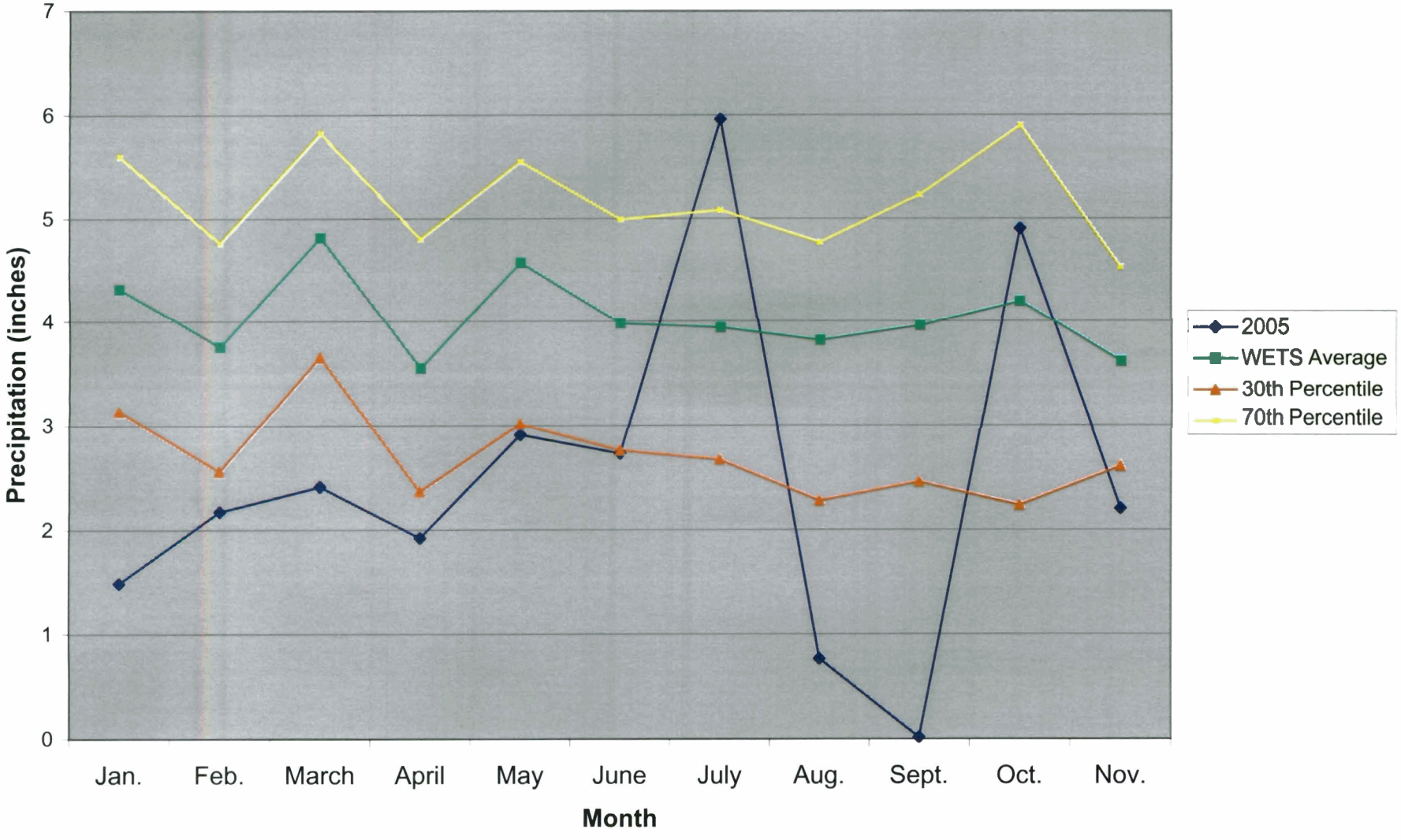


Figure 3
Monitoring Locations
Pott Creek Mitigation Bank

Figure 2. 2005 Precipitation Data for Pott Creek Mitigation Bank Site



Twenty-one of the twenty-four gauges recorded saturation in the upper 12 inches of soil for more than 12.5% of the growing season. Gauges 8 (11.3%), 13 (5.4%), and 19 (5.9%), recorded saturation periods greater than 5% of the growing season.

Referring to **Figure 2**, January, February, March, April, May, August, September, and November received less than the 30th percentile precipitation average. June and October received near normal rainfall while July was above normal (data from N.C. Climate Office, Lincolnton Airport weather station). The unusually low precipitation amounts received during a period from January through May undoubtedly contributed to the decrease in saturation periods recorded.

2.1.4 Specific Gauge Problems

Gauge 11 (65 days) malfunctioned and did not record groundwater elevations from July 12 to October 9 (replaced with a WM40 gauge on October 10). However, jurisdictional hydrology was recorded at this gauge while it was functioning properly, showing saturation of more than 12.5% of the growing season.

2.1.5 Hydrologic Monitoring Conclusions

Twenty-one of the twenty-four gauges recorded saturation in the upper 12 inches of soil for more than 12.5% of the growing season. Gauges 8 (11.3%), 13 (5.4%), and 19 (5.9%), recorded saturation periods greater than 5% of the growing season. In previous monitoring years, gauges 8, 13, and 19 have maintained saturation periods of greater than 12.5% of the growing season. The decrease in saturation periods are undoubtedly a direct result of unusually low precipitation amounts that were received on site, during the 2005 growing season.

2.2 Vegetation

2.2.1 Success Criteria and Monitoring Methodology

2005 is the third year of the five-year monitoring period. As per USACE guidance, 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).

A total of 12 random 0.1-acre plots were established near groundwater monitoring gauges, with the review of the MBRT, to monitor tree survival. These plots provide a 3.2% sample of the bottomland hardwood wetland mitigation areas.

2.2.2 Description of Species

The following species were originally planted in 2002 in the Piedmont-Mountain Bottomland Forest Wetland Restoration Area:

Fraxinus pennsylvanica, green ash
Betula nigra, river birch
Quercus phellos, willow oak
Quercus lyrata, overcup oak
Quercus palustris, pin oak
Celtis laevigata, sugarberry

In 2003 these species were replanted. Also, smooth alder (*Alnus serrulata*), silky dogwood (*Cornus ammomum*) and buttonbush (*Cephalanthus occidentalis*) were planted in the bottomland forest area by the planting contractor, rather than in the riparian zone.

2.2.3 Results of Vegetative Monitoring-2005

The results of the tree survival survey are included in **Table 3**. The average number of total trees per acre for the site is 532. The average number of targeted species per acre for the site is 469. Species composition is comprised of green ash (~68%), sycamore (~9%), river birch (~12%), overcup oak (~4%), willow oak (~3%), with the other species listed making up the remaining 4%.

2.2.4 Wetland Vegetation Monitoring Discussion and Conclusions

The 2005 vegetative monitoring data indicate an increase in total trees counted, average number of trees per acre, and average number of targeted species per acre relative to the 2004 data. While the species composition is still weighted towards green ash as it was in 2004, green ash now comprises 10% more of the total species composition per 2005 data. Oak species (overcup and willow oak) account for 7% of species in 2005 compared to 12% in 2004.

A combination of factors may be responsible for the continued high percentage of surviving green ash individuals versus the oaks. The 2005 vegetative monitoring data indicated that approximately 7% of the surviving trees were oak. These trees grow at a slower rate than the green ash and river birch and consequently are more difficult to locate and count in the weeds that have established across the site. It is likely that a significant number of oak/sugarberry seedlings were missed in the counting process due to weeds, herbaceous cover, and loss of leaves. These shade-tolerant species may reappear in the monitoring data as they reach a stature that increases their visibility in the future.

Table 3. Summary of Wetland Tree Survival-2005[1]															Total	Trees per acre
Plot#	**GA[2]**	**RB[2]**	**WO[2]**	**OO[2]**	**SA[2]**	**SD[2]**	**BB[2]**	**CW**	**SY**	**YP**	**BW**	**BE**	**SG**	**RM**		
1	32	1					2								35	350
2	16	15		5					2						38	380
3	48	5		1			5								59	590
4	53	9	8	3			1								74	740
5	43	7	2	2											54	540
6	12	4	3	2			3	2	13			5			44	440
7	9	12						2	8						31	310
8	1		1						25	1		2			30	300
9	42	5	1	5				2	6			4			65	650
10	10	7	3	4					3						27	270
11	83	4													87	870
12	87	4		2			1								94	940
Totals:	**436**	**73**	**18**	**24**			**12**	**6**	**57**	**1**		**11**			**638**	**532**
% of Total:	68	12	3	4	0	0	2	<1	9	<1	0	2	0	0	100	
Average Number of Target Species Trees Per Acre for the Site:															**469**	

[1]Species are coded as follows: GA=green ash, RB=river birch, WO=willow oak, OO=overcup oak SA=smooth alder, SD=silky dogwood, BB=buttonbush, CW=cottonwood, SY=sycamore, YP=yellow-polar, BW=black willow, BE=box-elder, SG=sweetgum, RM=red maple

[2]Targeted Species

3.0 STREAM

3.1 Stream Data

3.1.1 Longitudinal Profile

A 3000' monitoring reach was established for performing annual surveys to ascertain the stability of the stream restoration by monitoring channel degredation and aggregadation. The third year monitoring survey is compared to the as-built and previous monitoring surveys on the plots included in **Appendix E**. It should be noted that a brush barrier remained at the restoration reach lower limit until remedial construction was stabilized in May 2003 as directed by the Division of Land Quality. Consequently, backwater from the barrier remained in the channel until that time. Overall the profile appears to have degraded and aggraded fairly equally in its evolution to a stable stream.

3.1.2 Permanent Cross-Sections

Eight (8) permanent cross-sections were established for monitoring the channel dimension morphology. Plots of the third year survey are overlaid on the as-built and previous monitoring surveys included in **Appendix F** (also see **Appendix A**, Monitoring Data Record). The as-built cross sections were plotted from either cross sections surveyed close by the permanent monitoring cross section or by interpolating from two cross sections on either side. Before the first year of project monitoring, cross-section two (2) required remedial construction after review and consultation with the MBRT. The reconstruction of the left bank is apparent on the cross section plot.

Generally, the 2005 permanent cross-sections reflect an acceptable stream morphology. The bankfull cross-sectional areas of the riffles and pools surveyed have adjusted each year to the variable flow rates and site inundation due to the Pott Creek over bank flows.

3.1.3 Channel Substrate Composition at Perm. Cross-Sections

The stream bed data is included in **Appendix A**. Subsequent annual analyses will be performed to monitor the stream bed stability. No stream bed data was collected during the as-built survey.

3.1.4 Bankfull Event Verification

Bankfull events were recording in Monitoring Year-1 (2003) and Monitoring Year-2 (2004). In accordance with the monitoring protocol, no further verification of bankfull events is required.

3.1.5 Stream Vegetation

The riparian zone, which varies from 10 to 30 feet and averages 20 feet on either side of the stream, was planted with riparian species such as smooth alder (*Alnus serrulata*), silky dogwood (*Cornus ammomum*) and buttonbush (*Cephalanthus occidentalis*), as per the mitigation plan. Additional bottomland hardwood species such as oaks, green ash, and were also planted, in a scattered manner, in this zone to provide species with taller growth forms to provide shade in the long term. Common riparian pioneer species such as cottonwood (*Populus deltoides*), river birch (*Betula nigra*) and sycamore (*Platanus occidentalis*) were also documented in the survey. Two vegetation monitoring plots measuring 20 feet by 110 feet were randomly located, one upstream of the forested reach and one downstream of the forested reach. They were used to estimate seedling survival in the riparian zone (seedling survival in the 30-foot wide buffer outside of the inner 20-foot buffer is estimated in the wetland vegetation monitoring data, approximately 420 trees/ac for targeted species). A riparian zone width of 20 feet on each side of the 4,325-foot stream is 3.1 acres in size. The two 1/20th acre plots are approximately 3% of the total 3.1-acre area of the riparian zone.

The results of the riparian zone vegetation survey are included in **Table 4**.

Table 4. Results of Riparian Vegetation Survey-2005 Pott Creek Mitigation Bank	
Plot 1	
Species	**Tree count**
Smooth alder	28
Overcup oak	1
Sycamore	18
Willow oak	1
Cottonwood	15
Black willow	23
Subtotal	**86**
Plot 2	
Species	**Tree count**
Smooth alder	5
Silky dogwood	5
River birch	31
Willow oak	1
Black willow	33
Cottonwood	13
Sycamore	4
Subtotal	**144**
Total	**92**
Average/Plot	**89**

Pictures of the riparian vegetation plots are included in **Appendix C**.

There were 86 total trees in Plot 1. If the unplanted sycamore, cottonwood, and black willow seedlings are not considered, there were 30 planted seedlings in the plot. In the 2005 monitoring period, live stakes were not counted separately from other shrubs in both plots.

There were 92 total trees in Plot 2, and if the unplanted river birch, cottonwood, box-elder, and black willow individuals are not counted, there were 11.

The average number of individuals per plot using the total tree counts is 89. The average number of individuals per plot disregarding volunteer individuals is 21. The combined area of two plots is $1/10^{th}$ acre. The estimated total number of trees per acre is therefore 1,780 (20 X 129) and the estimated number of planted trees per acre is 420 (20X 21).

Percent herbaceous cover in Plot 1 was estimated to be 90 percent, and herbaceous cover in Plot 2 was also estimated to be 90 percent, for an average of 90 percent.

3.1.6 Stream Vegetation Discussion and Conclusions

Without including volunteer tree seedlings, there are approximately 420 trees per acre surviving in the riparian zone. There are actually approximately 1,780 trees per acre if natural recruitment is included in the tree count. There is also very adequate herbaceous cover in the riparian zone, with soft rush (*Juncus effusus*) dominating the edge of water. Cattail (*Typha latifolia*) established itself in portions of the upstream channel, and was treated with Rodeo®, a glyphosate-based herbicide specifically labeled for use in stream and wetland areas. Once the overstory canopy shades the channel, the cattail will not survive. However, cattail growth will continue to be monitored and controlled in future growing seasons if necessary.

3.1.7 Benthic Macroinvertebrate Monitoring

Sampling for benthic macroinvertebrates took place on October 31, 2005. The samples were analyzed and species identified. The monitoring data is summarized in the stream monitoring data form and in the data analysis from Pennington and Associates, located in **Appendix A**.

4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

2005 gauge data indicated that the site met successful hydrologic monitoring criteria. All the gauges recorded saturation in the upper 12 inches of soil for more than 12.5% of the growing season except gauges 8, 13, and 19. These gauges recorded saturation in the upper 12 inches of soil for 11.3%, 5.4%, and 5.9% of the growing season respectively.

Vegetation plot data indicated that the site also achieved successful vegetation monitoring criteria in 2005. The average number of targeted species per acre across the site was 469, which is 46% above the success criterion of 320 stems per acre. Riparian zone vegetation monitoring data indicated an average of 420 trees per acre and an average percent herbaceous cover area of 90%.

During the 2005 monitoring year, kudzu had encroached from an adjacent land parcel. The kudzu was treated with herbicide and contained before any significant damage had occurred. There was no mortality on the planted tree species as a result of the kudzu encroachment or the herbicide treatment. There was also a beaver dam constructed in June 2005. The beaver dam was constructed just upstream from the restored stream channel's confluence with Pott Creek. The beaver dam was removed and the beavers have not reconstructed the dam. The Pott Creek Wetland Mitigation Site will be monitored to ensure that kudzu encroachment or beaver activity does not instigate any farther complications.

The 2005 stream channel longitudinal profile indicates that the channel has retained its general as-built dimensions, and in some areas has beneficially (for lotic habitat) deepened pools. Cross-sectional data indicate that the monitoring cross-sections have also retained their general as-built dimensions and remain stable. Pebble counts indicated generally the same substrate class in 2005 as encountered in the previous monitoring periods. Herbaceous vegetation has become well-established along the stream banks and is helping to provide channel shading and additional habitat. It is important to note that with the recorded bankfull events observed in 2003 and in 2004, a minimum of four bankfull events have already occurred at the site, two more than the required two bankfull events per five year monitoring period.

APPENDIX A

Monitoring Data Record

Project Title: Pott Creek Mitigation Bank COE Action ID:
Stream Name: Unnamed Tributary to Pott Creek DWQ Number:
City, County and other Location Information: Killian Road (SR 1008), Lincoln County, N.C.
Date Construction Completed: March 2003 Monitoring Year: (3) of 5
Ecoregion: Piedmont 8 digit HUC unit: 03050102
USGS Quad Name and Coordinates: Reepsville 35 31'21.84N , 81 18' 0.017W
Rosgen Classification: C/E
Length of Project: 4,327 lf Urban or Rural: Rural Watershed Size: 0.74 mi^2
Monitoring DATA collected by: ESW, WES, DCW, JMH Date: 3/2005 through 11/2005
Applicant Information:
Name: Rummel, Klepper and Kahl, LLP
Address: 900 Ridgefield Drive, Suite 350, Raleigh, N.C. 27609
Telephone Number: 888-521-4455 Email Address: tpeacock@rkkengineers.com
Consultant Information:
Name: Same as above
Address:
Telephone Number: Email Address:
Project Status: Third year monitoring complete.

Monitoring Level required by COE and DWQ (404/Sect. 10 permit/401 Cert).: Level 1 2 **3** *(circle one)*
Monitoring Level 3 requires completion of *Section 1*
Monitoring Level 2 requires completion *Section 1 and Section 2*
Monitoring Level 1 requires completion of *Section 1, Section 2 and Section 3*
If biological monitoring is required by DWQ, then Section 4 should also be completed

Section 1. PHOTO REFERENCE SITES

(Monitoring at all levels must complete this section)

Attach site map showing the location and angle of all reference photos with a site designation (name, number, letter, etc.) assigned to each reference photo location. Photos should be provided for all structures and cross section locations, should show both banks and include an upstream and downstream view. Photos taken to document physical stability should be taken in winter. Photos taken to document vegetation should be taken in summer (at representative locations). Attach photos and a description of each reference photo or location. We recommend the use of a photo identification board in each photo to identify location.

Total number of reference photo locations at this site: 27
Dates reference photos have been taken at this site: Stream monitoring – March 2005
Stream vegetation – November 2005
Individual from whom additional photos can be obtained (name, address, phone):
Howard Woodall, RK&K, 888-521-4455
Other Information relative to site photo reference:

Please see photos in **Appendix C** of the Monitoring Report

If required to complete Level 3 monitoring only stop here; otherwise, complete Section 2.

Section 2. PLANT SURVIVAL

Attach plan sheet indicating plots and sample area locations and reference photos. (please refer to monitoring report)

Survival plots:

DATE:	12/11/03	11/9/04	10/12/05		
Area within the easement is:	~3 ac (rip.zone)	~3 ac (rip.zone)	~3 ac (rip.zone)		
Area sampled by survival plots:	20' x 110'	20' x 110'	20' x 110'		
Number of survival plots sampled:	2	2	2		
Random or nonrandom site selection:	random	random	random		
% Coverage within survival plots is:	92.5%	95%	90%		
Photos of reference plots taken: yes/no	yes	yes	yes		

Provide a written description of specific data or findings and photos as needed for clarity.

Live Stake counts:

DATE:	12/11/03	11/9/04	10/12/05		
Area within the easement is:	~3 ac (rip.zone)	~3 ac (rip.zone)	~3 ac (rip.zone)		
Area sampled for stake survival:	20' x 110'	20' x 110'	20' x 110'		
Number of plots sampled:	2	2	2		
Random or nonrandom site selection:	random	random	random		
Average number of surviving stakes:	2	*	*		
Range of survival for all plots:	2	*	*		

Provide a written description of specific data or findings as needed for clarity.

*live stakes were not distinguished from other shrubs within the streamside vegetation monitoring plots in 2004

Tree counts:

DATE:	12/11/03	11/9/04	10/12/05		
Area within the easement is:	~3 ac	~3 ac	~3 ac		
Area sampled for tree survival:	1/20th ac	1/20th ac	1/20th ac		
Number of plots sampled:	2	2	2		
Random or nonrandom site selection:	random	random	random		
Average number of surviving trees:	840	680	489		
Range of survival for all plots:	480-1,200 tpa	200-1,160 tpa	270-940 tpa		

Provide a written description of specific data or findings as needed for clarity. Please see Section 3.1.5 in the report for complete description of riparian vegetation sampling protocol and data analysis.

Bankfull Events:

Date Measured:	August '03	August '04			
Method of Verification:	Stream Gauge	Stream Gauge			

COMMENTS:

Two bankfull events have been recorded on the site. Verification is no longer required.

If required to complete Level 1 and Level 2 monitoring only stop here; otherwise, complete Section 3.

Section 3. CHANNEL STABILITY

Attach plan sheet(s) indicating the locations of cross-sections and beginning and ending of longitudinal profiles if the entire reach is not profiled. Year to year changes in cross-sections, longitudinal profile and bed material should be plotted and submitted. Comparison overlays from previous years for profile and cross-section monitoring should be provided.

Cross-sections: attach plots of each cross-section showing year to year changes.

Provide the following data for each cross-section:

Date measured	March 2005	March 2005	March 2005	March 2005	March 2005
Cross-section being measured	1	2	3	4	5
X-sect. area (sf): as-built/present	4.37/4.59	4.65/9.51	4.40/8.10	3.94/4.08	4.59/7.66
Wbkf (ft): as-built/present	7.2/5.8	10.5/13.9	5.5/6.4	6.3/5.9	9.9/14.0
FPA width (ft): as-built/present	38/46	38/42	25.7/200	200/200	200/45
Width/depth: as-built/present	11.9/7.3	23.5/20.3	7.0/5.1	10.1/8.5	21.2/25.5
Entrenchment ratio: as-built/present	5.3/7.9	3.6/3.0	4.6/31.3	31.7/33.9	20.3/3.2
Stream Type: as-built/present*	E/E	pool	pool	E/E	pool

* only required for riffle cross-sections

Date measured	March 2005	March 2005	March 2005		
Cross-section being measured	6	7	8		
X-sect. area (sf): as-built/present	5.74/7.33	5.67/6.02	3.08/8.66		
Wbkf (ft): as-built/present	9.5/11.4	11.8/10.8	9.4/15.4		
FPA width (ft): as-built/present	40/40	42/43.5	35/45		
Width/depth: as-built/present	15.7/17.8	24.4/19.2	28.7/26.8		
Entrenchment ratio: as-built/present	4.2/3.5	3.6/4.0	3.7/2.9		
Stream Type: as-built/present*	C/C	C/C	pool		

* only required for riffle cross-sections

Longitudinal profiles: Attach plots of the longitudinal profile showing year to year changes and the locations of installed or natural structures that affect profile.

Date measured	March 30, 2005
Avg. slope riffles: as-built/present	
Avg. slope pools: as-built/present	
Number of riffles: as-built/present	
Number of pools: as-built/present	

See stream monitoring profile in **Appendix E**.

Pebble counts: Attach a printout of pebble count data and a graphical plot of bed material showing the cumulative % finer than X millimeters and the number of particles in standard size classes. Year to year changes in bed material should also be plotted and provided.

Date measured	March 2005				
Cross-section being measured	1 thru 8				
D16: as-built/present	--- / 0.062				
D50: as-built/present	--- / 0.21				
D84: as-built/present	--- / 1.3				

This table represents the total pebble count analysis. See **Appendix F** for individual cross section data. As-built data obtained prior to defining monitoring protocol, thus bed data from as-built survey is not available.

Visual Inspection: The entire stream project as well as each in-stream structure and bank stabilization/revetment structure must be evaluated and problems addressed.

Date Inspected	Station Number	Station Number	Station Number	Station Number	Station Number
March 2005	10+50 Rt.	13+00 Lt.	19+00 Lt.	21+00 Lt.	22+50 Lt.
Structure Type	root wads	root wads	root wads	root wads	root wads
Is water piping through or around structure?	No	No	No	No	No
Head cut or down cut present?	No	No	No	No	No
Bank or scour erosion present?	No	No	No	No	No
Other problems noted?	None	None	None	None	None

Date Inspected	Station Number	Station Number	Station Number	Station Number	Station Number
April 2004	33+50 Rt.	51+00 Rt.	52+00 Rt.		
Structure Type	root wads	root wads	root wads		
Is water piping through or around structure?	No	No	No		
Head cut or down cut present?	No	No	No		
Bank or scour erosion present?	No	No	No		
Other problems noted?	None	None	None		

NOTE: Attach separate narrative sheets to each monitoring report describing/discussing the overall monitoring results. Include the identification of specific problem areas/channel failures, estimated cause and proposed/required remedial action. This should include a brief discussion of any parameter that has changed significantly from as-built. (See success criteria discussion in Section 11.)

See the monitoring report for additional discussion.

After review of the site with the MBRT, it was determined that 1) the grade control log cross vanes should be removed and 2) the root wads (too high) and left channel bank (undefined) at sta. 19+00 should be reconstructed. These two tasks were accomplished prior to performing the monitoring survey.

The area change on cross section 3 is attributed to the morphology of a pool section. The team will continue to closely monitor the changes to this cross section.

The area change on cross section 8 is attributed to the fact that the erosion control brush barrier was still in place at the time of the first year monitoring survey as requested by the Division of Land Quality, and this particular reach of the stream was continually inundated. The cross section appears to have experienced sediment deposition during this period and should balance itself over the course of time. The team will continue to closely monitor the changes in this cross section as well.

In performing monitoring Level 1, determine if the DWQ Certification conditions require biological monitoring. Should conditions require monitoring of biological communities, complete Section 4; otherwise, stop here.

Section 4. BIOLOGICAL INDICATORS (may be required for monitoring Level 1, see permit requirements)
Attach a map and narrative showing locations where biological samples were collected, list of taxa collected, explaining conditions during sampling, the types of samples taken, an explanation of the data collected and all other information pertinent to understanding this data set. If the sample is a follow-up to earlier samples discuss any differences found or statistical comparisons. The complete macroinvertebrate monitoring report has been sent to Mr. Dave Penrose of the 401/Wetlands Unit, NCDWQ. The summary of species collected and analysis is attached in this Appendix.

Invertebrate populations

Date sampled:	10/20/03				11/9/04							
Site	1	2	3	4	1	2	3	4	1	2	3	4
Qualitative Metrics:												
EPT Taxa Richness	1	0	N/A	N/A	3	2	N/A	N/A	4	2	N/A	N/A
EPT Abundance	1	0	N/A	N/A	9	86	N/A	N/A	7	2	N/A	N/A
Total Taxa Richness	10	11	N/A	N/A	14	14	N/A	N/A	25	9	N/A	N/A
Biotic Index value	7.71	7.82	N/A	N/A	7.94	6.80	N/A	N/A	8.59	7.84	N/A	N/A
Quantitative Metrics:												
Standing Crop/Density (#/m^2)												
Biomass (g/m^2)												
Biotic Index value												
Species (taxa) Diversity												

Fish populations (fish sampling was not a monitoring requirement for this project)

Date sampled:												
Site	1	2	3	4	1	2	3	4	1	2	3	4
Qualitative Metrics:	N/A											
Number of fish												
Number of species												
% of tolerant fish sp.												
% of intolerant fish sp.												
% with disease or wounds												
Catch per unit effort												
NC IBI score												
NC IBI rating												
Quantitative Metrics:												
Standing Crop/Density (#/m^2)												
Biomass (g/m^2)												
Species (taxa) Diversity												

BENTHIC MACROINVERTEBRATES COLLECTED FROM POTTS CREEK, LINCOLN CO., NC, RK, OCTOBER 2005.

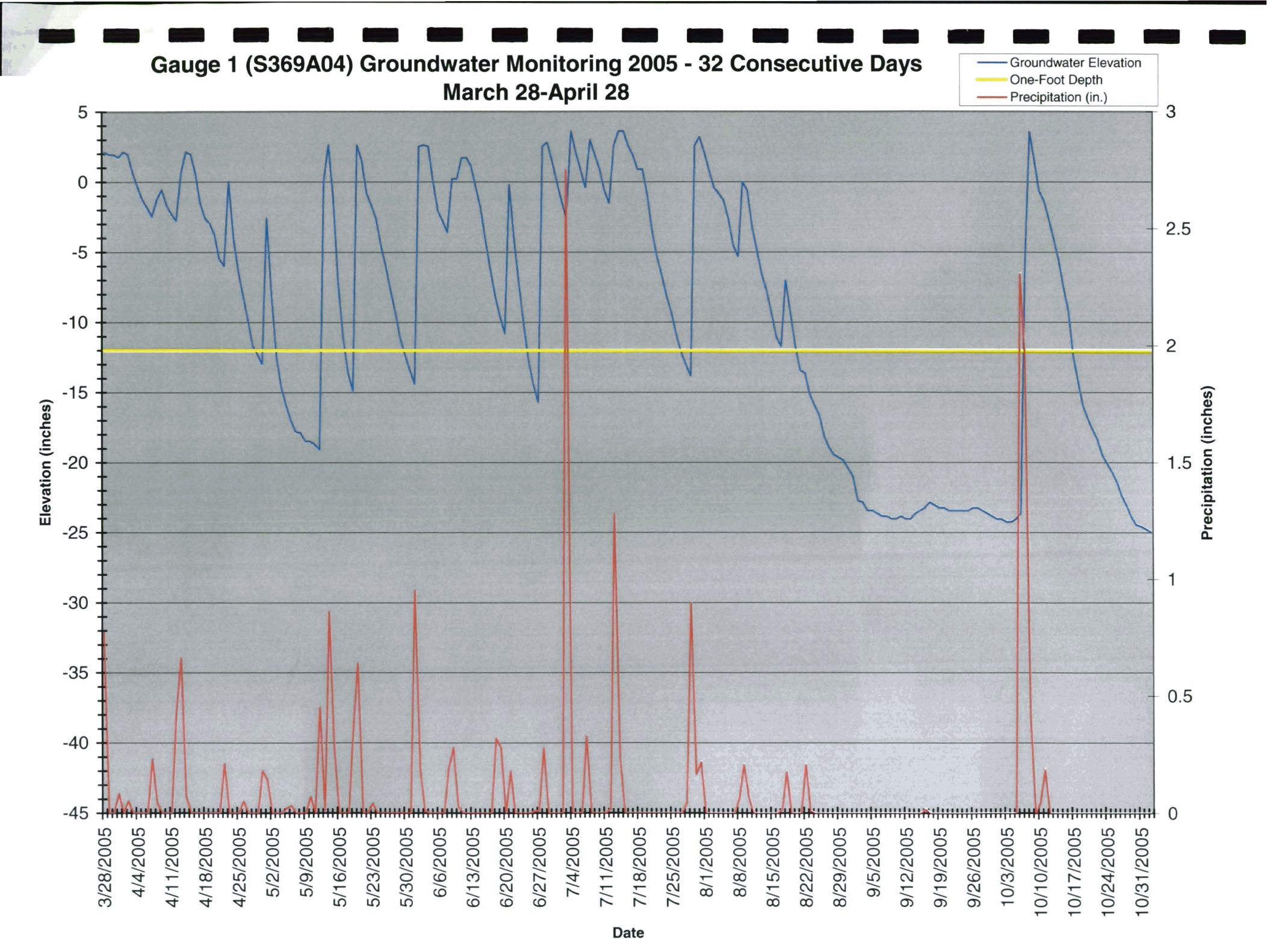
SPECIES	T.V.**	F.F.G.***	Sta. A1	Sta. B-2
MOLLUSCA				
Gastropoda				
Basommatophora				
Lymnaeidae		SC		
Pseudosuccinea columella	7.7	SC	1	
Planorbidae				
Menetus dilatatus	8.2	SC		2
ANNELIDA				
Oligochaeta	*1	CG		
Tubificida				
Tubificidae w.o.h.c.	7.1	CG		1
ARTHROPODA				
Arachnoidea				
Acariformes				
Lebertiidae				
Lebertia sp.	5.5		2	
Crustacea				
Copepoda			1	
Cladocera				
Daphnidae				
Ceriodaphnia sp.			1	
Amphipoda				
Talitridae				
Hyalella azteca	7.8	CG	16	4
Decapoda				
Cambaridae	7.5		1	5
Insecta				
Ephemeroptera				
Baetidae				
Callibaetis sp.	9.8	CG	3	
Caenidae				
Caenis sp.	7.4	CG	2	
Ephemeridae				
Hexagenia sp.	4.9	CG		1
Leptophlebiidae				
Leptophlebia sp.	6.2	CG	1	1
Odonata				
Coenagrionidae	*9	P		
Argia sp.	8.2	P	1	
Enallagma sp.	8.9	P	7	
Ischnura sp.	9.5		38	
Corduliidae				
Epicordulia princeps	5.6	P	1	
Libellulidae	*9	P		
Erythemis simplicicollis	9.7		2	
Libellula sp.	9.6	P		2
Pachydiplax longipennis	9.9		1	
Hemiptera				
Corixidae	9	PI	2	
Trichoptera				

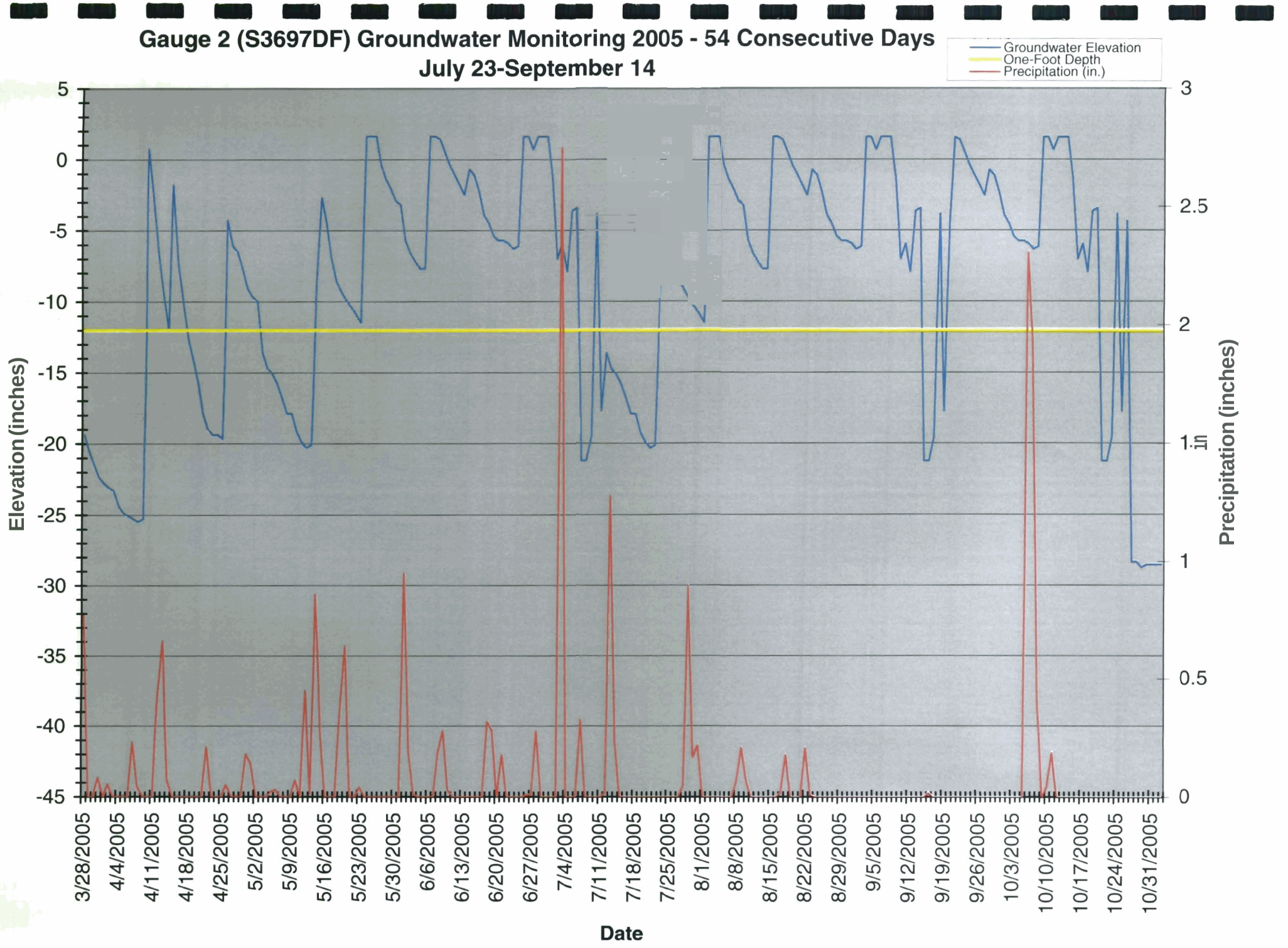
BENTHIC MACROINVERTEBRATES COLLECTED FROM POTTS CREEK, LINCOLN CO., NC, RK, OCTOBER 2005.

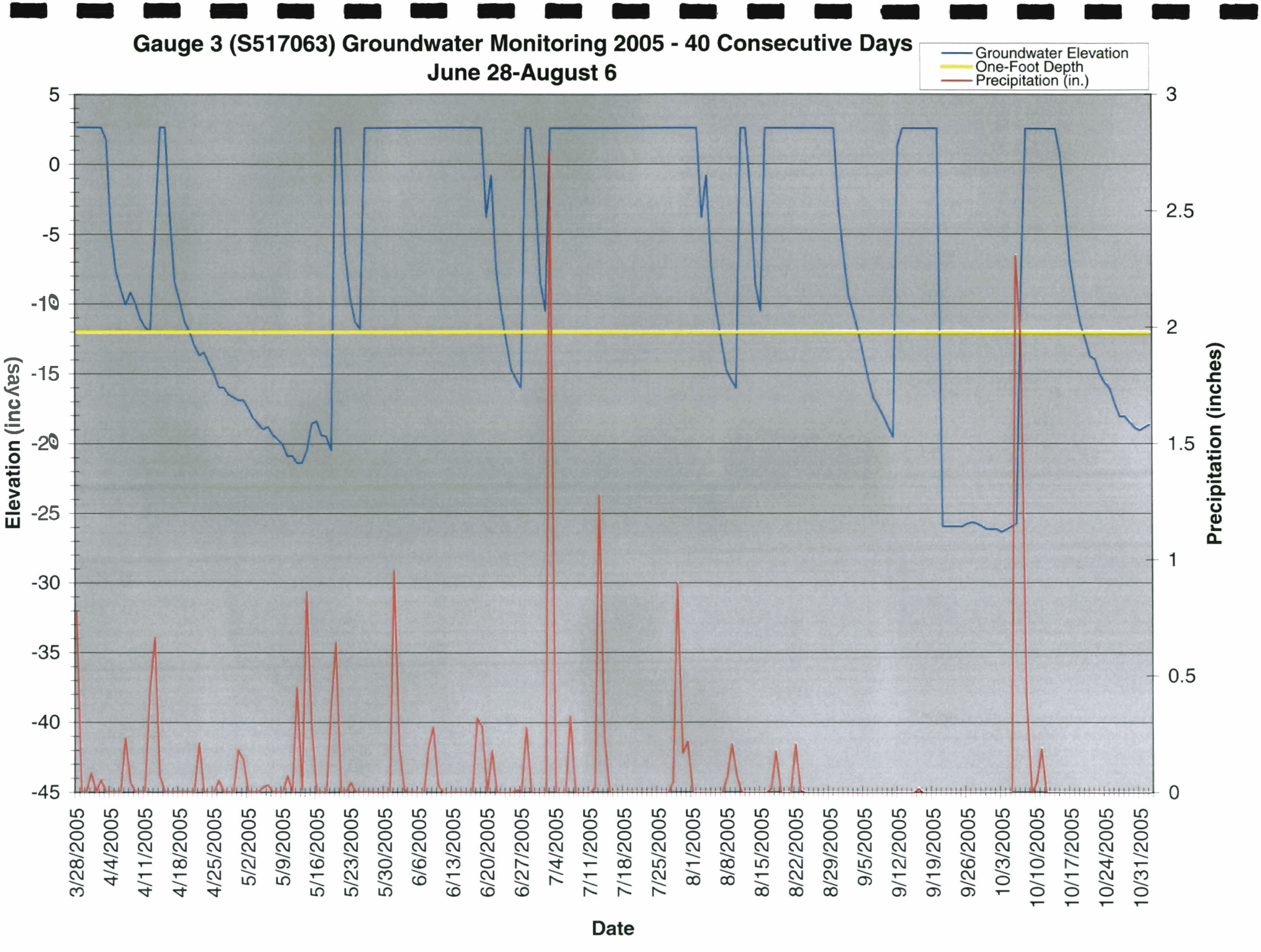
SPECIES	T.V.**	F.F.G.***	Sta. A1	Sta. B-2
Leptoceridae				
Triaenodes sp.	**4.5**	**SH**	1	
Coleoptera				
Dytiscidae	***5**	**P**		
Hydroporus sp.	**8.6**	**PI**		1
Laccophilus sp.	**10**	**P**		1
Haliplidae				
Peltodytes sp.	**8.7**	**SH**	1	
Diptera				
Chironomidae				
Ablabesmyia mallochi	**7.2**	**P**	1	
Corynoneura sp.	**6**	**CG**	1	
Dicrotendipes neomodestus	**8.1**	**CG**	2	
Polypedilum illinoense	**9**	**SH**	1	
Rheotanytarsus sp.	**5.9**	**FC**	1	
Tanytarsus sp.	**6.8**	**FC**	1	
Tribelos sp.	**5.9**	**FC**	1	

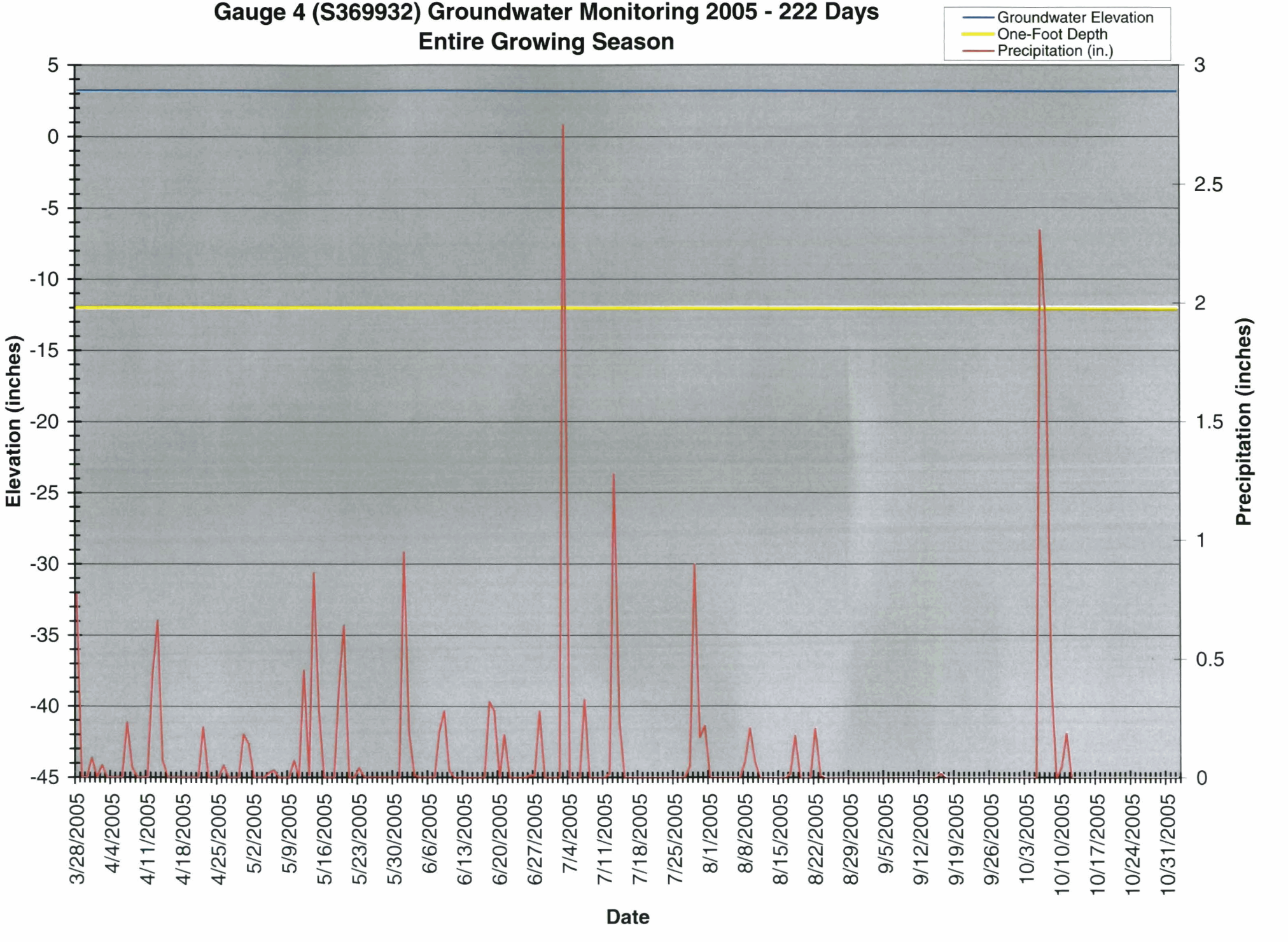
TOTAL NO. OF ORGANISMS	**90**	**18**
TOTAL NO. OF TAXA	**25**	**9**
EPT INDEX	**4**	**2**
EPT Abundance	**7**	**2**
Ratio of EPT and Chironomidae Abundance	**0.875**	
Biotic Index	**8.59**	**7.84**

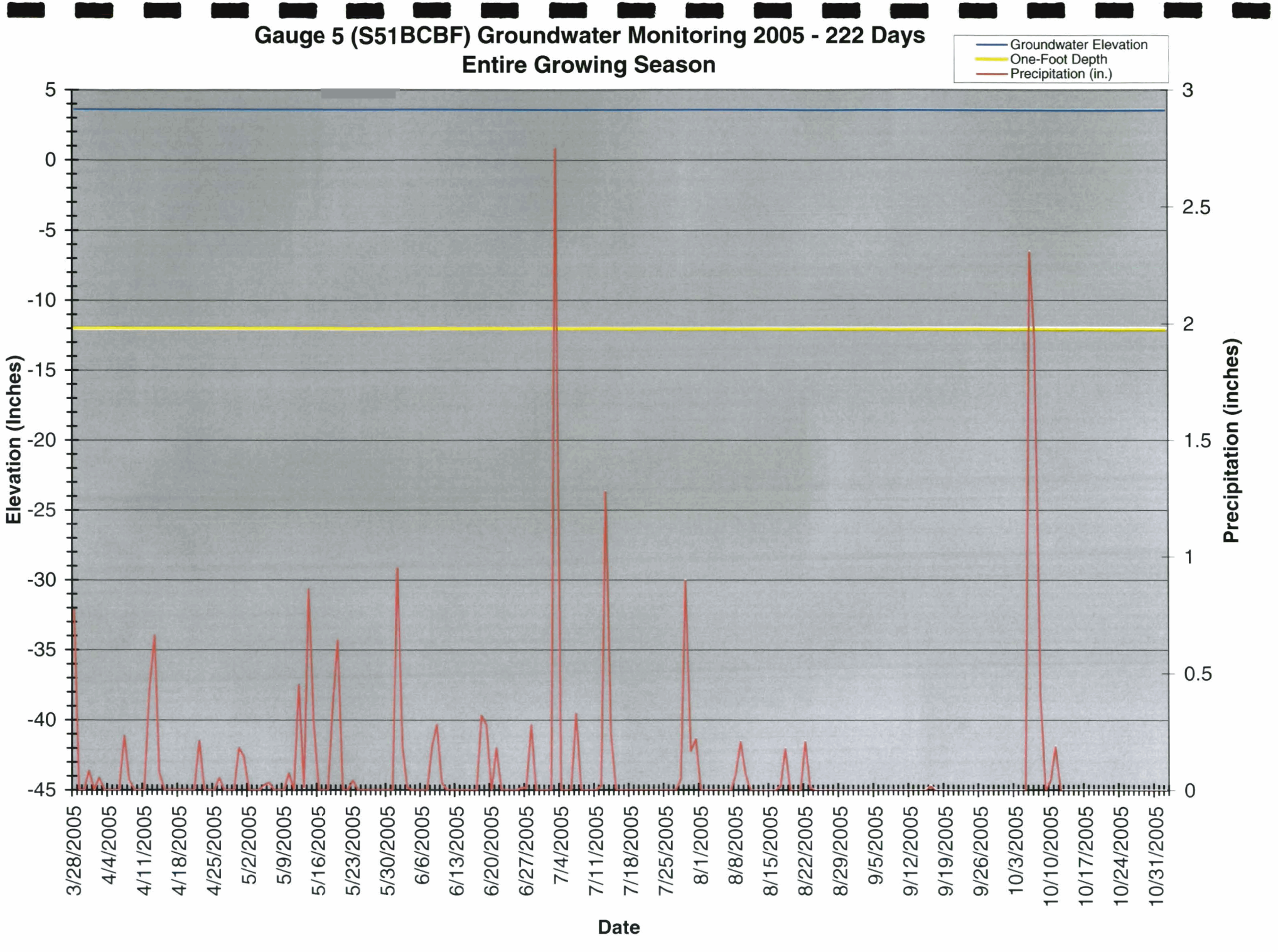
APPENDIX B

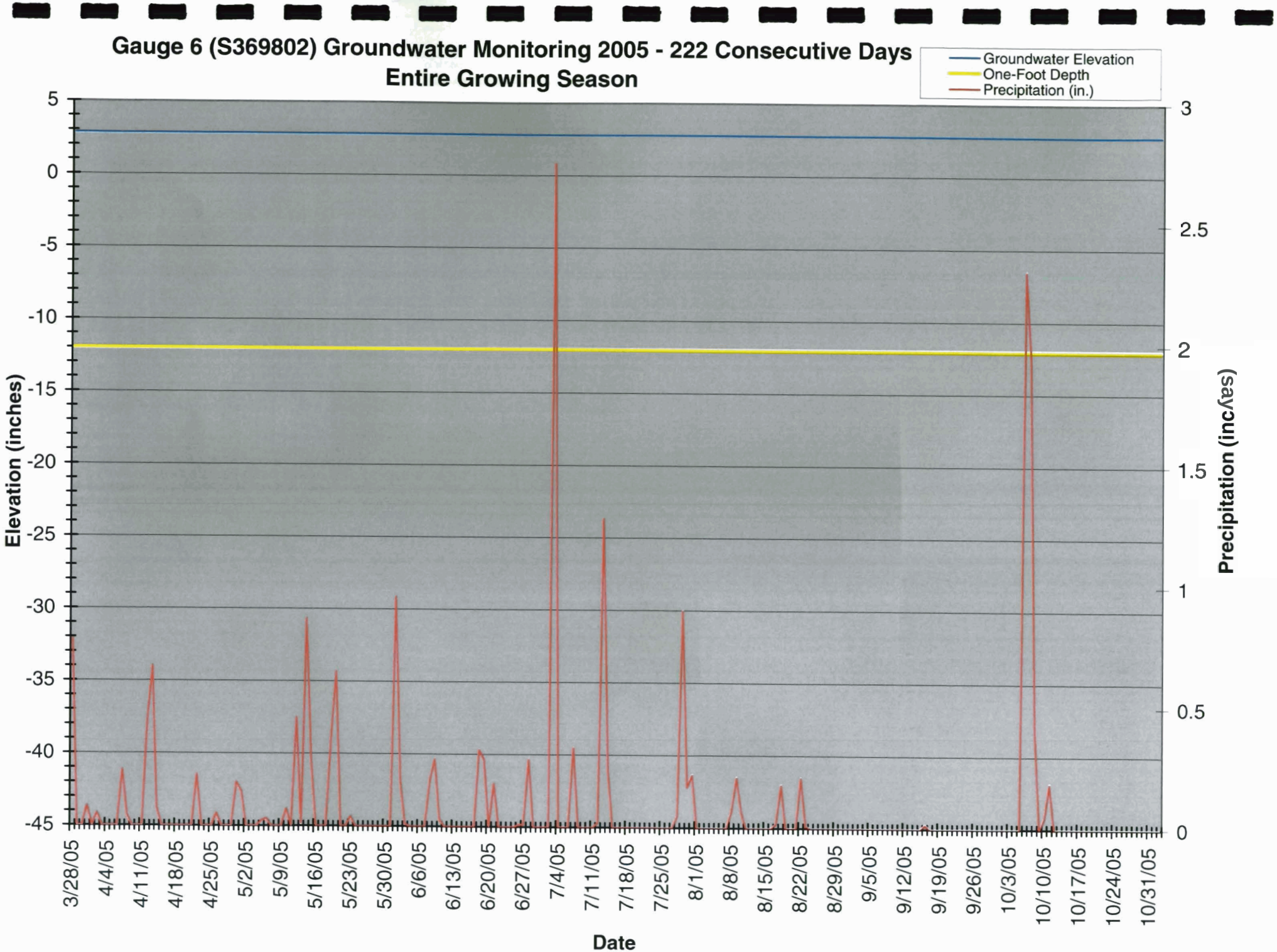

Gauge 1 (S369A04) Groundwater Monitoring 2005 - 32 Consecutive Days
March 28-April 28
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/2005
4/4/2005
4/11/2005
4/18/2005
4/25/2005
5/2/2005
5/9/2005
5/16/2005
5/23/2005
5/30/2005
6/6/2005
6/13/2005
6/20/2005
6/27/2005
7/4/2005
7/11/2005
7/18/2005
7/25/2005
8/1/2005
8/8/2005
8/15/2005
8/22/2005
8/29/2005
9/5/2005
9/12/2005
9/19/2005
9/26/2005
10/3/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005
Date

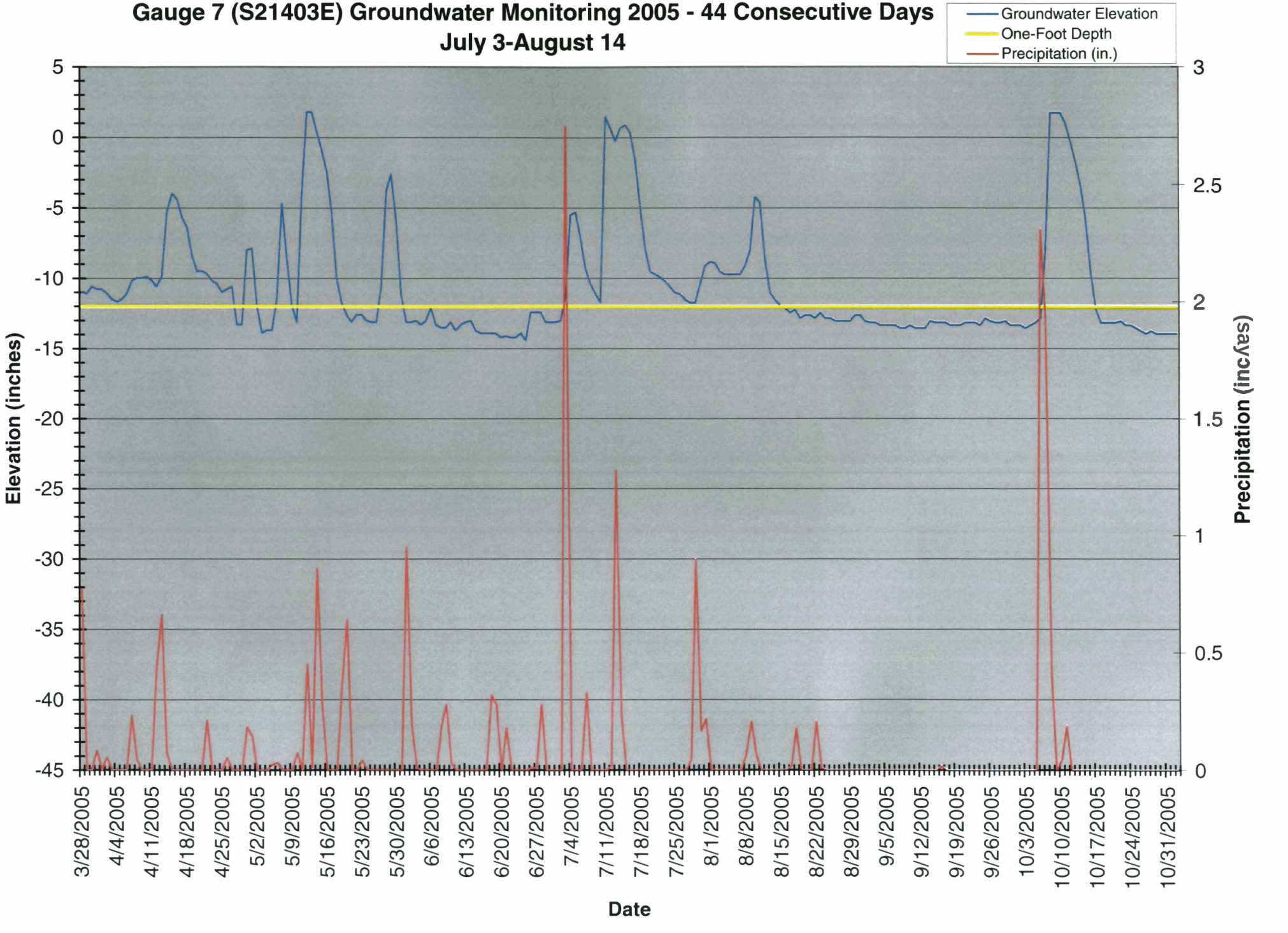

Gauge 2 (S3697DF) Groundwater Monitoring 2005 - 54 Consecutive Days
July 23-September 14
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
in
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/2005
4/4/2005
4/11/2005
4/18/2005
4/25/2005
5/2/2005
5/9/2005
5/16/2005
5/23/2005
5/30/2005
6/6/2005
6/13/2005
6/20/2005
6/27/2005
7/4/2005
7/11/2005
7/18/2005
7/25/2005
8/1/2005
8/8/2005
8/15/2005
8/22/2005
8/29/2005
9/5/2005
9/12/2005
9/19/2005
9/26/2005
10/3/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005
Date

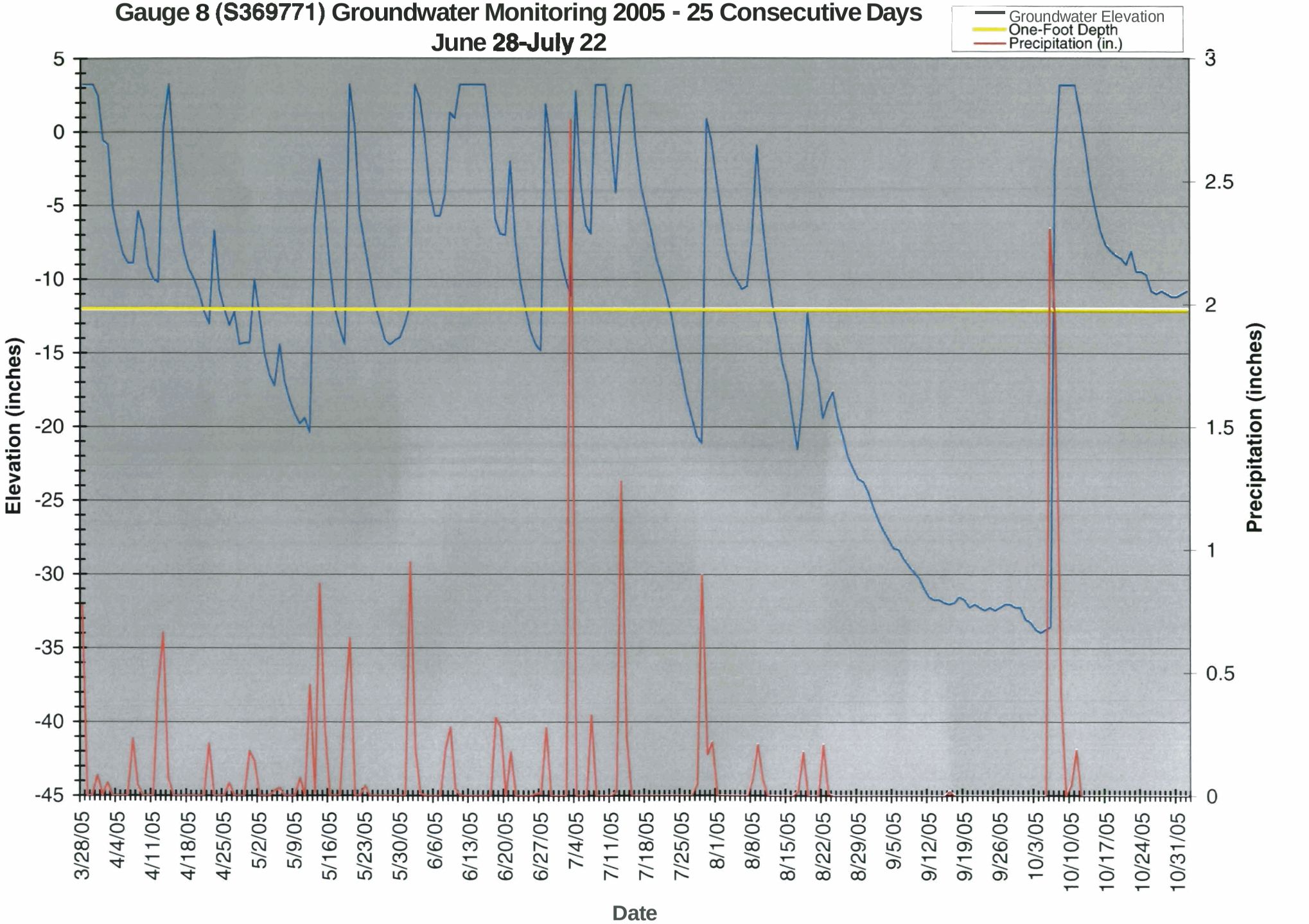

Gauge 3 (S517063) Groundwater Monitoring 2005 - 40 Consecutive Days
June 28-August 6
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/2005
4/4/2005
4/11/2005
4/18/2005
4/25/2005
5/2/2005
5/9/2005
5/16/2005
5/23/2005
5/30/2005
6/6/2005
6/13/2005
6/20/2005
6/27/2005
7/4/2005
7/11/2005
7/18/2005
7/25/2005
8/1/2005
8/8/2005
8/15/2005
8/22/2005
8/29/2005
9/5/2005
9/12/2005
9/19/2005
9/26/2005
10/3/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005

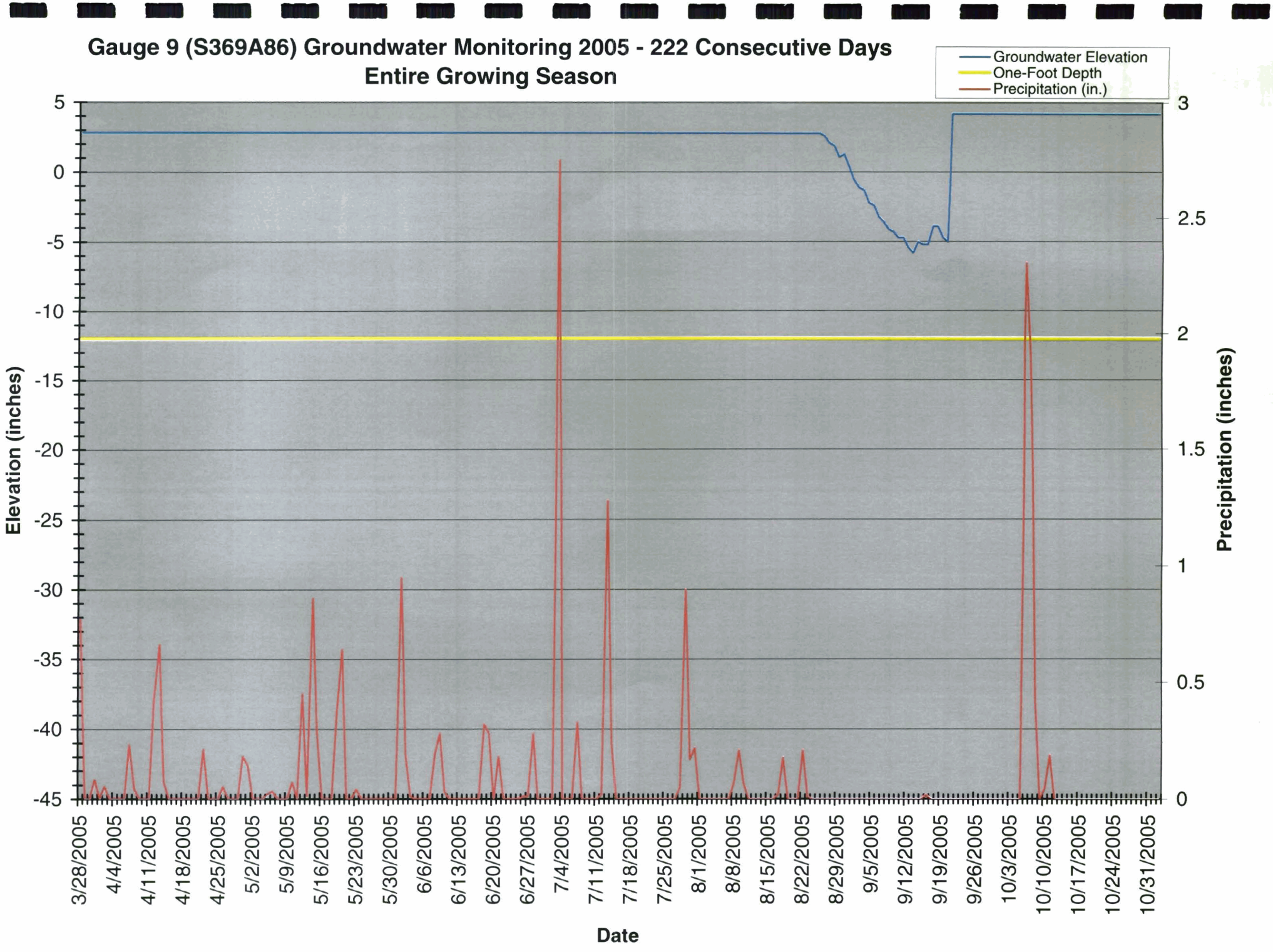

Gauge 4 (S369932) Groundwater Monitoring 2005 - 222 Days
Entire Growing Season
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/2005
4/4/2005
4/11/2005
4/18/2005
4/25/2005
5/2/2005
5/9/2005
5/16/2005
5/23/2005
5/30/2005
6/6/2005
6/13/2005
6/20/2005
6/27/2005
7/4/2005
7/11/2005
7/18/2005
7/25/2005
8/1/2005
8/8/2005
8/15/2005
8/22/2005
8/29/2005
9/5/2005
9/12/2005
9/19/2005
9/26/2005
10/3/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005

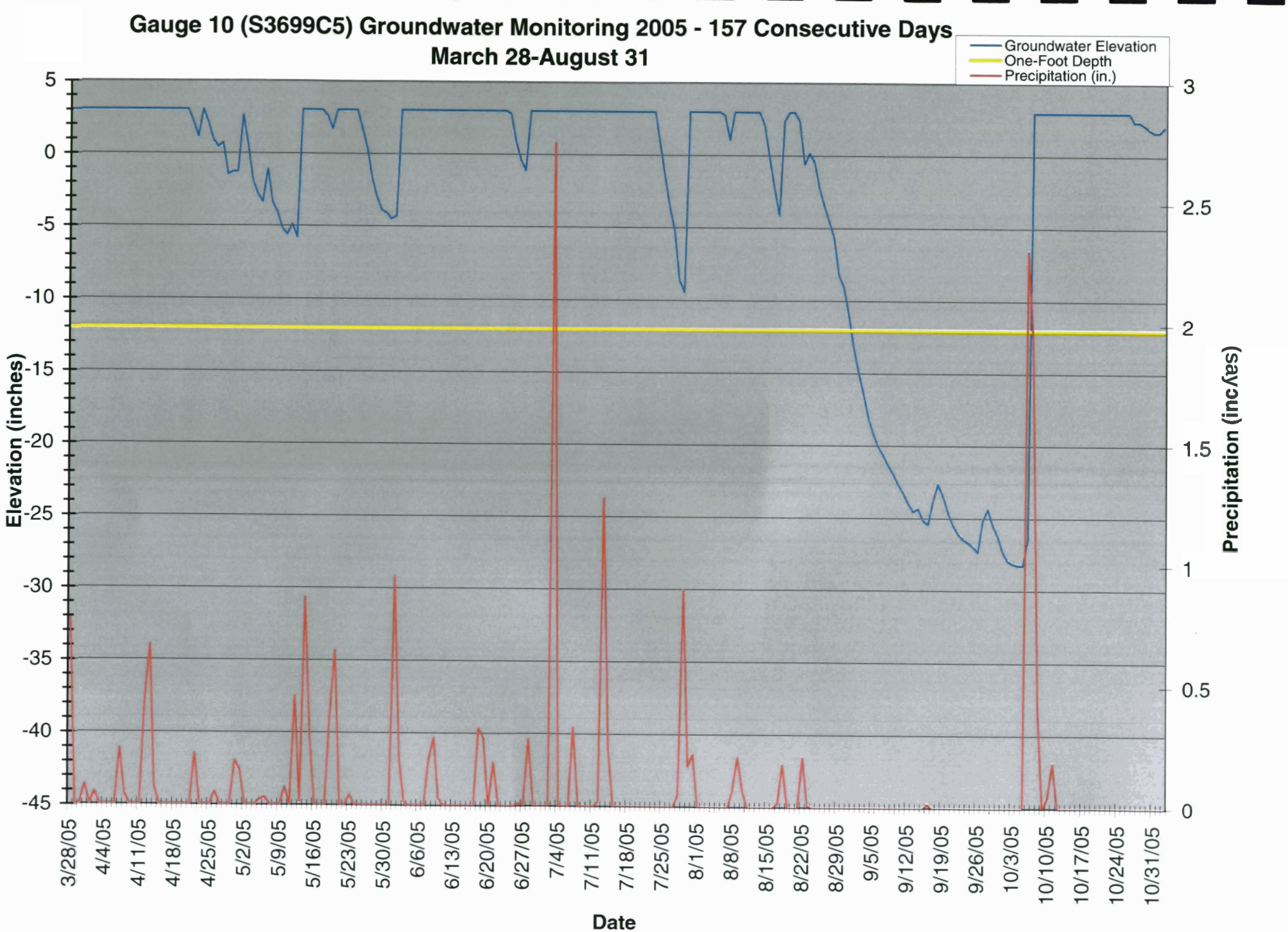

Gauge 5 (S51BCBF) Groundwater Monitoring 2005 - 222 Days
Entire Growing Season
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (Inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/2005
4/4/2005
4/11/2005
4/18/2005
4/25/2005
5/2/2005
5/9/2005
5/16/2005
5/23/2005
5/30/2005
6/6/2005
6/13/2005
6/20/2005
6/27/2005
7/4/2005
7/11/2005
7/18/2005
7/25/2005
8/1/2005
8/8/2005
8/15/2005
8/22/2005
8/29/2005
9/5/2005
9/12/2005
9/19/2005
9/26/2005
10/3/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005

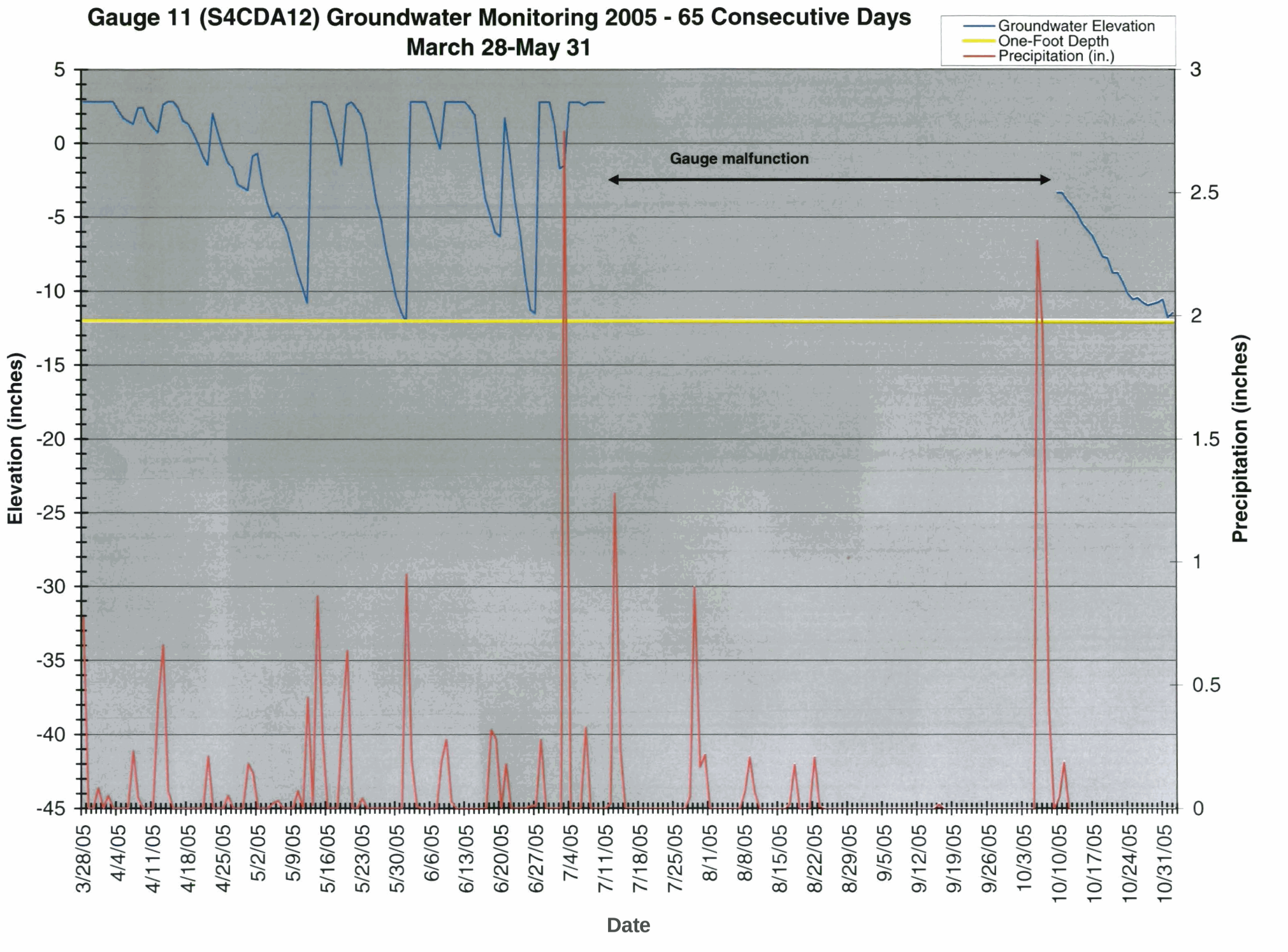

Gauge 6 (S369802) Groundwater Monitoring 2005 - 222 Consecutive Days
Entire Growing Season
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05

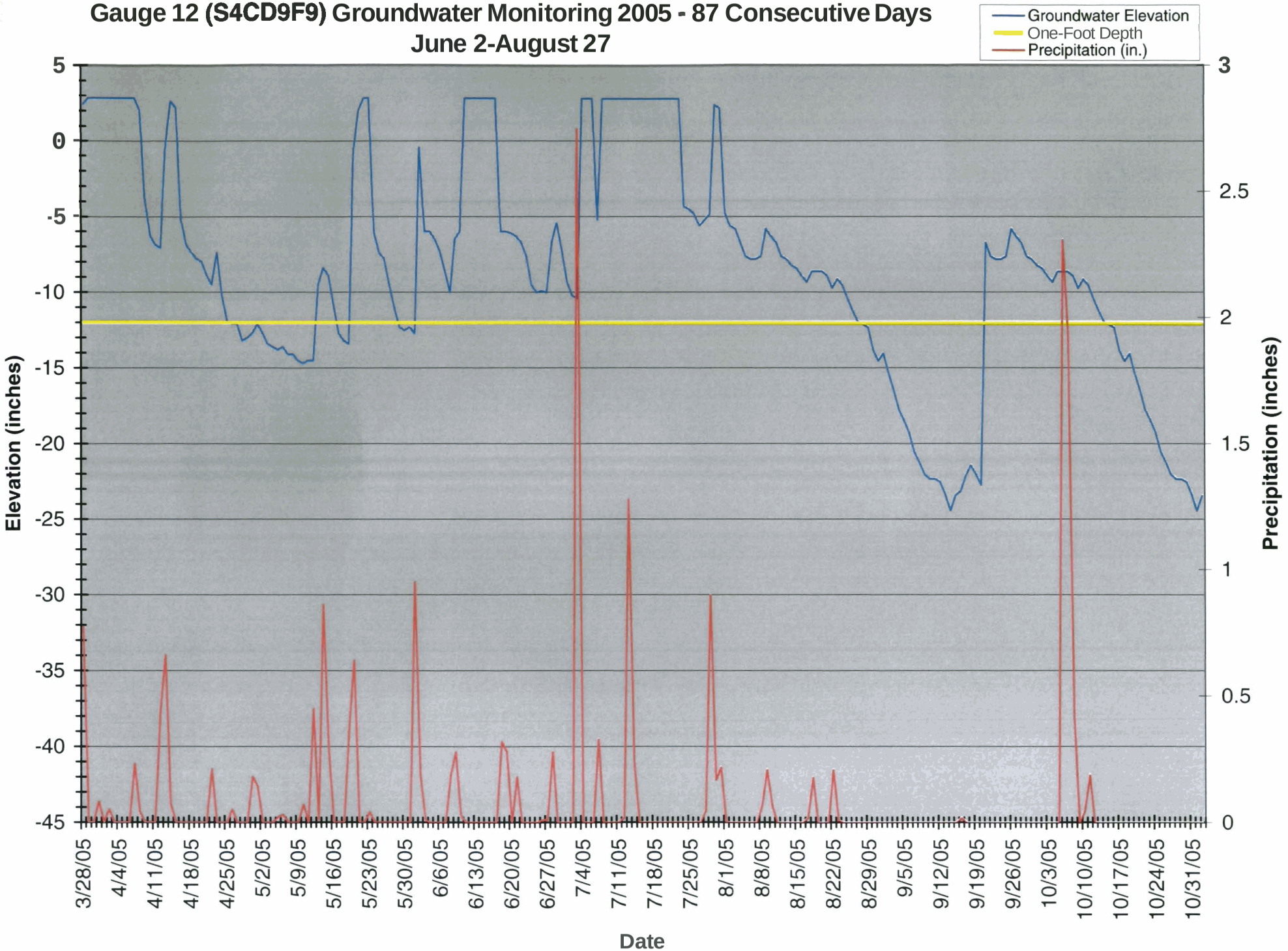

Gauge 7 (S21403E) Groundwater Monitoring 2005 - 44 Consecutive Days
July 3-August 14
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/2005
4/4/2005
4/11/2005
4/18/2005
4/25/2005
5/2/2005
5/9/2005
5/16/2005
5/23/2005
5/30/2005
6/6/2005
6/13/2005
6/20/2005
6/27/2005
7/4/2005
7/11/2005
7/18/2005
7/25/2005
8/1/2005
8/8/2005
8/15/2005
8/22/2005
8/29/2005
9/5/2005
9/12/2005
9/19/2005
9/26/2005
10/3/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005
Date

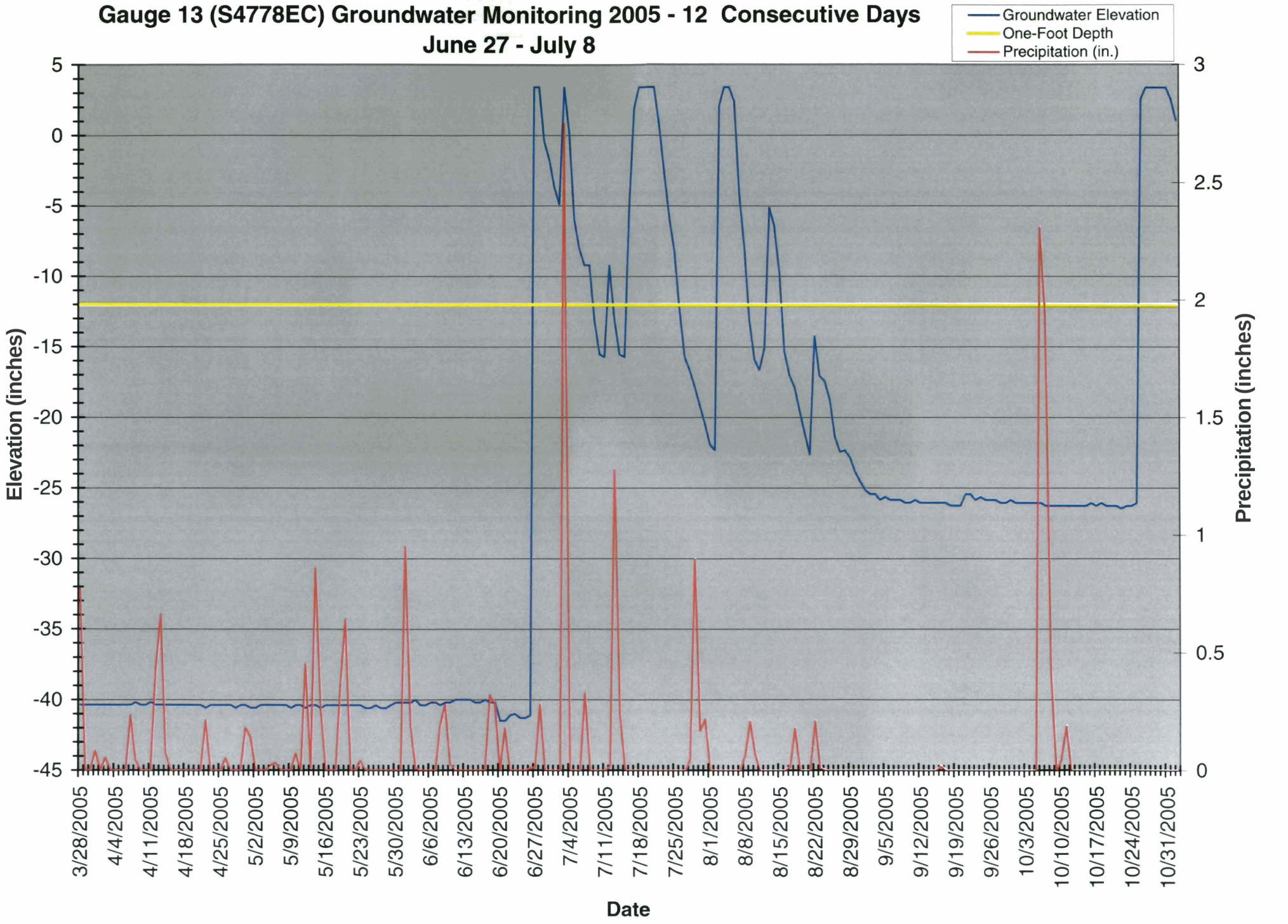

Gauge 8 (S369771) Groundwater Monitoring 2005 - 25 Consecutive Days
June 28-July 22
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05

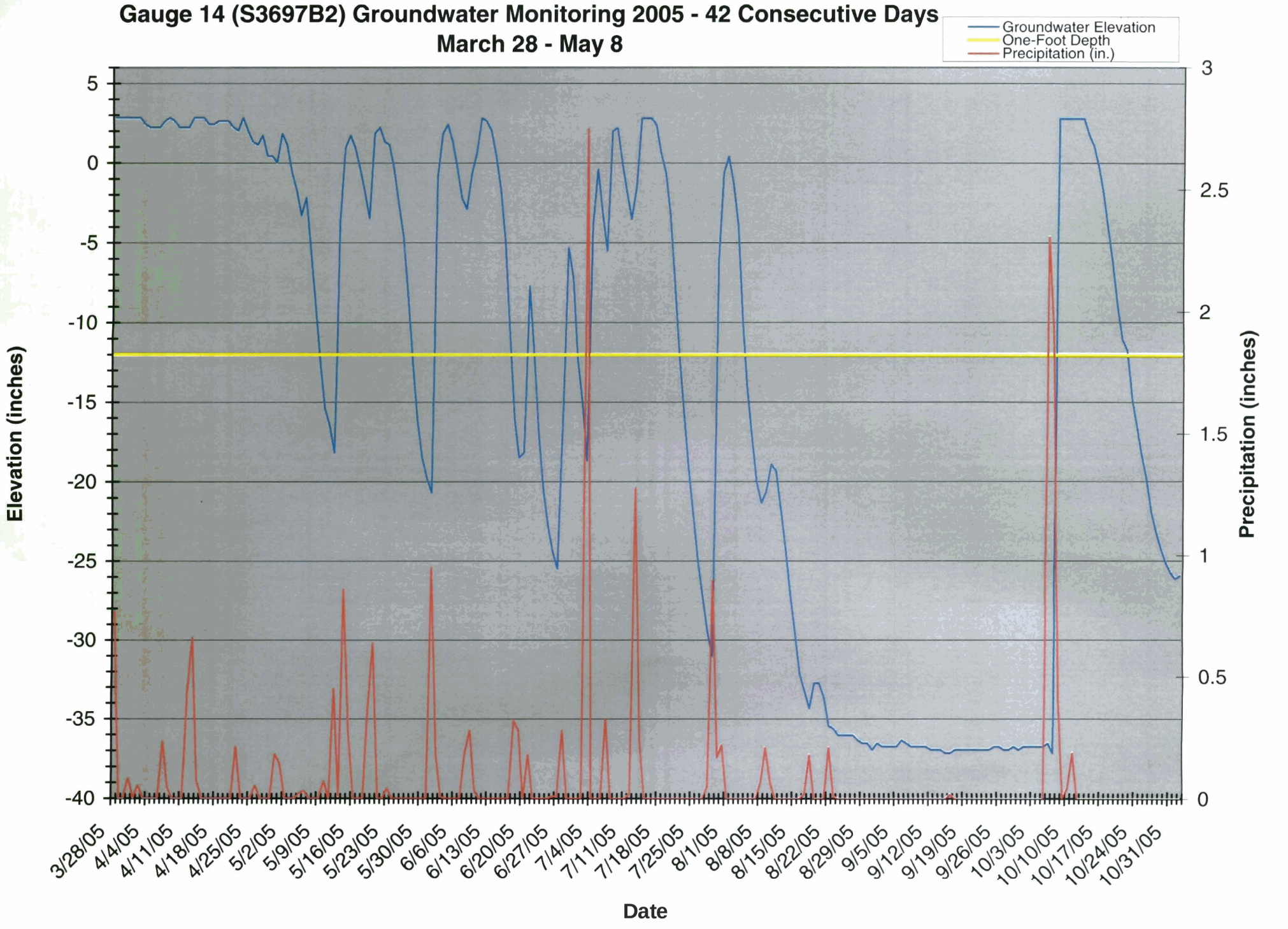

Gauge 9 (S369A86) Groundwater Monitoring 2005 - 222 Consecutive Days
Entire Growing Season
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/2005
4/4/2005
4/11/2005
4/18/2005
4/25/2005
5/2/2005
5/9/2005
5/16/2005
5/23/2005
5/30/2005
6/6/2005
6/13/2005
6/20/2005
6/27/2005
7/4/2005
7/11/2005
7/18/2005
7/25/2005
8/1/2005
8/8/2005
8/15/2005
8/22/2005
8/29/2005
9/5/2005
9/12/2005
9/19/2005
9/26/2005
10/3/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005

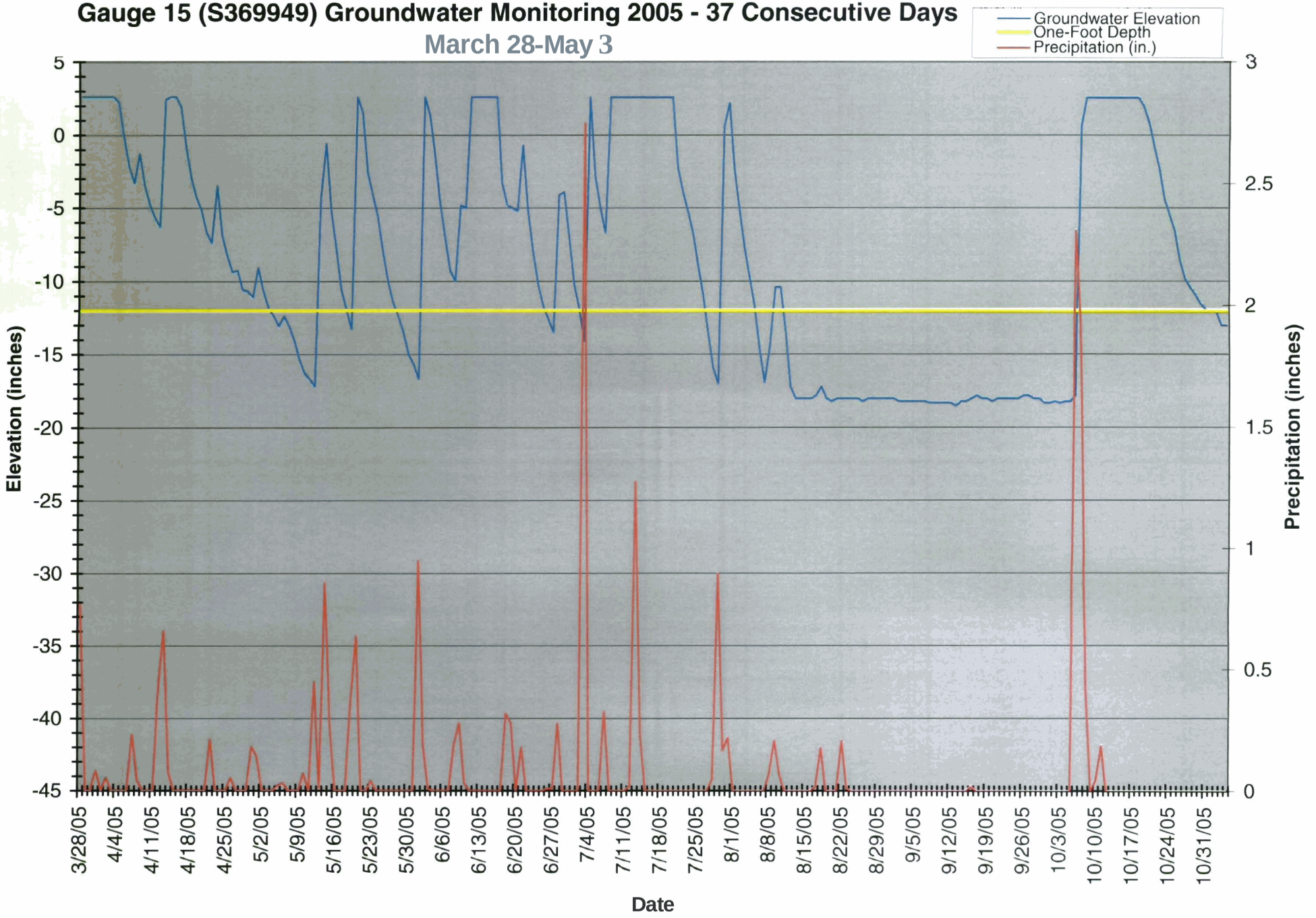

Gauge 10 (S3699C5) Groundwater Monitoring 2005 - 157 Consecutive Days
March 28-August 31
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05

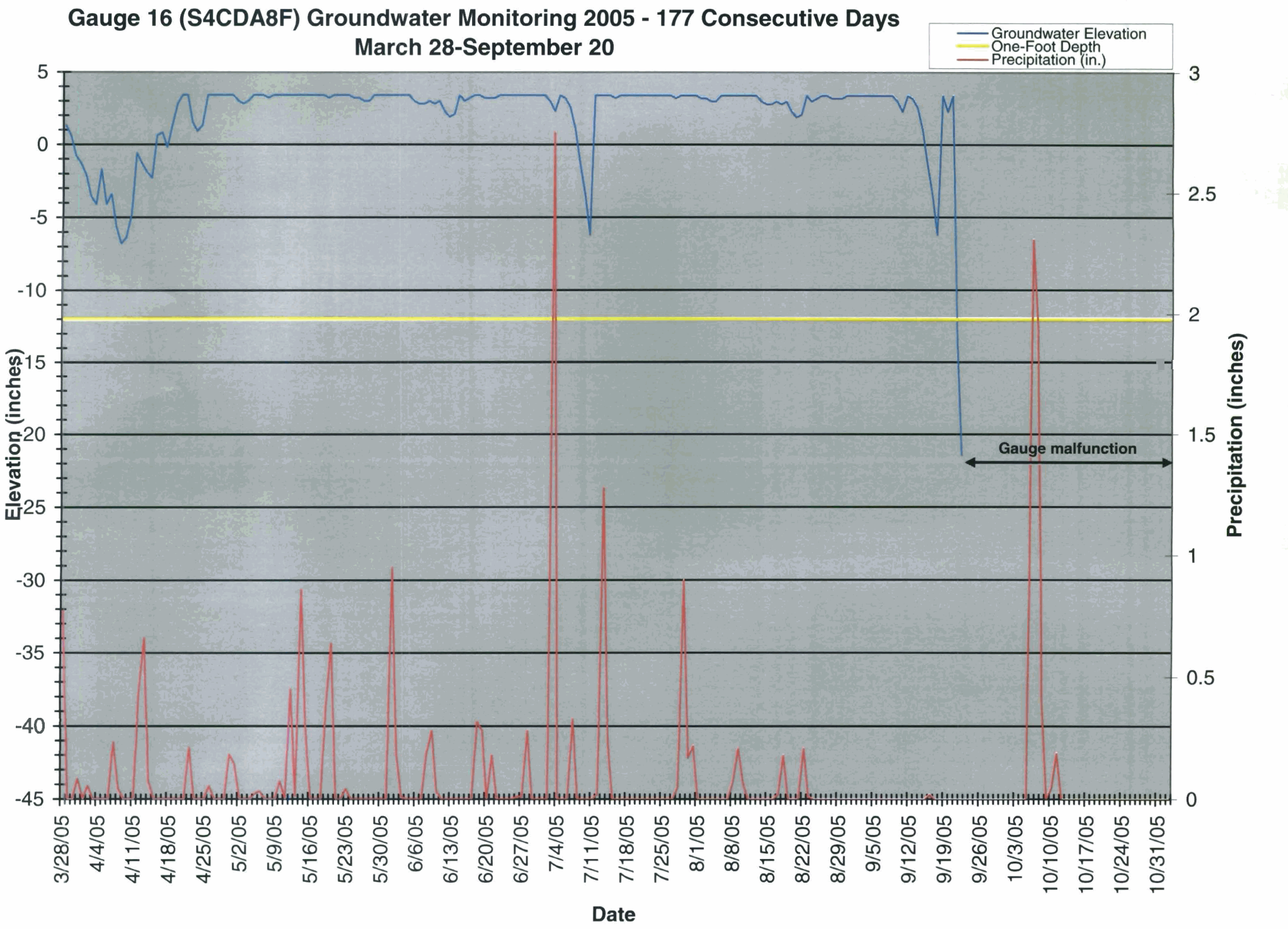

Gauge 11 (S4CDA12) Groundwater Monitoring 2005 - 65 Consecutive Days
March 28-May 31
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Gauge malfunction
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05

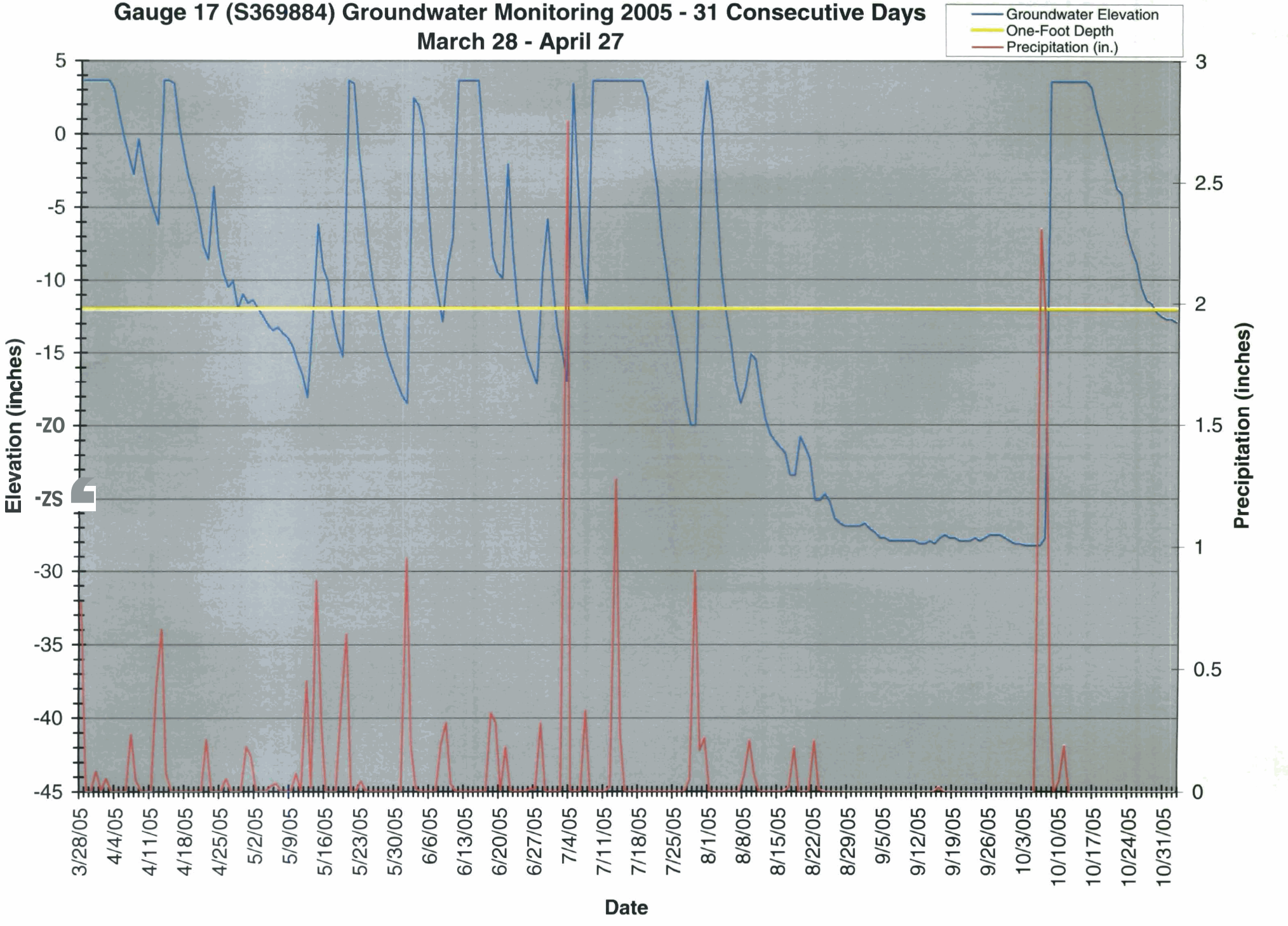

Gauge 12 (S4CD9F9) Groundwater Monitoring 2005 - 87 Consecutive Days
June 2-August 27
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05
Date

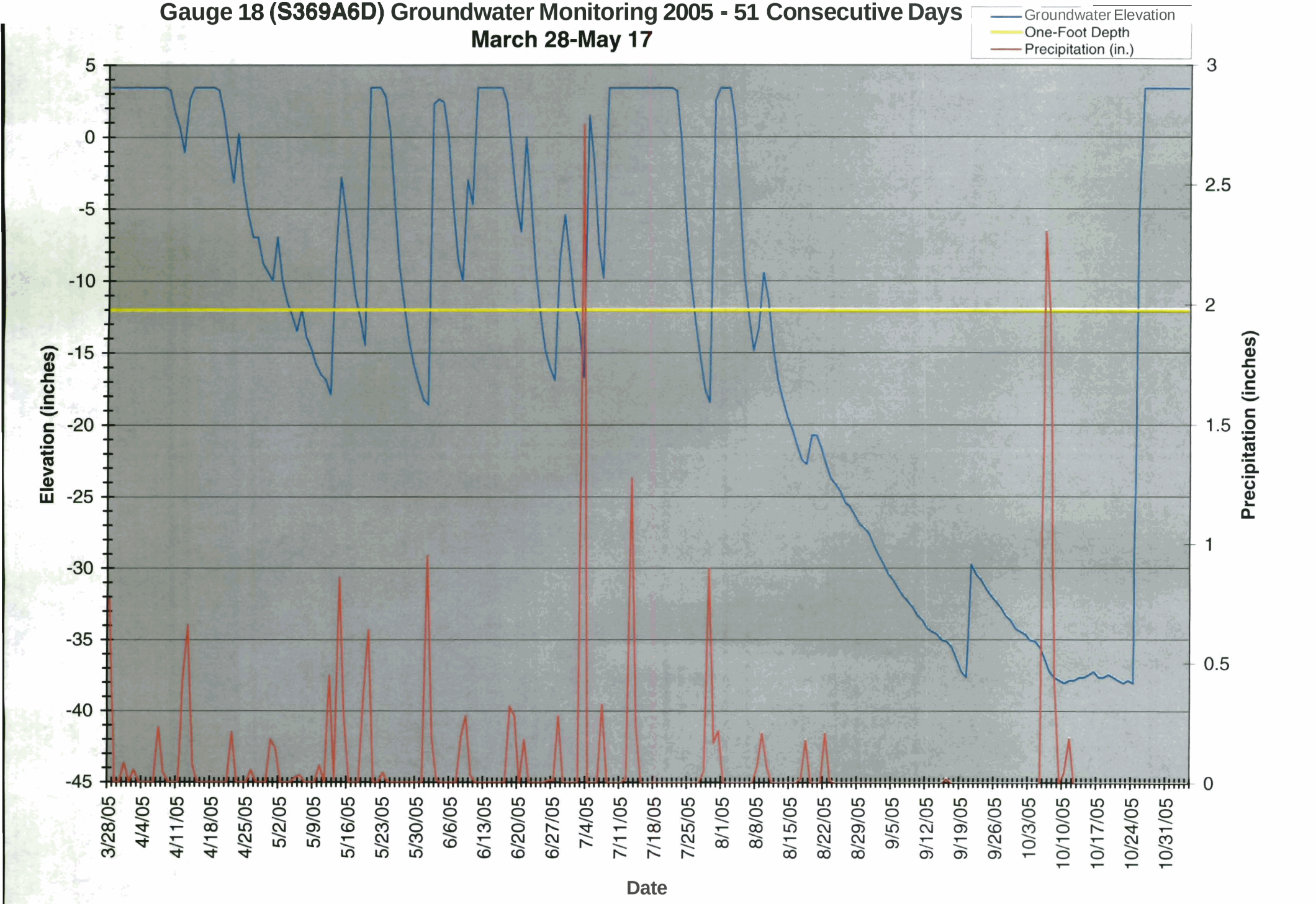

Gauge 13 (S4778EC) Groundwater Monitoring 2005 - 12 Consecutive Days
June 27 - July 8
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/2005
4/4/2005
4/11/2005
4/18/2005
4/25/2005
5/2/2005
5/9/2005
5/16/2005
5/23/2005
5/30/2005
6/6/2005
6/13/2005
6/20/2005
6/27/2005
7/4/2005
7/11/2005
7/18/2005
7/25/2005
8/1/2005
8/8/2005
8/15/2005
8/22/2005
8/29/2005
9/5/2005
9/12/2005
9/19/2005
9/26/2005
10/3/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005

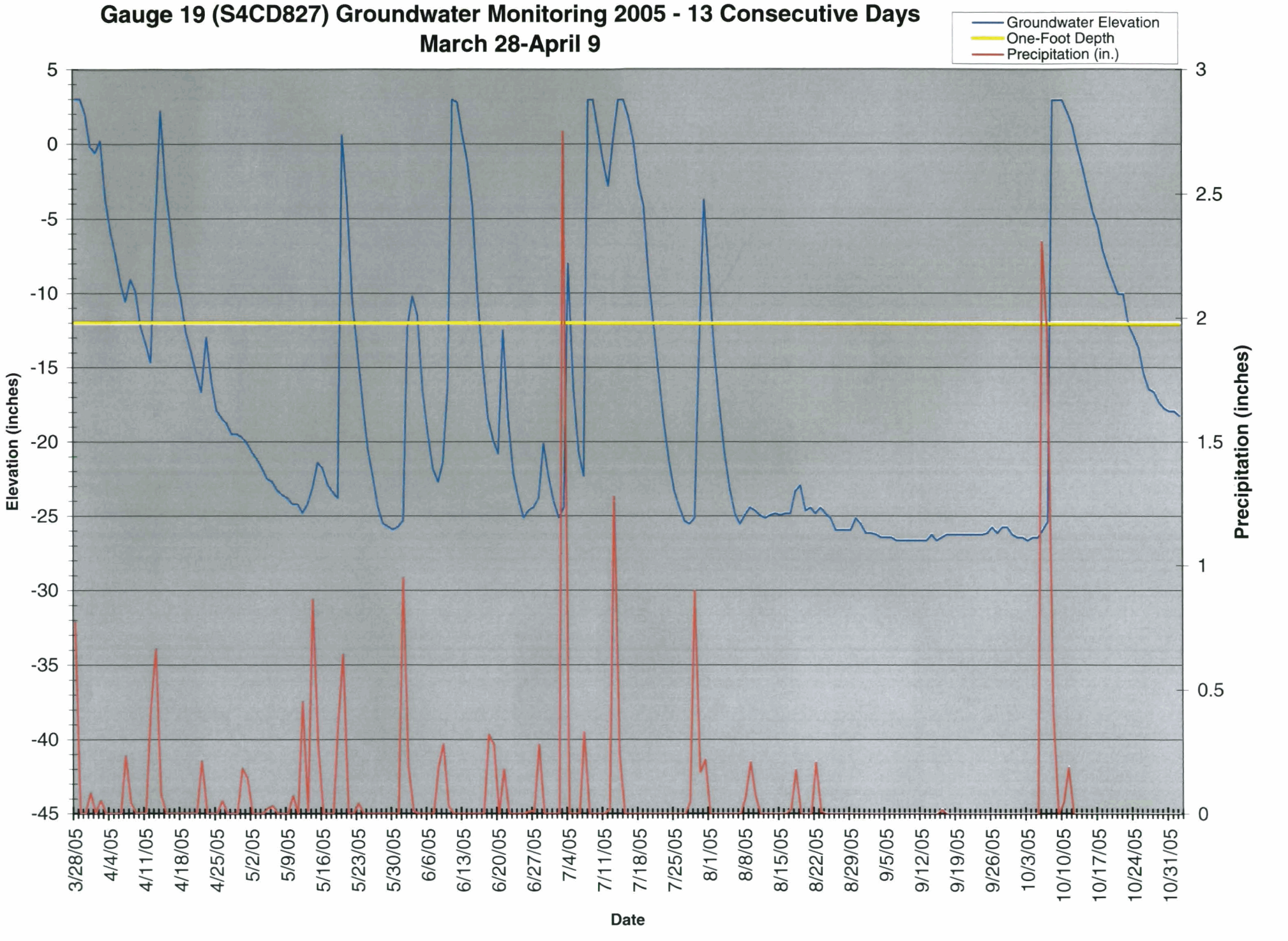

Gauge 14 (S3697B2) Groundwater Monitoring 2005 - 42 Consecutive Days
March 28 - May 8
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05
Date

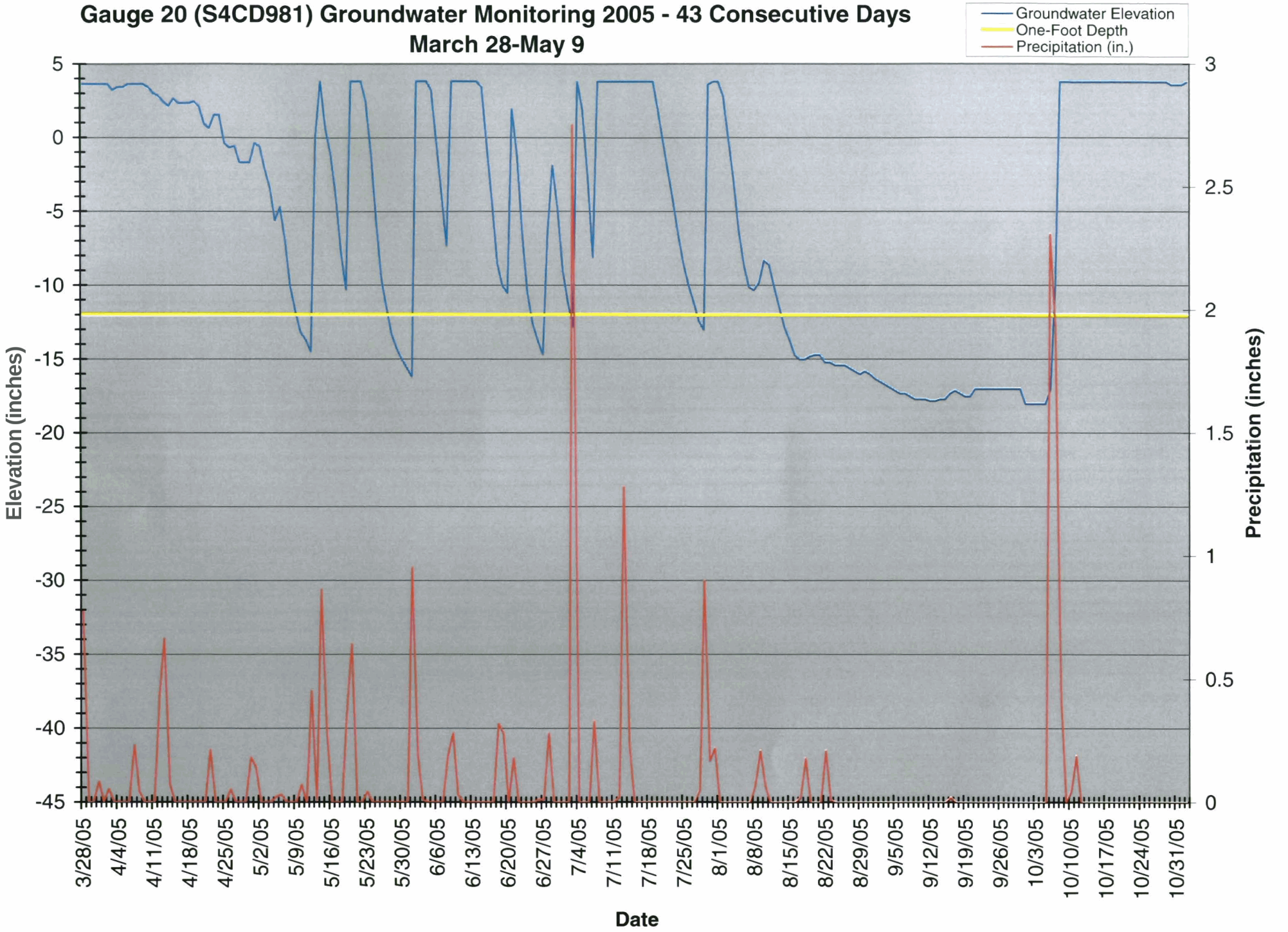

Gauge 15 (S369949) Groundwater Monitoring 2005 - 37 Consecutive Days
March 28-May 3
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05

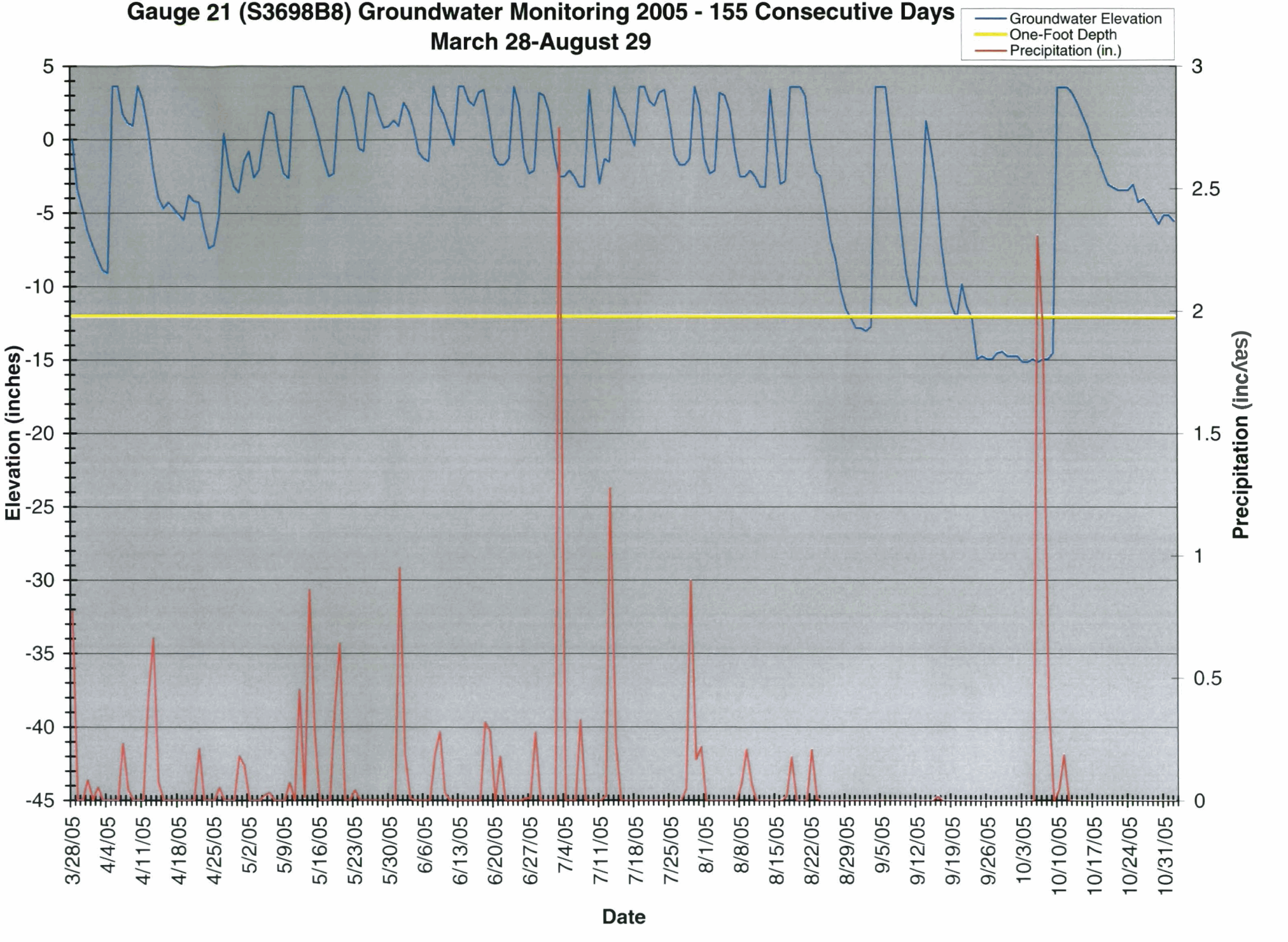

Gauge 16 (S4CDA8F) Groundwater Monitoring 2005 - 177 Consecutive Days
March 28-September 20
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Gauge malfunction
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05

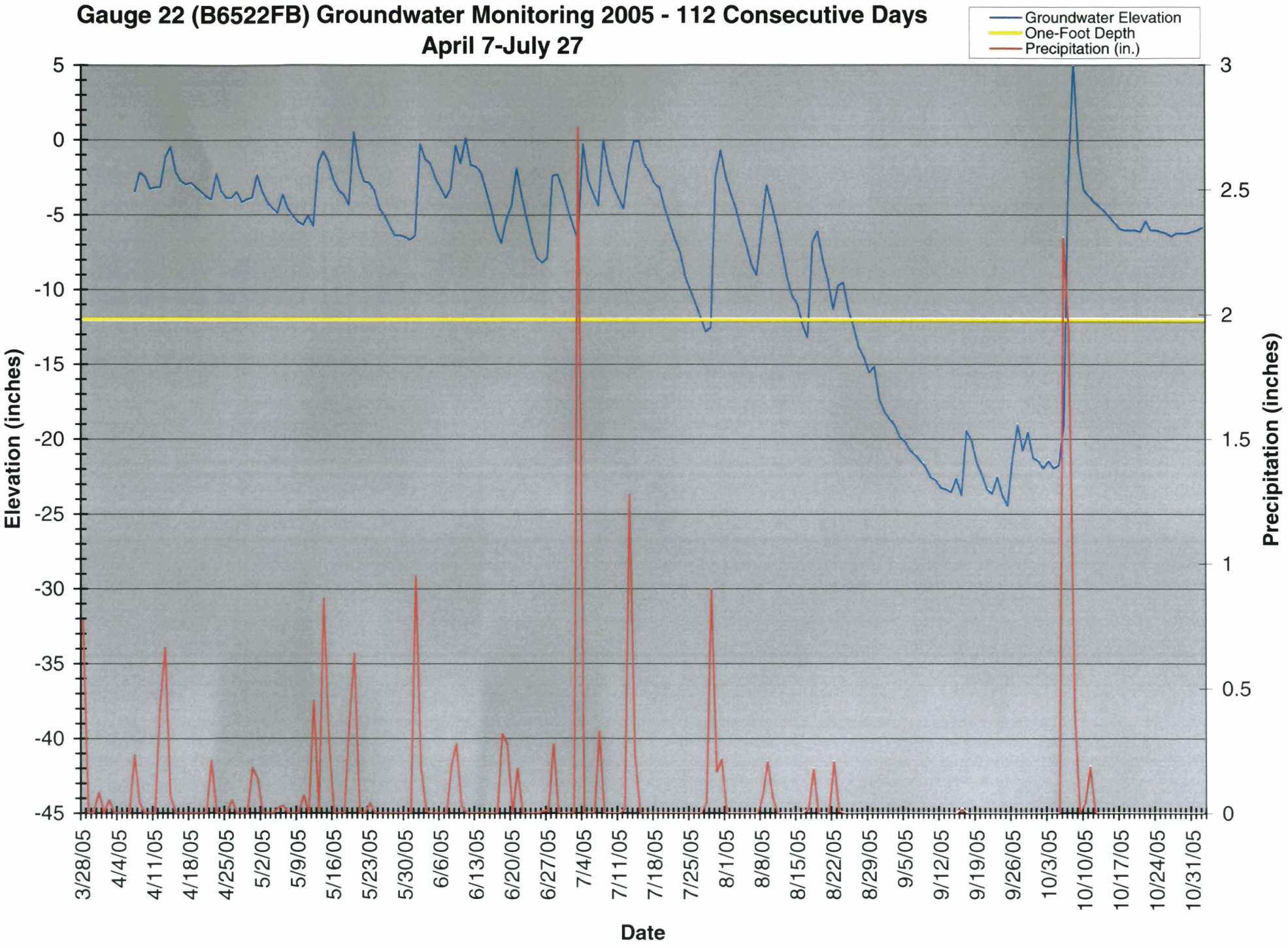

Gauge 17 (S369884) Groundwater Monitoring 2005 - 31 Consecutive Days
March 28 - April 27
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05

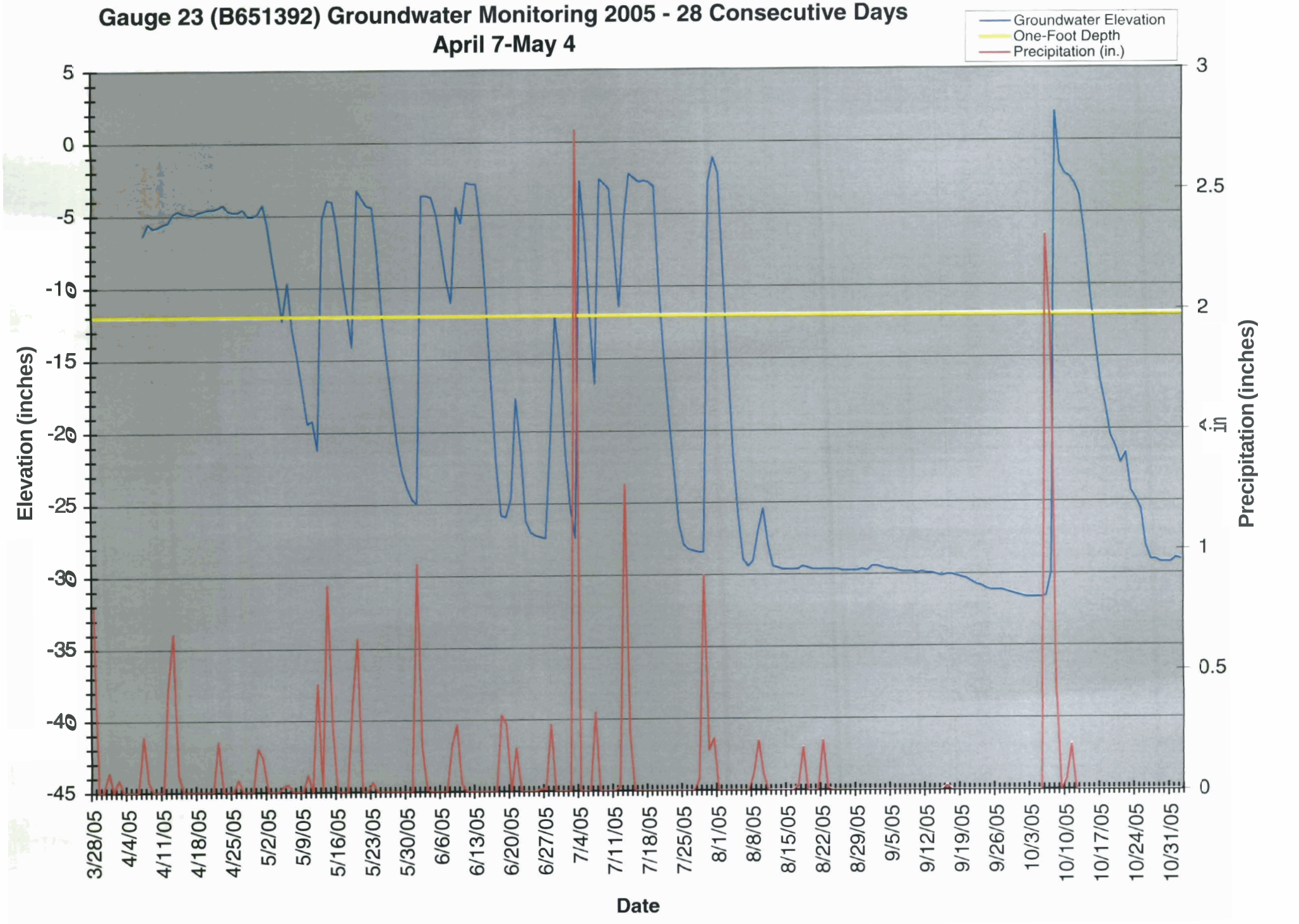

Gauge 18 (S369A6D) Groundwater Monitoring 2005 - 51 Consecutive Days
March 28-May 17
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05

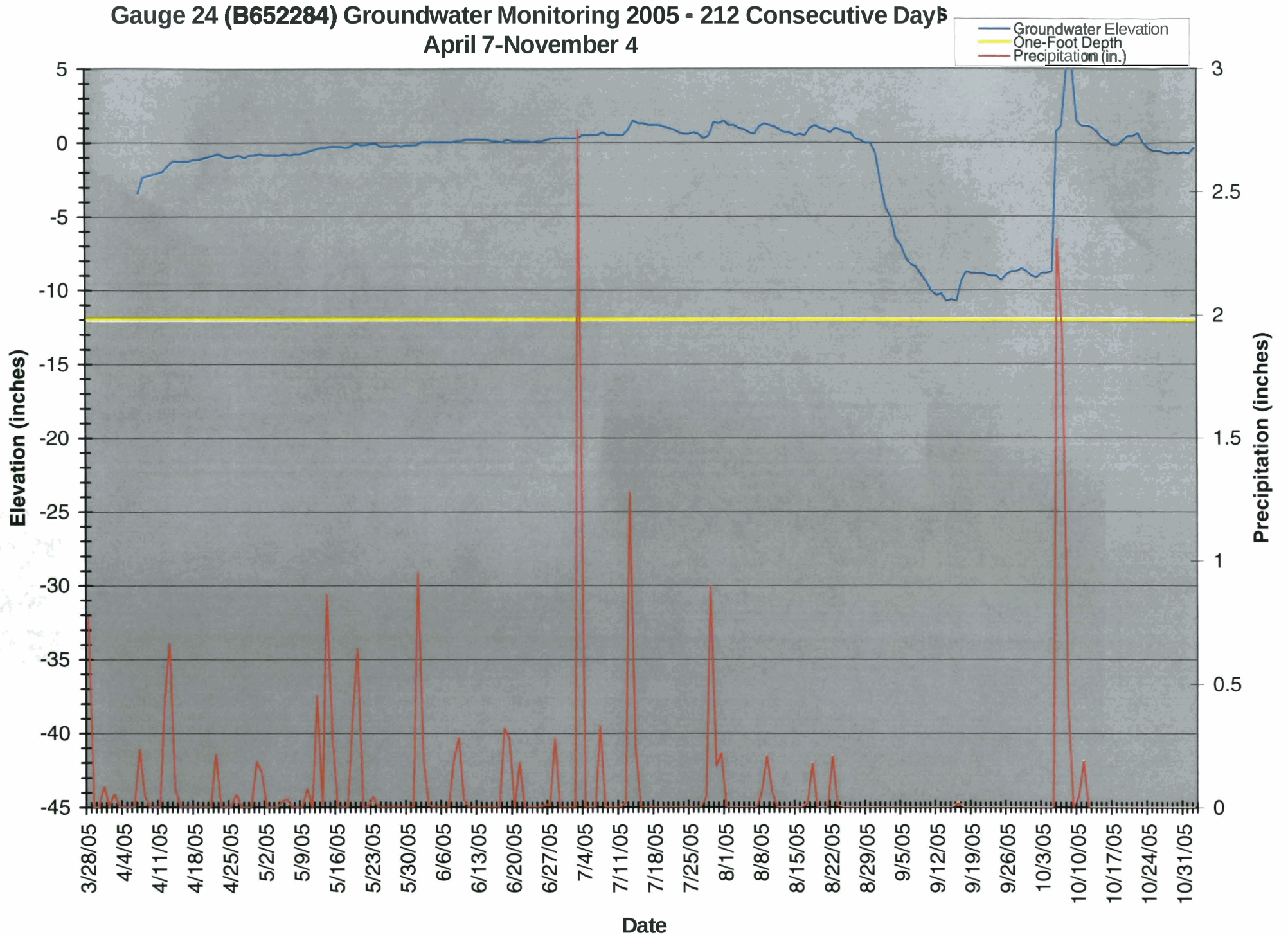

Gauge 19 (S4CD827) Groundwater Monitoring 2005 - 13 Consecutive Days
March 28-April 9
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05

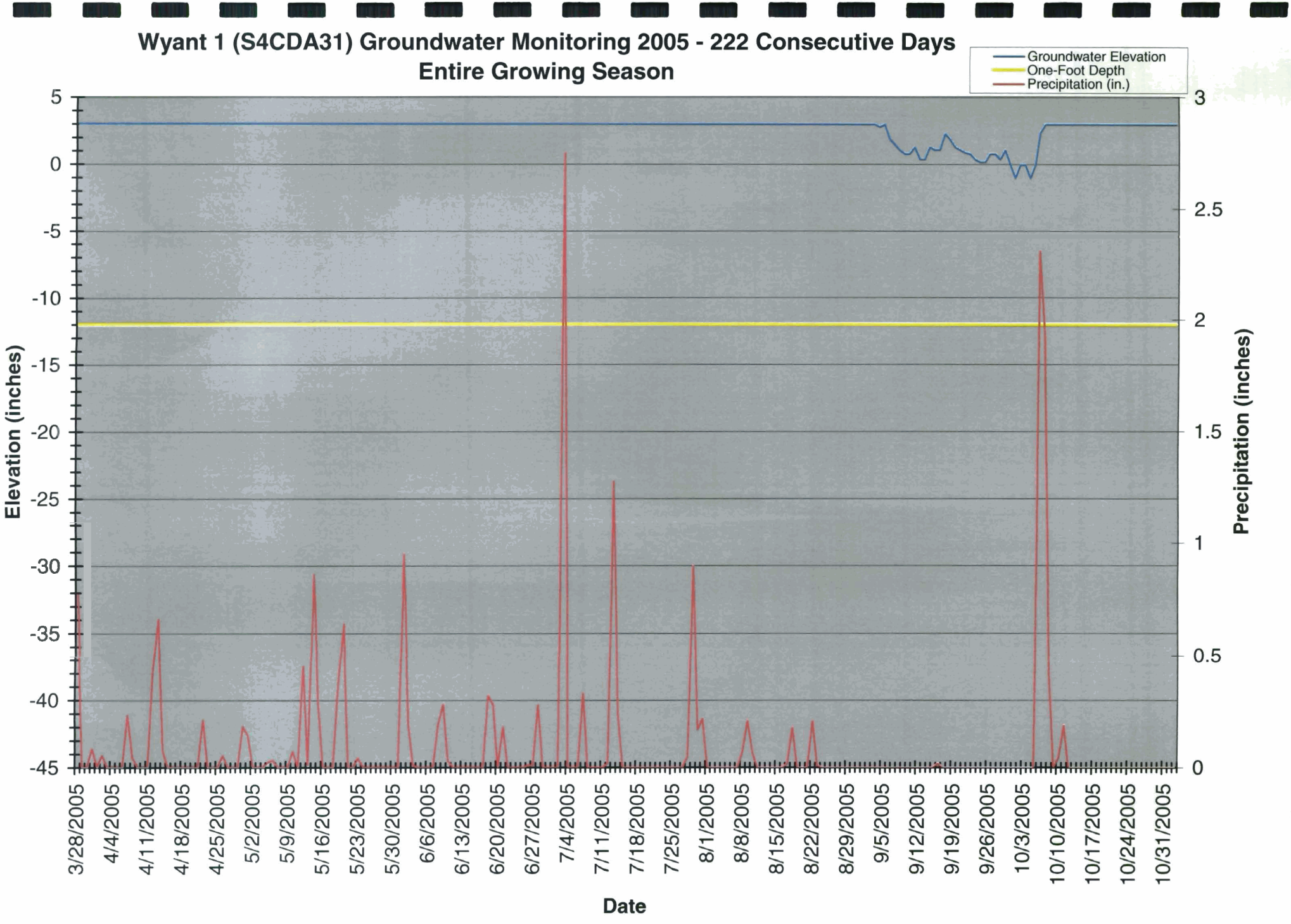

Gauge 20 (S4CD981) Groundwater Monitoring 2005 - 43 Consecutive Days
March 28-May 9
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05
Date

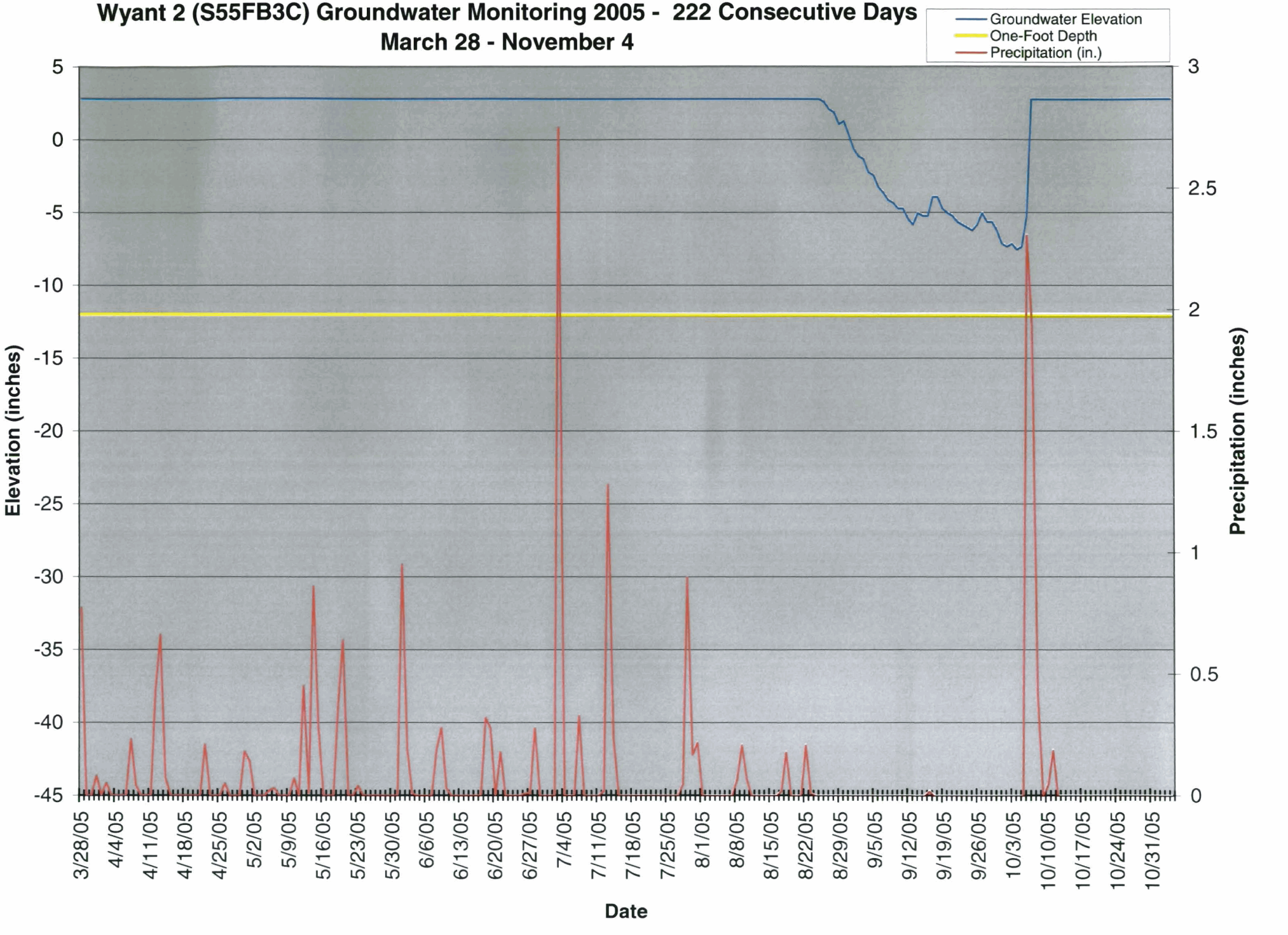

Gauge 21 (S3698B8) Groundwater Monitoring 2005 - 155 Consecutive Days
March 28-August 29
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05


Gauge 22 (B6522FB) Groundwater Monitoring 2005 - 112 Consecutive Days
April 7-July 27
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05


Gauge 23 (B651392) Groundwater Monitoring 2005 - 28 Consecutive Days
April 7-May 4
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05


Gauge 24 (B652284) Groundwater Monitoring 2005 - 212 Consecutive Days
April 7-November 4
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05
Date


Wyant 1 (S4CDA31) Groundwater Monitoring 2005 - 222 Consecutive Days
Entire Growing Season
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/2005
4/4/2005
4/11/2005
4/18/2005
4/25/2005
5/2/2005
5/9/2005
5/16/2005
5/23/2005
5/30/2005
6/6/2005
6/13/2005
6/20/2005
6/27/2005
7/4/2005
7/11/2005
7/18/2005
7/25/2005
8/1/2005
8/8/2005
8/15/2005
8/22/2005
8/29/2005
9/5/2005
9/12/2005
9/19/2005
9/26/2005
10/3/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005
Date


Wyant 2 (S55FB3C) Groundwater Monitoring 2005 - 222 Consecutive Days
March 28 - November 4
Groundwater Elevation
One-Foot Depth
Precipitation (in.)
Elevation (inches)
Precipitation (inches)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
3
2.5
2
1.5
1
0.5
0
3/28/05
4/4/05
4/11/05
4/18/05
4/25/05
5/2/05
5/9/05
5/16/05
5/23/05
5/30/05
6/6/05
6/13/05
6/20/05
6/27/05
7/4/05
7/11/05
7/18/05
7/25/05
8/1/05
8/8/05
8/15/05
8/22/05
8/29/05
9/5/05
9/12/05
9/19/05
9/26/05
10/3/05
10/10/05
10/17/05
10/24/05
10/31/05
Date

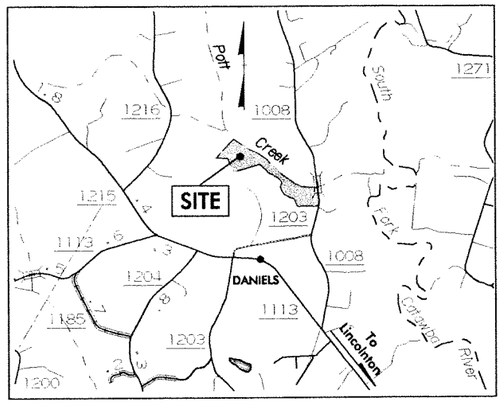
APPENDIX C

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-9999WM	1	1
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	
8.1777741			

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

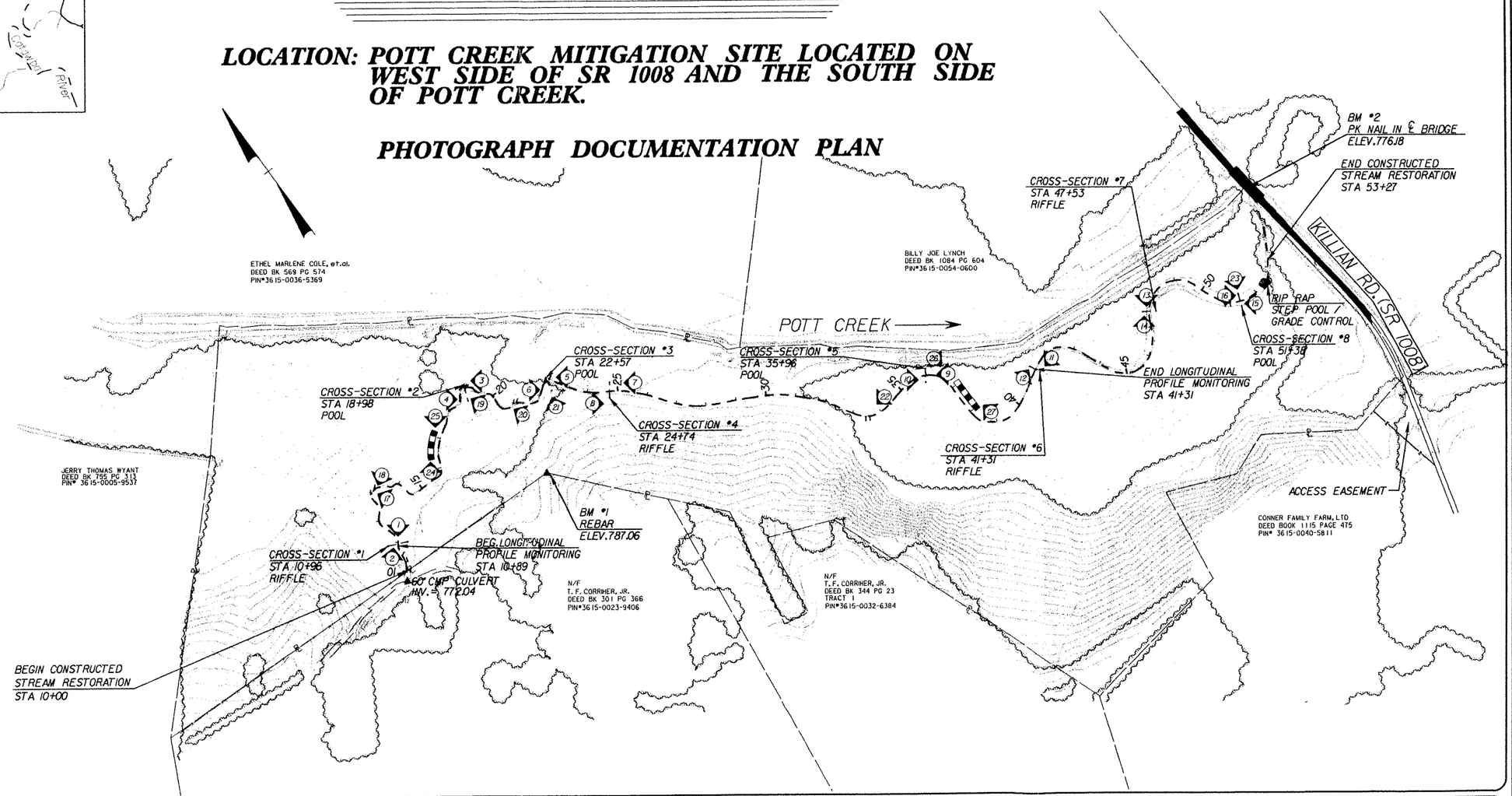
LINCOLN COUNTY

LOCATION: POTT CREEK MITIGATION SITE LOCATED ON WEST SIDE OF SR 1008 AND THE SOUTH SIDE OF POTT CREEK.



VICINITY MAP
NOT TO SCALE

PHOTOGRAPH DOCUMENTATION PLAN



LEGEND

- ROOT WAD
- (00) PHOTOGRAPH NO. & ORIENTATION
- 1–16 MONITORING CROSS SECTIONS
- 17–23 STRUCTURES (ROOT WADS)
- 24–27 STREAM VEGETATION PLOTS

0' 500'
SCALE:

PROJECT AREA

TOTAL WETLAND MITIGATION = 37.89 Ac

LENGTH OF STREAM RESTORATION = 4327 ft.

RK&K

PLANS PREPARED BY :
RUMMEL, KLEPPER & KAHL, LLP
consulting engineers
5800 FARINGDON PLACE, SUITE 105
RALEIGH, NORTH CAROLINA 27609

FOR
DIVISION OF HIGHWAYS

10 YEARS 1991-2001

PROPERTY OWNED BY :
CATAWBA LANDS CONSERVANCY

NOTES:
1. BOUNDARY INFORMATION TAKEN FROM PLAT ENTITLED "MARSH RESOURCES, INC., BOUNDARY SURVEY" PREPARED BY WILKINS & ASSOCIATES, MOORESVILLE, NC AND DATED 31 JANUARY 2000
2. CONTOURS SHOWN ARE A COMPILATION OF AERIAL PHOTOGRAPHY DATA PREPARED BY GEODATA CORP. DATED JUNE 20, 2002 AND DETAILED CHANNEL SURVEY PERFORMED BY RK&K ENGINEERS

DATE: DECEMBER 16, 2003

R-9999WM

PROJECT: 8.1777741

PROJECT: 8.1777741 R-9999WM PHOTO DOCUMENTATION

POTT CREEK MITIGATION SITE - MONITORING PHOTOGRAPHS

01. Looking u/s at XSC 1

03. Looking u/s at XSC 2

02. Looking d/s from XSC 1

04. Looking d/s from XSC 2

POTT CREEK MITIGATION SITE - MONITORING PHOTOGRAPHS

05. Looking u/s at XSC 3

07. Looking u/s at XSC 4

06. Looking d/s from XSC 3

08. Looking d/s from XSC 4

POTT CREEK MITIGATION SITE - MONITORING PHOTOGRAPHS

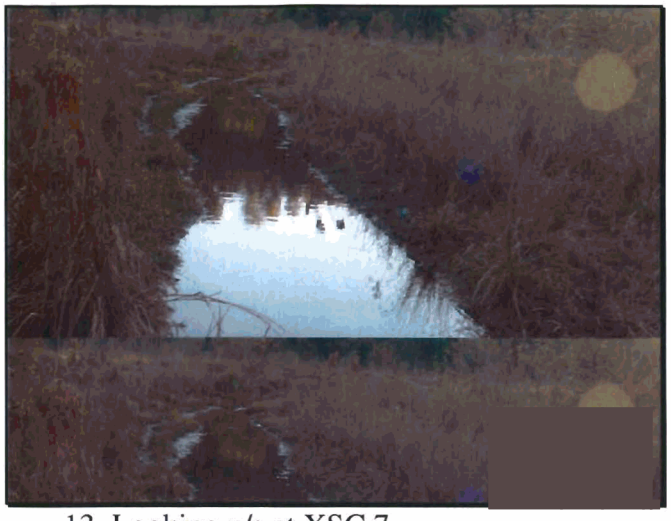
09. Looking u/s at XSC 5

11. Looking u/s at XSC 6

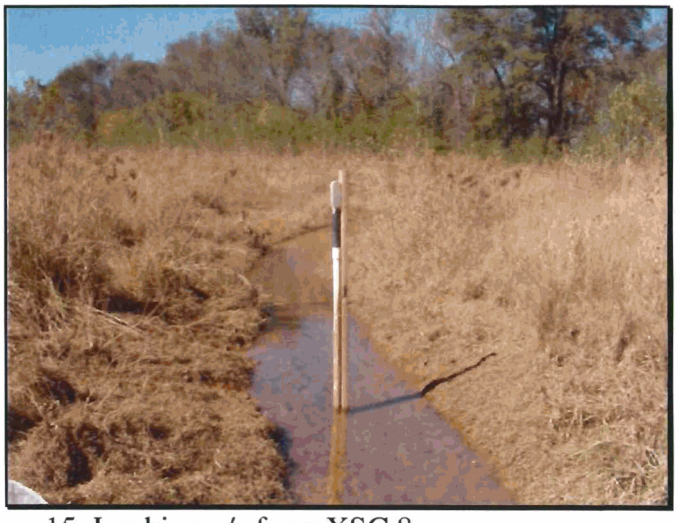
10. Looking d/s from XSC 5

12. Looking d/s from XSC 6

POTT CREEK MITIGATION SITE - MONITORING PHOTOGRAPHS



13. Looking u/s at XSC 7



15. Looking u/s from XSC 8

14. Looking d/s from XSC 7

16. Looking d/s from XSC 8

POTT CREEK MITIGATION SITE - MONITORING PHOTOGRAPHS

17. Root wads at sta. 13+00 looking d/s

19. Root wads at XSC 2 looking u/s

18. Root wads at sta. 13+00 looking u/s

20. Root wads at sta. 21+00 looking u/s

POTT CREEK MITIGATION SITE - MONITORING PHOTOGRAPHS

21. Root wads at XSC 3

23. Root wads at sta. 51+00

22. Root wads at sta. 33+50

POTT CREEK MITIGATION SITE - MONITORING PHOTOGRAPHS

24. At the upstream stake, looking d/s

26. At the upstream stake, looking d/s

25. At the downstream stake, looking u/s

27. At the downstream stake, looking u/s

F:\WORD\DOCUMENT\300-039
\Monitoring Reports\2005\2005_mont_photo_6.doc

APPENDIX D

R–9999WM

PROJECT: 8.1777741

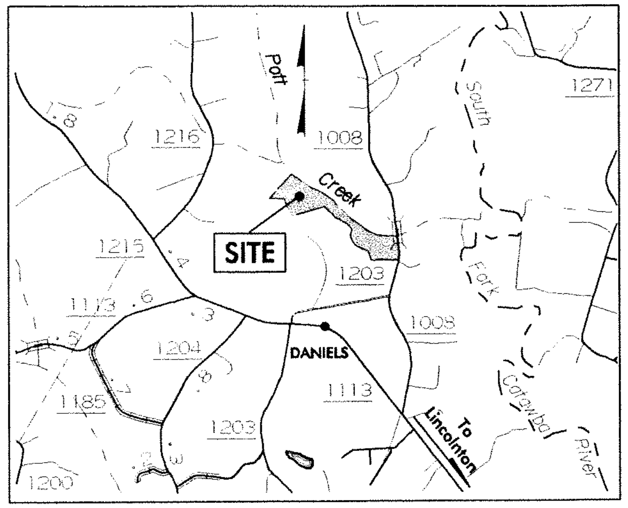
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R–9999WM	1	1
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
8.1777741			

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

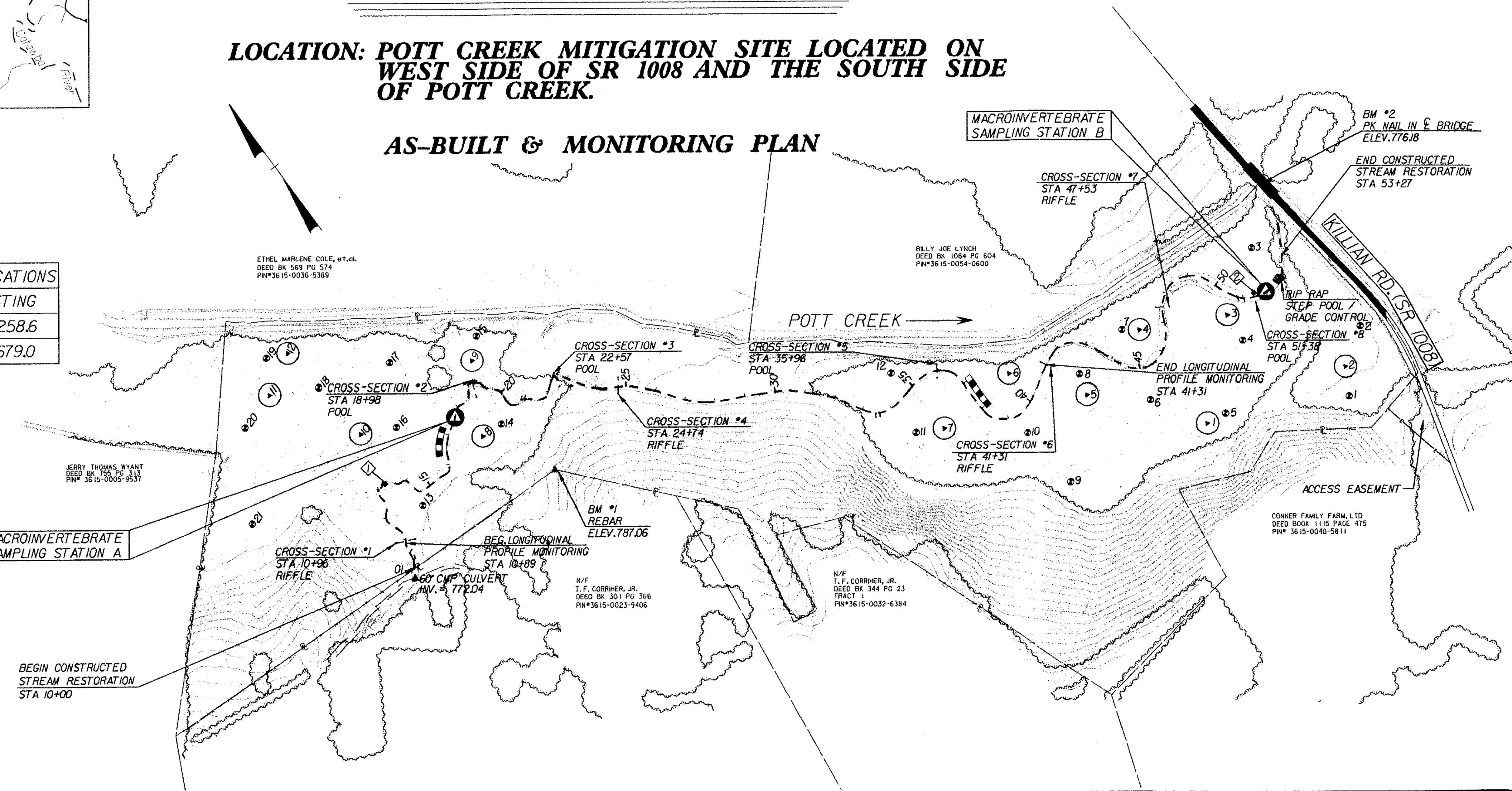
LINCOLN COUNTY

LOCATION: POTT CREEK MITIGATION SITE LOCATED ON WEST SIDE OF SR 1008 AND THE SOUTH SIDE OF POTT CREEK.

AS–BUILT & MONITORING PLAN



VICINITY MAP
NOT TO SCALE



MACROINVERTEBRATE SAMPLING LOCATIONS		
STATION	NORTHING	EASTING
A	654364.6	1313258.6
B	653103.9	1315679.0

LEGEND

- MONITORING GUAGE
- VEGETATION MONITORING PLOT (37.2' R = 0.1 AC)
- STREAM GAUGE
- ROOT WAD
- MACROINVERTEBRATE SAMPLING LOCATIONS
- STREAM VEGETATION MONITORING PLOT

0' 500'
SCALE:

PROJECT AREA

TOTAL WETLAND MITIGATION = 37.89 Ac

LENGTH OF STREAM RESTORATION = 4327 ft.

PLANS PREPARED BY :
RUMMEL, KLEPPER & KAHL, LLP
consulting engineers
5800 FARINGDON PLACE, SUITE 105
RALEIGH, NORTH CAROLINA 27609

FOR
DIVISION OF HIGHWAYS

PROPERTY OWNED BY :
CATAWBA LANDS CONSERVANCY

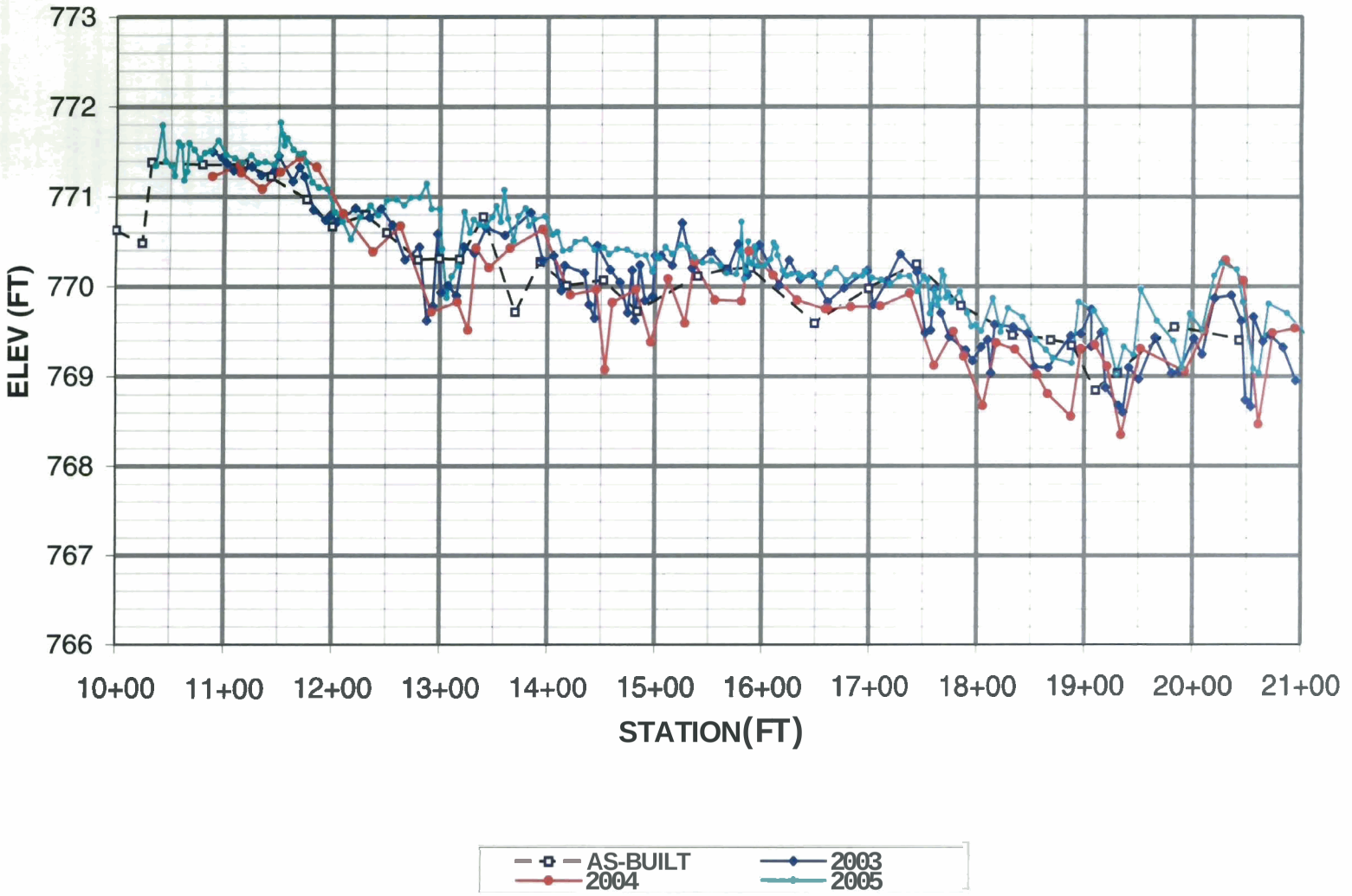
NOTES:
1. BOUNDARY INFORMATION TAKEN FROM PLAT ENTITLED "MARSH RESOURCES, INC. BOUNDARY SURVEY" PREPARED BY WILKINS & ASSOCIATES, MOORESVILLE, NC AND DATED 31 JANUARY 2000
2. CONTOURS SHOWN ARE A COMPILATION OF AERIAL PHOTOGRAPHY DATA PREPARED BY GEODATA CORP. DATED JUNE 20, 2002 AND DETAILED CHANNEL SURVEY PERFORMED BY RK&K ENGINEERS

DATE: DECEMBER 16, 2003

APPENDIX E

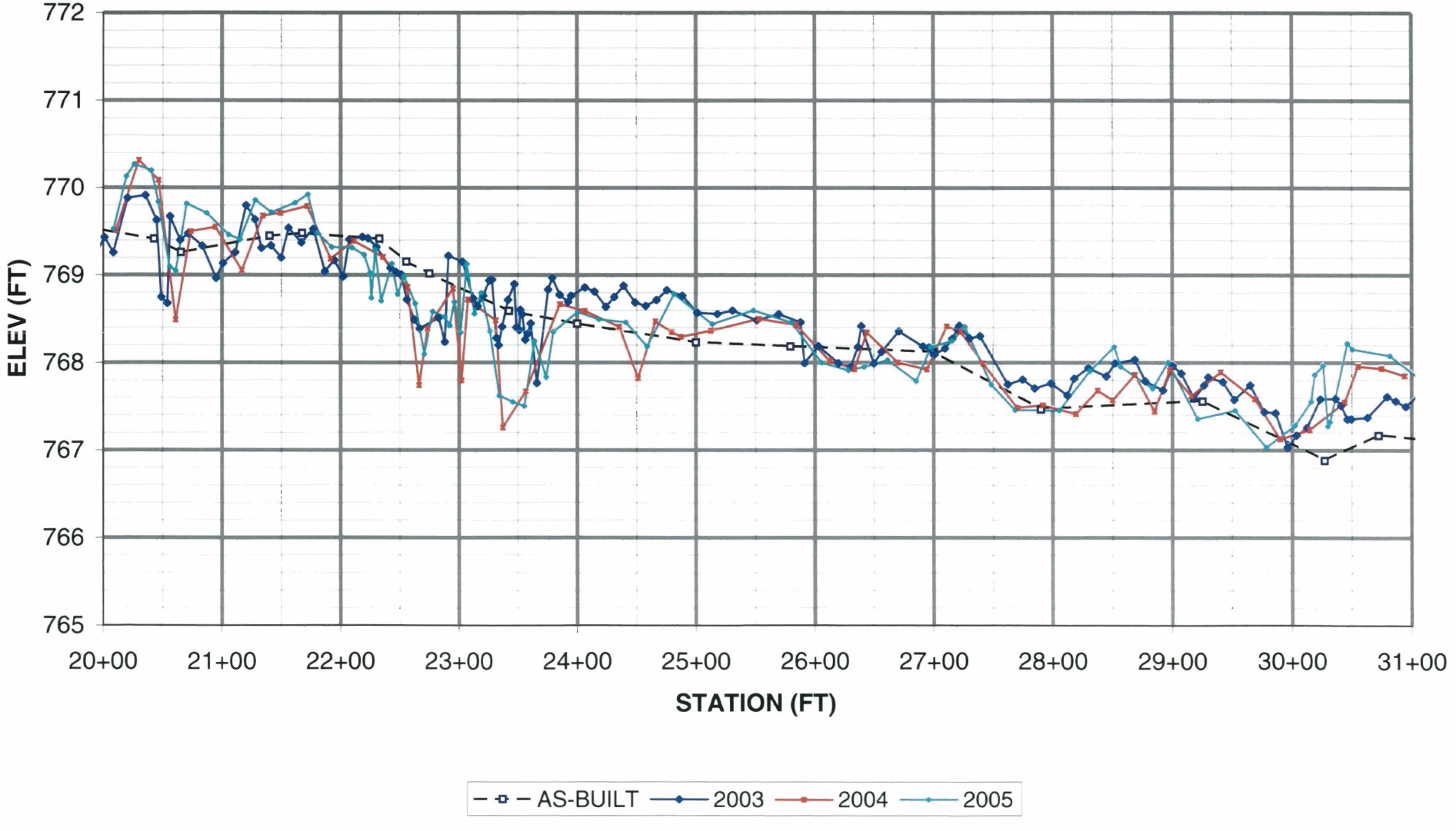
STREAM PROFILES

1 OF 3



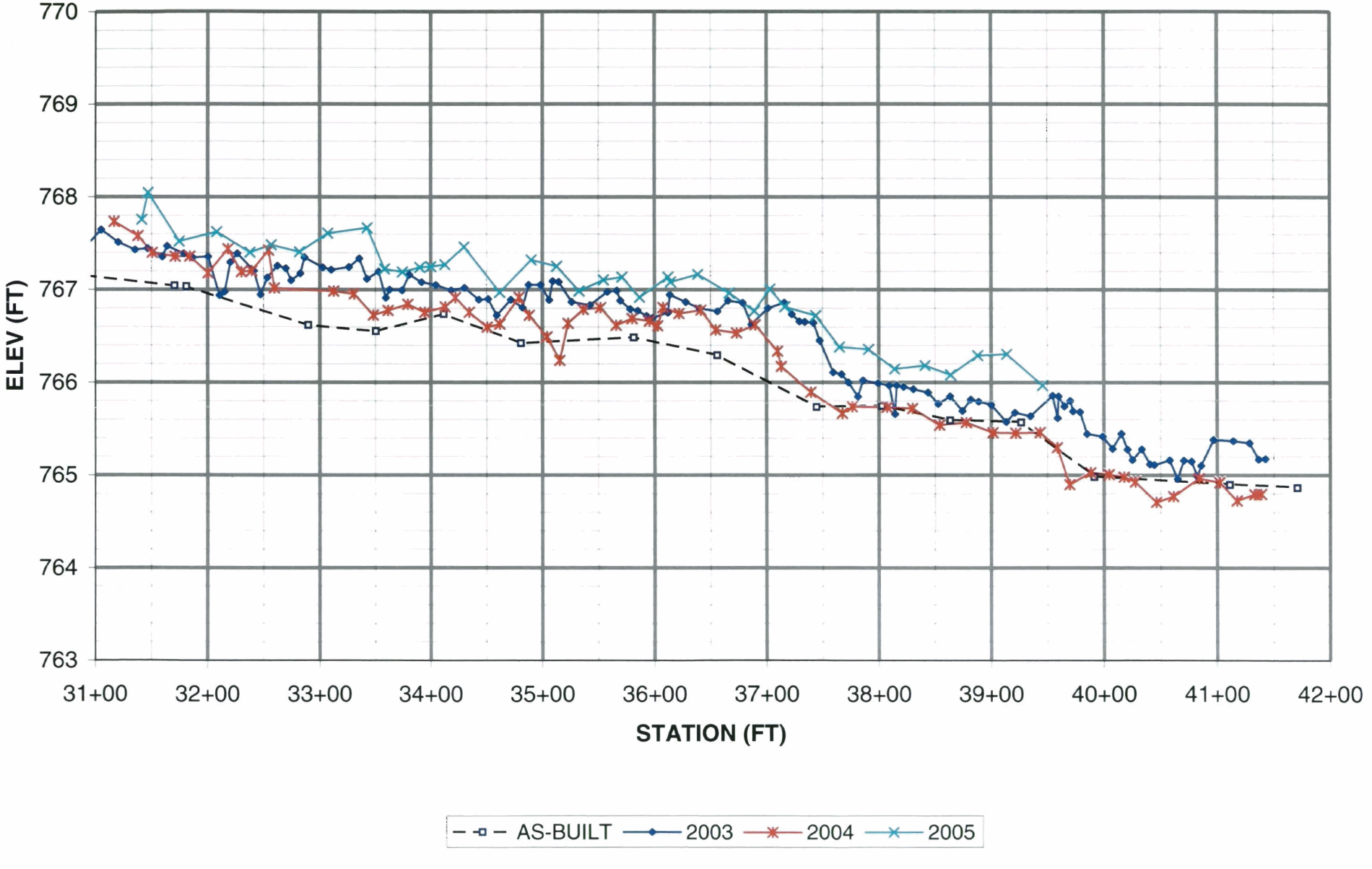
STREAM PROFILES

2 OF 3



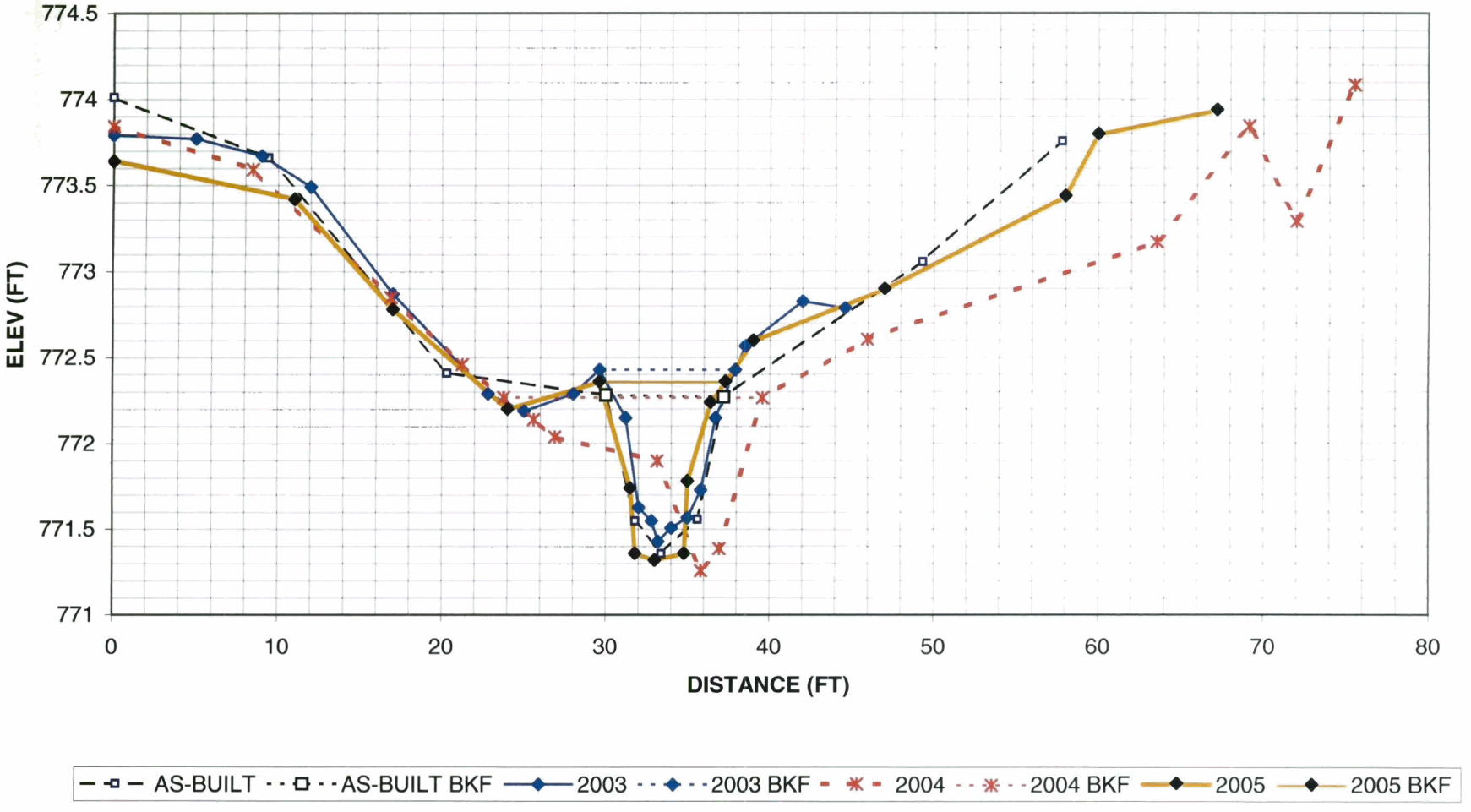
STREAM PROFILES

3 OF 3

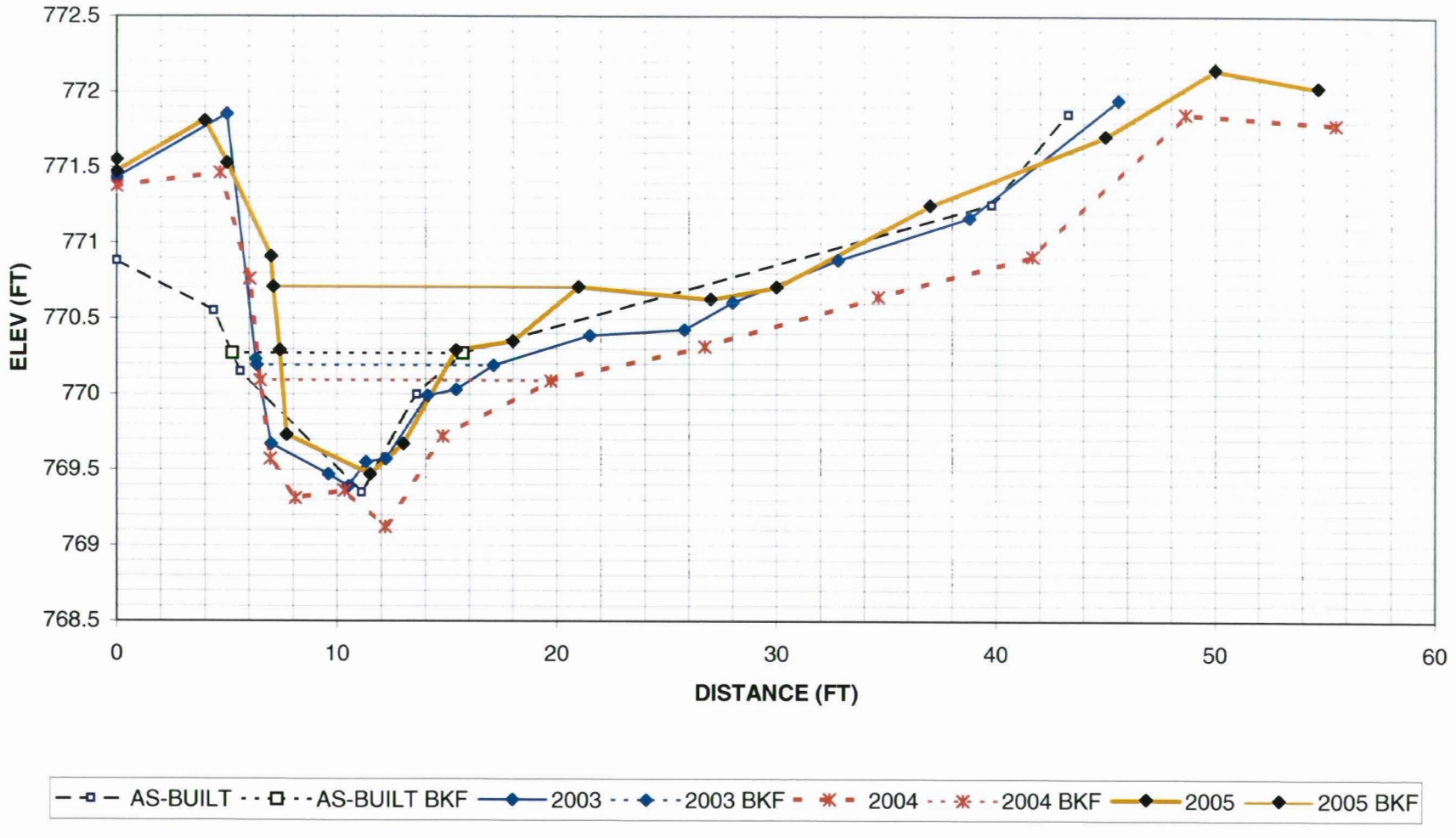


APPENDIX F

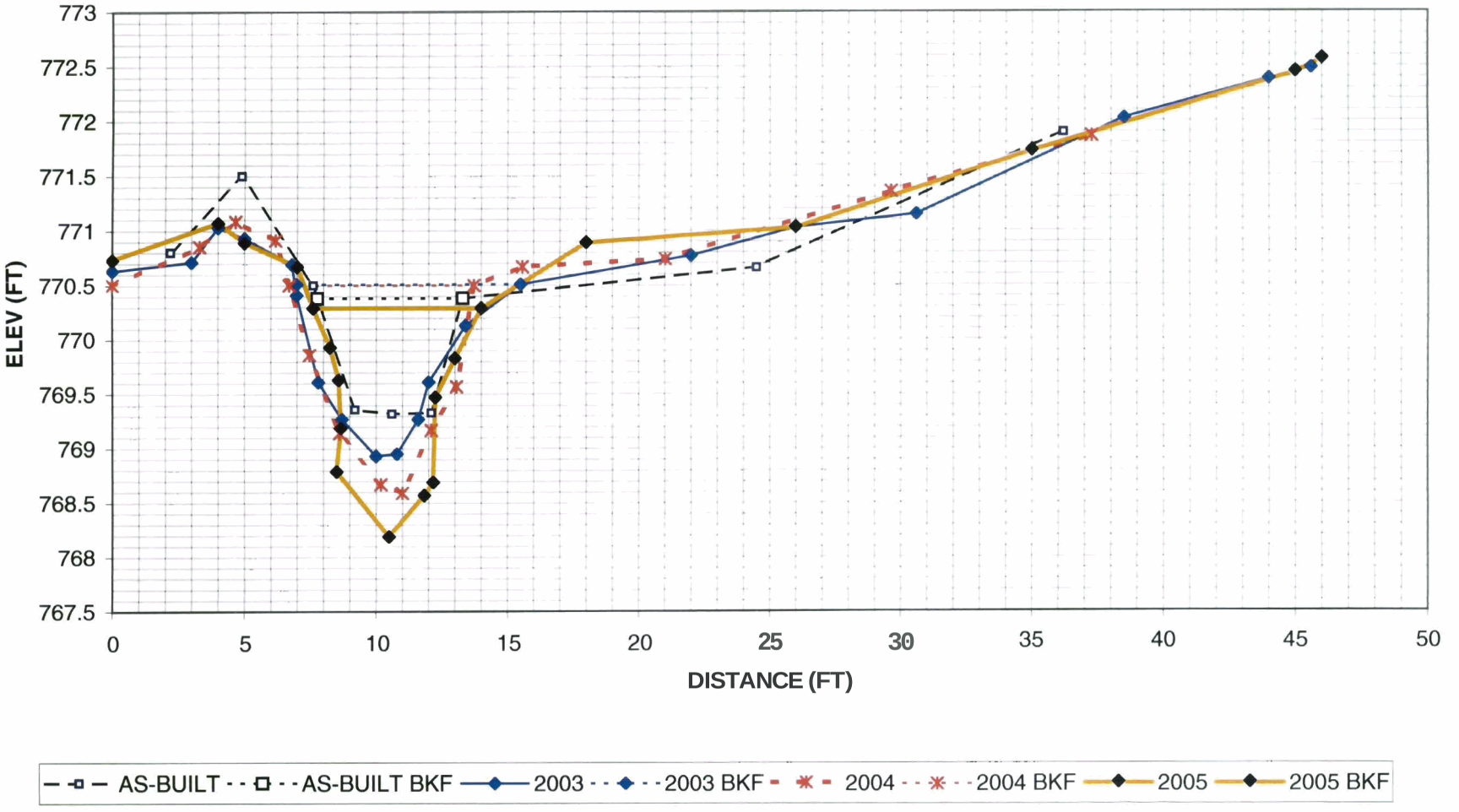
CROSS SECTION 1- RIFFLE
STA. 10+96



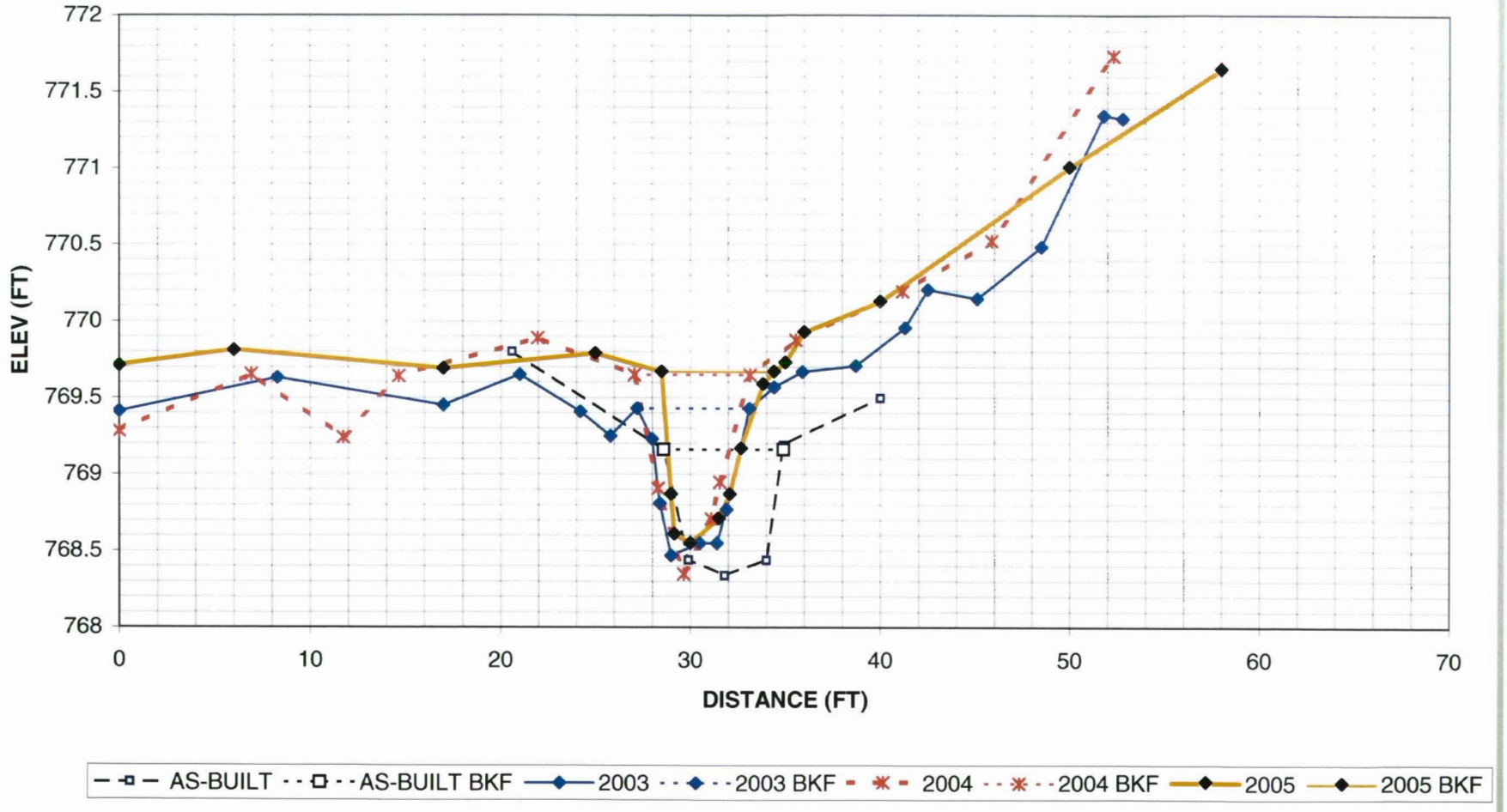
CROSS SECTION 2- POOL
STA. 18+98



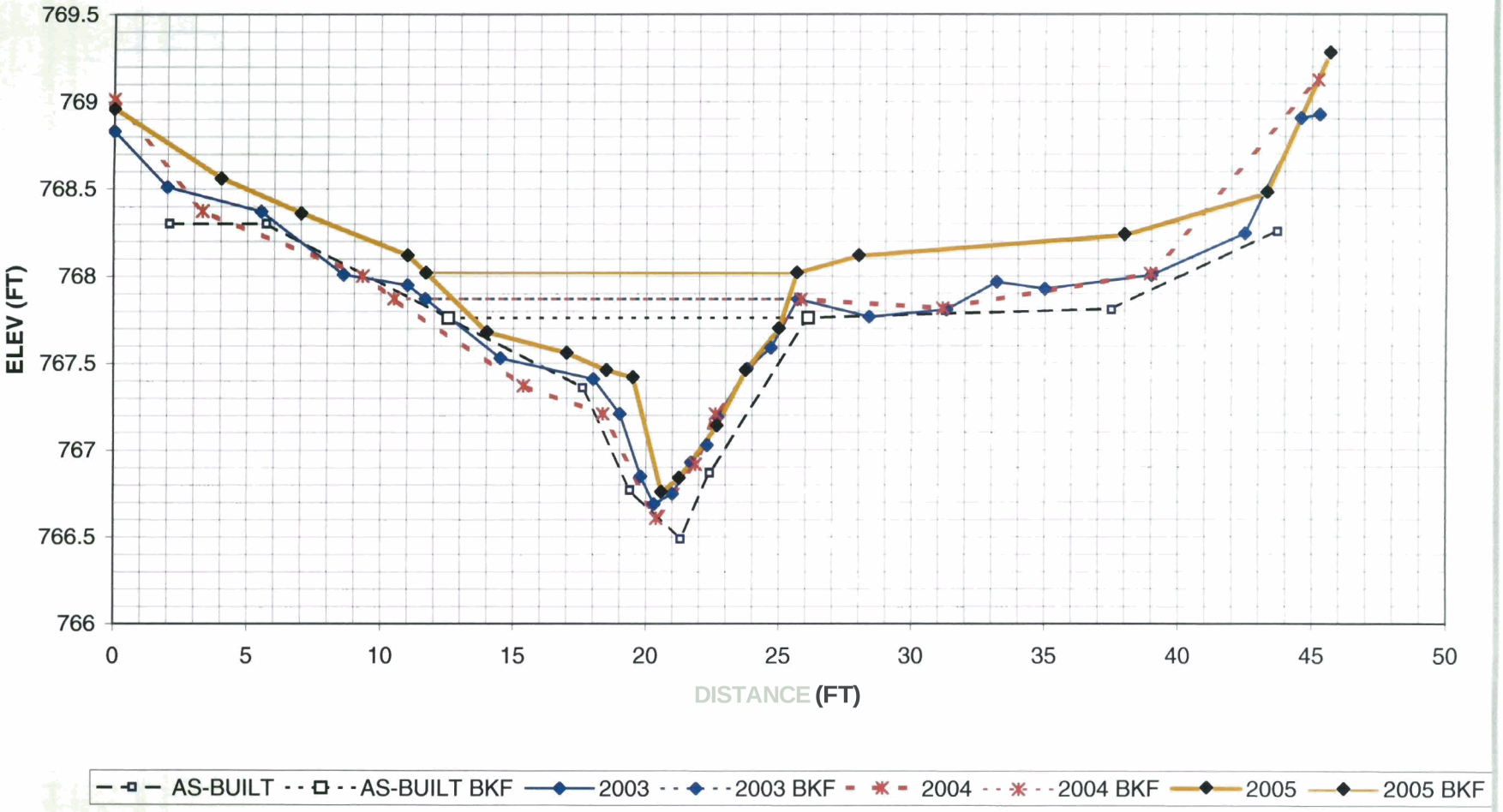
CROSS SECTION 3- POOL
STA. 22+57



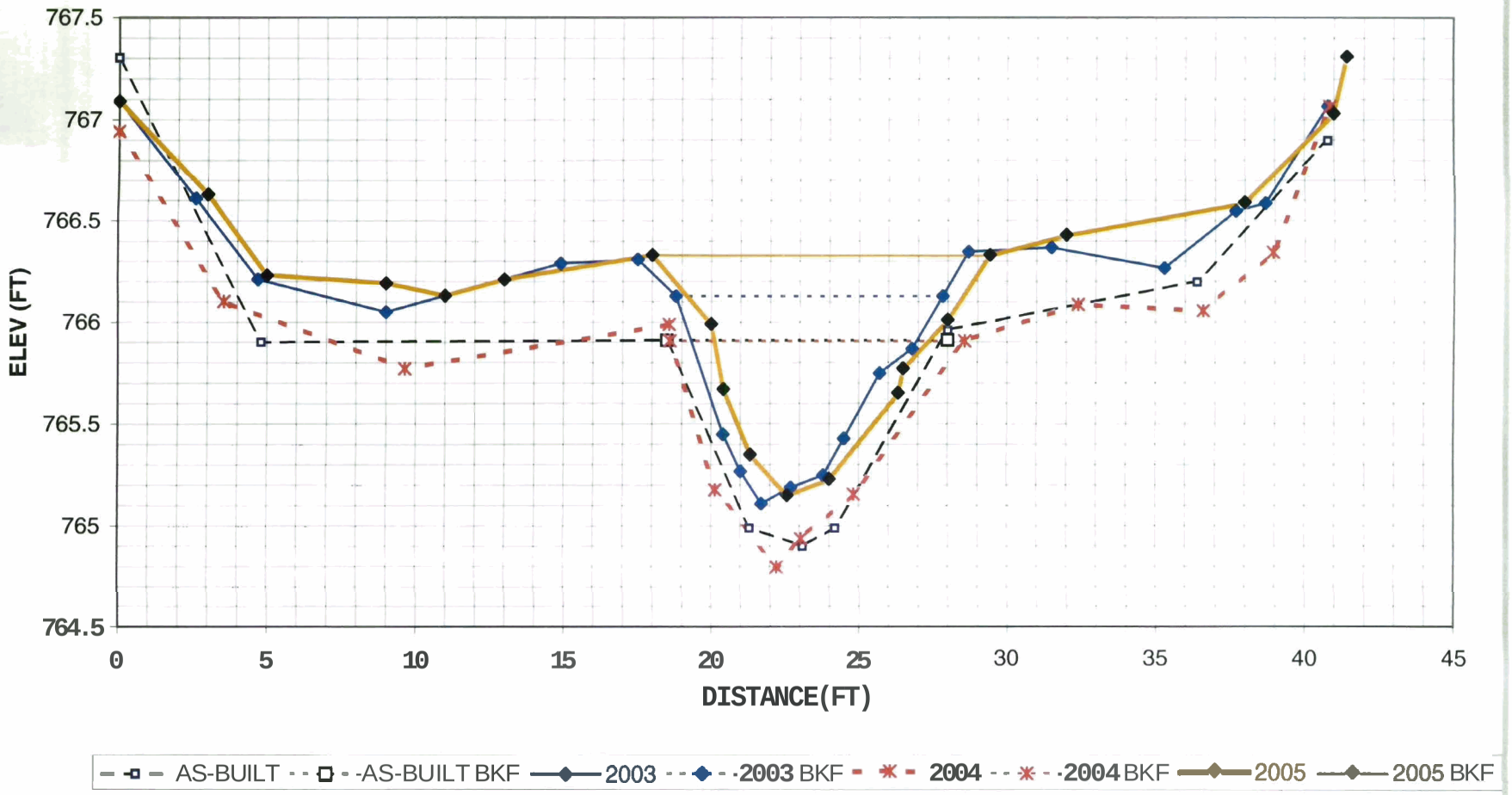
CROSS SECTION 4- RIFFLE
STA. 24+74



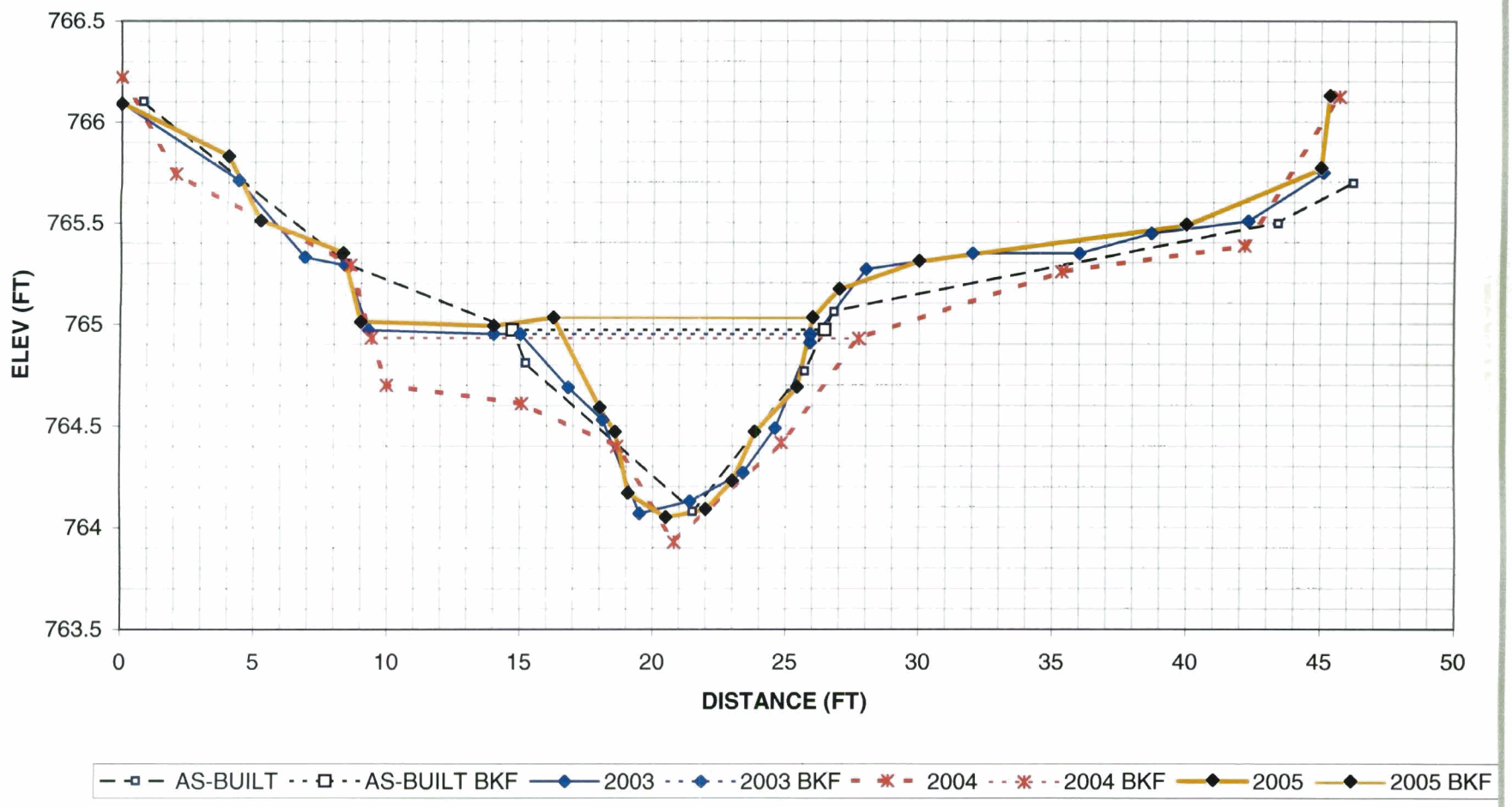
CROSS SECTION 5- POOL
STA. 35+96



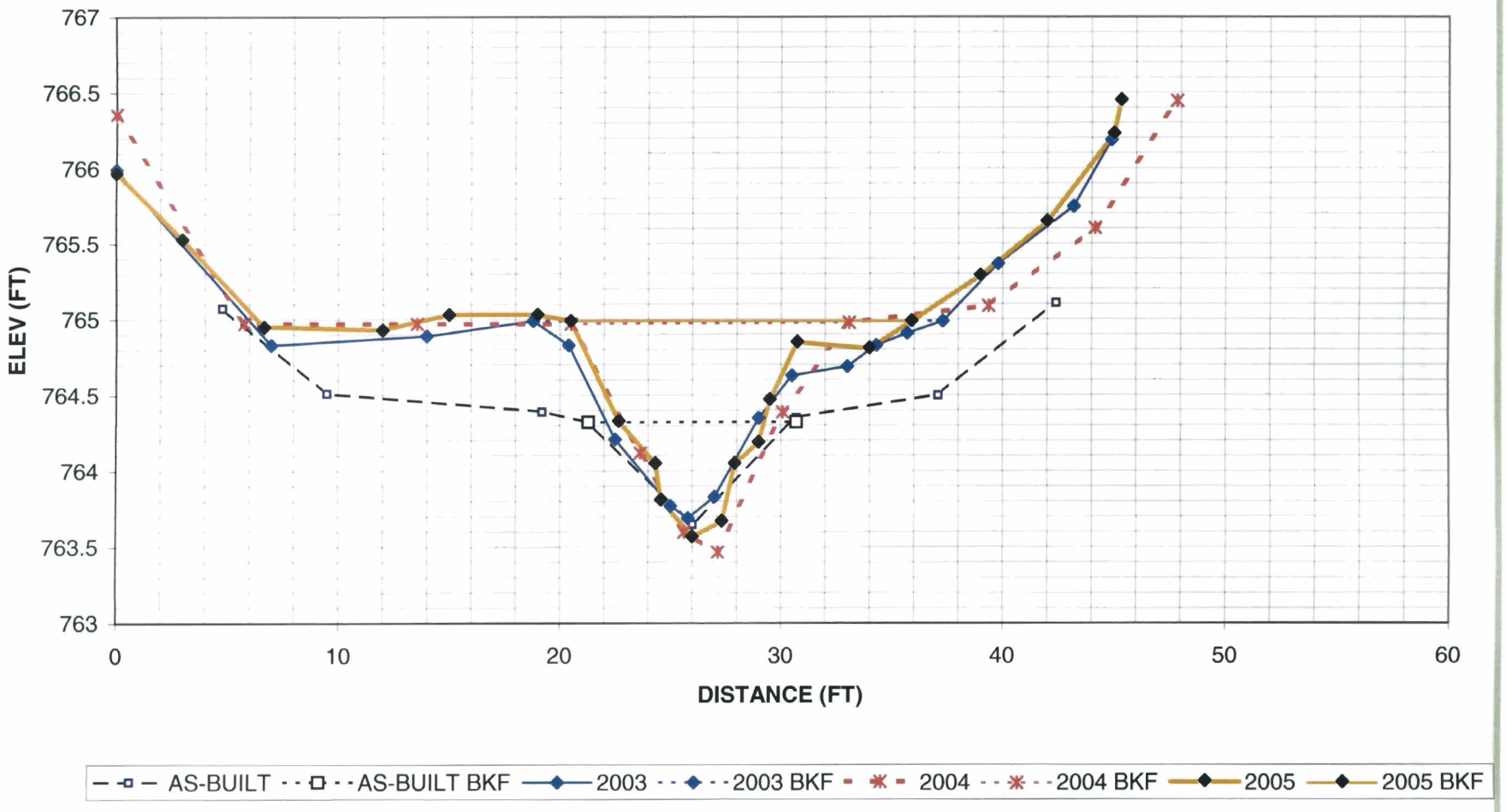
CROSS SECTION 6- RIFFLE
STA. 41+31



CROSS SECTION 7- RIFFLE
STA. 47+53



CROSS SECTION 8- POOL
STA. 51+38



1) Total Pebble Count

Two individual samples may be entered below. Select sample type for each.

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	**34**
very fine sand	0.062 - 0.125	**23**
fine sand	0.125 - 0.25	**32**
medium sand	0.25 - 0.5	**21**
coarse sand	0.5 - 1	**19**
very coarse sand	1 - 2	**14**
very fine gravel	2 - 4	**7**
fine gravel	4 - 6	**4**
fine gravel	6 - 8	**4**
medium gravel	8 - 11	**1**
medium gravel	11 - 16	**1**
coarse gravel	16 - 22	
coarse gravel	22 - 32	
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	

total particle count: 160

bedrock ----------

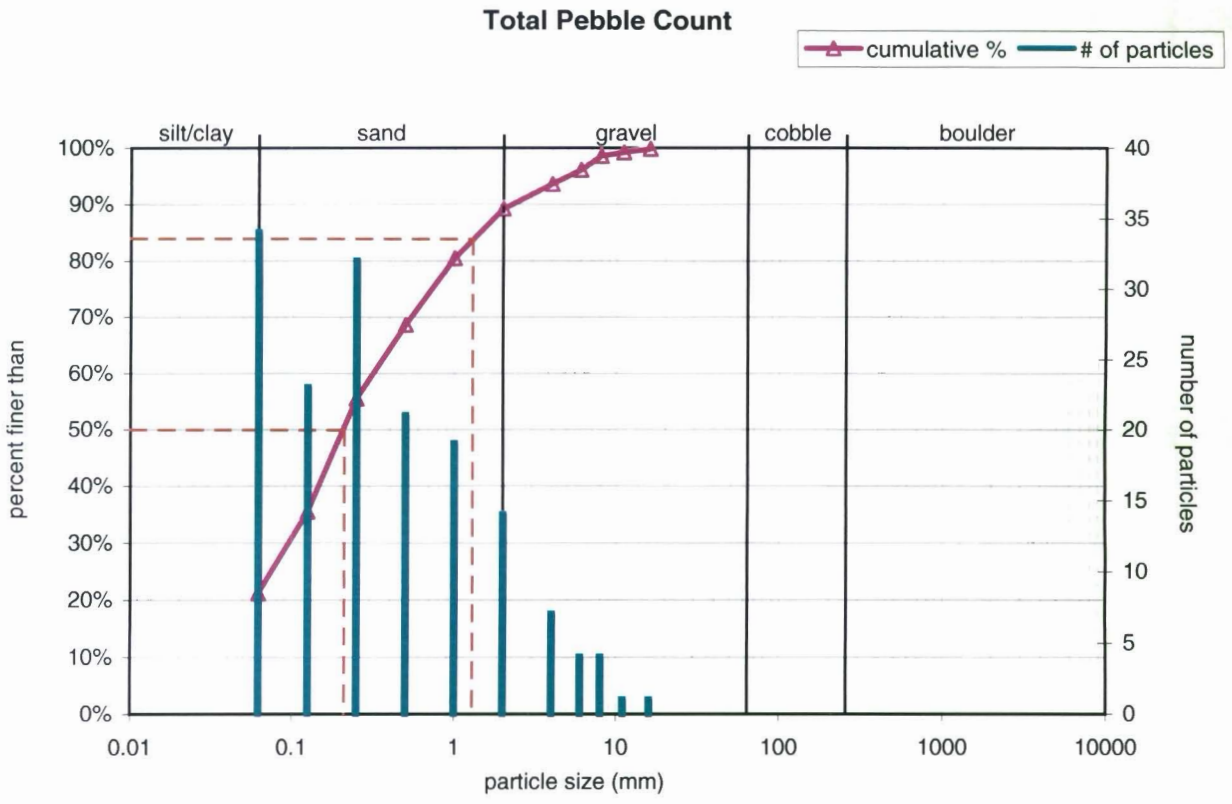
clay hardpan ----------

detritus/wood ----------

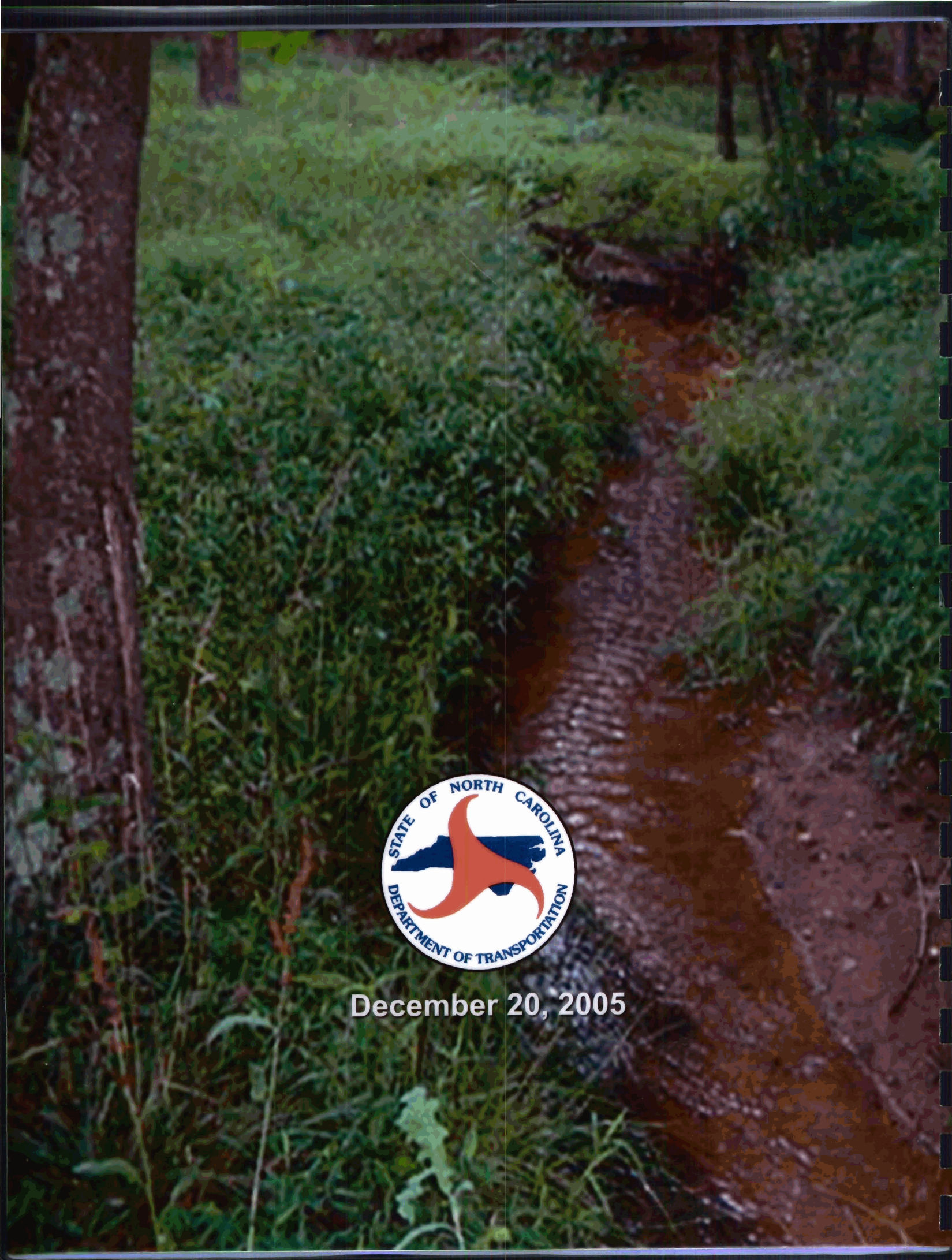
artificial ----------

total count: 160

Note: Total Count Pott Creek 2005



Size (mm)		Size Distribution		Type	
D16	0.062	mean	0.3	silt/clay	21%
D35	0.12	dispersion	4.8	sand	68%
D50	0.21	skewness	0.11	gravel	11%
D65	0.41			cobble	0%
D84	1.3			boulder	0%
D95	4.9				


STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
December 20, 2005