SALT TRACT MITIGATION SITE 2009
2009 Annual Monitoring Report (Year 4)

Cape Fear River Basin,
Moore County, North Carolina

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

Ecosystem Enhancement PROGRAM

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2009 Annual Monitoring Report (Year 4)

SUMMARY

The 327 acre Sandhills Area Land Trust (SALT) Wetland Mitigation Site in Moore County, North Carolina was established by the North Carolina Department of Transportation (NCDOT) as mitigation for the R-210 (US Bypass) in 1998 and designated as permanent conservation status. Through an agreement with the North Carolina Ecosystem Enhancement Program (EEP) and NCDOT, EEP has accepted the transfer of all off-site mitigation projects. Therefore, EEP will be responsible for fulfilling the remaining requirements and future remediation for the Site. The NCDOT monitoring report format has been retained for clarity and continuity.

The following report summarizes the monitoring activities that have occurred in the past year at the Site. Monitoring Year 1 data were collected in 2006 by NCDOT – Roadside Environmental Unit. In Monitoring Year 2 (2007) monitoring was conducted by The Louis Berger Group, Inc. In Monitoring Year 3 (2008) EcoScience (now PBS&J) began conducting monitoring activities. The 2009 monitoring report represents the fourth year of vegetation and hydrological monitoring. The Site must demonstrate both hydrologic and vegetation success for a minimum of five years or until the Site is deemed successful.

The Site contains a total of 13 hydrologic monitoring gauges. The 2009 hydrologic monitoring results revealed that 10 of the 11 monitoring gauges within restoration areas met the success criteria (groundwater within 12 inches of the surface for at least 12.5 percent of the growing season). One monitoring gauge indicated groundwater within 12 inches of the surface for less than 5 percent of the growing season.

Approximately 15.9 of the 24.5 acres of planting on the Site were planted to approximate the bottomland hardwood community type. Approximately 8.6 acres of upland buffer were planted with longleaf pine. The 2009 vegetation monitoring results revealed an average density of 437.5 trees per acre of planted species. Although this average is above the minimum success criteria of 320 trees per acre, the vegetation fails to meet established success criteria based on low diversity.

Unauthorized road improvements to an access road on-site has reduced water levels in the wetland restoration and enhancement areas. EEP has been notified of these changes.

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Site is located in southern Moore County, immediately north of Lakebay Road (SR 2023) along the Little River, approximately 0.5 miles west of the town of Lobelia (Figure 1, Appendix A). It is located in USGS hydrologic unit 03020201110040 (USGS). The Site is bordered to the north and west by forested land, to the east by agriculture, and to the south by SR 2023. The Site comprises 327 acres and includes restoration of both riverine hardwood and swamp forest wetlands.

1.2 PURPOSE

In order to demonstrate successful wetland mitigation, hydrological and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrological conditions and vegetation survival. The following report details the results of hydrological and vegetative monitoring at the Site during the 2009 growing season.

Included in this report are analyses of both hydrologic and vegetative monitoring results, as well as local climate conditions throughout the growing season, and site photographs.

1.3 PROJECT HISTORY

December 2001	Site KG Sheared and Drum Chopped
July 2002	Site Sprayed
February 2003	Site Planted
January 2006	Ditches Plugged
January 2006	Monitoring Gauges reprogrammed
March-November 2006	Hydrologic Monitoring (Year 1)
February 2007	Vegetation Monitoring (Year 1)
April-October 2007	Hydrologic Monitoring (Year 2)
August 2007	Vegetation Monitoring (Year 2)
March-November 2008	Hydrologic Monitoring (Year 3)
October 2008	Vegetation Monitoring (Year 3)
March-November 2009	Hydrologic Monitoring (Year 4)
August 2009	Vegetation Monitoring (Year 4)

2.0 HYDROLOGY

2.1 SUCCESS CRITERIA

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology state that the restoration areas must be inundated or saturated (within 12 inches of the surface) by surface water or groundwater for at least 12.5 percent of the growing season (consecutive days) during a normal precipitation year. Areas that have between 5 and 12.5 percent of the growing season may be considered hydric under certain conditions. Areas inundated for less than 5 percent of the growing season are classified as non-wetlands.

The growing season in Moore County begins March 23 and ends November 7. These dates correspond to a 50 percent probability that temperatures will not drop to 28 degrees Fahrenheit or lower after March 23 and before November 7 (Natural Resources Conservation Service, Soil Survey of Moore County). The growing season is 230 days.

2.2 HYDROLOGIC DESCRIPTION

In January 2006, 13 Remote Data Systems (RDS) continuous logging groundwater gauges were installed. The on-site gauge locations are shown on Figure 2, Appendix A. The monitoring gauges record daily readings of depth to groundwater. This year's data represents the fourth growing season that the gauges have been monitored. The Site was designed to receive hydrologic inputs from rainfall, groundwater, and surface water from overbanking events. Biologists first visited the Site for Year 4 monitoring in March 2009. During the visit, Gauges 1 and 2 were found to be submerged underwater due to beaver activity and remained underwater during all subsequent site visits. As a result, there is no recorded data for these two gauges, but visual observations during site visits confirm that this area of the site stays inundated for 100 percent of the growing season. In 2009, a damaged Gauge 3 was replaced with a new Gauge 7 (the original Gauge 7 was not found, and no reference is found to it in the Louis Berger Group's Year 2 Annual Monitoring Report). The new Gauge 7 was not placed at the original Gauge 3 location due to risk of flooding. All other gauges were found in working order.

Rain gauge data were not available from the site during the 2009 monitoring period. Precipitation data was gathered from the National Climatic Data Center affiliated with NOAA[1]. The official weather station from which the precipitation data was collected is located approximately 8 miles from the site at Ft. Bragg's water treatment plant in Spring Lake, North Carolina.

2.3 RESULTS OF HYDROLOGIC MONITORING

2.3.1 Site Data

The maximum number of consecutive days that groundwater was within 12 inches of the surface was calculated for each monitoring gauge and converted into a percentage of the 230-day growing season (March 23-November 7). The results are presented in Table 1.

Appendix B contains the hydrographs for each monitoring gauge for the current monitoring year. The corresponding precipitation data collected from the National Climatic Data Center is also provided on each hydrograph.

Figure 2 provides the hydrologic results for the current monitoring year. Gauges highlighted in green indicate wetland hydrology for more than 12.5 percent of the growing season. Gauges highlighted in yellow are those that had wetland hydrology between 5 and 12.5 percent of the growing season. Gauges highlighted in red are those that were found to be damaged or non-functioning.

Table 1. SALT Tract Hydrologic Monitoring Results

Monitoring Gauge	< 5%	5-12%	>12%	Max. Act. %	Success Dates	Number of Consecutive Days
STGW1					NA	
STGW2					NA	
STGW3					NA	
STGW4			√	50	3/23/09- 6/29/09 7/14/09-11/07/09	98 116
STGW5			√	50	3/23/09- 7/02/09 7/14/09-11/07/09	101 116
STGW6			√	50	3/23/09- 6/29/09 7/14/09-11/07/09	98 116
STGW7			√	33	3/23/09- 6/07/09 6/16/09-06/23/09 7/29/09 – 9/04/09 10/17/09 – 10/18/09 10/28/09 – 11/07/09	76 7 37 1 10
STGW8			√	25	3/23/09- 5/21/09 5/27/09-06/03/09 6/16/09 – 6/20/09 07/29/09 – 8/10/09 08/15/09 – 08/20/09 08/23/09 – 09/01/09	59 7 4 12 5 9
STGW9	√			2.6	3/29/09- 04/04/09 04/15/09 08/06/09 08/14/09 08/23/09	6 1 1 1 1
STGW10			√	25	3/23/09- 5/21/09 5/26/09-06/03/09 6/16/09 – 6/19/09 06/21/09 06/23/09 08/05/09 – 08/08/09 08/14/09 – 08/17/09 08/23/09 – 9/01/09	59 8 3 1 1 3 4 9
STGW11			√	43	3/23/09- 07/01/09 07/17/09-09/13/09 09/25/09 – 11/07/09	100 58 43
STGW12			√	34	3/23/09- 06/11/09 06/16/09-06/23/09 07/21/09 – 09/05/09 09/25/09 – 11/07/09	80 7 46 43
STGW13			√	42	3/23/09- 06/28/09 07/17/09-09/13/09 09/23/09 – 11/07/09	97 58 45
STGW14			√	35	3/23/09- 06/12/09 06/15/09-06/26/09 07/16/09 – 09/09/09 09/25/09 – 11/07/09	81 11 55 43

2.3.2 Climatic Data

Figure 3 (Appendix A) provides an evaluation of the local climate in comparison with historical data in order to determine whether 2009 was a year with "average" rainfall. The bars are the monthly rainfall totals for the 2009 hydrologic year collected from nearby weather stations. Also represented on the figure are the 30th and 70th percentiles of monthly precipitation for the Fort Bragg Wastewater Treatment Plant weather station. The historical data and monthly data were collected by the Southeast Regional Climate Data.

A normal yearly rainfall in the area is approximately 46.3 inches. The total rainfall measured from November 2008 through July 2009 was approximately 31 inches. Months with below average rainfall include: January, February, April, June and July of 2009. November 2008, December 2008, March 2009 and May 2009 all received above average rainfall.

2.4 CONCLUSION

The 2009 year represents the fourth year of hydrologic monitoring of the Site. In general, water levels showed a typical pattern of flooding during the spring, followed by a late summer and fall draw down period, punctuated by peaks associated with precipitation events. Overall, 10 of the 11 on-site monitoring gauges met the success criteria (groundwater within 12 inches of the surface for at least 12.5 percent of the growing season). One on-site monitoring gauge indicated groundwater within 12 inches of the surface for less than 5 percent of the growing season.

3.0 VEGETATION

3.1 SUCCESS CRITERIA

The 2009 monitoring report represents the fourth year of vegetation monitoring and requires a minimum survival of 320 stems per acre in order to meet success criteria. The required survival criterion will decrease by 10 percent each year after the third year of vegetation monitoring. The number of plants of one species is not to exceed 20 percent of the total number of plants of all species planted. Vegetation monitoring followed methods described in the EEP Stem Counting Protocol. The taxonomic standard for vegetation follows Flora of the Carolinas, Virginia, Georgia, and surrounding areas[2]. Photograph locations are shown in Figure 4 (Appendix A). Site photographs are provided in Appendix C, pages C1-C8.

3.2 DESCRIPTION OF SPECIES

The following tree species were planted in the Wetland Areas:

Chamaecyparis thyoides, Atlantic White Cedar
Taxodium distichum, Baldcypress
Quercus laurifolia, Laurel Oak
Nyssa sylvatica var*. biflora*, Swamp Blackgum
Quercus nigra, Water Oak
Quercus phellos, Willow Oak

3.3 RESULTS OF VEGETATION MONITORING

The following table lists the densities of planted tree species recorded in each established 0.06-acre (50-foot by 50-foot) plot marked with yellow fiberglass NCDOT stakes. (Figure 4, Appendix A). All 4 vegetation plots exceeded the minimum density requirements during Year 4 monitoring. An inventory of planted species is listed in Table 2.

Table 2. Vegetation Monitoring Statistics

Plot Number	1	2	3	4	Total
Atlantic White Cedar *Chamaecyparis thyoides*	6 *(15%)*	23 *(64%)*	4 *(9%)*	14 *(24%)*	**47 (26%)**
Bald Cypress *Taxodium distichum*	0 (0%)	2 (6%)	2 (5%)	8 (14%)	**12 (7%)**
Laurel Oak *Quercus laurifolia*	1 (3%)	1 (2%)	0 (0%)	6 (10%)	**8 (5%)**
Swamp Blackgum *Nyssa sylvatica* var. *biflora*	7 (17%)	2 (6%)	7 (17%)	8 (14%)	**24 (14%)**
Water Oak *Quercus nigra*	16 (41%)	7 (20%)	27 (64%)	22 (38%)	**72 (41%)**
Willow Oak *Quercus phellos*	9 (24%)	1 (2%)	2 (5%)	0 (0%)	**12 (7%)**
Total (2009, Year 4)	**39**	**36**	**42**	**58**	**175**
Total (2008, Year 3)	50	39	45	62	196
Total (2007, Year 2)	21	13	33	54	121
Total (2006, Year 1)	22	11	28	44	105
Total (2006, at Planting)	27	39	46	50	162
2009 Density (Trees/Acre)	390	360	420	580	
Average Tree Density					**437.5**

3.4 CONCLUSION

Of the 327 acres on this site, approximately 15.9 acres involved wetland tree planting. An upland area that consisted of 8.6 acres of longleaf pine was also planted. The 2009 vegetation monitoring results revealed an average density of 437.5 trees per acre of planted species. This average is above the minimum success criteria of 320 trees per acre after the third growing season. However, the total number of planted stems at each plot has two species that are comprised of more than 20 percent of the total. Atlantic white cedar and water oak comprise 26 percent and 41 percent of the total number of remaining planted stems in all of the vegetation plots, respectively. These factors indicate a lack of diversity, and all four plots fail to meet established success criteria.

4.0 PROBLEM AREAS

In 2009, unauthorized improvements were made within the conservation easement to an access road that enters the site from the south. Improvements included the installation of three culverts and resurfacing the road with gravel. These improvements have reduced water levels in the adjacent wetlands that include both wetland restoration and enhancement areas. Photos of the culverts and the improved access road are included in Appendix C, pages C9-C10. EEP has been notified of these changes.

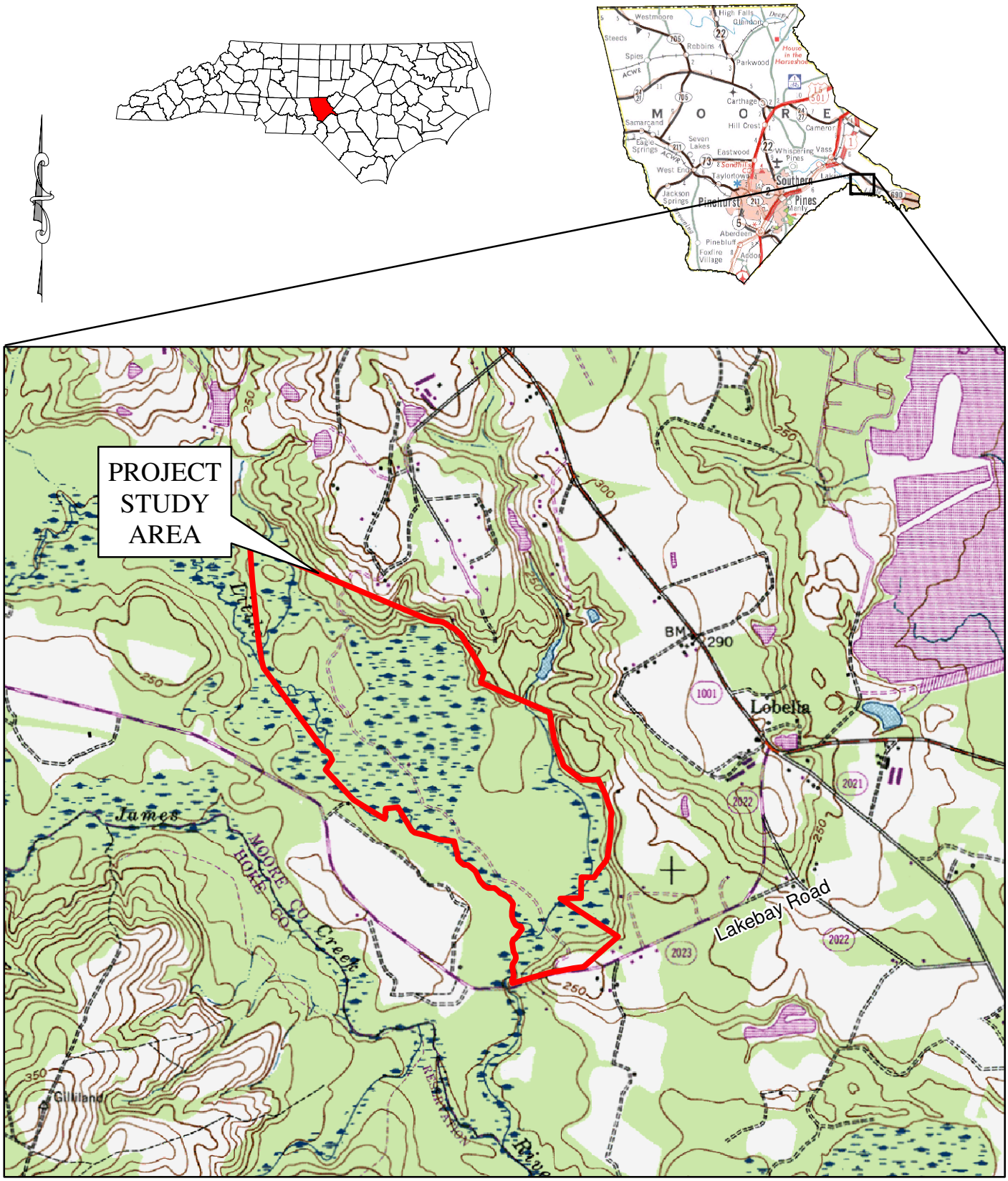
5.0 REFERENCES

[1] National Climatic Data Center and NOAA Satellite and Information Service, Record of Climatological Observations. Last updated 08/2009, http://www.ncdc.noaa.gov/oa/ncdc.html.

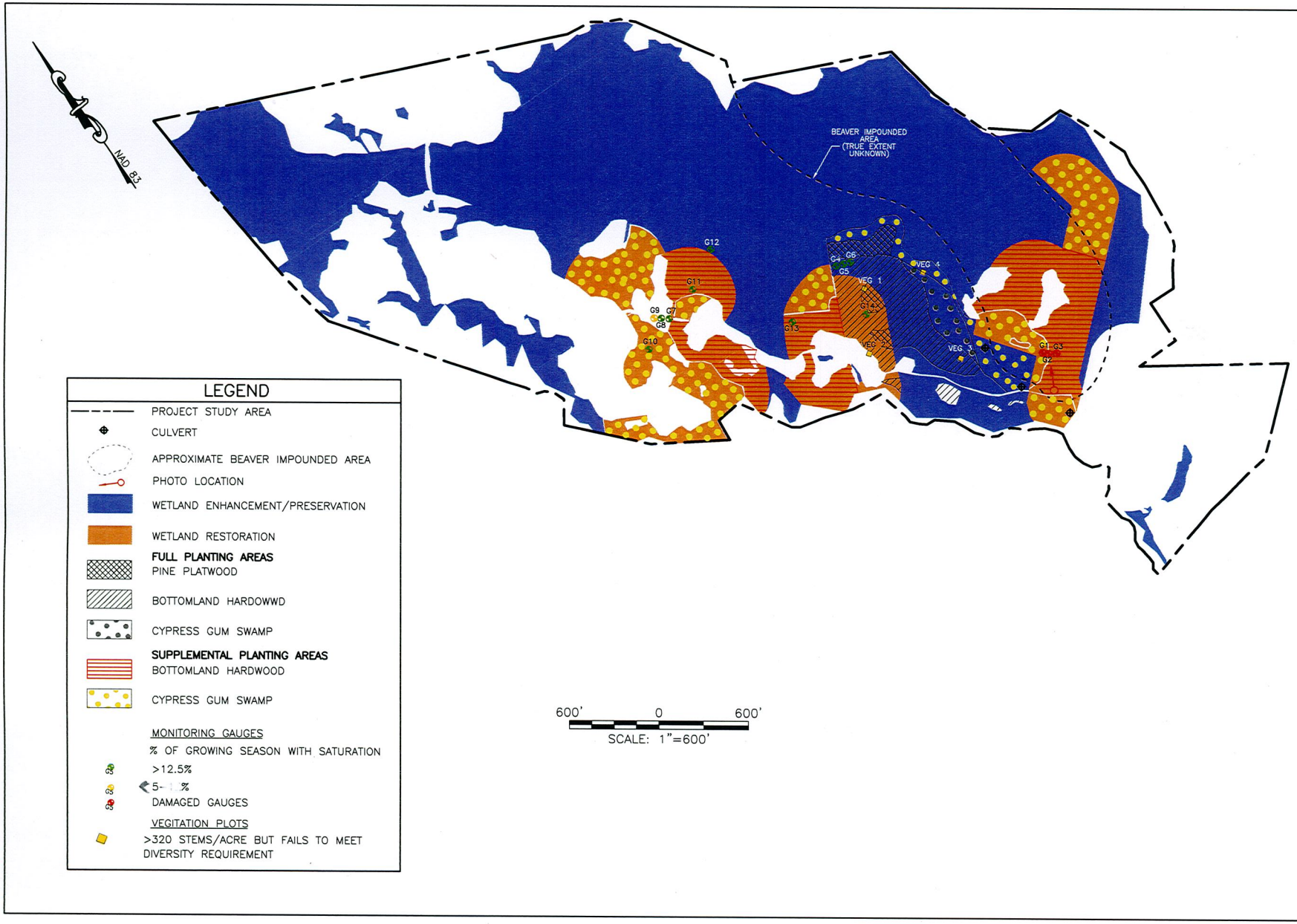
[2] Weakley, A.S. 2007. Flora of the Carolinas, Virginia, Georgia, and surrounding areas. Working draft of January 2007. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina. 1015pp.

APPENDIX A

FIGURES



PBS&J	Client: Ecosystem Enhancement Program	**SITE LOCATION** SALT Tract Monitoring Site Moore County, North Carolina	Dwn By: TAL / Ckd By: JW Date: APRIL 2009 Scale: AS SHOWN PBS&J Project No. 100005069	FIGURE 1



PBSJ

REVISIONS

Client:

Ecosystem Enhancement Program

Project:

SALT TRACT MONITORING SITE

MOORE COUNTY, NORTH CAROLINA

Title:

CURRENT CONDITIONS AREA PLAN VIEW

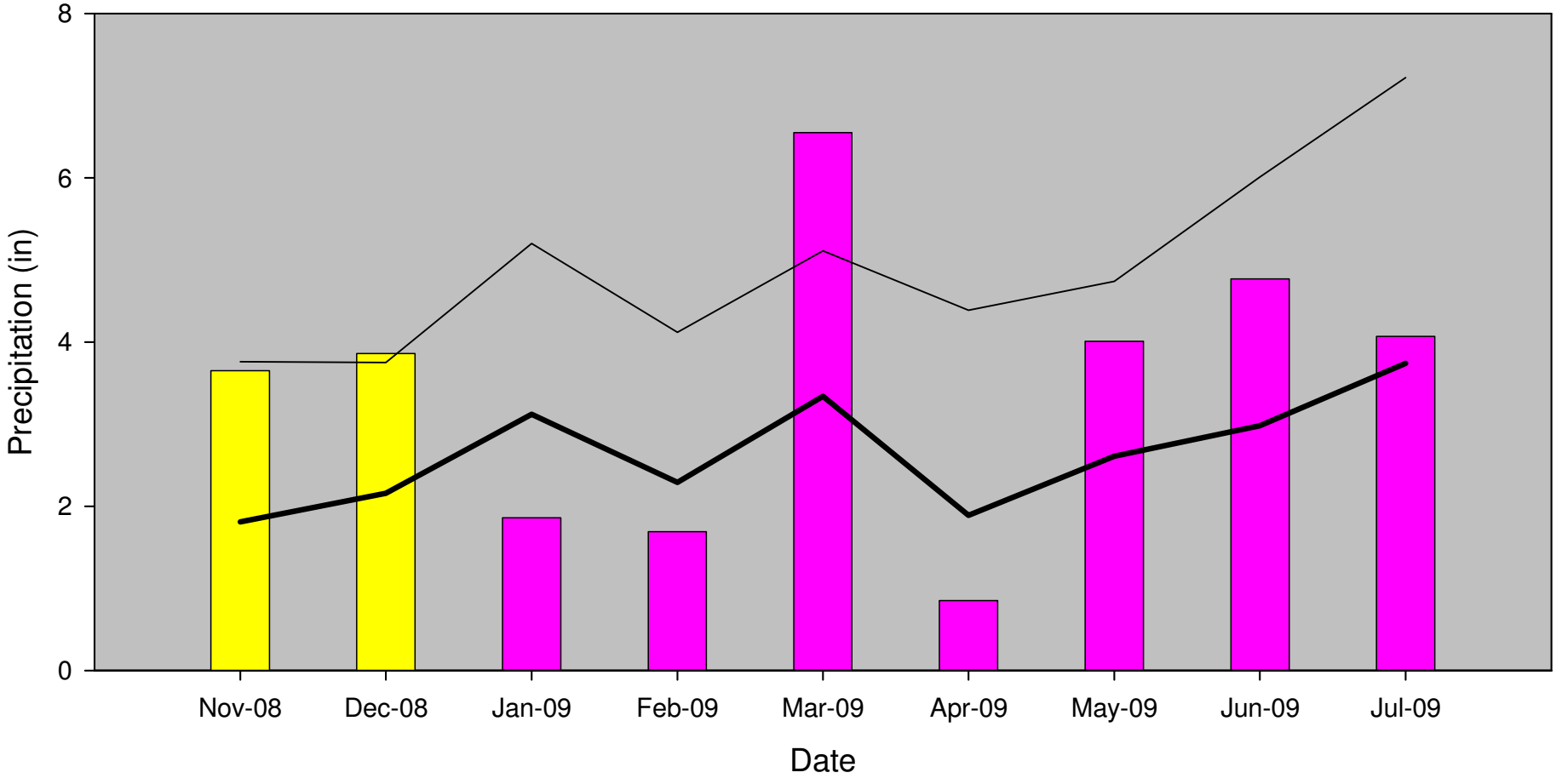
Dwn. By:	Ckd. By:
TL	AE
Date:	Scale:
NOV 2009	As Shown

PBSJ Project No.: 100005069

FIGURE

2

Figure 3. SALT Tract 30-70 Percentile Graph 2009
Fort Bragg WWTP, NC



Data Sources:
Monthly Precipitation- National Climatic Data Center (online)
30-70 Percentile-NRCS National Water and Climate Center (online)
* Extent of available data as of October 2009.

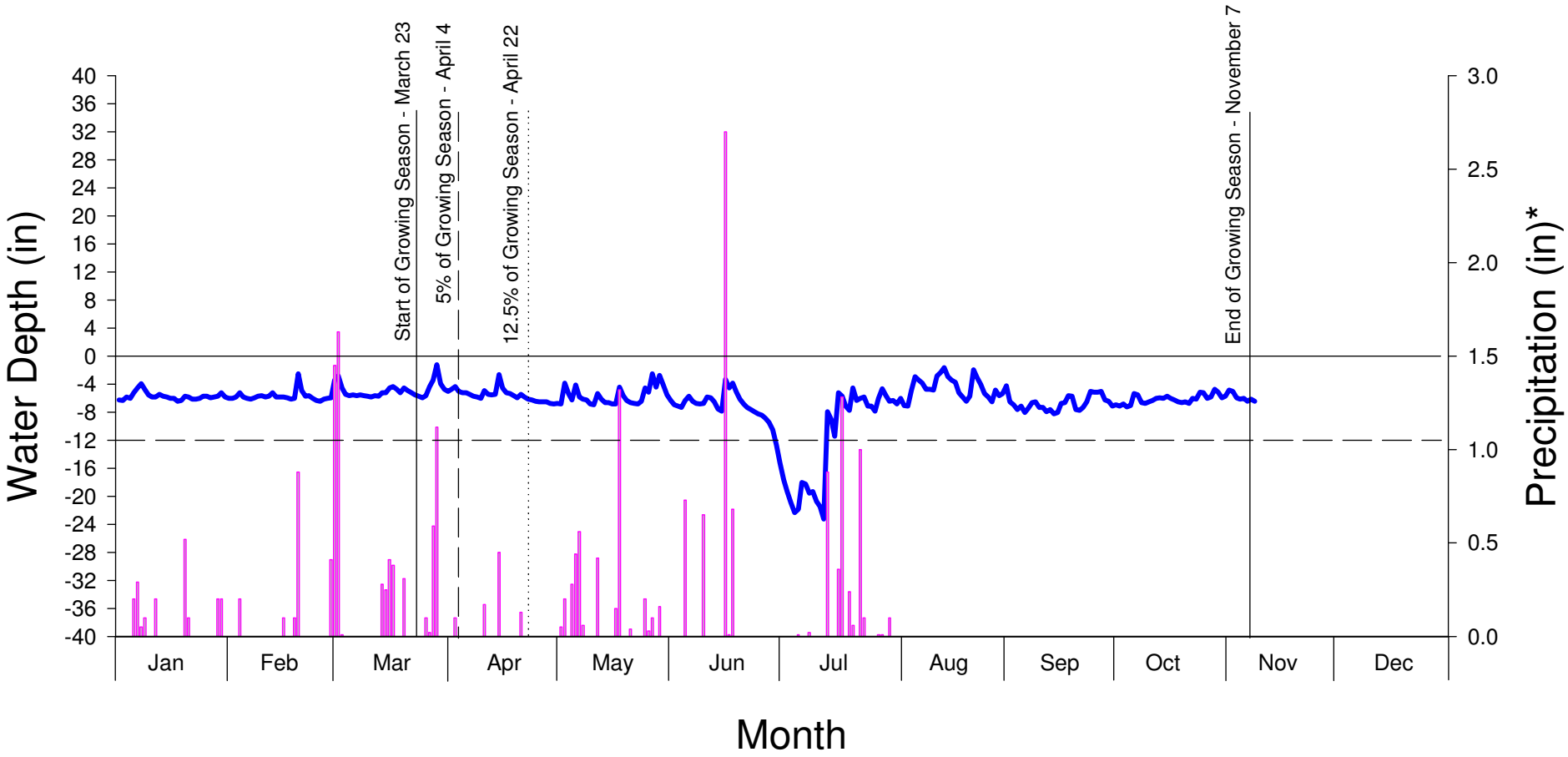
APPENDIX B

GROUNDWATER GAUGE HYDROGRAPHS

SALT Tract

2009

Monitoring Gauge 4 - EBD67B1

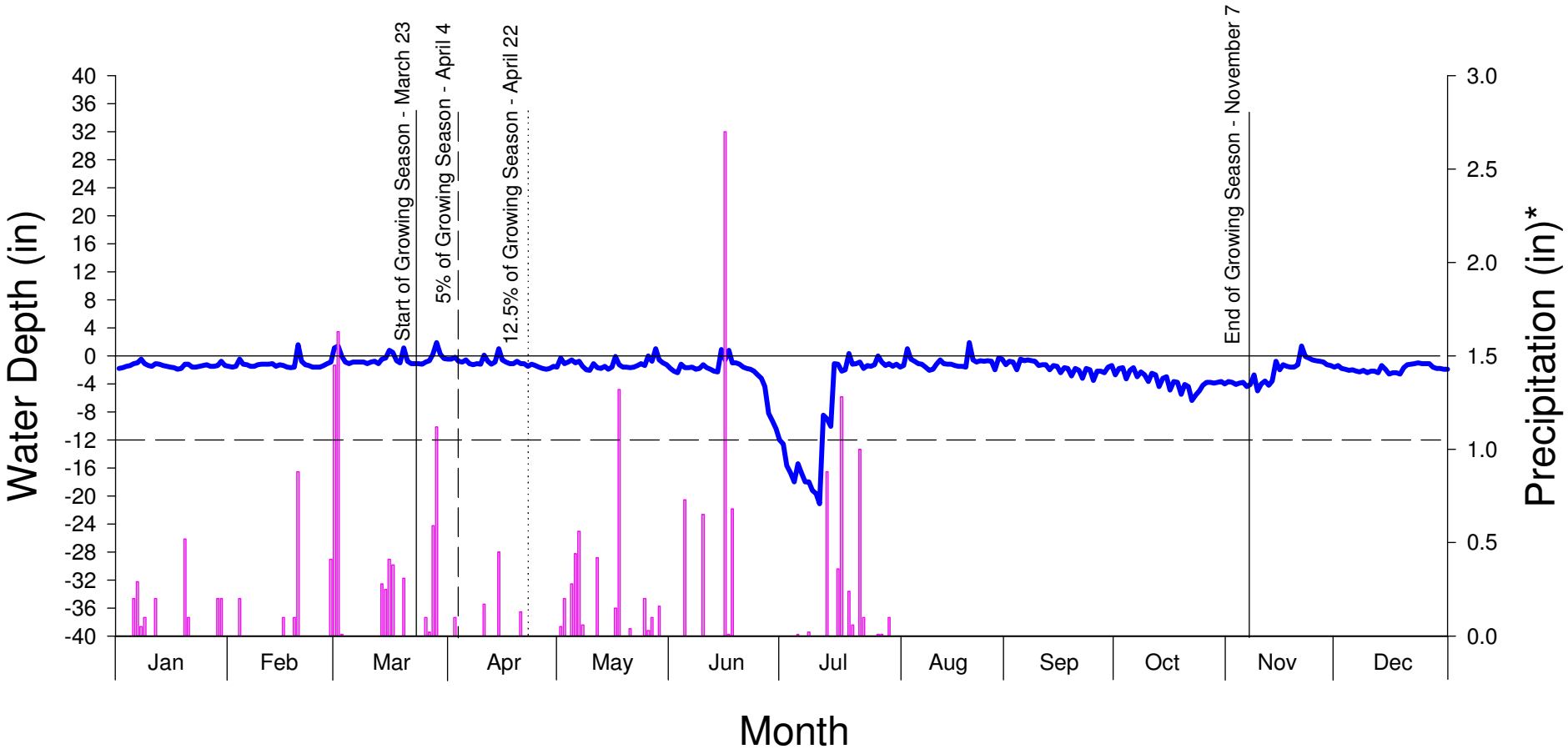


Data Sources:
Monthly Precipitation- National Climatic Data Center (online)
* Extent of available data as of October 2009.

SALT Tract

2009

Monitoring Gauge 5 - 9DE3FBF

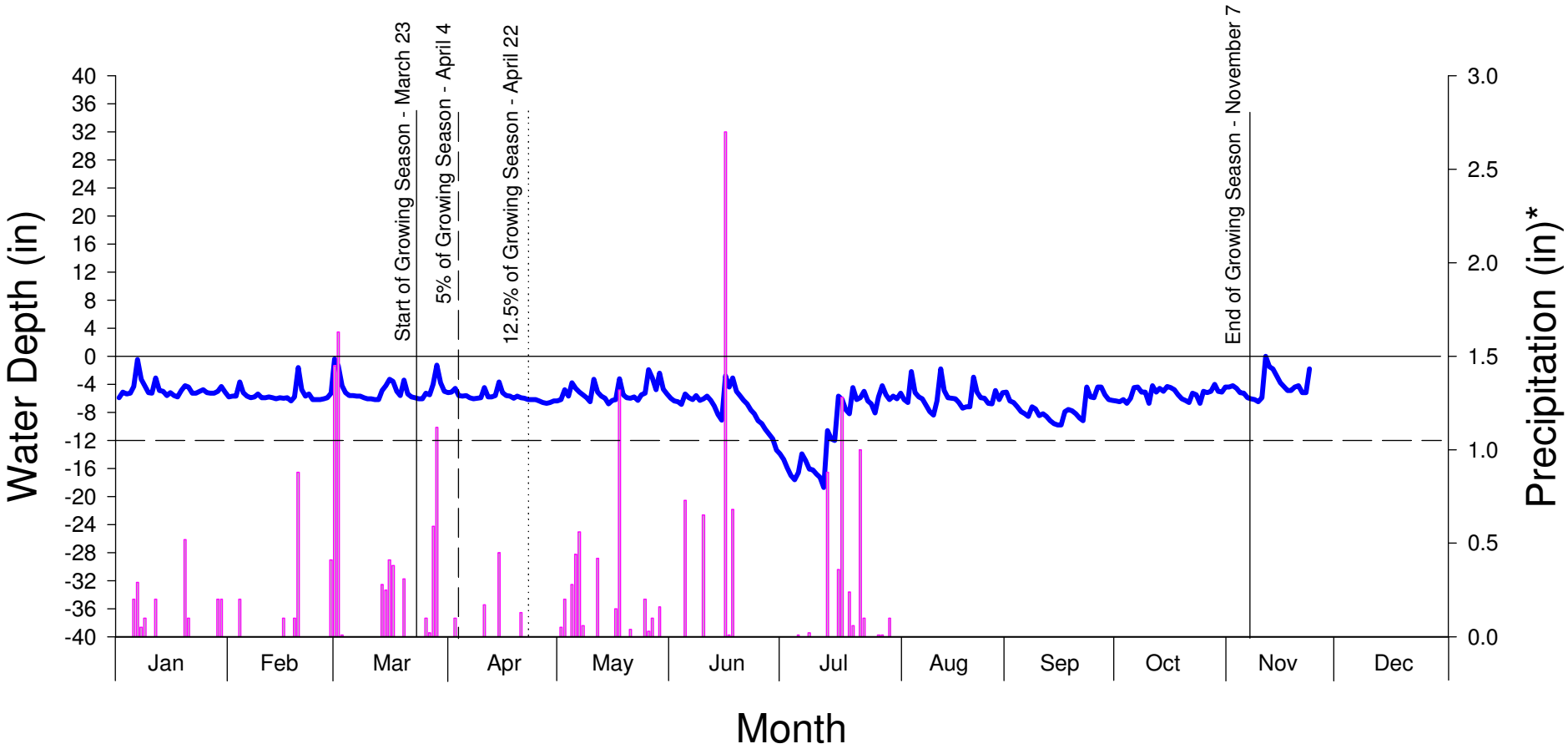


Data Sources:
Monthly Precipitation- National Climatic Data Center (online)
* Extent of available data as of October 2009.

SALT Tract

2009

Monitoring Gauge 6 - 1130EA31

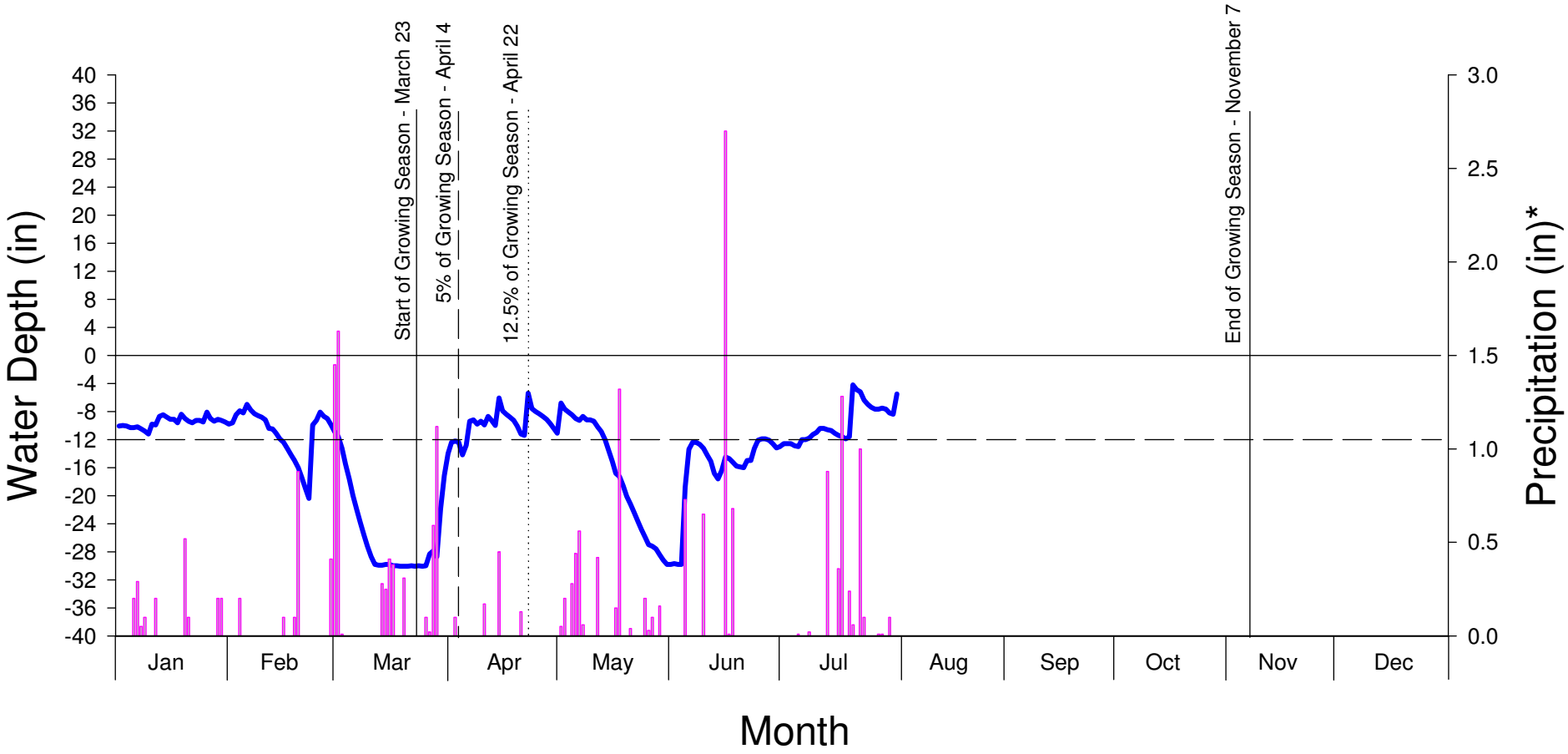


Data Sources:
Monthly Precipitation- National Climatic Data Center (online)
* Extent of available data as of October 2009.

SALT Tract

2009

Monitoring Gauge 7 - 1130D335

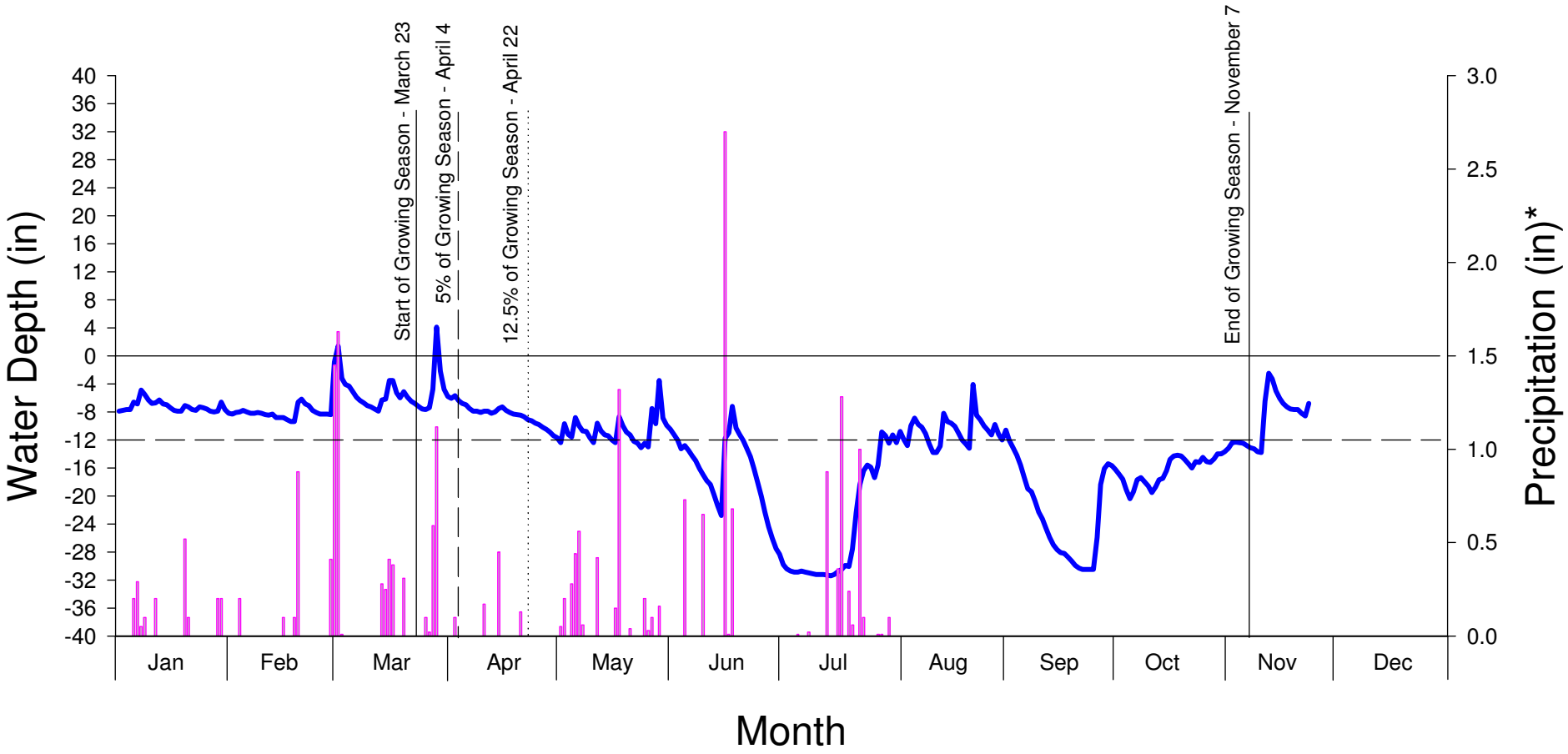


Data Sources:
Monthly Precipitation- National Climatic Data Center (online)
* Extent of available data as of October 2009.

SALT Tract

2009

Monitoring Gauge 8 - 9BEA3F2



Data Sources:
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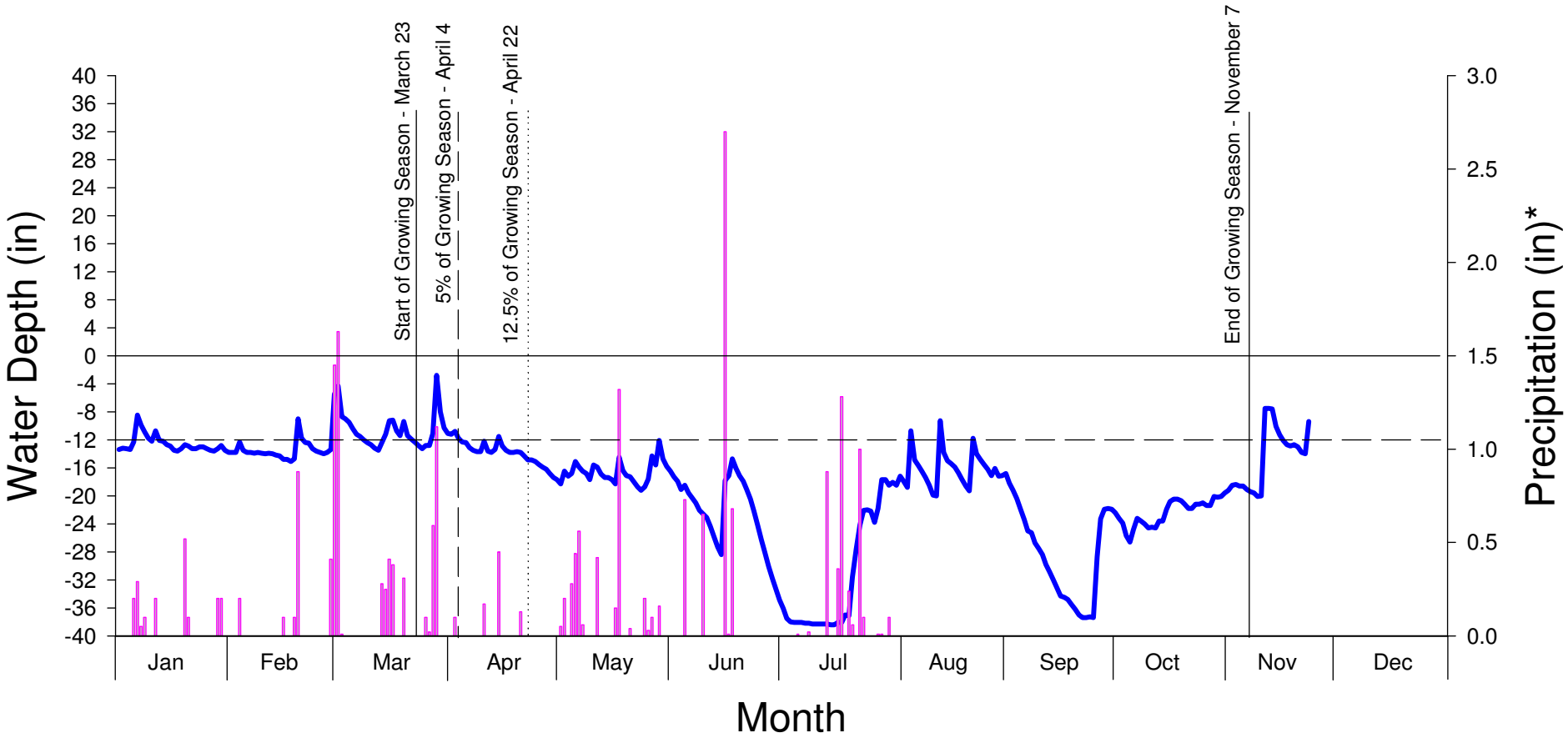
* Extent of available data as of October 2009.

SALT Tract

2009

Monitoring Gauge 9 - 1130EA3C



Data Sources:
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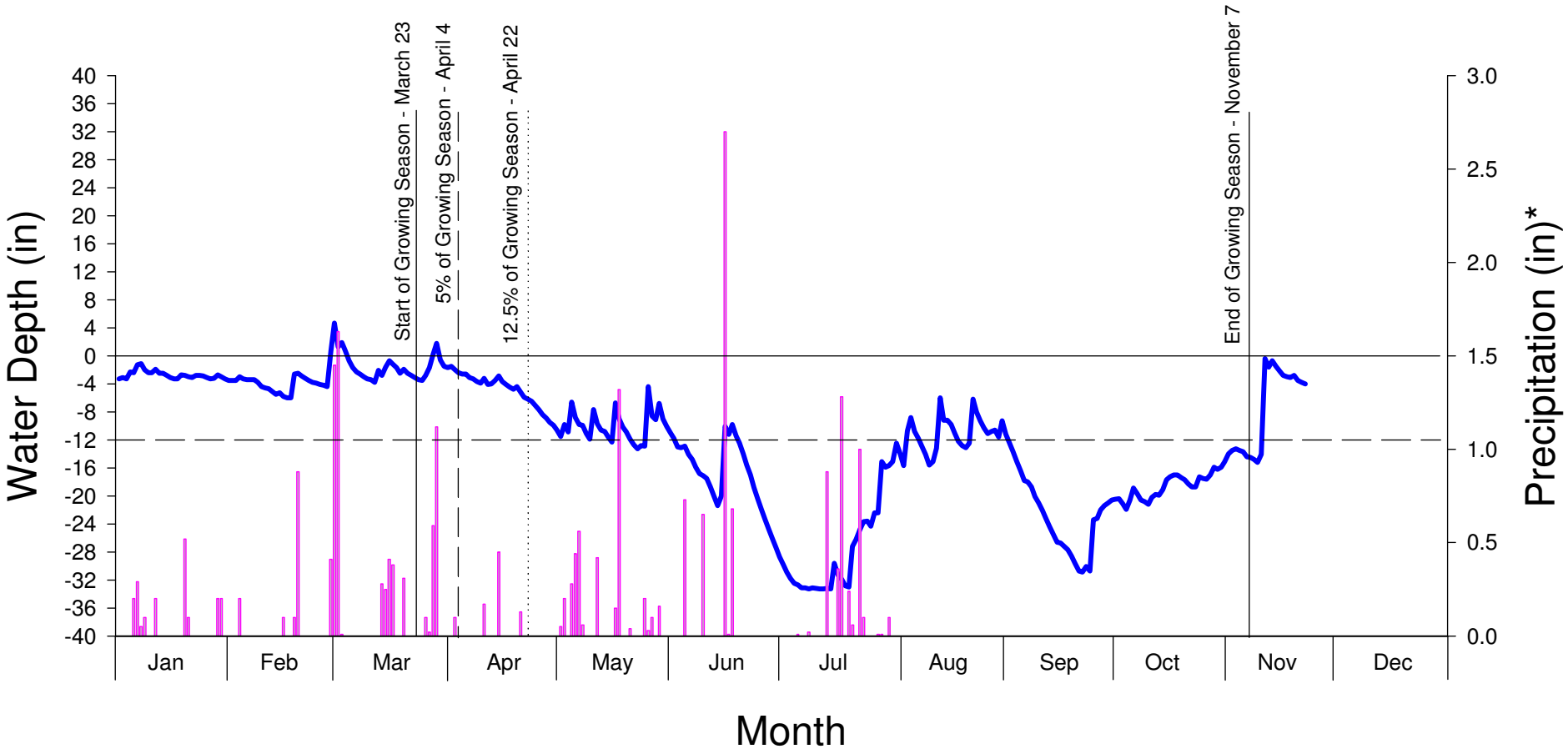
SALT Tract

2009

Monitoring Gauge 10 - 9BEA3FB



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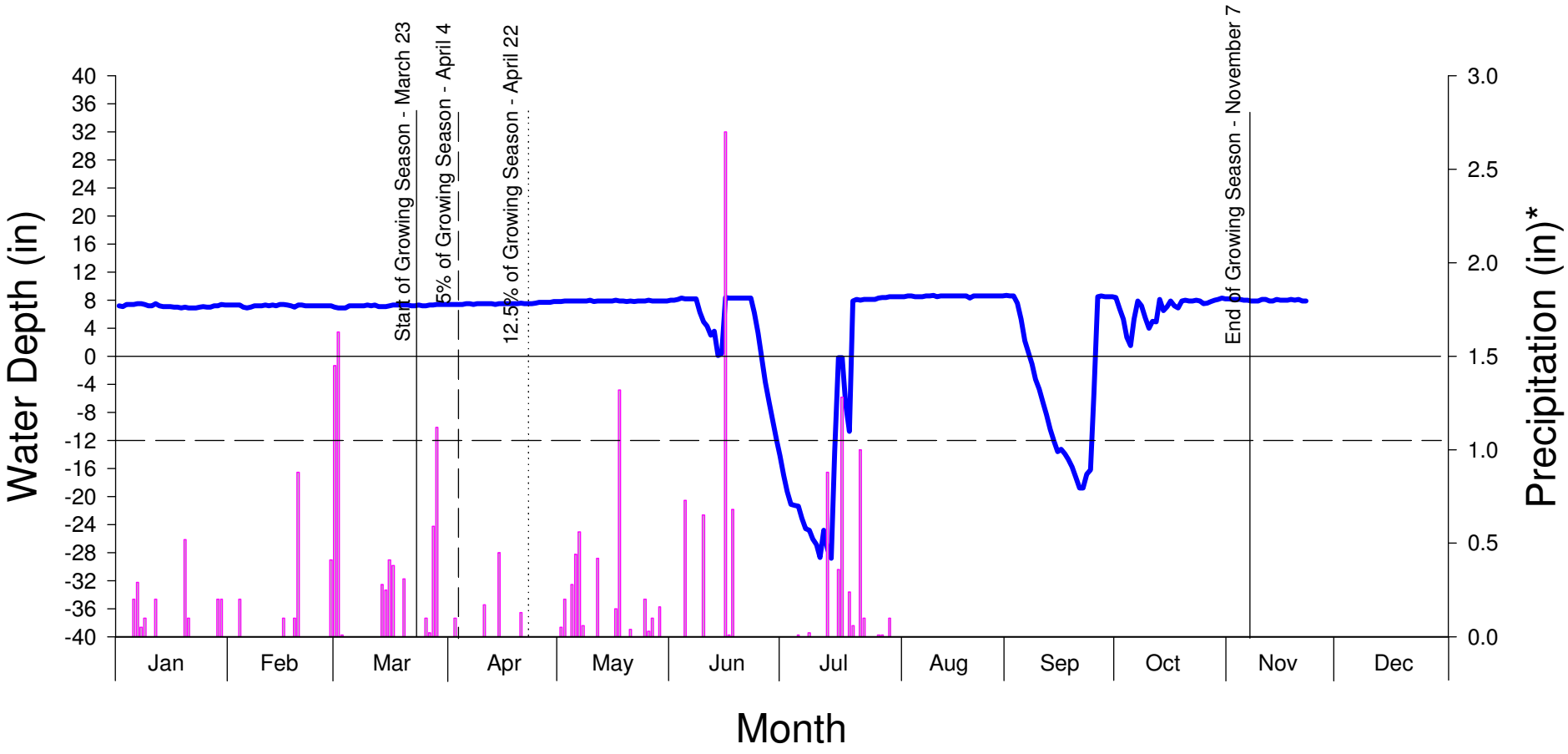
SALT Tract

2009

Monitoring Gauge 11 - 9BEA41A

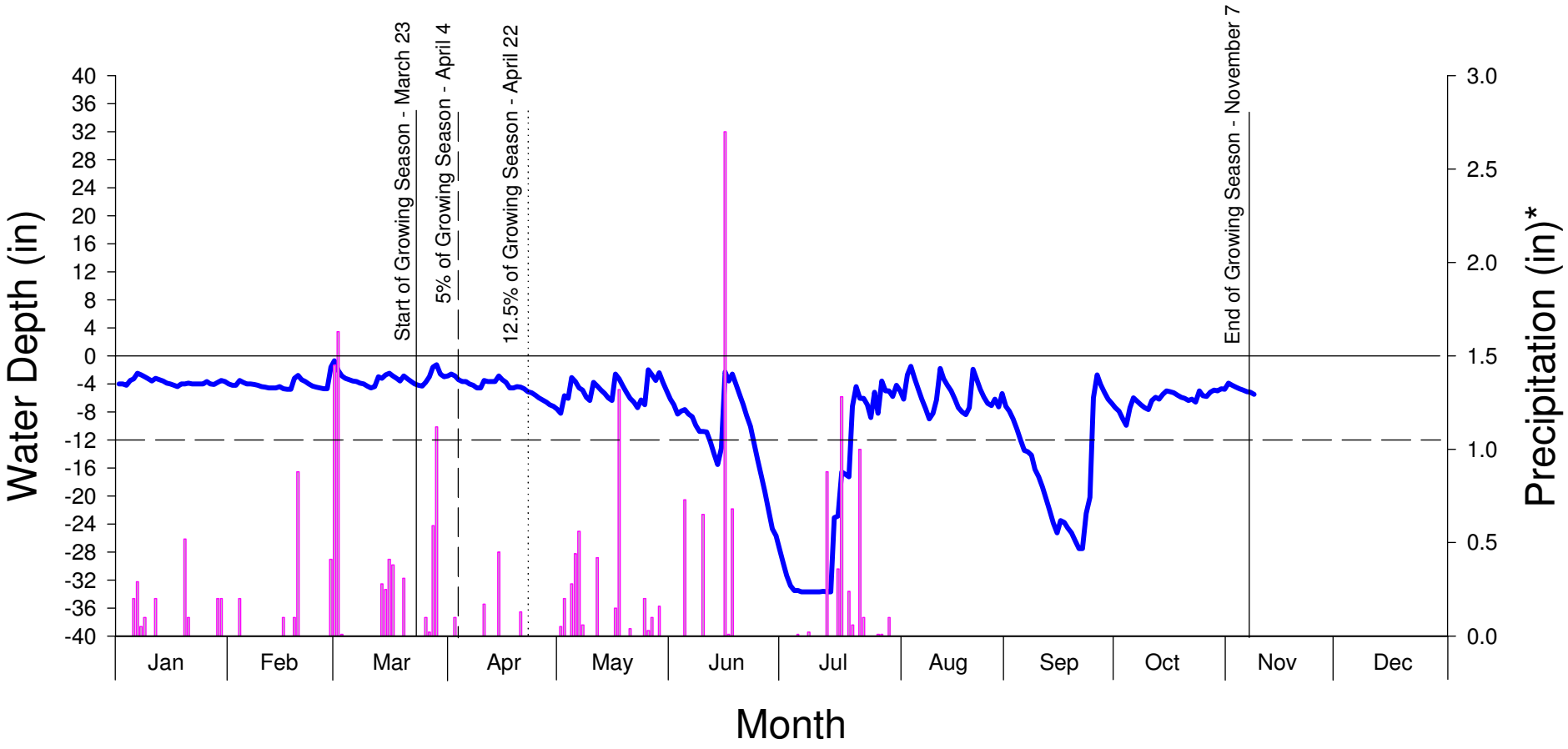


Data Sources:
Monthly Precipitation- National Climatic Data Center (online)
* Extent of available data as of October 2009.

SALT Tract

2009

Monitoring Gauge 12 - 9DE5E9D



Data Sources:
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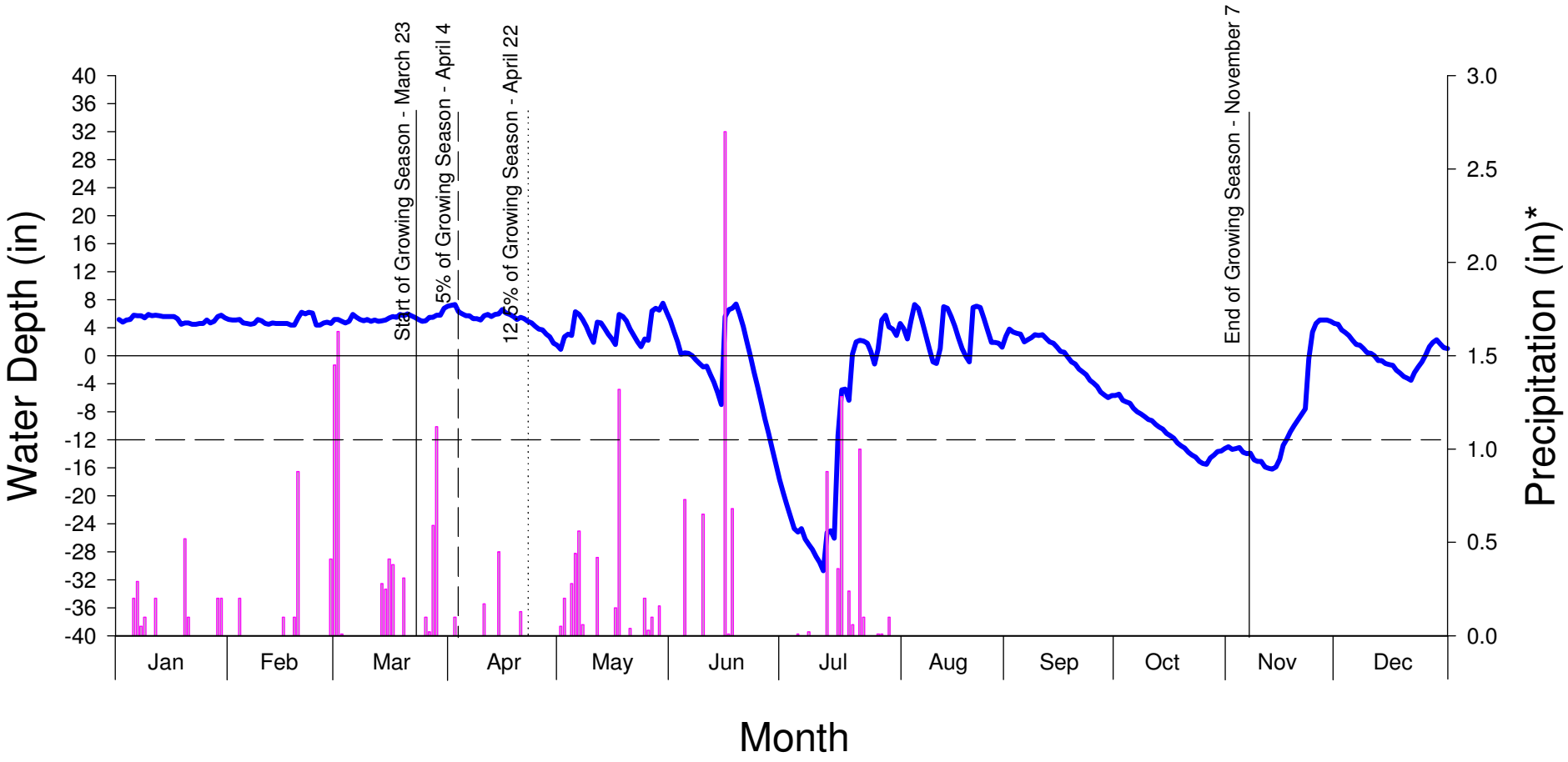
* Extent of available data as of October 2009.

SALT Tract

2009

Monitoring Gauge 13 - 9BEA44D



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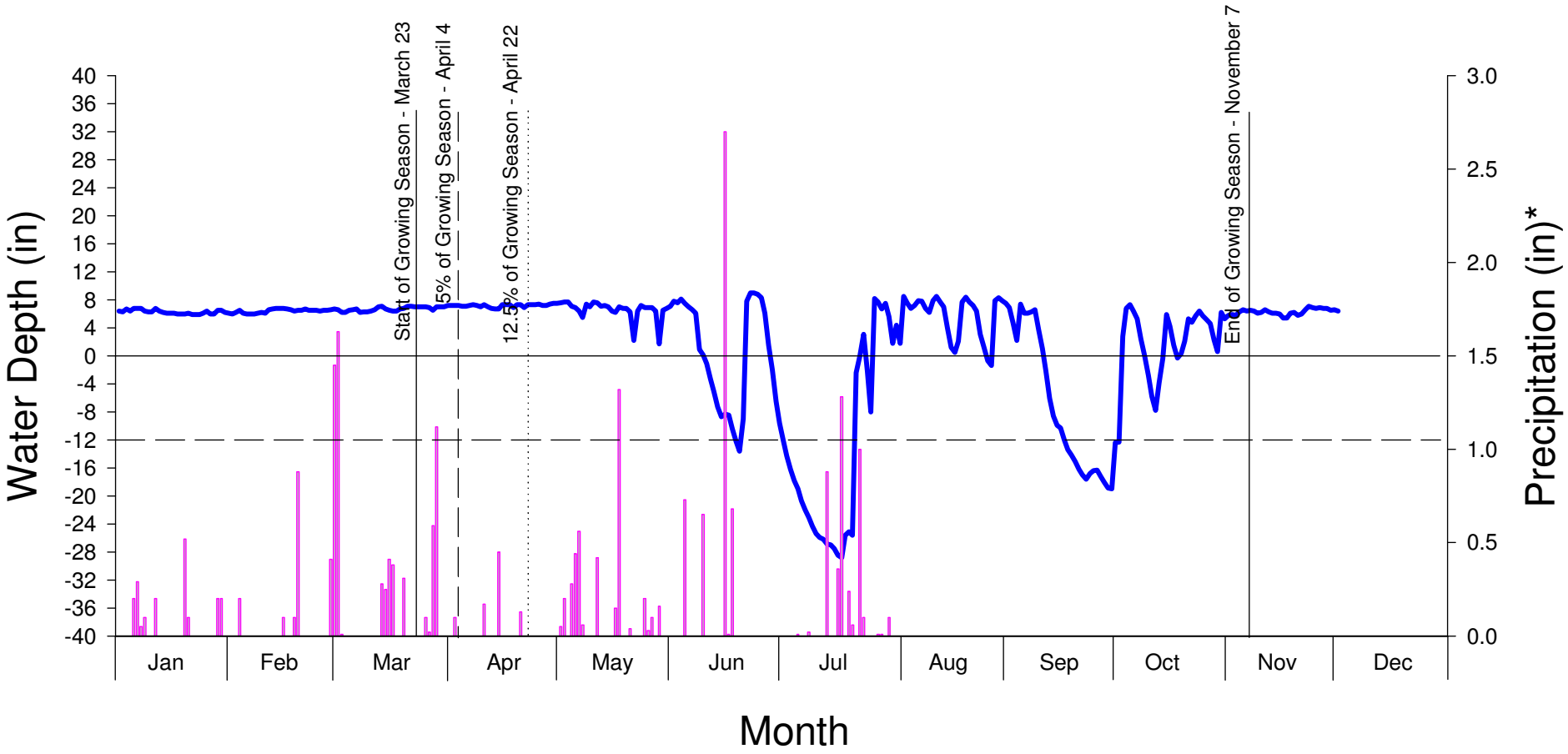
* Extent of available data as of October 2009.

SALT Tract

2009

Monitoring Gauge 14 - 9BE9099



Data Sources:
Monthly Precipitation- National Climatic Data Center (online)
* Extent of available data as of October 2009.

APPENDIX C

SITE PHOTOS

Vegetation Plot 1 looking north. August 28, 2009.

Vegetation Plot 1 looking east. August 28, 2009.

Vegetation Plot 1 looking south. August 28, 2009.

Vegetation Plot 1 looking west. August 28, 2009.

Vegetation Plot 2 looking north. August 28, 2009.

Vegetation Plot 2 looking east. August 28, 2009.

Vegetation Plot 2 looking south. August 28, 2009.

Vegetation Plot 2 looking west. August 28, 2009.

Vegetation Plot 3 looking north. August 28, 2009.

Vegetation Plot 3 looking east. August 28, 2009.

Vegetation Plot 3 looking south. August 28, 2009.

Vegetation Plot 3 looking west. August 28, 2009.

Vegetation Plot 4 looking north. August 28, 2009.

Vegetation Plot 4 looking east. August 28, 2009.

Vegetation Plot 4 looking south. August 28, 2009.

Vegetation Plot 4 looking west. August 28, 2009.

Culvert 1 - November 23, 2009.

Culvert 2 - November 23, 2009.

Culvert 3 - November 23, 2009.

Road with culverts installed - November 23, 2009.