YEAR 2 (2013)
ANNUAL MONITORING REPORT
SLIVER MOON NON-RIPARIAN WETLAND MITIGATION SITE

CRAVEN COUNTY, NORTH CAROLINA
EEP PROJECT ID: 95017

PREPARED FOR:

NC Department of Environment & Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

PREPARED BY:

Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, NC 27604

December 2013

EXECUTIVE SUMMARY

Restoration Systems, LLC has established the Sliver Moon Non-Riparian Wetland Mitigation Site (Site) that is designed specifically to assist in fulfilling North Carolina Ecosystem Enhancement Program wetland restoration goals. The Site is located approximately 4 miles east of Dover, North Carolina in the western portion of Craven County (Figure 1) and positioned within the Core Creek Targeted Local Watershed (TLW) 03020202080010 of the Neuse River Basin (8-digit HUC 03020202). Core Creek has been assigned a Best Usage Classification of **C; NSW, Sw** and is considered biologically impaired. This report serves as the Year 2 (2013) annual monitoring report.

The 17.1-acre project encompasses 14 acres of non-riparian wetland restoration, for a total for 14 non-riparian wetland mitigation units (WMUs). The restoration plan consisted of filling and plugging perimeter and interior ditches followed by planting the Site with native hardwood understory and canopy species.

The project goals aim to address stressors identified in the TLW and include the following:

- Remove non-point sources of pollution associated with vegetation maintenance including:
  a. the cessation of broadcasting fertilizer, pesticides, and other agricultural chemicals into and adjacent to Site drainage ditches and
  b. providing a vegetated wetland to aid in the treatment of runoff.
- Restore wetland hydroperiods that satisfy wetland jurisdictional requirements and approximate the Site's natural range and variation.
- Promote floodwater attenuation by filling ditches and enhancing groundwater storage capacity.
- Restore and reestablish natural community structure, habitat diversity, and functional continuity.
- Enhance and protect the Site's full potential of wetland functions and values in perpetuity.

In order to avert hydrologic trespassing issues with the property immediately to the west, a meandering shallow swale was constructed through the Site. The swale ultimately connects into the remaining southeastern ditch (Figure 2, Appendix B). Found during construction activities, the 6-inch corrugated pipe drained surface water originating from subsurface springs located within the adjacent western property. Elevations were taken of the pipe and throughout the Site to determine the path of least resistance. This approach was taken for two reasons 1) to minimize the possible draw down from the swale and 2) to maintain and enhance the Site's existing micro-topography, minimizing the amount of cut soil. Filling the western boundary ditch without allowing the surface hydrology to naturally flow through the Site would have undoubtedly inundated the neighbor's road and surrounding land. Ultimately, the additional surface hydrology is a bonus to the Site and will help further the success of the wetland restoration.

Fourteen vegetation plots (10-meters by 10-meters in size) were established and permanently monumented. These plots were surveyed in July 2013 for the Year 2 (2013) monitoring season following guidelines established in *CVS-EEP Protocol for Recording Vegetation, Version 4.2*

(Lee et al. 2008). Vegetation sampling across the Site was above the required average density with 546 planted stems per acre surviving. In addition, each individual plot was above success criteria with the exception of Plot 5; however, when including natural recruits of red maple (*Acer rubrum*) the plot was well-above success criteria.

Agricultural encroachment in the southern margins of the Site occurred in the spring of 2012, after site planting had occurred. Carolina Silvics replanted the encroached area in the winter of 2012/2013 with approximately 40-3 gallon containerized sweetbay magnolia (*Magnolia virginiana*), 200 bare-root black gums (*Nyssa sylvatica var. sylvatica*), 700 bare-root swamp chestnut oaks (*Quercus michauxii*), 200 bare-root water oaks (*Quercus nigra*), and 200 bare-root willow oaks (*Quercus phellos*). Planted trees are doing well. Additionally, the southern boundary was marked more visibly to alleviate further encroachment into the Site.

Nine groundwater monitoring gauges were installed at the Site with an additional groundwater gauge installed in a reference wetland located immediately adjacent to the western boundary of the Site. All nine monitored gauges were inundated/saturated within 12 inches of the surface for greater than 7.5 percent of the year 2 (2013) growing season (21 days), which extends from February 7 to November 14 (281 days).

Site vegetation and wetland hydrology met success criteria for Year 2 (2013) monitoring.

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1.0 PROJECT BACKGROUND

1.1 Location and Setting

Located approximately 4 miles east of Dover, North Carolina in western Craven County, the Site is situated within the Carolina Flatwoods section of the Middle Atlantic Coastal Plain physiographic province of North Carolina, United States Geological Survey (USGS) HUC 03020202 (NC Division of Water Quality [NCDWQ] Subbasin Number 03-04-08) of the Neuse River Basin. The Site is situated within an interstream flat north of Core Creek, NCDWQ Stream Index Number 27-90.

Directions to the Site (Figure 1, Appendix A) from the City of Kinston:

- Travel southeast on US 70 Bypass for 7.2 miles
- Turn left at SR 1005/Dover Road
- Continue on Old US Highway 70 for 0.3 mile
- Continue onto West Kornegay Street for 1.3 Miles
- Continue onto Old US Highway 70 for 3.7 miles
- Turn left at Daisy Land
- Point in center of Site: Latitude: 35.205882 °N, Longitude: -77.361332 °W

1.2 Project Objectives

Project goals include the following:

- Improving Water Quality
  - Removing non-point sources of pollution associated with agricultural activities, including a) eliminating the application of fertilizer, pesticides, and other agricultural materials into ditches that flow to adjacent streams and wetlands and b) providing a vegetated wetland to aid in the treatment of pollutants such as sediment and/or agricultural pollutants from the adjacent landscape.
  - Reducing sedimentation onsite and in adjacent ditches by a) reducing ditch erosion associated with tillage and b) planting a diverse woody vegetative to reduce runoff.
- Enhancing Flood Attenuation
  - Promoting floodwater attenuation by a) removing ditches to reduce the amount of runoff that occurs during high precipitation; b) restoring wetland hydroperiods that satisfy wetland jurisdictional requirements and approximate the Site's natural range of variation; c) restoring non-riparian wetlands, resulting in increased storage capacity during precipitation events within the Site; d) revegetating the Site to reduce sheet flow off the Site.
- Restoring Non-riparian Habitat
  - Restore and reestablish natural community structure, habitat diversity, and functional continuity.
- Enhance and protect the Site's full potential of wetland functions and values in perpetuity.

Project objectives include the following:

- Providing 14 non-riparian WMUs, as calculated in accordance with the requirements stipulated in RFP #16-003571. This will be accomplished by restoring 14 acres of non-riparian wetland by eliminating row crop production, filling agricultural ditches, restoring historic water table elevations, redirecting ditches located near the Site to avoid possible draw-down, and planting the Site with native non-riparian forest vegetation.
- Protecting the Site in perpetuity with a conservation easement.

1.3 Monitoring Plan View

Monitoring features (vegetation plots and groundwater gauges) are depicted in Figure 2 (Appendix B). Tables 1 through 3 summarize project components and mitigation credits, project activities and reporting history, and project contacts, respectively (Appendix A).

2.0 ANNUAL MONITORING

Monitoring of restoration efforts will be performed for a minimum of 7 years or until success criteria are fulfilled. The detailed monitoring plan is depicted in Figure 2 (Appendix B).

2.1 Vegetation

Monitoring of planted vegetation will follow guidelines outlined in the *Carolina Vegetation Survey (CVS) EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) and will be conducted annually between June 1 and September 30 until vegetation success criteria are achieved. Fourteen, 10-meter by 10-meter vegetation plots have been placed within restored wetlands (Figure 2, Appendix B). Vegetation will receive a visual evaluation on a periodic basis to ascertain the degree of overtopping of planted elements by nuisance species.

Agricultural encroachment in the southern margins of the Site occurred in the spring of 2012, after site planting had occurred. Carolina Silvics replanted the encroached area in the winter of 2012/2013 with approximately 40-3 gallon containerized sweetbay magnolia (*Magnolia virginiana*), 200 bare-root black gums (*Nyssa sylvatica var. sylvatica*), 700 bare-root swamp chestnut oaks (*Quercus michauxii*), 200 bare-root water oaks (*Quercus nigra*), and 200 bare-root willow oaks (*Quercus phellos*). Planted trees are doing well. Additionally, the southern boundary was marked more visibly to alleviate further encroachment into the Site.

2.1.1 Vegetation Success Criteria

Success criteria are dependent upon the density and growth of living, planted stems throughout the planted areas of the Site, all of which is characterized as Non-riverine Wet Hardwood Flat (Schafale and Weakley 1990). The presence of desirable volunteer species will be considered by the United States Army Corps of Engineers (USACE) and Interagency Review Team (IRT) in making a determination whether the Site has successfully met the stated goals and objectives. An average density of 320 stems per acre of living, planted stems must be surviving in the first three monitoring years. Subsequently, 260 living, planted stems-per-acre must be surviving in Year 5 and 210 living, planted stems-per-acre in Year 7.

2.1.2 Vegetation Monitoring Results

Fourteen vegetation plots (10-meter by 10-meter in size) were established and permanently monumented. These plots were surveyed in July 2013 for the Year 2 (2013) monitoring period. Vegetation sampled across the Site exceeded the required average density with 546 planted stems-per-acre surviving. In addition, each individual plot exceeded success criteria based on planted stems alone with the exception of Plot 5; however, when including naturally recruited red maple (*Acer rubrum*) this plot was well-above success criteria.

Summary of Planted Vegetation Plot Results

Plot	Planted Stems/Acre Counting Towards Success Criteria				
	Year 1 (2012)	Year 2 (2013)	Year 3 (2014)	Year 4 (2015)	Year 5 (2016)
1	688	607			
2	648	648			
3	486	364			
4	567	526			
5	324	162			
6	567	486			
7	607	688			
8	405	364			
9	486	445			
10	607	607			
11	567	567			
12	648	728			
13	769	769			
14	648	688			
Average of All Plots (1-14)	**572**	**546**			

2.2 Hydrology

Measurements of wetland hydrology were performed in accordance with traditional methods as per the April 2003 *USACE Wilmington District Stream Mitigation Guidelines* (USACE et al. 2003). Nine continuously recording, groundwater monitoring gauges were installed within the 14 acres of restoration in accordance with specifications in *Installing Monitoring Wells/Piezometers in Wetlands* (NCWRP 1993); in addition, one reference gauge was installed adjacent to the Site and monitored. Year 2 (2013) groundwater data are presented by gauge in Appendix D.

2.2.1 Hydrology Success Criteria

Based on the Site's location and hydrology source, target hydrological characteristics include saturation or inundation for 7.5 percent of the growing season at a minimum of 12 inches below ground level during average rainfall conditions for a period of seven years. During growing seasons with atypical climatic conditions, groundwater gauges in reference wetlands may be used by the USACE/IRT to evaluate hydrology success.

The growing season will primarily be determined by the Unite States Department of Agriculture (USDA) *Soil Survey of Craven County, North Carolina* (USDA 1989) (March 18-November 14 [242 days]). In abnormally seasonable years the growing season may be based on USACE Regional Supplement (USACE 2010), which states the following:

> The growing season has begun on a site in a given year when two or more different non-evergreen vascular plant species growing in the wetland or surrounding areas exhibit one or more of the following indicators of biological activity:

a. Emergence of herbaceous plants from the ground
b. Appearance of new growth from vegetative crowns (e.g., in graminoids, bulbs, and corms)
c. Coleoptile/cotyledon emergence from seed
d. Bud burst on woody plants (i.e., some green foliage is visible between spreading bud scales)
1. Emergence or elongation of leaves of woody plants
f. Emergence or opening of flowers

The end of the growing season is indicated when woody deciduous species lose their leaves and/or the last herbaceous plants cease flowering and their leaves become dry or brown, generally in the fall due to cold temperatures or reduced moisture availability. Early plant senescence due to the initiation of the summer dry season in some areas does not necessarily indicate the end of the growing season and alternative procedures (e.g., soil temperature) should be used.

Summary of Hydrology Success Criteria by Year

Year	Soil Temperatures/Date Bud Burst Documented	Monitoring Period Used for Determining Success	7.5 Percent of Monitoring Period
2012 (Year 1)	--	March 18-November 14 (242 days)	18 days
2013 (Year 2)	Bud burst on red maple (*Acer rubrum*) and elderberry (*Sambucus canadensis*) and soil temperature of 48°F documented on February 7, 2013	February 7-November 14 (281 days)	21 days
2014 (Year 3)			
2015 (Year 4)			
2016 (Year 5)			

2.2.2 Hydrology Monitoring Results

All nine monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 7.5 percent of the monitoring period used for 2013 (Year 2) (21 days), which extends from February 7 to November 14 (281 days).

No hydrology problem areas were identified within the Site during Year 2 (2013) monitoring.

Sliver Moon Wetland Restoration Site

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2012)* March 18 Growing Season Start	Year 2 (2013)** February 7 Growing Season Start	Year 3 (2014)	Year 5 (2016)	Year 7 (2018)
1	Yes/25 days (10.3 percent)	Yes/43 days (15.3 percent)			
2	Yes/117 days (48.3 percent)	Yes/96 days (34.2 percent)			
3	Yes/117 days (48.3 percent)	Yes/95 days (33.8 percent)			
4	No/13 days (5.4 percent)	Yes/29 days (10.3 percent)			
5	Yes/76 days (31.4 percent)	Yes/92 days (32.7 percent)			
6	Yes/24 days (9.9 percent)	Yes/43 days (15.3 percent)			
7	Yes/40 Days (16.5 percent)	Yes/93 days (33.1 percent)			
8	Yes/97 days (40.1 percent)	Yes/93 days (33.1 percent)			
9	Yes/42 days (17.4 percent)	Yes/67 days (23.8 percent)			
Ref	Yes/102 days (42.1 percent)	Yes/91 days (32.4 percent)			

* Groundwater gauges were installed at the Site on March 24, six days after the published NRCS growing season start date (March 18). Therefore, Year 1 (2012) hydrology success criteria is proposed to use the USDA published growing season dates in place of the proposed biological and physical indicators of growing season as described for the Site.

**Based on biological and physical indicators for the site, February 7 was determined the start of the growing season for year 2 (2013) monitoring.

3.0 CONCLUSIONS

Vegetation sampling across the Site was above the required average density with 546 planted stems-per-acre surviving. In addition, each individual plot was above success criteria with the exception of Plot 5; however, when including natural recruits of red maple (*Acer rubrum*) the plot was well-above success criteria. Areas disturbed by agricultural encroachment were planted with 40, 3-gallon containerized trees and 1300 bare-roots trees, which are doing well and successfully vegetating disturbed areas.

All nine monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 7.5 percent of the monitoring period used for 2013 (Year 2) (21 days), which extends from February 7 to November 14 (281 days).

Site vegetation and wetland hydrology met success criteria for Year 2 (2013) monitoring.

4.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

NC Wetlands Restoration Program (NCWRP). 1993. Installing Monitoring Wells/Piezometers in Wetlands (WRP Technical Note HY-IA-3.1). Department of Environment, Health, and Natural Resources, Raleigh, North Carolina

Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

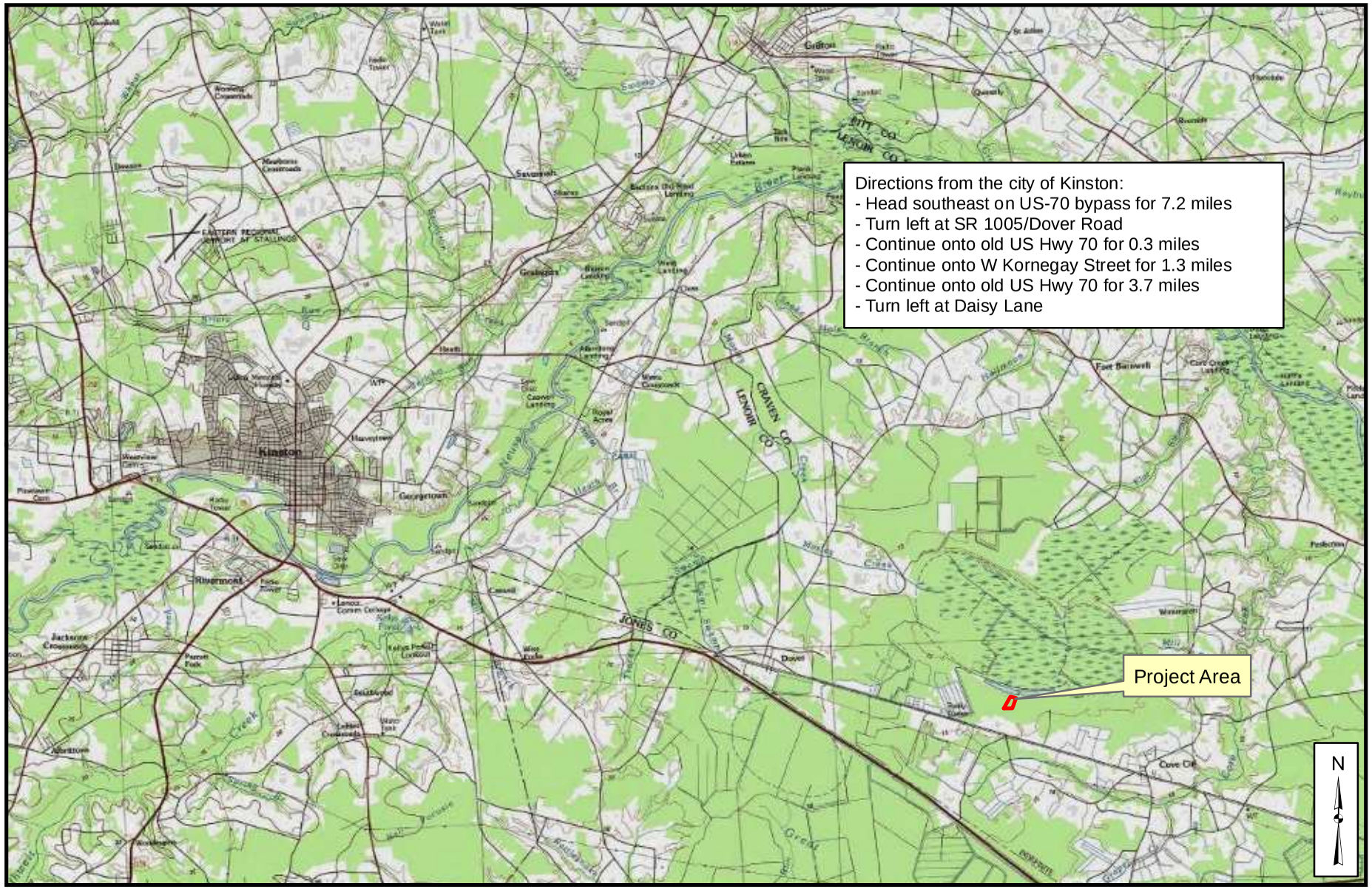
US Army Corps of Engineers (USACE). 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0). U.S. Army Engineer Research and Development Center, Environmental Laboratory, Vicksburg, MS. ERDC/EL TR-10-20. 154 pp.

US Army Corps of Engineers, US Environmental Protection Agency, NC Wildlife Resources Commission, NC Division of Water Quality (USACE et al.). 2003. Stream Mitigation Guidelines.

US Department of Agriculture (USDA). 1989. Soil Survey of Craven County, North Carolina. Natural Resources Conservation Service.

Appendix A.
General Tables and Figures

Figure 1. Site Location Map
Table 1. Project Components and Mitigation Credits
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Baseline Information & Attributes Table



Axiom Environmental, Inc.
Axiom Environmental
218 Snow Ave
Raleigh, NC 27603

Scale:
1 inch = 10,000 feet

Date:
Sept 2012

Project:
Sliver Moon

FIGURE 1:
SITE LOCATION MAP

This figure indicates where the Site is physically located along with directions to the Site.

Sliver Moon Non-Riparian Wetland Mitigation Site
RFP # 16-003571 EEP Project ID # 95017
Craven County, North Carolina

Imagery USGS Topographical Map
Coordinate System: NAD 1983 NC FEET

Table 1. Project Components and Mitigation Credits

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, EEP Project ID: 95017

Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals					14				

Project Components						
Project Component -or- Reach ID	Stationing/Location	Existing Footage/Acreage	Approach (PI,PII etc.)	Restoration – or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Non-riparian restoration	NA	17.01	NA	Restoration	14	1:1

Component Summation						
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	0	0	0	14	0	0
Enhancement		0	0	0	0	0
Enhancement 1	0					
Enhancement II	0					
Creation		0	0	0		
Preservation	0	0	0	0		0
High Quality Preservation	0	0	0	0		0

Table 2. Project Activity and Reporting History

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, EEP Project ID: 95017

Activity or Report	Data Collection Complete	Completion or Delivery
CE Document	NA	October - 2011
Conservation Easement	NA	February - 2012
Mitigation Plan	NA	February - 2012
Construction	NA	March - 2012
Bare Root Planting	NA	March - 2012
Baseline Monitoring Document	April-2012	August 2012
Year 1 Monitoring	October 2012	November 2012
Supplemental Planting/Easement Marking		Winter 2012/2013
Year 2 Monitoring	November 2013	November 2013
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

Table 3. Project Contacts Table

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, EEP Project ID: 95017

	Firm	POC & Address
Designer:	Restoration Systems, LLC with preliminary consulting by Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Ave. Raleigh, NC 27603
Construction Contractor:	Land Mechanics, Inc.	Lloyd Glover; 919.422.3392 780 Landmark Road Willow Spring, NC 27592-7756
Planting Contractor:	Carolina Silvics	Dwight McKinney 252.482.8491 908 Indian Trail Road Edenton, NC 27932
Seeding Contractor:	Land Mechanics, Inc.	Lloyd Glover; 919.422.3392 780 Landmark Road Willow Spring, NC 27592-7756
Nursery Stock Suppliers:	ArborGen	1.888.888.7158
Baseline Data Collection	Restoration Systems, LLC	Ray Holz; 919.604.9314 1101 Haynes St. Raleigh, NC 27604
Vegetation Monitoring:	Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Avenue Raleigh, NC 27603
Wetland Monitoring:	Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Avenue Raleigh, NC 27603

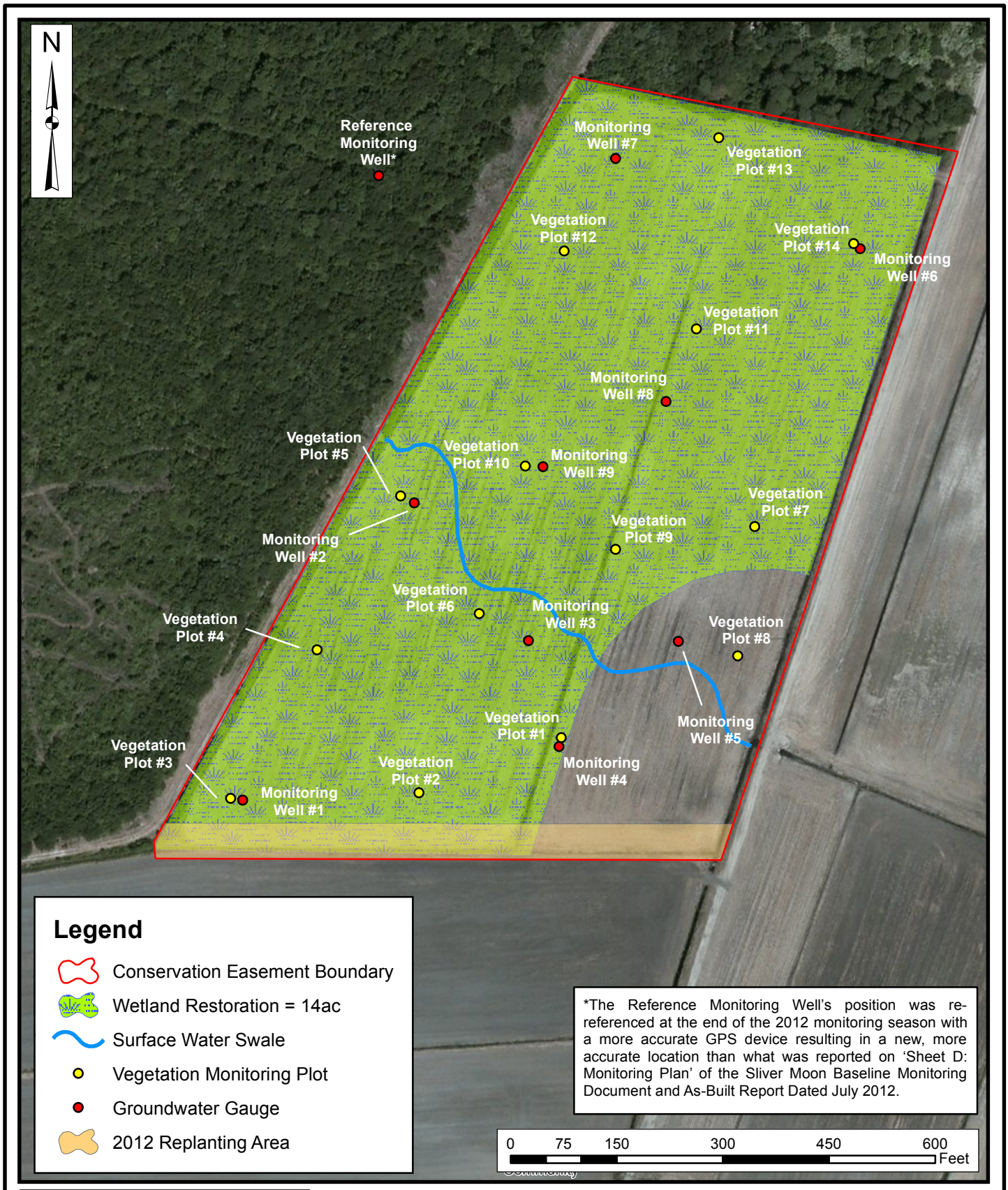
Table 4: Project Baseline Information & Attributes Table

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, EEP Project ID: 95017

Project Information			
Project Name	Sliver Moon		
County	Craven		
Project Area (acres)	17.01		
Project Coordinates (latitude and longitude)	35.204817, -77.360605 (NAD 83/WGS 84)		
Project Watershed Summary Information			
Physiographic Province		Carolina Flatwoods section of the Middle Atlantic Coastal Plain	
River Basin		Neuse	
USGS Hydrologic Unit 8-digit	03020202	USGS Hydrologic Unit 14-digit	03020202080010
DWQ Sub-basin		03-04-08	
Project Drainage Area, Total Outfall (acres)		+/- 130	
Groundwater Treated by Site (acres)		+/- 20	
Project Drainage Area Percentage of Impervious Area		< 1%	
CGIA Land Use Classification		Cropland and Pasture	
Wetland Summary Information			
Parameters		**Wetland 1**	
Size of Wetland (acres)		14.00	
Wetland Type (non-riparian, riparian riverine or riparian non riverine)		Non-riparian	
Mapped Soil Series		Torhunta & Pantego	
Drainage class		Poorly Drained	
Soil Hydric Status		Class A	
Source of Hydrology		Rain Events	
Hydrologic Impairment		Ditches	
Native vegetation community		Non-Riverine Wet Harwood Forest	
Percent composition of exotic invasive vegetation		0%	
Regulatory Considerations			
Regulation		**Applicable?**	**Resolved?**
Waters of the United States – Section 404		Yes	Yes
Waters of the United States – Section 401		Yes	Yes
Endangered Species Act		No	
Historic Preservation Act		No	
Coastal Zone Management Act [CZMA/Coastal Area Management Act (CAMA)]		No	
FEMA Floodplain Compliance		No	
Essential Fisheries Habitat		No	
Sediment & Erosion Control Plan (S&EC)		Yes	Yes

APPENDIX B
VISUAL ASSESSMENT DATA

Figure 2. Current Condition Plan View
Table 5. Vegetation Condition Assessment



Axiom Environmental
218 Snow Ave
Raleigh, NC 27603

CURRENT CONDITION PLAN VIEW
SLIVER MOON WETLAND RESTORATION SITE
Craven County, North Carolina

Dwn. by.	KRJ
Date:	Nov. 2013
Project:	10-001

FIGURE 2

Table 5: Vegetation Condition Assessment

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, EEP Project ID: 95017

Planted Acreage – 17.01 acres (Entire Easement)					
Vegetation Category		**Mapped Acreage**	**CCPV Symbol**	**Number of Polygons**	**% of planted Acreage**
Areas of Concern	No areas of vegetation concern observed at the Site during year 2 (2013) monitoring.	NA	NA	NA	0%
Exotic Invasive Species	No invasive species observed at the Site during year 2 (2013) monitoring.	NA	NA	NA	0%

APPENDIX C
VEGETATION DATA

Table 6. 2013 (Year 2) Planted and Total Stems/Acre
Table 7. Vegetation Plot Criteria Attainment
Table 8. CVS Vegetation Plot Metadata
Vegetation Plot Photographs

Table 6. 2013 (Year 2) Planted and Total Stems/Acre
Sliver Moon Non-riparian Wetland Mitigation Site

			Current Plot Data (MY2 2013)																						
			Sliver M-RS-0001			Sliver M-RS-0002			Sliver M-RS-0003			Sliver M-RS-0004			Sliver M-RS-0005			Sliver M-RS-0006			Sliver M-RS-0007			Sliver M-RS-0008		
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
Acer rubrum	red maple	Tree			6			2			19			22			39			23						24
Baccharis halimifolia	eastern baccharis	Shrub						1												1			5			
Betula	birch	Tree																								
Betula nigra	river birch	Tree													1	1	1									
Carya	hickory	Tree				1	1	1						1												
Liquidambar styraciflua	sweetgum	Tree																								
Liriodendron tulipifera	tuliptree	Tree	2	2	2	3	3	3				1	1	1				2	2	2	1	1	1			
Magnolia virginiana	sweetbay	Tree				2	2	2				1	1	6							2	2	2			
Morella	bayberry	shrub	1	1	1							1	1	1	1	1	1									
Morella cerifera	wax myrtle	shrub				1	1	1				1	1	1										1	1	1
Nyssa	tupelo	Tree	3	3	3	2	2	2	1	1	1				1	1	1									
Nyssa sylvatica	blackgum	Tree							2	2	2	2	2	2	1	1	1									
Persea	bay	Tree																								
Persea palustris	swamp bay	tree				1	1	1	3	3	3															
Pinus taeda	loblolly pine	Tree																								
Quercus	oak	Tree	2	2	2							1	1	1							2	2	2			
Quercus laurifolia	laurel oak	Tree				1	1	1	1	1	1	1	1	1				5	5	5	7	7	7	3	3	3
Quercus michauxii	swamp chestnut oak	Tree										1	1	1							4	4	4	1	1	1
Quercus nigra	water oak	Tree	3	3	3				1	1	1							2	2	2						
Quercus pagoda	cherrybark oak	Tree	2	2	2	2	2	2	1	1	1										1	1	1	3	3	3
Quercus phellos	willow oak	Tree	2	2	2	3	3	3				4	4	4				3	3	3				1	1	1
Rhus copallinum	flameleaf sumac	shrub									1															
Ulmus americana	American elm	Tree									1															
		Stem count	15	15	21	16	16	19	9	9	30	13	13	41	4	4	43	12	12	36	17	17	22	9	9	33
		size (ares)	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		
		Species count	7	7	8	9	9	11	6	6	9	9	9	11	4	4	5	4	4	6	6	6	7	5	5	6
		Stems per ACRE	607	607	849.8	647.5	647.5	768.9	364.2	364.2	1214	526.1	526.1	1659	161.9	161.9	1740	485.6	485.6	1457	688	688	890.3	364.2	364.2	1335

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

Table 6. 2013 (Year 2) Planted and Total Stems/Acre (continued)
Sliver Moon Non-riparian Wetland Mitigation Site

			Current Plot Data (MY2 2013)																	Annual Means								
			Sliver M-RS-0009			Sliver M-RS-0010			Sliver M-RS-0011			Sliver M-RS-0012			Sliver M-RS-0013			Sliver M-RS-0014			MY2 (2013)			MY1 (2012)			MY0 (2012)		
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
Acer rubrum	red maple	Tree			3			4			8			12			6			9			177			6		
Baccharis halimifolia	eastern baccharis	Shrub						1			16			3			1						28			4		
Betula	birch	Tree													1	1	1				1	1	1	1	1	1			
Betula nigra	river birch	Tree										3	3	3	5	5	5				9	9	9	1	1	1			
Carya	hickory	Tree																			1	1	2						
Liquidambar styraciflua	sweetgum	Tree									4			3						2			9						
Liriodendron tulipifera	tuliptree	Tree				6	6	6				2	2	2	3	3	3	6	6	6	26	26	26	28	28	30	27	27	27
Magnolia virginiana	sweetbay	Tree	2	2	2	2	2	2	1	1	1	3	3	3				3	3	3	16	16	21	17	17	17	18	18	18
Morella	bayberry	shrub	1	1	1				1	1	1				3	3	3	1	1	1	9	9	9	9	9	9			
Morella cerifera	wax myrtle	shrub	1	1	1				1	1	1							2	2	2	7	7	7	1	1	1			
Nyssa	tupelo	Tree				6	6	6	4	4	4				1	1	1				18	18	18	15	15	15			
Nyssa sylvatica	blackgum	Tree				1	1	1	1	1	1										7	7	7	11	11	11	20	20	20
Persea	bay	Tree																						1	1	1			
Persea palustris	swamp bay	tree	1	1	1																5	5	5	10	10	10	9	9	9
Pinus taeda	loblolly pine	Tree												2									2			2			
Quercus	oak	Tree																			5	5	5	7	7	7			
Quercus laurifolia	laurel oak	Tree							1	1	1				1	1	1	4	4	4	24	24	24	18	18	18	32	32	32
Quercus michauxii	swamp chestnut oak	Tree	5	5	5																11	11	11	17	17	17	29	29	29
Quercus nigra	water oak	Tree	1	1	1				2	2	2	2	2	2	4	4	4	1	1	1	16	16	16	20	20	20	28	28	28
Quercus pagoda	cherrybark oak	Tree							1	1	1	1	1	1							11	11	11	16	16	16	32	32	32
Quercus phellos	willow oak	Tree							2	2	2	7	7	7	1	1	1				23	23	23	26	26	26	28	28	28
Rhus copallinum	flameleaf sumac	shrub																					1						
Ulmus americana	American elm	Tree																					1						
		Stem count	11	11	14	15	15	20	14	14	42	18	18	38	19	19	26	17	17	28	189	189	413	198	198	212	223	223	223
		size (ares)	1			1			1			1			1			1			14			14			14		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.35			0.35			0.35		
		Species count	6	6	7	4	4	6	9	9	12	6	6	10	8	8	10	6	6	8	16	16	22	16	16	19	9	9	9
		Stems per ACRE	445.2	445.2	566.6	607	607	809.4	566.6	566.6	1700	728.4	728.4	1538	768.9	768.9	1052	688	688	1133	546.3	546.3	1194	572.3	572.3	612.8	644.6	644.6	644.6

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

Table 7. Vegetation Plot Criteria Attainment based on Planted Stems

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, EEP Project ID: 95017

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	93%
2	Yes	
3	Yes	
4	Yes	
5	No*	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	
11	Yes	
12	Yes	
13	Yes	
14	Yes	

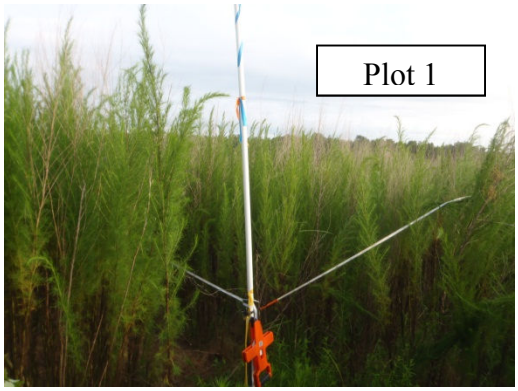
*This plot didn't meet success criteria based on planted stems alone; however, when including naturally recruited stems of red maple (*Acer rubrum*) this plot was well-above success criteria.

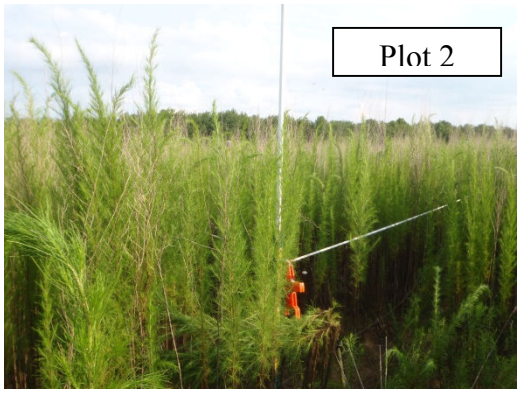
Table 8. CVS Vegetation Plot Metadata

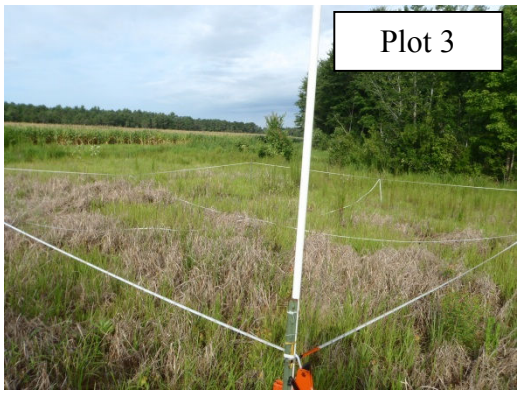
Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, EEP Project ID: 95017

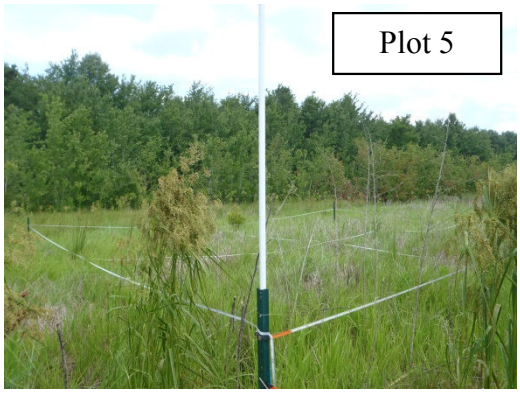
Report Prepared By	Corri Faquin
Date Prepared	8/5/2013 16:05
database name	RS-SliverMoon-Wall-2013-A-v2.3.1.mdb
database location	\\AE-SBS\RedirectedFolders\KJernigan\Desktop
computer name	KEENAN-PC
file size	56918016
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database 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	Sliver M
project Name	Sliver Moon Non-riparian Wetland Mitigation Site
Description	14 ac. Non-riparian wetland Mitigation Site in the Neuse 01 River Basin
River Basin	Neuse
length(ft)	730
stream-to-edge width (ft)	1100
area (sq m)	56000
Required Plots (calculated)	13
Sampled Plots	14

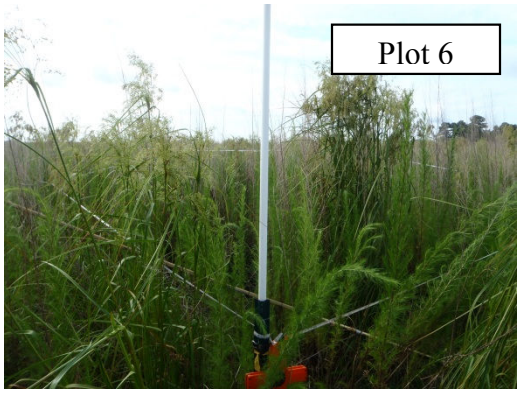
Sliver Moon
2013 (Year 2) Vegetation Monitoring Photographs
Taken July 2013





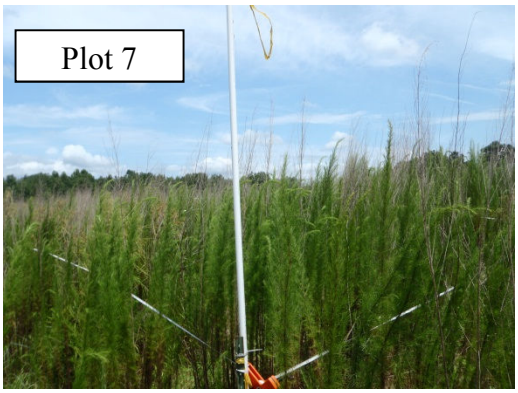




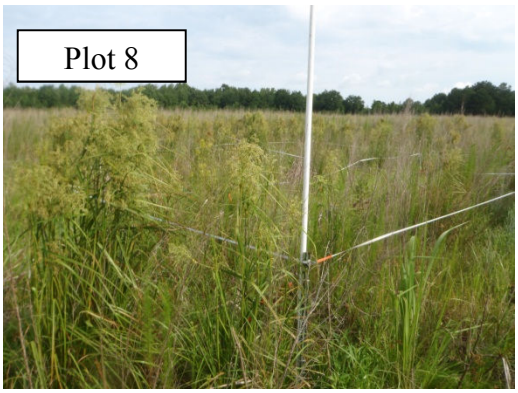


Sliver Moon
2013 (Year 2) Vegetation Monitoring Photographs
Taken July 2013
(continued)

Plot 7



Plot 8



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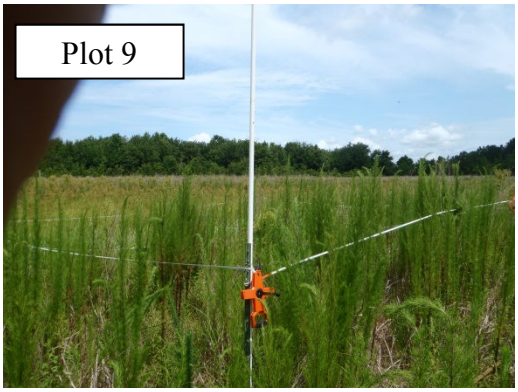
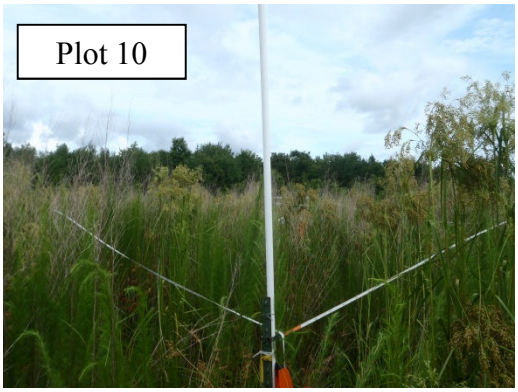
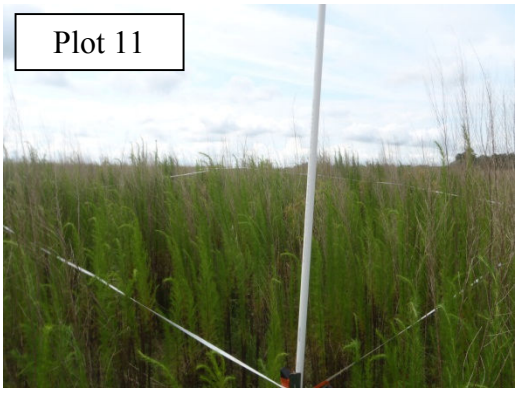


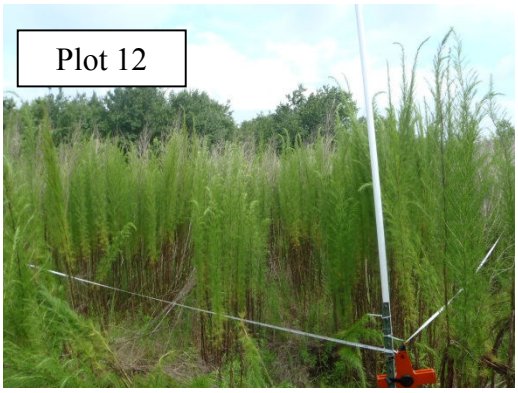
Plot 10



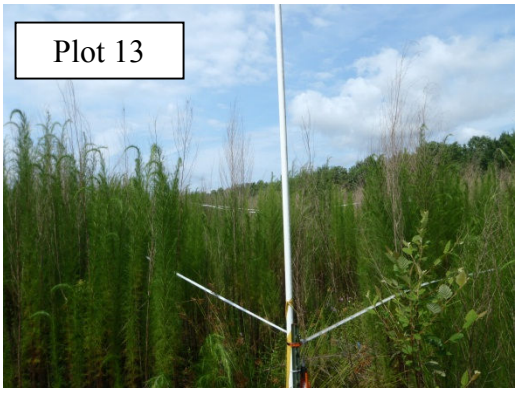
Plot 11



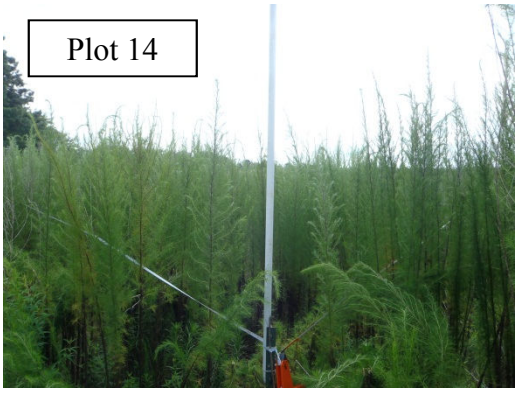
Plot 12



Plot 13



Plot 14



APPENDIX D
HYDROLOGY DATA

Table 9. Wetland Gauge Attainment Data
2013 Groundwater Gauge Graphs

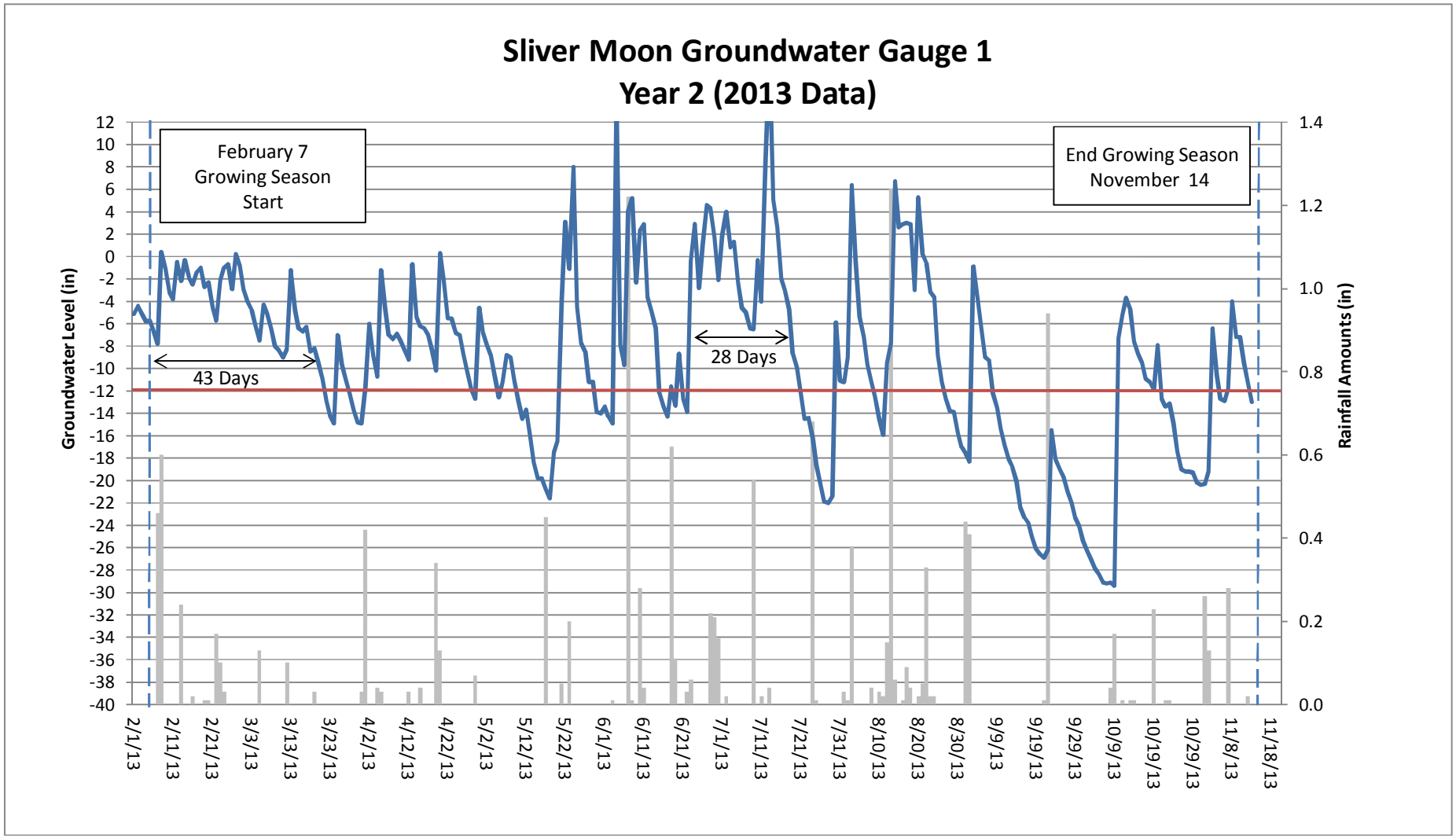
Table 9. Wetland Gauge Attainment Data

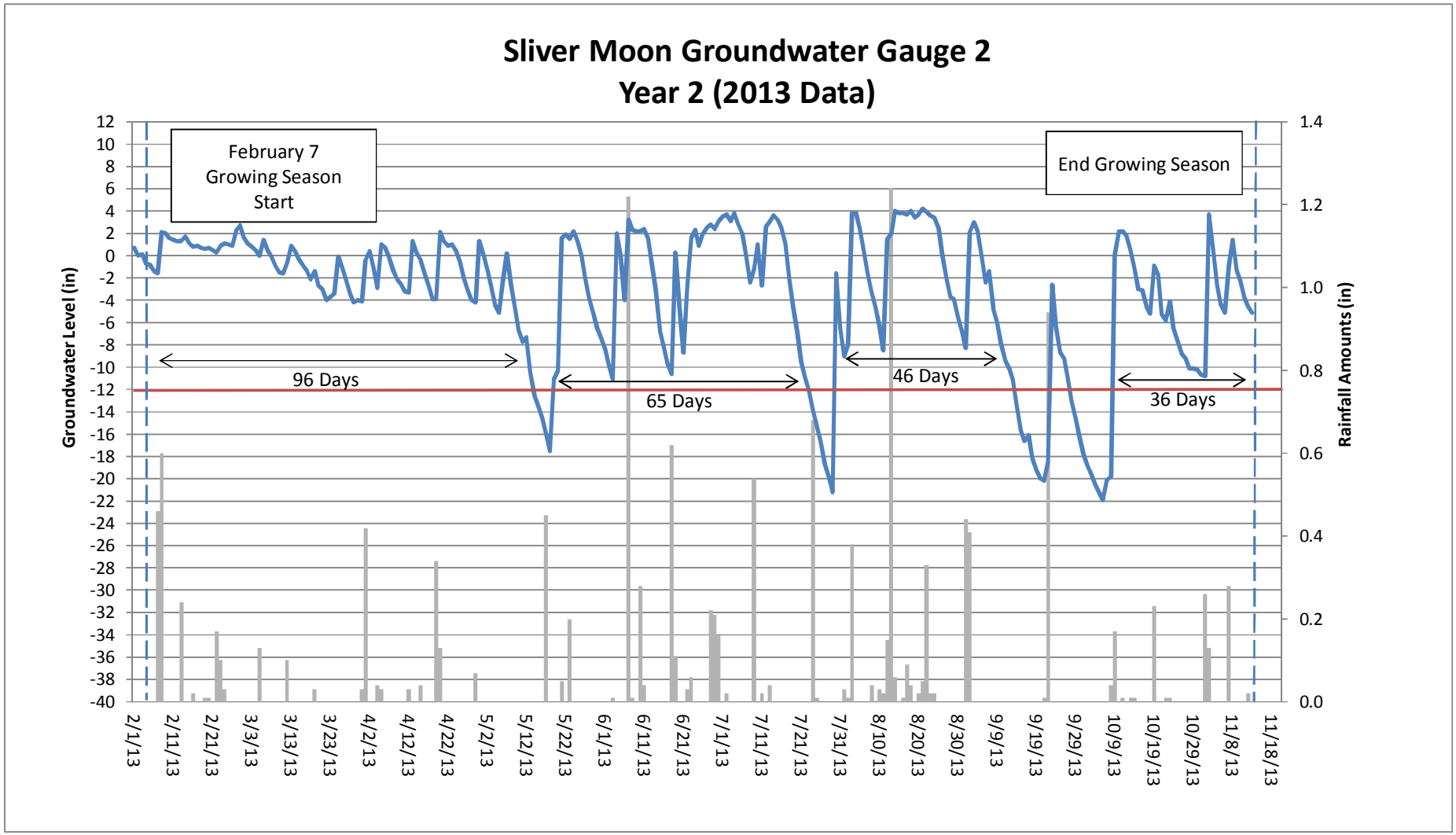
Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, EEP Project ID: 95017

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2012)* March 18 Growing Season Start	Year 2 (2013)** February 7 Growing Season Start	Year 3 (2014)	Year 5 (2016)	Year 7 (2018)
1	Yes/25 days (10.3 percent)	Yes/43 days (15.3 percent)			
2	Yes/117 days (48.3 percent)	Yes/96 days (34.2 percent)			
3	Yes/117 days (48.3 percent)	Yes/95 days (33.8 percent)			
4	No/13 days (5.4 percent)	Yes/29 days (10.3 percent)			
5	Yes/76 days (31.4 percent)	Yes/92 days (32.7 percent)			
6	Yes/24 days (9.9 percent)	Yes/43 days (15.3 percent)			
7	Yes/40 Days (16.5 percent)	Yes/93 days (33.1 percent)			
8	Yes/97 days (40.1 percent)	Yes/93 days (33.1 percent)			
9	Yes/42 days (17.4 percent)	Yes/67 days (23.8 percent)			
Ref	Yes/102 days (42.1 percent)	Yes/91 days (32.4 percent)			

* Groundwater gauges were installed at the Site on March 24, six days after the published NRCS growing season start date (March 18). Therefore, Year 1 (2012) hydrology success criteria is proposed to use the USDA published growing season dates in place of the proposed biological and physical indicators of growing season as described for the Site.

**Based on biological and physical indicators for the site, February 7 was determined the start of the growing season for year 2 (2013) monitoring.


Sliver Moon Groundwater Gauge 1
Year 2 (2013 Data)
Groundwater Level (in)
Rainfall Amounts (in)
February 7
Growing Season
Start
End Growing Season
November 14
43 Days
28 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
8/30/13
9/9/13
9/19/13
9/29/13
10/9/13
10/19/13
10/29/13
11/8/13
11/18/13


Sliver Moon Groundwater Gauge 2
Year 2 (2013 Data)
February 7
Growing Season
Start
End Growing Season
96 Days
65 Days
46 Days
36 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
8/30/13
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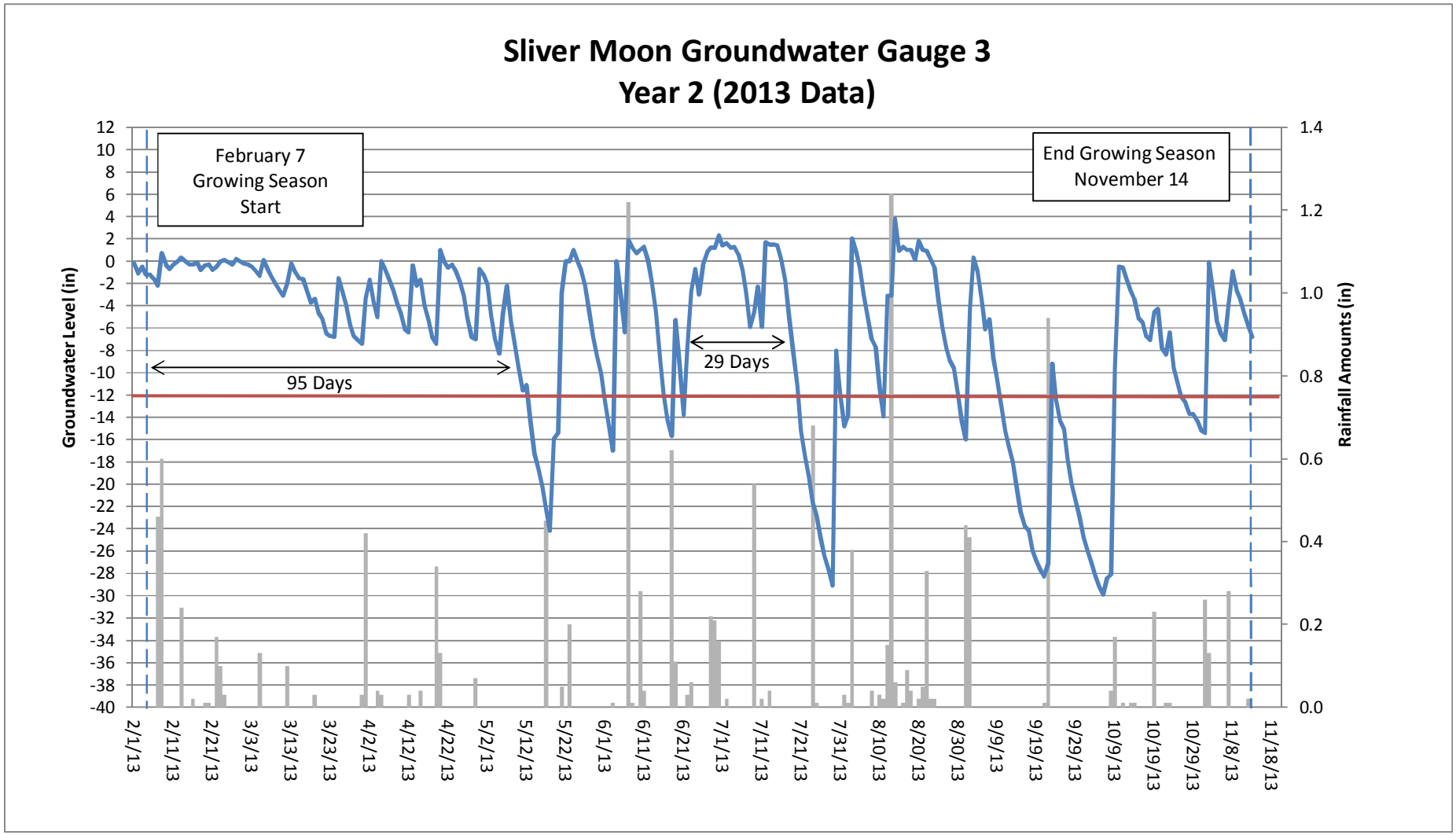
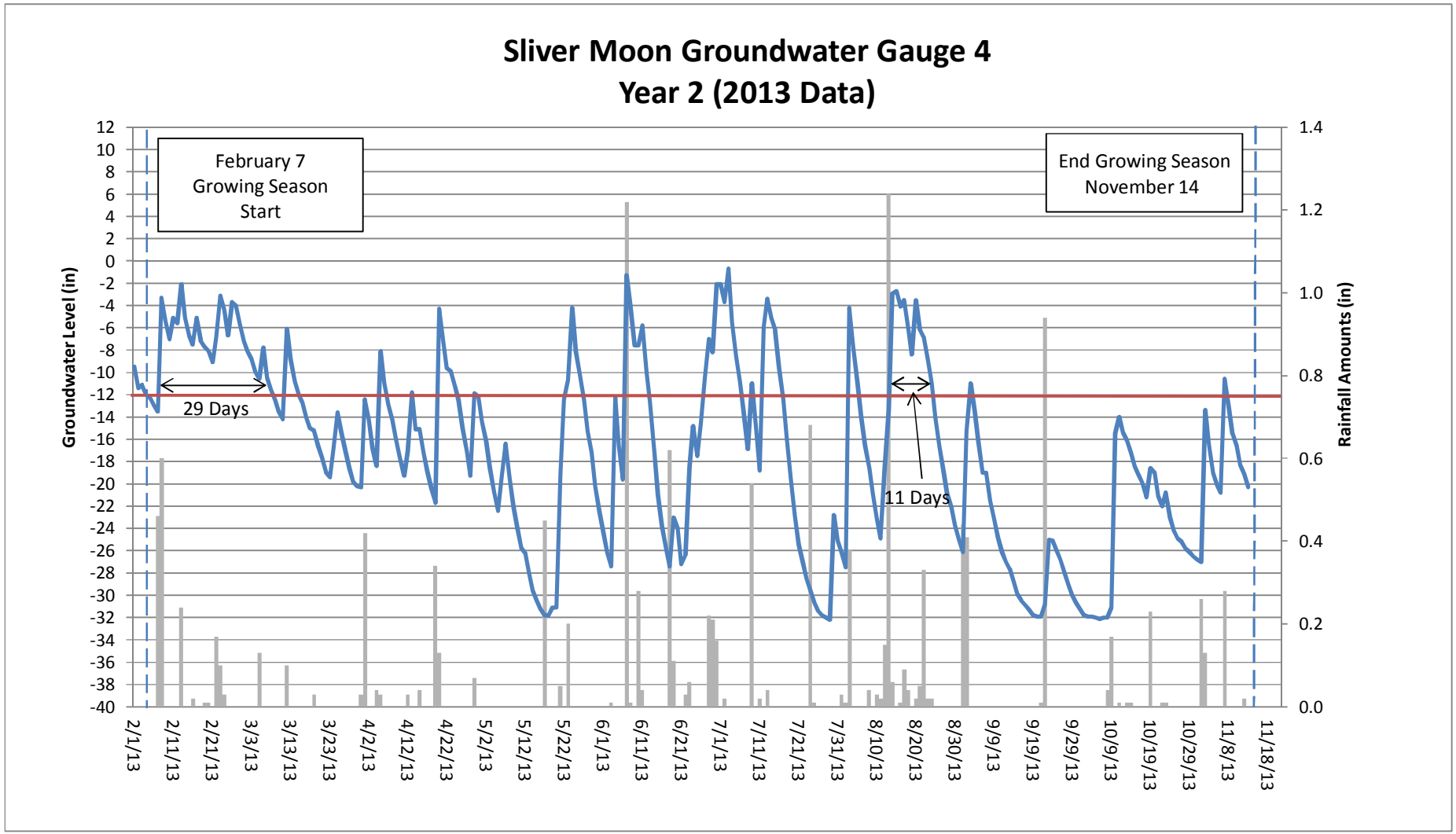
10/29/13
11/8/13
11/18/13


Sliver Moon Groundwater Gauge 3
Year 2 (2013 Data)
February 7
Growing Season
Start
End Growing Season
November 14
95 Days
29 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
8/30/13
9/9/13
9/19/13
9/29/13
10/9/13
10/19/13
10/29/13
11/8/13
11/18/13


Sliver Moon Groundwater Gauge 4
Year 2 (2013 Data)
February 7
Growing Season
Start
End Growing Season
November 14
29 Days
11 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
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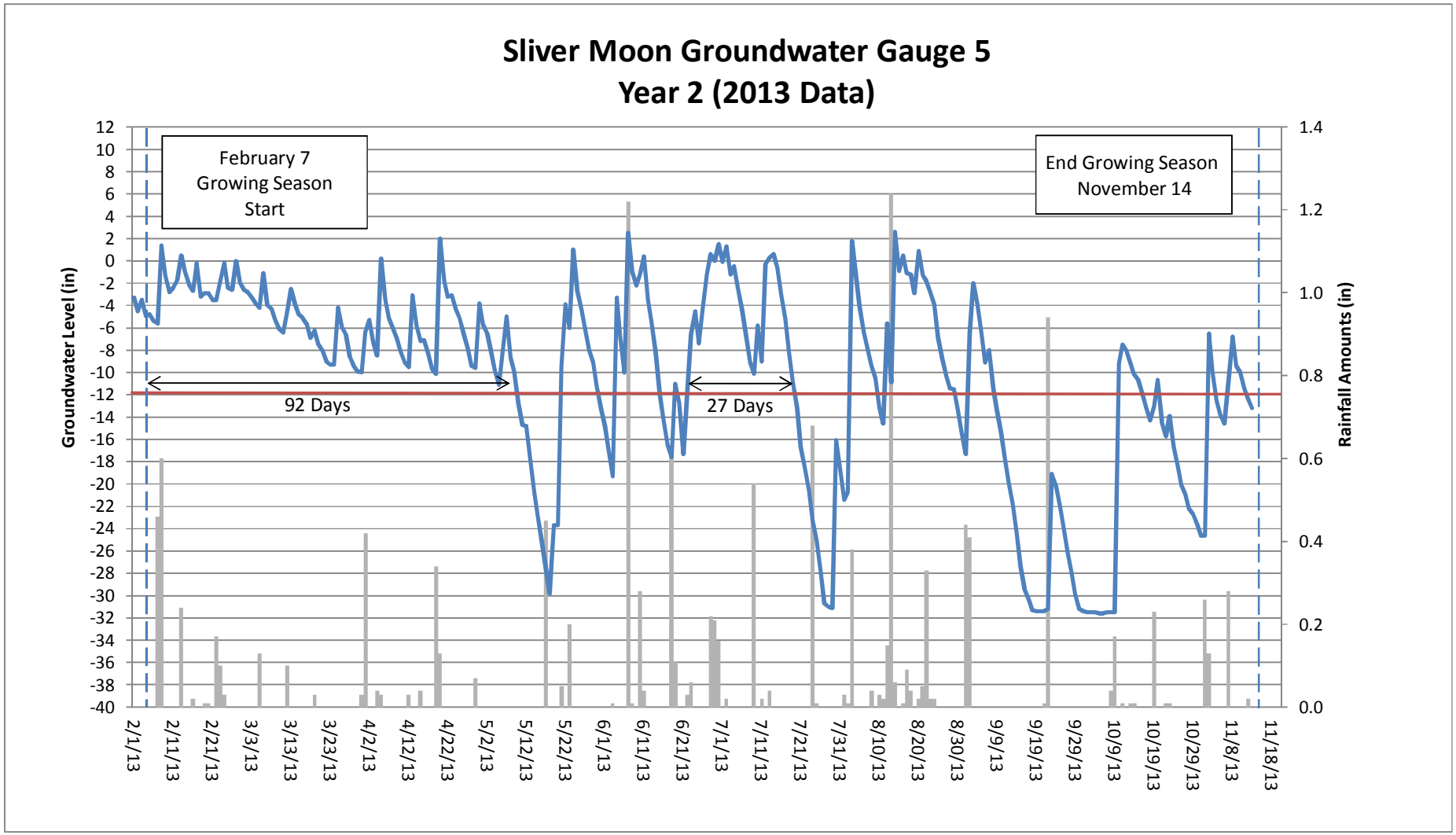
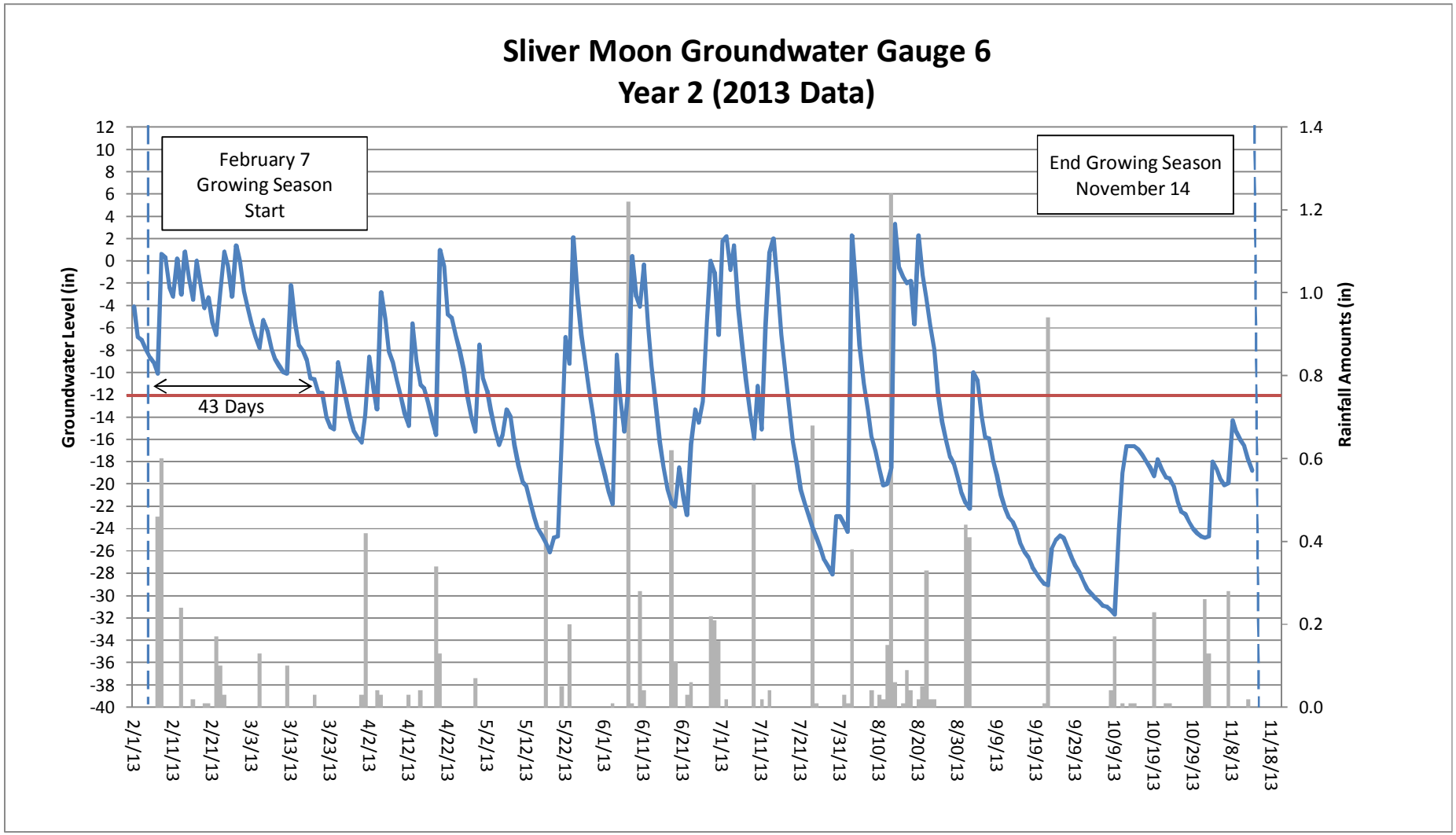
10/29/13
11/8/13
11/18/13


Sliver Moon Groundwater Gauge 5
Year 2 (2013 Data)
February 7
Growing Season
Start
End Growing Season
November 14
92 Days
27 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
8/30/13
9/9/13
9/19/13
9/29/13
10/9/13
10/19/13
10/29/13
11/8/13
11/18/13


Sliver Moon Groundwater Gauge 6
Year 2 (2013 Data)
February 7
Growing Season
Start
End Growing Season
November 14
43 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
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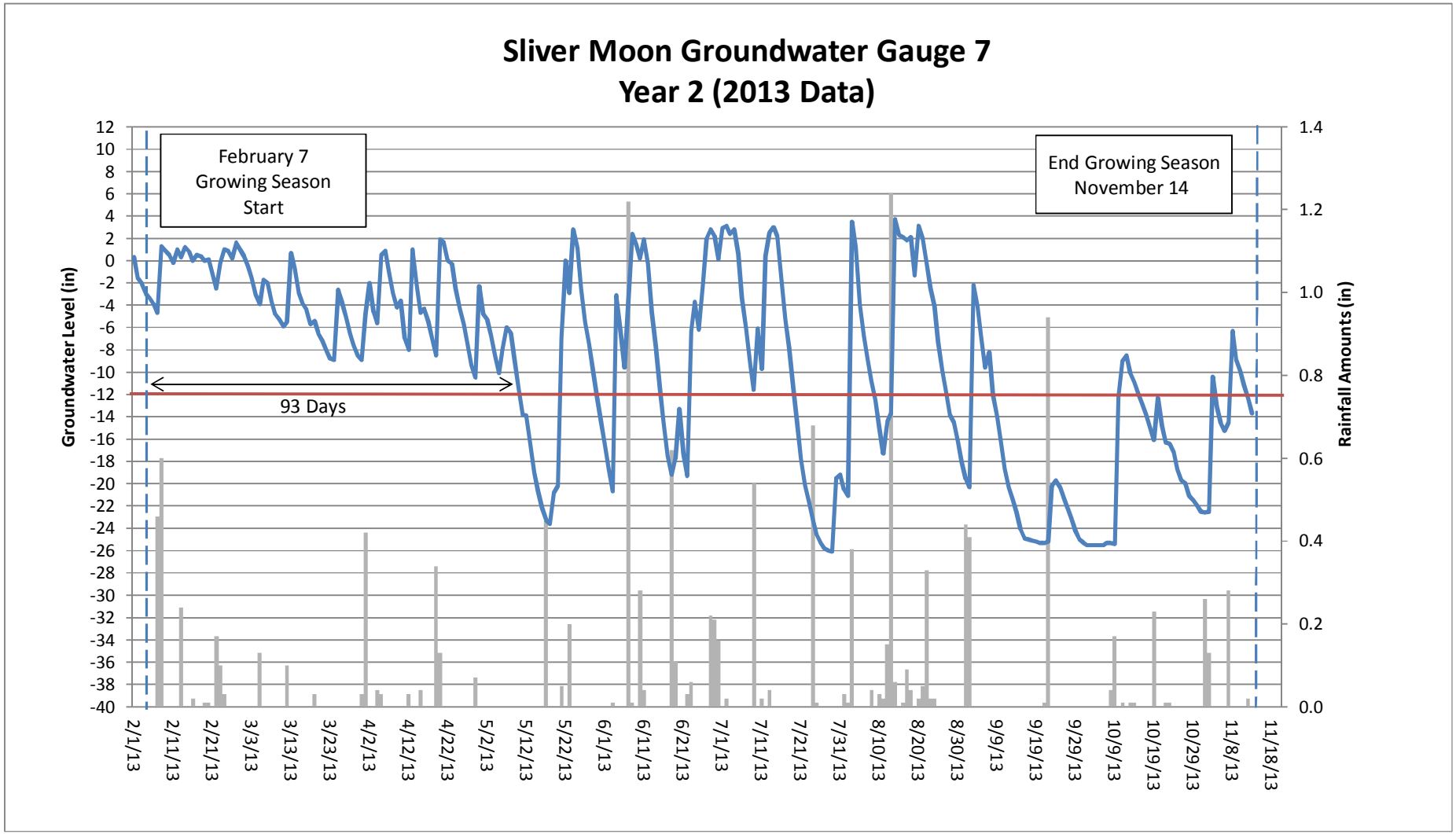
11/8/13
11/18/13


Sliver Moon Groundwater Gauge 7
Year 2 (2013 Data)
February 7
Growing Season
Start
End Growing Season
November 14
93 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
8/30/13
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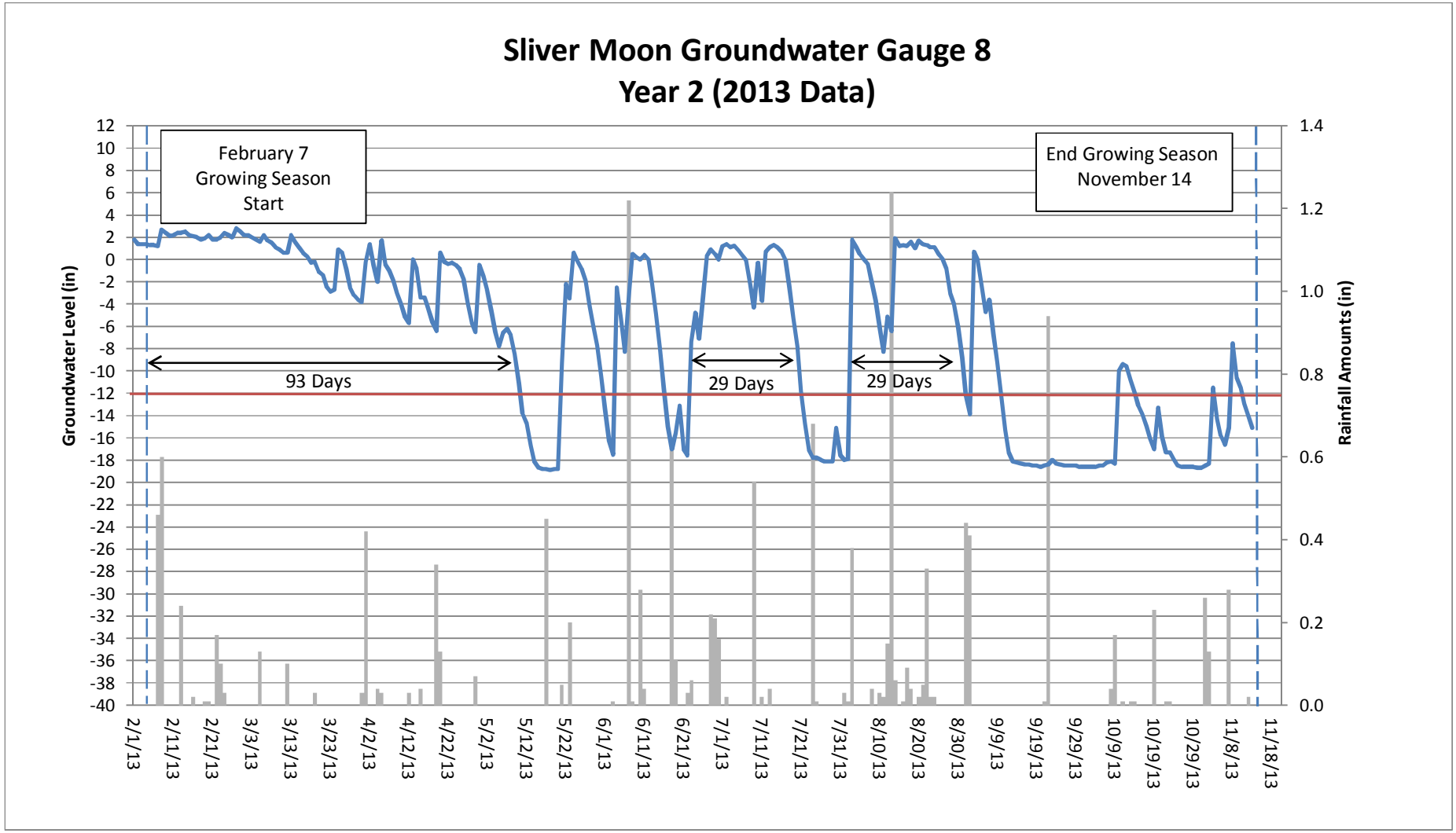
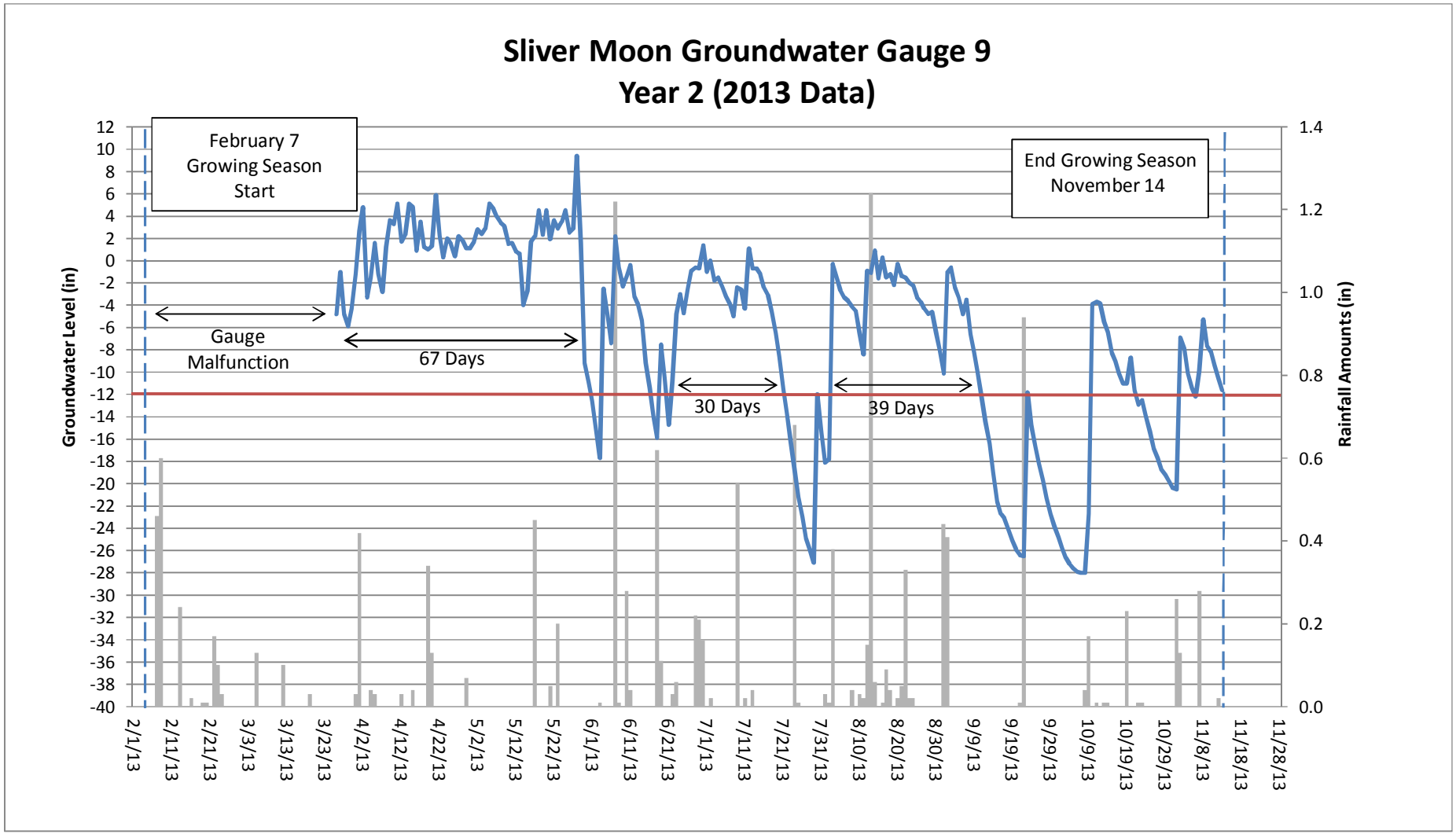
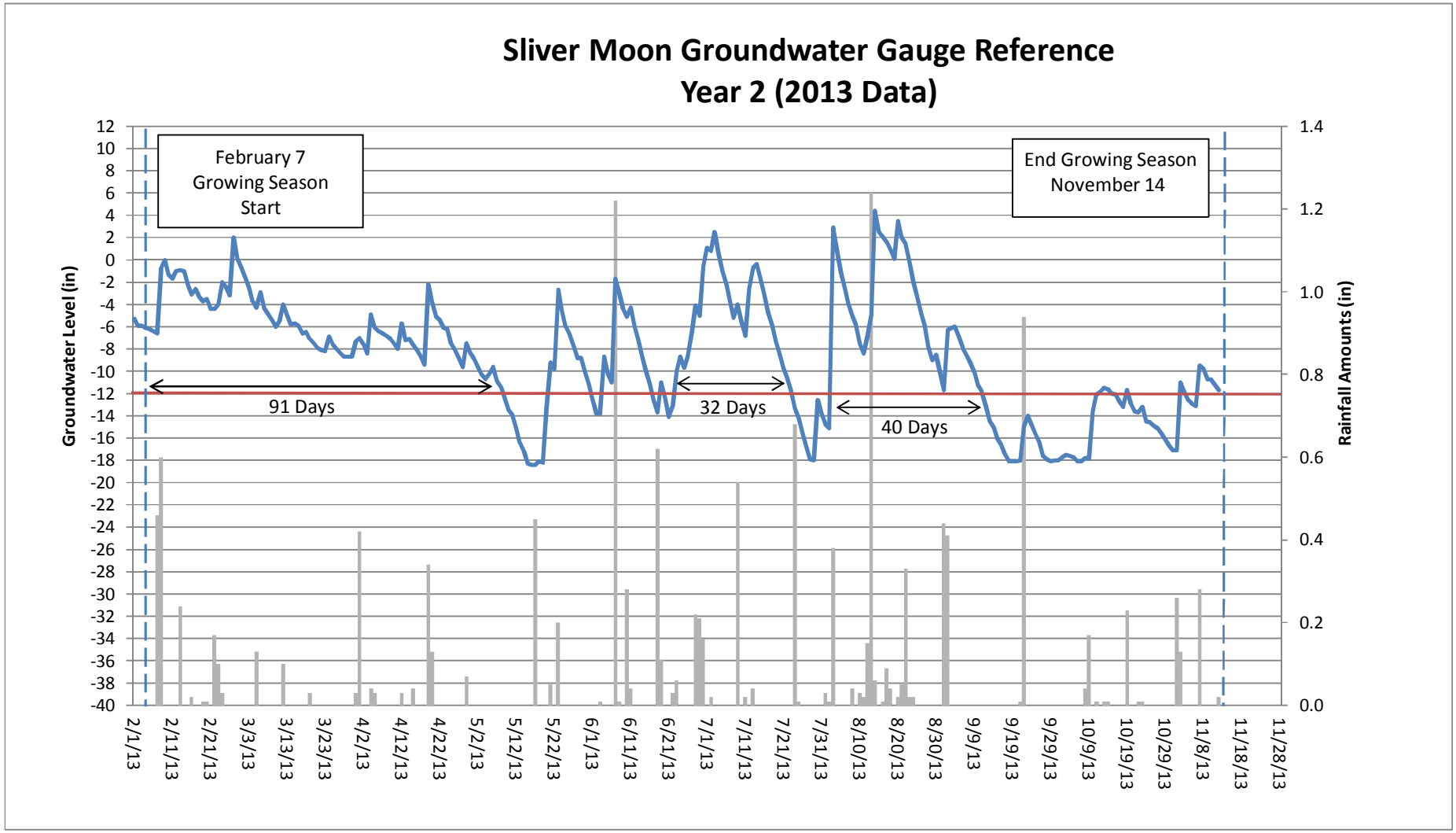
10/9/13
10/19/13
10/29/13
11/8/13
11/18/13


Sliver Moon Groundwater Gauge 8
Year 2 (2013 Data)
February 7
Growing Season
Start
End Growing Season
November 14
93 Days
29 Days
29 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
8/30/13
9/9/13
9/19/13
9/29/13
10/9/13
10/19/13
10/29/13
11/8/13
11/18/13


Sliver Moon Groundwater Gauge 9
Year 2 (2013 Data)
February 7
Growing Season
Start
End Growing Season
November 14
Gauge
Malfunction
67 Days
30 Days
39 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
8/30/13
9/9/13
9/19/13
9/29/13
10/9/13
10/19/13
10/29/13
11/8/13
11/18/13
11/28/13


Sliver Moon Groundwater Gauge Reference
Year 2 (2013 Data)
February 7
Growing Season
Start
End Growing Season
November 14
91 Days
32 Days
40 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2/1/13
2/11/13
2/21/13
3/3/13
3/13/13
3/23/13
4/2/13
4/12/13
4/22/13
5/2/13
5/12/13
5/22/13
6/1/13
6/11/13
6/21/13
7/1/13
7/11/13
7/21/13
7/31/13
8/10/13
8/20/13
8/30/13
9/9/13
9/19/13
9/29/13
10/9/13
10/19/13
10/29/13
11/8/13
11/18/13
11/28/13