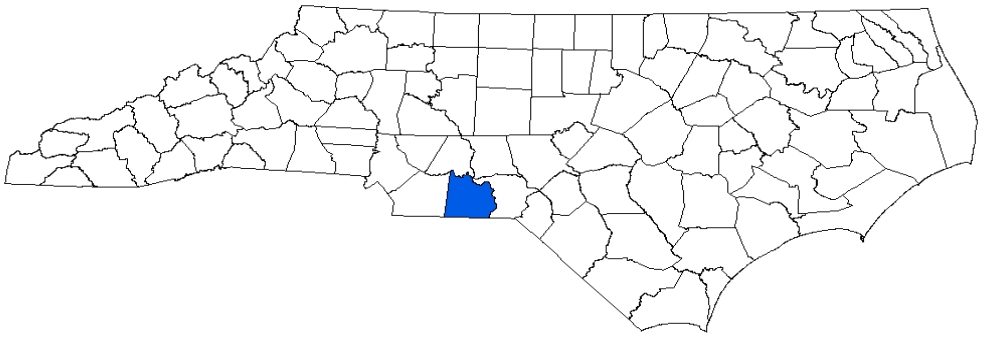
ANNUAL REPORT FOR 2007
Monitoring Year 4



Key Branch Mitigation Site
Anson County
WBS Element 34398.4.1
TIP No. R-2239WM

Submitted to:

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

November 2007

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SUMMARY

The 118 acre Key Branch Mitigation Site is located in Anson County and was constructed in 2003. The site must meet jurisdictional success criteria for both wetland hydrology and vegetation for five consecutive years or until the site is deemed successful.

The following report details the monitoring activities during the 2007 growing season. Data represents results from 2007, the fourth year of hydrologic and vegetation monitoring.

Hydrology is monitored with fourteen groundwater gauges, two stream gauges, a rain gauge and four groundwater gauges at the reference site. Throughout Key Branch, eight DOT vegetation plots and fifteen riparian vegetation plots were monitored to measure woody stem density per acre.

Anson County experienced Extreme Drought as recorded by the Palmer Drought Severity Index for much of 2007[1]. Only two of the fourteen groundwater gauges met the success criteria for jurisdictional hydrology (saturation within 12" of the surface for greater than 12.5% of the growing season). This result mirrors Monitoring Year 3 in that two of fourteen groundwater gauges met the wetland criteria then and they were the same gauges, 2 and 6. In addition, none of the 4 reference wetland gauges met the wetland hydrology criteria for 2007; however two of these gauges met wetland criteria the previous monitoring year.

The two, onsite stream gauges (SG-1, SG-2) experienced periodic inundation and demonstrated overbank flooding during the growing season, but it was during a period of drought and the inundation was assumed to have been as a result of a beaver dam found downstream of both gauges.

In Monitoring Year 4, vegetation monitoring of the site revealed an average tree density of 733 trees per acre within the wetland restoration acreage (DOT vegetation plots) and an average tree density of 542 trees per acre for the stream restoration acreage (riparian vegetation plots). This average is quite higher than the minimum success criteria of 290 trees per acre for Year 4. This is partially due to replanting that was completed in February 2005.

1.0 INTRODUCTION

1.1 Project Description

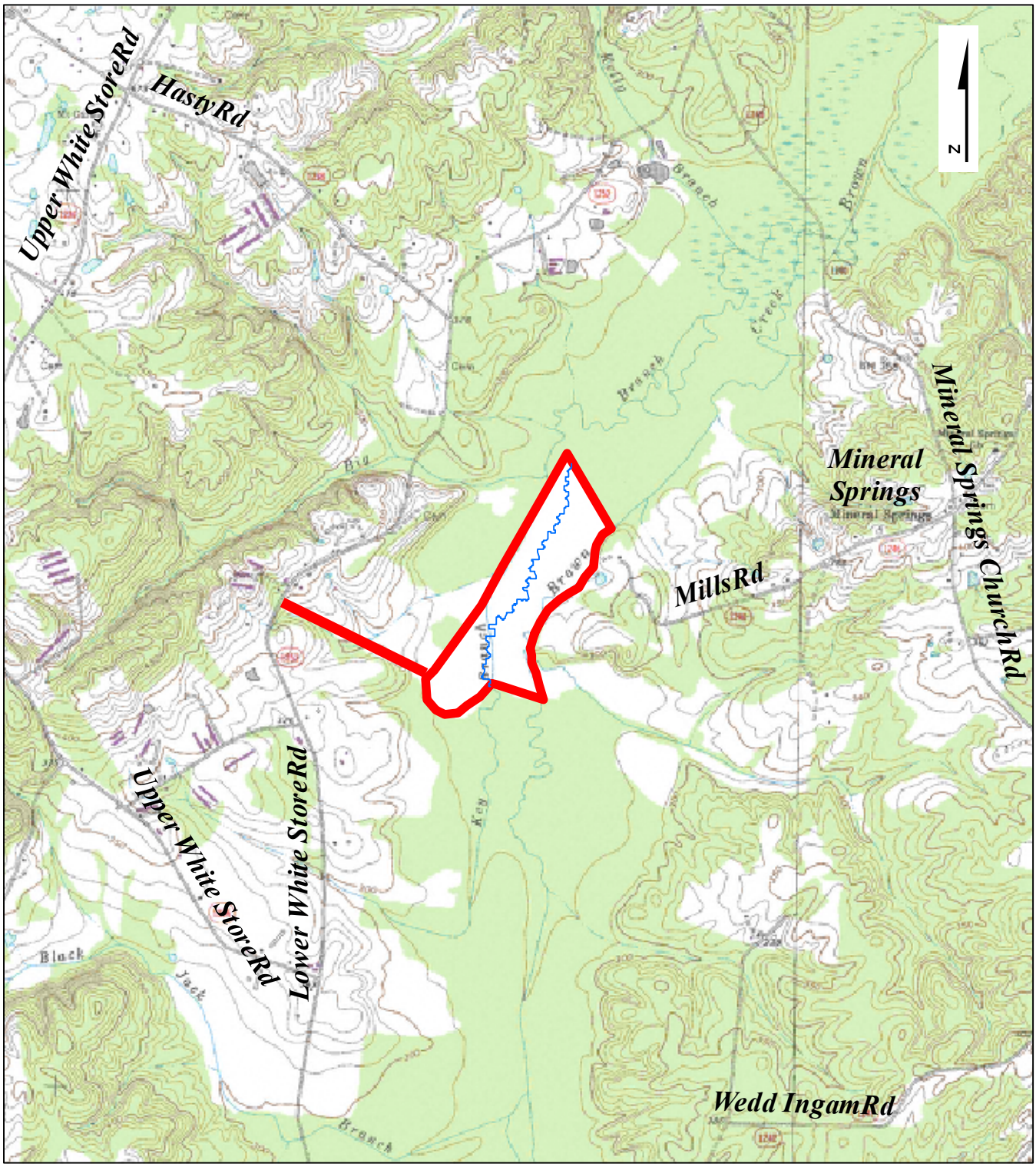
The Key Branch Mitigation Site is located in Anson County and encompasses approximately 118 acres. It is situated between Lower White Store Road (SR 1252) and Mineral Springs Church Road (SR 1240) (Figure 1).

1.2 Purpose

In order to demonstrate successful mitigation, the site must be monitored for a minimum of five years or until success criteria are achieved. Success criteria are based on federal guidelines for wetland mitigation. Criteria for hydrologic conditions and vegetation survival are included in these documents. The following report describes the results of the hydrologic and vegetation monitoring during the 2007 growing season at the Key Branch Mitigation Site. EEP instructed Berger not to do a detailed stream survey of Key Branch because the drought caused low water in the channel for much of the year with significant periods of no-flow. This coupled with several beaver impoundments interrupted normal fluvial conditions. It was decided that cross-section photographs were sufficient to document the condition of the stream in 2007.

1.3 Project History

Fall 2003	Construction
November 2003	Site Planted
March-November 2004	Hydrologic Monitoring (Year 1)
July 2004	Vegetation Monitoring (Year 1)
February 2005	Site Replanted
March-November 2005	Hydrologic Monitoring (Year 2)
August 2005	Vegetation Monitoring (Year 2)
March-November 2006	Hydrologic Monitoring (Year 3)
September 2006	Vegetation Monitoring (Year 3)
March-November 2007	Hydrologic Monitoring (Year 4)
September 2007	Vegetation Monitoring (Year 4)



Directions:
Go west on Hwy 74 from Wadesboro in Anson County to Peachland.
Turn onto Mineral Springs Rd. and follow south, turn right onto Lower White Store Rd.
You will pass Hasty Rd. on the right, continue 3/4 mile. There is a turkey farm across from the entrance which is unmarked and gravel.
Turn left into the Key Branch site .

0 1,250 2,500 5,000 Feet

Source: NCDOT USGS Quadrangle Images, 146.

Ecosystem Enhancement Program

FIGURE 1
PROJECT VICINITY MAP
KEY BRANCH WETLAND & STREAM RESTORATION
Project No. 00013
Monitoring Year 4 of 5
Anson County, North Carolina

THE LOUIS BERGER GROUP, INC.
30A Vreeland Road
Florham Park, NJ 07932

November 2007

2.0 HYDROLOGY

2.1 Success Criteria

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology state that areas must be inundated or saturated (within 12 inches of the surface) by surface or groundwater for at least a consecutive 12.5% of the growing season. Areas inundated for less than 5% of the growing season are classified as non-wetlands. Areas inundated between 5% and 12.5% of the growing season can be classified as wetlands depending upon such factors as the presence of wetland vegetation and hydric soils.

The growing season in Anson County begins March 11 and ends November 23 (258 days)[2]. These dates correspond to a 50% probability that air temperatures will not drop below 28°F or lower after March 22 and before November 15[3]. Minimum wetland hydrology is required for at least 12.5% of this growing season; for Anson County, 12.5% equals 30 consecutive days. Local climate must represent average conditions for the area.

2.2 Hydrologic Description

Onsite hydrologic monitoring is facilitated by fourteen groundwater gauges, two stream gauges, and one rain gauge (Figure 2). Also, four groundwater gauges are regularly monitored at the Key Branch Wetland Reference Site.

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 258-day growing season. The results are presented in Table 1. Appendix A contains charts of the water depth for each groundwater and stream gauge.

Precipitation is shown on each graph as bars. These graphs show the reaction at each monitoring location of the groundwater level to specific rainfall events.

The hydrologic monitoring results of the groundwater gauges are provided in Figure 3.

STREAM FLOW

71+82.88

71+00

70+00

69+00

68+00

67+00

66+00

65+00

64+00

63+00

62+00

61+00

XSECT 12

XSECT 11

60+00

59+00

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58+00

57+00

XSECT 11

56+00

XSECT 11

55+00

54+00

KBMG-12

XSECT 10

53+00

XSECT 10

52+00

51+00

50+00

KBMG-10

49+00

kb photo 6-7

KBMG-11

XSECT 9

XSECT 9

48+00

47+00

46+00

44+00

45+00

XSECT 8

XSECT 8

43+00

41+00

42+00

40+00

KBMG-14

XSECT 7

39+00

XSECT 7

38+00

RESTORED WETLAND
(91.4 ACRES)

KBMG-9

37+00

MATCHLINE 1

MATCHLINE 2

XSECT 6

35+00

36+00

KBSG-2

XSECT 6

34+00

33+00

32+00

EXISTING FOREST
(NOT PLANTED)

EXISTING FOREST
(NOT PLANTED)

PRESERVED WETLAND
(6 ACRES)

RESTORED WETLAND
(91.4 ACRES)

LEVEE BREAK

BROWN CREEK

N

LEGEND

- ROOT WAD
- LOG VANE
- J-HOOK VANE
- STEP POOL
- ROCK CROSS VANE
- XSECT 1 / XSECT 1 — CROSS SECTION
- RESTORED WETLAND
- PRESERVED WETLAND
- MONITORING GAUGE
- 2005 GPS THALWEG
- PHOTO LOCATION

SCALE IN FEET

200 0 100

Elevation Data – KCI Associates of North Carolina, P.A. 2003.

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FIGURE 2 SHEET 1
GAUGE LOCATION MAP

KEY BRANCH WETLAND & STREAM RESTORATION
Project No. 00013
Monitoring Year 4 of 5
Anson County, North Carolina

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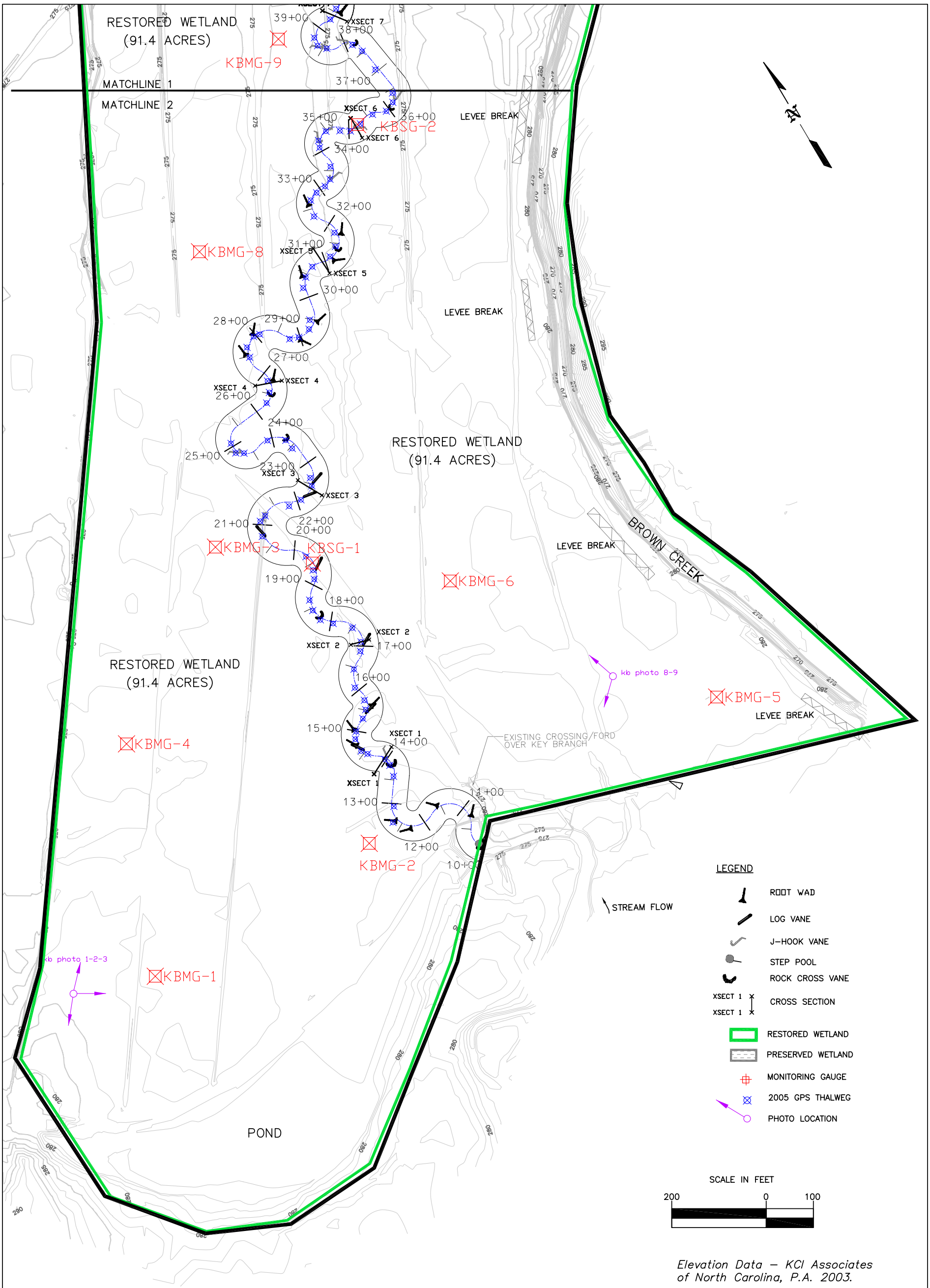
February 2008



Elevation Data – KCI Associates of North Carolina, P.A. 2003.

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FIGURE 2 SHEET 2
STREAM PROBLEM AREA PLAN VIEW
KEY BRANCH WETLAND & STREAM RESTORATION
Project No. 00013
Monitoring Year 4 of 5
Anson County, North Carolina

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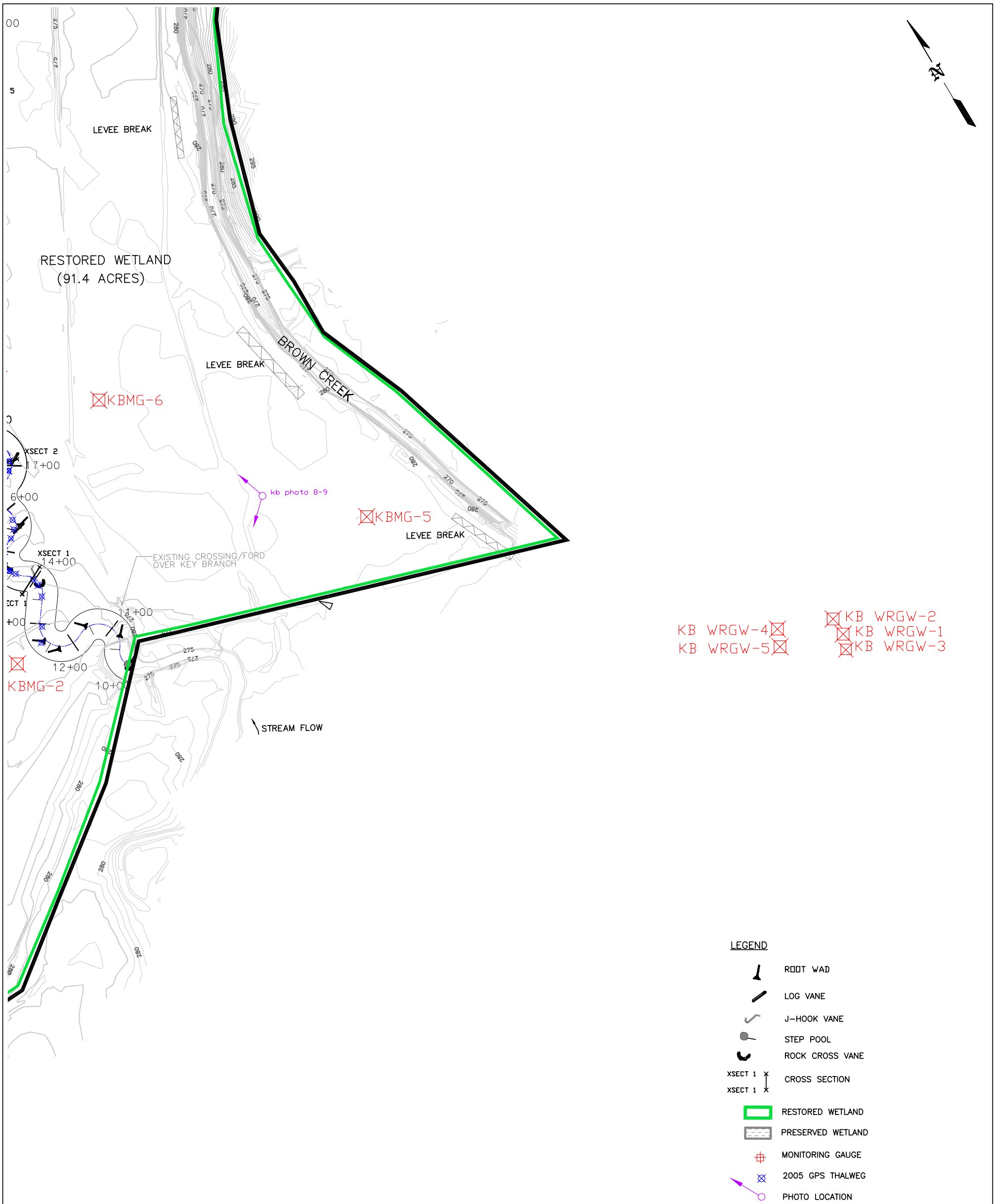
2008



Elevation Data – KCI Associates of North Carolina, P.A. 2003.

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FIGURE 2 SHEET 3
GAUGE LOCATION MAP

KEY BRANCH WETLAND & STREAM RESTORATION
Project No. 00013
Monitoring Year 4 of 5
Anson County, North Carolina

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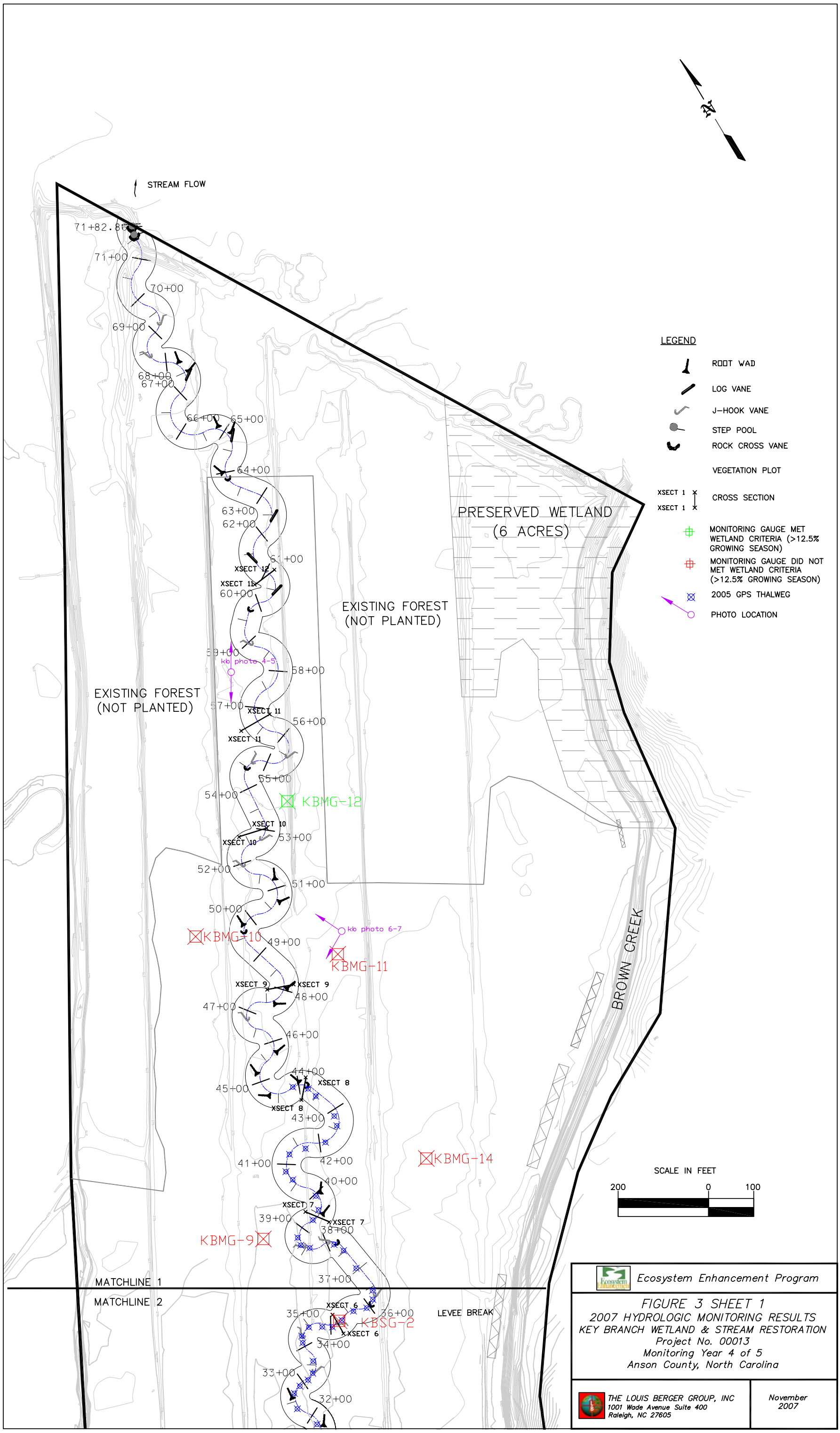

Ecosystem Enhancement Program

FIGURE 3 SHEET 1
2007 HYDROLOGIC MONITORING RESULTS
KEY BRANCH WETLAND & STREAM RESTORATION
Project No. 00013
Monitoring Year 4 of 5
Anson County, North Carolina

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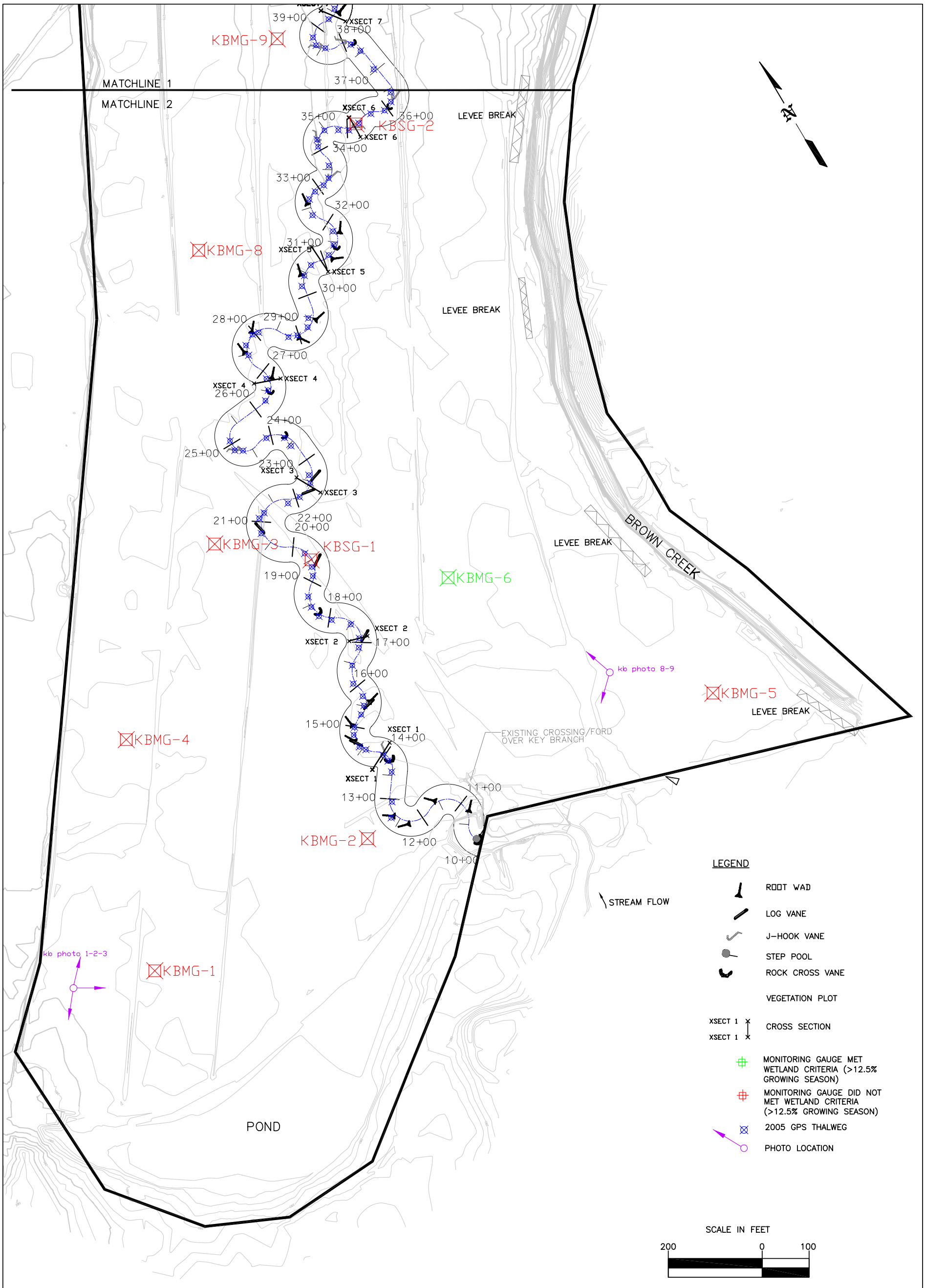

Ecosystem Enhancement Program

FIGURE 3 SHEET 2
2007 HYDROLOGIC MONITORING RESULTS
KEY BRANCH WETLAND & STREAM RESTORATION
Project No. 00013
Monitoring Year 4 of 5
Anson County, North Carolina

THE LOUIS BERGER GROUP, INC
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November
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Table 1. 2007 Hydrologic Monitoring Results

Monitoring Gauge	>12.5%	Actual %	Dates
KBMG-1	**no**	7.7	April 12 – May 1
KBMG-2	**no**	5.8	April 12 – April 26
KBMG-3	**no**	6.2	April 12 – April 27
KBMG-4	**no**	7.0	April 12 – April 29
KBMG-5	**no**	5.8	April 12 – April 26
KBMG-6	**yes**	15.9	March 23 - May 2
KBMG-7	**no**	6.6	April 12 – April 28
KBMG-8	**no**	7.4	April 12 – April 30
KBMG-9	**no**	6.6	April 12 – April 28
KBMG-10	**no**	5.4	April 12 – April 25
KBMG-11	**no**	6.2	April 12 – April 27
KBMG-12	**yes**	25.5	March 23 - May 26
KBMG-13	**no**	7.0	April 12 – April 29
KBMG-14	**no**	5.8	April 12 – April 26

2.3.2 Climatic Data

Figure 4 is a comparison of 2007 monthly rainfall to historical precipitation for the area. This comparison indicates whether 2007 was “average” in terms of climate conditions by comparing the 2007 monthly rainfall to that of historical monthly rainfall. The figure averages all rainfall data collected between 1973 and 2007 and compares the monthly amounts below which 30 percent and 70 percent of all observations may be found with the actual 2007 monthly rainfall amount. The NOAA National Data Office provided all historical rainfall data[4].

The Key Branch mitigation site experienced zero months of above average rainfall. May, July and November recorded below average rainfall. January thru April, June and October recorded average rainfall. Overall, 2007 was a drought year recording a rain deficit of greater than 9 inches for the second half of the year, and earning an extreme drought rating from the Palmer Drought Severity Index[5].

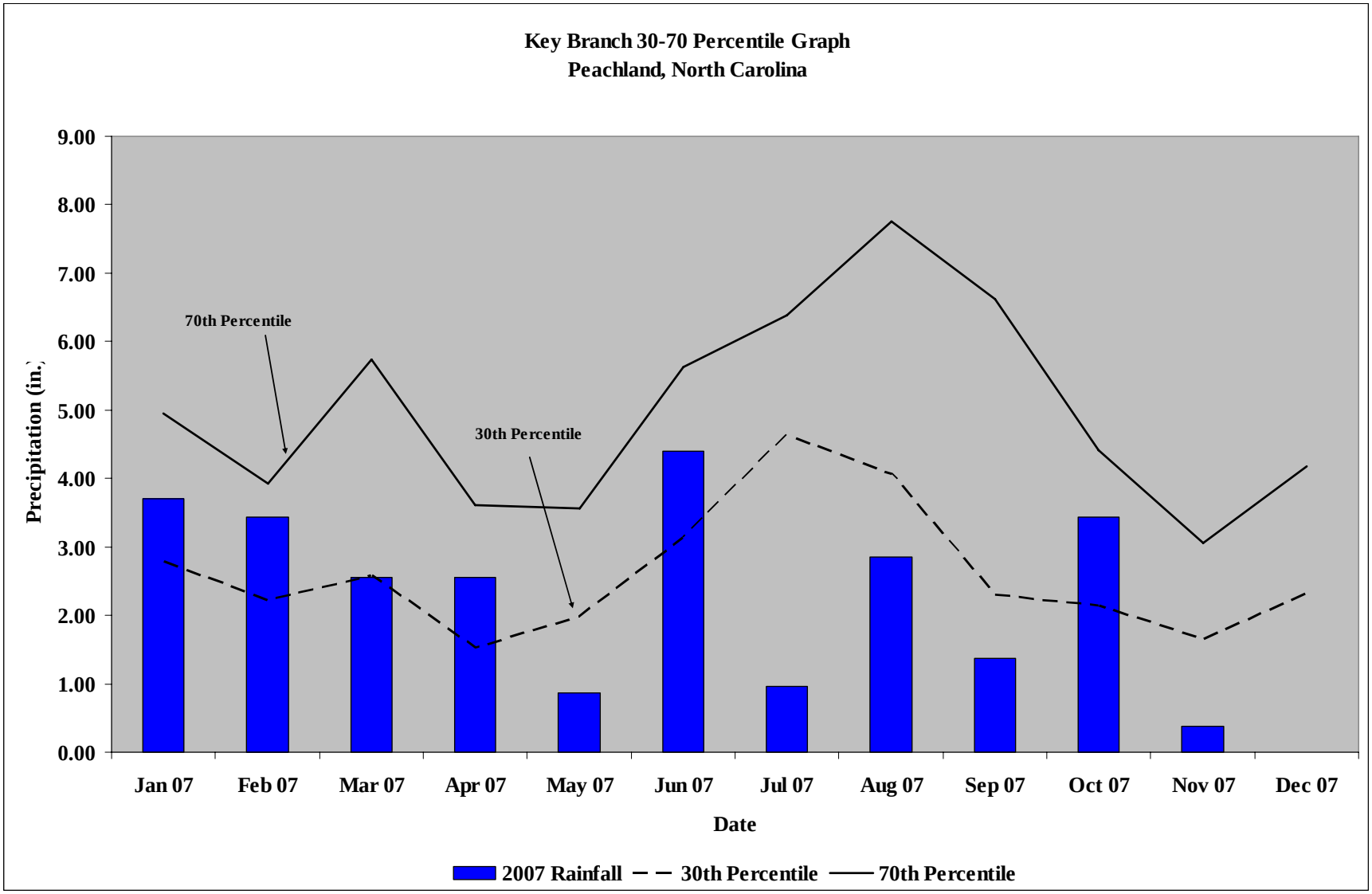
Key Branch 30-70 Percentile Graph
Peachland, North Carolina
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Precipitation (in.)
70th Percentile
30th Percentile
Jan 07
Feb 07
Mar 07
Apr 07
May 07
Jun 07
Jul 07
Aug 07
Sep 07
Oct 07
Nov 07
Dec 07
Date
2007 Rainfall
30th Percentile
70th Percentile

Figure 4

2.4 Conclusions

Two of the fourteen groundwater-gauges met the success criteria for jurisdictional hydrology (saturation within 12" of the surface for greater than 12.5% of the growing season). All four of the groundwater gauges located in the wetland reference area did not meet the jurisdictional hydrology. The two onsite stream gauges (SG-1, SG-2) experienced periodic inundation and demonstrated overbank flooding during the growing season. The extreme drought resulted in a draw down of water levels within the stream channel for the majority of the growing season.

3.0 VEGETATION: KEY BRANCH MITIGATION SITE MONITORING YEAR 4)

3.1 Success Criteria

According to the 2003 USACE Stream Mitigation Guidelines, the success criteria state that at least 320 stems per acre must survive after the completion of the third growing season. 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.)[6] DOT Stem Counting Protocol was used as the standard sampling methodology.

3.2 Description of Species

Based on the mitigation plan, the wetland restoration area and the riparian restoration area were to be planted with the following species:

Wetland
Quercus pagoda, Cherrybark Oak
Quercus phellos, Willow Oak
Quercus michauxii, Swamp Chestnut Oak
Quercus lyrata, Overcup Oak
Quercus nigra, Water Oak
Ulmus americana, American Elm
Fraxinus pennsylvanica, Green Ash
Betula nigra, River Birch

Riparian
Betula nigra, River Birch
Salix nigra, Black Willow
Cephalanthus occidentalis, Buttonbush
Cornus amomum, Silky dogwood

An as-built planting plan was not available for this site.

3.3 Results of Vegetation Monitoring

Riparian Plots	Acer rubrum	Betula nigra	Cornus amomum	Diospyrus virginiana	Fraxinus pennsylvanica	Ilex deciduosa	Liquidambar styraciflua	Quercus laurifolia	Quercus lyrata	Quercus michauxii	Quercus velutina	Salix nigra	Ulmus alata	Total stems (Year 4)	Density (trees/acre)
1		1	3	12								1		17	688
2			1		4				1	1		2		9	364
3			1	1	4				1			3		10	405
4			1		7		4		1					13	526
5		1			1		7		1			3		13	526
6					2	1		1	3			5		12	486
7		1												1	40
8			1									2		3	121
9		2	1						3					6	243
10			1	1	3		1	1		2			1	10	405
11	1		5	12	5		1			1				25	1012
12			2		1					1				4	162
13		1	5	39		1					1			47	1902
14		3	10				2						2	17	688
15		3	1									10		14	567
														Average density 542	

DOT Plots	Betula nigra	Celtis occidenalis	Cephalanthus occidentalis	Cornus amomum	Diospyrus virginiana	Fraxinus pennsylvanica	Ligustrum japonica	Liquidambar styraciflua	Quercus laurifolia	Quercus lyrata	Quercus michauxii	Quercus nigra	Quercus pagoda	Quercus palustris	Quercus phellos	Quercus velutina	Salix nigra	Ulmus alata	Ulmus americana	Ulmus rubra	Total stems (Year 4)	Density trees/acre
1	6	1	1	1	12	10	1	5		2	11		1	2	1	2				5	61	1097
2	1					4			8	8	2	1			1						25	450
3	4			1		32			2	8		1			1			4	1		54	971
4	4					4											2				10	180
5	4			1		6			4	10	6										31	558
6	1				5	10			2	26			3		6						53	953
7	2				12	8		1	3	9	4				11						50	899
8	2					11		1	4	15	6	1	1	1							42	756
																				Average density 733		

Stem counts were low in plots 7, 8 and 12. Within the three plots, herbaceous cover was 100% and generally a monoculture existed with little to no diversity (plot photos are provided in Appendix B). There was no observed explanation the day of the survey for the low stem counts. In 2005 riparian plot placement was established through random selection; a comparison of these plots year on year revealed that both plots 7 and 8 had low stem counts from Monitoring Year 2 (2005) forward. Plot 12 had 8 silky dogwood (*Cornus amomum*) in Monitoring Year 2, but since then it appears many have been lost. Four-foot aster that appears to be taking over plot 12 has likely outcompeted them.

A summary table of the stem count sampling results for Monitoring Years 2, 3 and 4 is provided below for riparian plots.

Riparian Plots	2005	26	21	22	20	19	18	17	16	15	13	14	12	11	10	9	23	24	25
	2006	26	21	22	20	19	18	17	16	15	13	14	12	11	10	9	23	24	25
	2007	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Betula nigra	2005	2	0	0	0	1	0	0	0	1	0	0	0	0	1	3	5	0	1
	2006	2	0	0	0	1	0	2	0	1	0	0	0	1	1	3	6	0	1
	2007	1	0	0	0	1	0	1	0	2	0	0	0	1	3	3	n.s.	n.s.	n.s.
Cornus amomum	2005	0	0	0	0	0	0	0	3	0	0	12	8	16	13	1	0	0	0
	2006	4	1	0	9	0	0	1	2	4	2	4	3	3	7	1	0	0	0
	2007	3	1	1	1	0	0	0	1	1	1	5	2	5	10	1	n.s.	n.s.	n.s.
Fraxinus pennsylvanica	2005	0	3	0	1	1	1	0	0	0	1	0	1	0	0	0	0	1	0
	2006	1	5	0	4	1	3	0	0	0	3	4	1	0	0	0	1	1	2
	2007	0	4	4	7	1	2	0	0	0	3	5	1	0	0	0	n.s.	n.s.	n.s.
Quercus laurifolia	2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	2007	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	n.s.	n.s.	n.s.
Quercus lyrata	2005	1	1	1	1	1	4	0	0	2	0	0	0	1	0	0	0	0	0
	2006	0	1	0	1	0	4	0	0	3	0	0	0	0	0	0	0	0	1
	2007	0	1	1	1	1	3	0	0	3	0	0	0	0	0	0	n.s.	n.s.	n.s.
Quercus michauxii	2005	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	1
	2006	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1
	2007	0	1	0	0	0	0	0	0	0	2	1	1	0	0	0	n.s.	n.s.	n.s.
Salix nigra	2005	1	2	3	1	1	7	2	0	0	0	0	0	0	0	6	3	0	0
	2006	1	2	0	2	3	7	0	2	0	0	0	0	0	0	6	9	0	0
	2007	1	2	3	0	3	5	0	2	0	0	0	0	0	0	10	n.s.	n.s.	n.s.

n.s. = "not sampled" From year 2006 to 2007, per NCEEP instructions a reduction in the number of riparian plots requiring sampling went down from 18 to 15 plots.

NCDOT performed the vegetation monitoring in 2004, the results from 2004 were not available for this comparison as they were published in a document other than the Annual Monitoring Report – the only report provided to Berger. Annual comparisons of stem counts for Monitoring Years 2, 3 and 4 are provided below.

DOT Plots	Year	1	2	3	4	5	6	7	8
Betula nigra	2005	6	0	3	1	0	0	0	1
	2006	4	0	3	1	1	0	0	1
	2007	6	1	4	4	4	1	2	2
Fraxinus pennsylvanica	2005	10	3	11	1	0	10	1	4
	2006	4	2	16	1	0	16	5	4
	2007	10	4	32	4	6	10	8	11
Quercus laurifolia	2005	0	7	0	0	0	2	15	0
	2006	0	3	0	0	2	2	7	0
	2007	0	8	2	0	4	2	3	4
Quercus lyrata	2005	4	14	11	0	4	28	10	0
	2006	0	5	11	0	4	23	8	3
	2007	2	8	8	0	10	26	9	15
Quercus michauxii	2005	11	2	0	0	2	0	3	4
	2006	5	2	0	0	1	0	1	4
	2007	11	2	0	0	6	0	4	6
Quercus pagoda	2005	1	0	0	0	8	0	0	7
	2006	2	3	0	0	1	1	0	0
	2007	0	0	0	0	0	3	0	1
Quercus phellos	2005	2	2	1	0	0	4	7	0
	2006	0	0	2	0	0	4	9	0
	2007	1	1	1	0	0	6	11	0
Salix nigra	2005	0	0	0	0	0	0	0	0
	2006	1	0	0	1	0	0	0	0
	2007	0	0	0	2	0	0	0	0

3.4 Conclusions

Of the 118 acres on this site, approximately 70.2 acres involved tree planting. There were eight vegetation-monitoring plots established throughout the wetland planting areas in 2004 (Year 1), with an average stem density of 680 stems/acre. When below average densities were found, the site was replanted in February 2005. In subsequent monitoring events, the average density for DOT plots increased from 521 stems/acre Monitoring Year 2 (2005) to 535 stems/acre Monitoring Year 3 (2006). In Monitoring Year 4 (2007), the average density for DOT plots in wetland planting area exceeded the minimum success criteria at 733 stems/acre.

In Monitoring Year 2, 130 new plots were added within wetland planting areas. Monitoring results from 2005 (443 stems/acre) and 2006 (486 stems/acre) revealed that average densities across the site exceeded the minimum success criteria of 320 stems/acre, and were reasonably consistent with the results from the eight DOT plots.

18 of the 130 new plots were riparian plots that were incorporated into the sampling methodology in 2005. Monitoring results from the riparian plots found average densities in 2005 (326 stems/acre) and 2006 (362 stems/acre) exceeded minimum success criteria of 320 stems/acre. The results for 2007 (542 stems/acre) are fairly consistent with previous monitoring results; however the average density of riparian plots may be slightly skewed from what actually exists within the 18 riparian plots because just 15 of the 18 riparian plots were required to be monitored in 2007.

4.0 Overall Conclusions/Recommendations

Monitoring Year 4 (2007) revealed an average density of 733 trees per acre based on sampling results for the original eight DOT plots, and an average density of 542 trees per acre for the fifteen riparian plots. Both groups greatly exceeded the minimum success criteria of 290 trees per acre for Year 4.

For the fourth year of monitoring, two of the fourteen groundwater-gauges met the success criteria for jurisdictional hydrology (saturation within 12” of the surface for greater than 12.5% of the growing season). All four groundwater gauges located in the wetland reference area failed to meet the jurisdictional hydrology. The two onsite stream gauges (SG-1, SG-2) recorded periodic inundation and demonstrated overbank flooding during the growing season. Overbank flooding may have been caused by a downstream beaver dam.

The beaver dams onsite are slated to be removed in the late fall of 2007.

References

[1] National Oceanic and Atmospheric Administration's Drought Information Center, The Palmer Drought Severity Index, http://www.drought.noaa.gov/palmer.html

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[4] National Climatic Data Center and NOAA Satellite and Information Service, Record of Climatological Observations. Last updated 5 2007, http://hurricane.ncdc.noaa.gov/DLY

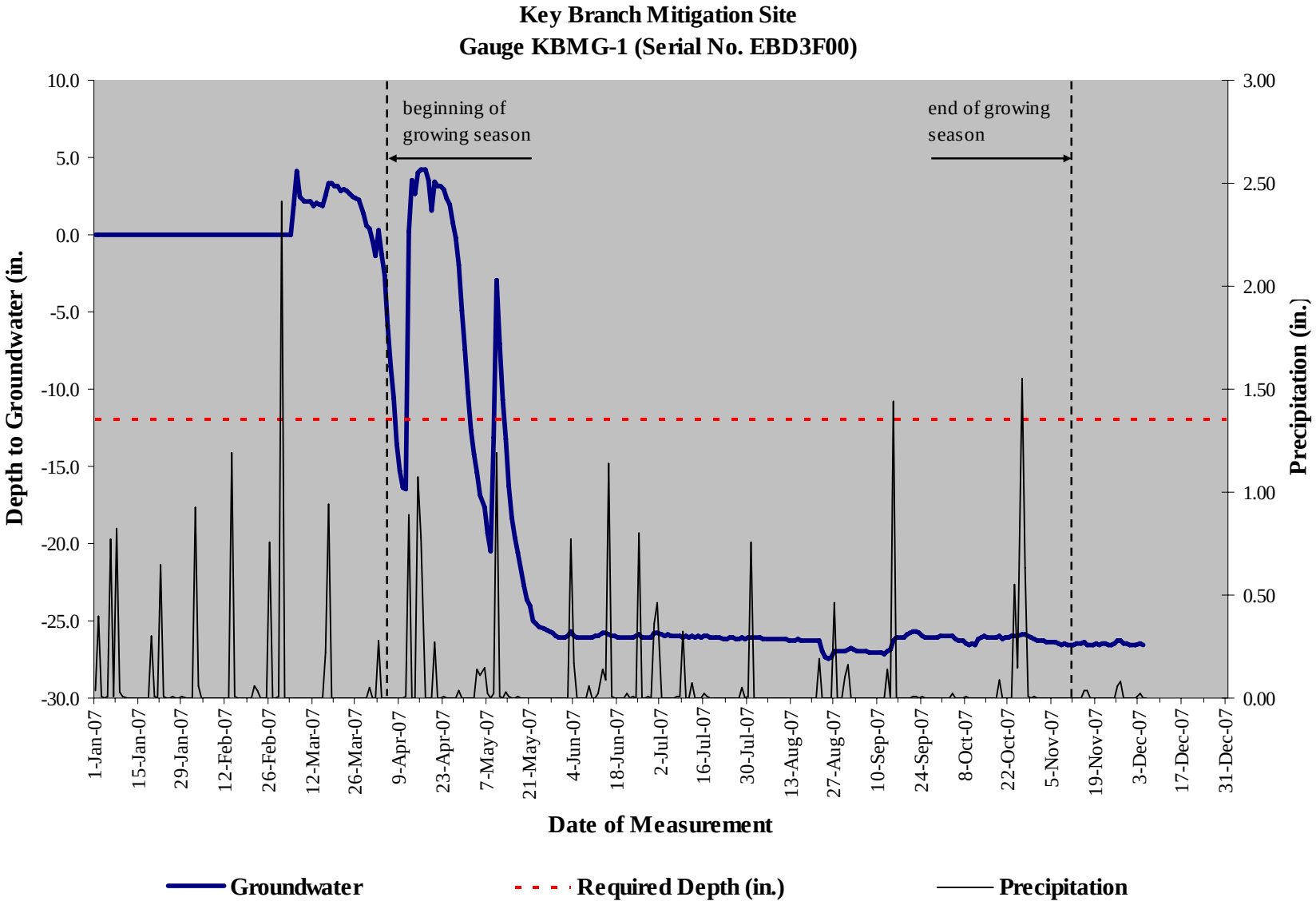
[5] National Oceanic and Atmospheric Administration's Drought Information Center, The Palmer Drought Severity Index, http://www.drought.noaa.gov/palmer.html

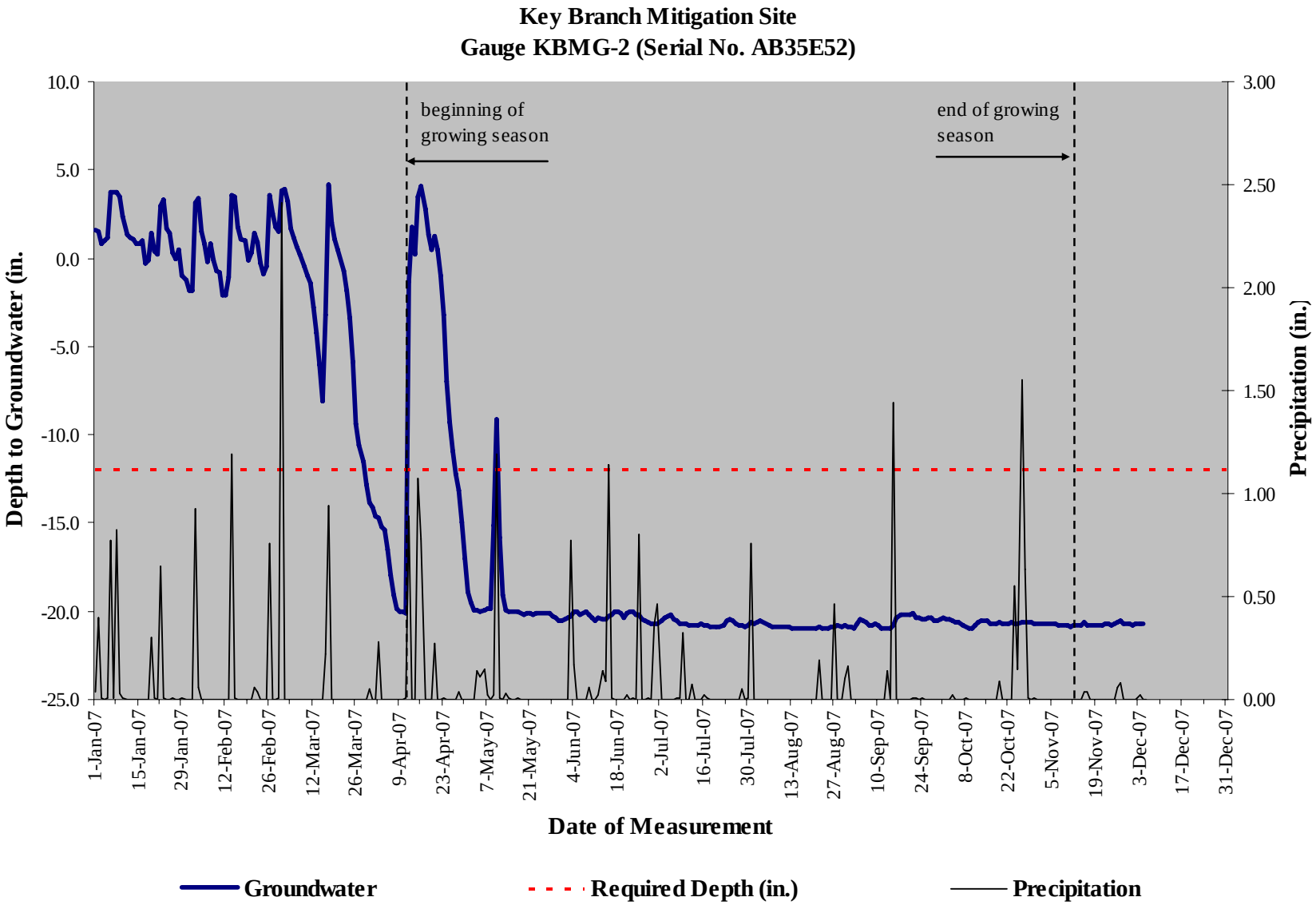
[6] Stream Mitigation Guidelines, April 2003. Authored by a workgroup consisting of USACE (Wilmington District, USEPA, NCWRC and NCDWQ. Riparian Restoration pg. 18. www.saw.usace.army.mil/WETLANDS/Mitigation/mit_weblinks.html

APPENDICES

APPENDIX A

1. GAUGE DATA GRAPHS


Key Branch Mitigation Site
Gauge KBMG-1 (Serial No. EBD3F00)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
30-Jul-07
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-2 (Serial No. AB35E52)
beginning of growing season
end of growing season
Depth to Groundwater (in.
Precipitation (in.)
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5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
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21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
30-Jul-07
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
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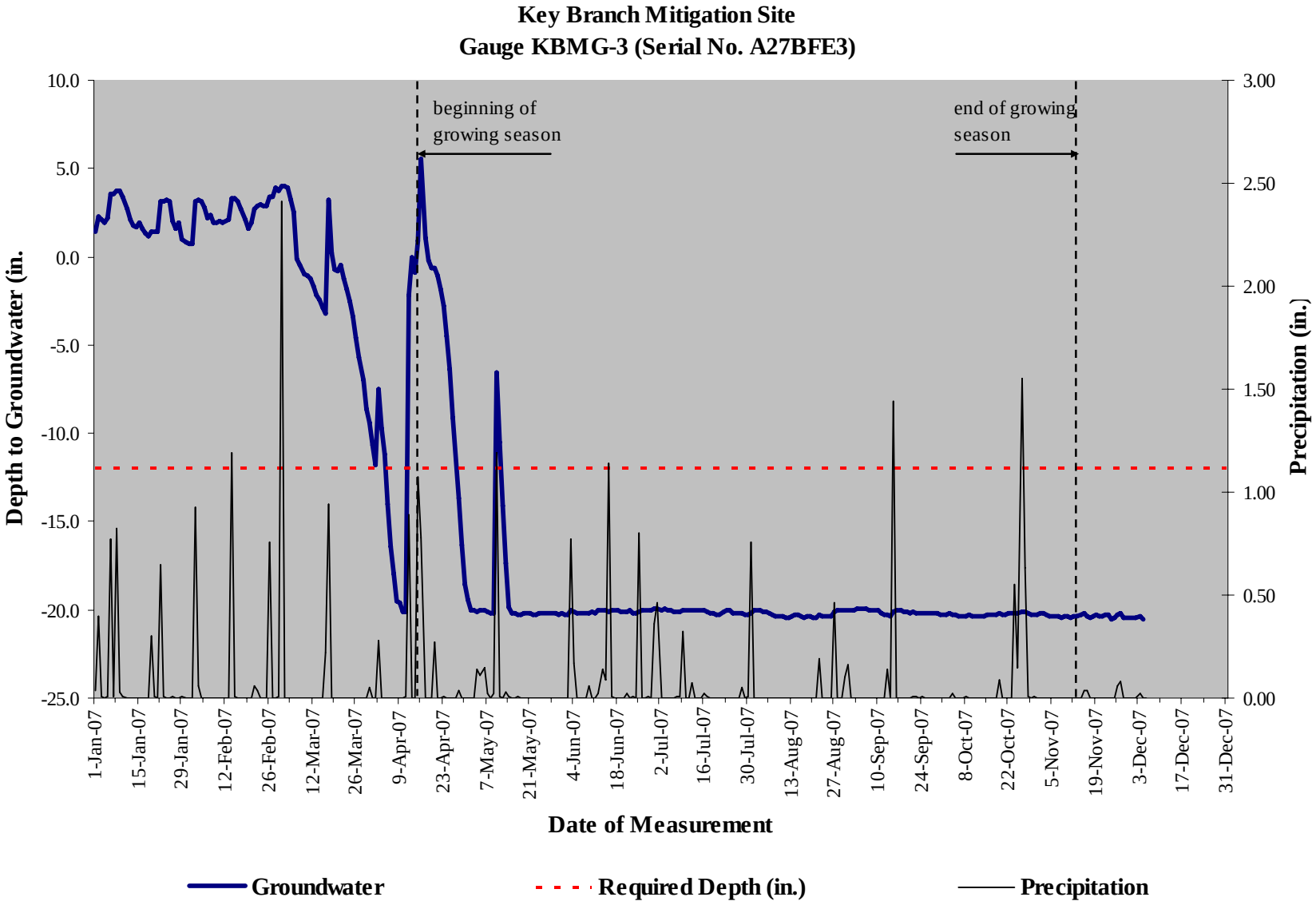
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-3 (Serial No. A27BFE3)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
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5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
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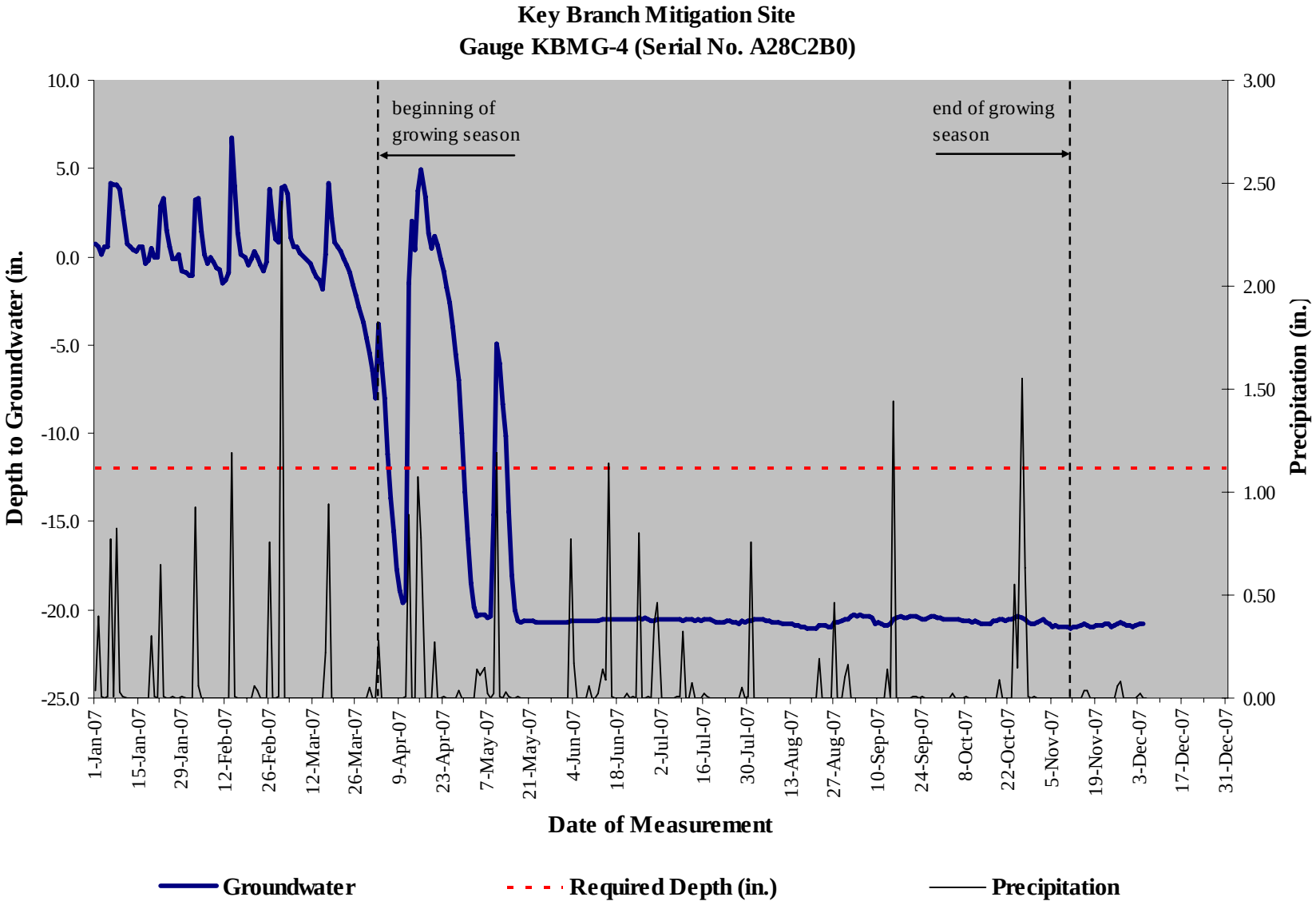
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-4 (Serial No. A28C2B0)
beginning of growing season
end of growing season
Depth to Groundwater (in.
Precipitation (in.)
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5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
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12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
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2-Jul-07
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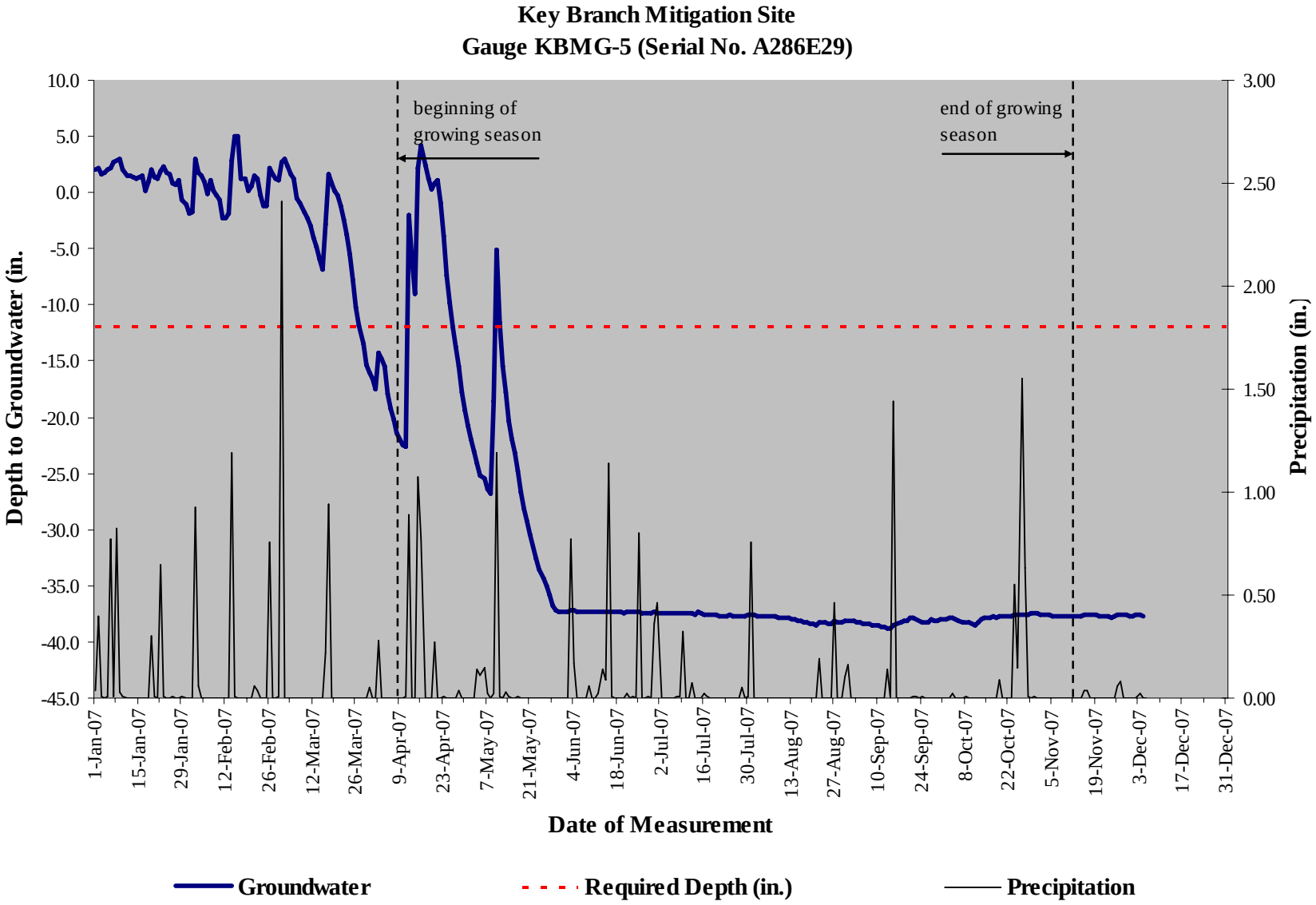
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-5 (Serial No. A286E29)
beginning of growing season
end of growing season
Depth to Groundwater (in.
Precipitation (in.)
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
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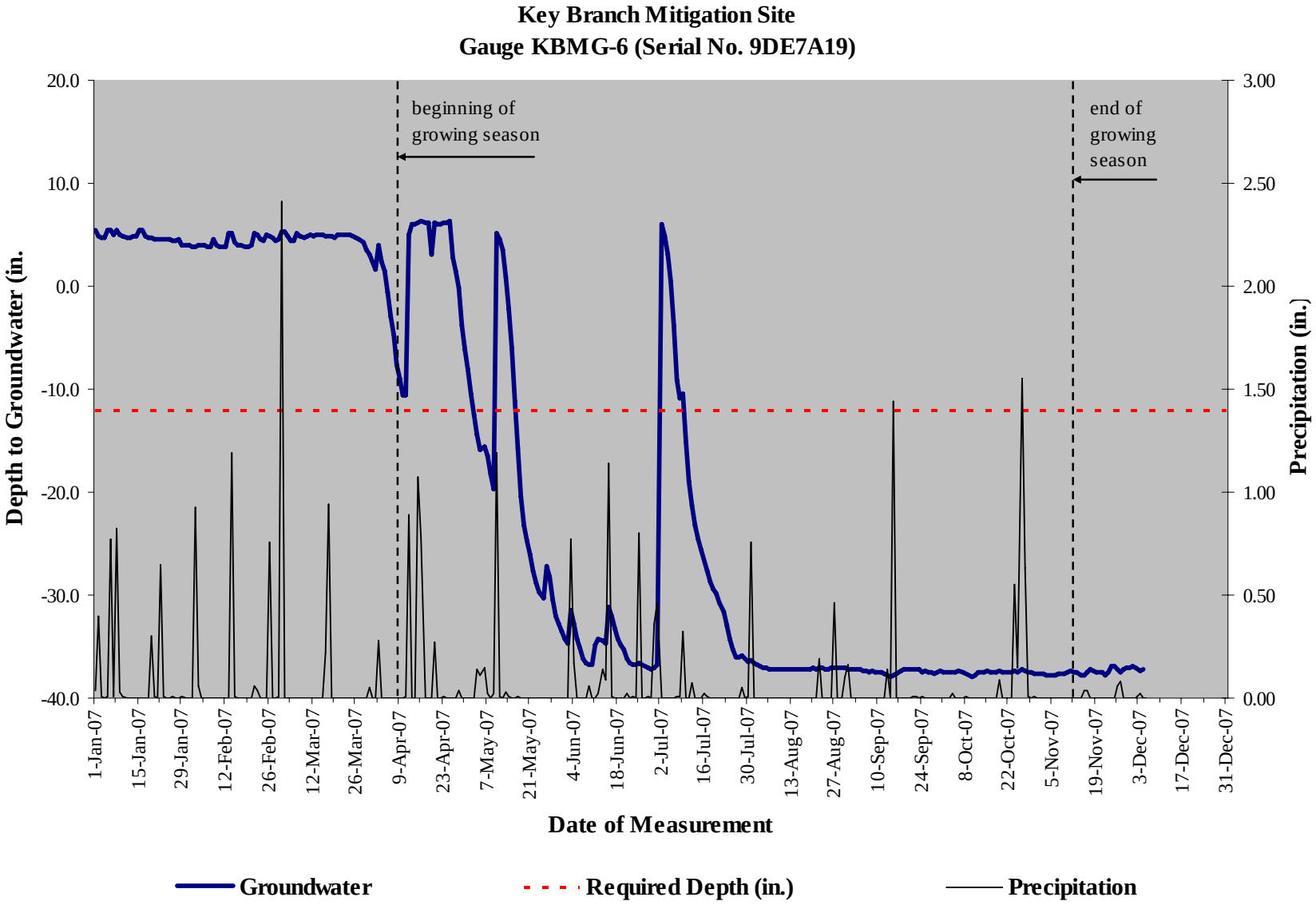
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-6 (Serial No. 9DE7A19)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
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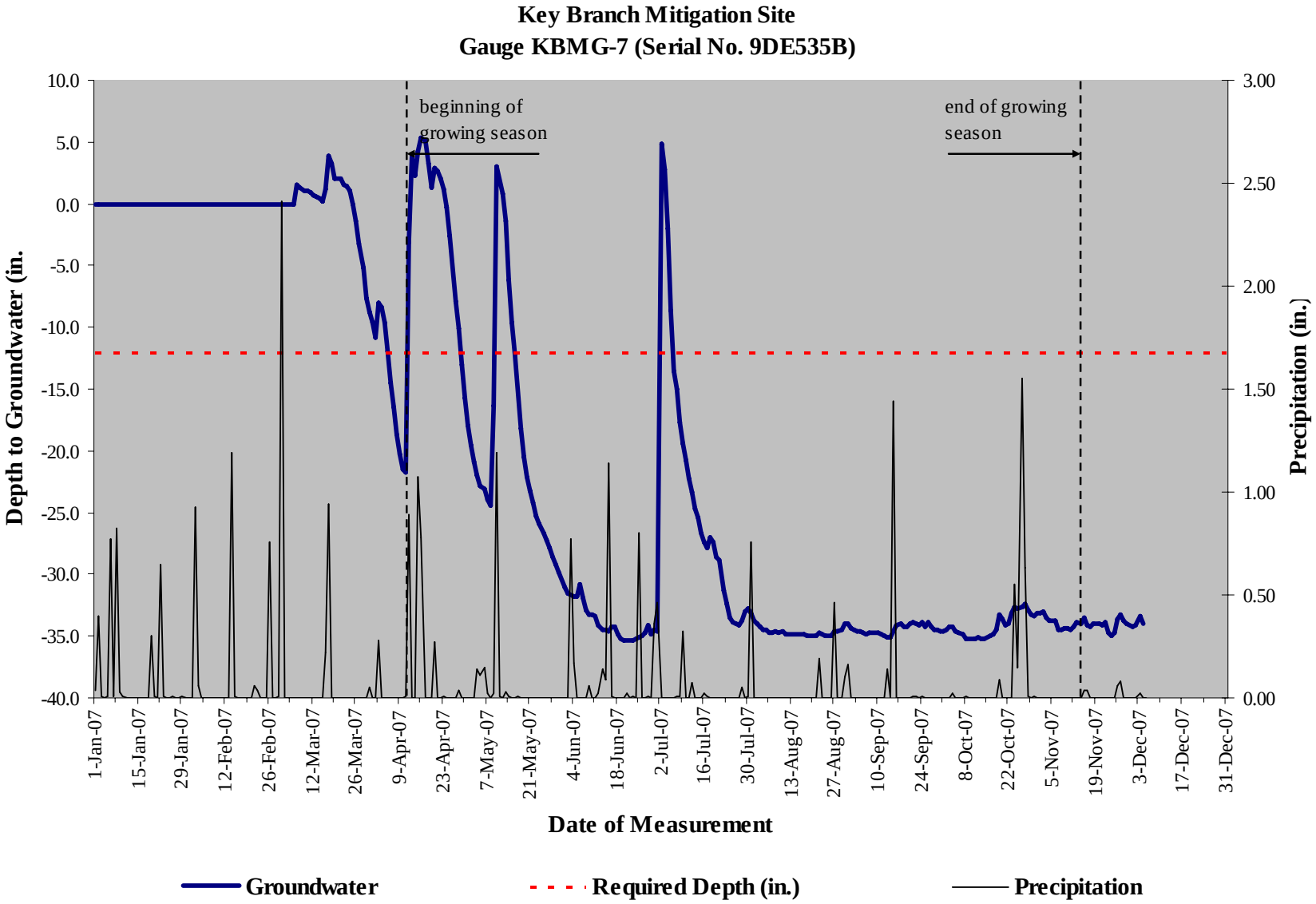
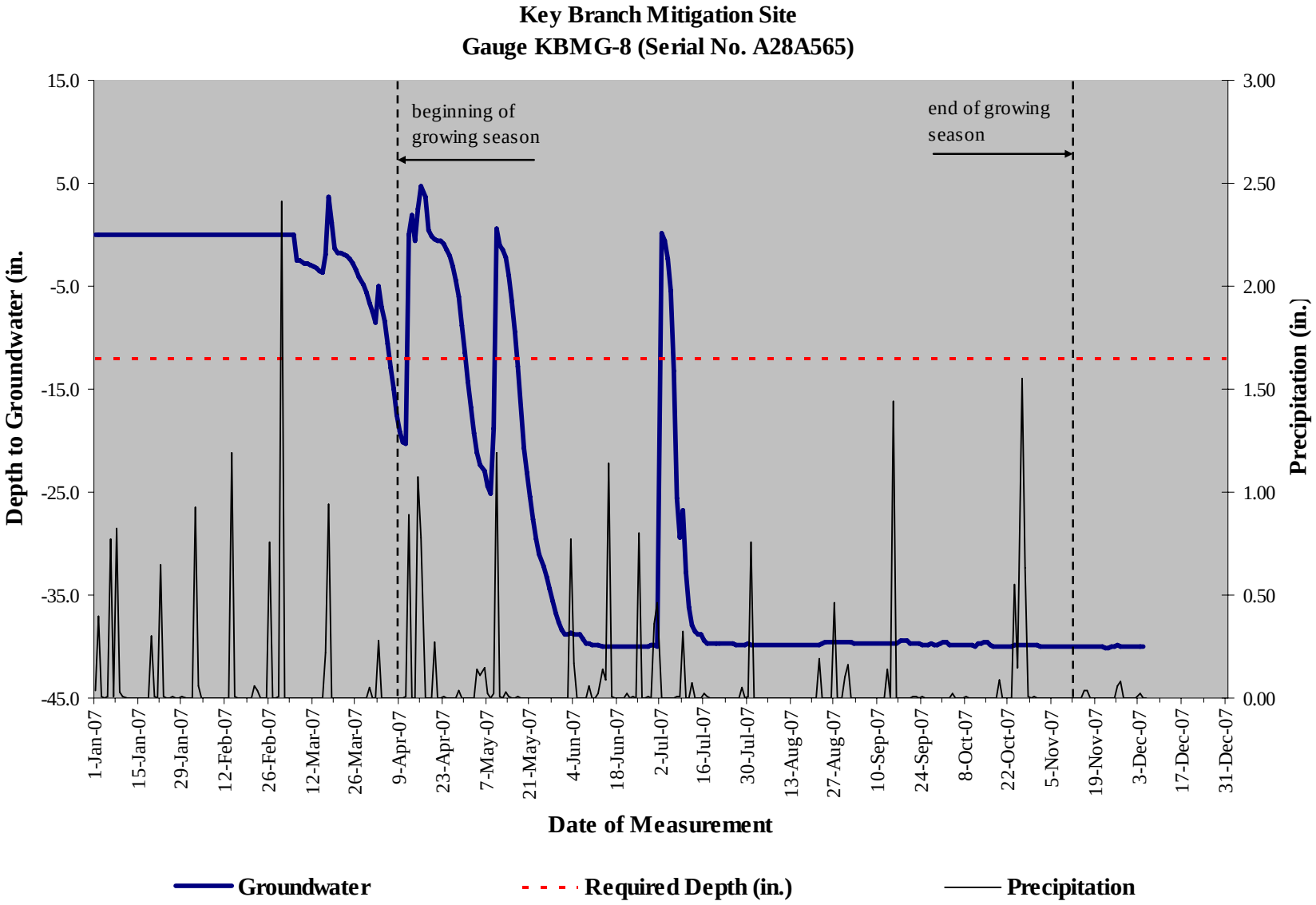
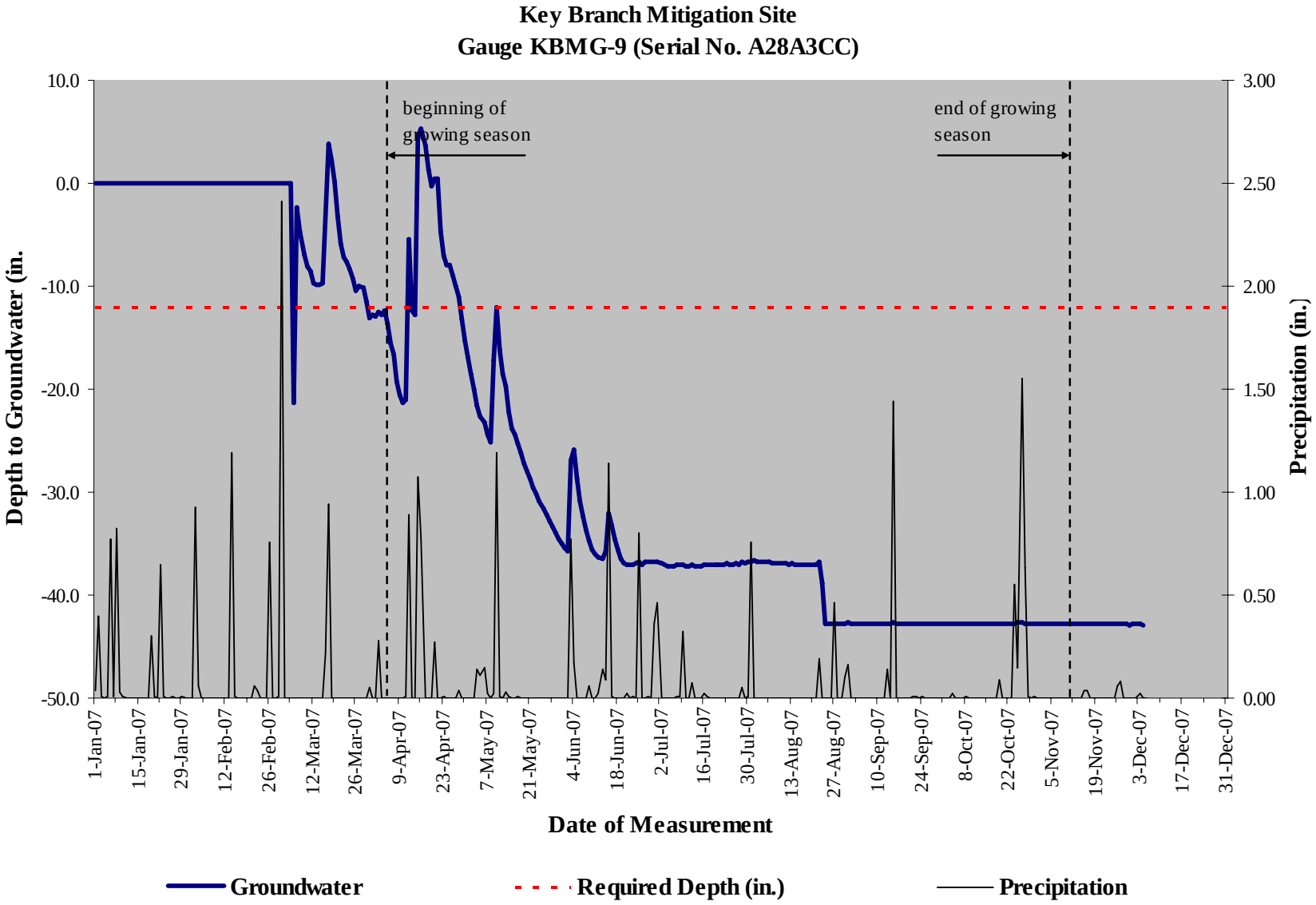
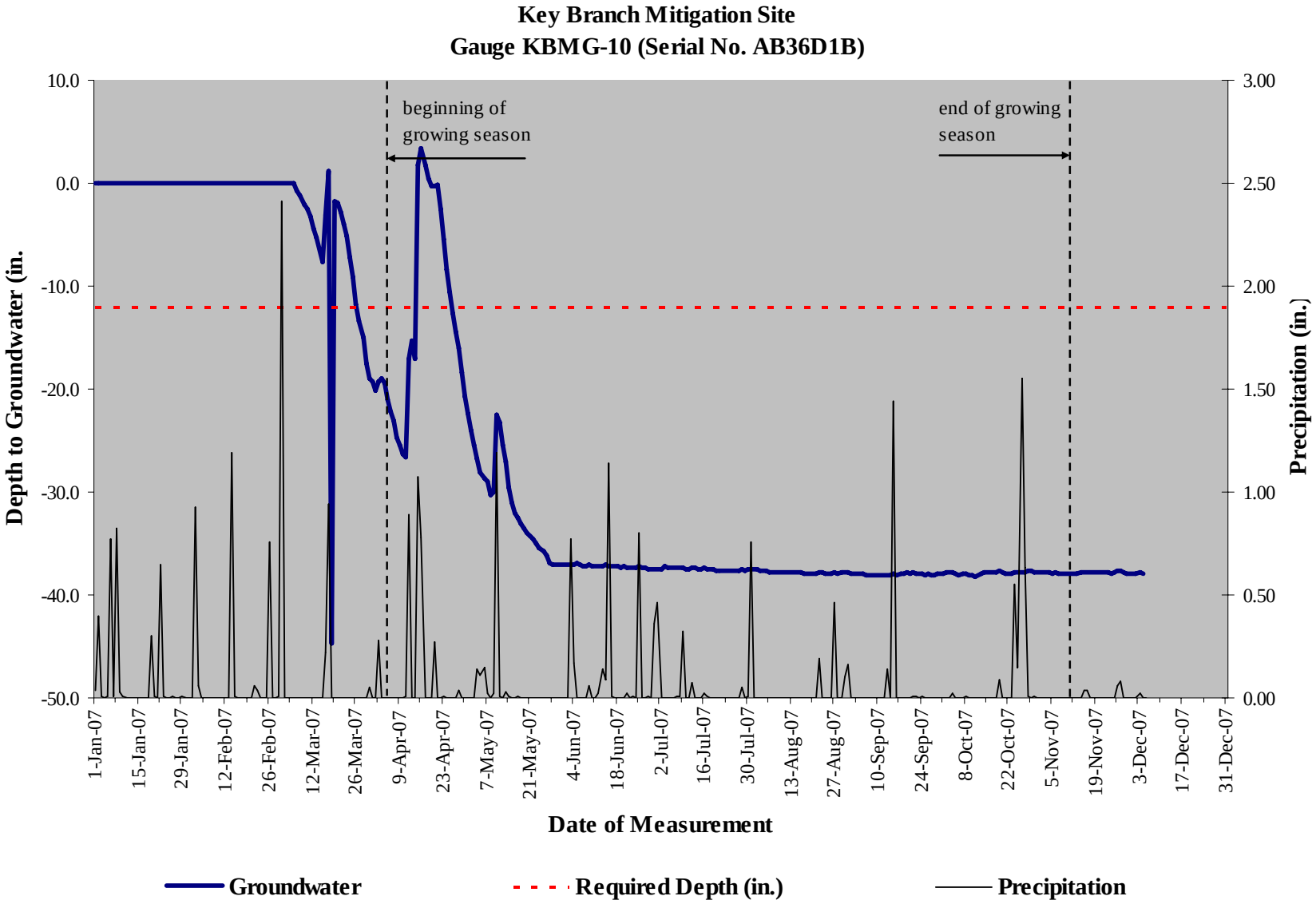
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-7 (Serial No. 9DE535B)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
30-Jul-07
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-8 (Serial No. A28A565)
beginning of growing season
end of growing season
Depth to Groundwater (in.
Precipitation (in.)
15.0
5.0
-5.0
-15.0
-25.0
-35.0
-45.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
30-Jul-07
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-9 (Serial No. A28A3CC)
beginning of growing season
end of growing season
Depth to Groundwater (in.
Precipitation (in.)
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
30-Jul-07
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-10 (Serial No. AB36D1B)
beginning of growing season
end of growing season
Depth to Groundwater (in.
Precipitation (in.)
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
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16-Jul-07
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10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
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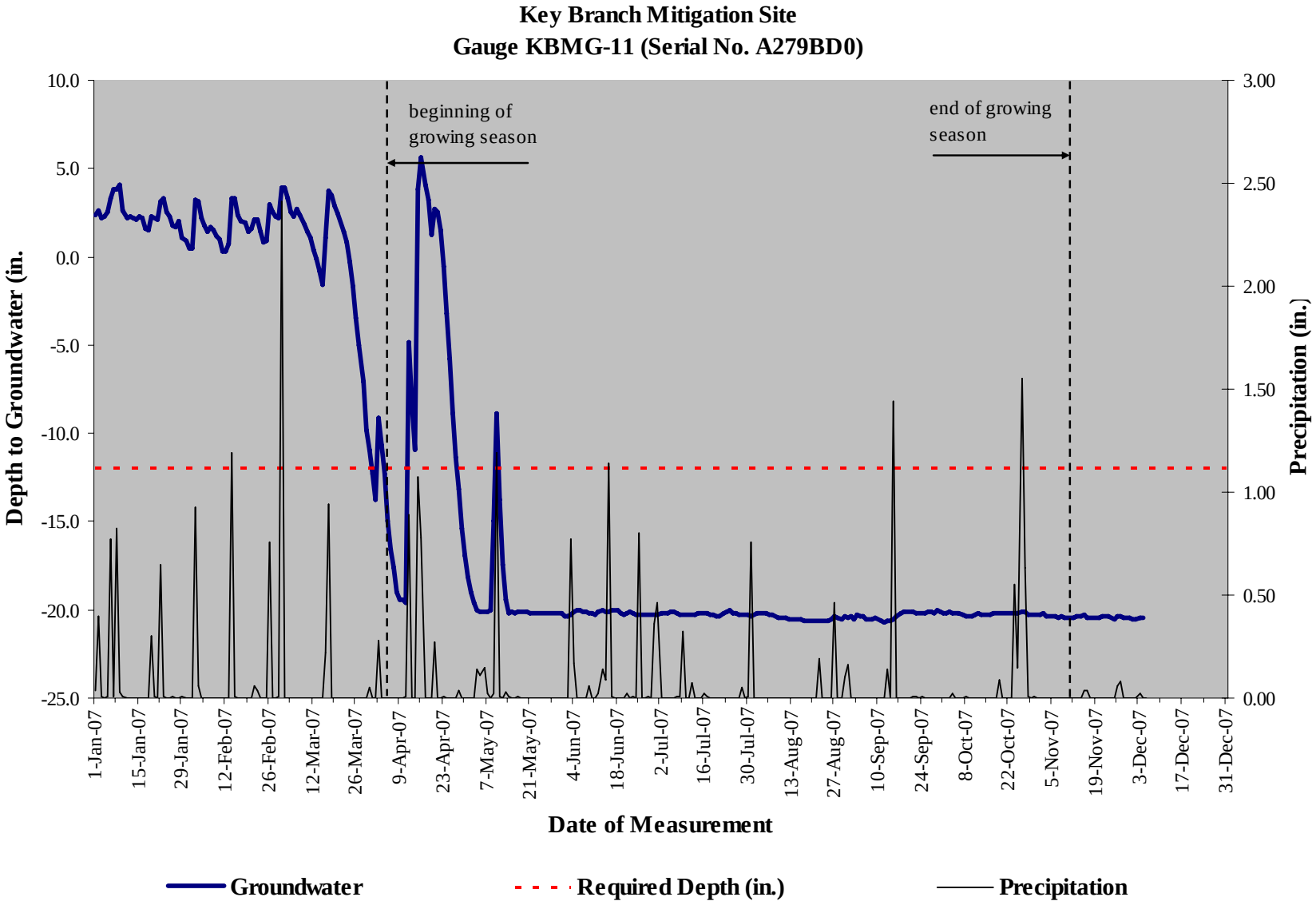
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-11 (Serial No. A279BD0)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
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5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
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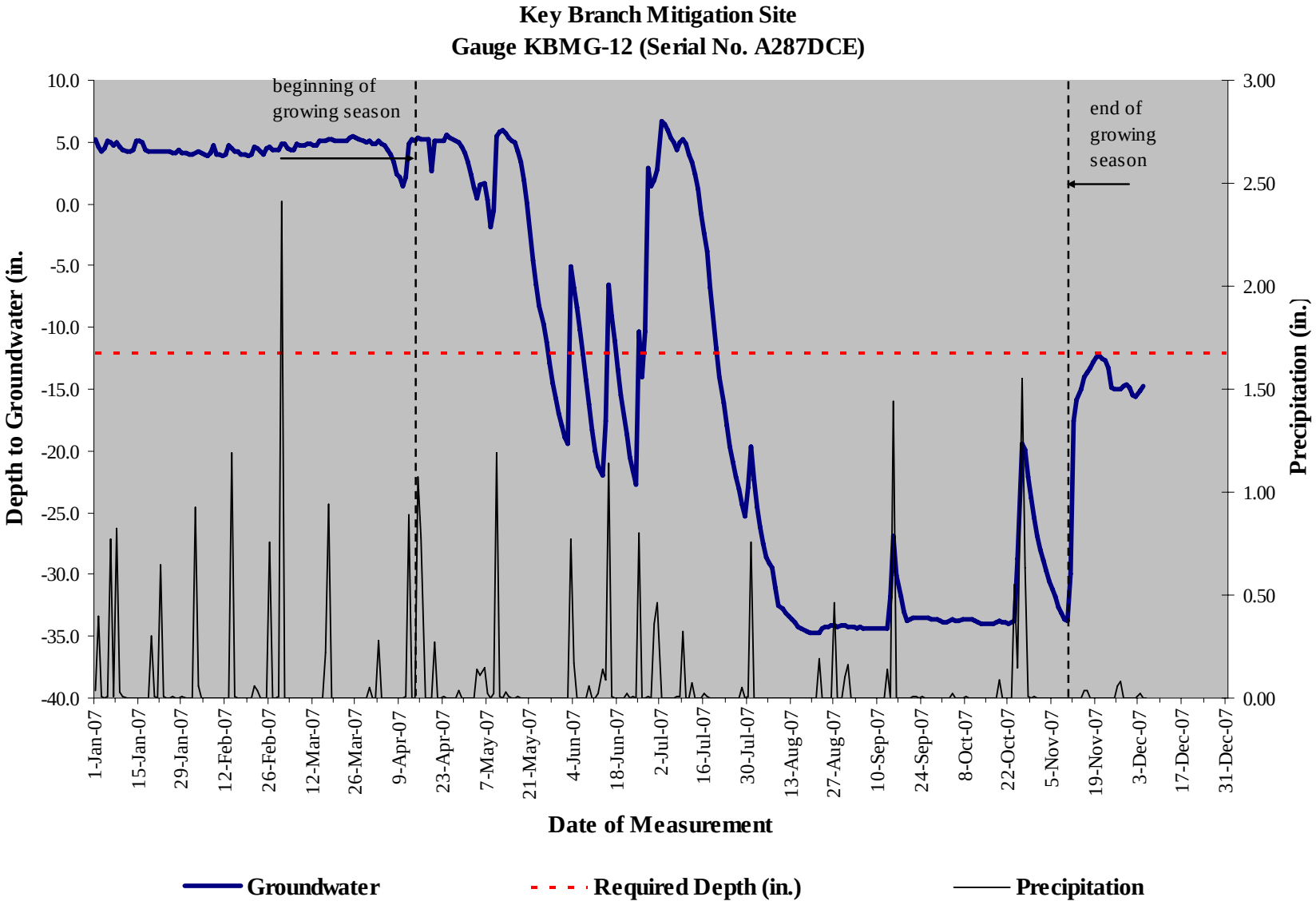
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-12 (Serial No. A287DCE)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
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5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
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26-Mar-07
9-Apr-07
23-Apr-07
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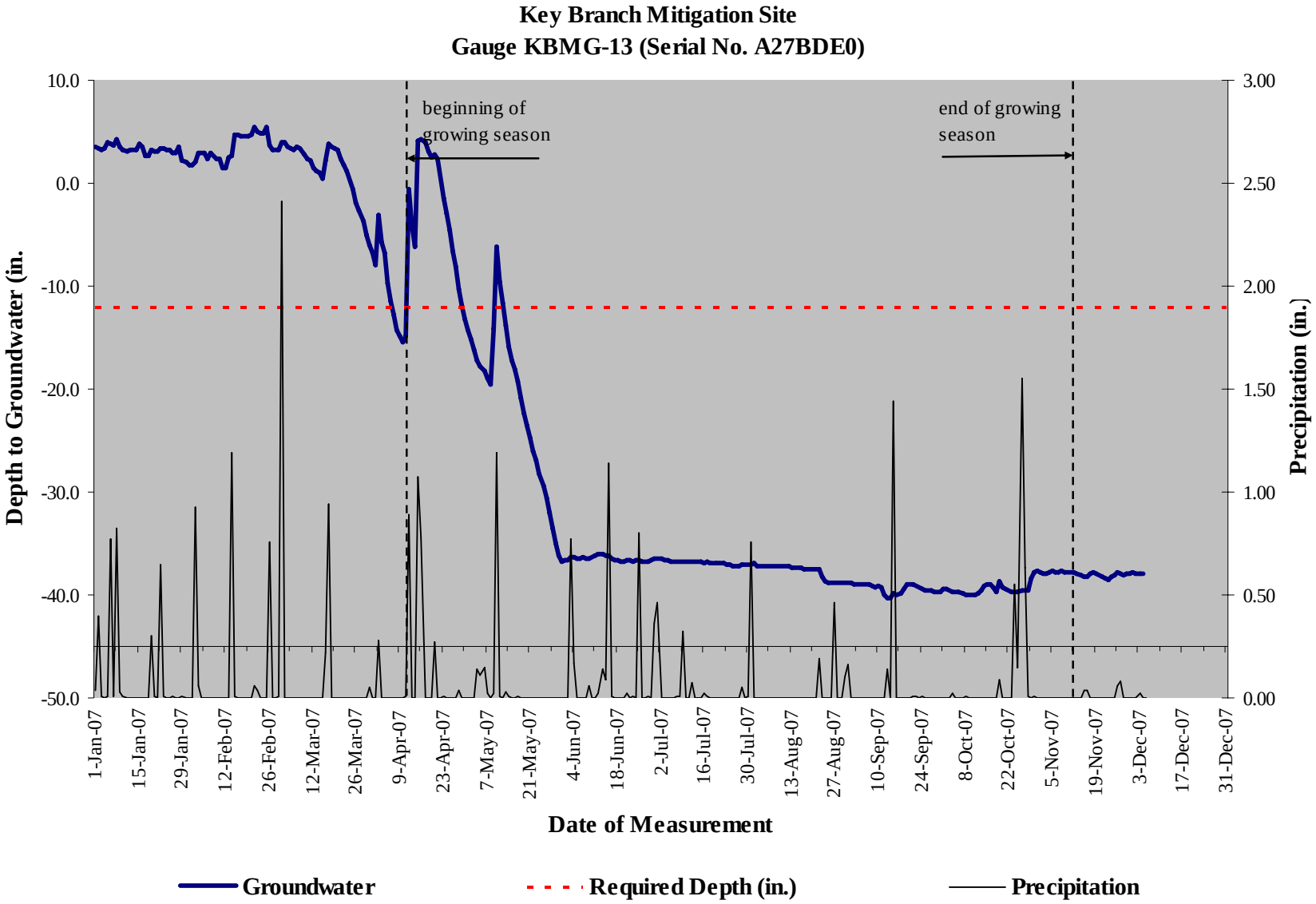
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-13 (Serial No. A27BDE0)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
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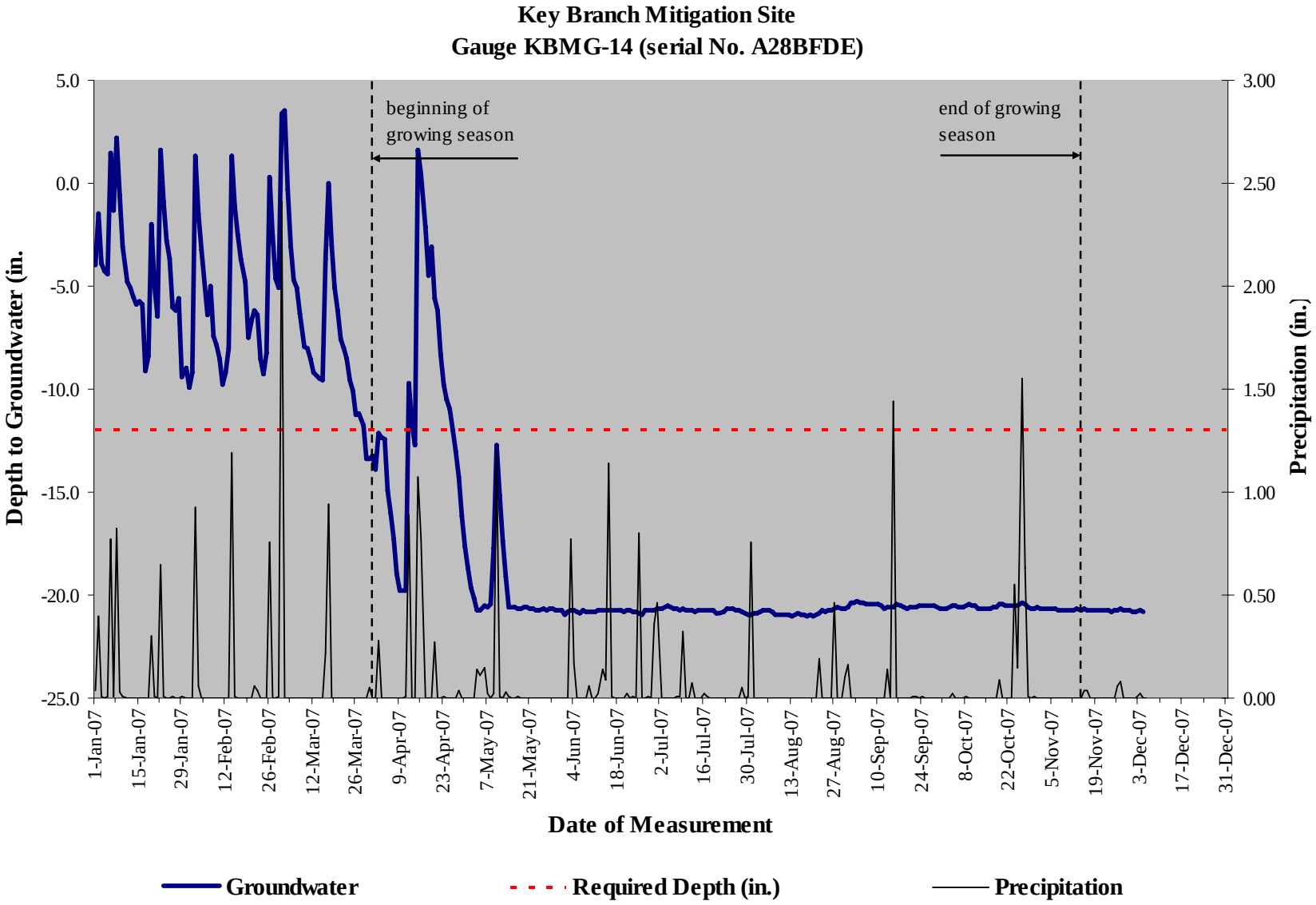
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge KBMG-14 (serial No. A28BFDE)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
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29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
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2-Jul-07
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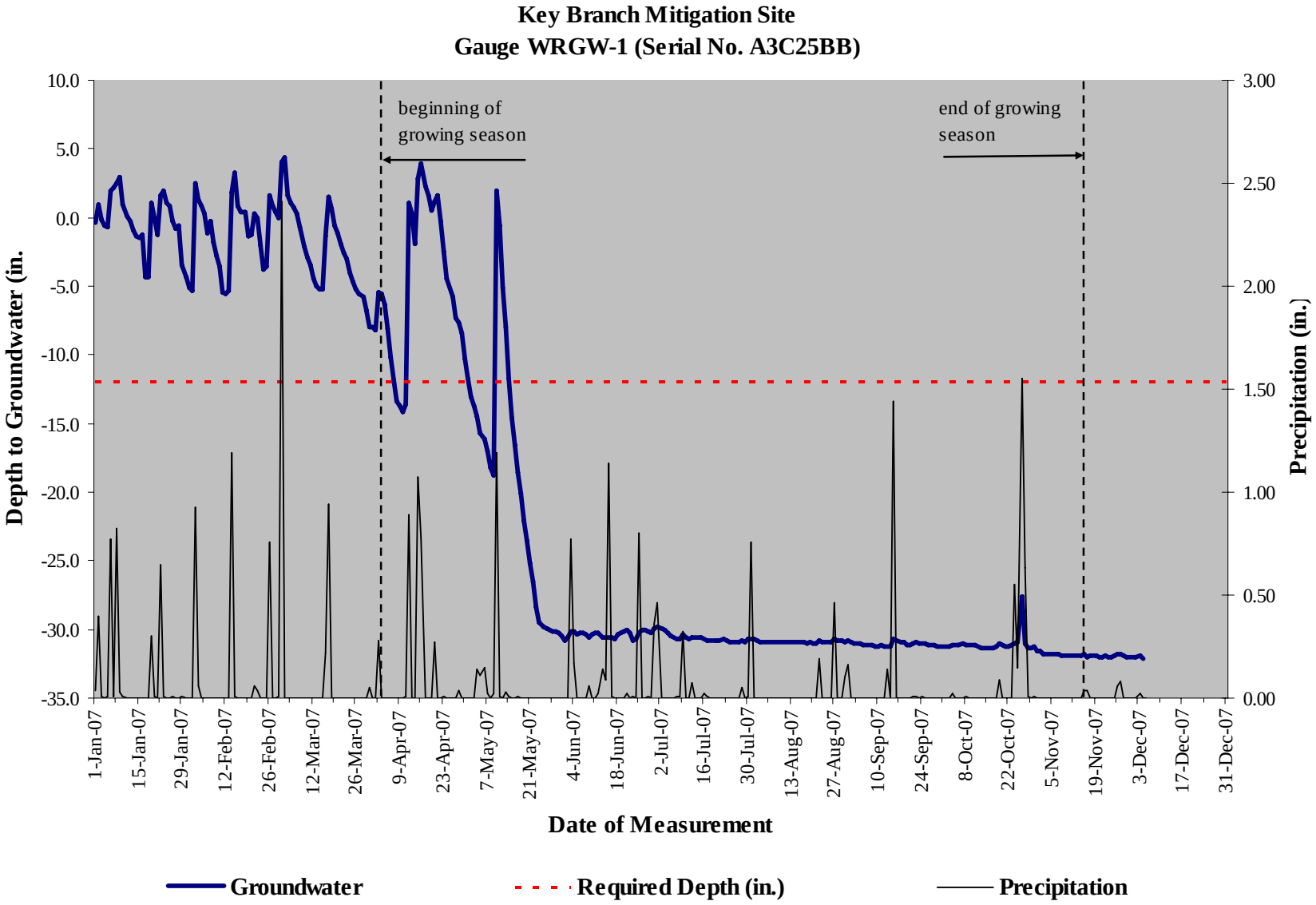
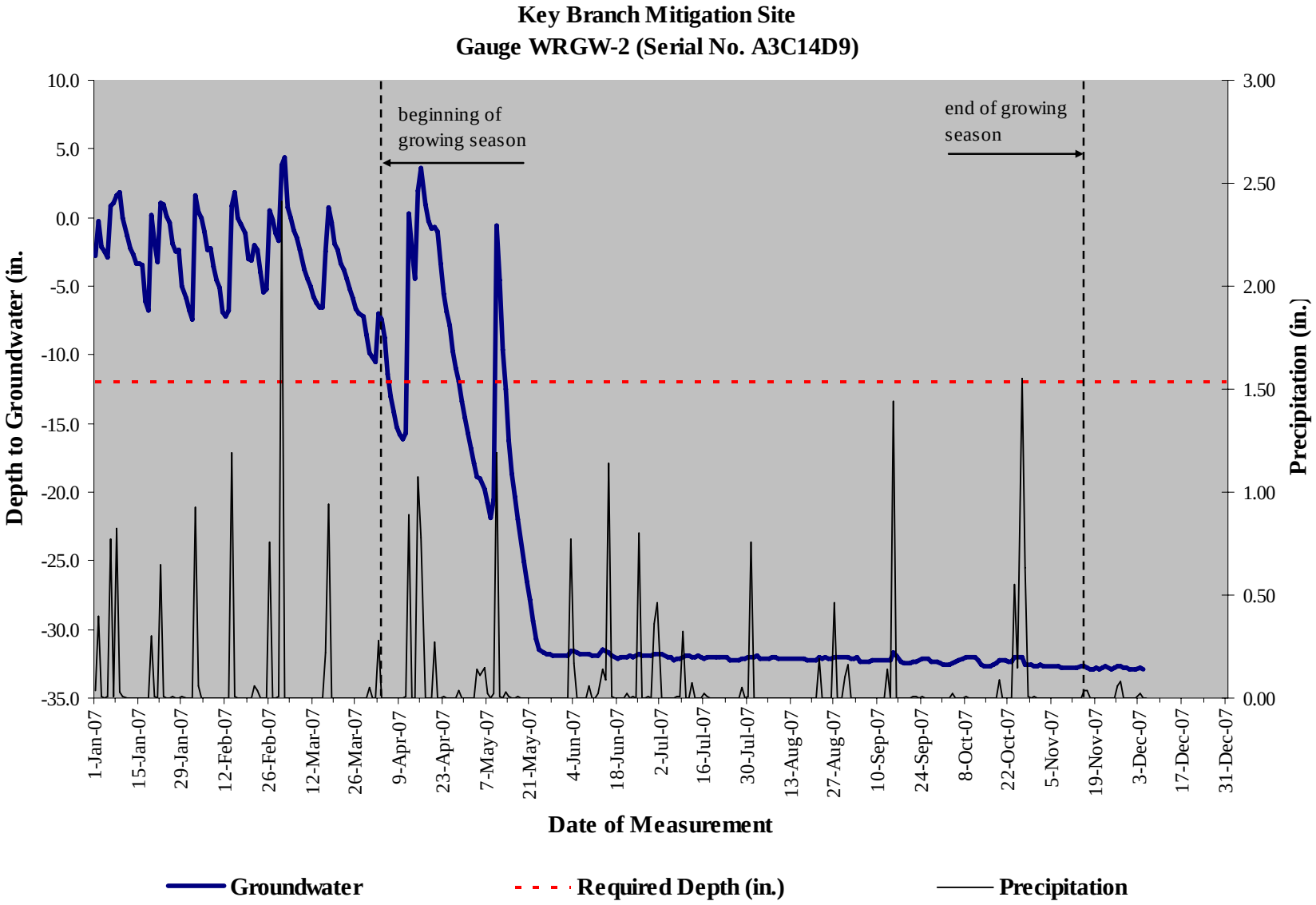
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge WRGW-1 (Serial No. A3C25BB)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
30-Jul-07
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge WRGW-2 (Serial No. A3C14D9)
beginning of growing season
end of growing season
Depth to Groundwater (in.
Precipitation (in.)
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
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21-May-07
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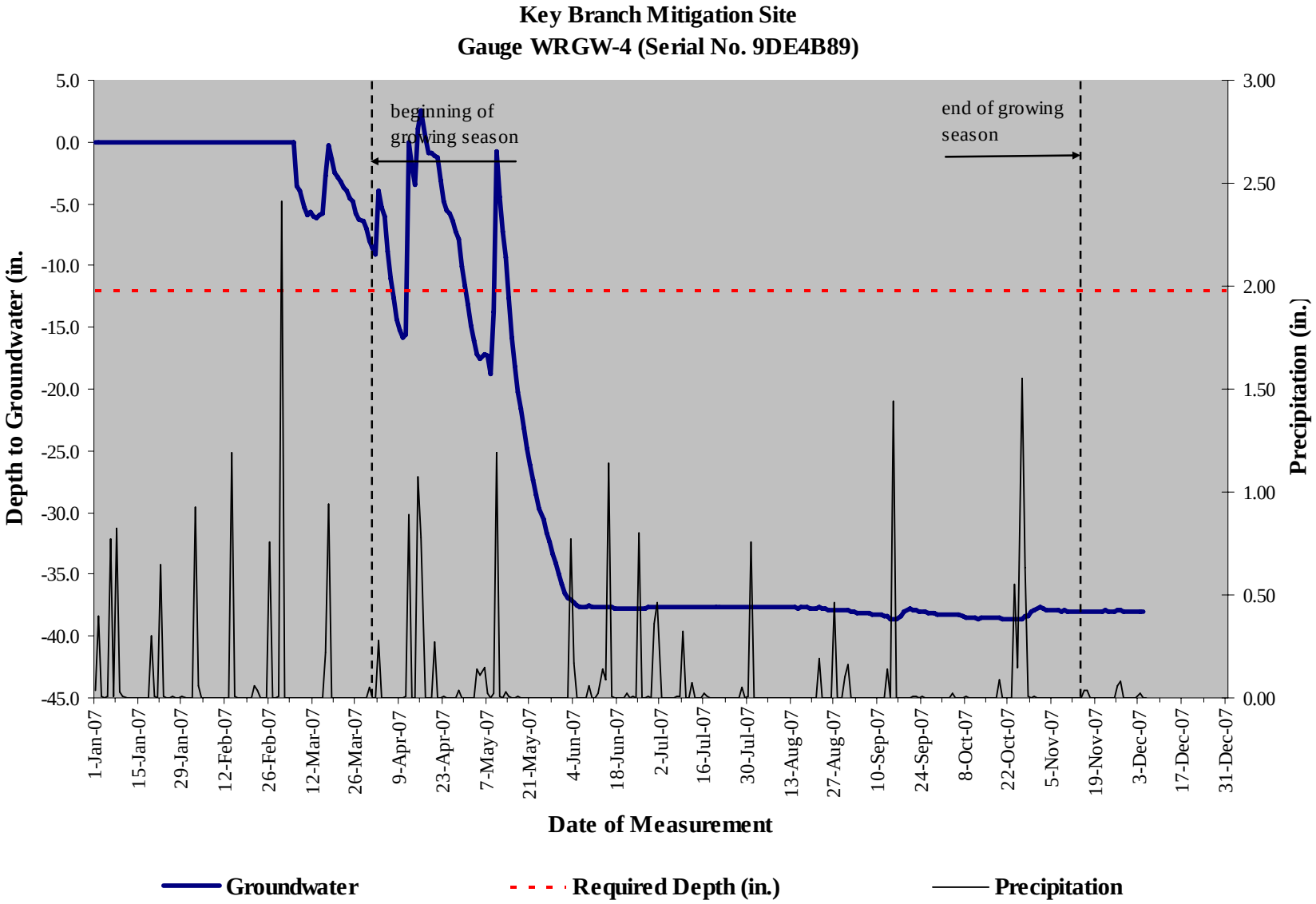
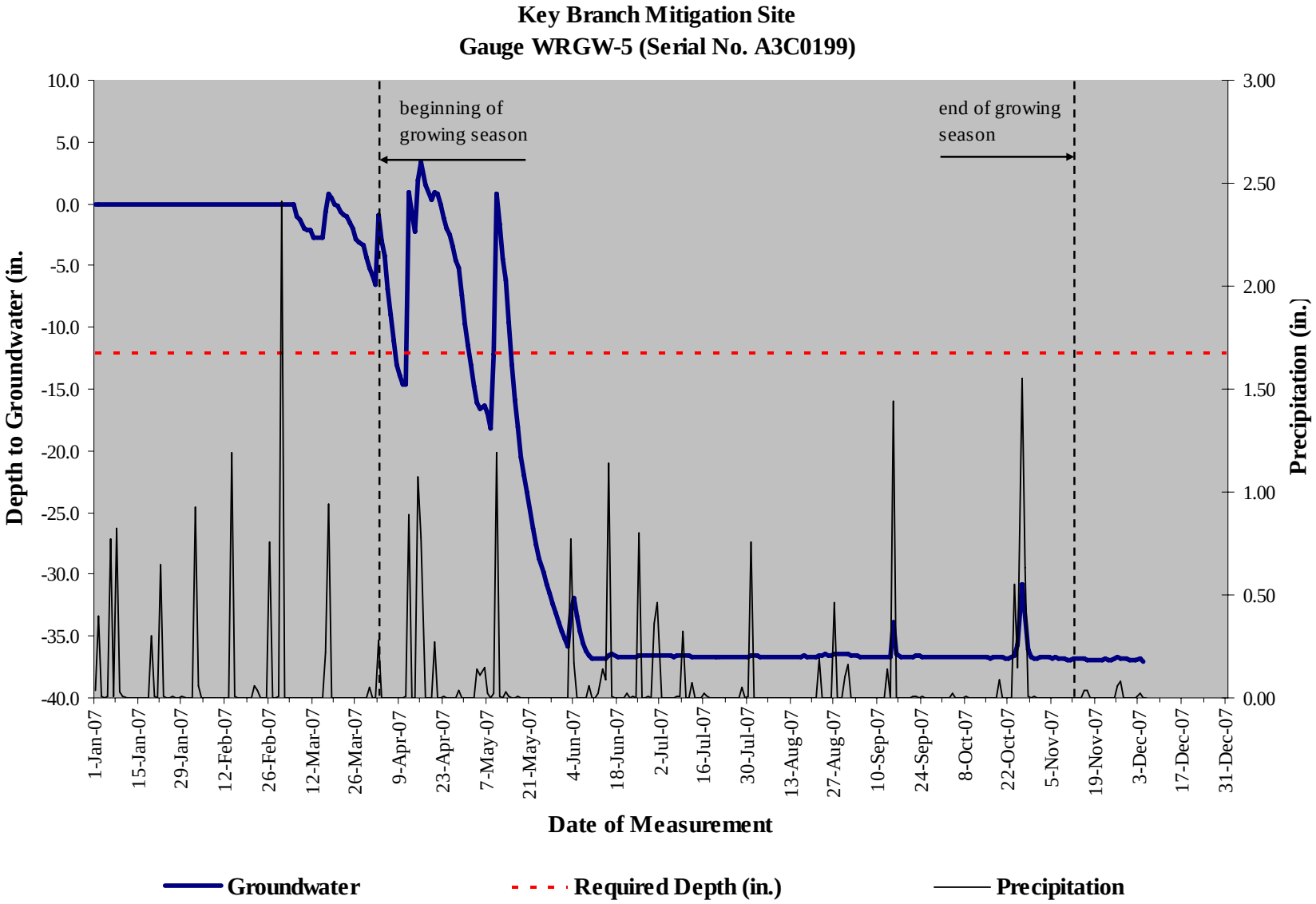
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation

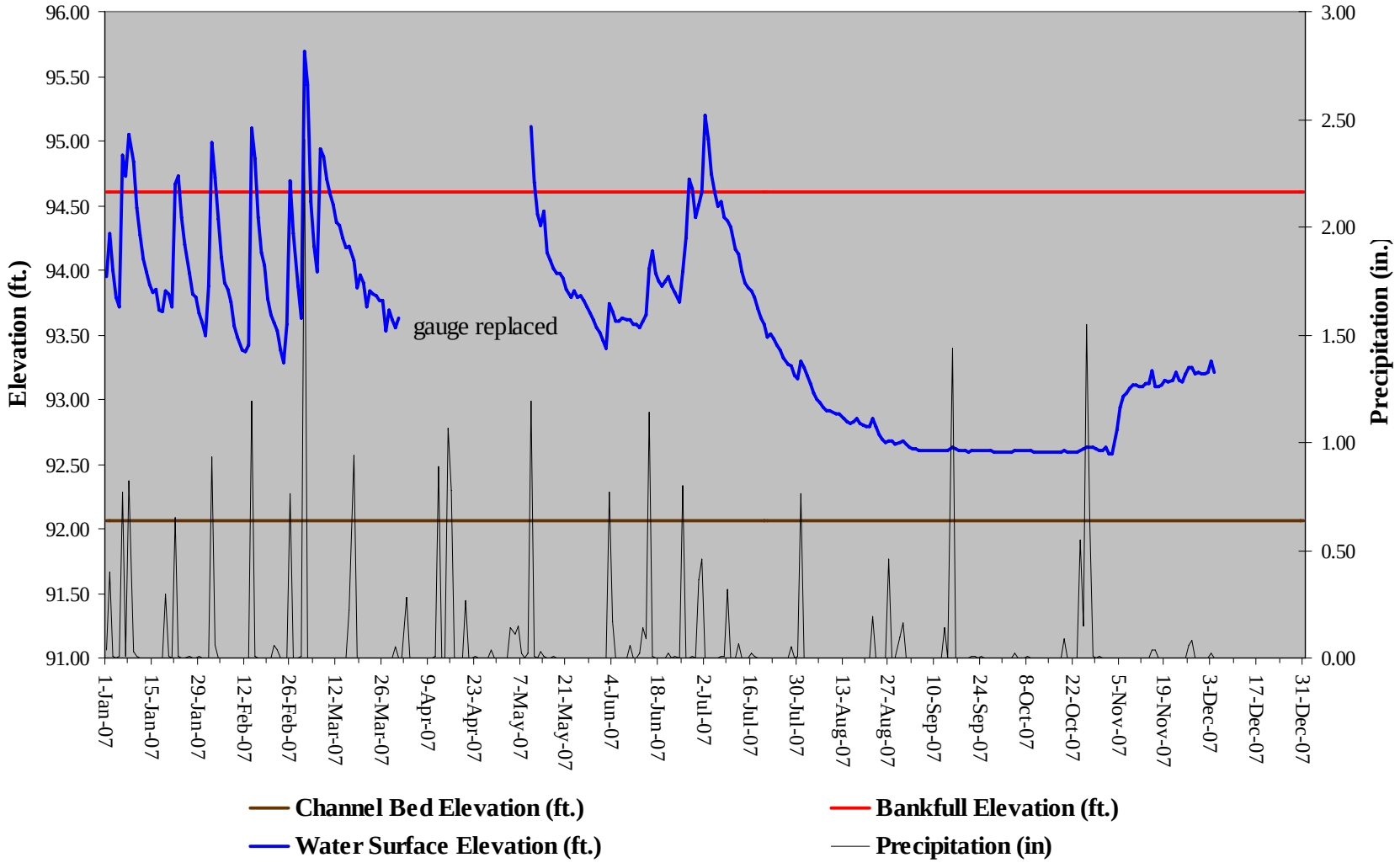

Key Branch Mitigation Site
Gauge WRGW-4 (Serial No. 9DE4B89)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
30-Jul-07
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation


Key Branch Mitigation Site
Gauge WRGW-5 (Serial No. A3C0199)
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-07
15-Jan-07
29-Jan-07
12-Feb-07
26-Feb-07
12-Mar-07
26-Mar-07
9-Apr-07
23-Apr-07
7-May-07
21-May-07
4-Jun-07
18-Jun-07
2-Jul-07
16-Jul-07
30-Jul-07
13-Aug-07
27-Aug-07
10-Sep-07
24-Sep-07
8-Oct-07
22-Oct-07
5-Nov-07
19-Nov-07
3-Dec-07
17-Dec-07
31-Dec-07
Date of Measurement
Groundwater
Required Depth (in.)
Precipitation

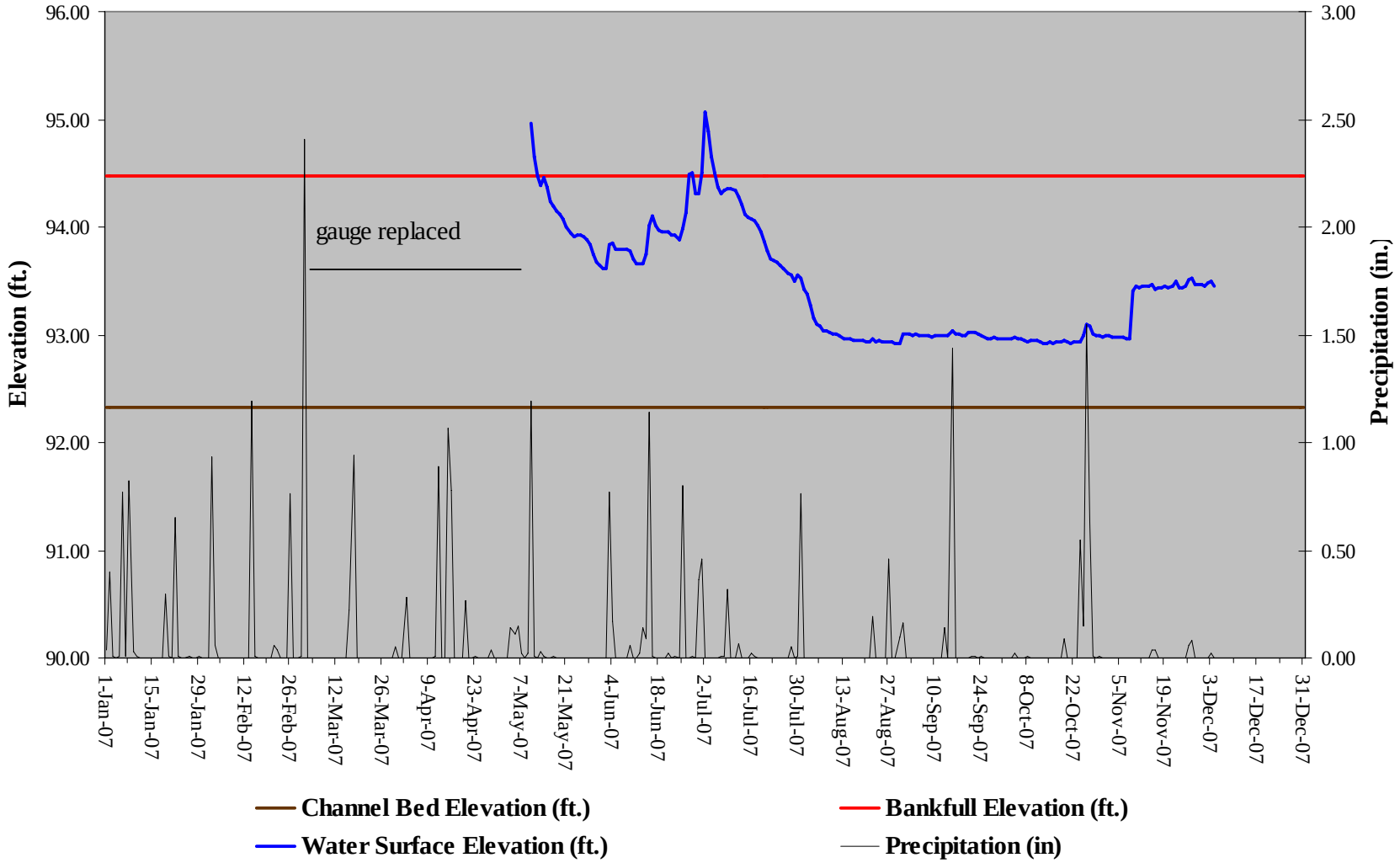
APPENDIX A

2. STREAM GAUGE DATA

Key Branch Mitigation Site
Stream Gauge KBSG-1 (Serial No. 9DE41EA)



Key Branch Mitigation Site
Stream Gauge KBSG-2 (Serial No. AB3639B)



APPENDIX B

SITE PHOTOS AND PLOT LOCATIONS

APPENDIX B

1. VEGETATION PROBLEM AREA PHOTOS

Streamside Boar Wallow Pits, Station 15+70-16+00 – 9/13/2007

APPENDIX B

2. VEGETATION MONITORING PLOT PHOTOS

DOT Vegetation Plots

Plot 1 9/12/2007

Plot 2 9/12/2007

Plot 3 9/12/2007

Plot 4 9/12/2007

Plot 5 9/12/2007

Plot 6 9/12/2007

Plot 7 9/12/2007

Plot 8 9/12/07

Riparian Vegetation Plots

Plot 1 (Formerly Plot 26 in 2006 Report)-9/13/2007

Plot 2 (Formerly Plot 21 in 2006 Report)-9/13/2007

Plot 3 (Formerly Plot 22 in 2006 Report)-9/13/2007

Plot 4 (Formerly Plot 20 in 2006 Report)-9/13/2007

Plot 5 (Formerly Plot 19 in 2006 Report)-9/13/2007

Plot 6 (Formerly Plot 18 in 2006 Report)-9/13/2007

Plot 7 (Formerly Plot 17 in 2006 Report)-9/13/2007

Plot 8 (Formerly Plot 16 in 2006 Report)-9/13/2007

Plot 9 (Formerly Plot 15 in 2006 Report)-9/13/2007

Plot 10 (Formerly Plot 13 in 2006 Report)-9/13/2007

Plot 11 (Formerly Plot 14 in 2006 Report)-9/13/2007

Plot 12 (Formerly Plot 12 in 2006 Report)-9/13/2007

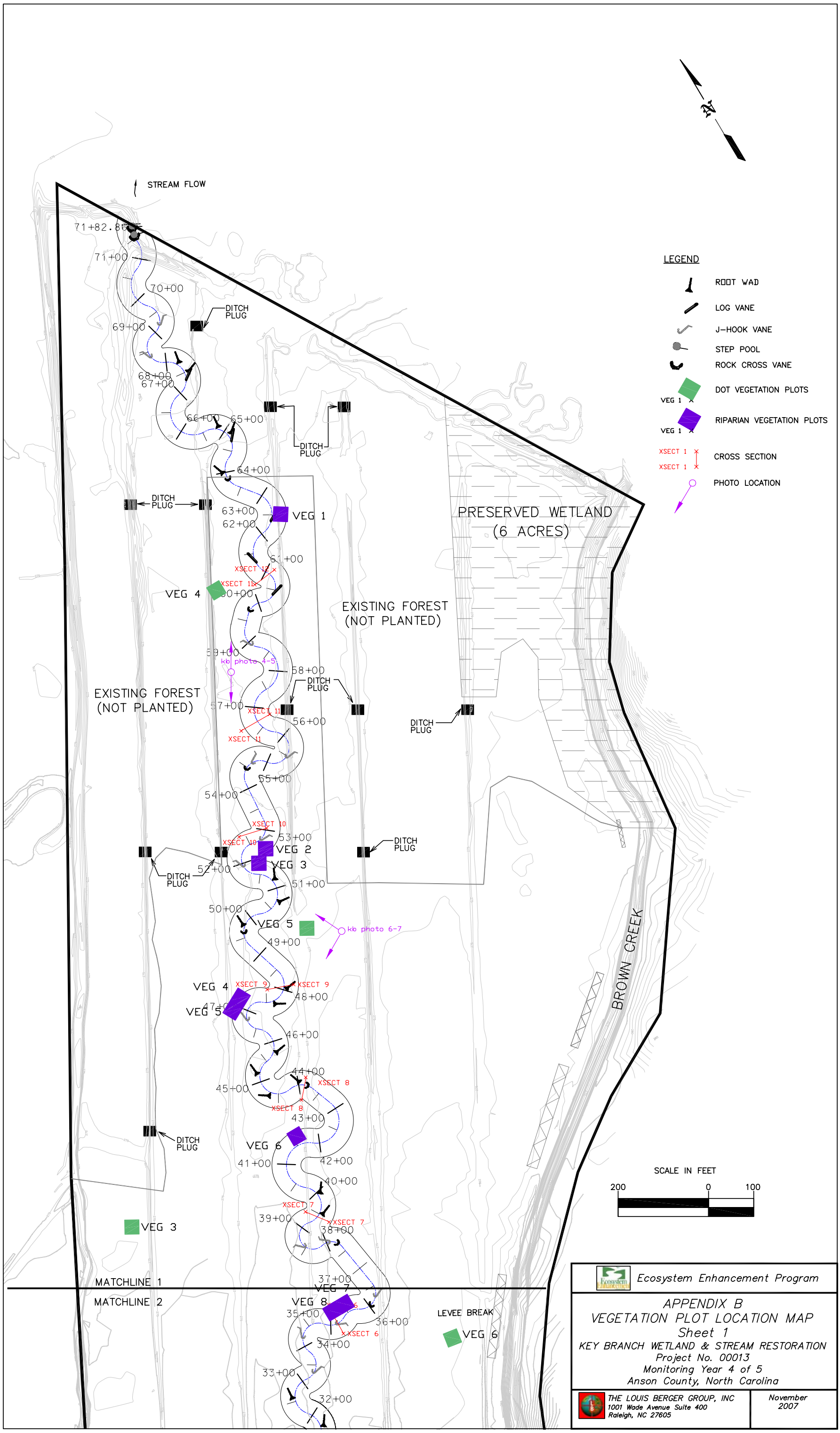
Plot 13 (Formerly Plot 11 in 2006 Report)-9/13/2007

Plot 14 (Formerly Plot 10 in 2006 Report)-9/13/2007

Plot 15 (Formerly Plot 9 in 2006 Report)-9/13/2007

APPENDIX B

3. VEGETATION PLOT LOCATIONS



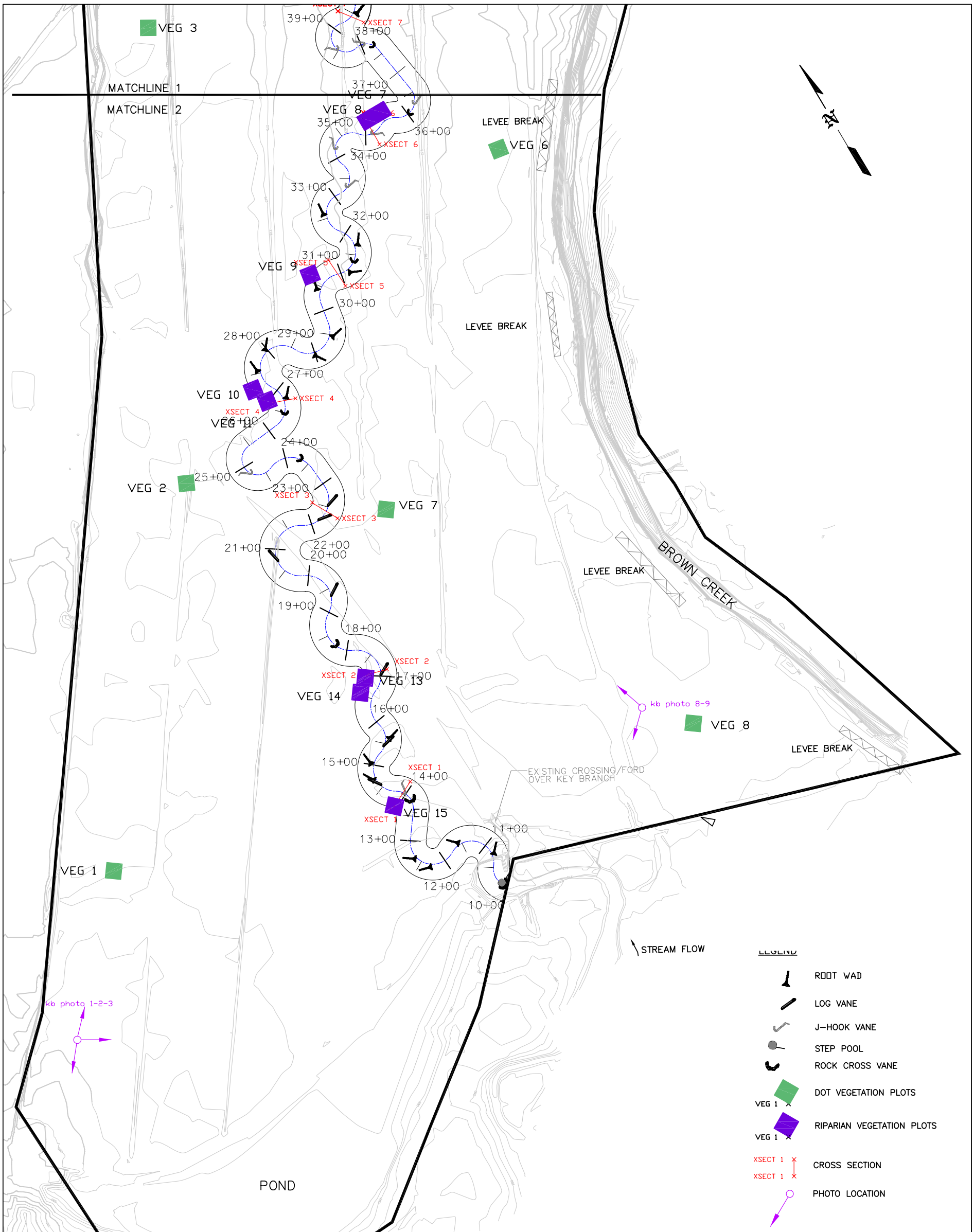
Ecosystem Enhancement Program

APPENDIX B
VEGETATION PLOT LOCATION MAP
Sheet 1

KEY BRANCH WETLAND & STREAM RESTORATION
Project No. 00013
Monitoring Year 4 of 5
Anson County, North Carolina

THE LOUIS BERGER GROUP, INC
1001 Wade Avenue Suite 400
Raleigh, NC 27605

November 2007



Ecosystem Enhancement Program

APPENDIX B
VEGETATION PLOT LOCATION MAP
Sheet 2

KEY BRANCH WETLAND & STREAM RESTORATION
Project No. 00013
Monitoring Year 4 of 5
Anson County, North Carolina

THE LOUIS BERGER GROUP, INC
1001 Wade Avenue Suite 400
Raleigh, NC 27605

November
2007

APPENDIX B

4. CROSS SECTION PHOTOS

Berger was instructed by NCEEP not to do any stream survey work on this site for 2007, only collect cross section photographs at each cross section. Because the number of vegetation plots required to be sampled were also reduced dramatically from 2006, we assume the request not to survey the stream in 2007 might be due to budget issues.

Cross Section 1 - 9/13/2007

Cross Section 2 – 9/13/2007

Cross Section 3 – 9/13 2007

Cross Section 4 – 9/13/2007

Cross Section 5 – 9/12/2007

Cross Section 6 – 9/12/2007

Cross Section 7 – 9/12/2007

Cross Section 8 – 9/12/2007

Cross Section 9 – 9/12/2007

Cross Section 10 – 9/12/2007

Cross Section 11 – 9/12/2007

Cross Section 12 -9/12/2007

APPENDIX B

5. STREAM PHOTO-STATION PHOTOS

Photo Station 1 9/12/2007

Photo Station 2 9/12/2007

Photo Station 3 9/12/2007

Photo Station 4 9/12/2007

Photo Station 5 9/12/2007

Photo Station 6 9/12/2007

Photo Station 7 9/13/2007

Photo Station 8 9/13/2007

Photo Station 9 9/13/2007