Goodman Property Stream Mitigation Project
EEP ID (IMS#) 92761
FDP Contract Number D000616
USACE Action ID # SAW-2008-03188
DWQ Project# 08-1647

CLOSEOUT REPORT

STREAM

Project Site and Classifications	
Project County	Lenoir County
General Location	West side of Kinston
Basin	Neuse
Physiographic Region	Coastal Plain
Ecoregion	8.3.5 Southeastern Plains
USGS Hdryo Unit	03020202
NCDWQ Sub-basin	03-04-05
Cowardin Classification	PSS, PFO
Thermal Regime	Warm
Trout Water	No
Project Performers	
Source Agency	EEP
Provider	Albemarle Restorations, LLC
Designer	Ecotone, Inc.
Monitoring Firm	Woods, Water and Wildlife, Inc.
Channel Remediation	Woods, Water and Wildlife, Inc.
Plant Remediation	Carolina Silvics, Inc.
Property Interest Holder	EEP

Project Activities and Timeline	
Activity or Report	**Date of Delivery**
Restoration Plan	Oct. 2008
Final Design -90%	Oct. 2008
Construction	Mar. 2009
Temporary S & E mix applied to entire project area	Feb. 2009
Permanent seed mix applied to entire project area	Mar. 2009
Containerized and Bare Root Planting	Mar. 2009
Mitigation Plan/As-built	Jun. 2009
Year 1 monitoring	Feb. 2010
Year 2 monitoring	Nov. 2010
Supplemental Planting	Dec. 2010
Year 3 monitoring	Nov. 2011
Year 4 monitoring	Dec. 2012
Year 5 monitoring	Dec. 2013

Project Setting and Background Summary

The Goodman Stream Restoration Site is located on Pruitt Road approximately 5 miles west of Kinston in Lenoir County, North Carolina. It was constructed by Albemarle Restorations, LLC, under contract with EEP to provide compensatory stream mitigation credits in the Neuse River Basin. Construction activities in accordance with the approved restoration plan began February 11, 2009 and were completed on March 26, 2009. Tree and shrub planting on the site occurred on March 27, 2009. An emergent wetland seed mixture was sown the same day. All planting was done in accordance with the approved restoration plan. The mitigation plan provides for the **restoration** of 4,325 linear feet of swamp run and the **preservation** of 3,205 linear feet of existing swamp run. Supplemental planting was done on a small area of the project in December, 2010.

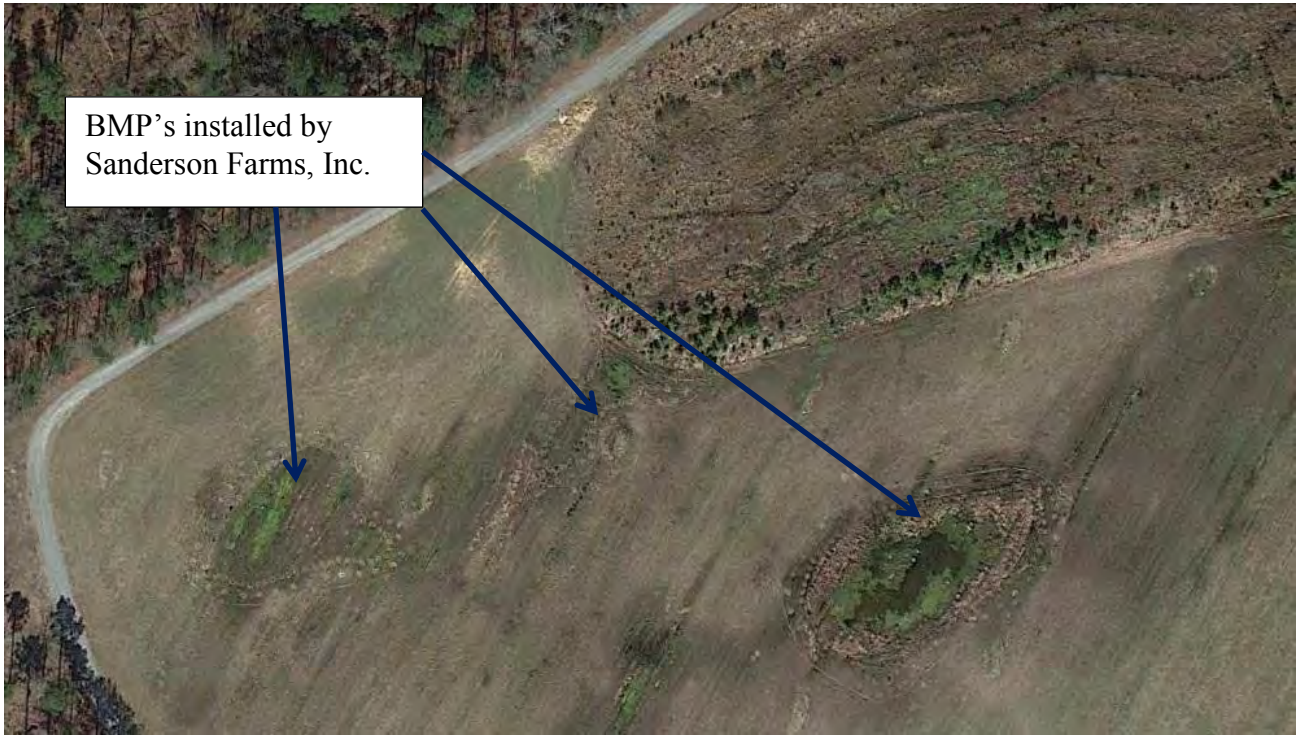
Vegetation and water flow monitoring began in 2009 after construction and planting was completed. Eight water level monitoring gauges are installed in pairs at strategic positions throughout the site to measure surface and subsurface water levels. Two additional gauges are installed in the stream preservation area to act as reference gauges and to provide for a comparison of water levels and flow in a naturally occurring riparian headwater system. A rain gauge is installed on the site and checked against cooperator data from the Kinston area. In addition to the data gathered by the gauges, flow events were video and photo recorded during the monitoring period.

Goals and Objectives:

The goal of the Goodman Property Stream Mitigation Project was to restore a diverse riparian headwater swamp run system typically found in the middle to upper reaches of first or zero order tributary systems. The project is to serve as compensation for stream loss in the Neuse River Basin. The restoration plan was developed and implemented to restore topography and hydrology that more closely resembled that of similar undisturbed land. The original swamp run had been channelized and straightened to improve drainage from the agricultural land surrounding it. Restoration resulted in the development of a swamp run that followed a historical and more natural path. Tree and shrub planting was designed to restore a wetland forest ecosystem that is typically found in the immediate area characteristic of similar soils, topography and hydrology.

The specific objective of the project was to restore a diverse riparian headwater swamp run system to provide the following ecological benefits:

1) Water quality improvements, including nutrient, toxicant and sediment retention and reduction, increasing dissolved oxygen levels, as well as reducing excessive algae growth, and reducing surface water temperatures in receiving waters by providing permanent shading in the form of a shrub/scrub and forested headwater wetland system.
2) Wildlife habitat enhancement by adding to the existing adjacent forested areas to create a continuous travel corridor between habitat blocks and provide a wide range of habitat areas (open water, emergent, shrub/scrub and forested) for amphibians, reptiles, birds, insects and mammals.
3) Flood flow attenuation during storm events to help reduce sedimentation and erosion downstream, and improve long term water quality within the Neuse River.
4) Passive outdoor recreation and educational opportunities for the landowner and the surrounding community. During the course of the project, the easement area and surrounding property changed ownership. Sanderson Farms, Inc. now uses the property surrounding the project area for wastewater disposal, negating the use of the property and project area for the purposes stated in this objective.



Change in Adjacent Land Use

Sanderson Farms, Inc. purchased the property on which the project is located from the Goodman family early in the life of the project. They now use the area adjacent to the project for dispersal of treated wastewater from their nearby processing plant. In 2012, Sanderson Farms installed several BMP plantings in the wastewater disposal area on portions of the field that were perennially wet and not conducive to farming practices. The photo at left shows three such plantings at the headwater end of the South Swamp Run. Several of these plantings are adjacent to the project area, are permanently staked off and planted with a variety of wetland tree species. The treated wastewater is dispersed over the remainder of the disposal area via an array of permanently installed spray heads which are located in such a way as to maintain a minimum twenty-five foot setback from adjacent properties (including the restoration and preservation areas) and to direct the wastewater spray away from any adjacent properties. All the plantings installed by Sanderson Farms, Inc. were done in accordance with their wastewater disposal permit.

Success Criteria

Vegetation: The vegetation success criterion was developed in accordance with the CVS-EEP protocol. The Goodman project was planned to include a contiguous plant community consistent with those found naturally occurring along local swamp runs. The species mix was based on the vegetation noted at the reference site and all species are classified from FAC to OBL. The site was originally planted at a density of 614 stems per acre in March of 2009. In December of 2010, an additional 800 stems were planted in the southern run from gauges 3 and 4 to the upstream terminus. The success criterion in year 5 is to have a minimum of 260 live stems per acre.

The area at the upstream end of the southern run suffered heavier mortality than the rest of the site, probably due to moisture stress. Rainfall in 2009 was probably adequate for most of the site, but the soils in that part of the project are very sandy. Since the replanting, the trees in that area have done well. The only other area of note is around plot 5. The herbaceous layer in that part of the project is just very thick and dense due to its wetter

nature around the confluence of the two runs. The trees on that plot are somewhat stunted, but surviving and should do well once they have adequate crown above the herbaceous layer.

Flow: The primary success criteria for the Riparian Headwater/Zero Order Stream system will be the documentation of 2 flow events within a normal rainfall year in 3 of the 5 years of monitoring. Groundwater monitoring gauges were installed at key locations in the project to gather evidence of rising and falling water levels in the runs which would prove water was flowing through the project. These gauges have recorded many flow events during the monitoring period, but the best evidence comes in the form of video documentation. Flow patterns have developed over the course of monitoring. The northern branch is fed from an existing swamp run and mirrors the reference area nearly perfectly. When water is flowing in the reference area, it will also be flowing in the northern run. The southern run is rainwater fed but also also serves as a drain for the surrounding fields to the extent that the landowners have installed their own conservation measures adjacent to the project area in perennially wet areas. Since flow events in the southern run are rainwater fed and by nature short-lived, video evidence of water actually flowing at the absolute upstream limit is difficult to obtain. However, there is ample evidence that water does move into the project from the surrounding fields and some of it is recorded with the video evidence.

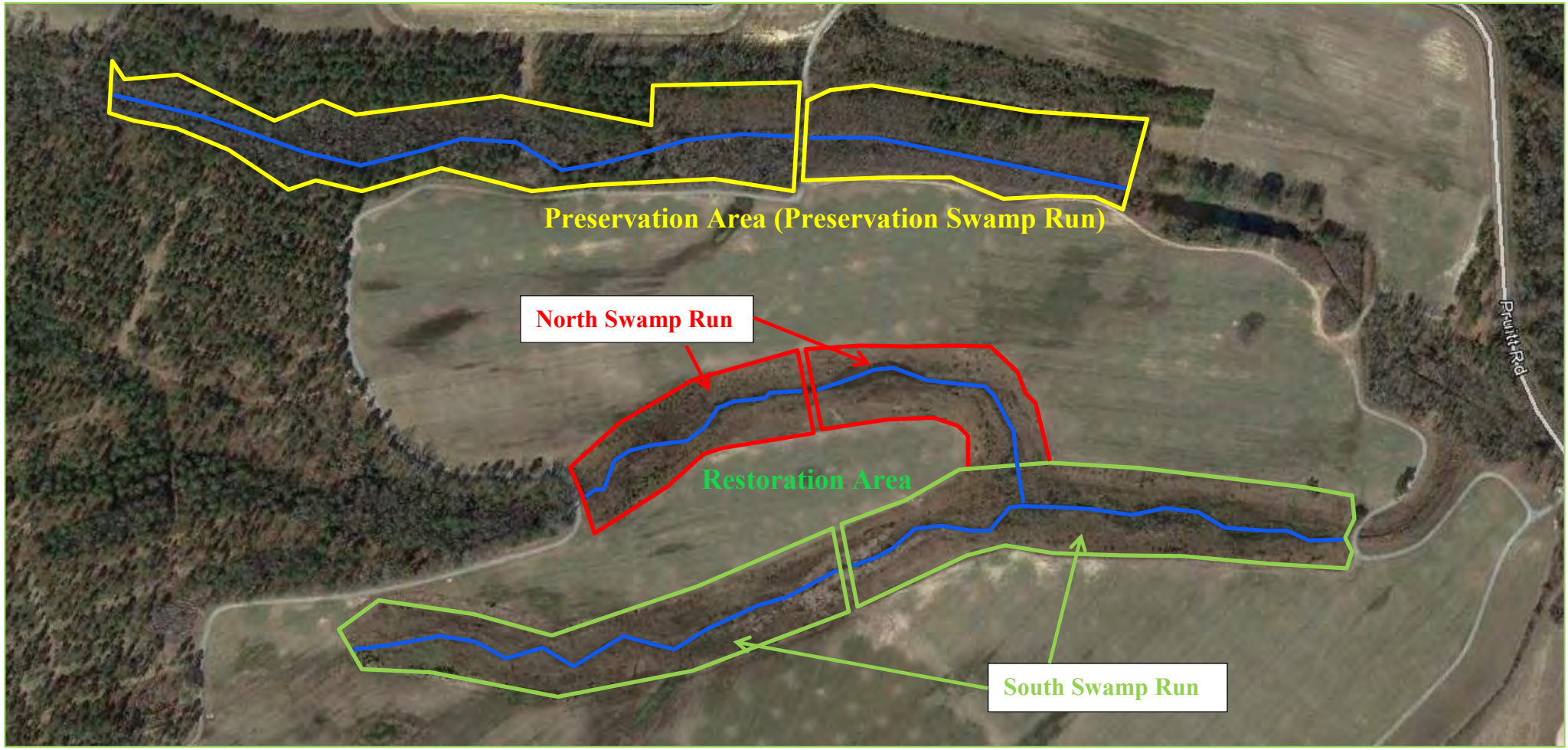
ASSET TABLE

Reach/Segment	Mitigation Type	Watershed Acreage	Pre-Construction Linear Feet	As Built Linear Feet	Mitigation Ratio	Mitigation Units SMU/WMU
Northern Swamp Run	Stream Restoration	78	0	1,531	1:1	1,531 SMU's
Southern Swamp Run	Stream Restoration	91	0	2,865	1:1	2,865 SMU's
Preservation Swamp Run	Stream Preservation	6,309	0	3,205	5:1	641 SMU's

Note: Culvert crossings and waterline crossings are excluded from the easement area and As-Built stream lengths.

MITIGATION UNIT TOTALS

Stream Mitigation Units (SMU)	Riverine Wetland Units	Non-Riverine Wetland Units	Total Wetland (WMU)	Riparian Buffer	Nutrient Offset
5,037	0	0	0	0	0



Reach		SMU's
Preservation Swamp Run		641
North Swamp Run		1,531
South Swamp Run		2,865
As-built Stream Alignment		

Figure 1. Asset Map

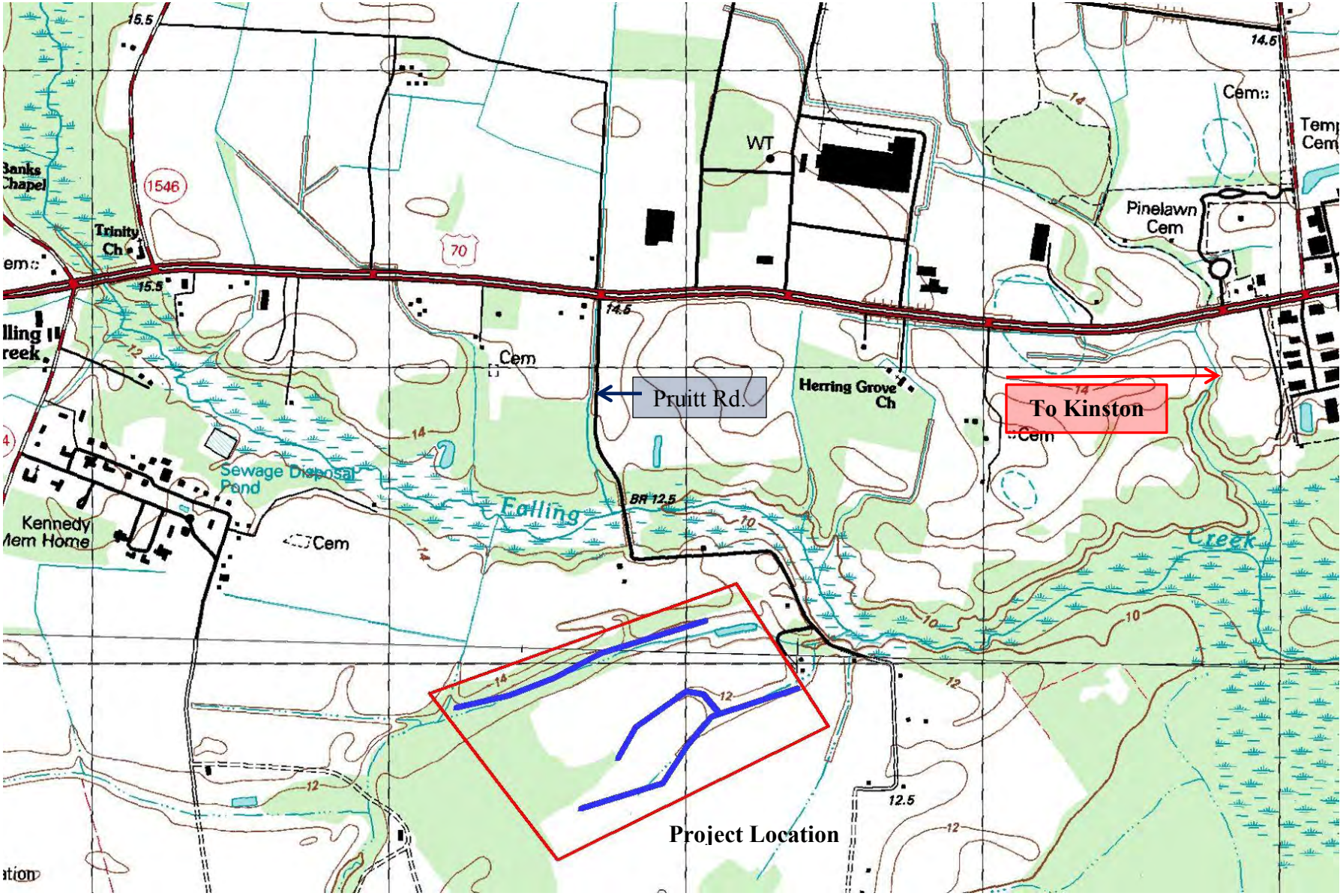


Figure 2. Vicinity Map

Figure 3. Watershed Map

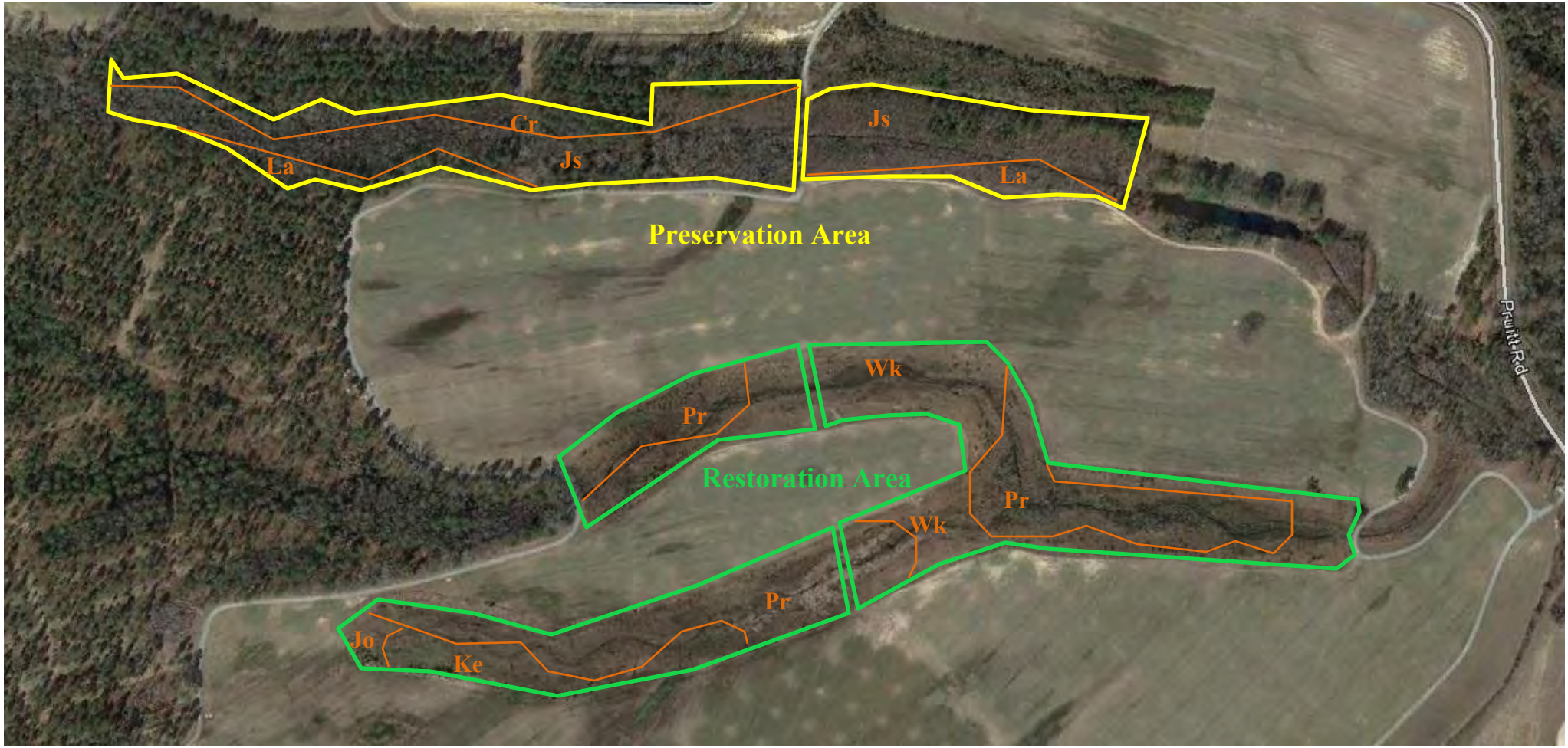


Figure 4. Soil Series

Cr: Craven fine sandy loam Js: Johnston La: Lakeland sand

Jo: Johns sandy loam Ke: Kenansville loamy sand Pr: Portsmouth loam Wk: Wickham loamy sand

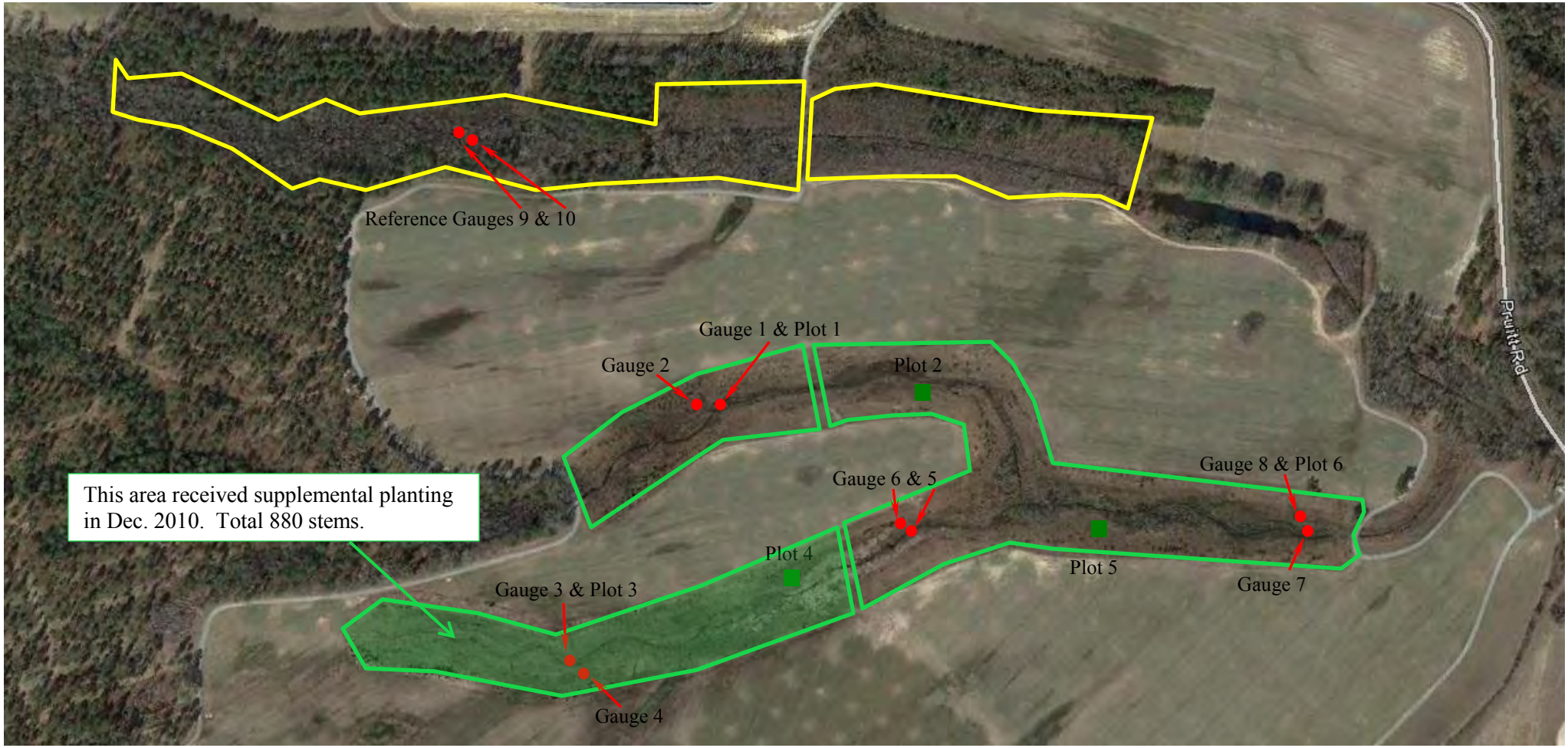


Figure 5. Maintenance and Monitoring

Table 1. Survival for all Stems by Plot and Species Year 5 and Per Acre Stem Count Life of Project

	Species	CommonName	Total Stems	# plots	avg# stems	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
	Cephalanthus occidentalis	common buttonbush	5	4	1.25	1	1	1	2		
	Fraxinus pennsylvanica	green ash	2	2	1				1	1	
	Itea virginica	Virginia sweetspire	3	2	1.5				1	2	
	Myrica	wax myrtle	2	1	2	2					
	Nyssa biflora	swamp tupelo	7	1	7		7				
	Quercus bicolor	swamp white oak	2	1	2				2		
	Quercus phellos	willow oak	8	4	2	3	1		2		2
	Taxodium distichum	bald cypress	21	4	5.25	2		7		4	8
TOT:	8	8	50	8		8	9	8	8	7	10
					Year						
Stems per Acre					2013	330	371	330	330	289	412
					2012	371	330	330	371	289	412
					2011	371	330	330	371	289	412
					2010	412	330	247	289	454	495
					2009	454	454	330	330	577	536

Table 2. Planting Schedule

Quantity	Trees: Common Name	Trees: Scientific Name	Percent of Total
2700	Bald Cypress	Taxodium distichum	180%
600	Water tupelo	Nyssa aquatica	40%
1500	Swamp Black Gum	Nyssa biflora	100%
2000	Willow Oak	Quercus phellos	133%
1000	Swamp Chestnut Oak	Quercus michauxii	67%
400	Water Oak	Quercus nigra	27%
700	River Birch	Betula nigra	47%
700	Green Ash	Fraxinus pennsylvanica	47%
9600	Total Tree Stems		640%
	Shrubs		
	Common Name	**Scientific Name**	
1000	Button Bush	Cephalanthus occidentalis	67%
745	Virginia Sweetspire	Itea virginica	50%
1000	Wax Myrtle	Myrica cerifera	67%
2745	Total Shrub Stems		183%
12345	Total Stems		

Table 2 shows the original planting schedule from 2009 but does not include the supplemental planting done in 2010 at the upstream end of the South Swamp Run around gauges 3 and 4. In December, 2010, an additional 800 stems were added in that area due to high mortality. 200 stems of each of the following were added to that area: green ash, wax myrtle, swamp chestnut oak and bald cypress. Survival in general has been relatively stable since then.

Table 3. Vegetation Vigor by Species 2013 (Year 5)

	Species	CommonName	4	3	2	1	0	Missing	Unknown
	Cephalanthus occidentalis	common buttonbush	4	1					
	Fraxinus pennsylvanica	green ash	1	1				1	
	Itea virginica	Virginia sweetspire	2	1				1	
	Nyssa biflora	swamp tupelo		6		1			
	Quercus bicolor	swamp white oak	2					1	
	Quercus phellos	willow oak	4	3			1		
	Taxodium distichum	bald cypress	19	2					
	Myrica	wax myrtle	1	1					
TOT:	**8**	**8**	**33**	**15**		**1**	**1**	**3**	

Table 4. Vegetation Damage by Species

	Species	CommonName	Count of Damage Categories	(no damage)	Other/Unknown Animal
	Cephalanthus occidentalis	common buttonbush	0	5	
	Fraxinus pennsylvanica	green ash	0	3	
	Itea virginica	Virginia sweetspire	0	4	
	Myrica	wax myrtle	1	1	1
	Nyssa biflora	swamp tupelo	0	7	
	Quercus bicolor	swamp white oak	0	3	
	Quercus phellos	willow oak	0	8	
	Taxodium distichum	bald cypress	0	21	
TOT:	**8**	**8**	**1**	**52**	**1**

Table 5. Vegetation Damage by Plot

	Plot	Count of Damage Categories	(no damage)	Other/Unknown Animal
	1	1	7	1
	2	0	9	
	3	0	8	
	4	0	9	
	5	0	9	
	6	0	10	
TOT:	**6**	**1**	**52**	**1**

Verification of Flow Events

Seven separate flow events were video documented during the five-year monitoring period 2009-2013. Table 6 below lists the dates of video documentation and the corresponding above ground peak high water mark for those dates for each of the in-stream gauges 1, 3, 5 and 7.

Table 6. Flow Events Video Recorded and Corresponding Water Depth

		Depth of Water (ft.) Above Ground at Gauge			
Year	Date	**1**	**3**	**5**	**7**
2009	12/9/2009	1.0	0.5	1.1	0.9
2010	1/27/2010	0.7	0.2	1.1	0.2
	10/1/2010	0.6	0.6	1.4	1.2
2011	8/31/2011	0.8	0.3	1.3	0.6
	11/8/2011	0.6	0.4	1.0	0.6
2012	11/13/2012	0.7	0.5	1.0	0.7
2013	3/29/2013	1.0	0.6	1.0	0.4

Figure 6. Goodman In-Stream Monitoring Gauges 1, 3, 5 and 7 - 2013 Composite

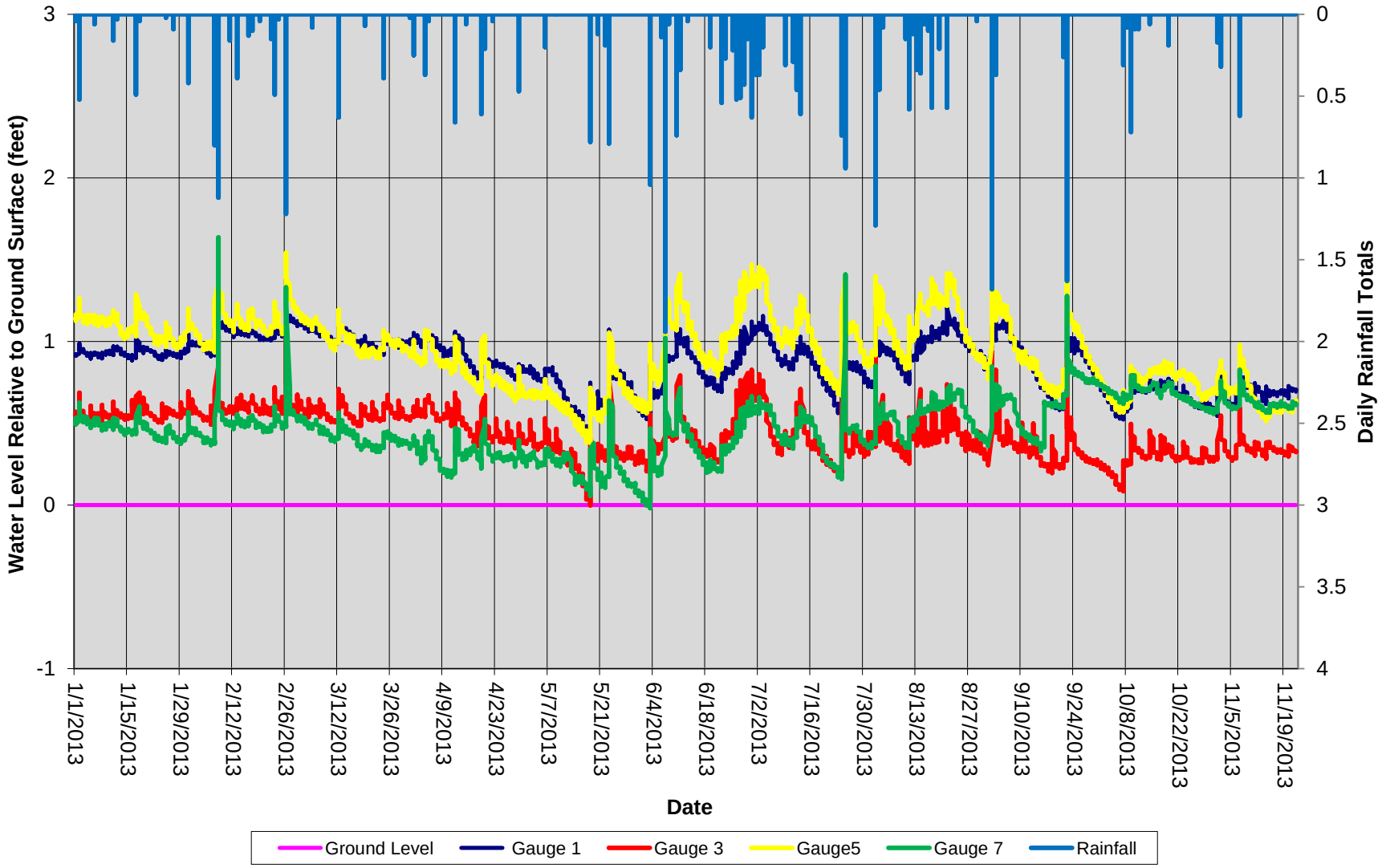


Figure 7. Goodman In-Stream Monitoring Gauges 1, 3, 5 and 7 - 2009-2013(5-Year) Composite

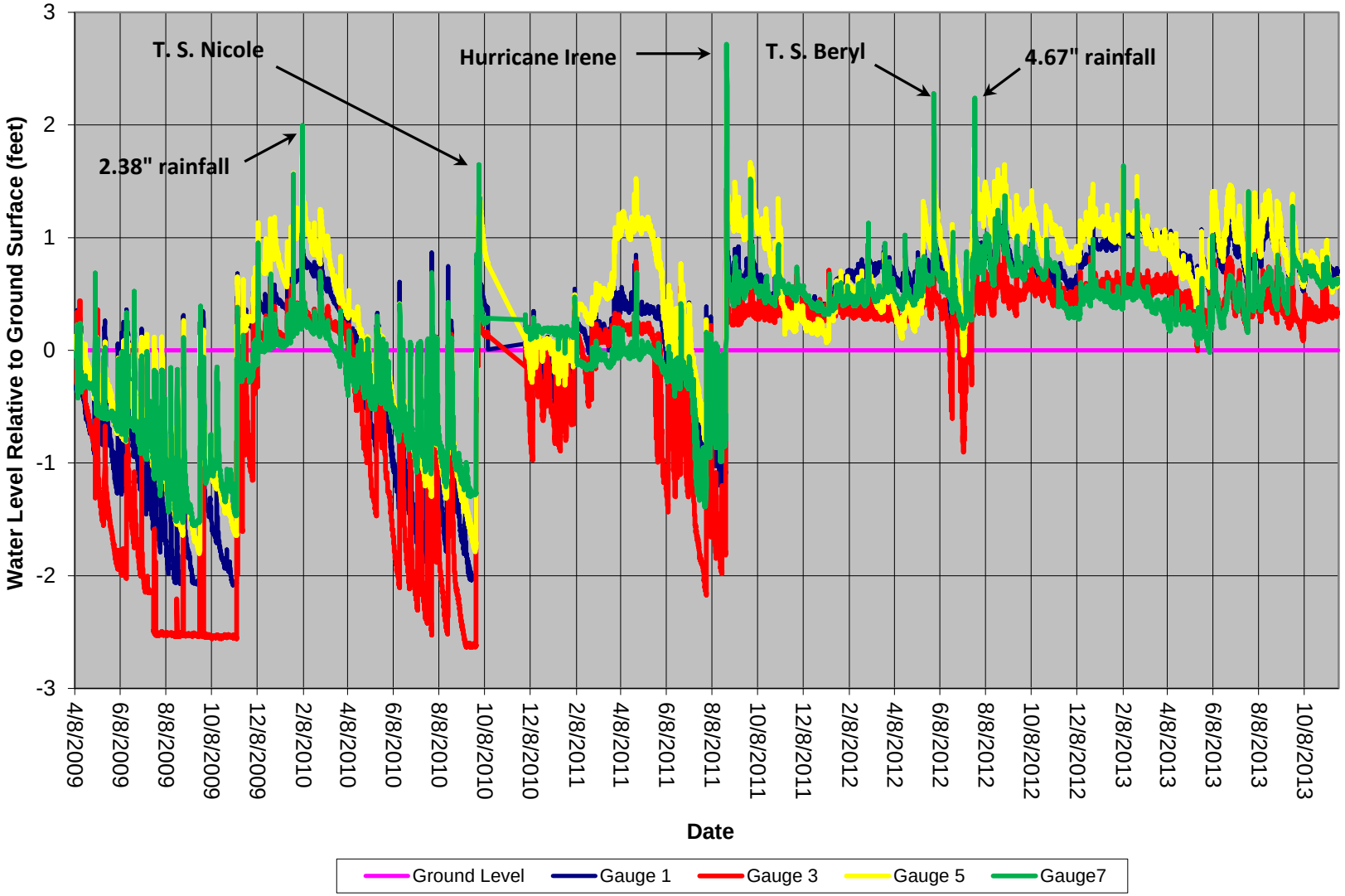


Figure 8. Average monthly and annual rainfall comparison to historic

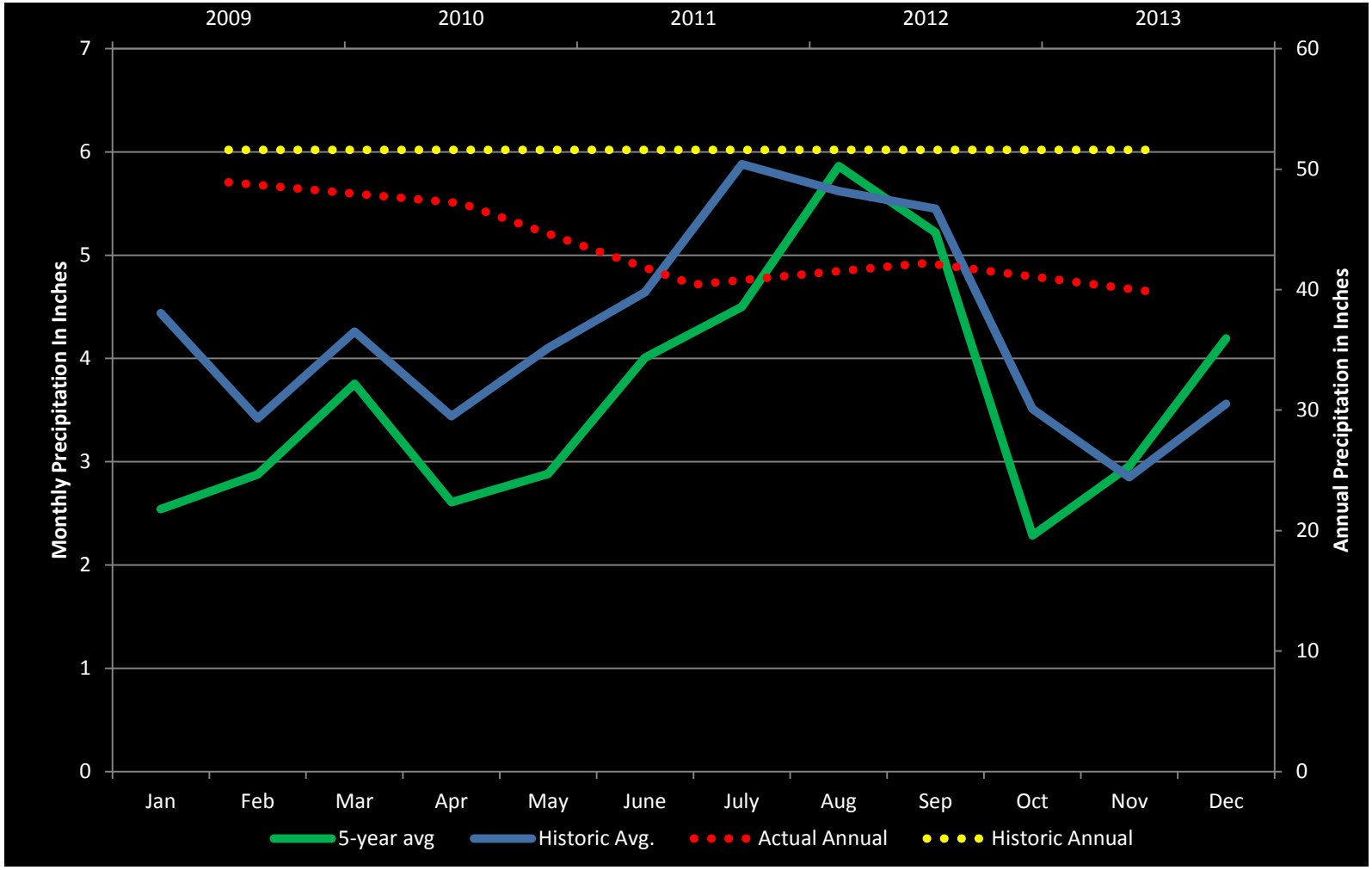
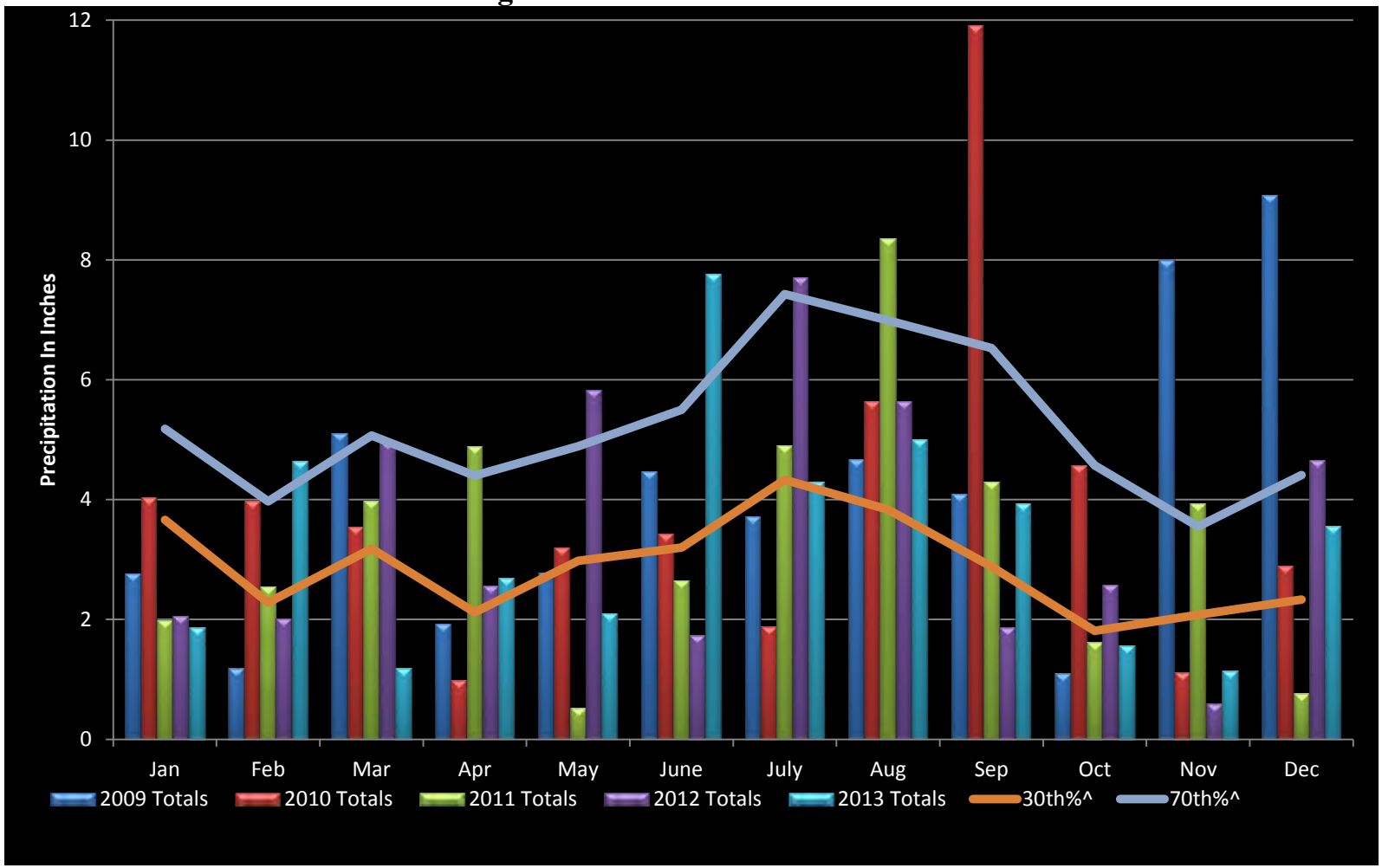


Figure 9. Historic vs. observed rainfall



EEP Recommendations and Conclusions

Contingencies

Pre-Construction Photos – 2007

Ditched stream draining the cropland prior to swamp run restoration.

View of the valley showing “hook” tributary or the center tributary prior to swamp run restoration.

Post-Construction Photos 2008

Graded Swamp Run

Confluence of swamp runs. Natural stand of willows left intact.

Facing upstream in the restored northern swamp run.

Looking downstream in the northern restored swamp run one month post-construction.

Preconstruction aerial view of project area

Post construction aerial view of project area

Debris deposition cause by rainfall flood event in November 2013 at headwater end of South Swamp Run.

Photo from March 2013 showing extend of flooding during a flow event in the North Swamp Run.

Appendix A: Watershed Planning Summary

Appendix B: Land Ownership and Protection

Appendix C: Jurisdictional Determinations and Permits

Appendix D: Debit Ledger