

# Monitoring Report Year 2

## Watts Site

DMS Project No. 413  
NCDENR Contract # 6113  
USACE Action ID SAW-2005-11813  
NCDWR Project # 05-1354v2  
State Construction Project No. 09-07804-01A-01-1  
Perquimans County, NC



Prepared for the  
NC Department of Environmental Quality  
Division of Mitigation Services

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North Carolina Department of Environmental Quality

Submission Date: **November 2016**

Data Collection Date: **August 2016**

**Prepared by:**



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*This assessment and report are consistent with NCDENR Division of Mitigation Services Template Version Feb. 2014 for Baseline Monitoring Document Format, Data Requirements and Content Guidance.*

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## 1.0 PROJECT SUMMARY

### 1.1 Project History and Background

The Watts Property (Site) is in eastern Perquimans County, approximately 13 miles southeast of US-17 on Norma Drive. The Site is owned in fee by the State of North Carolina. To access the Site from Hertford, drive north along US-17 and turn right onto New Hope Rd and follow for approximately 13 miles and turn left on Little River Shores Rd, turn left onto Tuscarora Trail and left on Norma Dr. The Site is on the left approximately 0.1 mile down Norma Dr. It is situated in the Coastal Plain physiographic region and the Pasquotank River Basin (Hydrologic Unit 03010205).

The Site encompasses approximately 48 acres of former agriculture land and has a direct hydrologic connection with the Little River. The Site watershed consists of agricultural land and forest. There is no impervious area within the drainage area. The drainage area for the Site is 136 acres at the lower end of the stream.

Prior to construction activities the stream was deepened and channelized and the surrounding wetland complex was drained for row crop agricultural production. These modifications resulted in significant alterations to surface and groundwater hydrology in addition to degraded aquatic and terrestrial habitats within the Site.

### 1.2 Project Goals and Objectives

The Site is located in the Pasquotank River Basin; eight digit CU 03010205 and the 14-digit HUC 03010205060020. The Pasquotank River Basin Restoration Priorities (EEP, 2009) restoration goals for CU 03010205 include supporting implementation of the NC Coastal Habitat Protection Plan (NCCHPP). The following are the goals of the NCCHPP:

- Improve effectiveness of existing rules and programs protecting coastal fish habitats
- Identify, designate, and protect strategic habitat areas.
- Enhance habitat and protect it from physical impacts.
- Enhance and protect water quality.

In addition to the above mentioned CU goals the following are Site specific goals established in the mitigation plan (NCDENR, 2012):

- Restore ditched wetlands to improve the habitat, fishery and flood control functions;
- Reduce sediment loading and other pollutants from the surface runoff by increasing the soils retention, filtration and nutrient uptake functions of wetland and riparian areas;
- Restore and protect wildlife corridors and other key links to high value habitat areas; and
- Restore and protect natural breeding, nesting and feeding habitat to promote species richness and diversity.

The goals established in the 2012 mitigation plan were addressed through the following project objectives:

- Promote wetland hydrology by filling drainage ditches;
- Reduce pollutant runoff by grading the headwater valley for increased residence time of stormflows;
- Promote wildlife habitat by reforestation with native hardwoods.

### 1.3 Project Success Criteria

The stream and wetland restoration success criteria for the Site were established in the approved mitigation plan. The success criteria were discussed with the Interagency Review Team (IRT) during the finalization of the mitigation plan. The agreed upon success criteria are a compromise between the current requirements in the Monitoring Requirements and Performance Standards for Compensatory Mitigation in North Carolina (USACE, 2013) and the success criteria found in the Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina (USACE, 2005) which was the current reference document when the Site was originally acquired for mitigation.

The stream and wetland restoration and enhancement sections of the project were assigned specific performance criteria components for hydrology, vegetation and morphology (streams only). Performance criteria will be evaluated for a minimum of five years post-construction monitoring. If all performance criteria have been met the Division of Mitigation Services (DMS) may propose the Site for closeout after five years of monitoring.

The project success criteria for stream, wetland and vegetation are as follows:

- Stream restoration success includes visual documentation of flow within the low point of the valley, during monitoring years 1-4 and visual documentation of a primary flow path, stream channel or ordinary high water mark, post monitoring year 4;
- Wetland hydrology success will include a minimum of a 8% hydroperiod in years of normal of rainfall;
- Vegetation success will include stem densities of 320 stems/acre in MY3 and 260 stems/acre in MY5.

Two pressure transducers were installed but are not related to project success. The information gathered from the transducers will be included in the monitoring report as supplemental data.

### 1.4 Annual Monitoring Results

The headwater channel was visually assessed two times throughout MY2 for success criteria. During the winter the channel exhibited several visual indicators for the MY 1-4 success criteria. Wrack lines were observed adjacent to the channel, vegetation was laid over in the direction of stream flow, and standing water was also observed (Appendix D). The stream restoration met the success criteria described in the mitigation plan. Additionally, the three (3) cross-sections were stable throughout MY2 and both pressure transducers demonstrated 36 consecutive days of surface water.

Six groundwater gauges were installed to determine the wetland hydroperiod. Four of the six groundwater gauges met the minimum 8% hydroperiod; successful hydroperiods ranged from 18.6% to 26.3%. Two gauges (no. 3 and no. 5) did not meet the success criteria. The on-site rain gauge experienced above average rainfall for the months of April through July. It is expected the Site will continue to recharge groundwater.

Eight CVS vegetation plots and eight random strip plots have been established to monitor vegetation success. The random strip plot totals include planted and volunteer hardwood trees. Seven of the CVS vegetation plots met success criteria of 320 planted stems/acre. Vegetation plot 1 (VP1) did not meet the success criteria with the inclusion of planted and volunteer specimens. The planted densities ranged from 283 to 1,052 stems per acre. Five of the eight random plots met the MY2 success criteria; the densities ranged from 122 to 810 stems per acre. Areas with thicker herbaceous vegetation had lower stem densities across the site.

## 2.0 METHODOLOGY

Vegetation plot monitoring data were collected following the standard CVS-EEP Protocol for Recording Vegetation, Level II, Version 4.2 (Lee et al. 2008). Strip plot data was collected in 25m X 4m plots spaced at random throughout the site. The rain gauge, groundwater gauges and pressure transducers are monitored quarterly. The rain gauge was replaced in June of 2016 due to inaccurate data collection. Rain data from the CRONOS website, gauge KECG, was used in addition to on-site rain data. Information for the CCPV was collected using a Garmin GPS.

## 3.0 REFERENCES

- Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2008. CVS-EEP Protocol for Recording Vegetation Version 4.2. Available at: <http://cvs.bio.unc.edu/protocol/cvs-eep-protocol-v4.2-lev1-2.pdf>.
- NCDENR Division of Mitigation Services, 2009. Pasquotank River Basin Restoration Priorities, September 2009. Available at [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=336f3816-416e-4ee1-854e-056021e726f8&groupId=60329](http://portal.ncdenr.org/c/document_library/get_file?uuid=336f3816-416e-4ee1-854e-056021e726f8&groupId=60329).
- NCDENR Division of Mitigation Services, 2012. Watts Final Mitigation Plan. Prepared by Ecological Engineering, LLP.
- NCDENR Division of Mitigation Services, 2014. Annual Monitoring and Closeout Reporting Format, Data Requirements, and Content Guidance. Available at: [http://portal.ncdenr.org/c/document\\_library/get\\_file?p\\_l\\_id=60409&folderId=18877169&name=DLFE-86604.pdf](http://portal.ncdenr.org/c/document_library/get_file?p_l_id=60409&folderId=18877169&name=DLFE-86604.pdf)
- NCDENR Division of Water Quality (NCDWQ), 2010. Basin Overview, Pasquotank River Subbasin 03-01-52. Available at: [http://h20.enr.state.nc.us/tmdl/documents/303d\\_Report.pdf](http://h20.enr.state.nc.us/tmdl/documents/303d_Report.pdf).
- North Carolina State Climate Office, 2010. Elizabeth City Station, Available: <http://www.ncclimate.ncsu.edu/cronos/normals.php?station=312719>
- US Army Corps of Engineers, 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. AD/A176.
- US Army Corps of Engineers, 2013. Monitoring Requirements and Performance Standards for Compensatory Mitigation in North Carolina. Wilmington, NC.
- US Army Corps of Engineers and NCDENR Division of Water Quality (USACE & NCDWQ), 2005. Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina. Wilmington, NC.

## Appendix A

### Project Information Tables

**Table 1. Project Components and Mitigation Credits**  
Watts/ 413

Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	1,003				20.4	0.04			

Project Components							
Project Component	Stationing/Location	Existing Footage/ Acreage		Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
UT Little River	10+00 to 25+05	1,505		CPHSR*	Restoration	1,505	1.5:1
Non-Riparian Wetland	n/a	0 ac		n/a	Restoration	20.4	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	1,505			20.4		26.8
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						
HQ Preservation						

BMP Elements			
Element	Location	Purpose/Function	Notes

**BMP Elements**  
 \* CPHSR= Coastal Plain Headwater Stream Restoration (USACE et. al., 2007) BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer.



**Table 2. Project Activity and Reporting History**  
Watts/ 413

<b>Activity or Report</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Mitigation Plan	October-11	November-12
Final Design - Construction Plans	June-10	June-13
Construction		February-15
Temporary S&E Mix Applied to Entire Project Area		June-14
Permanent Seed Mix Applied to Streamside		June-14
Bare Root, Live Stake and Tubling Plantings Applied		December-14 & March-15
Baseline Monitoring Document	January-15 & April-15	May-15
Year 1 Monitoring	December-15	December-15
Site Replant	N/A	February-16
Year 2 Monitoring	August-16 & November-16	November-16
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

**Table 3. Project Contact Table**  
Watts/ 413

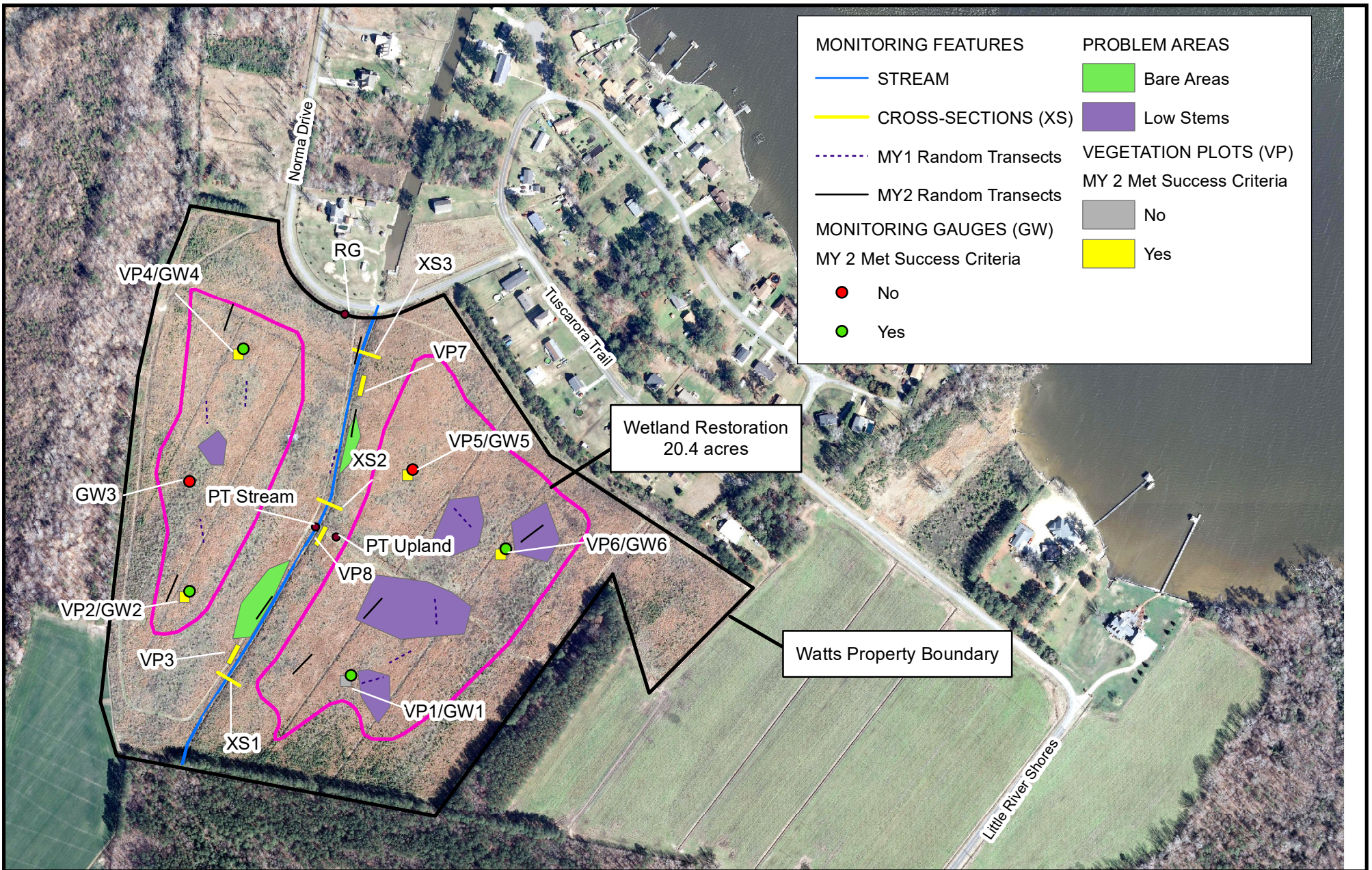
<b>Designer</b> Ecological Engineering, LLP Jenny S. Fleming, PE	<b>Firm Information/ Address</b> 1151 SE Cary Parkway Ste. 101, Cary, NC 27518 (919) 557-0929
<b>Construction Contractor</b> River Works, Inc. Bill Wright	<b>Firm Information/ Address</b> 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
<b>Planting Contractors</b> River Works, Inc. George Morris	<b>Firm Information/ Address</b> 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Keller Environmental, LLC Jay Keller	7921 Haymarket Ln. Raleigh, NC 27615 919-749-8259
<b>Seeding Contractor</b> River Works, Inc. George Morris	<b>Firm Information/ Address</b> 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
<b>Seed Mix Sources</b>	Green Resource (336) 855-6363
<b>Nursery Stock Suppliers</b>	ArborGen (843) 851-4129 Claridge Nursery 919-857-4801 Dykes and Son Nursery 931-668-8833
<b>Monitoring Performer</b> Ecological Engineering, LLP G. Lane Sauls Jr. (stream, vegetation & wetland)	<b>Firm Information/ Address</b> 1151 SE Cary Parkway Ste. 101, Cary, NC 27518 (919) 557-0929

**Table 4. Project Baseline Information and Attributes**  
Watts/ 413

Project Information		
Project Name	Watts	
County	Perquimans County	
Project Area	48.09 acres	
Project Coordinates (latitude and longitude)	36.1652791 N and 76.2676037 W	
Project Watershed Summary Information		
Physiographic Province	Coastal Plain	
River Basin	Pasquotank	
USGS Hydrologic Unit 8-digit	3010205	USGS Hydrologic Unit 14-digit
		3010205060020
DWQ Subbasin	03-01-52	
Project Drainage Area	136 acres	
Project Drainage Area Percentage of Impervious Area	0 acres	
CGIA Land Use Classification	Agricultural Land	
Reach Summary Information		
Parameters	Reach 1 (upper)	Reach 2
Length of Reach	750	755
Valley Classification	n/a	n/a
Drainage Area	110	136
NCDWQ Stream ID Score	25	33.25
NCDWQ Water Quality Classification	SC (receiving water)	SC (receiving water)
Morphological Description (stream type)	G5 or similar	G5 or similar
Evolutionary Trend	C to G to F	C to G to F
Underlying Mapped Soils	Roanoke silt loam	Roanoke silt loam
Drainage Classification	Poorly drained	Poorly drained
Soil Hydric Status	Hydric A	Hydric A
Slope	< 2%	< 2%
FEMA Classification	Zone AE	Zone AE
Native Vegetation Community	N/A	N/A
Percent Composition of Exotic Invasive Species	< 5%	< 5%
Wetland Summary Information		
Size of Wetland	0.06 acre	
Wetland Type	Hardwood Flat (NCWAM)	
Mapped Soil Series	Roanoke silt loam	
Drainage Classification	Poorly drained	
Soil Hydric Status	Hydric A	
Source of Hydrology	Groundwater and Surface	
Hydrologic Impairment	Clay confining layer	
Native Vegetation Community	N/A	
Percent Composition of Exotic Invasive Species	< 5%	
Regulatory Considerations		
	Applicable	Resolved/ Supporting Documentation
Waters of the United States - Section 404	Yes	Resolved/ 404 Permit
Waters of the United States - Section 401	Yes	Resolved/401 Permit
Endangered Species Act	Yes	Resolved/Categorical Exclusion
Historic Preservation Act	Yes	Resolved/Categorical Exclusion
Coastal Zone/Area Management Acts (CZMA/CAMA)	Yes	Resolved/Email from CAMA
FEMA Floodplain Compliance	Yes	Resolved/EEP Flood Checklist
Essential Fisheries Habitat	Yes	Resolved/Categorical Exclusion

## Appendix B

### Visual Assessment Data



Prepared For:



**Figure 1: Current Condition Plan View (CCPV)**  
**Watts Property**  
**DMS Project # 413**  
**Monitoring Year 2**

Perquimans County

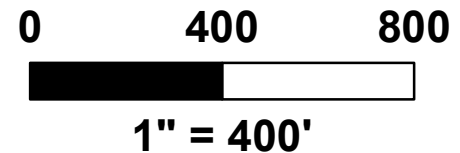


Table 5. Vegetation Condition Assessment		Watts DMS # 413				
Planted Acreage 23.9 Easement Acreage 48.1		Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material	0.1 ac	Yes	2	0.48	2.01%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY 3, 4, or 5 stem count criteria	0.1 ac	Yes	5	2.4	10.04%
<b>Total</b>				<b>7</b>	<b>1.72</b>	<b>12.05%</b>
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that is obviously small given the monitoring year	0.25 ac	n/a	0	0	0%
<b>Cumulative Total</b>				<b>7</b>	<b>1.72</b>	<b>12.05%</b>

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% Planted Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	0.1 ac	No	0	0	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	0.1 ac	No	0	0	0.0%

**Photostation Comparison**  
Watts- MY 2 (2016)

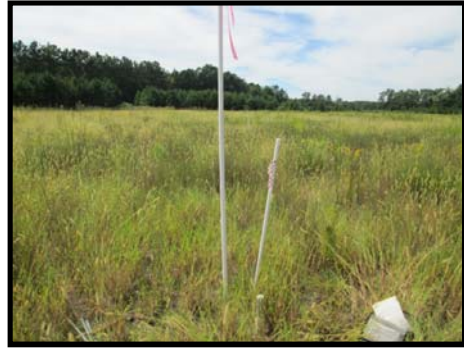
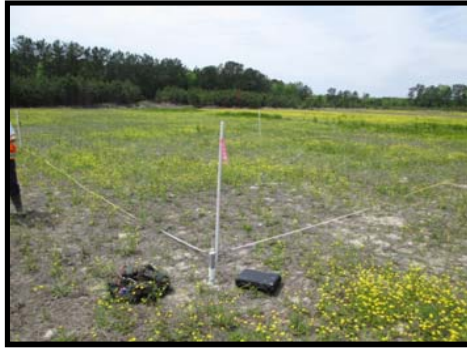
**Photo # and Location**

**Baseline Condition 2015**

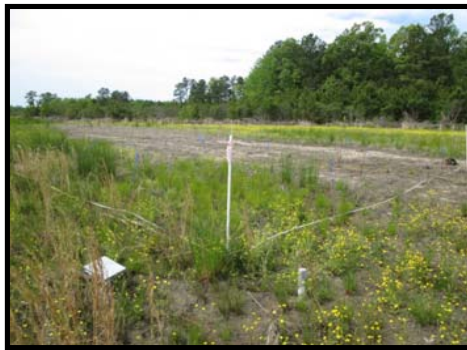
**MY 1 2015 (9/16/2015)**

**MY 2 2016 (8/4/2016)**

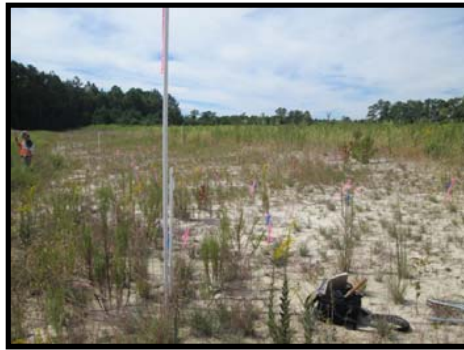
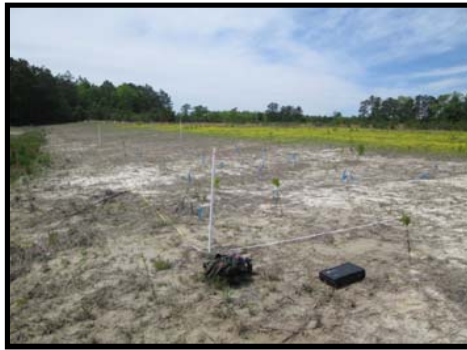
Photostation 1.  
Facing southwest  
along diagonal of  
Vegetation Plot 1.



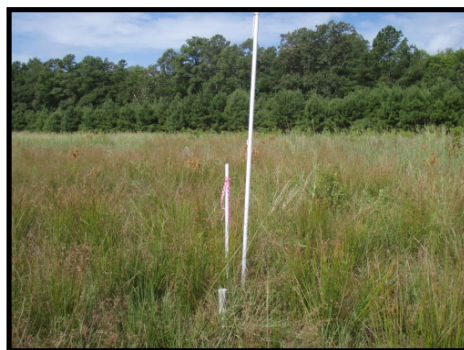
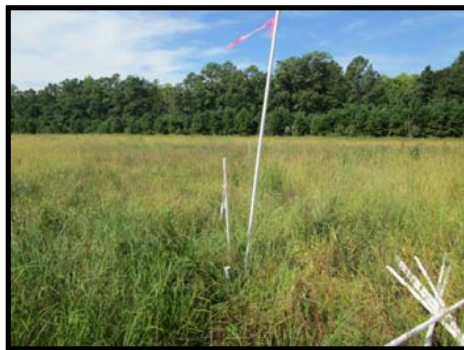
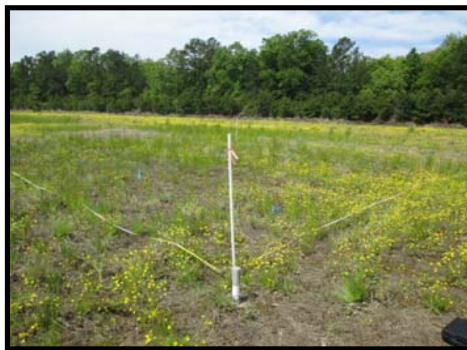
Photostation 2.  
Facing southwest  
along diagonal of  
Vegetation Plot 2.



Photostation 3.  
Facing southwest  
along diagonal of  
Vegetation Plot 3.



Photostation 4.  
Facing southwest  
along diagonal of  
Vegetation Plot 4.



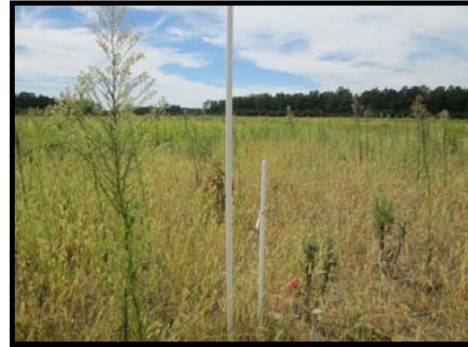
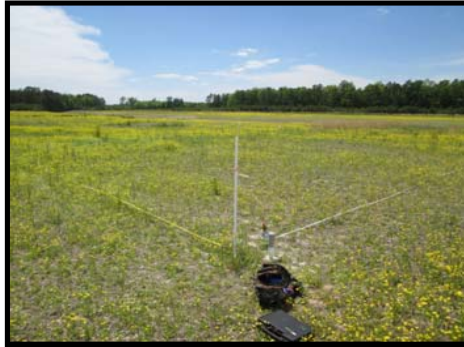
**Photostation  
Comparison -  
Page 2**

**Baseline Condition 2015**

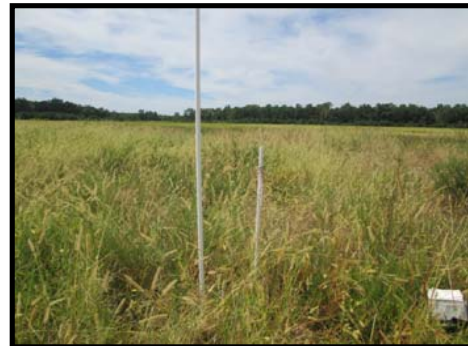
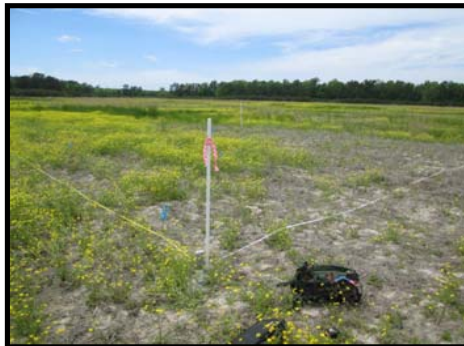
**MY 1 2015 (9/16/2015)**

**MY 2 2016 (8/4/2016)**

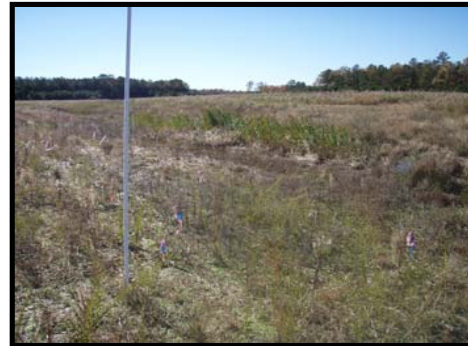
Photostation 5.  
Facing southwest  
along diagonal of  
Vegetation Plot 5



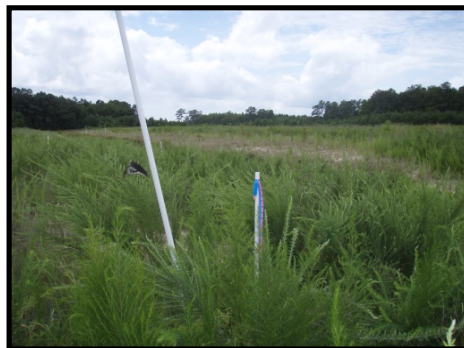
Photostation 6.  
Facing southwest  
along diagonal of  
Vegetation Plot 6.



Photostation 7.  
Facing southwest  
along diagonal of  
Vegetation Plot 7.



Photostation 8.  
Facing southwest  
along diagonal of  
Vegetation Plot 8.



**Appendix C**  
**Vegetation Data**



Table 6. Vegetation Plot Criteria Attainment  
Watts DMS # 413

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	No	88%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	
8	Yes	

**Table 7. CVS Vegetation Plot Metadata**  
**Watts-UT Little River DMS # 413**

<b>Report Prepared By</b>	Heather Smith
<b>Date Prepared</b>	8/5/2016 13:55
<b>database name</b>	EcologicalEngineering-2015-WattsYear-2.mdb
<b>database location</b>	P:\50000 State\EEP 50512\50512-010 Watts Monitoring\Reports\MY2_2016
<b>computer name</b>	WKST7
<b>file size</b>	45481984
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT</b>	
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Proj, planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Proj, total stems</b>	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.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes listed by species.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
<b>ALL Stems by Plot and spp</b>	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.
<b>PROJECT SUMMARY</b>	
<b>Project Code</b>	413
<b>project Name</b>	Watts-UT Little River
<b>Description</b>	Stream and Wetland
<b>River Basin</b>	Pasquotank
<b>length(ft)</b>	1,505
<b>Required Plots (calculated)</b>	8
<b>Sampled Plots</b>	8

Table 8. Planted and Total Stems

Project Name: Watts # 413

		Current Plot Data (MY2 2016)																								
Scientific Name	Common Name	Species Type	413-01-0001			413-01-0002			413-01-0003			413-01-0004			413-01-0005			413-01-0006			413-01-0007			413-01-0008		
			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	1	1	1			1	2	2	2	4	4	4	2	2	2				3	3	3	6	6	6
Baccharis halimifolia	eastern baccharis	Shrub						10			20			1					20			20			20	
Betula nigra	river birch	Tree	1	1	1				1	1	1	1	1	1	1	1	1									
Carpinus caroliniana	American hornbeam	Tree							3	3	3												1	1	1	
Carya	hickory	Tree																							2	
Cornus florida	flowering dogwood	Tree							4	4	4															
Diospyros virginiana	common persimmon	Tree										1	1	1												
Fraxinus pennsylvanica	green ash	Tree										1	1	1												
Liquidambar styraciflua	sweetgum	Tree						2			1			4			1									
Morella cerifera	wax myrtle	shrub									1															
Nyssa sylvatica	blackgum	Tree	2	2	2				1	1	1	1	1	1	4	4	4									
Pinus taeda	loblolly pine	Tree																							7	
Quercus	oak	Tree													1	1	1	4	4	4	4	4	4	1	1	1
Quercus alba	white oak	Tree																					3	3	3	
Quercus lyrata	overcup oak	Tree													2	2	2	5	5	5			10	10	10	
Quercus michauxii	swamp chestnut oak	Tree							4	4	4										5	5	5	1	1	1
Quercus nigra	water oak	Tree																3	3	3						
Quercus pagoda	cherrybark oak	Tree	1	1	1				2	2	2															
Quercus phellos	willow oak	Tree	2	2	2																		2	2	2	
Quercus rubra	northern red oak	Tree							1	1	1												2	2	2	
Taxodium distichum	bald cypress	Tree				10	10	10				1	1	1												
Unknown		Shrub or Tree							1	1	1															
Vaccinium stamineum	deerberry	Shrub																								
<b>Stem count</b>			7	7	7	10	10	23	19	19	48	9	9	14	10	10	11	12	12	32	12	12	32	26	26	48
<b>size (ares)</b>			1			1			1			1			1			1			1			1		
<b>size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
<b>Species count</b>			5	5	5	1	1	4	9	9	13	6	6	8	5	5	6	3	3	4	3	3	4	8	8	10
<b>Stems per ACRE</b>			283.3	283.3	283.3	404.7	404.7	930.8	768.9	768.9	1942.5	364.2	364.2	566.6	404.7	404.7	445.2	485.6	485.6	1295.0	485.6	485.6	1295.0	1052.2	1052.2	1942.5

**Table 8. Planted and Total Stems**

**Project Name: Watts # 413**

Scientific Name	Common Name	Species Type	Annual Means										
			MY2 (2016)			MY1 (2015)			MY0 (2015)				
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T		
Acer rubrum	red maple	Tree											
Baccharis halimifolia	eastern baccharis	Shrub	18	18	19	19	19	19	20	20	20		
Betula nigra	river birch	Tree			91			6			2		
Carpinus caroliniana	American hornbeam	Tree	4	4	4	3	3	3	3	3	3		
Carya	hickory	Tree	4	4	4	5	5	5	5	5	5		
Cornus florida	flowering dogwood	Tree			2								
Diospyros virginiana	common persimmon	Tree	4	4	4	5	5	5	8	8	8		
Fraxinus pennsylvanica	green ash	Tree	1	1	1	2	2	2	2	2	2		
Liquidambar styraciflua	sweetgum	Tree	1	1	1	1	1	1	1	1	1		
Morella cerifera	wax myrtle	shrub			8			6			3		
Nyssa sylvatica	blackgum	Tree			1								
Pinus taeda	loblolly pine	Tree	8	8	8	8	8	8	8	8	8		
Quercus	oak	Tree			7								
Quercus alba	white oak	Tree	10	10	10	22	22	24	34	34	34		
Quercus lyrata	overcup oak	Tree	3	3	3	3	3	3	1	1	1		
Quercus michauxii	swamp chestnut oak	Tree	17	17	17	15	15	15	15	15	15		
Quercus nigra	water oak	Tree	10	10	10	11	11	11	11	11	11		
Quercus pagoda	cherrybark oak	Tree	3	3	3								
Quercus phellos	willow oak	Tree	3	3	3	3	3	3	2	2	2		
Quercus rubra	northern red oak	Tree	4	4	4	4	4	4	2	2	2		
Taxodium distichum	bald cypress	Tree	3	3	3	1	1	1	2	2	2		
Unknown		Shrub or Tree	11	11	11	12	12	12	12	12	12		
Vaccinium stamineum	deerberry	Shrub	1	1	1	5	5	5	8	8	8		
<b>Stem count</b>									2	2	2		
<b>size (ares)</b>			105	105	215	119	119	133	136	136	141		
<b>size (ACRES)</b>			8			8			8				
<b>Species count</b>			0.20			0.20			0.20				
<b>Stems per ACRE</b>			17	17	22	16	16	18	17	17	19		
			531.1	531.1	1087.6	602.0	602.0	672.8	688.0	688.0	713.3		

Table 9. Random Vegetation Strip Plots

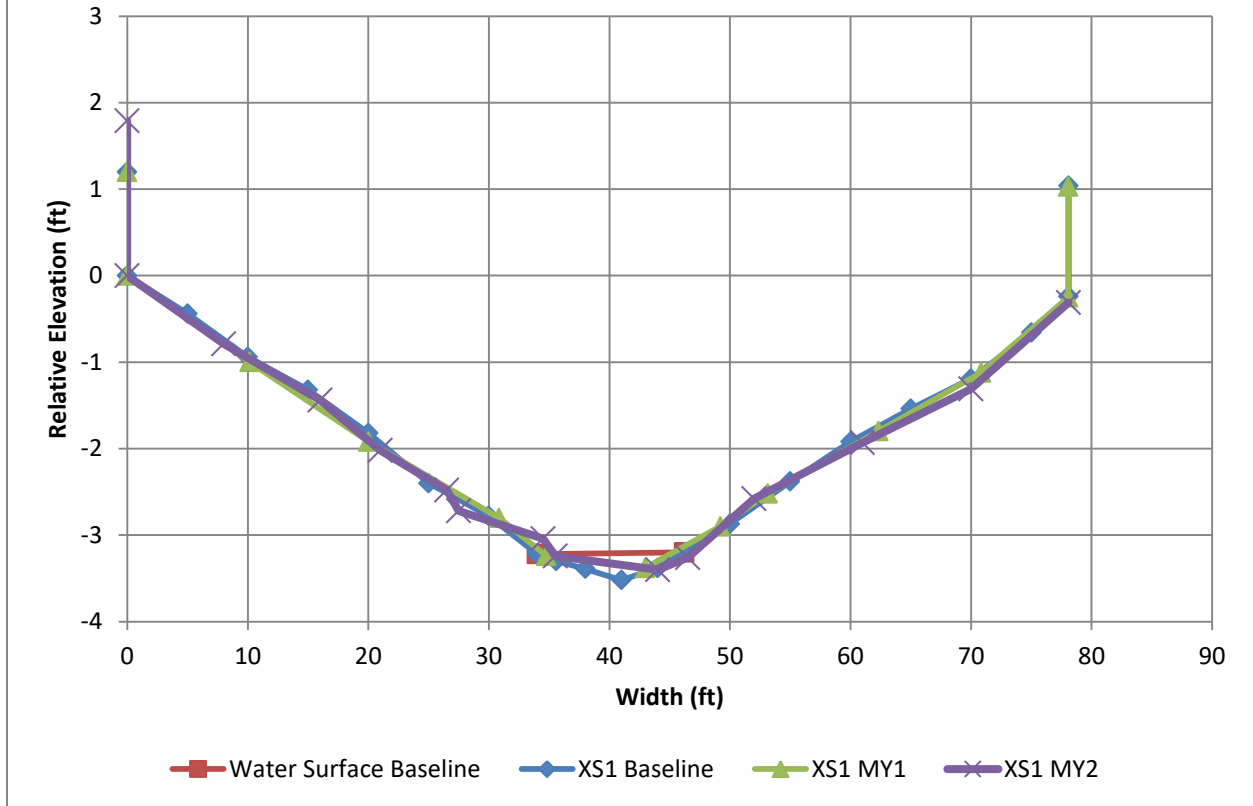
Strip Plot ID	Stems	Stem/Acre	Success Criteria Met
1	10	404.9	Yes
2	12	485.8	Yes
3	20	809.7	Yes
4	9	364.3	Yes
5	11	445.3	Yes
6	6	242.9	No
7	5	202.4	No
8	3	121.5	No

Note: Plot size is 0.0247 acres (100m<sup>2</sup>)

## Appendix D

### Stream Geomorphology

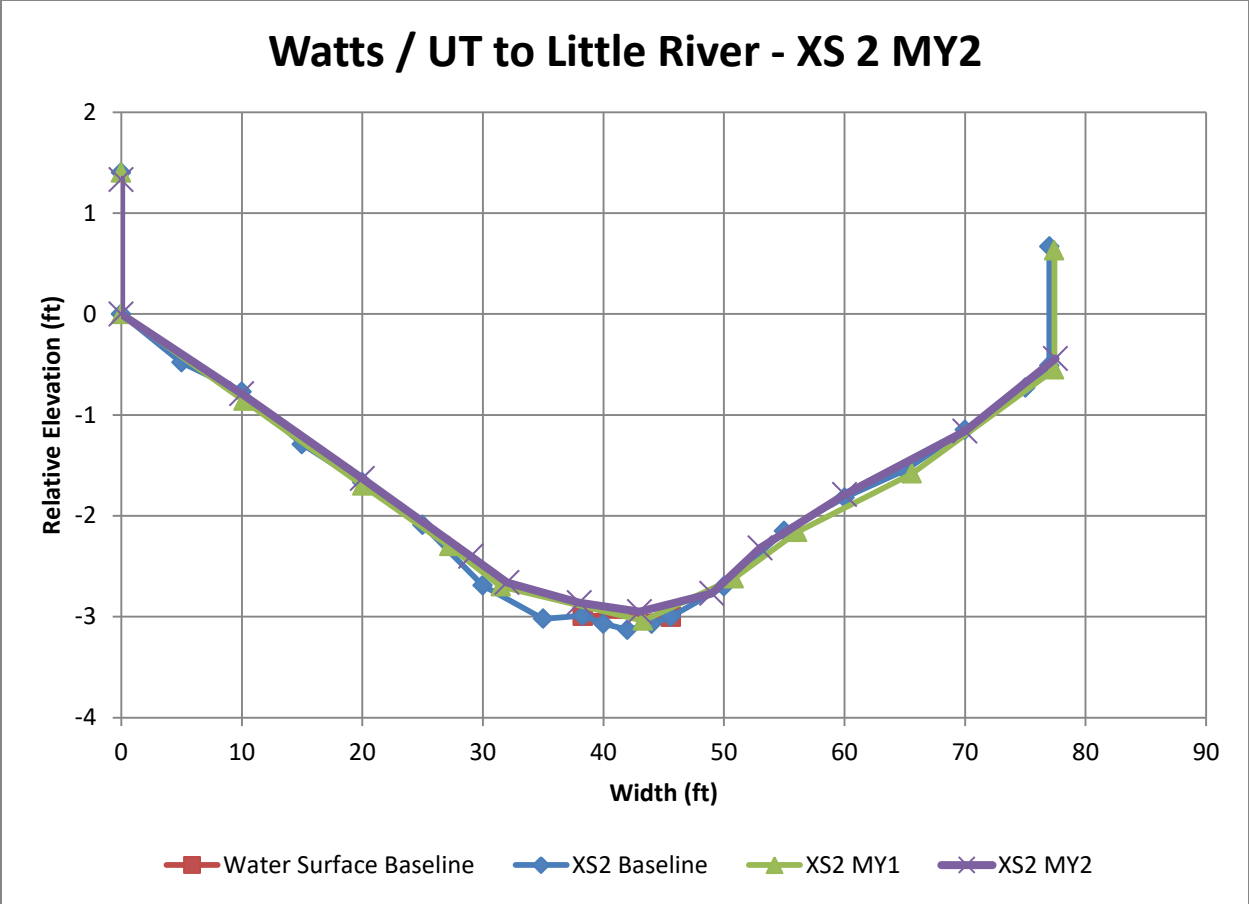
## Watts / UT to Little River - XS 1 MY2



Cross-sections are for general comparisons from year to year. They do not contain the typical features found in a single thread channel.



Cross-section 1 looking downstream.

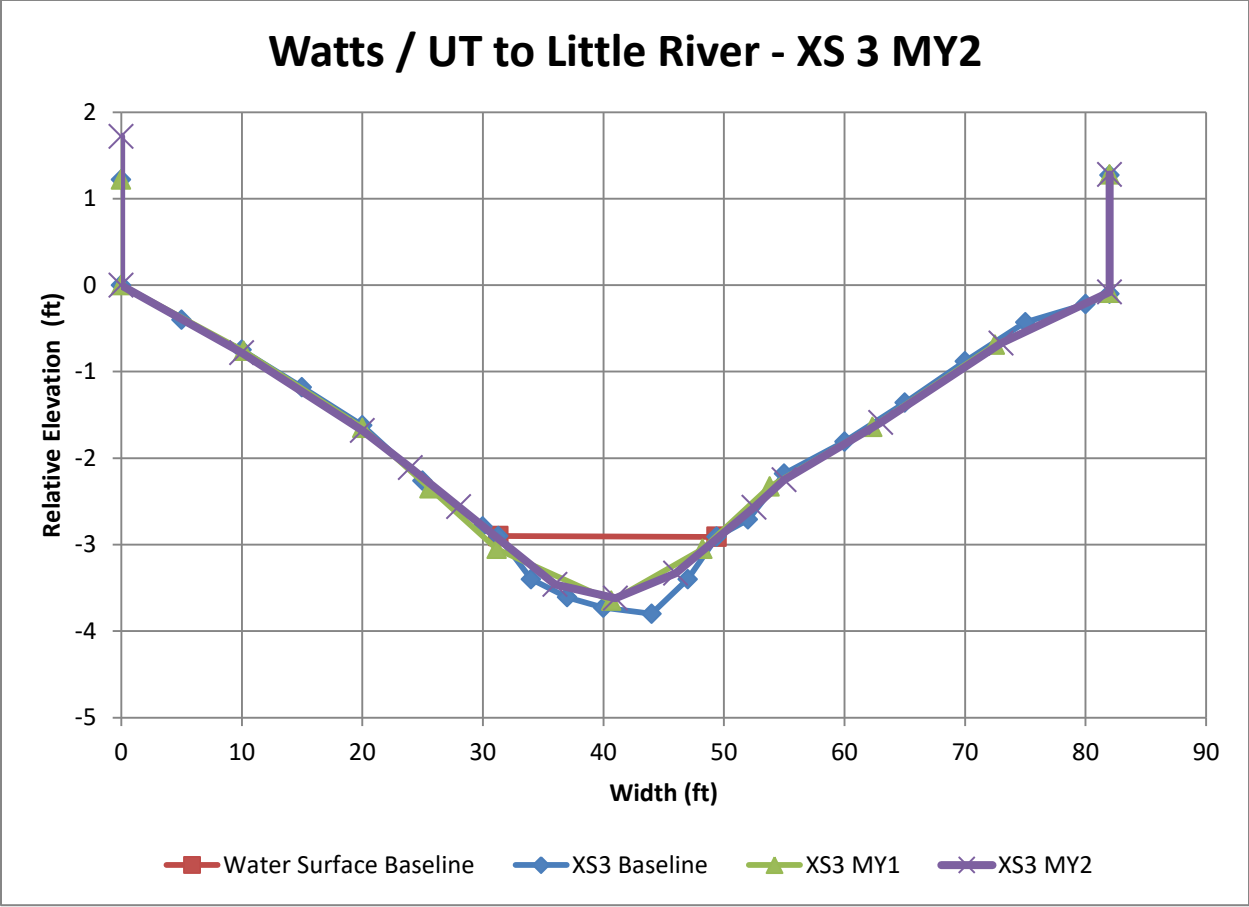


Cross-sections are for general comparisons from year to year. They do not contain the typical features found in a single thread channel.



Cross-section 2 looking downstream.



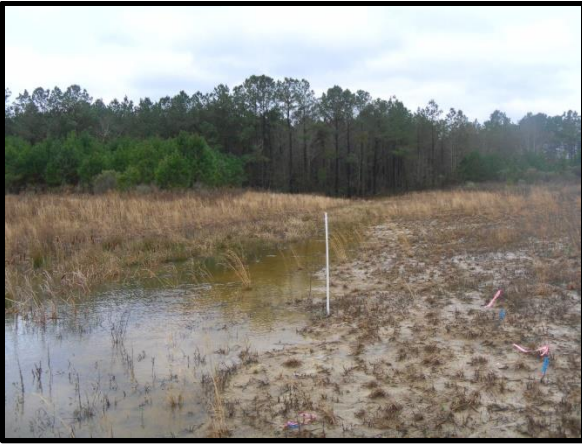


Cross-sections are for general comparisons from year to year. They do not contain the typical features found in a single thread channel.



Cross-section 3 looking downstream.

## Stream Formation Photos MY 2



Near VP 3: Water in the channel 2-5-2016



Mid Channel: Bank formation 6-30-2016



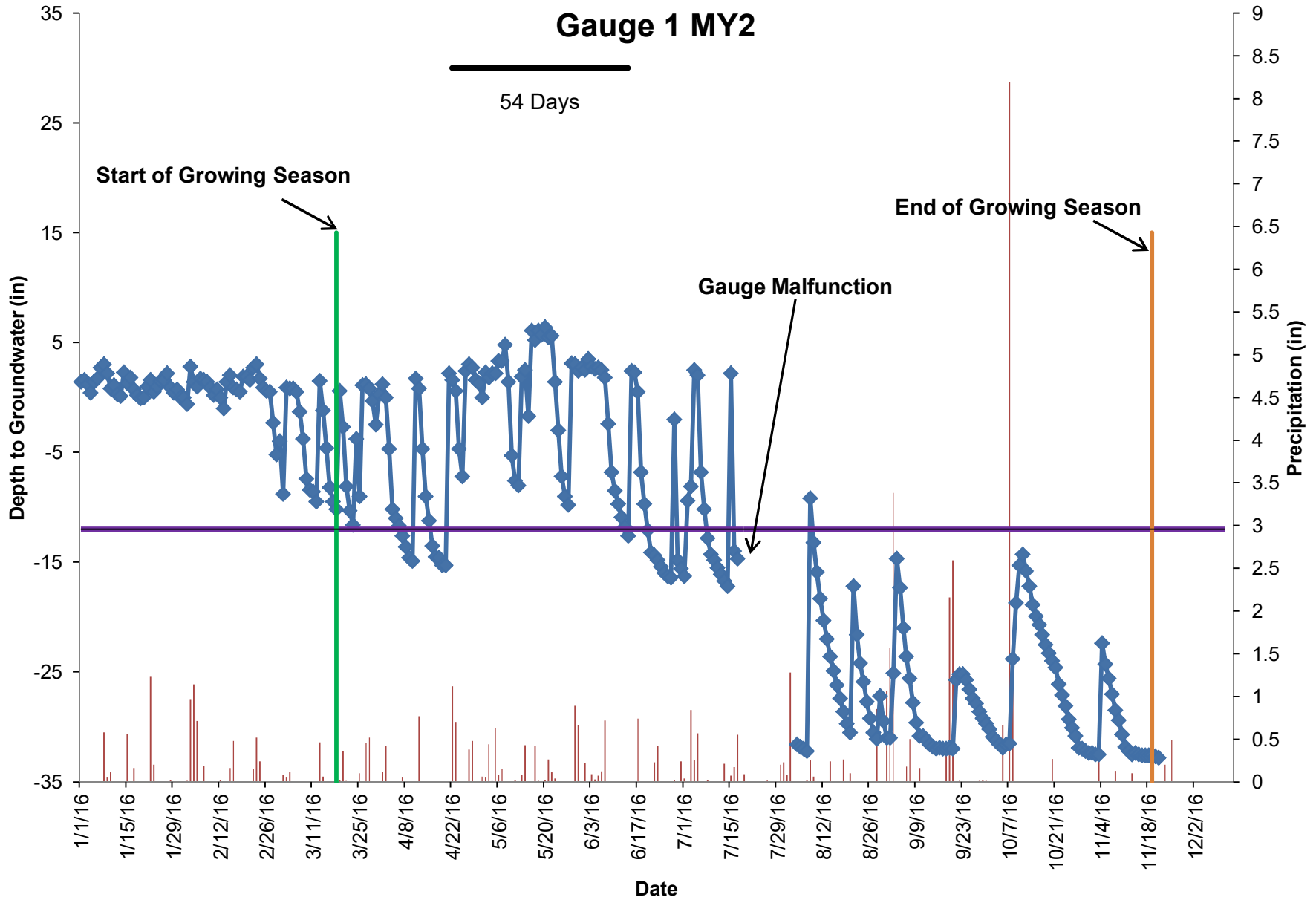
Near VP 3: Vegetation in channel 8-4-2016



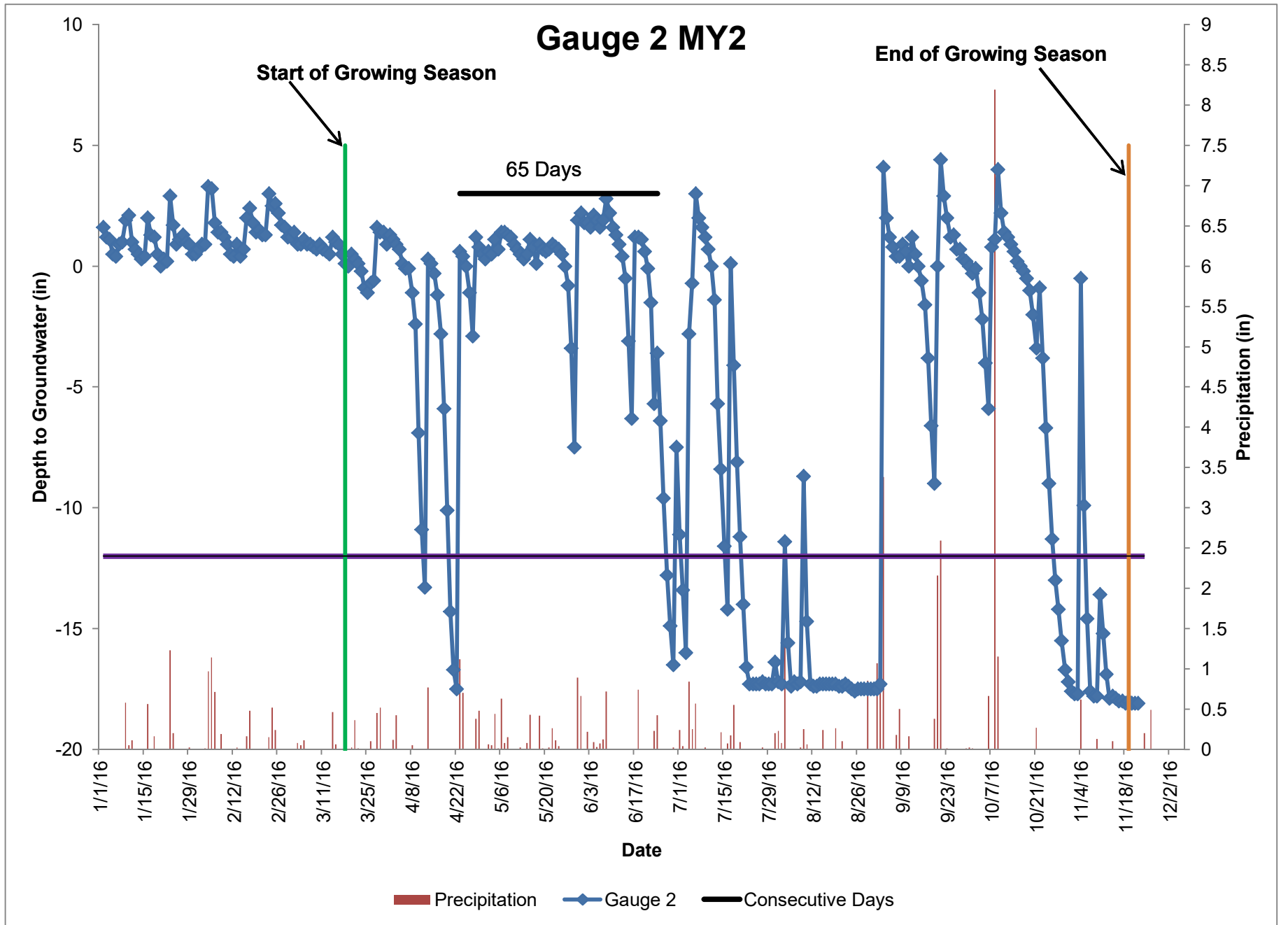
Near VP 7: Water in channel 8-4-2016

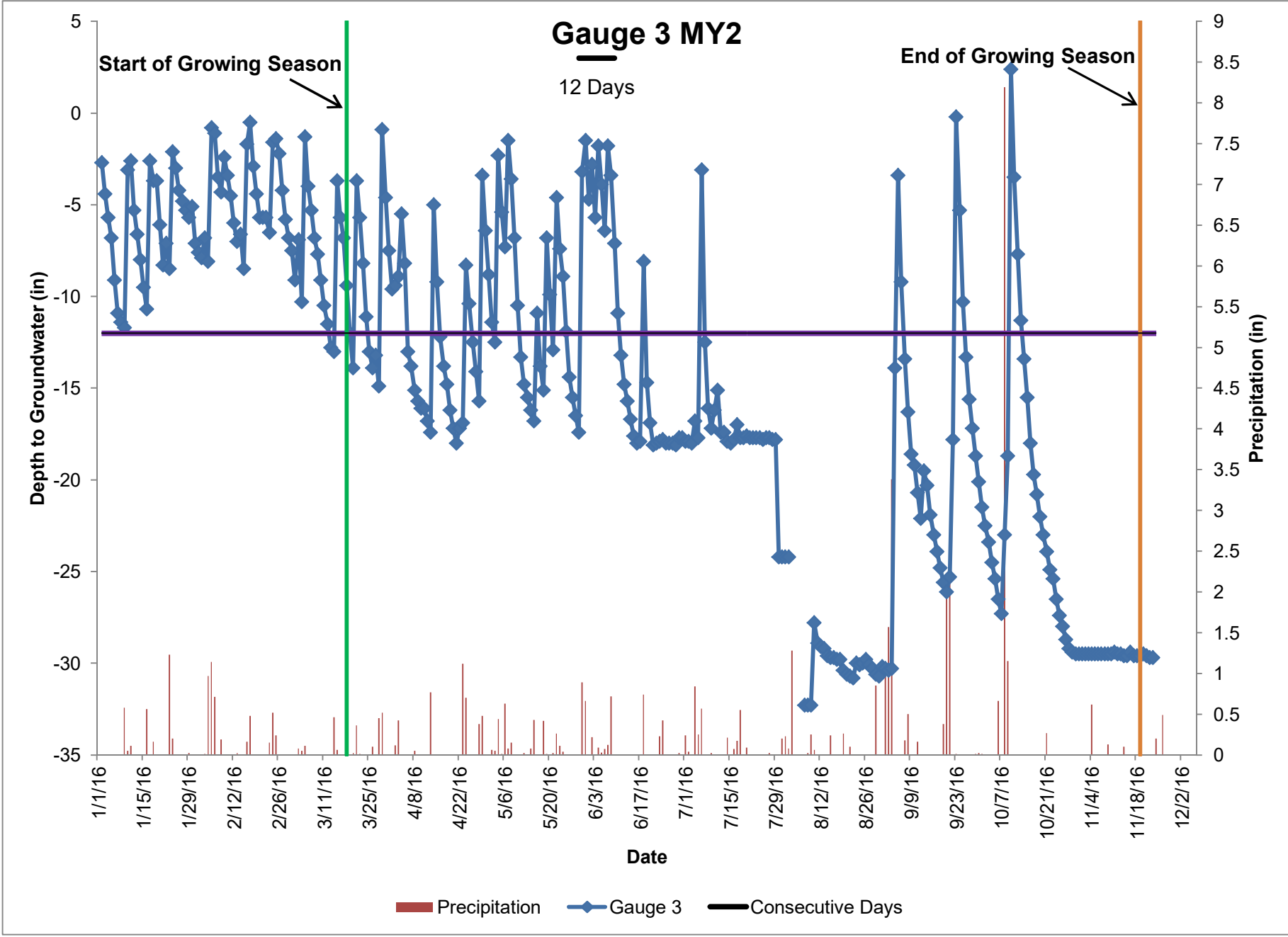
**Appendix E**  
**Hydrology Data**

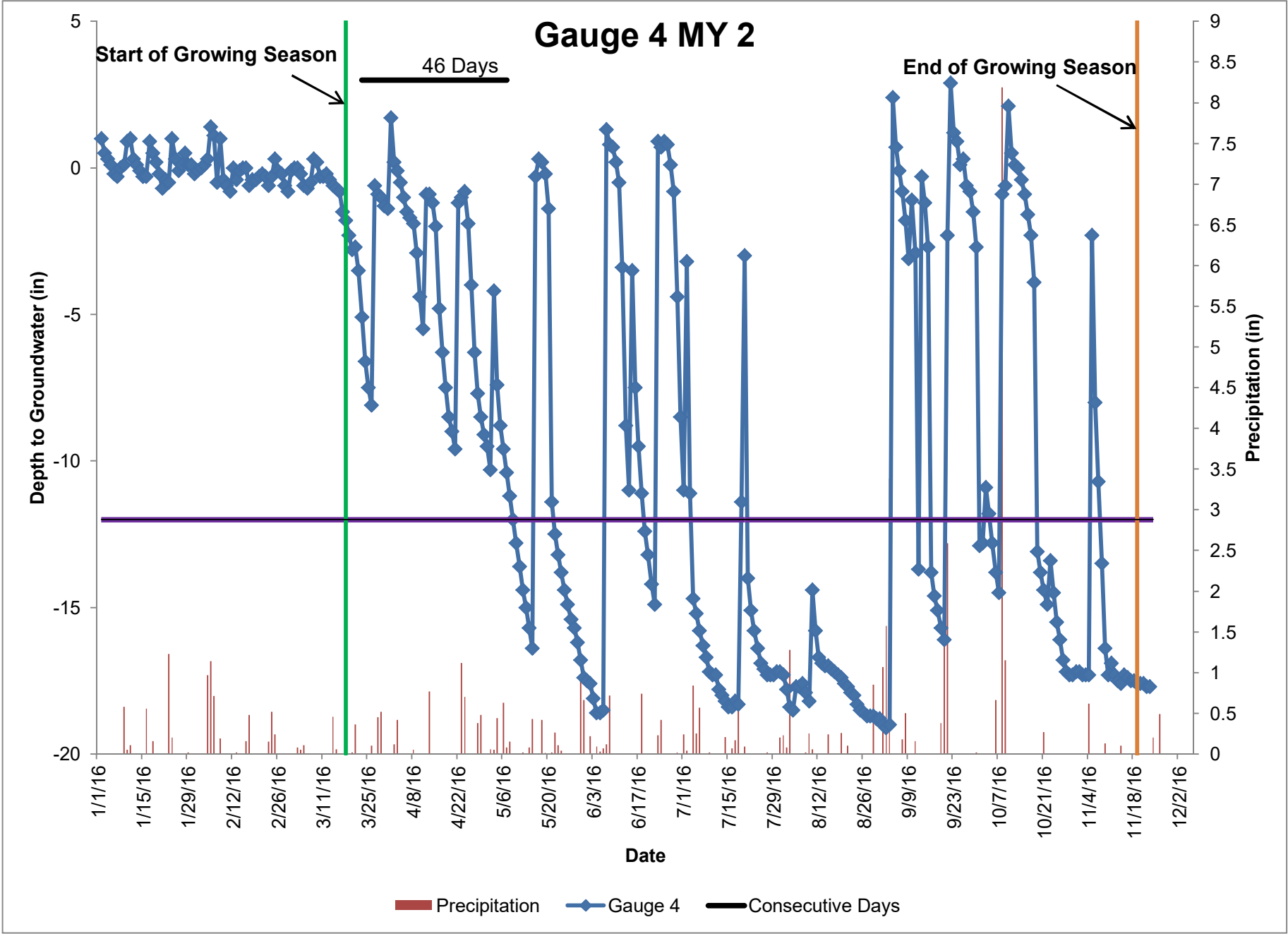
# Gauge 1 MY2



■ Precipitation    ◆ Gauge 1    — Consecutive Days





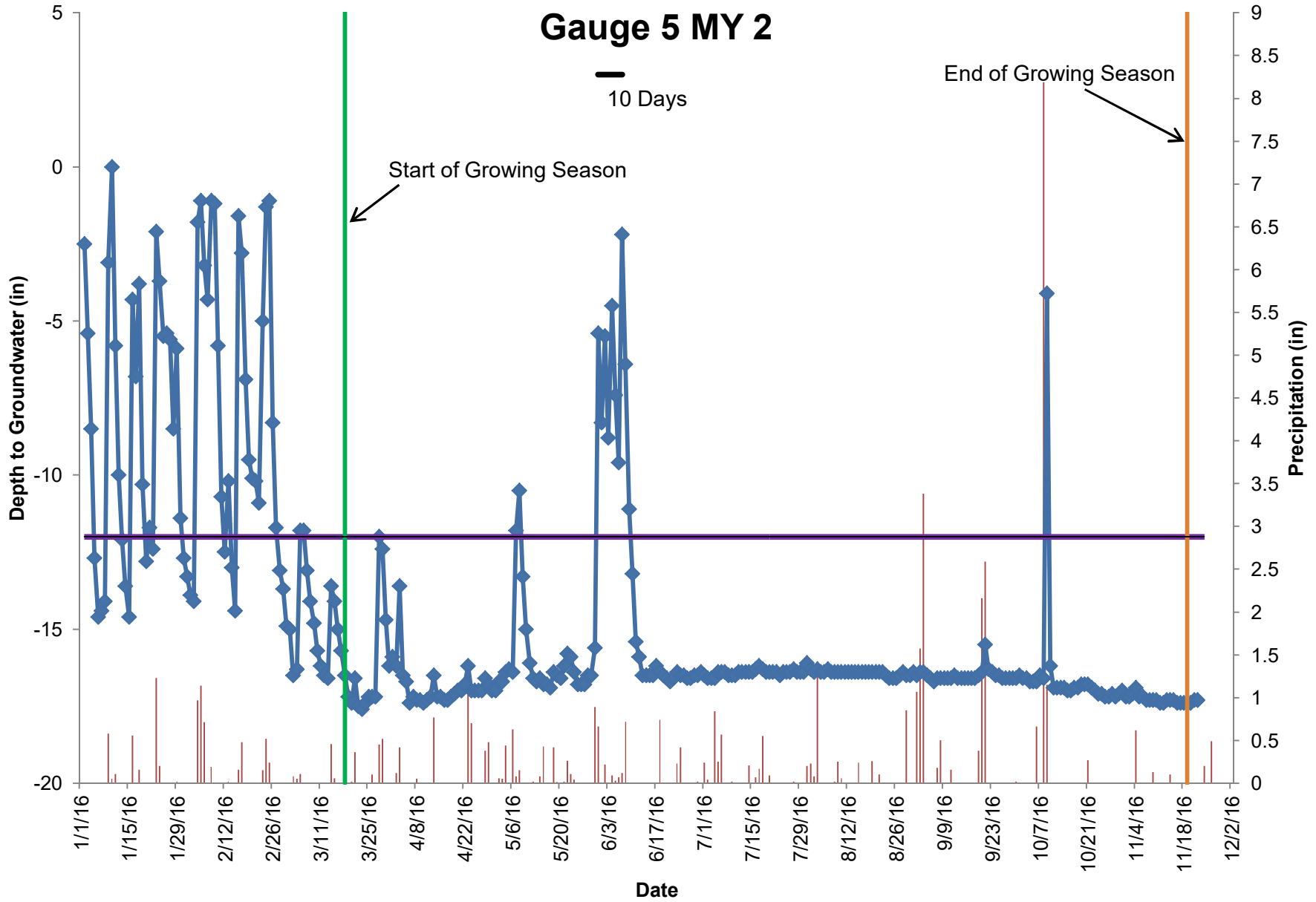


# Gauge 5 MY 2

10 Days

End of Growing Season

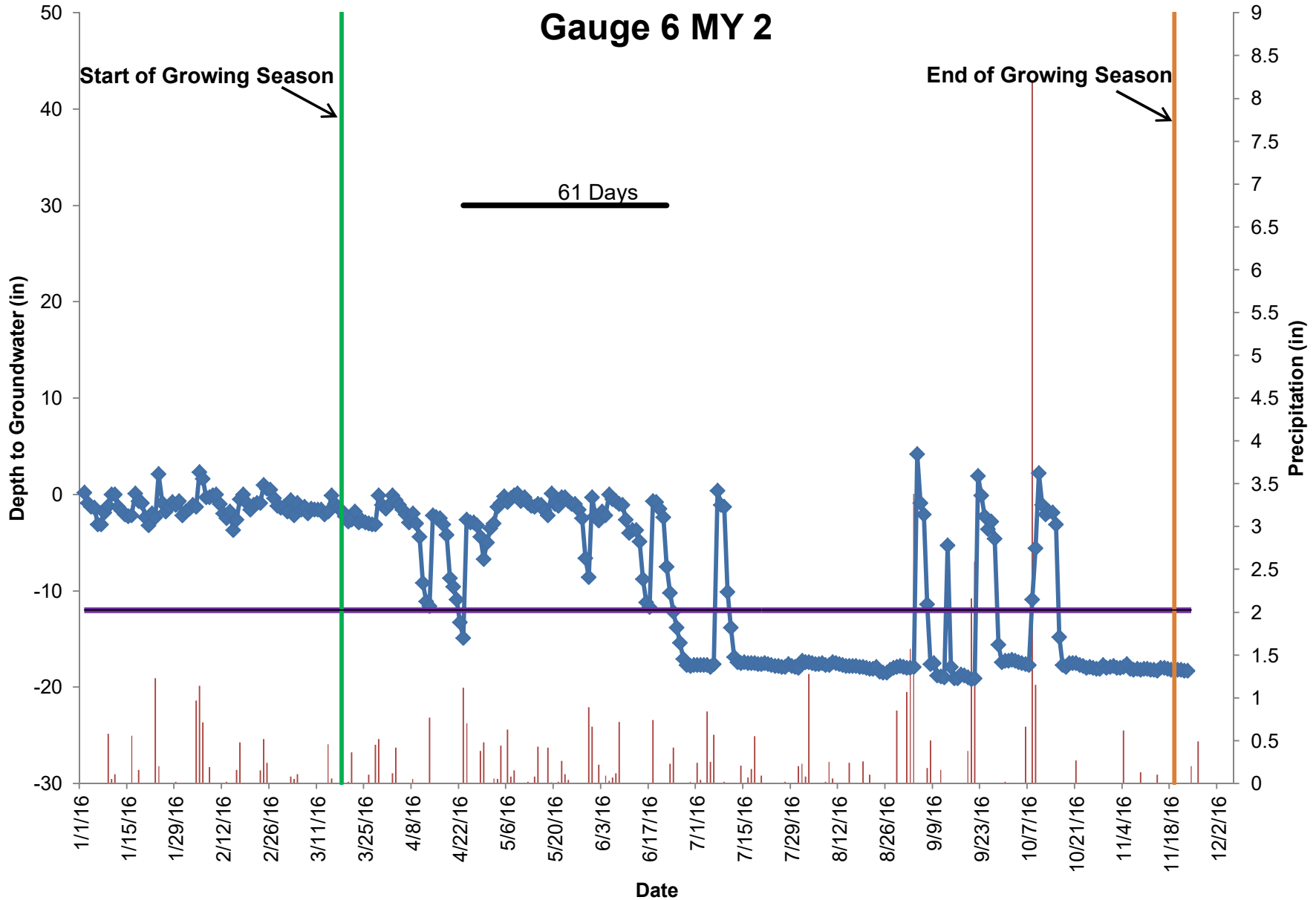
Start of Growing Season



Precipitation Gauge 5 Consecutive Days



# Gauge 6 MY 2

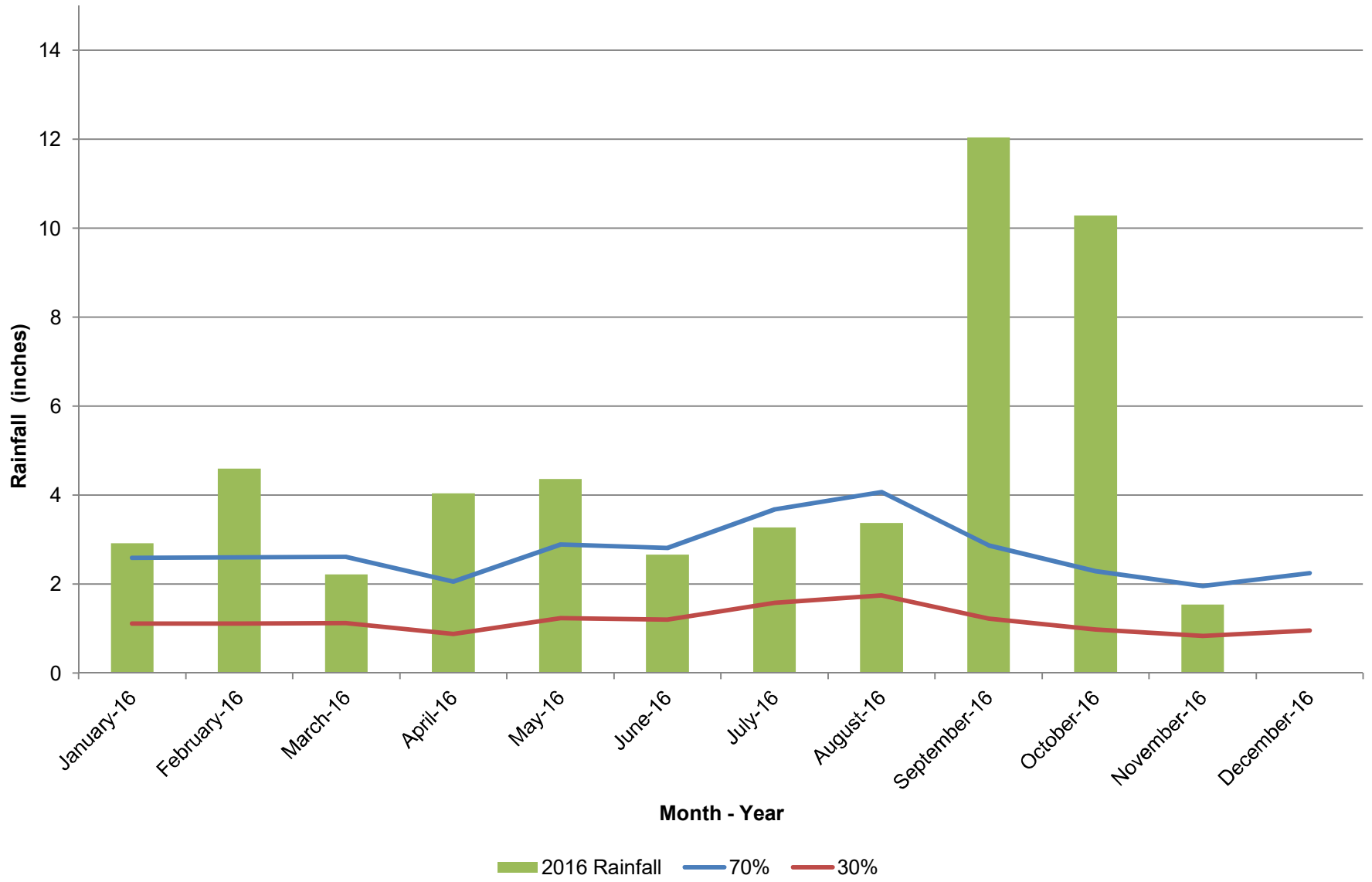


■ Precipitation    ◆ Gauge 6    — Consecutive Days

Table 10	Wetland Hydrology Attainment Table Watts Stream and Wetland Restoration DMS #413				
	Greater than 8% Continuous Saturation				
Gauge #	MY- 1 2015	MY- 2 2016	MY- 3 2017	MY- 4 2018	MY- 5 2019
1	Yes/25 10.2%	Yes/54 21.9%			
2	Yes/63 25.6%	Yes/65 26.4%			
3	No/7 2.8%	No/12 4.9%			
4	Yes/71 28.9%	Yes/46 18.7%			
5	No/8 3.3%	No/10 4.1%			
6	Yes/25 10.2%	Yes/61 24.8%			

Growing season is assumed to be 246 days.

# Watts Property Monitoring Year 2 2016 Monthly Precipitation Data 30/70 Graph



## Headwater Channel Depth Pressure Transducer Data MY2

