

**Roquist Wetland
Restoration Monitoring Report
EEP Project # 312
Monitoring Year – 02
2009**



Submitted to:



NCDENR-EEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

December 2009

Monitoring Firm



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Design Firm



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Cary, NC 27518**

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The North Carolina Ecosystem Enhancement Program (EEP) restored and preserved wetlands and preserved streams at the Roquist Wetland Site in Bertie County, North Carolina. The 3,926 acre site is located within the USGS 8-digit HUC 03010107 of the Roanoke River Basin. The project restored 45.2 acres of wetland and preserved an additional 3,776 acres of wetland and 3,660 linear feet of stream channel. Project construction was completed in 2008. The project goals and objectives are listed below.

- Restoration of 45.2 acres of previously ditched and filled nonriparian wetlands.
- Preservation of 3,366 acres of nonriparian wetlands.
- Preservation of 390 acres of high quality nonriparian wetlands.
- Preservation of 20 acres of riparian wetlands.
- Preservation of 3,660 linear feet of stream channel.

The restored wetlands were planted with fifteen different species of bare root trees and shrubs. Baseline vegetation monitoring was delayed until the end of the first growing season. Ten vegetation monitoring plots were established during the first monitoring year, following the CVS-EEP protocol. Because of this the data reported in the *Roquist Wetland Restoration Site Phase I Mitigation Report* is first year monitoring data and not baseline data as would typically be in the mitigation plan. The second year monitoring found a site average of 133 stems/acre, with seven of the ten vegetation monitoring plots having planted stem densities less than the success criteria of 260 stems/acre. Low planted stem densities were also found during the first year of monitoring, but due to the large amount of volunteer woody stems found in the plots, it is likely that volunteer vegetation will successfully vegetate the site throughout the monitoring period. The site's average stem density including volunteers is 911 stems/acre, with only three of the ten vegetation plots having densities less than 260 stems/acre. First year monitoring reported that wild hogs significantly damaged the planted vegetation, resulting in increased mortality.

To monitor wetland hydrology 12 gauges were established. Seven of these gauges (2, 3b, 5, 9, 11b, 14, and 15) were installed in restored wetlands. The remaining five gauges (1, 4, 6, 13, and 12) are reference gauges that were installed in existing wetlands, and are paired with a gauge in an adjacent restoration area. Two of the restoration gauges (14 and 15) are not paired with reference gauges. During the second growing season all of the restoration gauges met the success criteria of having saturated soil conditions occurring within 12 inches of the ground surface for a minimum of 12.5% (29 days) of the 231 day growing season (March 22 to November 8) during average climatic conditions, or having the hydroperiod in the restoration areas be within 20% of the corresponding reference hydroperiod during drought conditions. The daily rainfall data obtained from a local weather station shows that the area had average rainfall during the 2009 growing season.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on the EEPs website. All raw data supporting the tables and figures in the appendices are available upon request.

2.0 METHODOLOGY

The Level 2 of the CVS-EEP protocol (<http://cvs.bio.unc.edu/methods.htm>) was used to collect vegetation data from the Roquist site this year, the second year of monitoring.

3.0 REFERENCES

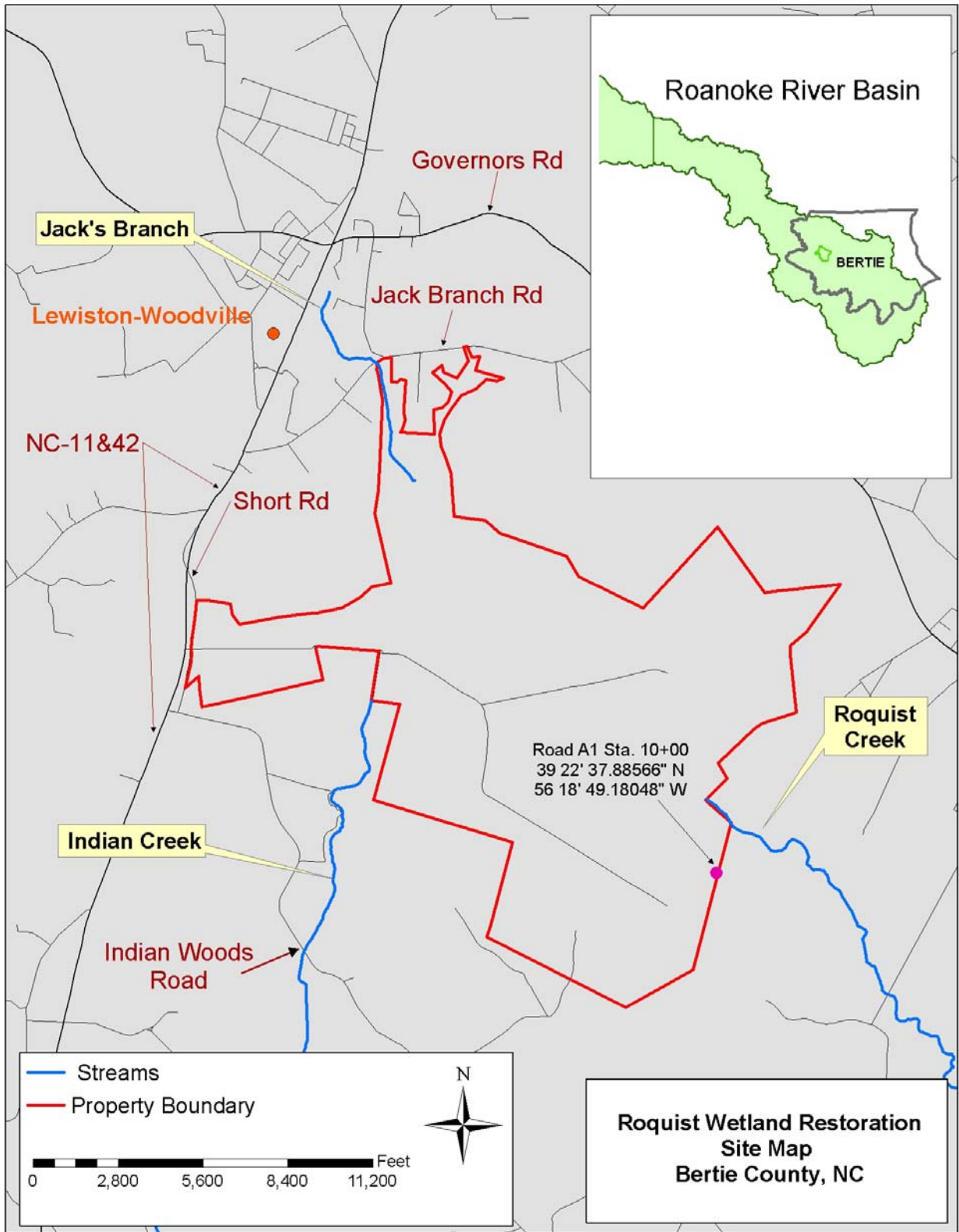
Lee, M. T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (<http://cvs.bio.unc.edu/methods.htm>)

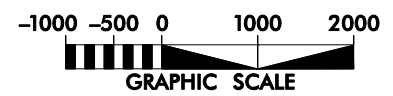
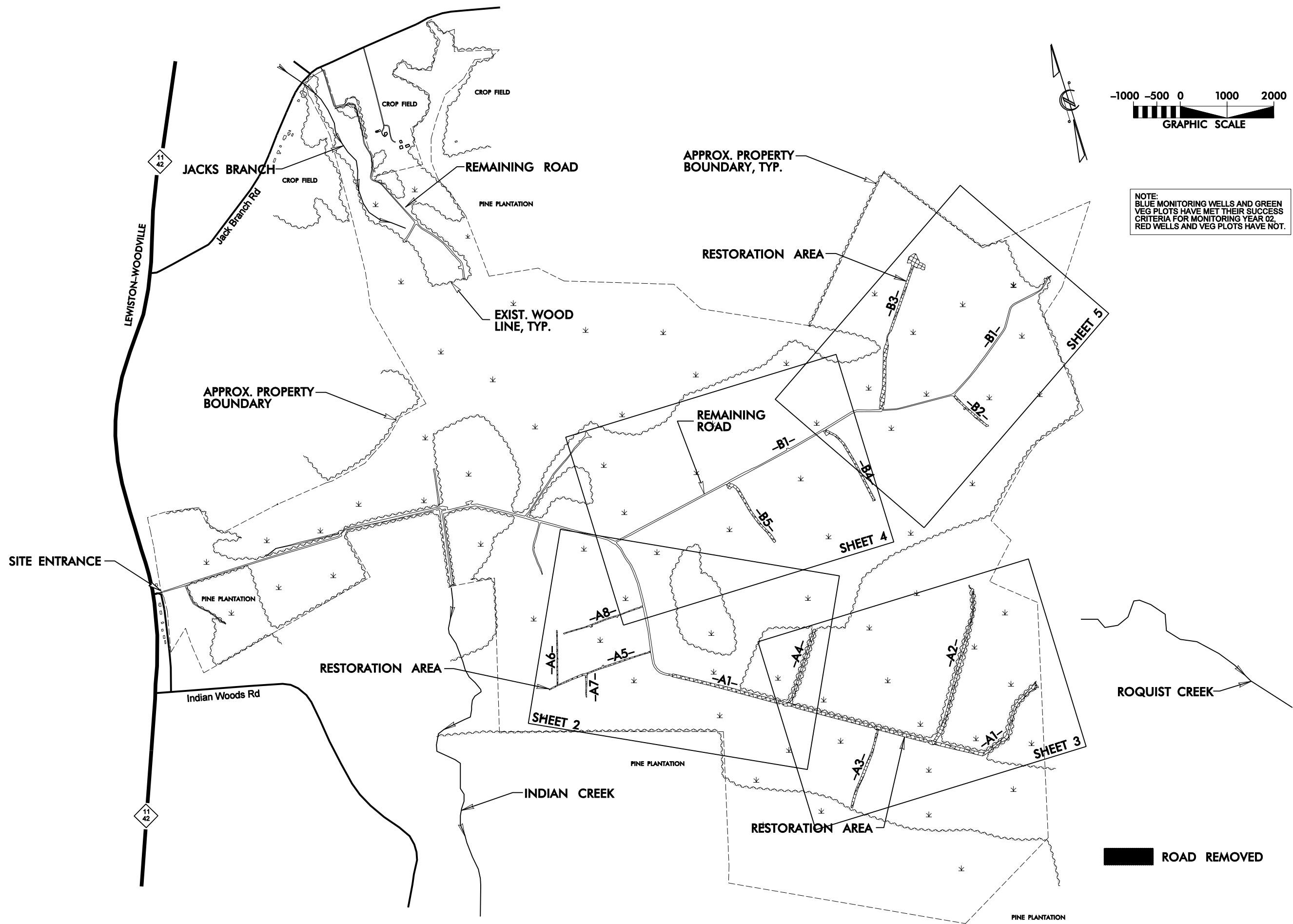
Weakley, A. S. 2006. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas. (http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2006-Jan.pdf)

Appendix A

General Figures and Plan Views

Figure 1. Site Map





NOTE:
 BLUE MONITORING WELLS AND GREEN
 VEG PLOTS HAVE MET THEIR SUCCESS
 CRITERIA FOR MONITORING YEAR 02.
 RED WELLS AND VEG PLOTS HAVE NOT.

SYMBOL	DESCRIPTION	DATE	APPROVED



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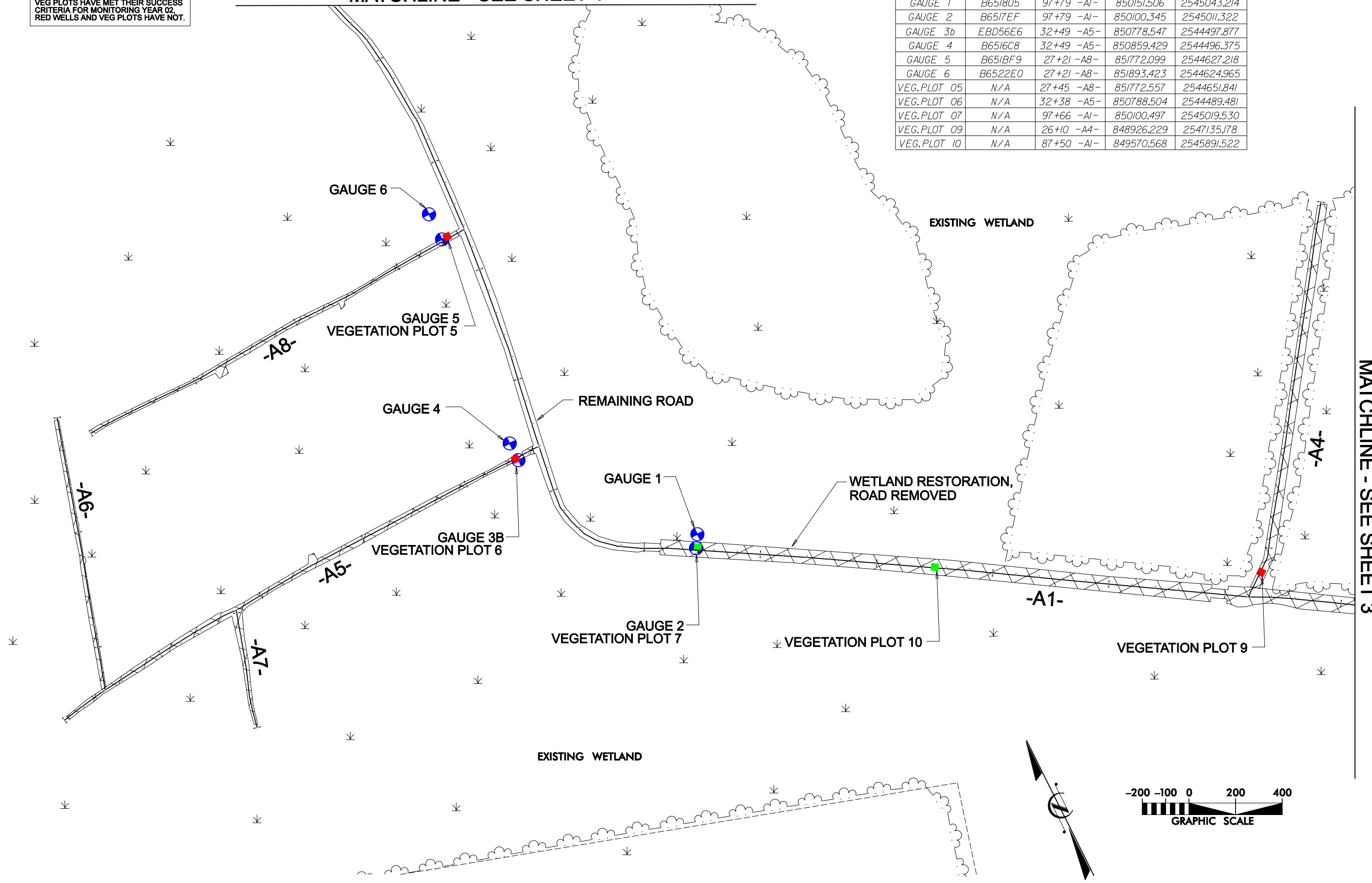
ROQUIST WETLAND SITE
 BERTIE COUNTY, NORTH CAROLINA
 EEP PROJECT NUMBER 312 - MY02

DATE: DEC 2009
 SCALE: 1" = 200'
**CURRENT
 CONDITION
 PLAN VIEW**
 SHEET 1 OF 5

NOTE:
 BLUE MONITORING WELLS AND GREEN
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 CRITERIA FOR MONITORING YEAR 02.
 RED WELLS AND VEG PLOTS HAVE NOT.

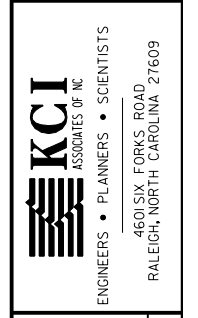
MATCHLINE - SEE SHEET 4

FEATURE	SERIAL NO.	LOCATION	NORTHING	EASTING
GAUGE 1	B651805	97+79 -A1-	850151.506	2545043.214
GAUGE 2	B6517EF	97+79 -A1-	850100.345	2545011.322
GAUGE 3b	EBD56E6	32+49 -A5-	850778.547	2544497.877
GAUGE 4	B6516C8	32+49 -A5-	850859.429	2544496.375
GAUGE 5	B651BF9	27+21 -A8-	851772.099	2544627.218
GAUGE 6	B6522E0	27+21 -A8-	851893.423	2544624.965
VEG.PLOT 05	N/A	27+45 -A8-	851772.557	2544651.841
VEG.PLOT 06	N/A	32+38 -A5-	850788.504	2544489.481
VEG.PLOT 07	N/A	97+66 -A1-	850100.497	2545019.530
VEG.PLOT 09	N/A	26+10 -A4-	848926.229	2547135.178
VEG.PLOT 10	N/A	87+50 -A1-	849570.568	2545891.522



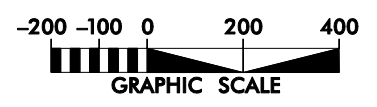
MATCHLINE - SEE SHEET 3

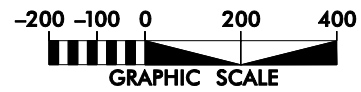
SYMBOL	DESCRIPTION	DATE	APPROVED



ROQUIST WETLAND SITE
 BERTIE COUNTY, NORTH CAROLINA
 EEP PROJECT NUMBER 312 - MY02
 A1, A4, A5, A6, A7, A8

DATE: DEC 2009
 SCALE: 1"= 400'
CURRENT CONDITION PLAN VIEW
 SHEET 2 OF 5





FEATURE	SERIAL NO.	LOCATION	NORTHING	EASTING
VEG. PLOT 08	N/A	27+20 -A3-	847721.603	2548701.399

NOTE:
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 CRITERIA FOR MONITORING YEAR 02.
 RED WELLS AND VEG PLOTS HAVE NOT.

MATCHLINE - SEE SHEET 2

VEGETATION PLOT 8

WETLAND RESTORATION,
 ROAD REMOVED

WETLAND RESTORATION,
 ROAD REMOVED

EXISTING WETLAND

EXISTING WETLAND

EXISTING WETLAND

SYL.	DESCRIPTION	DATE	APPROVED

REVISIONS



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ROQUIST WETLAND SITE
 BERTIE COUNTY, NORTH CAROLINA
 EEP PROJECT NUMBER 312 - MY02

A1, A2, A3

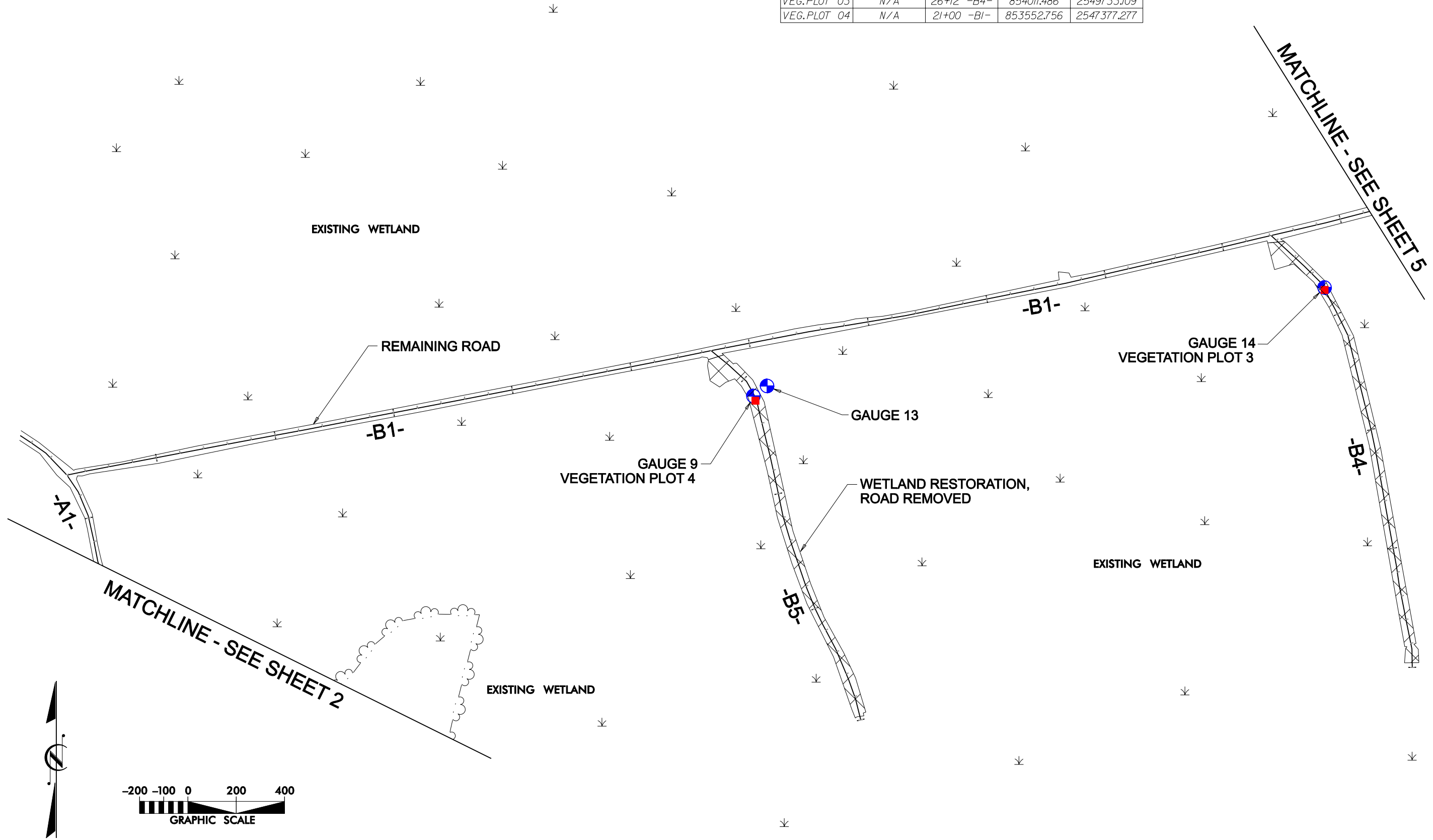
DATE: DEC 2009
 SCALE: 1"= 400'

**CURRENT
 CONDITION
 PLAN VIEW**

SHEET 3 OF 5

FEATURE	SERIAL NO.	LOCATION	NORTHING	EASTING
GAUGE 9	B652346	24+25 -B5-	853572.823	2547368.693
GAUGE 13	B6517DA	24+25 -B5-	853614.337	2547425.387
GAUGE 14	11312CDF	26+20 -B4-	854021.596	2549732.920
VEG.PLOT 03	N/A	26+12 -B4-	854011.486	2549733.109
VEG.PLOT 04	N/A	21+00 -B1-	853552.756	2547377.277

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SYMBOL	DESCRIPTION	DATE	APPROVED



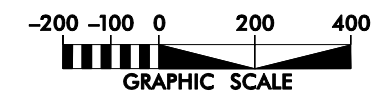
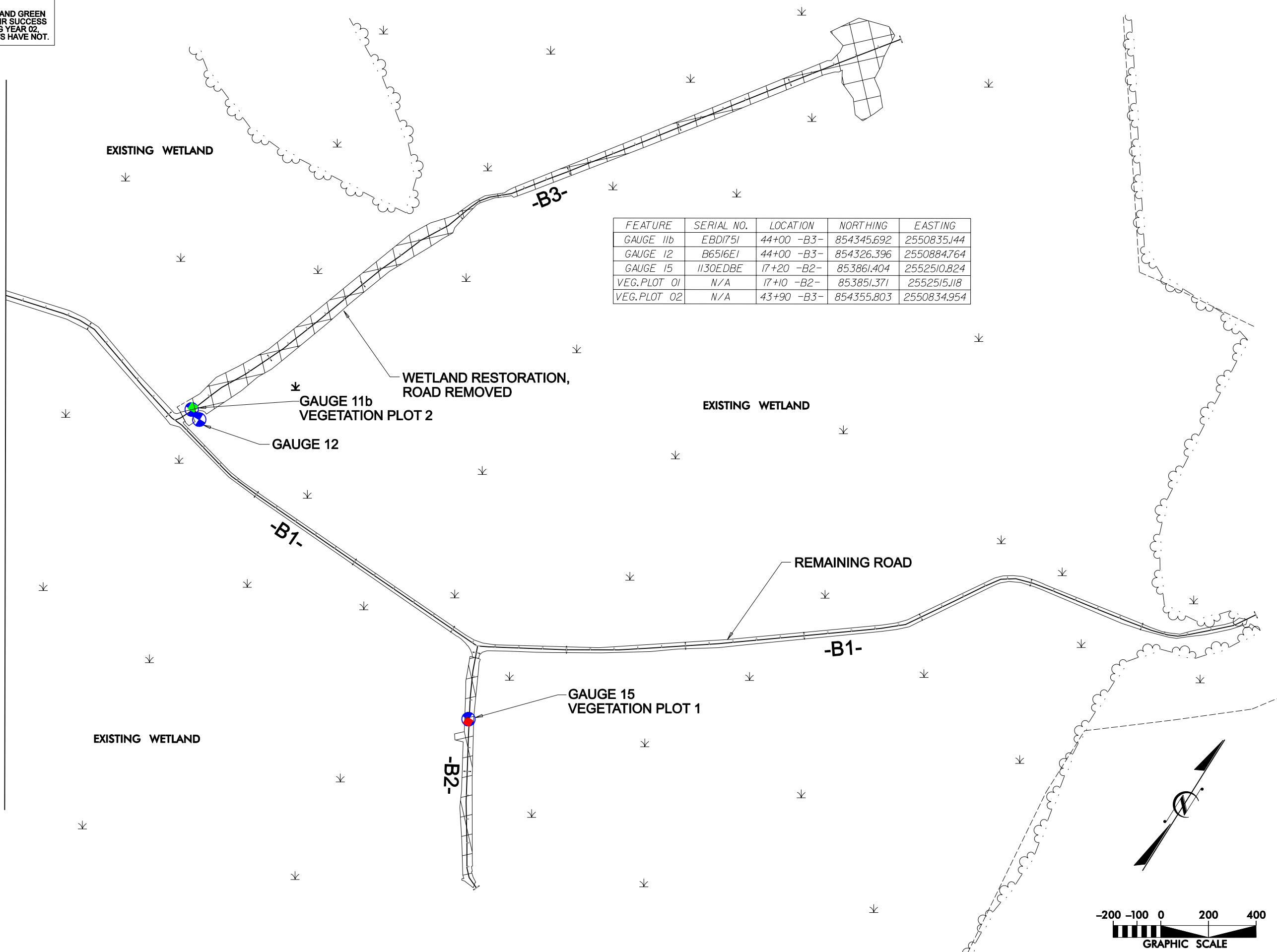
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 BERTIE COUNTY, NORTH CAROLINA
 EEP PROJECT NUMBER 312 - MY02
 B1, A4, A5

DATE: DEC 2009
 SCALE: 1" = 400'
 CURRENT
 CONDITION
 PLAN VIEW
 SHEET 4 OF 5

NOTE:
 BLUE MONITORING WELLS AND GREEN
 VEG PLOTS HAVE MET THEIR SUCCESS
 CRITERIA FOR MONITORING YEAR 02.
 RED WELLS AND VEG PLOTS HAVE NOT.

MATCHLINE - SEE SHEET 4



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ROQUIST WETLAND SITE
 BERTIE COUNTY, NORTH CAROLINA
 EEP PROJECT NUMBER 312 - MY02
 B1, B2, B3

DATE: DEC 2009
 SCALE: 1"= 400'
 CURRENT
 CONDITION
 PLAN VIEW
 SHEET 5 OF 5

Appendix B

General Project Tables

Table 1. Project Restoration Components				
Project Number and Name: 312 - Roquist Wetland				
Project Component	Type	Acreege / Linear Feet	Stationing	Comment
Restored Wetlands	Riparian		N/A	
	Non-Riparian	45.2 ac	N/A	
Preserved Wetlands	Riparian	20.0 ac	N/A	
	Non-Riparian	3,366 ac	N/A	
Preserved High Quality Wetlands	Preservation	390 ac	N/A	
Jack's Branch Stream Preservation	Preservation	3,660 lf	N/A	

Table 2. Project Activity and Reporting History		
Project Number and Name: 312 - Roquist Wetland		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	N/A	Aug 05
Final Design - 90%	N/A	Jul 06
Construction	N/A	Jan 08
Permanent Seeding	N/A	Jun 07
Bare-Root Planting	N/A	Jan 08
Mitigation Plan / Record Drawings (Year 1 Veg Monitoring Data)	Oct 08	Nov 08
Year 2 Monitoring	Oct 09	Dec 09

Table 3. Project Contacts Table	
Project Number and Name: 312 - Roquist Wetland	
Design Firm	HSM of North Carolina, Inc. 3333 Regency Parkway, Suite 120 Cary, North Carolina 27518 Contact: Mr. Rick Prosser Phone: (919) 460-6895
Construction Contractor	Sawyer's Land Developing, Inc. 275 Higginsport Road Belhaven, North Carolina 27810 Contact: Mr. Len Hunt Phone: (252) 943-2154
Aggregate Supplier	Hanson Rocky Mount Quarry #017 10471 NC-97 West Rocky Mount, North Carolina 27801 Phone: (252) 977-1611
Seeding Contractor	Holland Landscaping, Inc. 953 Blackrock Road Merry Hill, North Carolina 27957 Contact: Mr. Randy Holland Phone: (252) 856-4163
Planting Contractor / Bare-Root Plant Supplier	Emerald Forest, Inc. 4651 Black Woods Road Chesapeake, Virginia 23322 Contact: Mr. Peter McClintock Phone: (757) 421-0929
Bare-Root Plant Supplier	Int'l Paper SC Super Tree Nursery 5594 Highway 38 S Blenheim, South Carolina 29516 Phone: (843) 528-3203
Survey Contractor	H.C.Harris, Jr., Engineering & Surveying, P.A. 216 Main Street Winterville, North Carolina 28590 Contact: Mr. Cliff Harris, Jr. Phone: (252) 321-5607
Monitoring Performers	
MY-01	HSM of North Carolina, Inc. 3333 Regency Parkway, Suite 120 Cary, North Carolina 27518 Contact: Mr. Rick Prosser Phone: (919) 460-6895
MY-02	KCI Associates of NC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Attribute Table	
Project Number and Name: 312 – Roquist Wetland	
Project County	Bertie County
Drainage Area	21.4 mi ²
Drainage Impervious Cover Estimate (%)	<5%
Physiographic Region	Inner Coastal Plain
Ecoregion	Mid-Atlantic Floodplains and Low Terraces
Plant Communities	Nonriverine Swamp Forest and Nonriverine Wet Hardwood Forest
Dominant Soil Types	Leaf Sandy Loam
Reference Site ID	On Site
USGS HUC for Project and Reference	03010107
Any portion of the project segment 303d listed?	No - not rated
Any portion of the project segment upstream of a 303d listed segment?	No
Reasons for 303d Listing or Stressor	N/A
% of Project Fenced	0%

Appendix C

Vegetation Assessment Data

Table 5. Vegetation Plot Mitigation Success Summary Table		
Project Number and Name: 312 - Roquist Wetland		
Vegetation Plot ID	Monitoring Year 02 Planted Stem Density (stems/acre)	Vegetation Survival Threshold Met?
1	81	No
2	364	Yes
3	40	No
4	0	No
5	0	No
6	0	No
7	324	Yes
8	40	No
9	162	No
10	324	Yes

Table 6. Vegetation Metadata Table							
Project Number and Name: 312 – Roquist Wetland							
Report Prepared By		Brian Roberts					
Date Prepared		11/5/2009 11:58					
Database Name		KCI-2008-cvs-eep-entrytool-v2.2.7-MTL.mdb					
Database Location		C:\Users\broberts\Desktop\KCI_2008-entrytool-v2.2.7					
PROJECT SUMMARY-----							
Project Code	Project Name	Description	Length (ft)	Stream-to-Edge Width (ft)	Area (sq m)	Required Plots (calculated)	Sampled Plots
312	Roquist	Wetland restoration site in Bertie County, NC.	N/A	N/A	35,000	10	10

Table 7. Planted Stem Count by Plot and Species
Project Number and Name: 312 – Roquist Wetland

			Current Plot Data (MY2 2009)																											Annual Means								
Scientific Name	Common Name	Species Type	312-A-0001			312-A-0002			312-A-0003			312-A-0004			312-A-0005			312-A-0006			312-A-0007			312-A-0008			312-A-0009			312-A-0010			MY2 (2009)			MY1 (2008)		
			P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
<i>Acer rubrum</i>	red maple	Tree			1						2												25			16						10			54			19
<i>Baccharis</i>	baccharis	Shrub Tree			1			1																		2									4			
<i>Clethra alnifolia</i>	coastal sweetpepperbush	Shrub								1	1																				1	1		1	1		1	1
<i>Diospyros virginiana</i>	common persimmon	Tree						2						1									31			1			1						36			43
<i>Fraxinus pennsylvanica</i>	green ash	Tree		2	2		1	1																					12					3	15		3	3
<i>Itea virginica</i>	Virginia sweetspire	Shrub																																			1	1
<i>Leucothoe axillaris</i>	coastal doghobble	Shrub																																			1	1
<i>Liquidambar styraciflua</i>	sweetgum	Tree			1			1			4			3															2						11			12
<i>Nyssa biflora</i>	swamp tupelo	Tree																		1	1											1	1					
<i>Nyssa sylvatica</i>	blackgum	Tree					5	5															2	2					2	2		9	9		12	12		
<i>Quercus laurifolia</i>	laurel oak	Tree																								1	1		2	2		3	3		3	3		
<i>Quercus michauxii</i>	swamp chestnut oak	Tree					1	1															1	1					1	1		4	4		4	4		
<i>Quercus pagoda</i>	cherrybark oak	Tree																										1	1		1	1						
<i>Quercus phellos</i>	willow oak	Tree					1	1																		1	1					2	2		3	3		
<i>Quercus rubra</i>	northern red oak	Tree																																				115
<i>Quercus shumardii</i>	Shumard's oak	Shrub Tree																								1	58		1	1		2	59		3	3		
<i>Rhus copallinum</i>	flameleaf sumac	Shrub Tree												1			12																		13			5
<i>Salix nigra</i>	black willow	Tree			1																														1			1
<i>Taxodium distichum</i>	bald cypress	Tree																								1	1					1	1		1	1		
<i>Ulmus americana</i>	American elm	Tree																					4	4					1	1		5	5		4	4		
<i>Vaccinium corymbosum</i>	highbush blueberry	Shrub					1	5																										1	5		3	3
Stem count			0	2	6	0	9	17	0	1	7	0	0	4	0	0	1	0	0	12	0	8	64	0	1	20	0	4	76	0	8	18	0	33	225	0	39	234
size (ares)			1			1			1			1			1			1			1			1			1			1			10			10		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.25			0.25		
Species count			0	1	5	0	5	8	0	1	3	0	0	2	0	0	1	0	0	1	0	4	6	0	1	4	0	4	7	0	6	7	0	12	18	0	12	18
Stems per ACRE			0	80.9	243	0	364	688	0	40.5	283	0	0	162	0	0	40.5	0	0	486	0	324	2590	0	40.5	809	0	162	3076	0	324	728	0	134	911	0	158	947

P-LS – Planted Live Stake Stems

P-all – Planted Stems Total (with Live Stakes)

T – Total (Planted Including Live Stakes and Volunteers)

Vegetation Monitoring Plot Photos



Plot 1 Photo – 10/8/09 - MY 02



Plot 2 Photo – 10/8/09 - MY 02



Plot 3 Photo – 10/8/09 - MY 02



Plot 4 Photo – 10/8/09 - MY 02



Plot 5 Photo – 10/8/09 - MY 02



Plot 6 Photo – 10/8/09 - MY 02



Plot 7 Photo – 10/8/09 - MY 02



Plot 8 Photo – 10/8/09 - MY 02



Plot 9 Photo – 10/8/09 - MY 02



Plot 10 Photo – 10/8/09 - MY 02

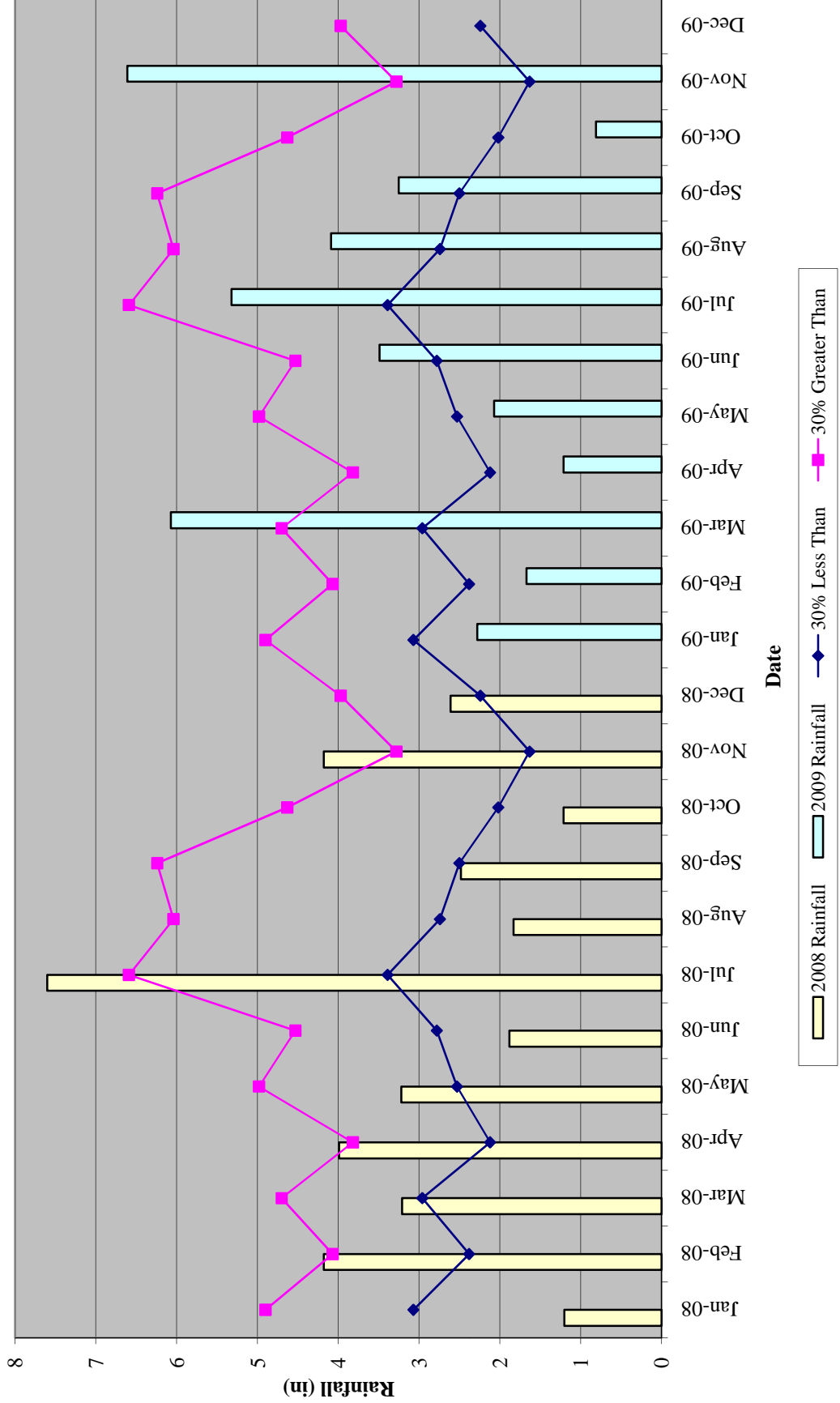
Appendix D

Wetland Assessment Data

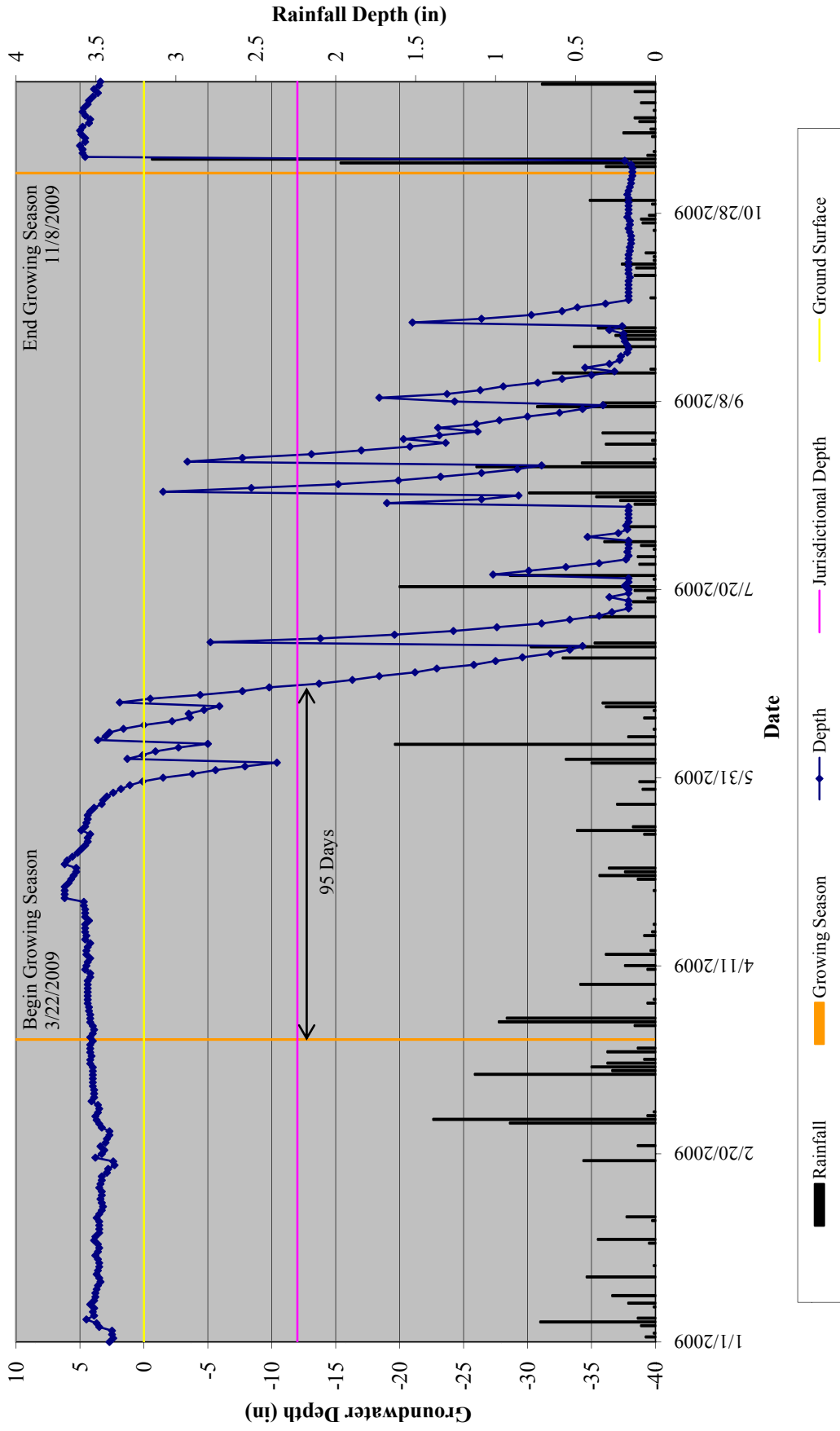
Table 8. Wetland Hydrology Criteria Attainment Table
Project Number and Name: 312 - Roquist Wetland

Gauge	Success Criteria Achieved/ Max Consecutive Days During Growing Season (Percentage)	
	Year 1 (2008)	Year 2 (2009)
Gauge 1 <i>(Reference for Gauge 2)</i>	Yes/90 (39%)	Yes/95 (41%)
Gauge 2	Yes/79 (32%)	Yes/71 (31%)
Gauge 3b	Yes/76 (33%)	Yes/44 (19%)
Gauge 4 <i>(Reference for Gauge 3b)</i>	Yes/79 (34%)	Yes/65 (28%)
Gauge 5	Yes/79 (34%)	Yes/69 (30%)
Gauge 6 <i>(Reference for Gauge 5)</i>	Yes/85 (37%)	Yes/73 (32%)
Gauge 9	Yes/78 (34%)	Yes/67 (29%)
Gauge 13 <i>(Reference for Gauge 9)</i>	Yes/98 (42%)	Yes/93 (40%)
Gauge 11b	Yes/92 (40%)	Yes/73 (32%)
Gauge 12 <i>(Reference for Gauge 11b)</i>	Yes/96 (42%)	Yes/97 (42%)
Gauge 14	Yes/83 (36%)	Yes/73 (32%)
Gauge 15	Yes/76 (33%)	Yes/66 (29%)

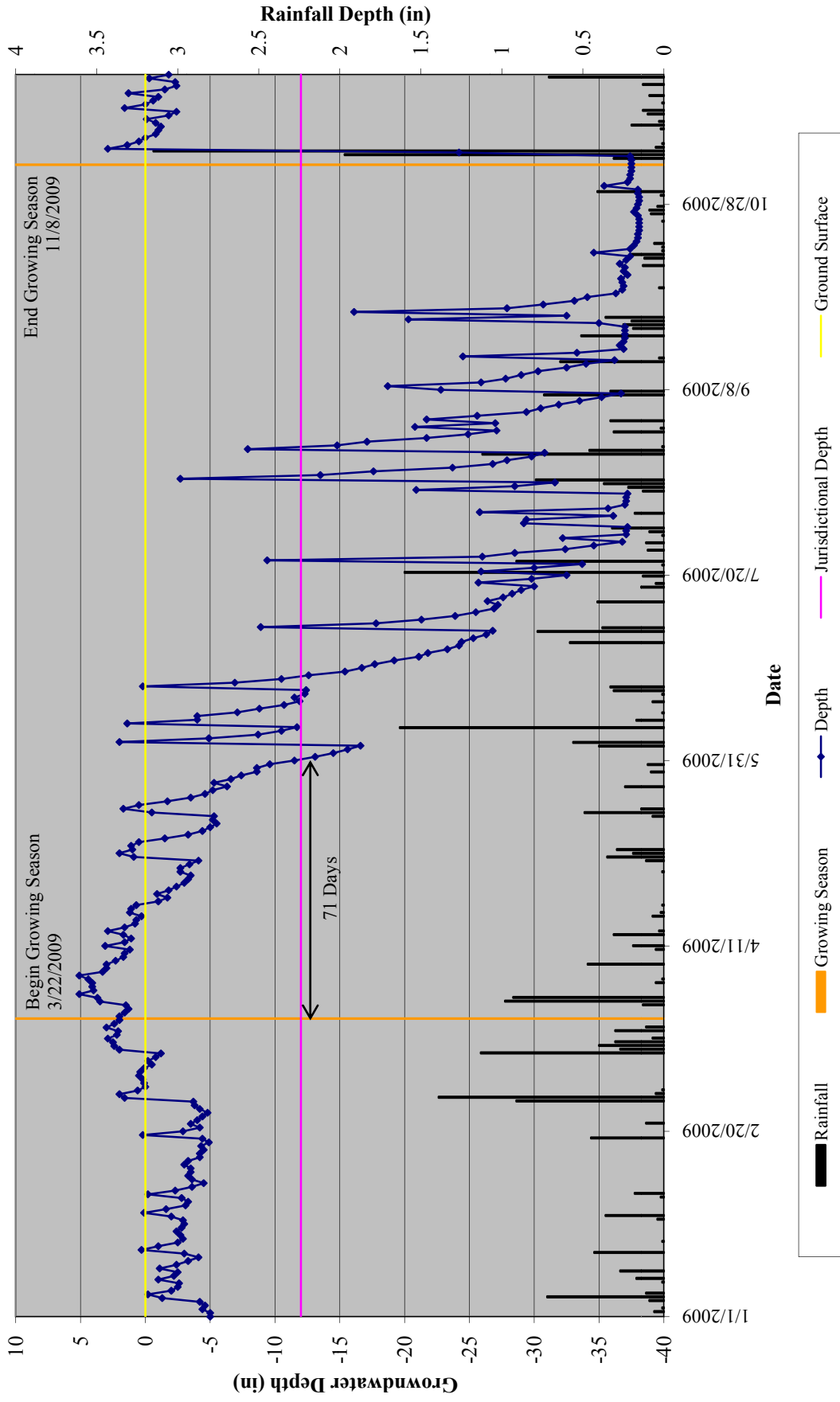
**Roquist 30-70 Percentile Graph 2008-2009
Lewiston-Woodville, NC Monthly Rainfall**



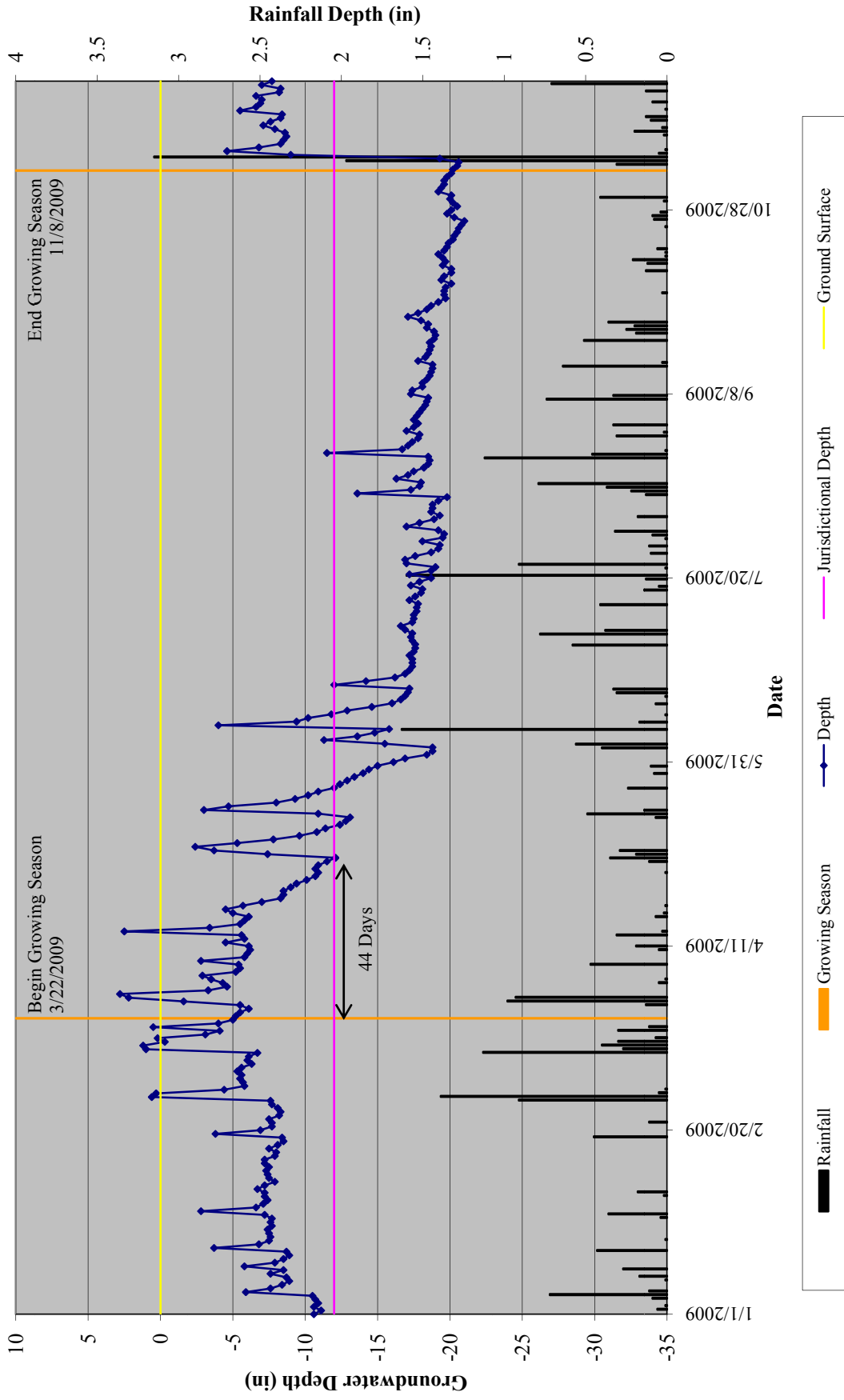
**Roquist MY02
Ground Water Monitoring Gauge #1 (Reference for Gauge #2)**



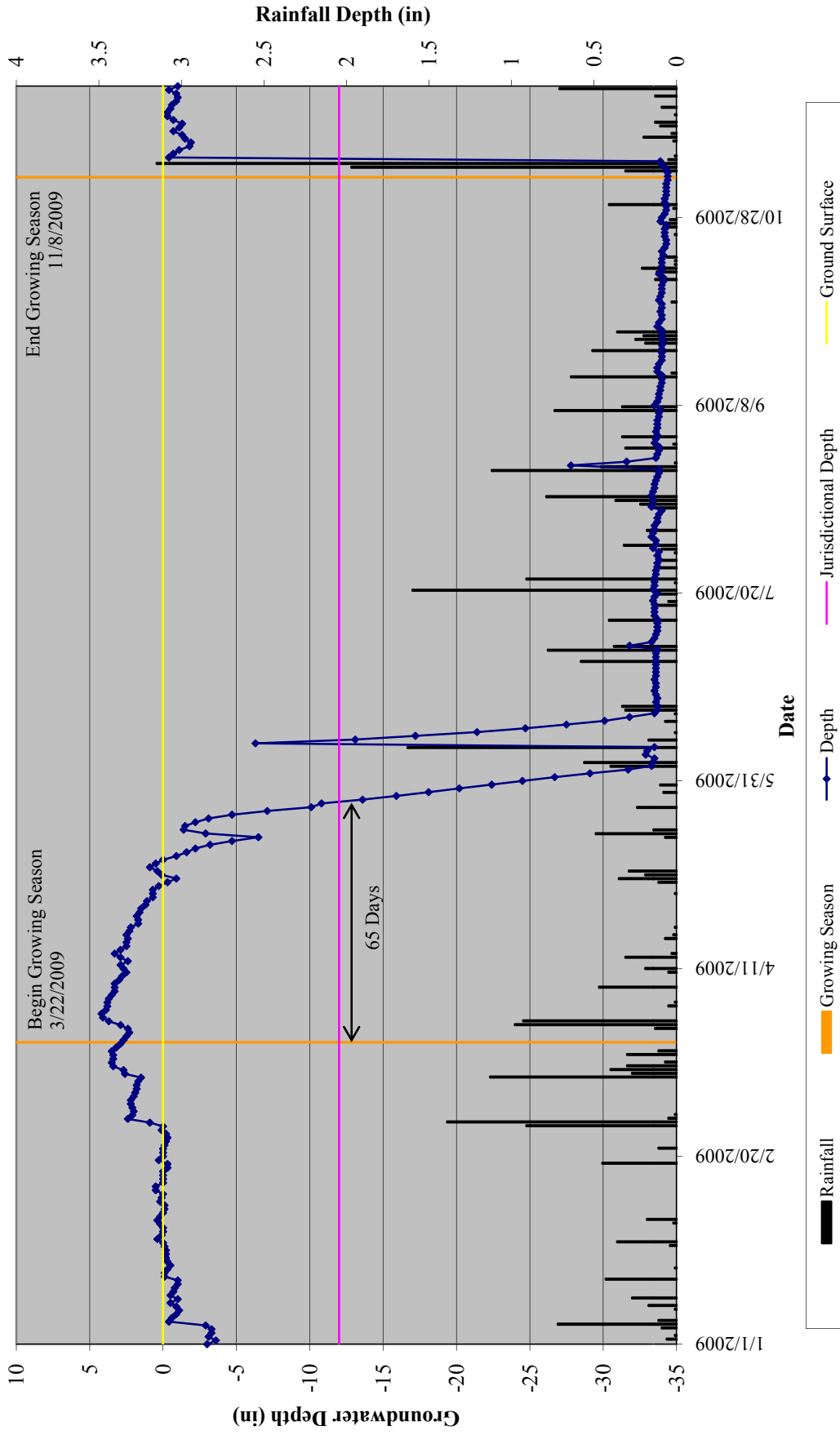
Roquist MY02 Ground Water Monitoring Gauge #2



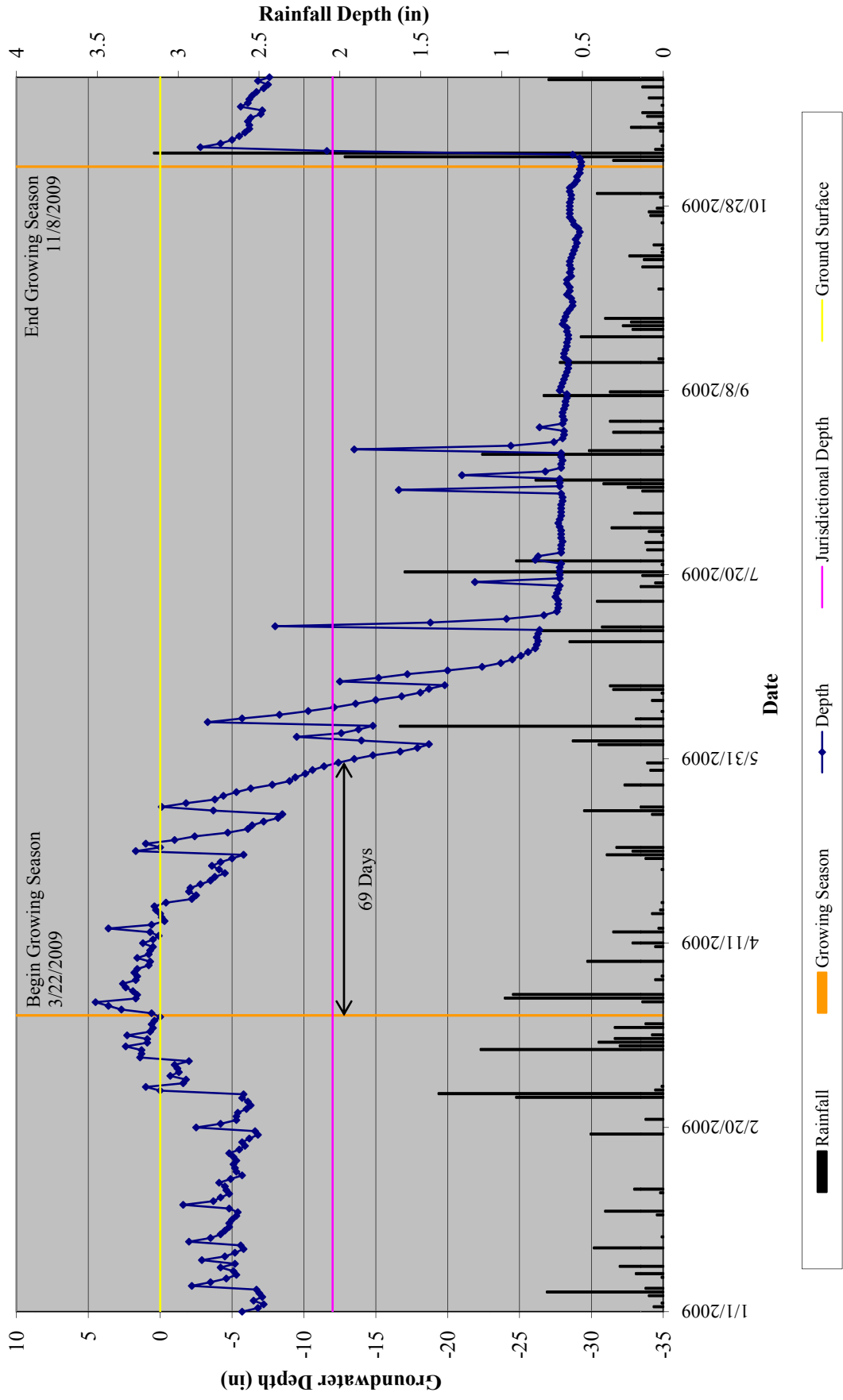
Roquist MY02 Ground Water Monitoring Gauge #3b



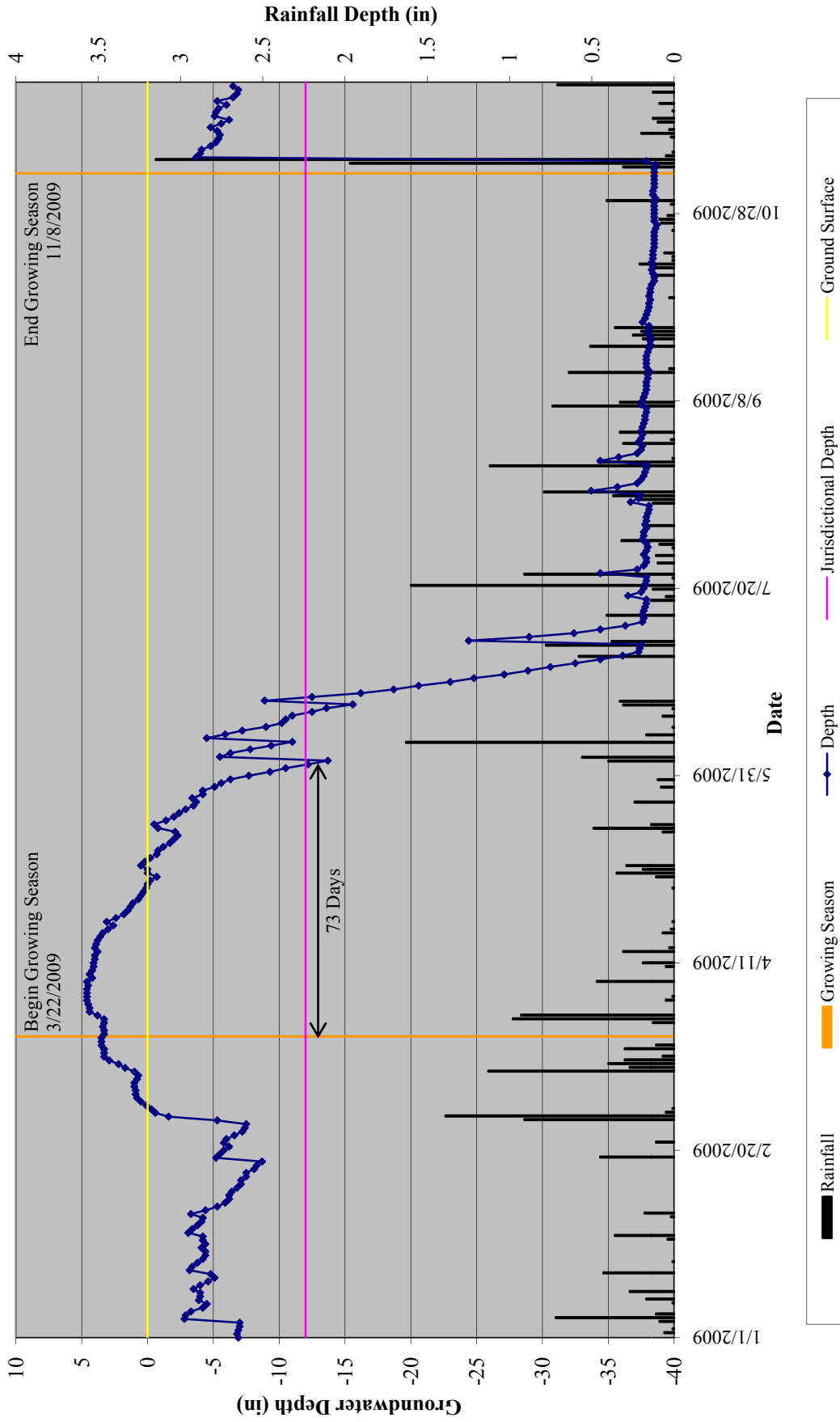
Roquist MY02 Ground Water Monitoring Gauge #4 (Reference for Gauge #3b)



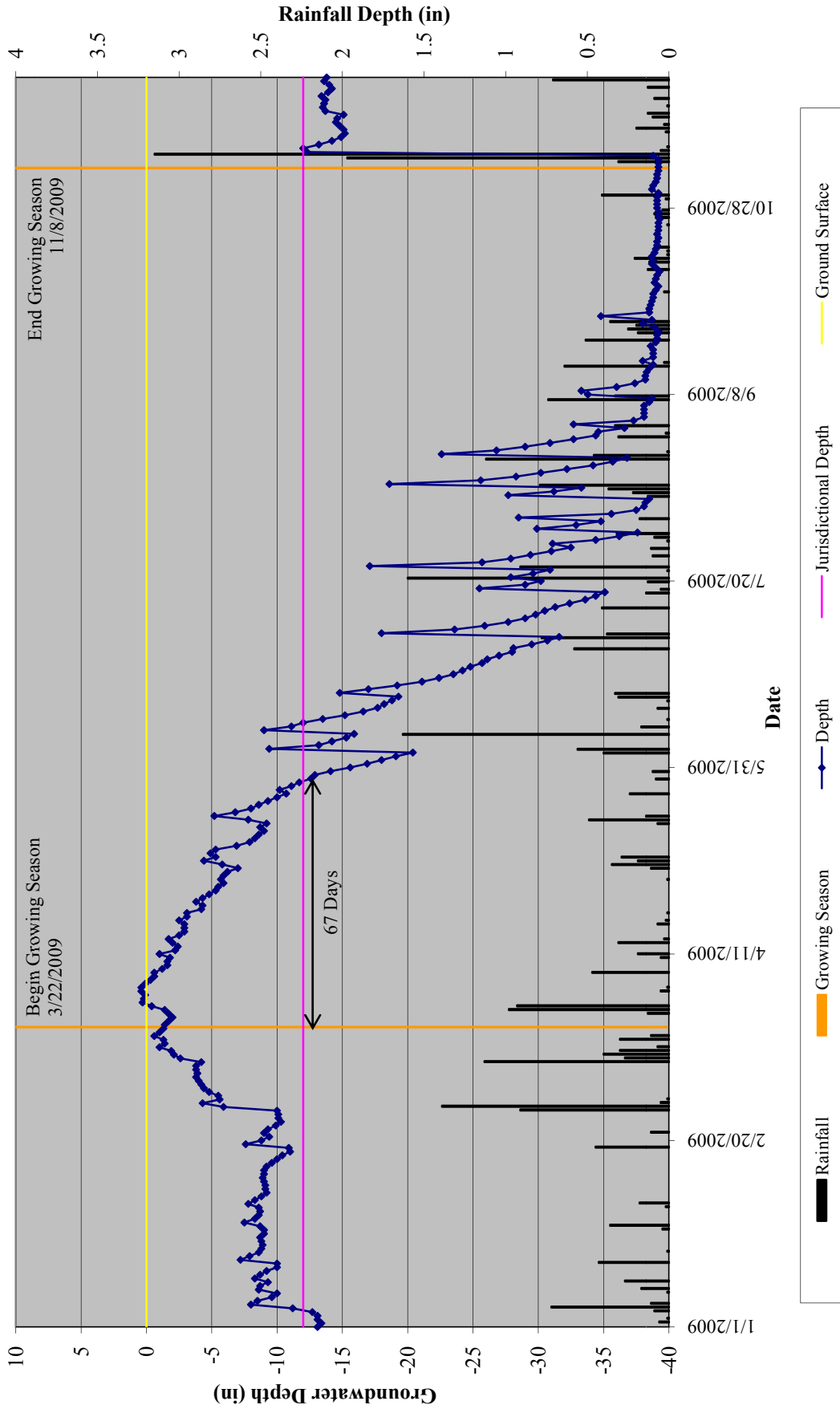
Roquist MY02 Ground Water Monitoring Gauge #5



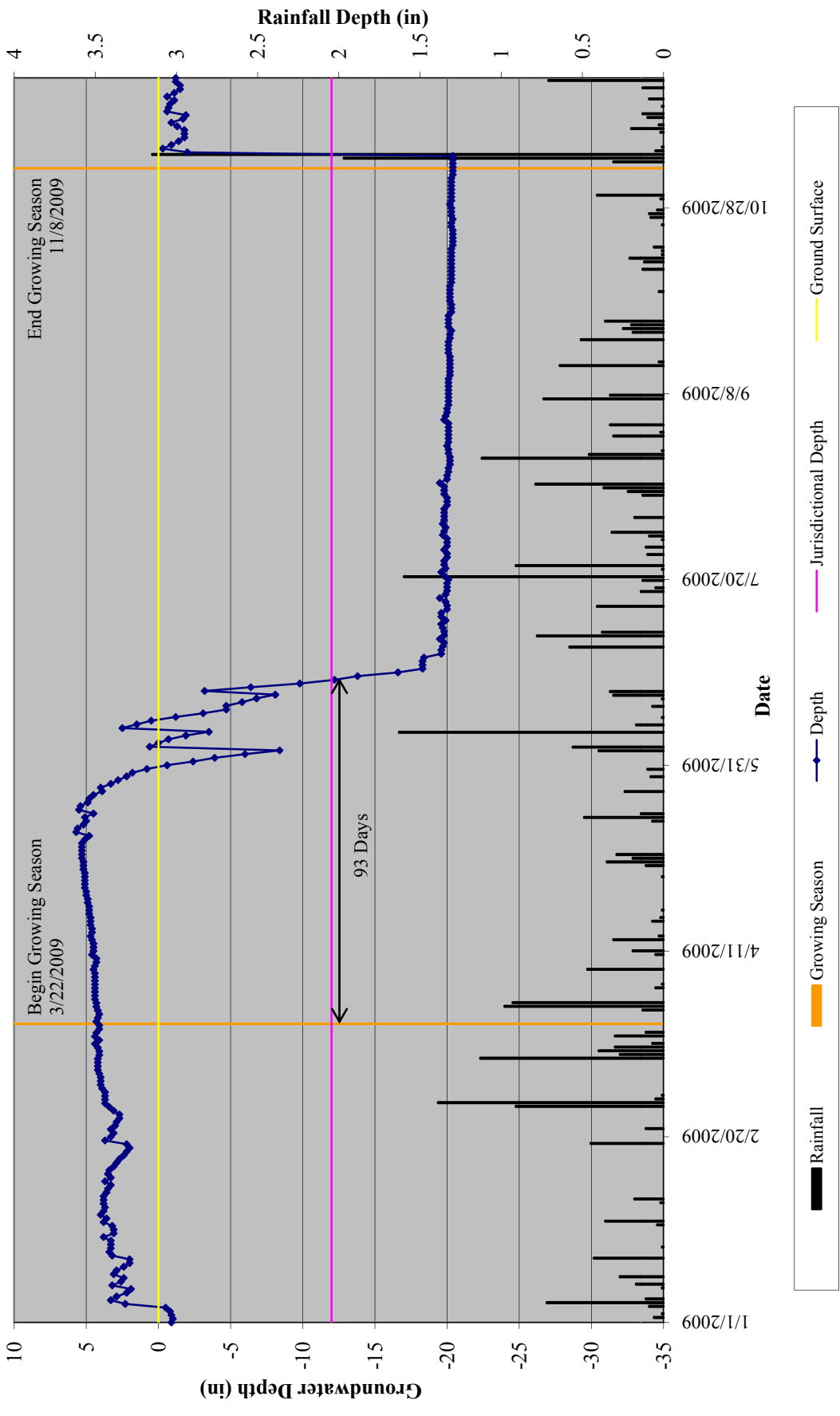
Roquist MY02 Ground Water Monitoring Gauge #6 (Reference for Gauge #5)



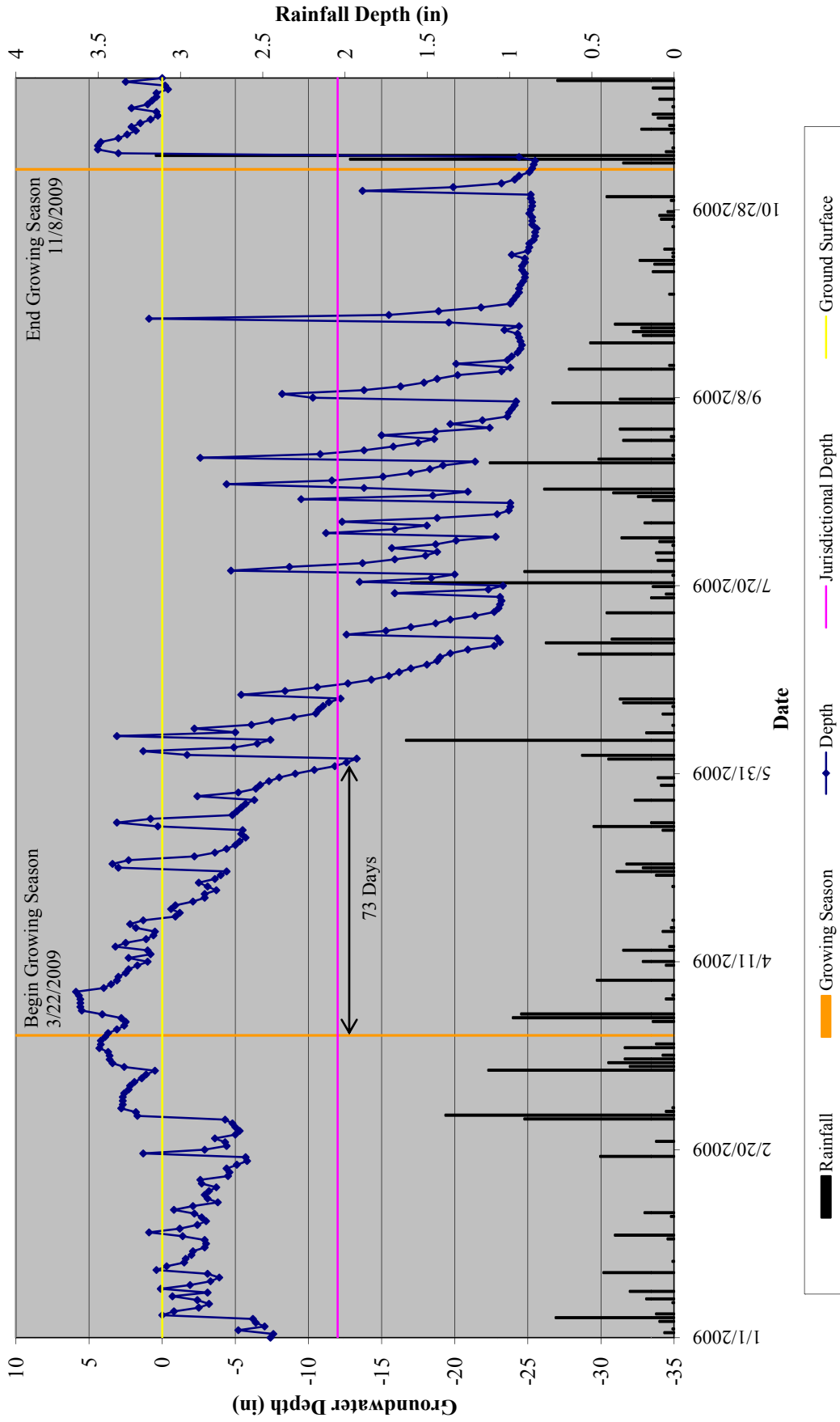
Roquist MY02 Ground Water Monitoring Gauge #9



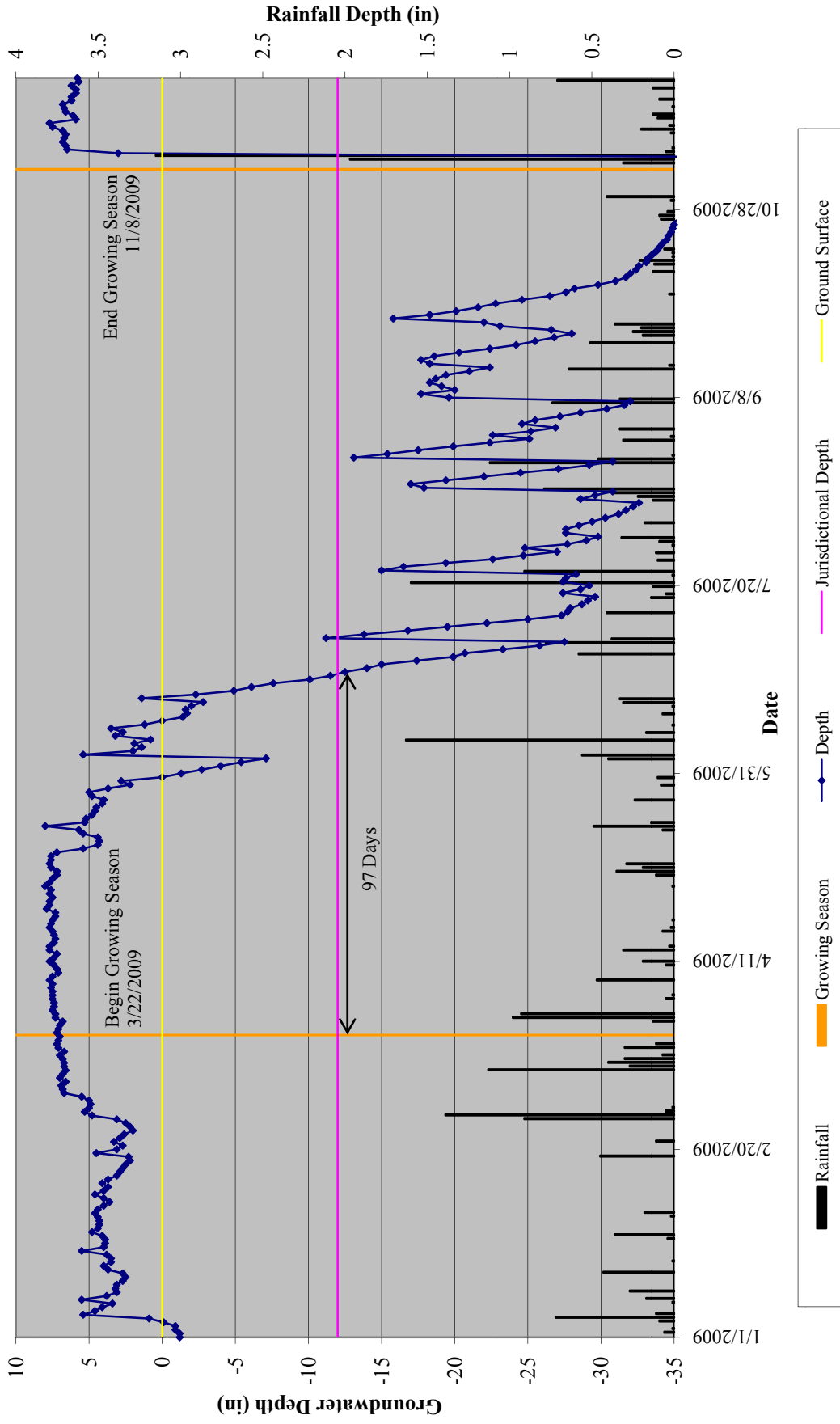
**Roquist MY02
Ground Water Monitoring Gauge #13 (Reference for Gauge #9)**



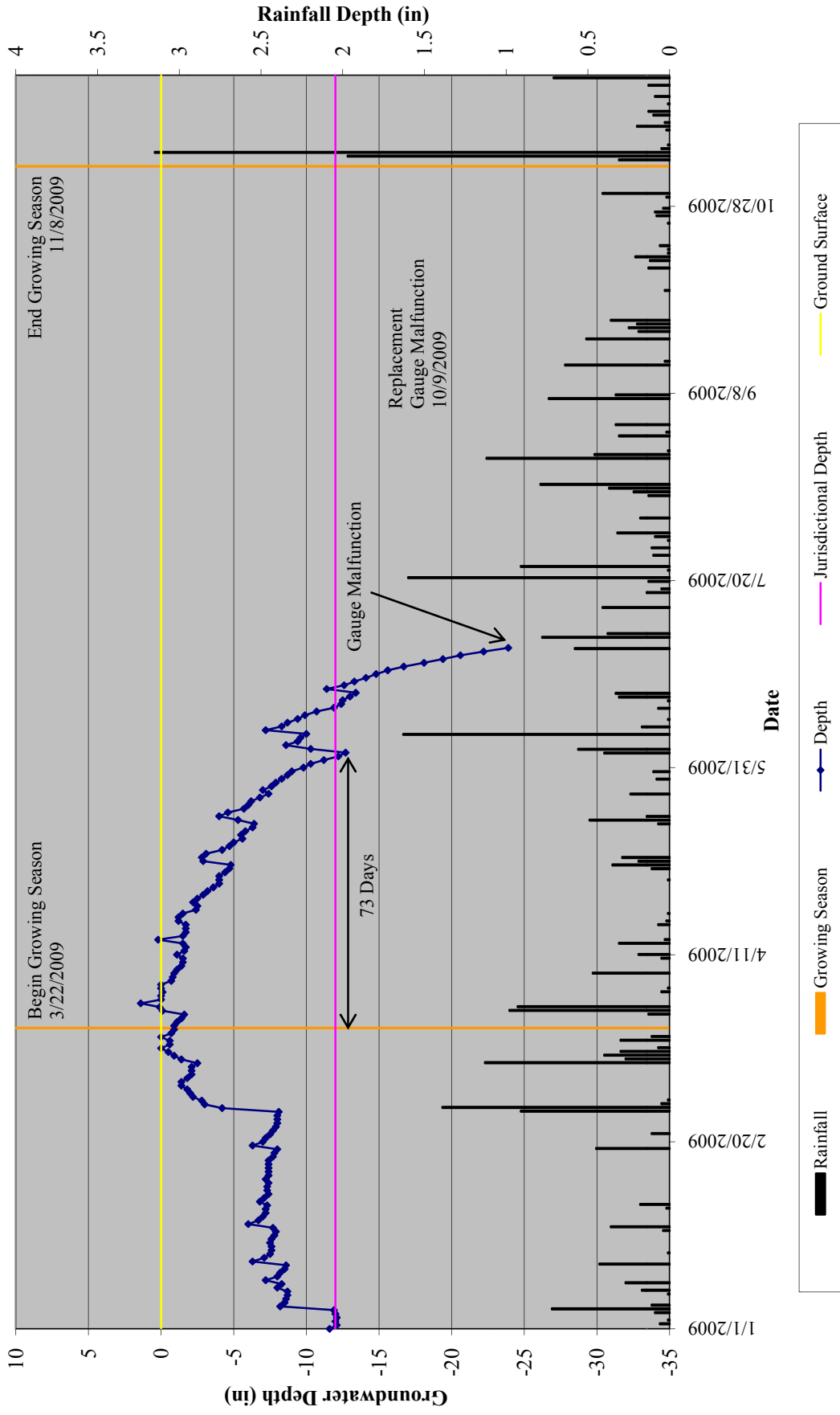
Roquist MY02 Ground Water Monitoring Gauge #11b



Roquist MY02 Ground Water Monitoring Gauge #12 (Reference for Gauge 11b)



Roquist MY02 Ground Water Monitoring Gauge #14



Roquist MY02 Ground Water Monitoring Gauge #15

