Little River
Stream and Wetland Enhancement Project

SCO No. 070715501
DENR Contract No. D08049S
EEP Project No. 226
Moore County, North Carolina

Year 3 of 5 Monitoring Report
Data Collection: January through December 2013
Submission Date: January 15, 2014

Prepared for:

Ecosystem Enhancement PROGRAM

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
217 West Jones Street, 3rd Floor, Suite 3000A; Raleigh, NC 27603

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Prepared by:

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3805 Wrightsville Avenue; Suite 15
Wilmington, NC 28403
(910) 452-0001

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3.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Little River Stream and Wetland Enhancement Site is located on a 125-acre conservation easement along Little River near Vass, NC (Moore County) within the Cape Fear River Basin #03030004 Cataloging Unit (Figure 1). It is located within a larger tract owned by J.J. Barnes and his family. The larger tract is actively managed for wildlife habitat to facilitate hunting on the overall tract. Prior to mitigation activities, the project site was a jurisdictional wetland with planted loblolly pine. The pine plantation was planted in the early 2000s as part of the CREP program. The stream and wetland enhancement project is funded by the North Carolina Ecosystem Enhancement Program (EEP).

The overall goal for the Little River Stream and Wetland Enhancement Site is to preserve and enhance a natural bottomland hardwood forest which exhibits desired functions appropriate to the existing geomorphic setting of the site.

Specific goals include:

1) Preservation of wildlife habitat; and
2) Natural community enhancement.

The project objectives include:

1) Partial removal of undesired vegetation via burning to promote desired species growth; and
2) Planting of the project site with specific native species to enhance natural habitat.

To accomplish these goals, the site was burned in December of 2010 and planted in January of 2011. The baseline field monitoring was performed by Stantec in February of 2011. Land Management Group, Inc. (LMG) performed Year One vegetation monitoring in October of 2011 and Year Two vegetation monitoring in September of 2012.

Stream enhancement II and preservation are both components of this project (Table 1). Three stream channels traverse the project site. Small portions of the channels have been altered in the past but currently appear stable. The project includes 3,593 linear feet of stream enhancement II on two tributaries to the Little River (Reach 1 & Reach 2) and 210 linear feet of stream preservation of one associated tributary (Reach 3).

Wetlands within the conservation easement boundary were enhanced or preserved. Approximately 39 acres of wetlands in the bottomland hardwood forest adjacent to the Little River channel and approximately nine acres of successional wetlands located in the northwest portion of the project site have been preserved. The wetlands within the approximately 48-acre loblolly pine plantation area and 7-acre grassy field area have been enhanced through the planting of native hardwood trees (See Table 1 for Project Components and Figure 2 for Component Location).

Vegetation monitoring is conducted on an annual basis using sixteen (16) permanent vegetation plots (Figure 2). The vegetation success criterion for the pine plantation area is the survival of 150 planted woody stems per acre at the end of the five-year monitoring period. The success criterion for the grassy field area is the survival of 260 planted woody stems per acre at the end of the five-year monitoring period. Monitoring Year 3 (MY3 2013) observed a mean stem density of 275 planted stems per acre in the plots. The plots located within pine plantation area (Plots 4-16) had an average of 264 planted stems per acre. The plots located in the grassy field area (Plots 1-3) had an average of 337 planted stems per acre. When volunteer stems and mature pines were included, the site had an overall mean stem density of 3,533 stems per acre. The stem density decreased to 3,265 stems per acre when mature pine trees were not counted. The plots located within pine plantation area had an average of 3,825 planted and volunteer stems per acre (3,536 stems per acre without mature pines). The plots located in the grassy field area had an average of 2,482 planted and volunteer stems per acre (2,297 stems per acre without mature pines). Please note that during MY2 2012 monitoring, three plots (#2, 12, and 13) did not meet the vegetation success criterion. However, during MY3 2013 monitoring, two additional stems that appeared to have been planted (old flagging was present) were discovered in Plot #13, which raised the mean stem density above the minimum success criterion. Therefore, only Plots #2 and #12 did not meet the vegetation success criterion in MY3 2013.

The project consisted of the enhancement and preservation of existing wetlands and streams within the site. Prior to mitigation, wetlands were determined and confirmed by a jurisdictional determination. Therefore, there is no hydrological success criterion. However, five continuous groundwater monitoring gauges were installed on the site in order to monitor and confirm hydrology. Four of the gauges are located in wetlands of the pine plantation and a fifth is a reference gauge located in a preserved wetland area on the west side of the project. During the growing season of MY3 (2013), the groundwater monitoring gauges located within the enhancement site demonstrated a water level within 12” of the soil surface for between 10% and 63% of the growing season. Rainfall was above average for part of this time (June of 2013).

- Gauge #1: 18% (42 days)
- Gauge #2: 10% (24 days)
- Gauge #3: 63% (139 days)
- Gauge #4: 60% (138 days)
- Reference Gauge: 63% (139 days)

Streams are visually assessed each year to monitor for stability. One crest gauge was installed on-site and is located adjacent to Vegetation Plot 7. Streams were stable during the MY3 monitoring assessment. The crest gauge was evaluated several times throughout 2013. During these visits, water was noted within the channel. Water staining was observed on the crest gauge on several occasions, indicating overbank flooding.

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 are available from EEP upon request.

4.0 METHODOLOGY

Vegetation

Sixteen (16) permanent vegetation plots are used for annual vegetation monitoring (Figure 2). All vegetation monitoring was completed in September 2013 utilizing the Carolina Vegetation Survey (CVS) – EEP protocol Level 2 (version 4.2).

Hydrology

A crest gauge was installed within a stream to monitor flow and is assessed through visual evaluation. Five groundwater monitoring gauges were installed on site (4 within the enhancement area and 1 within the reference area). All groundwater monitoring gauges were downloaded quarterly utilizing Remote Data System, Inc. data loggers and software. Data from the groundwater monitoring gauges are not used toward success criteria of the wetland.

Photo documentation was performed at prescribed locations across the site. A digital camera was used to take photos at each predetermined photo point location (Figure 2).

5.0 References

NCEEP. 2013. Little River Stream and Wetland Enhancement Year 2 of 5 Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. March, 2013.

NCEEP. 2012. Little River Stream and Wetland Enhancement Year 1 of 5 Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. March, 2012.

NCEEP. 2011. Little River Stream and Wetland Enhancement As-Built & Baseline Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. December, 2011.

NCEEP. 2010. Procedural Guidance and Content Requirements for EEP Monitoring Reports. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 1.3 January 15, 2010.

NCEEP. 2008. CVS-EEP Vegetation Sampling Protocol. North Carolina Department of

Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 4.2, 2008.

NCEEP. 2007. Little River Wetland Enhancement Restoration Plan. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. September 28, 2007.

US Army Corps Of Engineers. 1987. U.S. Army Corps. of Engineers. Tech Report Y-87-1, 1987 Wetland Delineation Manual, Washington, DC. AD/A176.

US Army Corps Of Engineers. 2005. U.S. Army Corps. of Engineers. Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina, Wilmington Regulatory Field Office.

6.0 Project Condition and Monitoring Data Appendices

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Appendix A.
Project Vicinity Map and Background Tables

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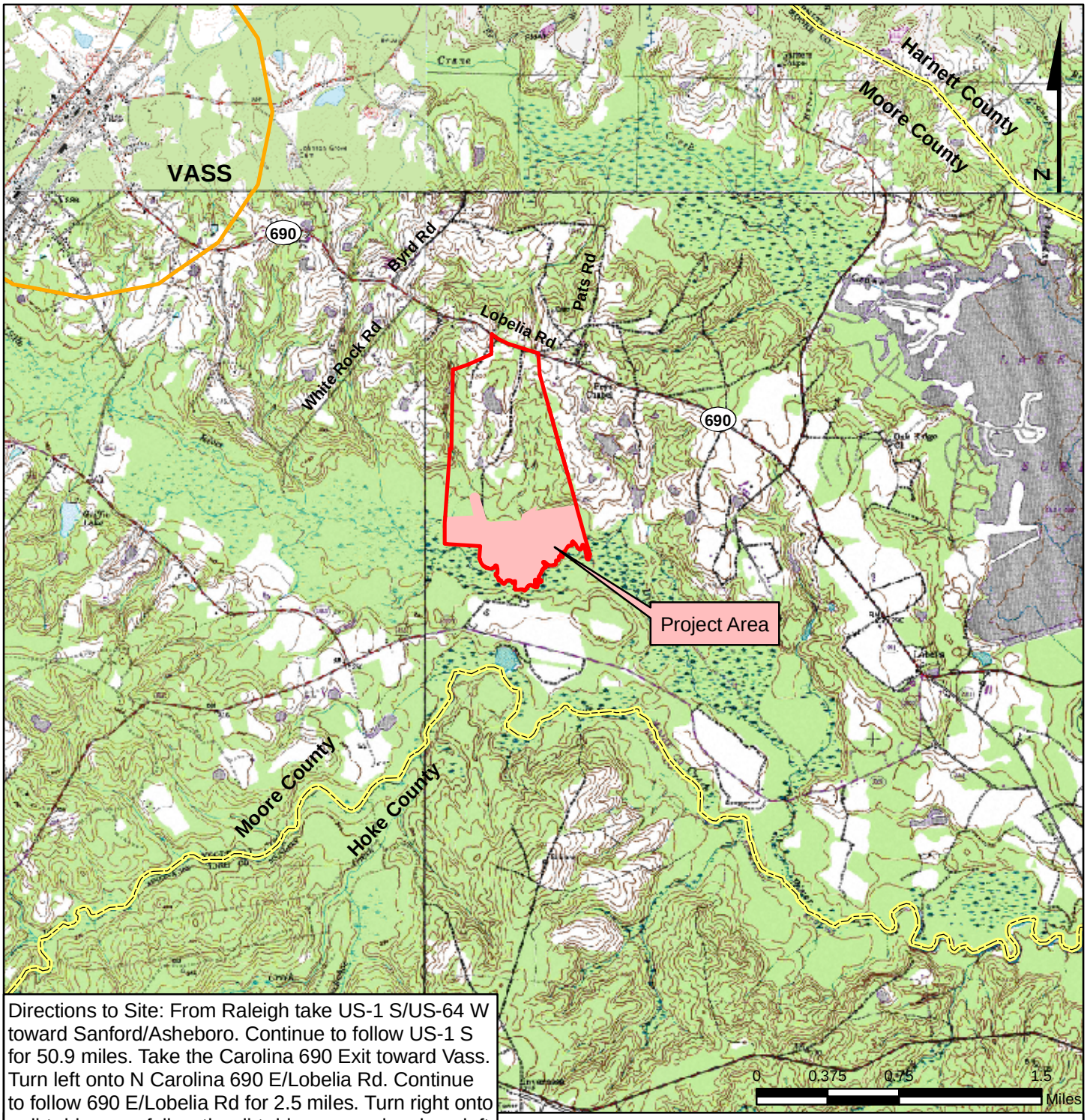

Directions to Site: From Raleigh take US-1 S/US-64 W toward Sanford/Asheboro. Continue to follow US-1 S for 50.9 miles. Take the Carolina 690 Exit toward Vass. Turn left onto N Carolina 690 E/Lobelia Rd. Continue to follow 690 E/Lobelia Rd for 2.5 miles. Turn right onto a dirt driveway, follow the dirt driveway and make a left at the fork. Continue down the dirt road to the NW corner of the site.

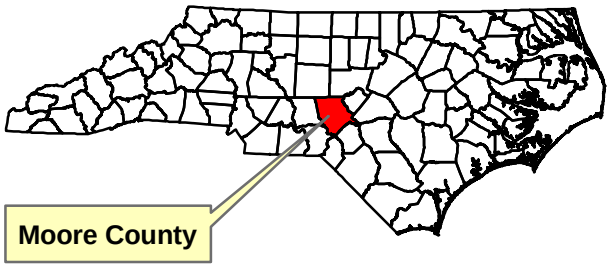

Figure 1. Vicinity Map

Little River Stream and Wetland Enhancement
EEP Project #226
Moore County, NC

7.5' USGS Topoquad Lobelia

Project boundary

J-Bar Ranch parcel boundary

Municipal boundary

Ecosystem Enhancement Program

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Table 1. Project Components and Mitigation Credits

Little River Stream and Wetland Enhancement Project/EEP Project No. 226

Mitigation Credits

	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	1437	21		27.5					

Project Components

Project Component or Reach ID	Stationing/Location	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio	Comment
Reach 1	Flows NW to SE across the middle of site	1,726	E	R	1,726	2.5:1	Enhancement - planting occurred in the riparian area of both banks
Reach 2	Flows NW to SE across the middle of site	1,867	E	R	1,867	2.5:1	Enhancement - planting occurred in the riparian area of both banks
Reach 3	Enters the site on middle N boundary, tributary of Reach 2	210	P	RE	210	10:1	Preservation - area is protected by a conservation easement with signage around the boundary
Wetland 1	Pine Plantation	47.8	E	RE	47.8	2.5:1	Enhancement - weedy vegetation was suppressed with fire and area was planted
Wetland 2	Grassy Field	7.0	E	RE	7.0	2:1	Enhancement - EI as a result of no trees present in this area. Area was burned and planted
Wetland 3	S boundary of site	39.4	P	RE	39.4	5:1	Preservation - area is protected by a conservation easement with signage around the boundary
Wetland 4	Successional Wetlands- NW portion of the site	9.3	P	RE	9.3	10:1	Preservation - area is protected by a conservation easement with signage around the boundary

Component Summation

Restoration Level	Stream (lf)	Riparian Wetland (ac)		Non-Riparian Wetland (ac)		Buffer (sq ft)	Upland (ac)
		Riverine	Non-Riverine				
Restoration							
Enhancement		54.8					
Enhancement I							
Enhancement II	3,593						
Creation							
Preservation	210	48.7					
HQ Preservation							

BMP Elements

Element	Location	Purpose/Function	Notes
n/a	n/a	n/a	n/a

Table 2. Project Activity and Reporting History Little River Stream and Wetland Enhancement Project -EEP Project No. 226		
Elapsed Time Since Grading Complete: n/a		
Elapsed Time Since Planting Complete: 36 months		
Number of Reporting Years[1]: 3		
Activity or Deliverable	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan	Sep-07	Oct-07
Final Design – Construction Plans	n/a	n/a
Construction	n/a	n/a
Seeding	n/a	n/a
Prescribed Burn	n/a	Dec-10
Planting	n/a	Jan-11
As-built (Year 0 Monitoring -baseline)	Feb-11	Dec-11
Year 1 Monitoring	Dec-11	Feb-12
Year 2 Monitoring	Dec-12	Jan-13
Year 3 Monitoring	Dec-13	Jan-14
Year 4 Monitoring	n/a	n/a
Year 5 Monitoring	n/a	n/a

1 = number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table Little River Stream and Wetland Enhancement Project -EEP Project No. 226	
Designer	Stantec Consulting Services, Inc. 801 Jones Franklin Road Suite 300; Raleigh, NC 27606
Primary project design POC	Amber Coleman (919) 865-7399
Construction Contractor	None
Planting Contractor	Carolina Silvics, Inc. 908 Indian Trail Road; Edenton, NC 27932
Planting Contractor POC	Mary-Margaret McKinney (252) 482-8491
Seeding Contractor	None
Seed Mix Sources	None
Nursery Stock Suppliers	ArborGen and Superior Trees
	Arborgen - 180 Westvaco road; Summerville, SC 29483
	Superior Trees - 12493 E US Highway; Lee, FL 32059
Monitoring Performers (MY0)	Stantec Consulting Services, Inc. 801 Jones Franklin Road Suite 300; Raleigh, NC 27606
Stream Monitoring POC	Amber Coleman (919) 865-7399
Vegetation Monitoring POC	Amber Coleman (919) 865-7399
Wetland Monitoring POC	Amber Coleman (919) 865-7399
Monitoring Performers (MY1 - MY3)	Land Management Group, Inc. 3805 Wrightsville Avenue, Suite 15; Wilmington, NC 28403
Stream Monitoring POC	Kim Williams (910) 452-0001
Vegetation Monitoring POC	Kim Williams (910) 452-0001
Wetland Monitoring POC	Kim Williams (910) 452-0001

Table 4. Project Baseline Information and Attributes				
Little River Stream and Wetland Enhancement Project -EEP Project No. 226				
Project Information				
Project Name	Little River Stream and Wetland Enhancement Project			
Project County	Moore			
Project Area (ac)	125.8			
Project Coordinates (Lat and Long)	35.223562, -79.240977			
Project Watershed Summary Information				
Physiographic Region	Sandhills			
River Basin	Cape Fear			
USGS HUC for Project (14 digit)	03030004070050			
NCDWQ Subbasin	03-03-14			
Project Drainage Area (sq mi)	0.52			
Project Drainage impervious cover estimate (%)	< 1%			
CGIA Land Use Classification	Active Forest Management and Harvesting; Unused			
Reach Summary Information				
Parameters	**Reach 1**	**Reach 2**	**Reach 3**	
Length of Reach (linear feet)	1,726	1,867	210	
Valley Classification	VIII			
Drainage Area (ac)	335			
NCDWQ Stream Identification Score	30	28	28	
NCDWQ Water Quality Classification	Perennial			
Morphological Description (stream type)	C5	E5	E5	
Evolutionary Trend	C5	C5	C5	
Underlying Mapped Soils	Bibb			
Drainage Class	Poorly Drained			
Soil Hydric Status	Yes			
Slope	0-1%			
FEMA Classification	Zone X			
Native Vegetation Community	Riverine bottomland hardwood			
Percent Composition Exotic Invasive Vegetation	0%	0%	0%	
Wetland Summary Information				
Parameter	**Wetland 1**	**Wetland 2**	**Wetland 3**	
Size (ac)	47.8	7	48.7	
Wetland Type	Riparian Riverine			
Mapped Soils Series	Bibb			
Drainage Class	Poorly Drained			
Soil Hydric Status	Hydric			
Source of Hydrology	Overbank flooding and groundwater			
Hydrologic Impairment	None			
Native Vegetation Community	Riverine bottomland hardwood			
Percent of Exotic/Invasive Vegetation	0%	0%	0%	
Regulatory Considerations				
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**	
Waters of the United States - Section 404	Yes	Yes	USACE 404 Permit	
Waters of the United States - Section 401	Yes	Yes	NCDWQ 401 Permit	
Endangered Species Act	No	n/a	n/a	
Historic Preservation Act	No	n/a	n/a	
Coastal Zone Management Act (CZMA) Coastal Area Management Act (CAMA)	No	n/a	n/a	
FEMA Floodplain Compliance	No	n/a	n/a	
Essential Fisheries Habitat	No	n/a	n/a	

Appendix B.
Visual Assessment Data

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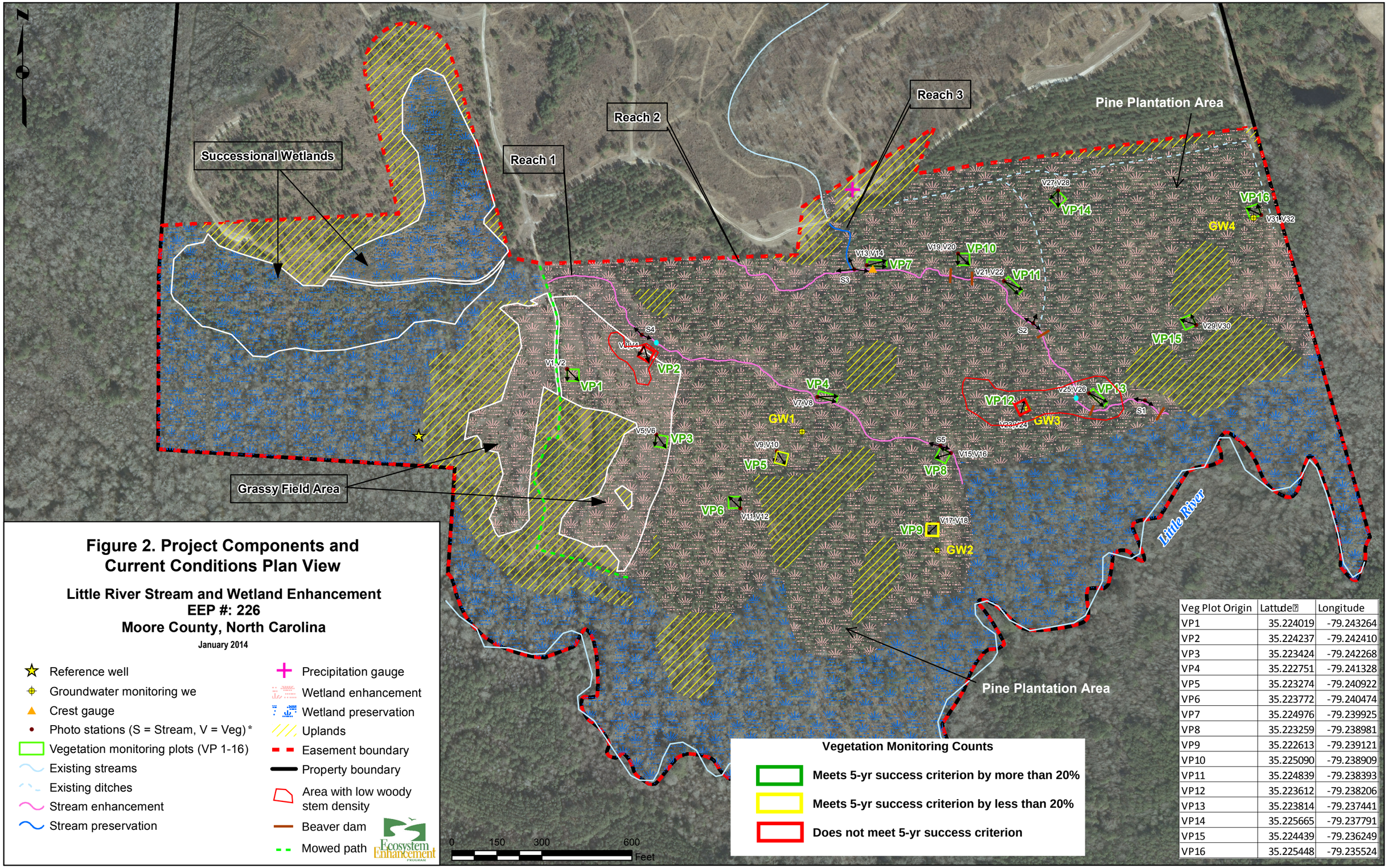

Figure 2. Project Components and Current Conditions Plan View

Little River Stream and Wetland Enhancement
EEP #: 226
Moore County, North Carolina

January 2014

- Reference well
- Groundwater monitoring we
- Crest gauge
- Photo stations (S = Stream, V = Veg) *
- Vegetation monitoring plots (VP 1-16)
- Existing streams
- Existing ditches
- Stream enhancement
- Stream preservation
- Precipitation gauge
- Wetland enhancement
- Wetland preservation
- Uplands
- Easement boundary
- Property boundary
- Area with low woody stem density
- Beaver dam
- Mowed path

Ecosystem Enhancement Program

Vegetation Monitoring Counts

- Meets 5-yr success criterion by more than 20%
- Meets 5-yr success criterion by less than 20%
- Does not meet 5-yr success criterion

Veg Plot Origin	Lattude	Longitude
VP1	35.224019	-79.243264
VP2	35.224237	-79.242410
VP3	35.223424	-79.242268
VP4	35.222751	-79.241328
VP5	35.223274	-79.240922
VP6	35.223772	-79.240474
VP7	35.224976	-79.239925
VP8	35.223259	-79.238981
VP9	35.222613	-79.239121
VP10	35.225090	-79.238909
VP11	35.224839	-79.238393
VP12	35.223612	-79.238206
VP13	35.223814	-79.237441
VP14	35.225665	-79.237791
VP15	35.224439	-79.236249
VP16	35.225448	-79.235524

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Table 5. Vegetation Condition Assessment Table

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material	N/A	N/A	N/A	N/A	N/A
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria	As in MY2 (2012), areas near Plot 2, 12 and 13 had stem densities lower than the five-year monitoring success criterion. However, Plot 2 did not meet criterion at baseline and this area was probably under-planted. Additionally, some ponding was observed near Plots 12 and 13 (may be from beaver dams along Reach 2).	Red Outline on Figure 2	2	1.5 ac	2.7%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year	N/A	N/A	N/A	N/A	N/A

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Stream Photo Station 1: looking upstream (northwest) (Dec. 17, 2013)

Stream Photo Station 1: looking downstream (southeast) (Dec. 17, 2013)

Stream Photo Station 2: looking upstream (northwest) (Dec. 17, 2013)

Stream Photo Station 2: looking northeast (Dec. 17, 2013)

Stream Photo Station 2: looking downstream (southeast) (Dec. 17, 2013)

Stream Photo Station 3: looking upstream along Reach 2 (west) (Dec. 17, 2013)

Stream Photo Station 3: looking upstream at Reach 3 (north) (Dec. 17, 2013)

Stream Photo Station 3: looking downstream along Reach 2 (east) (Dec. 17, 2013)

Stream Photo Station 4: looking upstream along Reach 1 (northwest) (Dec. 17, 2013)

Stream Photo Station 4: looking downstream along Reach 1 (southeast) (Dec. 17, 2013)

Stream Photo Station 5: looking upstream along Reach 1 (northwest) (Dec. 17, 2013)

Stream Photo Station 5: looking downstream along Reach 1 (southeast) (Dec. 17, 2013)

Vegetation Plot Photos (all photos recorded on September 17 & 18, 2013)

Photo Station V1 - Veg Plot 1 looking along X-axis (Sept 17, 2013)

Photo Station V2 - Veg Plot 1 looking across (Sept 17, 2013)

Photo Station V3 - Veg Plot 2 looking along X-axis (Sept 17, 2013)

Photo Station V4 - Veg Plot 2 looking across (Sept 17, 2013)

Photo Station V5 - Veg Plot 3 looking along X-axis (Sept 17, 2013)

Photo Station V6 - Veg Plot 3 looking across (Sept 17, 2013)

Photo Station V7 - Veg Plot 4 looking along X-axis (Sept 17, 2013)

Photo Station V8 - Veg Plot 4 looking across (Sept 17, 2013)

Photo Station V9 - Veg Plot 5 looking along X-axis (Sept 17, 2013)

Photo Station V10 - Veg Plot 5 looking across (Sept 17, 2013)

Photo Station V11 - Veg Plot 6 looking along X-axis (Sept 17, 2013)

Photo Station V12 - Veg Plot 6 looking across (Sept 17, 2013)

Photo Station V13 - Veg Plot 7 looking along X-axis (Sept 17, 2013)

Photo Station V14 - Veg Plot 7 looking across (Sept 17, 2013)

Photo Station V15 - Veg Plot 8 looking along X-axis (Sept 18, 2013)

Photo Station V16 - Veg Plot 8 looking across (Sept 18, 2013)

Photo Station V17 - Veg Plot 9 looking along X-axis (Sept 18, 2013)

Photo Station V18 - Veg Plot 9 looking across (Sept 18, 2013)

Photo Station V19 - Veg Plot 10 looking along X-axis (Sept 17, 2013)

Photo Station V20 - Veg Plot 10 looking across (Sept 17, 2013)

Photo Station V21 - Veg Plot 11 looking along X-axis (Sept 17, 2013)

Photo Station V22 - Veg Plot 11 looking across (Sept 17, 2013)

Photo Station V23 - Veg Plot 12 looking along X-axis (Sept 18, 2013)

Photo Station V24 - Veg Plot 12 looking across (Sept 18, 2013)

Photo Station V25 - Veg Plot 13 looking along X-axis (Sept 18, 2013)

Photo Station V26 - Veg Plot 13 looking across (Sept 18, 2013)

Photo Station V27 - Veg Plot 14 looking along X-axis (Sept 17, 2013)

Photo Station V28 - Veg Plot 14 looking across (Sept 17, 2013)

Photo Station V29 - Veg Plot 15 looking along X-axis (Sept 18, 2013)

Photo Station V30 - Veg Plot 15 looking across (Sept 18, 2013)

Photo Station V31 - Veg Plot 16 looking along X-axis (Sept 18, 2013)

Photo Station V32 - Veg Plot 16 looking across (Sept 18, 2013)

Appendix C.
Vegetation Plot Data

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Table 6. Vegetation Plot Criteria Attainment Little River Stream and Wetland Enhancement Project EEP		
Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
VP1	Y	88%
VP2	N	
VP3	Y	
VP4	Y	
VP5	Y	
VP6	Y	
VP7	Y	
VP8	Y	
VP9	Y	
VP10	Y	
VP11	Y	
VP12	N	
VP13	N	
VP14	Y	
VP15	Y	
VP16	Y	

Table 7. CVS Vegetation Plot Metadata Little River Stream and Wetland Enhancement Project EEP No. 226	
Report Prepared By	Kim Williams
Date Prepared	1/15/2014 13:30
Database Name	LittleRiver_226 _MY3_2013.mdb
Database Location	L:\Wetlands\2008\LittleRiver\Annual Monitoring Report\Year 3
Computer Name	KWILLIAMS
Description Worksheets in This Document	
Metadata	Description of database file, the report worksheets, and a summary of project and project data.
Proj Planted	Each project is listed with its PLANTED stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
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.
Project Summary	
Project Code	226
Project Name	Little River
Description	Stream and Wetland Enhancement
River Basin	Cape Fear
Length (ft)	
Stream-to-Edge Width (ft)	
Area (sq m)	
Required Plots (calculated)	16

Table 8. Planted and total stem counts (species by plot with annual means)

			Current Plot Data (MY3 2013)																																				
			E226-LMG-0001			E226-LMG-0002			E226-LMG-0003			E226-LMG-0004			E226-LMG-0005			E226-LMG-0006			E226-LMG-0007			E226-LMG-0008			E226-LMG-0009			E226-LMG-0010			E226-LMG-0011							
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T					
Acer rubrum	red maple	Tree			6			11			2			7			23			32						22			30			10			12					
Aronia arbutifolia	Red Chokeberry	Shrub																								15													
Clethra alnifolia	sweet pepperbush	Shrub																											30			20							
Cyrilla racemiflora	swamp titi	Shrub			14			33						40			11			4			18			7						12			9				
Diospyros virginiana	common persimmon	Tree																											1										
Fraxinus pennsylvanica	green ash	Tree	1	1	1				1	1	1	2	2	6	1	1	1	1	1	1	6	6	8	7	7	7					2	2	2	2	3				
Ilex glabra	inkberry	Shrub				1	1	1	2	2	2						5	1	1	1							2	2	102			2							
Ilex opaca	American holly	Shrub						1															7			1			1			7			2				
Itea virginica	Virginia sweetspire	Shrub																														5							
Juniperus virginiana	eastern redcedar	Tree																																	2				
Leucothoe axillaris	Dog hobble	Shrub																					7									10			8				
Ligustrum sinense	Chinese privet	shrub																																	8				
Lindera benzoin	northern spicebush	Shrub																																					
Liquidambar styraciflua	sweetgum	Tree			27			2			30												1			7			6						1				
Liriodendron tulipifera	tuliptree	Tree																																	2				
Lyonia lucida	fetterbush lyonia	Shrub																														2							
Magnolia virginiana	sweetbay	Shrub						1																		2						4			2				
Morella cerifera	wax myrtle	Shrub			4																																		
Nyssa sylvatica	blackgum	Tree	7	7	11	3	3	8	4	4	7				2	2	12	6	6	9				3	3	3							2	2	2				
Ostrya virginiana	hop hornbeam	Tree																								8													
Persea borbonia	red bay	Shrub																														5							
Pinus taeda	Loblolly pine	Tree			7			4			2			4			11			1			12			2			5			12			9				
Prunus serotina	black cherry	Shrub																																					
Quercus	oak	Tree	3	3	4																																		
Quercus laurifolia	laurel oak	Tree				1	1	3	2	2	2			5			3						2	2	2	7			1										
Quercus lyrata	overcup oak	Tree										5	5	5	1	1	1							2	2	2	2	2	2	5	5	6	2	2	3				
Quercus nigra	water oak	Tree																											6										
Quercus pagoda	cherry bark oak	Tree																																					
Rhus copallinum	flameleaf sumac	Shrub												2									37						15						10				
Symplocos tinctoria	horse sugar	Tree																																					
Stem count			11	11	74	5	5	64	9	9	46	7	7	69	4	4	67	8	8	48	6	6	92	14	14	83	4	4	199	7	7	97	6	6	73				
size (ares)			1			1			1			1			1			1			1			1			1			1			1						
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02						
Species count			3	3	8	3	3	9	4	4	7	2	2	7	3	3	8	3	3	6	1	1	8	4	4	12	2	2	11	2	2	13	3	3	14				
Stems per ACRE			445.2	445.2	2995	202.3	202.3	2590	364.2	364.2	1862	283.3	283.3	2792	161.9	161.9	2711	323.7	323.7	1942	242.8	242.8	3723	566.6	566.6	3359	161.9	161.9	8053	283.3	283.3	3925	242.8	242.8	2954				

Color for Density

Exceeds requirements by more than 20%
Exceeds requirements, but by less than 20%
Fails to meet requirements, but by less than 20%
Fails to meet requirements by more than 20%

Grassy Field Area 5-yr Success Criteria 260 stems/ac
Pine Plantation Area 5-yr Success Crite 150 stems/ac

Table 8 contd. Planted and total stem counts (species by plot with annual means)

Scientific Name	Common Name	Species Type	Current Plot Data (MY2 2013)															Annual Means			Annual Means		
			E226-LMG-0012			E226-LMG-0013			E226-LMG-0014			E226-LMG-0015			E226-LMG-0016			MY3 (2013)			MY0 (2010)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree			28			16			1			16			16			232			
Aronia arbutifolia	Red Chokeberry	Shrub									5				4	4	24	4	4	44	5	5	5
Clethra alnifolia	sweet pepperbush	Shrub			5						43						35			133			
Cyrilla racemiflora	swamp titi	Shrub			28	1	1	25			5			23			7	1	1	236	2	2	2
Diospyros virginiana	common persimmon	Tree																		1			
Fraxinus pennsylvanica	green ash	Tree							5	5	5	3	3	3	1	1	1	32	32	39	30	30	30
Ilex glabra	inkberry	Shrub	1	1	8						4			22			22	7	7	169	12	12	12
Ilex opaca	American holly	Shrub			1			1			1			2			3			27			
Itea virginica	Virginia sweetspire	Shrub																		5			
Juniperus virginiana	eastern redcedar	Tree																		2			
Leucothoe axillaris	Dog hobble	Shrub																		25			
Ligustrum sinense	Chinese privet	shrub																		8			
Lindera benzoin	northern spicebush	Shrub										1	1	1				1	1	1	6	6	6
Liquidambar styraciflua	sweetgum	Tree			8			3			8			10			11			114			
Liriodendron tulipifera	tuliptree	Tree									1									3			
Lyonia lucida	fetterbush lyonia	Shrub															8			10			
Magnolia virginiana	sweetbay	Shrub			4			1												14			
Morella cerifera	wax myrtle	Shrub																		4			
Nyssa sylvatica	blackgum	Tree	1	1	1							2	2	2				30	30	55	46	46	46
Ostrya virginiana	hop hornbeam	Tree			4															12			
Persea borbonia	red bay	Shrub																		5			
Pinus taeda	Loblolly pine	Tree			7			5			8			11			17			117			
Prunus serotina	black cherry	Shrub																		0			
Quercus	oak	Tree																3	3	4	4	4	4
Quercus laurifolia	laurel oak	Tree			3			14							3	3	3	8	8	43	7	7	7
Quercus lyrata	overcup oak	Tree				4	4	4	2	2	2	1	1	1				24	24	26	13	13	13
Quercus nigra	water oak	Tree																		6			
Quercus pagoda	cherry bark oak	Tree									1									1			
Rhus copallinum	flameleaf sumac	Shrub						2												66			
Symplocos tinctoria	horse sugar	Tree									11									11			
	Stem count		2	2	97	5	5	71	7	7	95	7	7	91	8	8	147	110	110	1413	125	125	125
	size (ares)		1			1			1			1			1			16			16		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.40			0.40		
	Species count		2	2	11	2	2	9	2	2	12	4	4	10	3	3	11	21	9	21	9	9	9
	Stems per ACRE		80.937	80.937	3925.5	202.34	202.34	2873.3	283.28	283.28	3844.5	283.28	283.28	3682.6	323.75	323.75	5948.9	275.0	275.0	3532.5	316.16	316.16	316.16

Grassy Field Area 5-yr Success Criterion: 260 stems/ac
Pine Plantation Area 5-yr Success Criterion: 150 stems/ac

Color for Density

Exceeds requirements by more than 20%
Exceeds requirements, but by less than 20%
Fails to meet requirements, but by less than 20%
Fails to meet requirements by more than 20%

Table 9. CVS - Damage by Plot
Little River Stream and Wetland Enhancement - EEP #226

	plot	Count of Damage Categories	(no damage)	Vine Strangulation	(other damage)
	E226-LMG-0001-year:3	0	11		
	E226-LMG-0002-year:3	0	6		
	E226-LMG-0003-year:3	0	11		
	E226-LMG-0004-year:3	0	7		
	E226-LMG-0005-year:3	0	5		
	E226-LMG-0006-year:3	2	8		2
	E226-LMG-0007-year:3	0	6		
	E226-LMG-0008-year:3	0	16		
	E226-LMG-0009-year:3	0	4		
	E226-LMG-0010-year:3	1	6	1	
	E226-LMG-0011-year:3	3	3	2	1
	E226-LMG-0012-year:3	1	1		1
	E226-LMG-0013-year:3	1	4		1
	E226-LMG-0014-year:3	0	7		
	E226-LMG-0015-year:3	0	8		
	E226-LMG-0016-year:3	0	8		
TOT:	**16**	**8**	**111**	**3**	**5**

Table 10. CVS - Planted Stems by Plot and Species
Little River Stream and Wetland Enhancement - EEP #226

	Comment	Species	SpType	CommonName	Total Planted Stems	# plots	avg# stems	plot E226-LMG-0001-year:3	plot E226-LMG-0002-year:3	plot E226-LMG-0003-year:3	plot E226-LMG-0004-year:3	plot E226-LMG-0005-year:3	plot E226-LMG-0006-year:3	plot E226-LMG-0007-year:3	plot E226-LMG-0008-year:3	plot E226-LMG-0009-year:3	plot E226-LMG-0010-year:3	plot E226-LMG-0011-year:3	plot E226-LMG-0012-year:3	plot E226-LMG-0013-year:3	plot E226-LMG-0014-year:3	plot E226-LMG-0015-year:3	plot E226-LMG-0016-year:3
		Aronia arbutifolia	Shrub	Red Chokeberry	4	1	4																4
		Cyrilla racemiflora	Shrub Tree	swamp titi	1	1	1												1				
		Fraxinus pennsylvanica	Tree	green ash	32	12	2.67	1		1	2	1	1	6	7		2	2			5	3	1
		Ilex glabra	Shrub	inkberry	7	5	1.4		1	2			1			2			1				
		Lindera benzoin	Shrub Tree	northern spicebush	1	1	1															1	
		Nyssa sylvatica	Tree	blackgum	30	9	3.33	7	3	4		2	6		3			2	1			2	
		Quercus	Shrub Tree	oak	3	1	3	3															
		Quercus laurifolia	Tree	laurel oak	8	4	2		1	2					2								3
		Quercus lyrata	Tree	overcup oak	24	9	2.67				5	1			2	2	5	2		4	2	1	
TOT:	**0**	**9**	**9**	**9**	**110**			**11**	**5**	**9**	**7**	**4**	**8**	**6**	**14**	**4**	**7**	**6**	**2**	**5**	**7**	**7**	**8**

Exceeds requirements, by more than 20%
Exceeds requirements, but by less than 20%
Fails to meet requirements, by less than 20%
Fails to meet requirements by more than 20%

Appendix D.
Hydrologic Data

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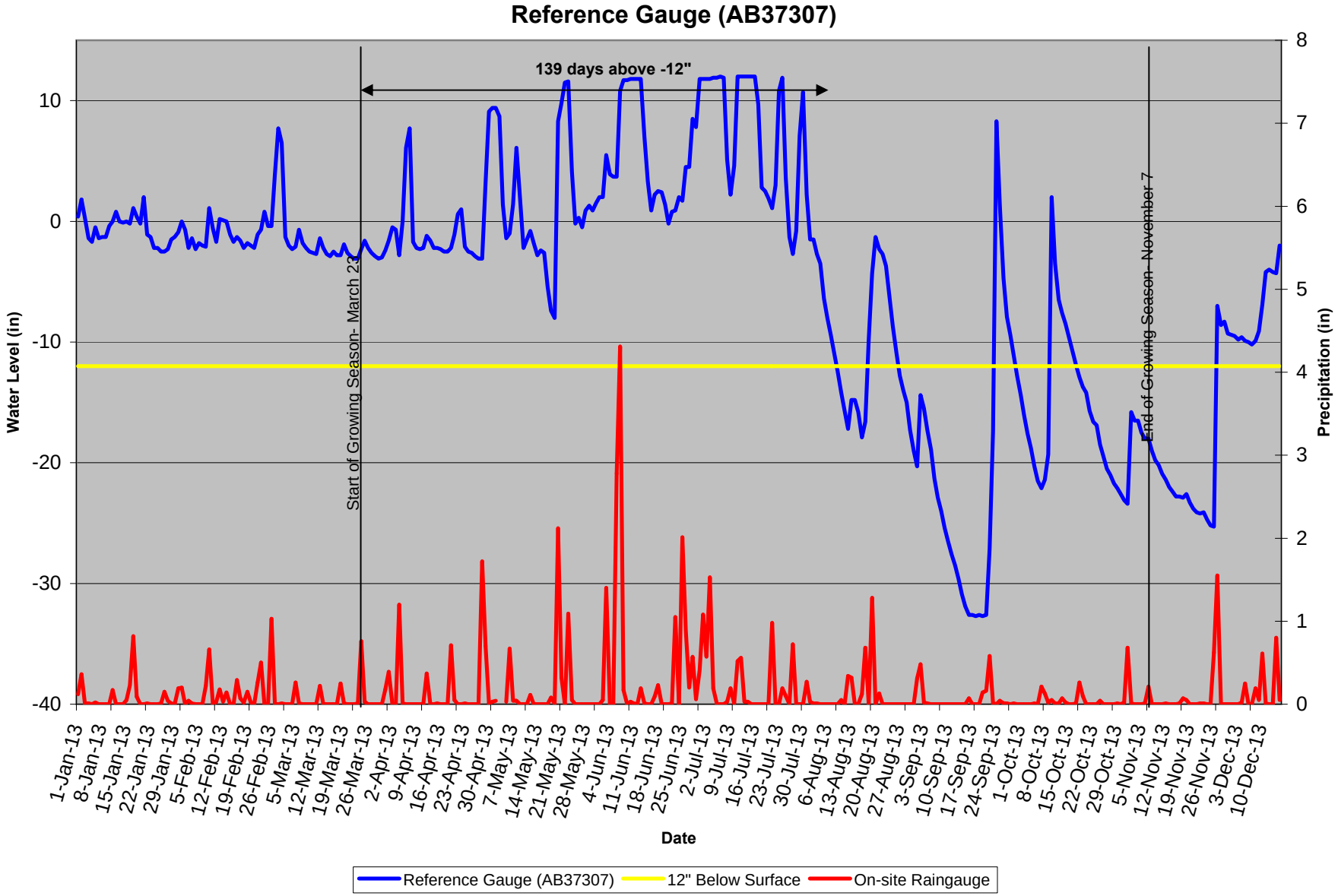
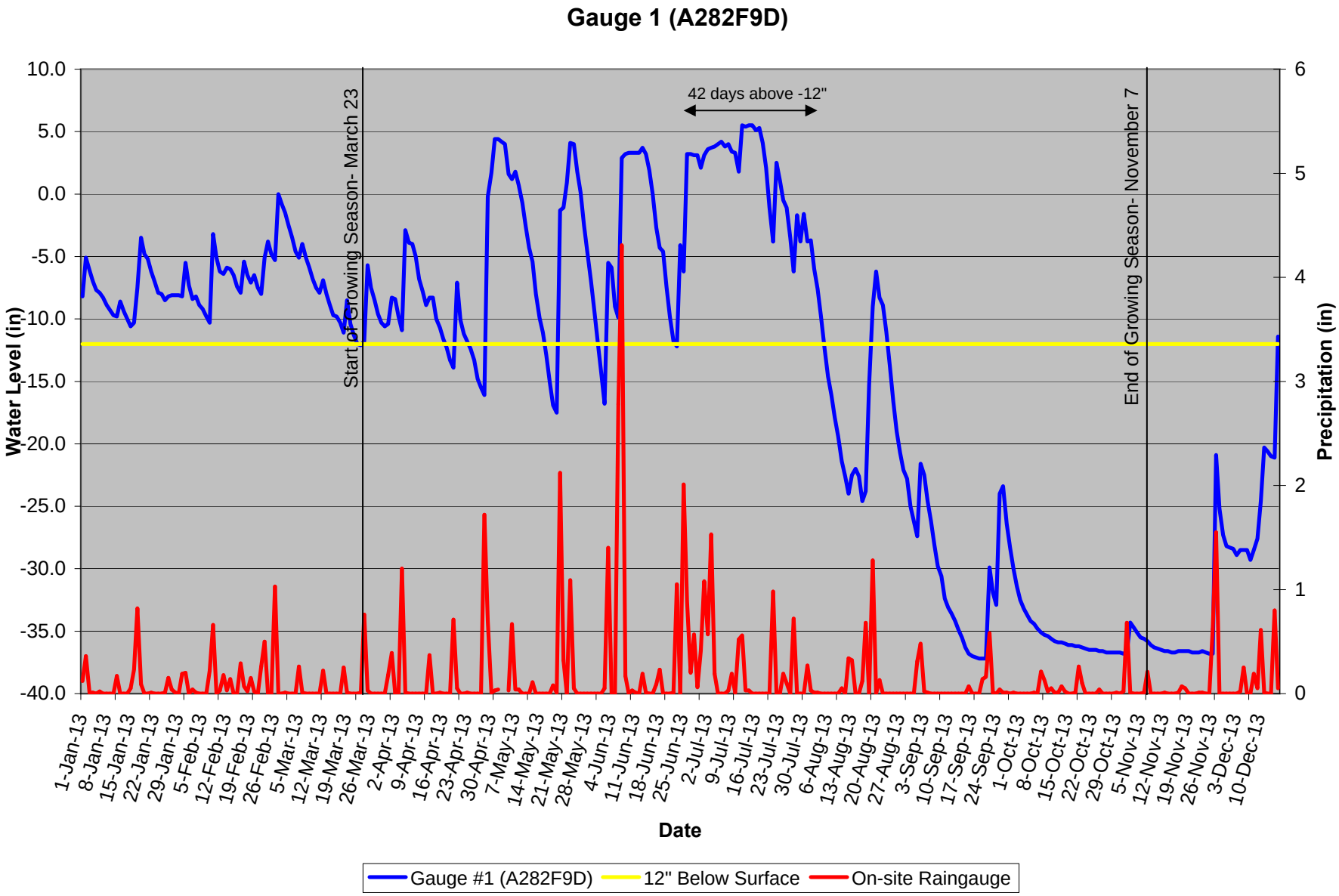
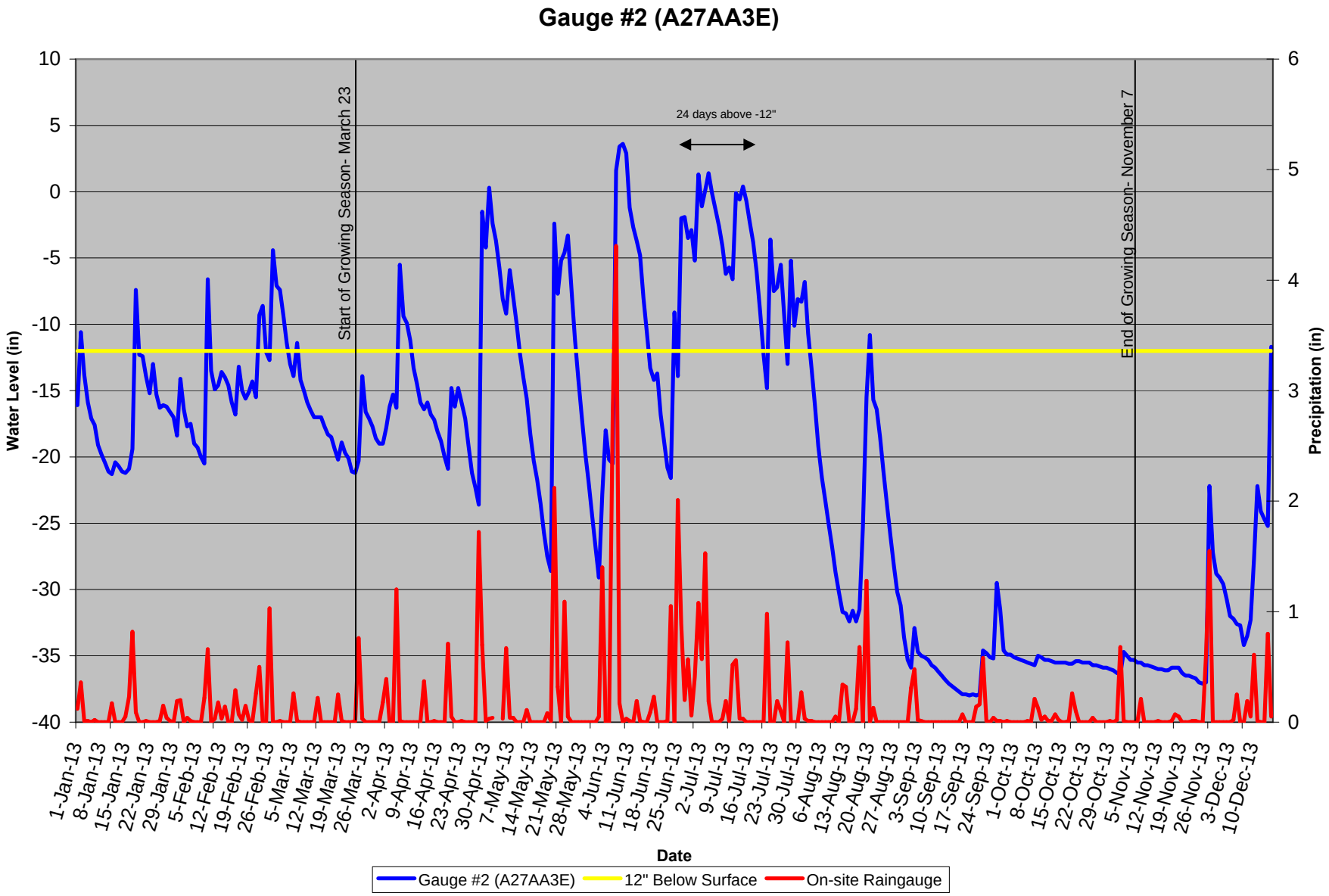
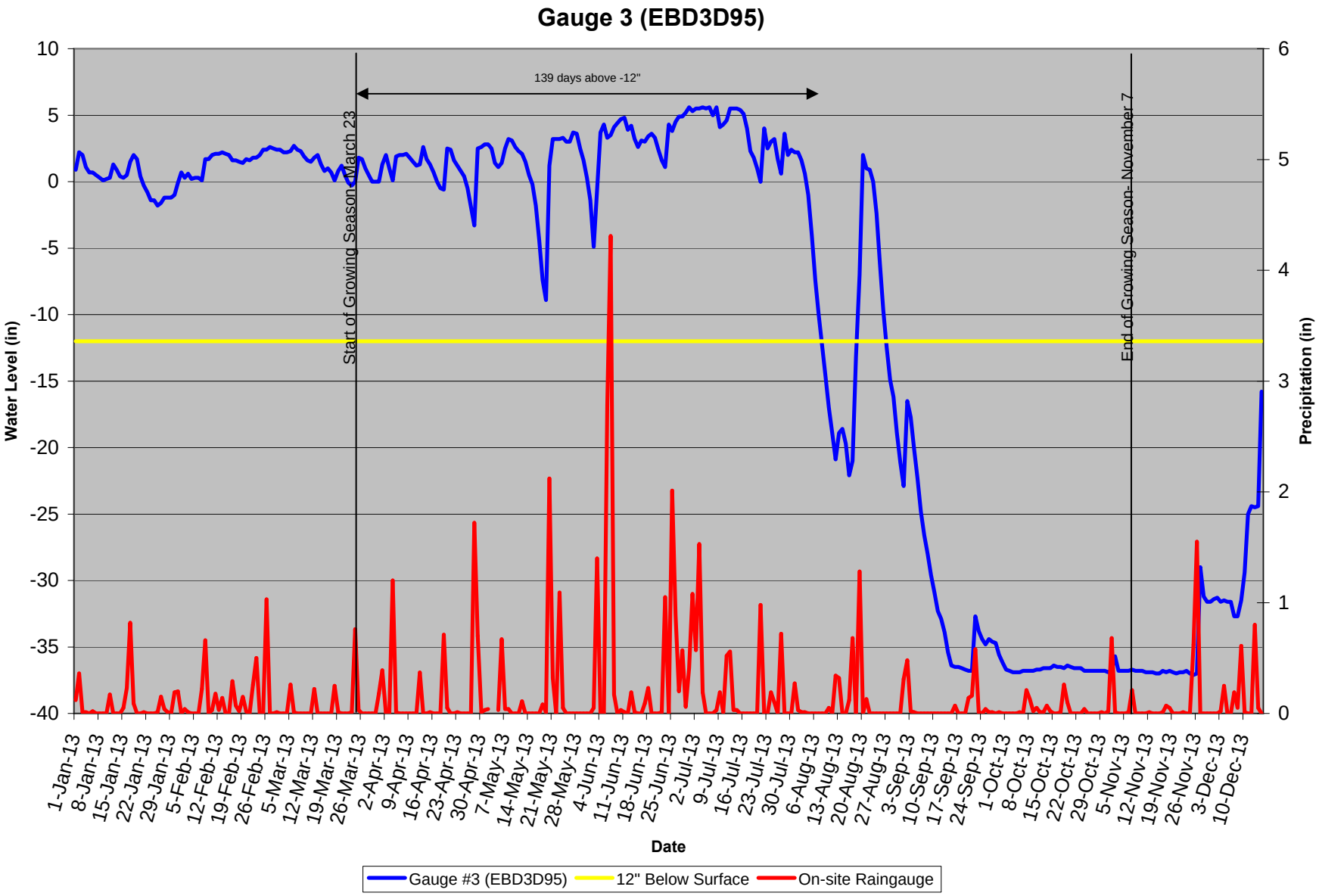
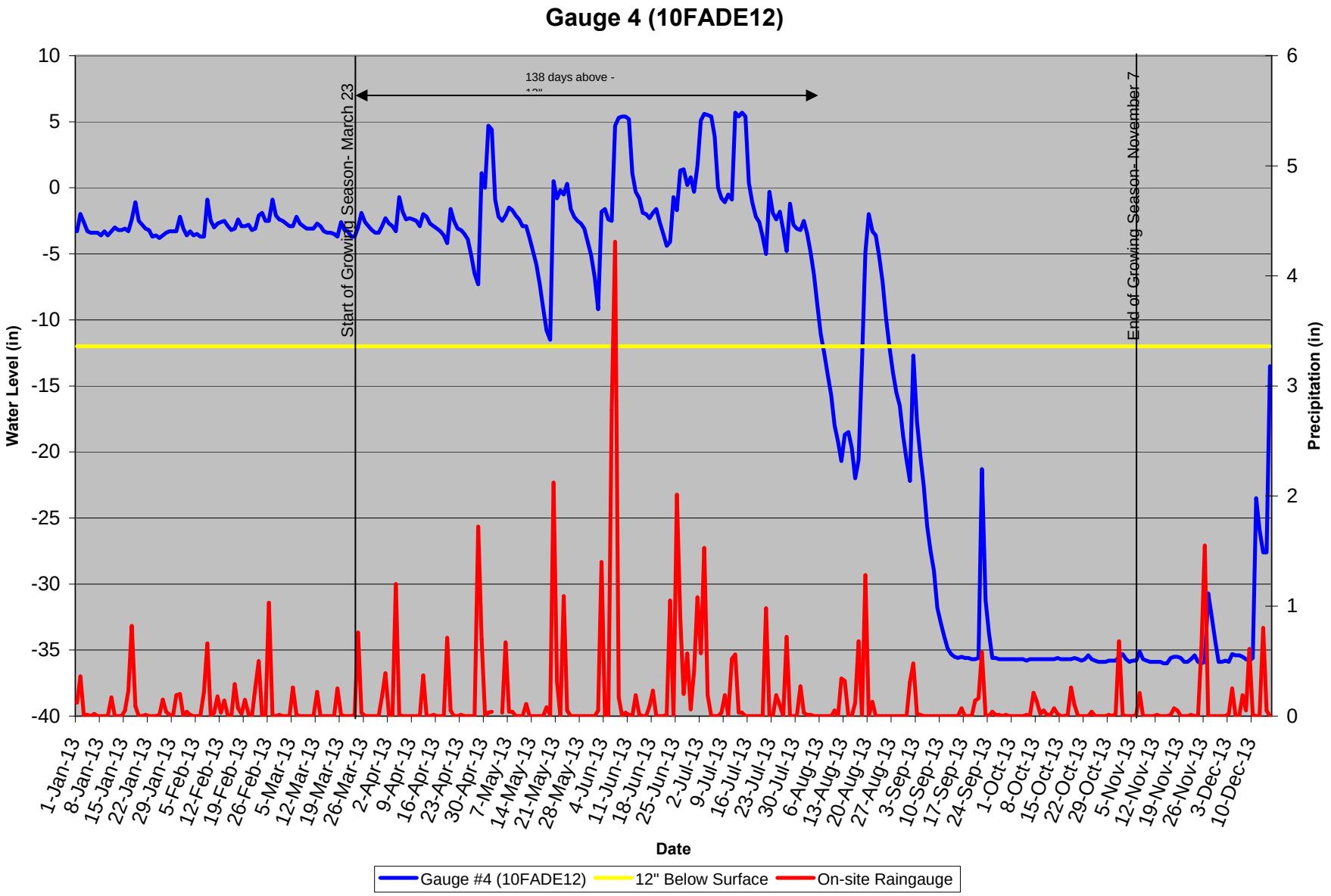
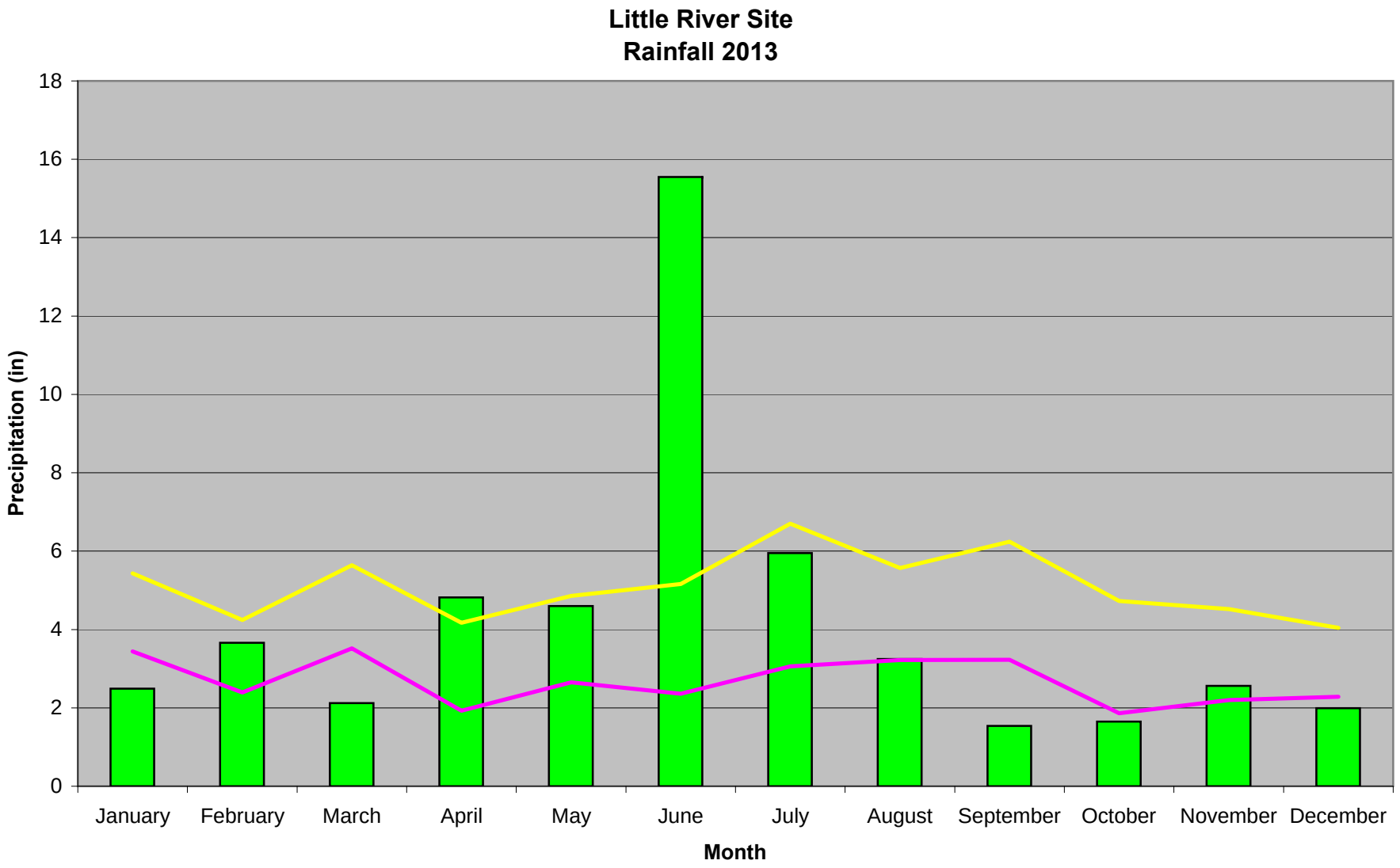

Reference Gauge (AB37307)
139 days above -12"
Start of Growing Season- March 23
End of Growing Season- November 7
Water Level (in)
Precipitation (in)
10
0
-10
-20
-30
-40
8
7
6
5
4
3
2
1
0
1-Jan-13
8-Jan-13
15-Jan-13
22-Jan-13
29-Jan-13
5-Feb-13
12-Feb-13
19-Feb-13
26-Feb-13
5-Mar-13
12-Mar-13
19-Mar-13
26-Mar-13
2-Apr-13
9-Apr-13
16-Apr-13
23-Apr-13
30-Apr-13
7-May-13
14-May-13
21-May-13
28-May-13
4-Jun-13
11-Jun-13
18-Jun-13
25-Jun-13
2-Jul-13
9-Jul-13
16-Jul-13
23-Jul-13
30-Jul-13
6-Aug-13
13-Aug-13
20-Aug-13
27-Aug-13
3-Sep-13
10-Sep-13
17-Sep-13
24-Sep-13
1-Oct-13
8-Oct-13
15-Oct-13
22-Oct-13
29-Oct-13
5-Nov-13
12-Nov-13
19-Nov-13
26-Nov-13
3-Dec-13
10-Dec-13
Date
Reference Gauge (AB37307)
12" Below Surface
On-site Raingauge


Gauge 1 (A282F9D)
42 days above -12"
Start of Growing Season- March 23
End of Growing Season- November 7
Water Level (in)
Precipitation (in)
Date
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
6
5
4
3
2
1
0
1-Jan-13
8-Jan-13
15-Jan-13
22-Jan-13
29-Jan-13
5-Feb-13
12-Feb-13
19-Feb-13
26-Feb-13
5-Mar-13
12-Mar-13
19-Mar-13
26-Mar-13
2-Apr-13
9-Apr-13
16-Apr-13
23-Apr-13
30-Apr-13
7-May-13
14-May-13
21-May-13
28-May-13
4-Jun-13
11-Jun-13
18-Jun-13
25-Jun-13
2-Jul-13
9-Jul-13
16-Jul-13
23-Jul-13
30-Jul-13
6-Aug-13
13-Aug-13
20-Aug-13
27-Aug-13
3-Sep-13
10-Sep-13
17-Sep-13
24-Sep-13
1-Oct-13
8-Oct-13
15-Oct-13
22-Oct-13
29-Oct-13
5-Nov-13
12-Nov-13
19-Nov-13
26-Nov-13
3-Dec-13
10-Dec-13
Gauge #1 (A282F9D)
12" Below Surface
On-site Raingauge


Gauge #2 (A27AA3E)
Water Level (in)
Precipitation (in)
Start of Growing Season- March 23
End of Growing Season- November 7
24 days above -12"
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
6
5
4
3
2
1
0
1-Jan-13
8-Jan-13
15-Jan-13
22-Jan-13
29-Jan-13
5-Feb-13
12-Feb-13
19-Feb-13
26-Feb-13
5-Mar-13
12-Mar-13
19-Mar-13
26-Mar-13
2-Apr-13
9-Apr-13
16-Apr-13
23-Apr-13
30-Apr-13
7-May-13
14-May-13
21-May-13
28-May-13
4-Jun-13
11-Jun-13
18-Jun-13
25-Jun-13
2-Jul-13
9-Jul-13
16-Jul-13
23-Jul-13
30-Jul-13
6-Aug-13
13-Aug-13
20-Aug-13
27-Aug-13
3-Sep-13
10-Sep-13
17-Sep-13
24-Sep-13
1-Oct-13
8-Oct-13
15-Oct-13
22-Oct-13
29-Oct-13
5-Nov-13
12-Nov-13
19-Nov-13
26-Nov-13
3-Dec-13
10-Dec-13
Date
Gauge #2 (A27AA3E)
12" Below Surface
On-site Raingauge


Gauge 3 (EBD3D95)
139 days above -12"
Start of Growing Season- March 23
End of Growing Season- November 7
Water Level (in)
Precipitation (in)
Date
Gauge #3 (EBD3D95)
12" Below Surface
On-site Raingauge


Gauge 4 (10FADE12)
138 days above -
Start of Growing Season- March 23
End of Growing Season- November 7
Water Level (in)
Precipitation (in)
Date
Gauge #4 (10FADE12)
12" Below Surface
On-site Raingauge



Precipitation data obtained from:
On-site rain gauge

30% & 70% precipitation data obtained from Moore County WETS Station: Carthage 8 SE, NC1515 1971-2000 (wcc.nrcs.usda.gov)