

WHITELACE CREEK STREAM ENHANCEMENT
AND WETLAND RESTORATION SITE
MONITORING REPORT (YEAR 5 OF 5)

Lenoir County, North Carolina
EEP Project No. 420



Prepared for:
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652



Status of Plan: Final
Submission Date: November 2010

Monitoring Firm:



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1.0 Executive Summary

The North Carolina Ecosystem Enhancement Program (EEP) enhanced 5,901 linear feet of the Whitelace Creek stream channel located west of Kinston, in Lenoir County, North Carolina. Additionally, 7.7 and 13.0 acres of wetland area were restored and enhanced, respectively. The site construction was completed in August of 2005, and planting occurred in March of 2006. This report provides the monitoring information for year five (5) of the stream enhancement and wetland restoration project.

Previous dredging and straightening of Whitelace Creek had lowered the streambed elevation, thereby causing a reduction in the acreage of riverine wetlands due to a lowered water table. Restoration and enhancement objectives for this project included the restoration of historic stream and wetland functions that existed on-site prior to dredging and vegetation removal. Site alterations at Whitelace Creek included the excavation or reestablishment of the floodplain and in-situ stream channel modification to the existing stream. The goals of these activities are as follows:

- to introduce surface water flood hydrodynamics from a 10.1 square mile watershed along the restored length of stream and floodplain
- to restore wetland hydrology
- to reforest the site with streamside and riparian forest communities.

Vegetative monitoring was performed using the Carolina Vegetation Survey Level 2 methodology on 9 of the original 15 plots, as requested by NCEEP. Monitoring revealed that only 3 of the 9 plots (33%) met the 5-year vegetative success criteria of 260 planted stems or greater per acre. Excessive beaver activity has affected many of the planted trees in vegetation plots; planted trees have also been damaged by deer browsing and flooding. It should be noted that vigorous woody volunteer recruitment (especially *Betula nigra*) was observed in the upper section of the reach near Vegetation Plots 1 and 2. Supplemental planting may be needed to ensure vegetative success.

Overall, the major issues on the site include localized flooding and foraging caused by beaver activity. The three downstream dams were removed on May 7, 2010. As of the monitoring visit on September 22, 2010 beavers had not rebuilt any dams in the lower half of the project. However, the partial dam (labeled as Dam 4 in MY4) is now much larger and is causing significant flooding on the upstream end of the site. The beaver lodge is still located approximately 20 feet from Vegetation Plot 11, although this area is no longer flooded. The beavers should be removed to allow the hydrology of the site to return to conditions outlined in the restoration plan. Beaver activity is likely to continue; therefore, areas of the site currently exhibiting weak planted species survival should be replanted with trees of appropriate species and size to withstand periodic inundation.

Other problems continue to include the presence of invasive or exotic species such as *Typha latifolia* and *Murdannia keisak*, and *Lespedeza cuneata*. Existing areas of *Typha* are located in small pockets along the middle to lower end of the project with the densest areas at the downstream end of the site. Currently

Typha does not appear to be negatively impacting the planted woody vegetation. *Lespedeza* is present along the drier slopes near Vegetation Plots 1 and 2 and does not appear to be spreading into the floodplain. Since flooding has been reduced in the downstream end of the site due to removal of the beaver dams, *Murdannia* has expanded to include a fairly large area in and around Veg Plot 11. A few small areas were noted around the former beaver dam near the gate. The *Typha*, *Murdannia*, and *Lespedeza* will continue to be observed throughout the monitoring period to ensure they do not negatively affect the growth and survival of planted species.

On September 22, 2010 the Year 5 monitoring survey was completed for the vegetation at the Whitelace Creek project site. As in previous years, a general assessment of stream stability was conducted. Results were the same as in the past in that the stream is stable and is well connected to the floodplain. Stream channels bars are still present which could lead to lateral migration and bank instability; however, migration and instability were not observed during current monitoring. As discussed above, beavers continue to be active on site. Photos of current beaver activity in the stream channel and adjacent floodplain are included in the Vegetation Problem Area Photos. All of the checks of the crest gauge indicated that the stream was either above bankfull at the time of the visit or had recently been at that level.

Groundwater data collected through November of 2010 was used to assess the compliance of the site with wetland hydrology criteria. Seven groundwater monitoring gauges are currently active on the project site. A site is considered to meet the requirements for wetland hydrology if the groundwater level is within 12 inches of the ground surface for 12.5% of the growing season consecutively. All 7 of the gauges met the criteria during the growing season of 2010. Three reference gauges are also currently active. All three of the reference gauges met the success criteria in 2010.

The groundwater level data continues to show that the restoration site exhibits longer hydroperiods than the reference site. While the reference wetlands should serve as an accurate hydrologic model for the restored site, the riverine reference wetlands seem to have a different hydrologic regime than the riverine wetlands onsite. Factors such as floodplain elevation, beaver activity, floodplain width, evapotranspiration and others may contribute to the differences.

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 EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

2.0 Methodology

2.1 VEGETATION ASSESSMENT

Fifteen vegetative sample plots were quantitatively monitored during the first growing season. Species composition, density, and survival were monitored during Year 0 and Year 1. The number of plots was reduced to nine for monitoring in the second year, as requested by NCEEP. These plots include the original plots named VP1, VP2, VP4, VP6, VP8, VP9, VP11, VP14, and VP15. The Carolina Vegetation Survey (CVS) methodology Version 2.2.7 was utilized for vegetative monitoring in Years 2, 3, 4, & 5. Level 2 (planted and natural stems) methodology was completed on all monitored plots.

As per the mitigation plan, the vegetative success criteria are based on the US Army Corps of Engineers Stream Mitigation Guidelines (USACE, 2003). The final vegetative success criteria is the survival of 260 5-year old planted woody stems per acre at the end of the Year 5 monitoring period. An interim measure of vegetation planting success was the survival of at least 320 3-year old planted woody stems per acre at the end of year 3 of the monitoring period. A ten percent mortality rate was accepted in year four (288 stems/acre) and another ten percent in year five resulting in a required survival rate of 260 trees/acre through year five.

The Year 5 stem counts within each of the nine vegetative monitoring plots are included in Exhibit Table 7 in Appendix C. Photos of the vegetative monitoring plots are also included in Appendix C.

2.2 STREAM ASSESSMENT

Changes in stream profile and pattern were not included in the stream enhancement project for Whitelace Creek. As such, cross-section and longitudinal profile surveys and pebble counts were not performed for the Year 5 monitoring, as directed by NCEEP. However, a general assessment of stream stability and problem areas was performed during field reconnaissance.

2.3 WETLAND ASSESSMENT

A site is considered to meet the requirements for wetland hydrology if the groundwater saturation is within 12 inches of the ground surface consecutively for 12.5% of the growing season (30 Days). The growing season in this area is from March 18th to November 8th for a total of 234 days (NRCS 2002). Seven groundwater monitoring gauges are currently active on the project site. Data from these gauges were collected and analyzed to assess their success. Three reference gauges are located northwest of the project site. Reference gauges 1 & 2 are located near the intersection of Sutton Road with Moseley Creek. Reference gauge 3 is located between Hillcrest Road and Moseley Creek, approximately 5500 feet north of Route 70. Please refer to the project Vicinity Map (Figure 1) in Appendix A for locations of the reference groundwater monitoring gauges. Graphs of precipitation and water level plots are included in Appendix E.

3.0 References

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (<http://cvs.bio.unc.edu/methods.htm>)

NC CRONOS. 2010. NC CRONOS Database – Cunningham Research Station (KINS). North Carolina State University State, Climate Office of North Carolina. <http://www.nc-climate.ncsu.edu/cronos>

NCEEP. 2009. Revised Table of Contents for 2009 Monitoring Report Submissions. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 1.2.1 June 1, 2009.

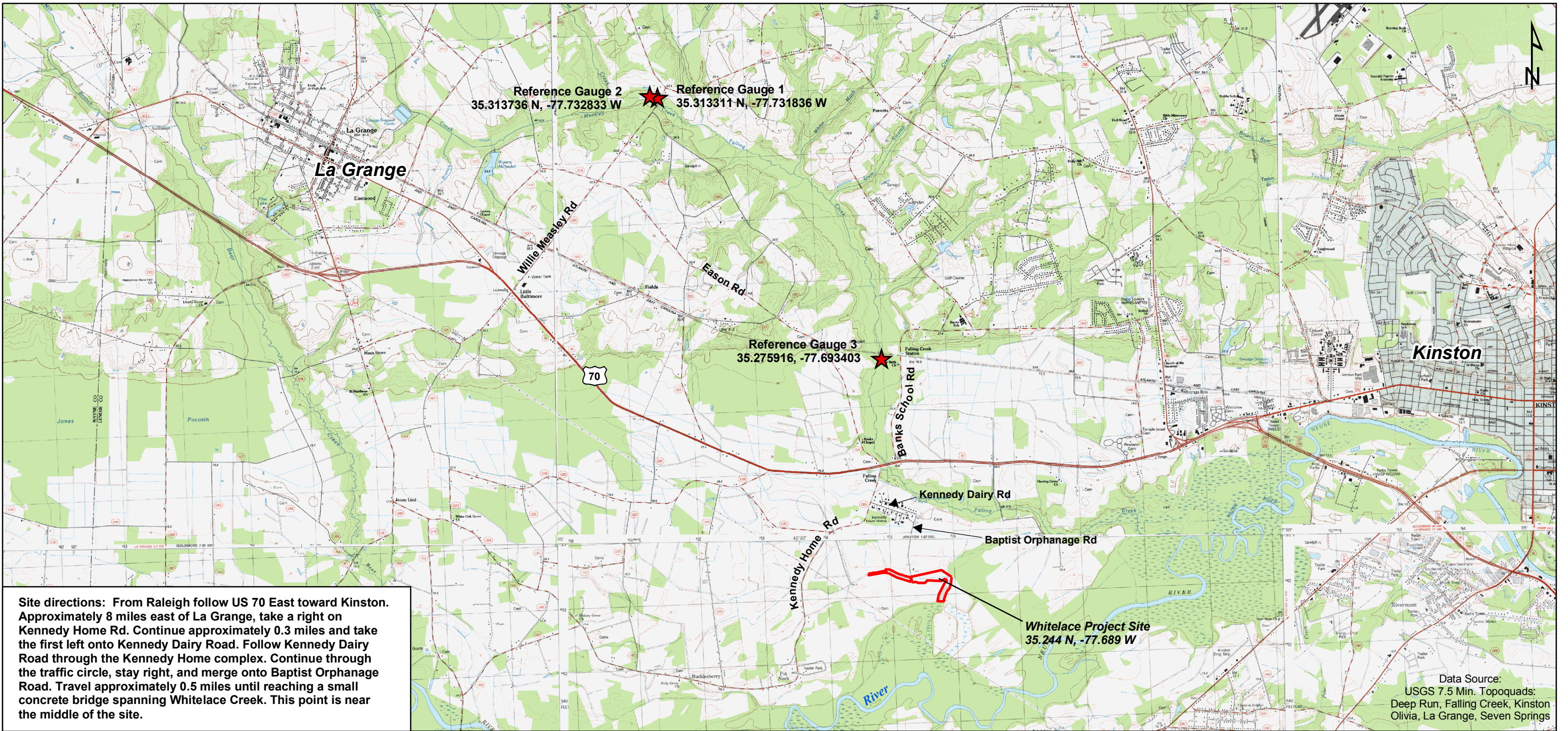
NRCS. 2002. WETS Table for Lenoir County, NC. Natural Resource Conservation Service, National Water and Climate Center.

USACE, EPA, NCWRC, NCDWQ. 2003 Stream Mitigation Guidelines

Weakley, Alan S. 2007. Flora of the Carolinas, Virginia, Georgia, and surrounding areas. University of North Carolina Herbarium. Chapel Hill, NC. Working draft as of January 11, 2007.

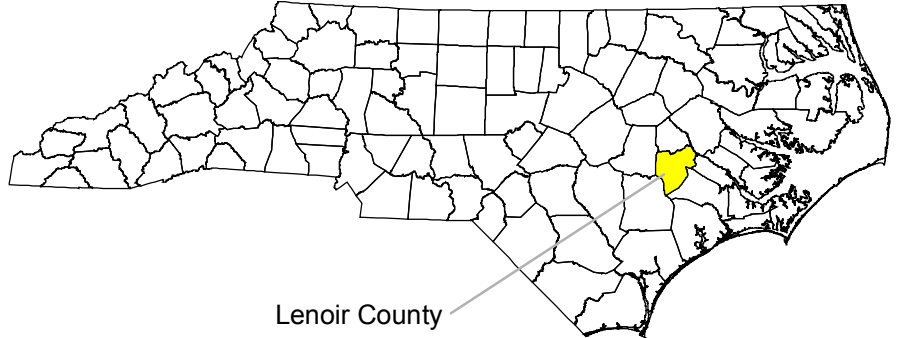
Project Condition and Monitoring Data Appendices

APPENDIX A. GENERAL FIGURES AND PLAN VIEWS



Site directions: From Raleigh follow US 70 East toward Kinston. Approximately 8 miles east of La Grange, take a right on Kennedy Home Rd. Continue approximately 0.3 miles and take the first left onto Kennedy Dairy Road. Follow Kennedy Dairy Road through the Kennedy Home complex. Continue through the traffic circle, stay right, and merge onto Baptist Orphanage Road. Travel approximately 0.5 miles until reaching a small concrete bridge spanning Whitelace Creek. This point is near the middle of the site.

Data Source:
USGS 7.5 Min. Topoquads:
Deep Run, Falling Creek, Kinston
Olivia, La Grange, Seven Springs



Lenoir County

- Reference Gauges
- Conservation Easement

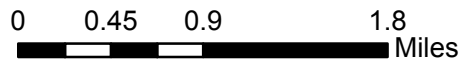
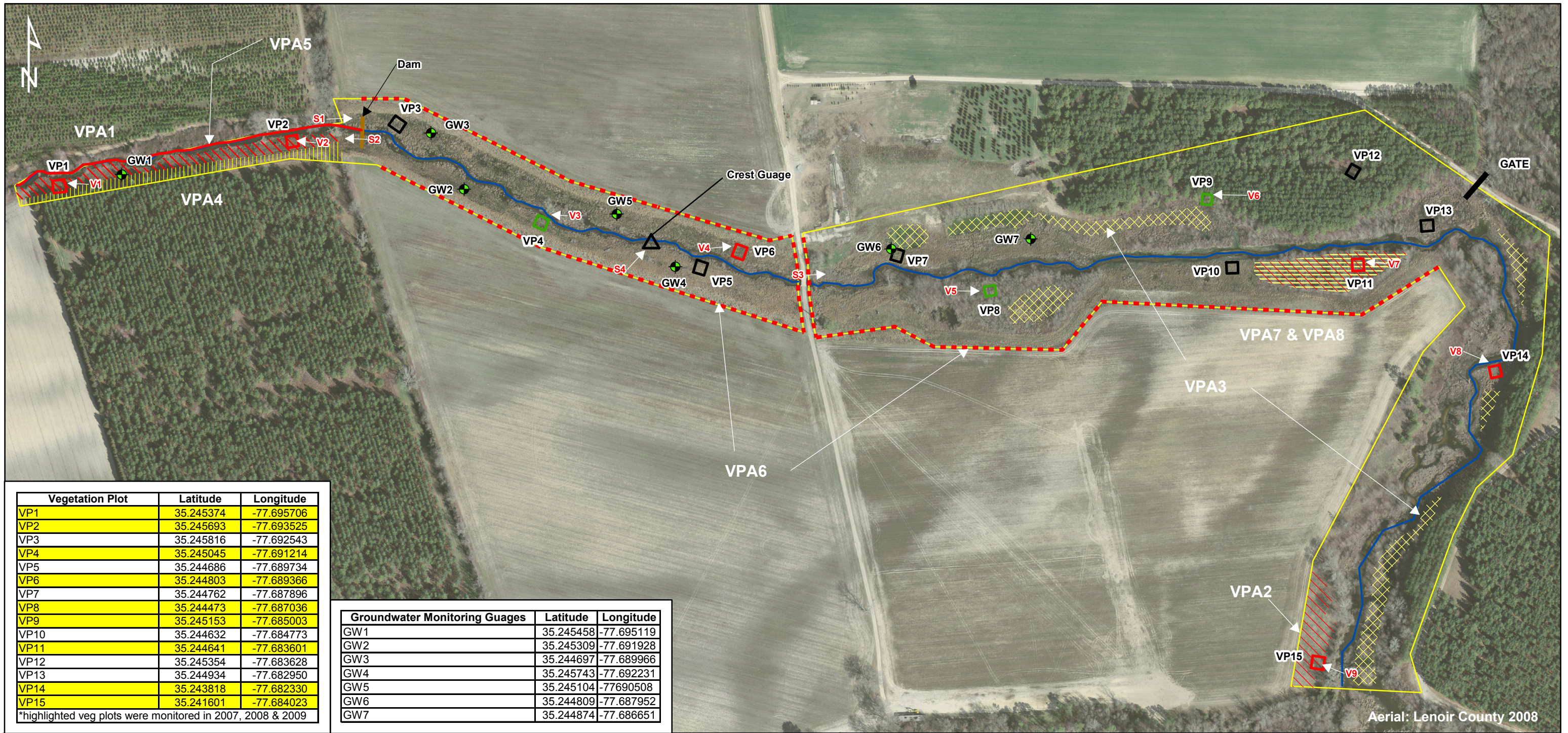


Figure 1 - Vicinity Map

Whitelace Creek Stream Enhancement and Wetland Restoration, EEP #420
Lenoir County, North Carolina
November, 2010



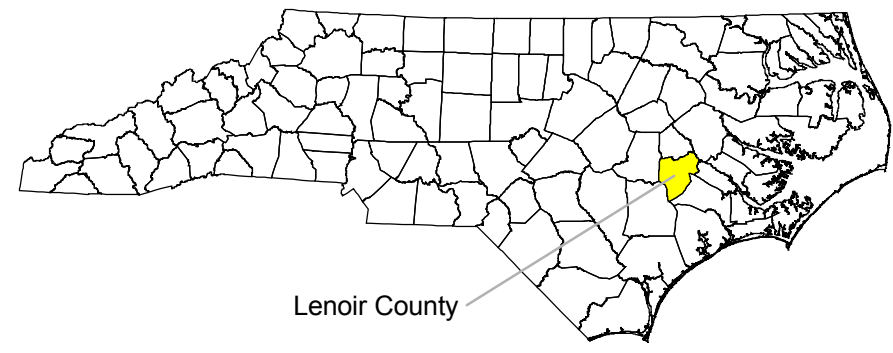
Stantec



Vegetation Plot	Latitude	Longitude
VP1	35.245374	-77.695706
VP2	35.245693	-77.693525
VP3	35.245816	-77.692543
VP4	35.245045	-77.691214
VP5	35.244686	-77.689734
VP6	35.244803	-77.689366
VP7	35.244762	-77.687896
VP8	35.244473	-77.687036
VP9	35.245153	-77.685003
VP10	35.244632	-77.684773
VP11	35.244641	-77.683601
VP12	35.245354	-77.683628
VP13	35.244934	-77.682950
VP14	35.243818	-77.682330
VP15	35.241601	-77.684023

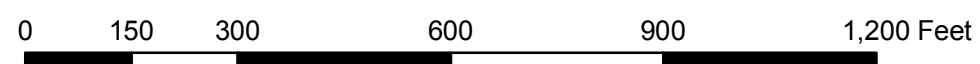
*highlighted veg plots were monitored in 2007, 2008 & 2009

Groundwater Monitoring Gauges	Latitude	Longitude
GW1	35.245458	-77.695119
GW2	35.245309	-77.691928
GW3	35.244697	-77.689966
GW4	35.245743	-77.692231
GW5	35.245104	-77.690508
GW6	35.244809	-77.687952
GW7	35.244874	-77.686651



- Vegetation Plots**
- Not Monitored
 - <288 stems/acre
 - >288 stems/acre
- Major Vegetation Problem Areas**
- Poor Planted Species Survival (VPA1, VPA2, VPA8)
 - Possible Encroachment (VPA6)
 - Flooding from Beaver Dam (VPA5)
- Minor Vegetation Problem Areas**
- Lespedeza (VPA4)
 - Murdannia (VPA7)
 - Typha (VPA3)
- Stream**
- Stream
 - Conservation Easement
- Photo Points (V=Veg, S=Stream)**
- V1
- Crest Gauge**
- Crest Gauge
- Monitoring Gauges**
- Successful for MY4 (7)
- Beaver Dams**
- Current

Figure 2 - Current Condition Plan View Map MY5
 Whitelace Creek Stream Enhancement and Wetland Restoration
 EEP Project Number 420
 Lenoir County, North Carolina
 November 2010



APPENDIX B. GENERAL PROJECT TABLES

Reach ID	Existing Feet/Acres	Type	Approach	Footage or Acreage	Stationing	Comment
Reach 1	2763	E1	P2	2763	9+65 - 37+58	Total accounts for 30 l.f. gap in easement at road crossing, and one sided easement at upstream section
Reach 2	2208	E2	P2	2208	37+58 - 59+66	
Riverine Wetland Restoration		R	NA	7.7 ac	NA	Stations 0+00 to 37+58 mark the extent of the floodplain grading
Riverine Wetland Enhancement		E	NA	13.0 ac	NA	
Neuse River Buffer Restoration		R	NA	6.4 ac	NA	

R = Restoration

E1 = Stream Enhancement 1

E2 = Stream Enhancement 2

S = Stabilization

P=Preservation

E = Wetland/Riparian Buffer Enhancement

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	NA	NA	Feb 2004
Final Design - 90%	NA	NA	Nov 2004
Construction	Aug 2005	NA	Aug 2005
Temporary S&E mix applied to entire project area	NA	NA	Jul 2005
Permanent seed mix applied to entire project area	NA	NA	Aug 2006
Bare Root Seedling Installation	Mar 2006	NA	Mar 2005
Mitigation Plan / As-built (Year 0 Monitoring - baseline)	NA	NA	Apr 2005
Final Report	NA	NA	Apr 2005
Year 1 Monitoring	Nov 2006	Nov 2006	Nov 2006
Year 2 Monitoring	Nov 2007	Nov 2007	Dec 2007
Year 3 Monitoring	Nov 2008	Nov 2008	Nov 2008
Year 4 Monitoring	Nov 2009	Nov 2009	Nov 2009
Year 5 Monitoring	Nov 2010	Nov 2010	Nov 2010

NA = Not Applicable

Table 3. Project Contacts Whitlace Creek Wetland Restoration Site/EEP Project No. 420	
Designer	EcoScience Corporation 1101 Haynes Street Suite 101 Raleigh, NC 27604
Construction Contractor	Shamrock Environmental Corporation PO Box 14987 Greensboro, NC 27415
Planting Contractor	Emerald Forest Incorporated 4651 Backwoods Road Chesapeake, VA 23322-2456
Seeding Contractor	Wheat Swamp Landscaping 4675 Ben Dail Road LaGrange, NC 28551-8038
Seed Mix Sources	IKEX, Inc. PO Box 250 Middlesex, NC 27557
Nursery Stock Suppliers	Warren County Nursery 6492 Beersheba Highway McMinnville, TN 37110 Pinelands Nursery and Supply 323 Island Road Columbus, NJ 08022 Coastal Plain Conservation Nursery 3067 Connors Drive Edenton, NC 27932
Monitoring Performers (Year 0-1)	EcoScience Corporation 1101 Haynes Street, Suite 101 Raleigh NC 27604 (919)828-3433
Monitoring Performers (Year 2-4)	Stantec Consulting Services, Inc. 801 Jones Franklin Road, Ste 300 Raleigh, NC 27606
Stream Monitoring POC Vegetation Monitoring POC Wetland Monitoring POC	David Bidelspach (919)851-6866 Amber Coleman (919)851-6866 Amber Coleman (919)851-6866

**Table 4 - Project Attribute Table
Whitelace Creek Wetland Restoration Site/EEP Project No. 420**

Project County	Lenoir
Drainage Area	10.1 sq mi
Drainage impervious cover estimate (%)	< 1 percent
Stream Order	2 nd order
Physiographic Region	Coastal Plain
Ecoregion	Southeastern Floodplains and Low Terraces
Rosgen Classification of As-built	C/E
Cowardin Classification	R2UB23Cb (Riverine, Lower Perennial, Unconsolidated Bottom, Sand/Mud, Seasonally Flooded, Beaver)
Dominant soil types	
Riverine Wetland Restoration	Johnston, stream channels, 80% of Site
Riverine Wetland Enhancement	Johnston, stream channels, 80% of Site
Reference site ID	01-05471-01A
USGS HUC for Project	03020202040020
USGS HUC for Reference	03020202040020
NCDWQ Subbasin for Project	03-04-05
NCDWQ Subbasin for Reference	03-04-05
NCDWQ Classification for Project	C SW NSW
NCDWQ Classification for Reference	C SW NSW
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	No
Percent of project easement fenced	No

Appendix C. Vegetation Assessment Data

Table 5 - Vegetation Plot Mitigation Success Summary		
Whitelace Creek Wetland Restoration Site / EEP Project No. 420		
Vegetation	Vegetation Density Met	Tract Mean
Plot ID	(260 stems/acre)	
VP1	N (202)	33% (216 stems/acre)
VP2	N (81)	
VP4	Y (405)	
VP6	N (162)	
VP8	Y (364)	
VP9	Y (324)	
VP11	N (0)	
VP14	N (243)	
VP15	N (162)	

Vegetation Monitoring Plot Photos



Photo Station 1: Vegetation Plot 1 (9/22/10).



Photo Station 2: Vegetation Plot 2 (9/22/10).



Photo Station 3: Vegetation Plot 4 (9/22/10)



Photo Station 4: Vegetation Plot 6 (9/22/10)



Photo Station 5: Vegetation Plot 8 (9/22/10)



Photo Station 6: Vegetation Plot 9 (9/22/10)



Photo Station 7: Vegetation Plot 11 (9/22/10)



Photo Station 8: Vegetation Plot 14 (9/22/10)



Photo Station 9: Vegetation Plot 15 (9/22/10)

Table 6. Vegetation Metadata	
Report Prepared By	Alex Baldwin
Date Prepared	11/2/2010 13:00
database name	Stantec_Whitelace2010_A.mdb
database location	U:\171300316\project\2-Whitelace\site_data\cv5
computer name	BALDWINA
file size	37093376
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	420
project Name	Whitelace Creek
Description	Wetland restoration and enhancement
River Basin	Neuse
length(ft)	5900
stream-to-edge width (ft)	100
area (sq m)	80,937
Required Plots (calculated)	NA

Table 7 - Stem Count Total by Plot and Species Whitelace Creek Stream Enhancement and Wetland Restoration Site EEP Project #420

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2010)																								Annual Means														
			420-Amber-0001			420-Amber-0002			420-Amber-0004			420-Amber-0006			420-Amber-0008			420-Amber-0009			420-Amber-0011			420-Amber-0014			420-Amber-0015			MY5 (2010)			MY4 (2009)			MY3 (2008)			MY2 (2007)		
			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	P-LS	P-all	T
Acer rubrum	red maple	Tree			4						1						48			25			5			1						84			87			19			4
Acer saccharinum	silver maple	Tree																														24			23						
Baccharis	baccharis	Shrub Tree																																	22			6			
Baccharis halimifolia	eastern baccharis	Shrub Tree									4			5			1			17									27			81						1			
Betula nigra	river birch	Tree		1	1			80			1						1						1						1	84	2	6	2	61	1	26					
Carpinus caroliniana var. car	Coastal American Horn	Shrub Tree					1	1		1	1																	2	2	2	2	2	2	2	2	2	2				
Carya	hickory	Tree																		1									1			1			1						
Carya aquatica	water hickory	Tree												1	1		1	1										2	2	2	2	2	2	2	2	2	3				
Chamaecyparis thyoides	Atlantic white cedar	Tree								1	1																	1	1	2	2	2	2	2	2	3	3				
Diospyros	diospyros	Tree																																	3						
Diospyros virginiana	common persimmon	Tree			3																					1			4			4									
Fraxinus	ash	Shrub Tree		1	1																							1	1	1	2	1	1	1	1						
Fraxinus pennsylvanica	green ash	Tree					1	1		1	1																	2	2	4	4	4	4	4	4	4	4				
Ilex opaca	American holly	Shrub Tree																		1									1			1									
Ligustrum sinense	Chinese privet	Shrub Tree																		1									1			1									
Liquidambar styraciflua	sweetgum	Tree			4																								7			38			18			15			
Liriodendron tulipifera var. t	Tulip-tree, Yellow Popl	Tree																																				2	2		
Nyssa biflora	swamp tupelo	Tree						3	3					1	1		2	2										6	6	6	6	5	5	6	9						
Pinus taeda	loblolly pine	Tree																		8									8			8									
Platanus occidentalis var. oc	Sycamore, Plane-tree	Tree																											1	1					1	1					
Prunus serotina	black cherry	Shrub Tree																		1									1												
Quercus	oak	Shrub Tree																					1	1		1	1	1	1	1	1	2	2	2	2	2	2				
Quercus laurifolia	laurel oak	Tree		1	1									1	1		1	1								1	1	4	4	4	4	3	3	4	4	4	4				
Quercus lyrata	overcup oak	Tree									2	2					1	1										3	3	2	2	2	2	2	2	2	2				
Quercus michauxii	swamp chestnut oak	Tree												1	1		1	1										2	2	3	3	3	3	3	3	3	3				
Quercus nigra	water oak	Tree																								1	1	1	1	1	1										
Quercus pagoda	cherrybark oak	Tree												1	1													1	1	2	2	3	3	3	3	3	3				
Quercus phellos	willow oak	Tree									1	1					1	1											2	2	3	3	2	2	2	2					
Salix nigra	black willow	Tree												12	11		2	2											28			38			18						
Taxodium distichum	bald cypress	Tree		2	2					1	1		1	1		3	3		3	3								6	6	16	16	18	18	16	16	15	15				
Toxicodendron radicans	eastern poison ivy	Shrub Vine																											4												
Ulmus americana var. ameri	American Elm, White E	Tree															1	1											1	1	1	1	1	1	1	1					
Ulmus rubra	slippery elm	Tree												1	1													1	1	1	1										
Unknown	unknown																												1												
Vitis	grape																												1												
Stem count			0	5	16	0	2	82	0	10	28	0	4	20	0	9	61	0	8	70	0	0	9	0	6	7	0	4	6	0	48	299	0	57	345	0	50	221	0	53	108
size (ares)			1			1			1			1			1			1			1			1			9			9			9			9					
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.22			0.22			0.22			0.22					
Species count			0	4	7	0	2	3	0	7	11	0	4	6	0	7	11	0	5	16	0	0	3	0	1	2	0	4	6	0	17	30	0	18	28	0	15	23	0	16	20
Stems per ACRE			0	202.3	647.5	0	80.94	3318	0	404.7	1133	0	161.9	809.4	0	364.2	2469	0	323.7	2833	0	0	364.2	0	242.8	283.3	0	161.9	242.8	0	215.8	1344	0	256.3	1551	0	224.8	993.7	0	238.3	485.6

Appendix D. Stream Assessment Data



Photo Station 1 (S1) – Overview of Project (looking downstream from Sta.10+00 (09/22/10))



Photo Station 2 (S2) - Overview of upstream portion of reach (looking upstream from Sta.10+00 (09/22/10))

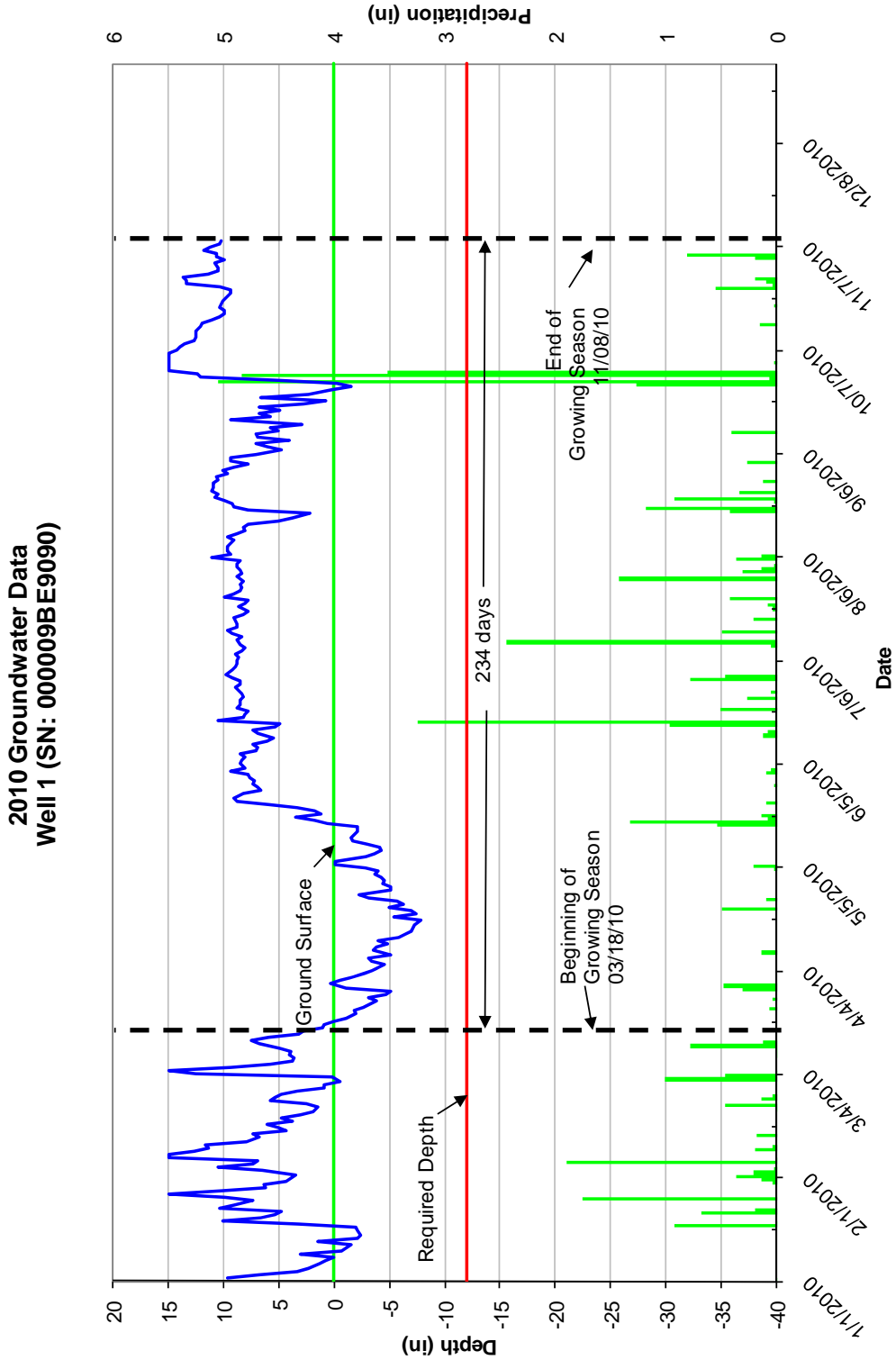


Photo Station 3 (S3) – Looking downstream from bridge (09/22/10)

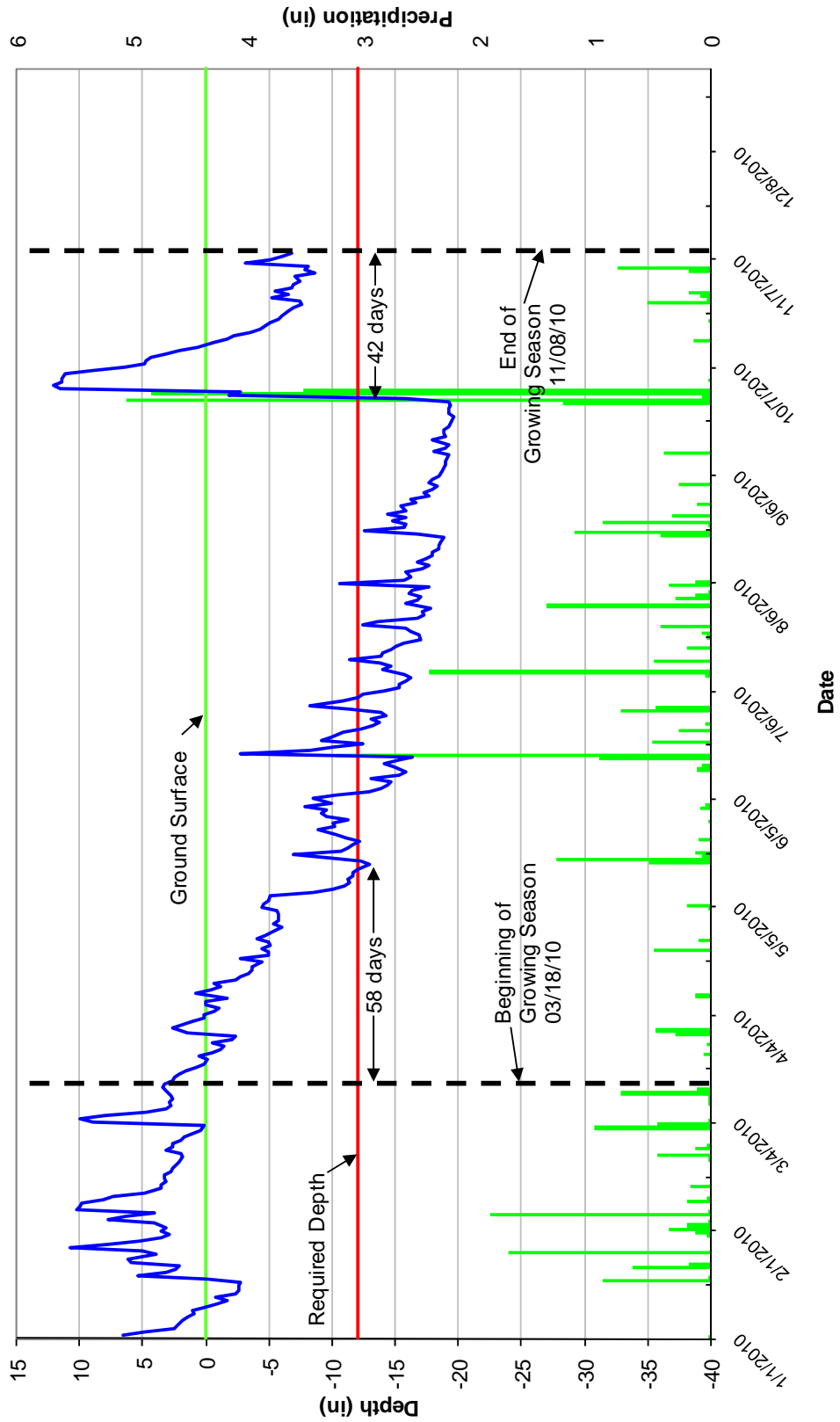


Photo Station 4 (S4) – Crest gauge (09/22/10)

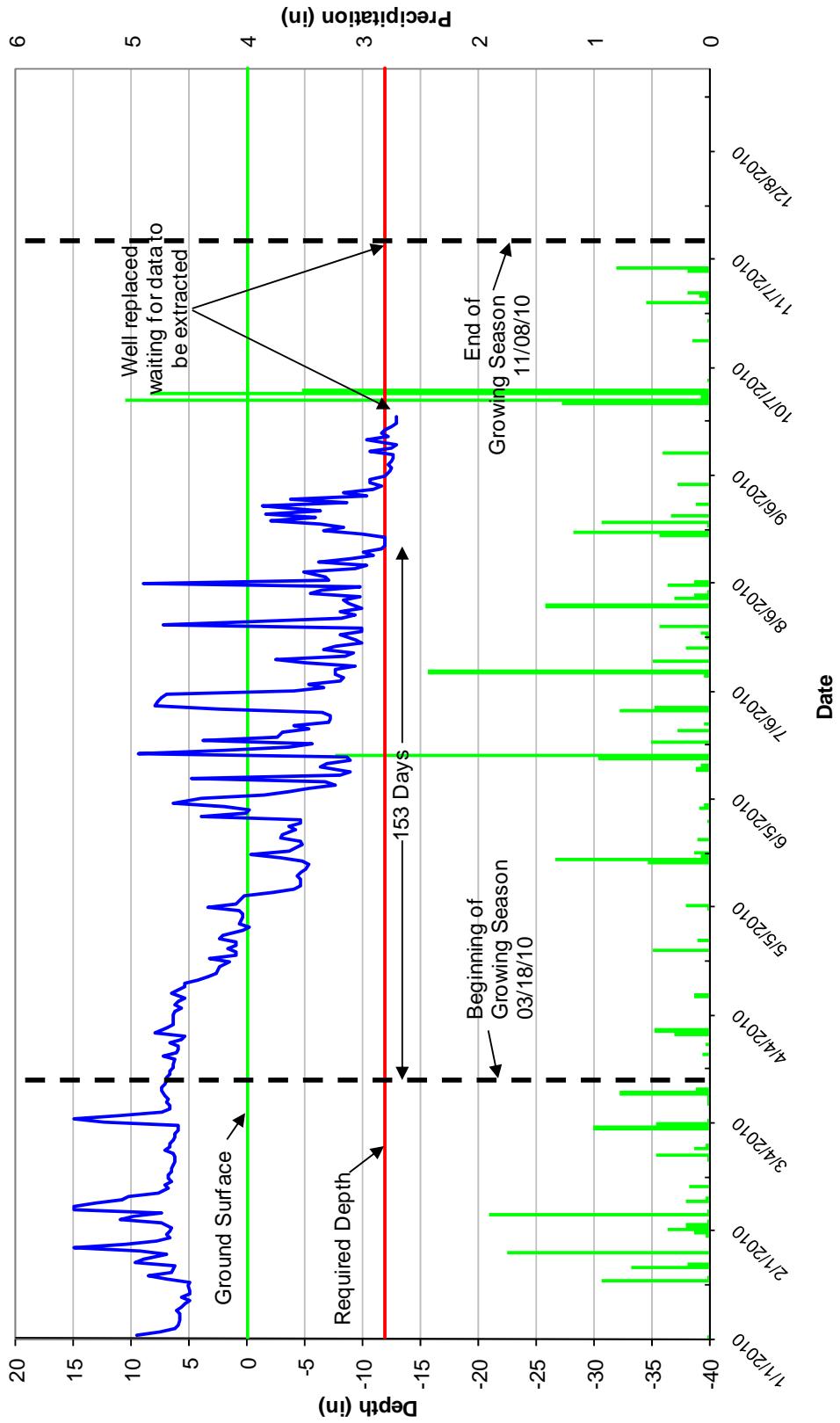
Appendix E. Wetland Assessment



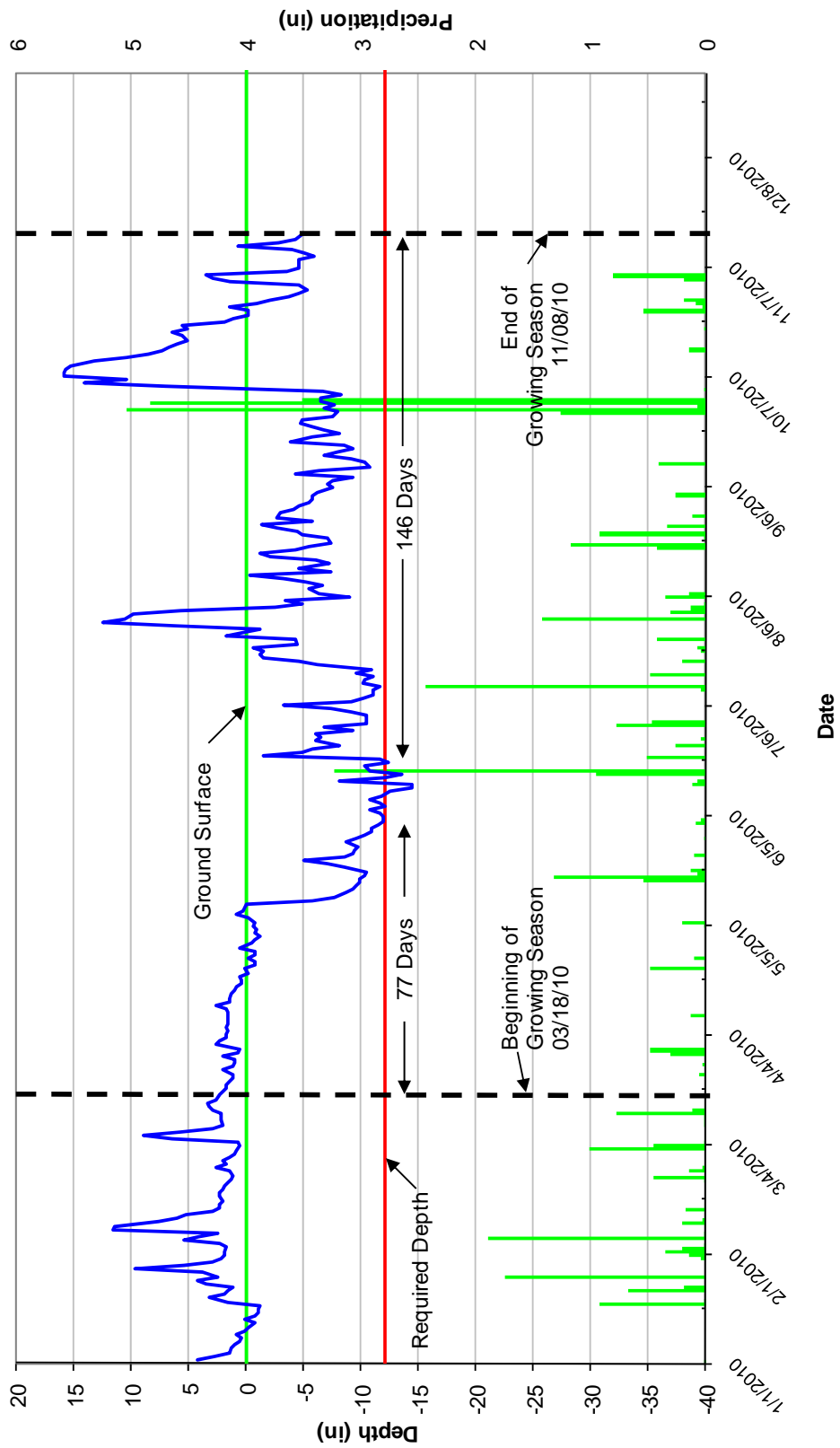
**2010 Groundwater Data
Well 2 (SN: 00000EBD106E)**



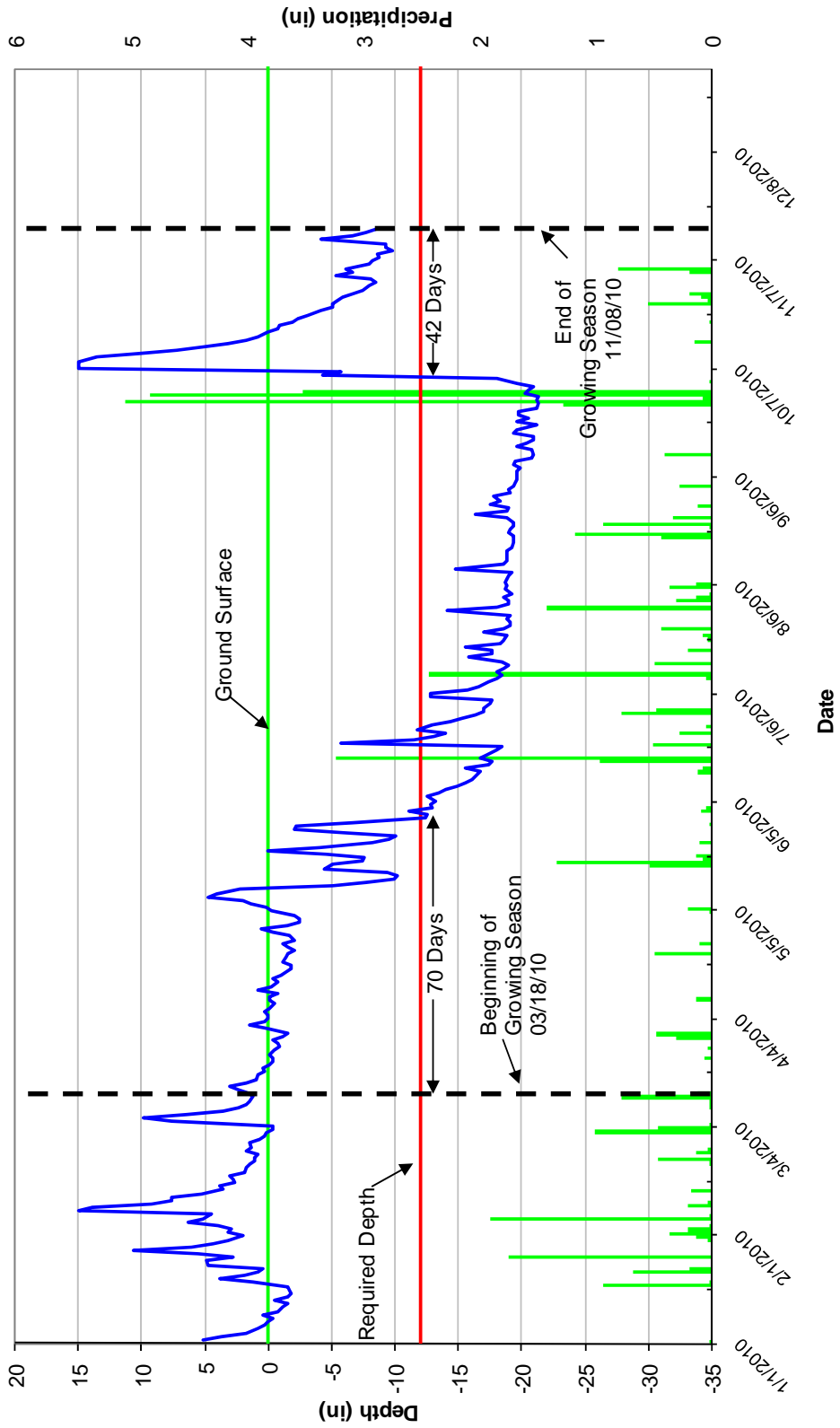
**2010 Groundwater Data
Well 3 (SN: 00000A287A2A)**



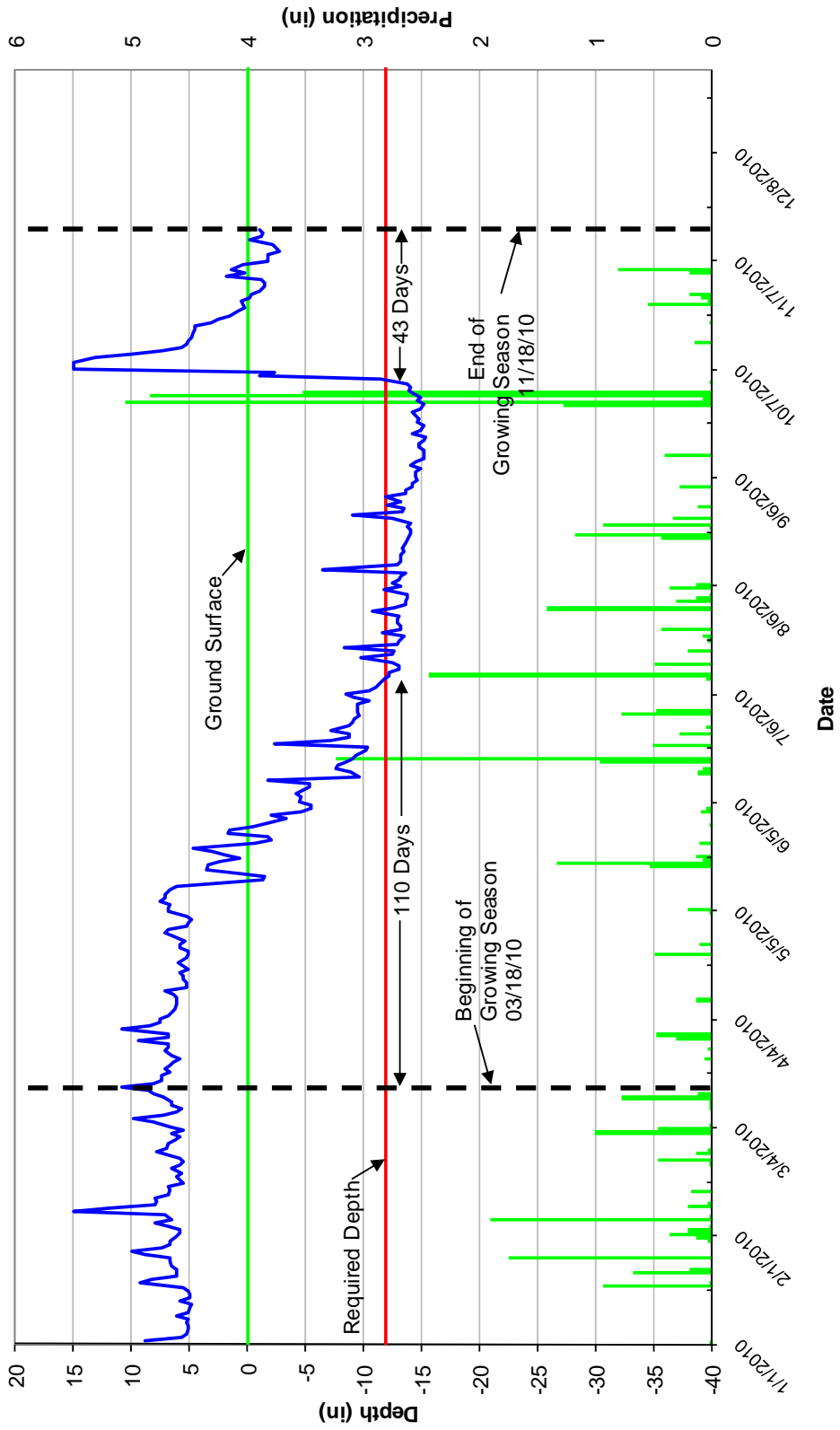
2010 Groundwater Data
Well 4 (SN: 00000EBDA66C)



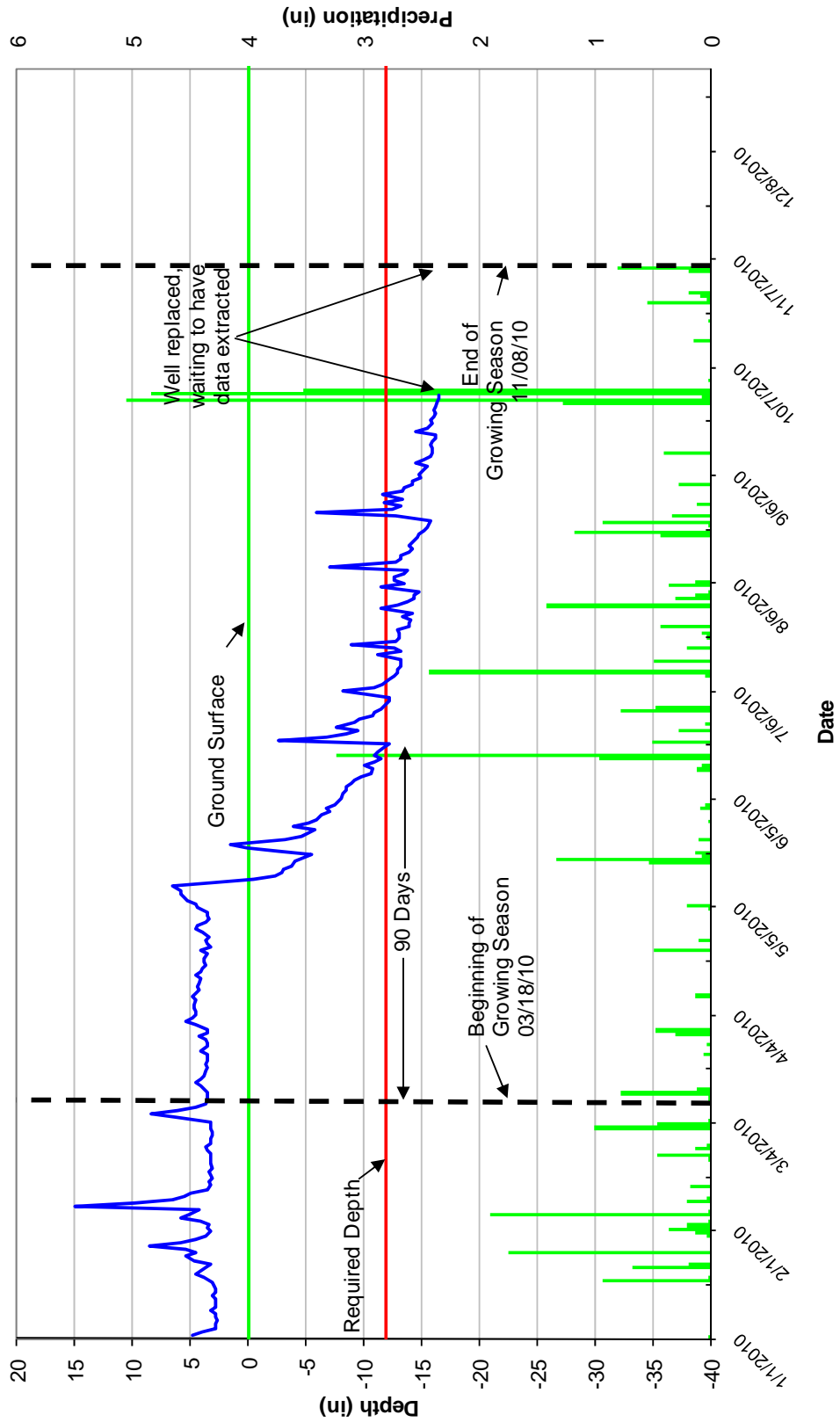
2010 Groundwater Data
Well 5 (SN: 00000EBCFF87)



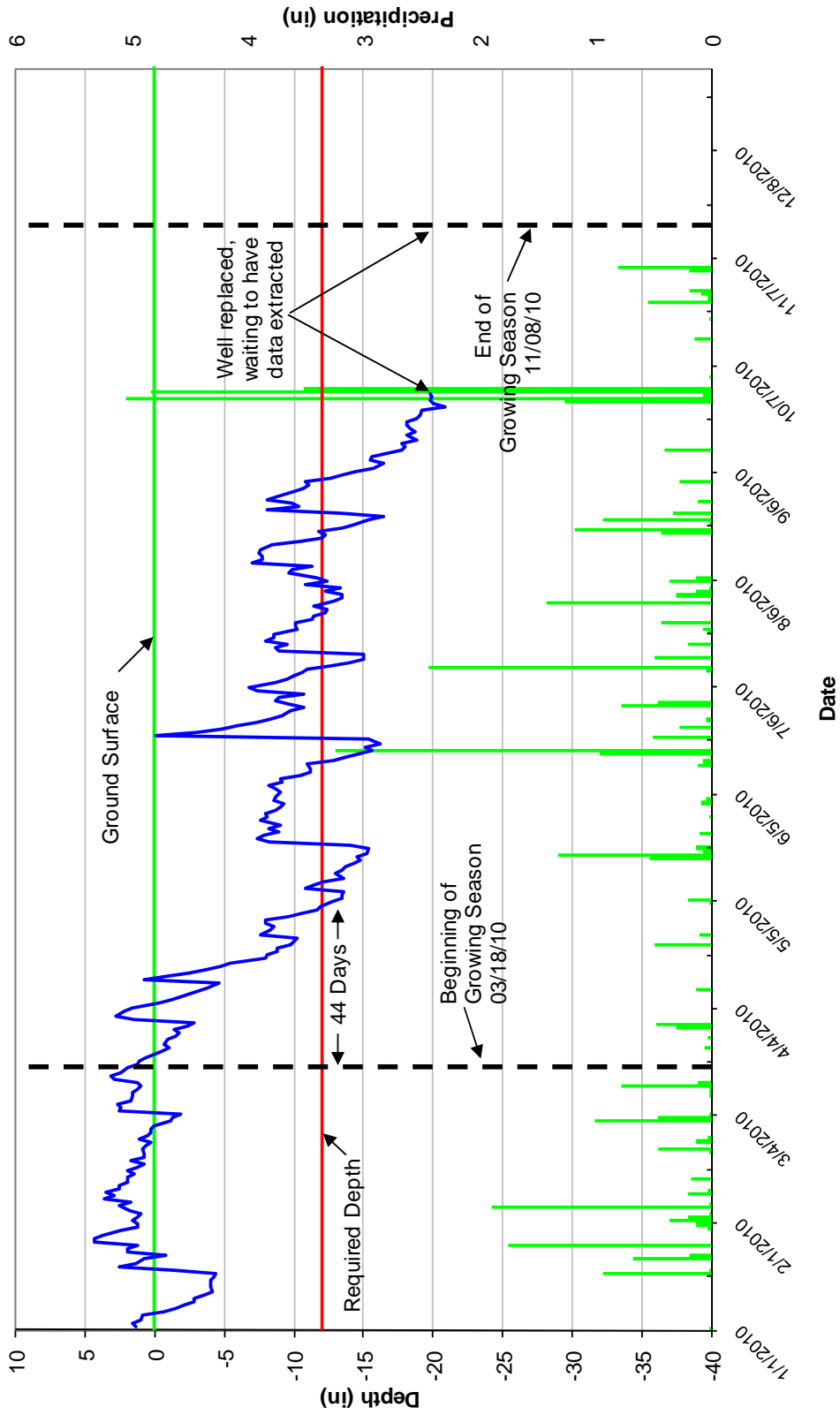
**2010 Groundwater Data
Well 6 (SN: 00000A28C526)**



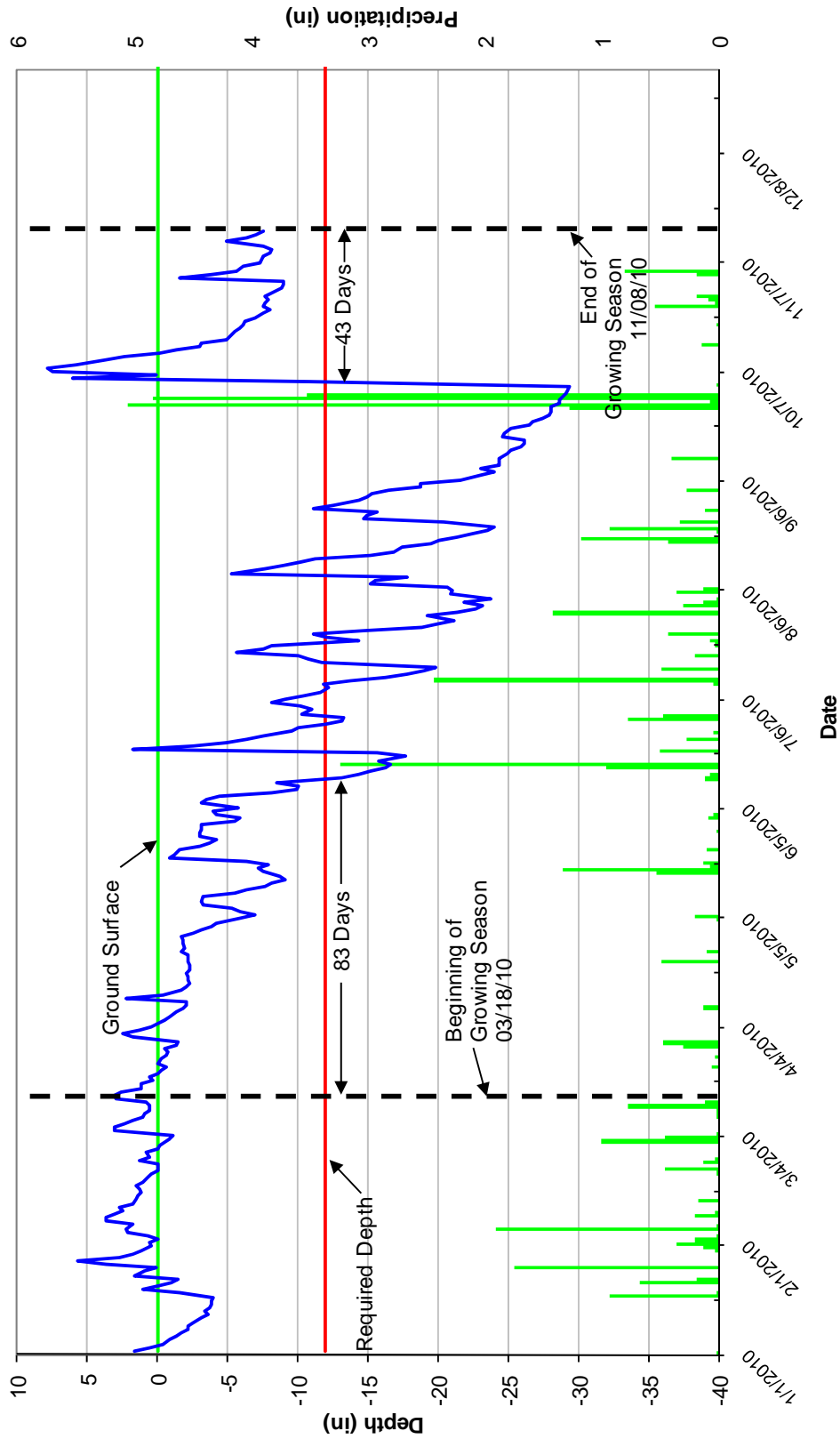
2010 Groundwater Data
Well 7 (SN: 00000EBD182C)



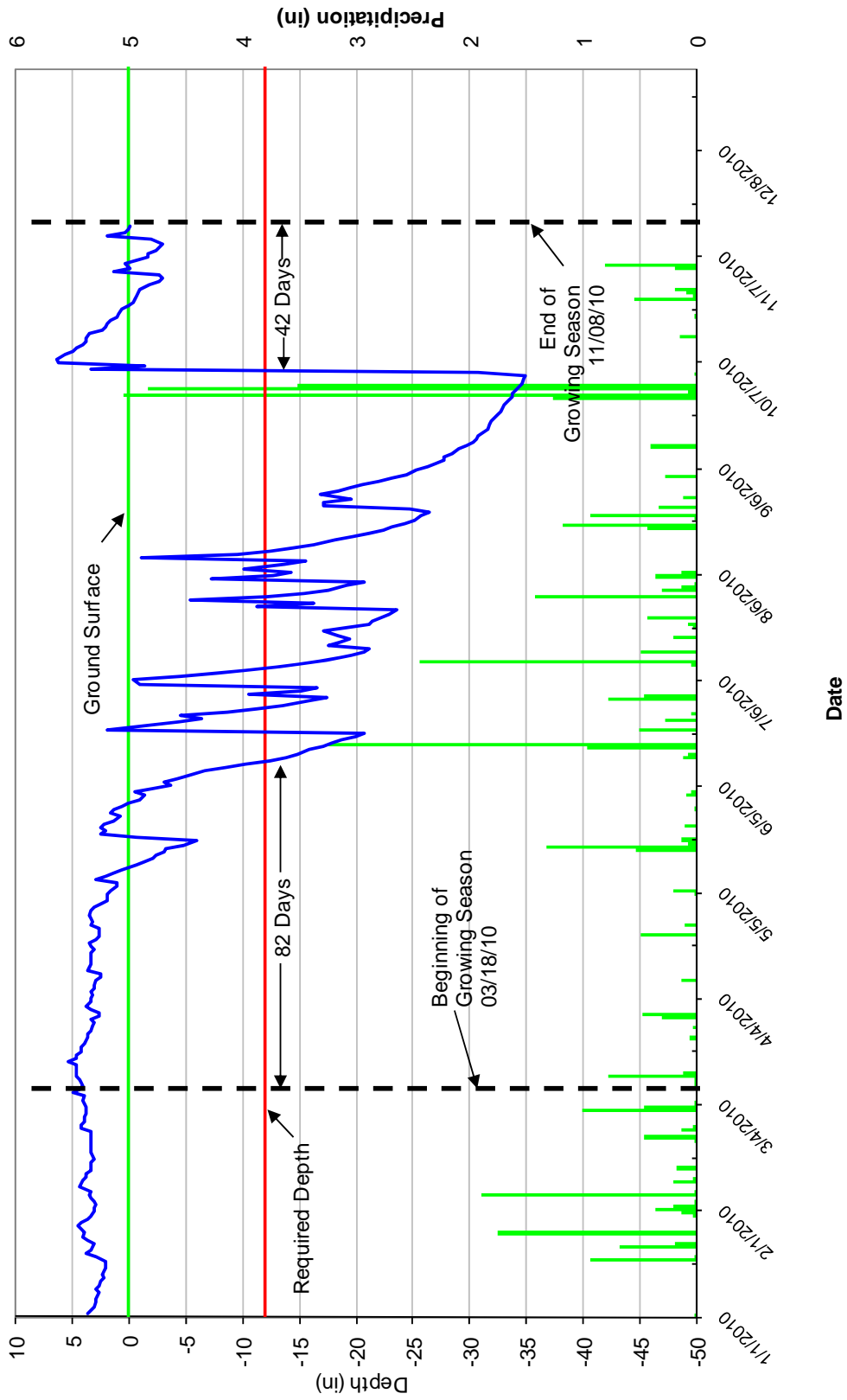
**2010 Groundwater Data
Well Ref-1 (SN: 00000EBD3CE6)**



2010 Groundwater Data
Well Ref-2 (SN: 000011310FE0)



2010 Groundwater Data
Well Ref-3 (SN:000009DE7694)



Whitelace Creek 2010 30-70 Percentile Graph
Lenoir County, North Carolina

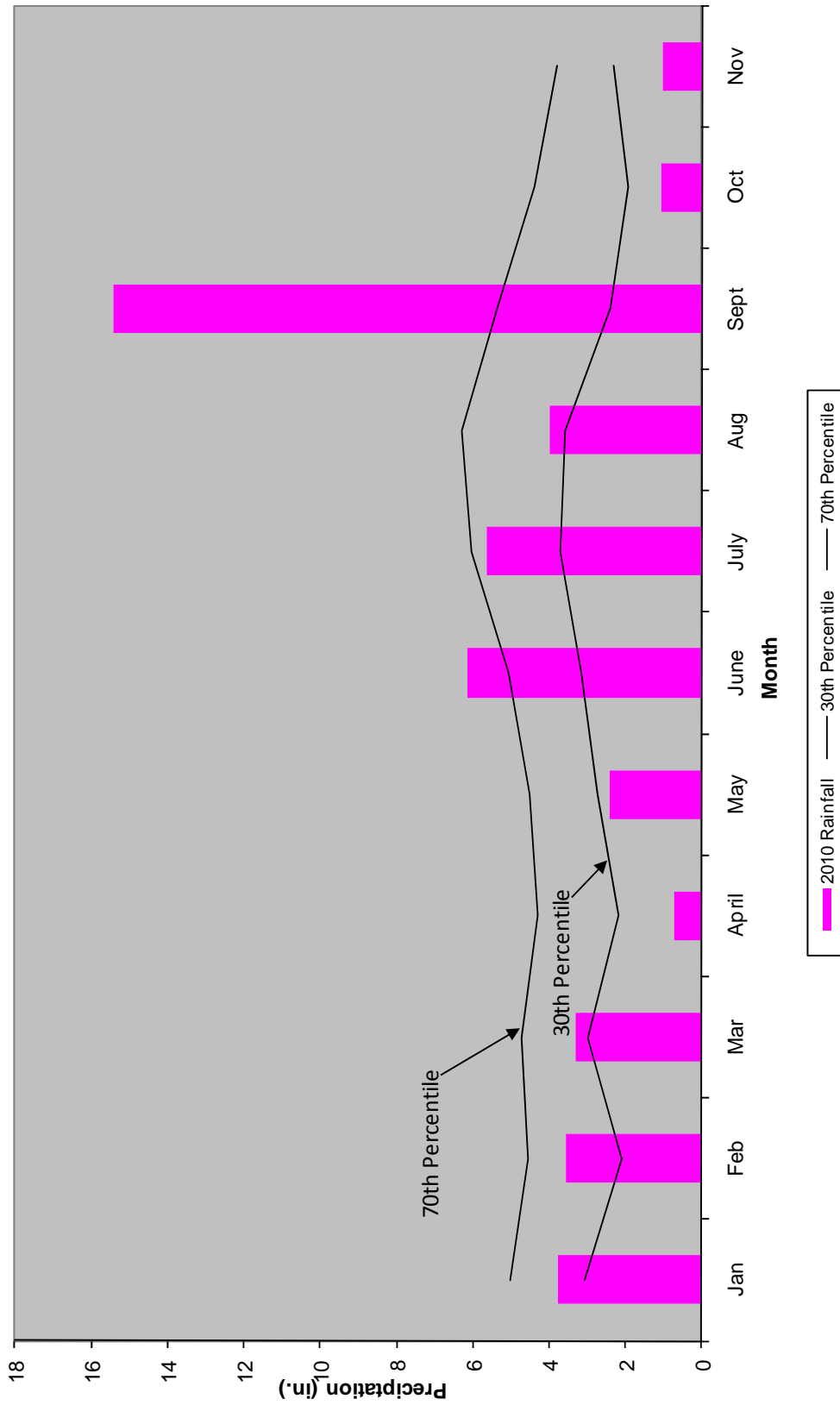


Table 10 - Summary of Groundwater Results for Years 1 - 5					
Whitlace Creek Stream Enhancement and Wetland Restoration Project / EEP Project No. 420					
Guage	Success Criteria Achieved/Max Consecutive Days During Growing Season				
	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)
GW1	Yes/234 days (100%)	Yes/73 days (31 %)	Yes/216 days (92 %)	Yes/234 days (100%)	Yes/234 days (100%)
GW2	Yes/140 days (60%)	No	Yes/128 days (55 %)	Yes/182 days (78%)	Yes/100 days (43%)
GW3	Yes/234 days (100%)	Yes/137 days (59 %)	Yes/168 days (72 %)	Yes/234 days (100%)	Yes/153 days (65%)
GW4	Yes/119 days (51 %)	No	Yes/70 days (30 %)	Yes/230 days (98%)	Yes/ 223 days (95%)
GW5	Yes/234 days (100%)	Yes/109 days (47 %)	Yes/149 days (64 %)	Yes/190 days (81%)	Yes/112 days (48%)
GW6	Yes/234 days (100%)	Yes/233 days (99 %)	Yes/180 days (77 %)	Yes/234 days (100%)	Yes/153 days (65%)
GW7	Yes/234 days (100%)	Yes/234 days (100 %)	Yes/173 days (74 %)	Yes/234 days (100%)	Yes/90 days (38%)
Reference Well 1	Yes/70 days (30 %)	Yes/80 days (34%)	Unknown	Yes/39 days (17%)	Yes/44 days (19%)
Reference Well 2	Yes/70 days (30 %)	Yes/132 days (56 %)	Unknown	Yes/45 days (19%)	Yes/126 days (54%)
Reference Well 3	Yes/70 days (30%)	Yes/159 days (68 %)	Yes/112 days (48 %)	Yes/125 days (53%)	Yes/124 days (53%)