

Monitoring Report Year 4

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

217 West Jones St.
Raleigh, NC 27603



North Carolina Department of Environmental Quality

Submission Date: **December 2018**

Data Collection Date: **October 2018 and November 2018**

NOT AN INSTRUMENT PROJECT



Mitigation Services
ENVIRONMENTAL QUALITY

ROY COOPER
Governor

MICHAEL REGAN
Secretary

December 12, 2018

Heather Smith
Ecological Engineering

Subject: DMS Comments on the Draft MY4 Report
Watts, Project ID #413 (Contract #6113) and

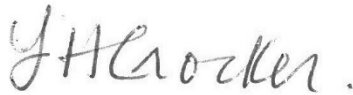
Heather,

After receiving the draft Mitigation Plan on November 29, 2018, DMS conducted its initial review. Please make the following updates prior to submitting the final monitoring report.

- Page 2, removed “but are not related to project success” in the final paragraph. The Mitigation Plan does indicate that these are a monitoring requirement.
 - **Removed**
- Page 2 Monitoring Results, discussion of groundwater gauges, can you add the following statement after the sentence ‘*It is expected the site will continue to recharge groundwater.* The gauges showing lower hydrology may be attributable to site micro-topography installed during construction grading. Additionally, staff observed several areas outside the creditable wetlands that indicate wetland hydrology, vegetation, and function.”
 - **The following was inserted “The gauges showing lower hydrology may be attributable to site micro-topography installed during construction grading. Additionally, staff observed several areas outside the creditable wetlands, as shown in the November 2012 Mitigation Plan, which indicate wetland hydrology, vegetation, and soils.”**
- Page 2, Monitoring results, vegetation plots. Please indicate that the two plots that did not achieve success are in the streamside area where a full re-plant is planned for this dormant season. Remove comment about veg plot 3 achieving success with volunteers because this is mostly loblolly and baccharis that makes that possible.
 - **Updated text “Vegetation plots 3 and 7 (VP3 and VP7) did not meet the success criteria. These plots are located in the streamside area and a full re-plant is scheduled for the 2018-2019 dormant season.”**
- Update success reference to 260 at MY5, because there is nothing in the MP about 288 at MY4.
 - **Updated text “Six of the CVS vegetation plots met success criteria for MY5 of 260 planted stems/acre.”**
- Page 2, Monitoring results, at the end of the last paragraph here where you reference a replant, please include a reference to the map provided by DMS and insert this as a figure in the report (Streamside and Invasive Planting Plan 2010-2020).
 - **Updated text “A supplemental planting of 3.3 acres is scheduled for the 2018-2019 dormant season (Figure 2).”**
- Although we did not require the random plots in MY4, these will be needed in MY5 to show that 2% of the planted area was monitored. That was a DMS mistake.
 - **No change to text but random plots will be conducted in MY5 and one of these will be in the wetland enhancement area unless DMS directs Ecological Engineering otherwise.**
- Table 1. Please provide a footnote as to why the credit is reduced to 1.5:1 ratio for this stream.

- The following was added to the footer of Table 1, “^=1.5:1 was agreed upon via emails in the 11/12 Mit Plan”
- Table 1. There was a 0.06-acre area of wetland enhancement at 1.5: 1 shown in the mitigation plan, but it is removed from the monitoring (although it’s shown in the RE section of this table). Why was it removed?
 - The wetland enhancement area is shown on the CCPV and the shapefile is on the Final Monitoring Report CD.
- Table 2. Add invasive treatment with the dates 7/2018 and 10/2018 please.
 - Dates were added.
- Table 5 Visual assessment. Your table five areas don’t match the CCPV. When I looked at these acreages in GIS and although I could not find all those shapes, it can’t be more than 2 acres for the low stem density areas. Please review GIS and correct table 5 to update.
 - The acreages and number of polygons in Table 5 match the GIS file. The GIS file is on the Final Monitoring Report CD.
- CCPV: the color coding on the gauges shows gauge 7 not meeting, and gauge 8 meeting but the text and data shows the opposite. Update those success color-coding on the CCPV.
 - The gauge coloring has been updated.

Thanks for your work,



Lindsay Crocker, DMS

Prepared by:



1151 SE Cary Parkway, Suite 101
Cary, NC 27518
919.557.0929

A handwritten signature in blue ink, appearing to read "Heather Smith".

Heather Smith, LSS, Project Scientist

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.

TABLE OF CONTENTS

	<u>Page</u>
1.0 Project Summary	1
1.1 Project History and Background	1
1.2 Project Goals and Objectives	1
1.3 Project Success Criteria	2
1.4 Annual Monitoring Results.....	2
2.0 Methodology	3
3.0 References	3
Appendix A. Project Information Tables	
Table 1. Project Components and Mitigation Credits	
Table 2. Project Activity and Reporting History	
Table 3. Project Contact Table	
Table 4. Project Baseline Information and Attributes	
Appendix B. Visual Assessment Data	
Figure 1. Current Condition Plan View	
Table 5. Vegetation Condition Assessment	
Figure 2. Streamside Invasive and Planting Plan 2018-2020	
Vegetation Plot Photos	
Appendix C. Vegetation Plot Data	
Table 6. Vegetation Plot Criteria Attainment	
Table 7. CVS Vegetation Plot Metadata	
Table 8. Planted and Total Stem Counts	
Table 9. Random Vegetation Strip Plots-Not Included	
Appendix D. Stream Geomorphology	
Cross Sections	
Stream Formation Photos	
Appendix E. Hydrology Data	
Hydrographs	
Table 10. Wetland Hydrology Attainment	
Rainfall Data	
Headwater Channel Hydrology Graph	

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 rainfall;
- Vegetation success will include stem densities of 320 stems/acre in MY3 and 260 stems/acre in MY5.

Two pressure transducers were installed. 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 MY4 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, a small bank was starting to form near the upstream portion of the stream, 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 MY4 and the pressure transducers demonstrated 118 consecutive days of surface water in the restored channel. There were 117 consecutive days with greater than two inches of water in the headwater channel.

Six groundwater gauges were originally installed to determine the wetland hydroperiod. An additional two gauges were added in March 2017 and March 2018, for a total of 10 groundwater gauges. Seven of the ten groundwater gauges met the minimum 8% hydroperiod; successful hydroperiods ranged from 13.8% to 43.9%. Three gauges (nos. 5, 8 & 9) did not meet the success criteria. The on-site rain gauge experienced above average rainfall in most months this year with the exception of June, August, and October. It is expected the Site will continue to recharge groundwater. The gauges showing lower hydrology may be attributable to site micro-topography installed during construction grading. Additionally, staff observed several areas outside the creditable wetlands, as shown in the November 2012 Mitigation Plan, which indicate wetland hydrology, vegetation, and soils.

Eight CVS vegetation plots have been established to monitor vegetation success. The random strip plots were not conducted during MY4 but they will be completed during MY5. Six of the CVS vegetation plots met success criteria for MY5 of 260 planted stems/acre. Vegetation plots 3 and 7 (VP3 and VP7) did not meet the success criteria. These plots are located in the streamside area and a full re-plant is scheduled for the 2018-2019 dormant season. Areas with thicker herbaceous vegetation had lower stem densities across the site. A few stems of Bradford pear (*Pyrus calleryana*) were noted throughout the site but are not widespread.

Invasive vegetation was treated twice during 2018 along the streamside and the non-riparian wetland areas, and pines were thinned. A supplemental planting of 3.3 acres is scheduled for the 2018-2019 dormant season (Figure 2).

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). The rain gauge, groundwater gauges and pressure transducers are monitored quarterly. Two additional groundwater gauges were installed in 2017 and 2018. Gauges 7 and 8 were installed on March 15, 2017 and gauges 9 and 10 on March 15, 2018. Rain data from the CRONOS website, station KECG, was used for portions of October and for the month of November. The on-site rain gauge was clogged during the November data download and was corrected during the November 19, 2018 site visit. The remaining months utilized the 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.

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

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.

North Carolina State Climate Office, 2018. 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.^=1.5:1 was agreed upon via emails in the 11/12 Mit Plan

Table 2. Project Activity and Reporting History
Watts/ 413

Activity or Report	Data Collection Complete	Completion or Delivery
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
Warranty Replant	N/A	February-16 & January-17
Year 2 Monitoring	August-16 & November-16	November-16
Year 3 Monitoring	August-17 & November-17	November-17
Invasive Treatment	N/A	July-18
Invasive Treatment	N/A	October-18
Year 4 Monitoring	October-18 & November-18	December-18
Year 5 Monitoring		

Table 3. Project Contact Table
Watts/ 413

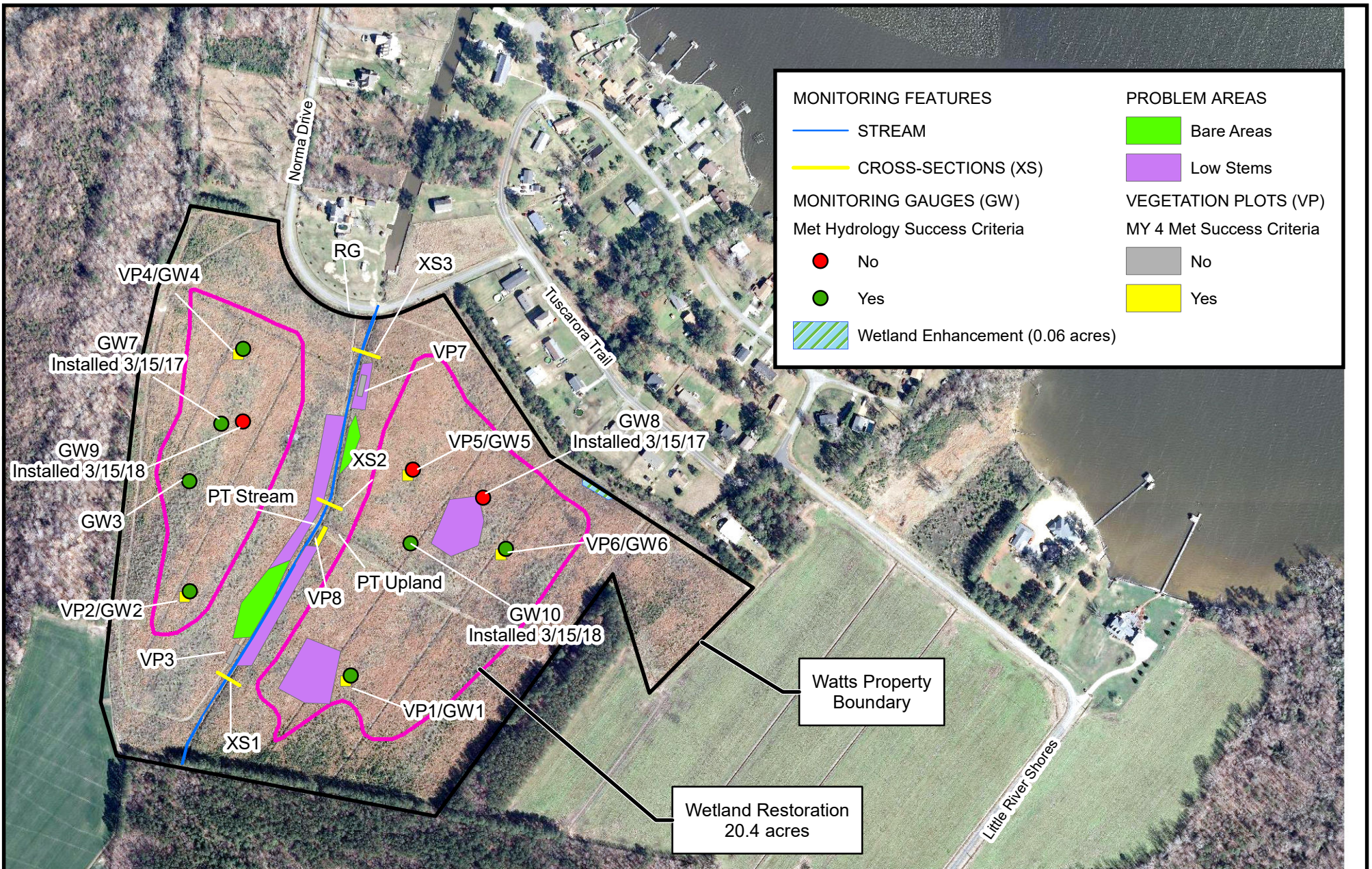
Designer Ecological Engineering, LLP Jenny S. Fleming, PE	Firm Information/ Address 1151 SE Cary Parkway Ste. 101, Cary, NC 27518 (919) 557-0929
Construction Contractor River Works, Inc. Bill Wright	Firm Information/ Address 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Planting Contractors River Works, Inc. George Morris	Firm Information/ Address 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
Seeding Contractor River Works, Inc. George Morris	Firm Information/ Address 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Seed Mix Sources	Green Resource (336) 855-6363
Nursery Stock Suppliers	ArborGen (843) 851-4129 Claridge Nursery (919) 857-4801 Dykes and Son Nursery (931) 668-8833
Monitoring Performer Ecological Engineering, LLP G. Lane Sauls Jr. (stream, vegetation & wetland)	Firm Information/ Address 1151 SE Cary Parkway Ste. 101, Cary, NC 27518 (919) 557-0929
Invasives Contractor Carolina Wetland Services, Inc Gregg Antemann	Firm Information/ Address 550 E. Westinghouse Blvd., Charlotte, NC, 28723 (704) 408-1683

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 4

Perquimans County

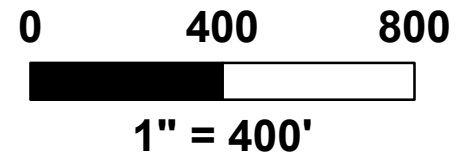
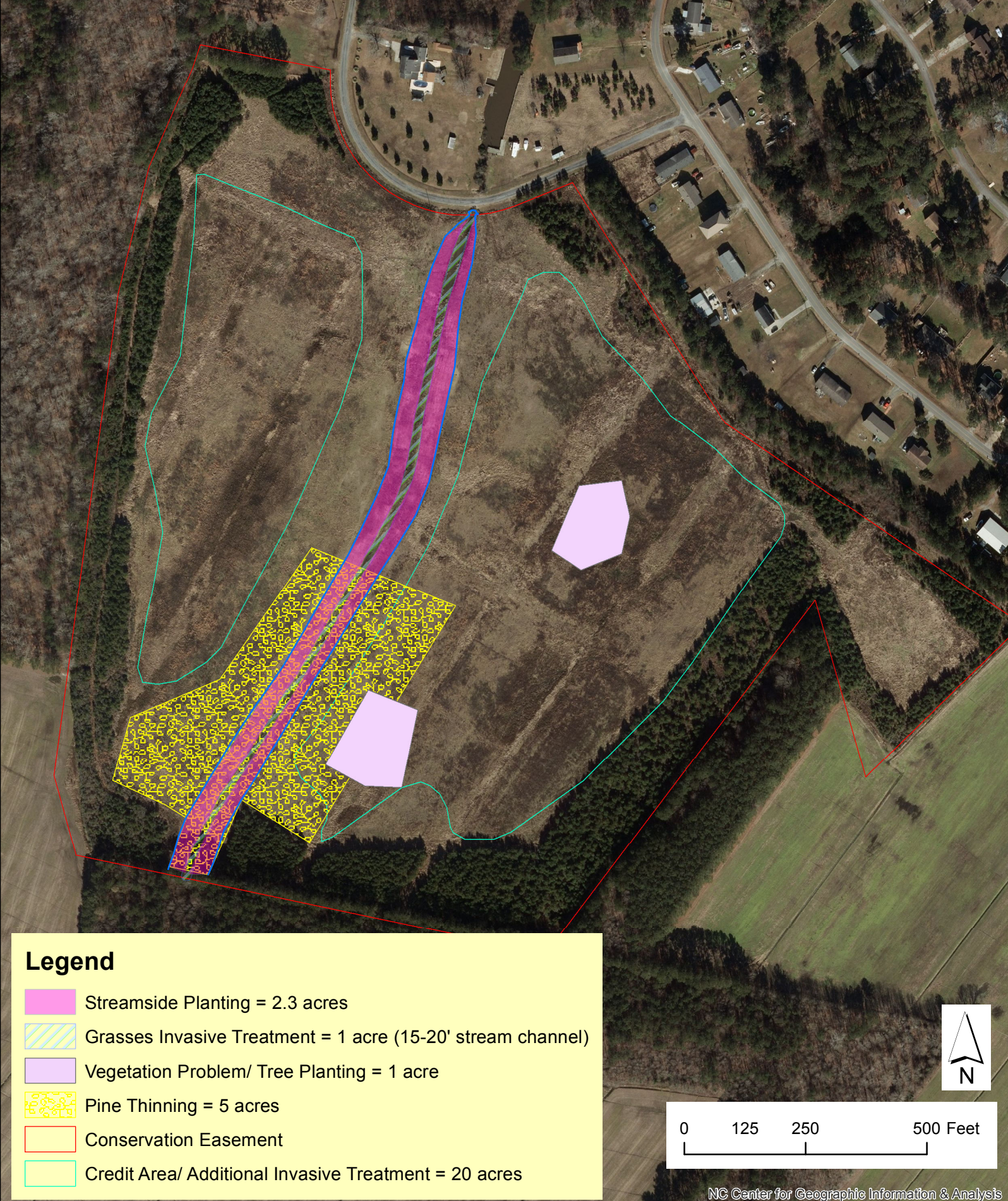


Table 5. Vegetation Condition Assessment		Watts DMS # 413				
Planted Acreage 23.9 Easement Acreage 48.1		Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material	0.1 ac	Yes	2	0.47	1.97%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY 3, 4, or 5 stem count criteria	0.1 ac	Yes	5	2.01	8.41%
Total				7	2.48	10.38%
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%
Cumulative Total				7	2.48	10.38%

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%

Figure 2 Watts Project ID #413 Streamside Invasive and Planting Plan 2018-2020



Photostation Comparison
Watts- MY 4 (2018)

Photo # and Location

Baseline Condition 2015

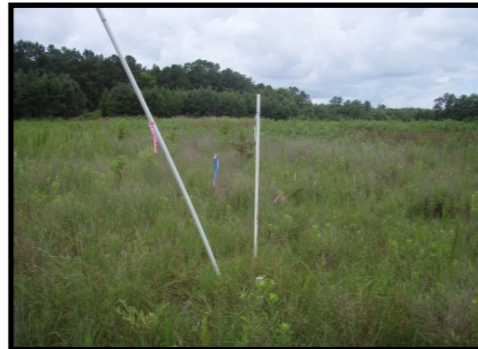
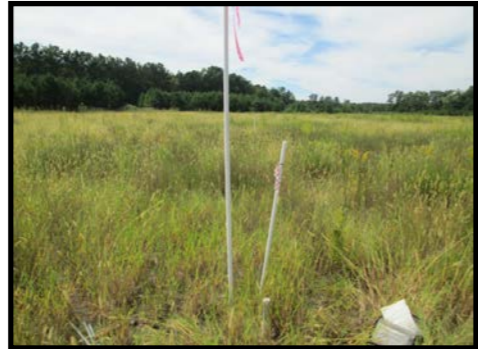
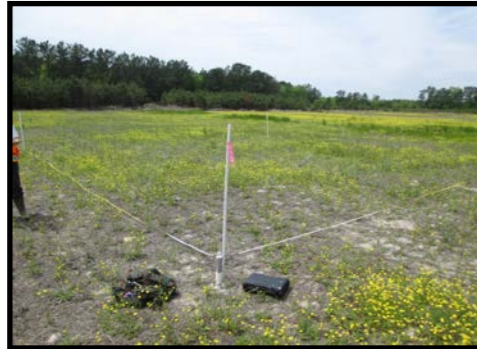
MY 1 2015 (9/16/2015)

MY 2 2016 (8/4/2016)

MY 3 2017 (8/16/2017)

MY 4 2018 (10/24/2018)

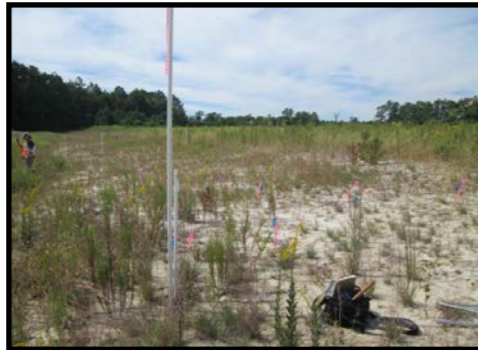
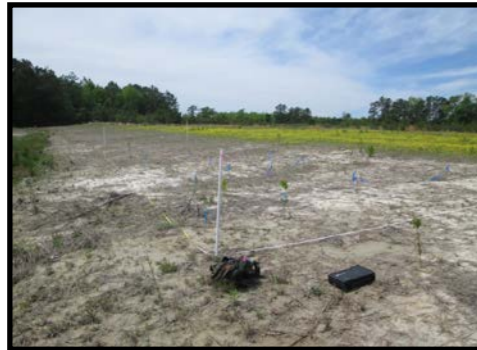
Photostation 1. Facing southwest along diagonal of Vegetation Plot 1.



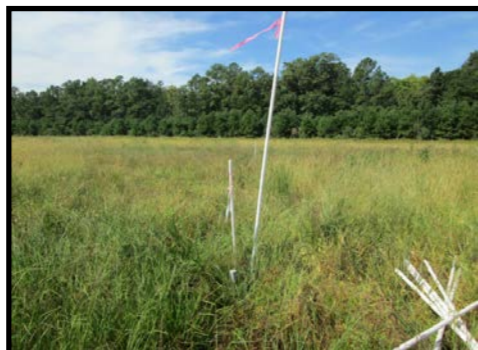
Photostation 2. Facing southwest along diagonal of Vegetation Plot 2.



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

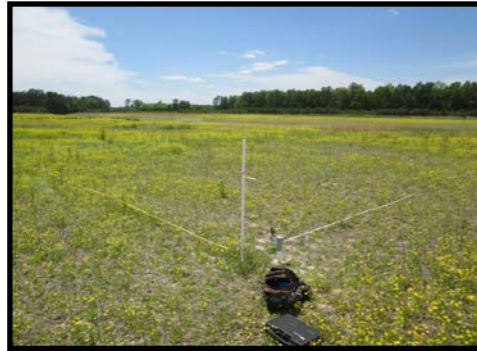
MY 1 2015 (9/16/2015)

MY 2 2016 (8/4/2016)

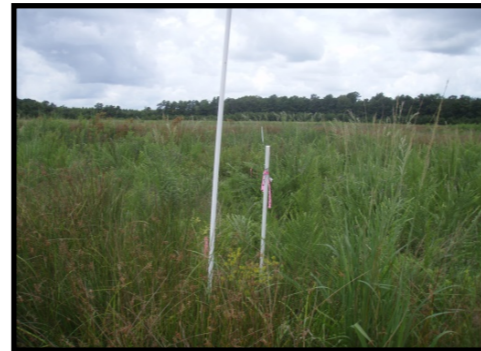
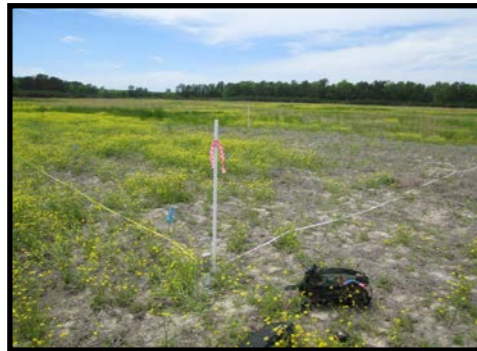
MY 3 2017 (8/16/2017)

MY 4 2018 (10/24/2018)

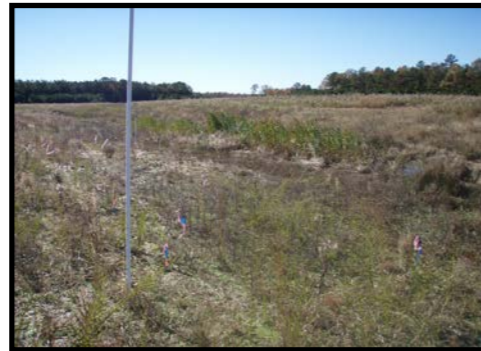
Photostation 5. Facing southwest along diagonal of Vegetation Plot 5



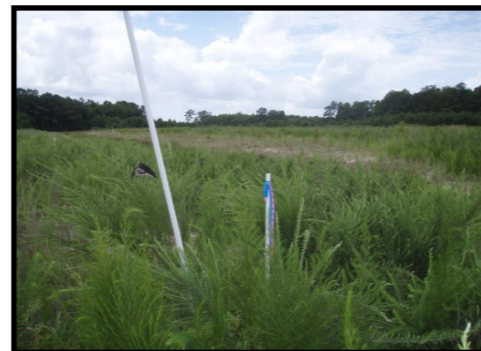
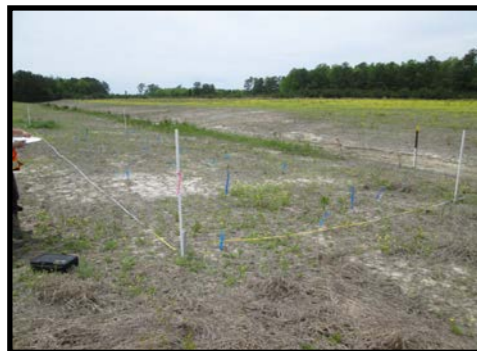
Photostation 6. Facing southwest along diagonal of Vegetation Plot 6.



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	Yes	88%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	No	
8	Yes	

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

Report Prepared By	Heather Smith
Date Prepared	11/8/2018 14:53
database name	EcologicalEngineering-2018-WattsYear-4.mdb
database location	P:\50000 State\EEP 50512\50512-010 Watts Monitoring\Reports\MY4_2018
computer name	WKST7
file size	48234496
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 listed by species.
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	413
project Name	Watts-UT Little River
Description	Stream and Wetland
River Basin	Pasquotank
length(ft)	1,505
Required Plots (calculated)	8
Sampled Plots	8

Table 8. Planted and Total Stems

Project Name: Watts #413

Scientific Name	Common Name	Species Type	Current Plot Data (MY4 2018)																							
			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	4	4	4	2	2	2				2	2	2	4	4	4
Baccharis halimifolia	eastern baccharis	Shrub			4			4			7			4					15							
Betula nigra	river birch	Tree	1	1	1							1	1	1												
Carpinus caroliniana	American hornbeam	Tree							1	1	1												1	1	1	
Carya	hickory	Tree																								
Cornus florida	flowering dogwood	Tree																								
Diospyros virginiana	common persimmon	Tree										1	1	1												
Fraxinus pennsylvanica	green ash	Tree										1	1	1												
Liquidambar styraciflua	sweetgum	Tree			2			2						3												
Morella cerifera	wax myrtle	shrub			3			1						3					4			4				
Nyssa sylvatica	blackgum	Tree	2	2	2				1	1	1				2	2	2									
Pinus taeda	loblolly pine	Tree			6						10											6				
Quercus	oak	Tree													1	1	1	3	3	3						
Quercus alba	white oak	Tree																					1	1	1	
Quercus lyrata	overcup oak	Tree	5	5	5										3	3	3	3	3	3			7	7	7	
Quercus michauxii	swamp chestnut oak	Tree							1	1	1										3	3	3			
Quercus nigra	water oak	Tree															3	3	3							
Quercus pagoda	cherrybark oak	Tree																		1	1	1				
Quercus phellos	willow oak	Tree	2	2	2																					
Quercus rubra	northern red oak	Tree							1	1	1															
Rhus copallinum	flameleaf sumac	shrub																								
Taxodium distichum	bald cypress	Tree				10	10	10				1	1	1												
Unknown		Shrub or Tree													1	1	1									
Vaccinium stamineum	deerberry	Shrub																								
	Stem count		10	10	25	10	10	17	5	5	25	8	8	15	9	9	13	9	9	34	6	6	6	13	13	13
	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		4	4	8	1	1	4	5	5	8	5	5	7	5	5	6	3	3	6	3	3	3	4	4	4
	Stems per ACRE		404.7	404.7	1012	404.7	404.7	688	202.3	202.3	1012	323.7	323.7	607	364.2	364.2	526.1	364.2	364.2	1376	242.8	242.8	242.8	526.1	526.1	526.1

Table 8. Planted and Total Stems

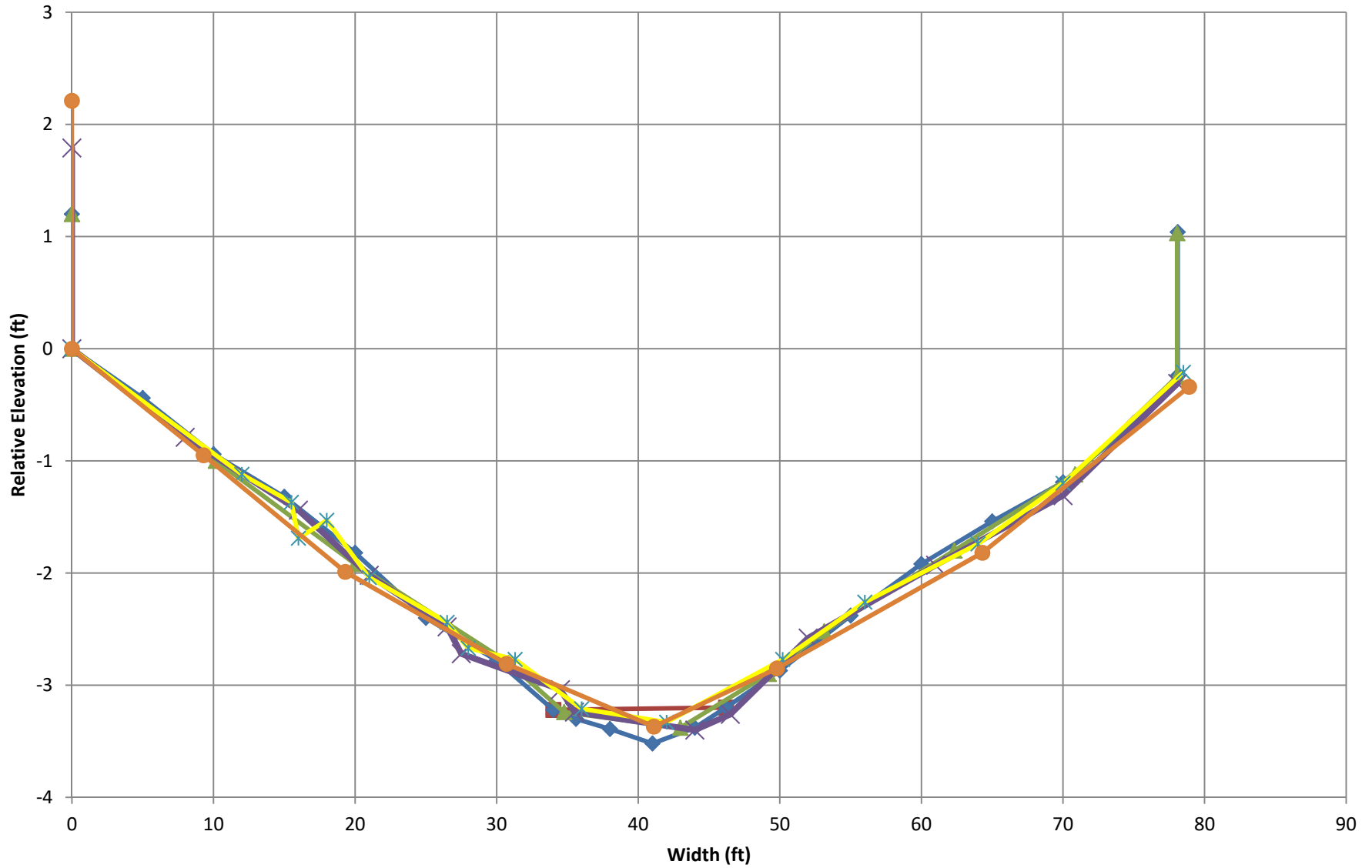
Project Name: Watts #413

Scientific Name	Common Name	Species Type	Annual Means														
			MY4 (2018)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
			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	13	13	13	15	15	15	18	18	19	19	19	19	20	20	20
Baccharis halimifolia	eastern baccharis	Shrub			34						91			6			2
Betula nigra	river birch	Tree	2	2	2	2	2	2	4	4	4	3	3	3	3	3	3
Carpinus caroliniana	American hornbeam	Tree	2	2	2	2	2	2	4	4	4	5	5	5	5	5	5
Carya	hickory	Tree						1			2						
Cornus florida	flowering dogwood	Tree				2	2	2	4	4	4	5	5	5	8	8	8
Diospyros virginiana	common persimmon	Tree	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
Fraxinus pennsylvanica	green ash	Tree	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Liquidambar styraciflua	sweetgum	Tree			7			7			8			6			3
Morella cerifera	wax myrtle	shrub			15						1						
Nyssa sylvatica	blackgum	Tree	5	5	5	5	5	5	8	8	8	8	8	8	8	8	8
Pinus taeda	loblolly pine	Tree			22						7						
Quercus	oak	Tree	4	4	4	4	4	4	10	10	10	22	22	24	34	34	34
Quercus alba	white oak	Tree	1	1	1	2	2	2	3	3	3	3	3	3	1	1	1
Quercus lyrata	overcup oak	Tree	18	18	18	22	22	22	17	17	17	15	15	15	15	15	15
Quercus michauxii	swamp chestnut oak	Tree	4	4	4	7	7	7	10	10	10	11	11	11	11	11	11
Quercus nigra	water oak	Tree	3	3	3	3	3	3	3	3	3						
Quercus pagoda	cherrybark oak	Tree	1	1	1	2	2	2	3	3	3	3	3	3	2	2	2
Quercus phellos	willow oak	Tree	2	2	2	4	4	4	4	4	4	4	4	4	2	2	2
Quercus rubra	northern red oak	Tree	1	1	1	3	3	3	3	3	3	1	1	1	2	2	2
Rhus copallinum	flameleaf sumac	shrub						2									
Taxodium distichum	bald cypress	Tree	11	11	11	11	11	11	11	11	11	12	12	12	12	12	12
Unknown		Shrub or Tree	1	1	1	1	1	1	1	1	1	5	5	5	8	8	8
Vaccinium stamineum	deerberry	Shrub													2	2	2
Stem count			70	70	148	87	87	97	105	105	215	119	119	133	136	136	141
size (ares)			8			8			8			8			8		
size (ACRES)			0.20			0.20			0.20			0.20			0.20		
Species count			16	16	20	17	17	20	17	17	22	16	16	18	17	17	19
Stems per ACRE			354.1	354.1	748.7	440.1	440.1	490.7	531.1	531.1	1088	602	602	672.8	688	688	713.3

Appendix D

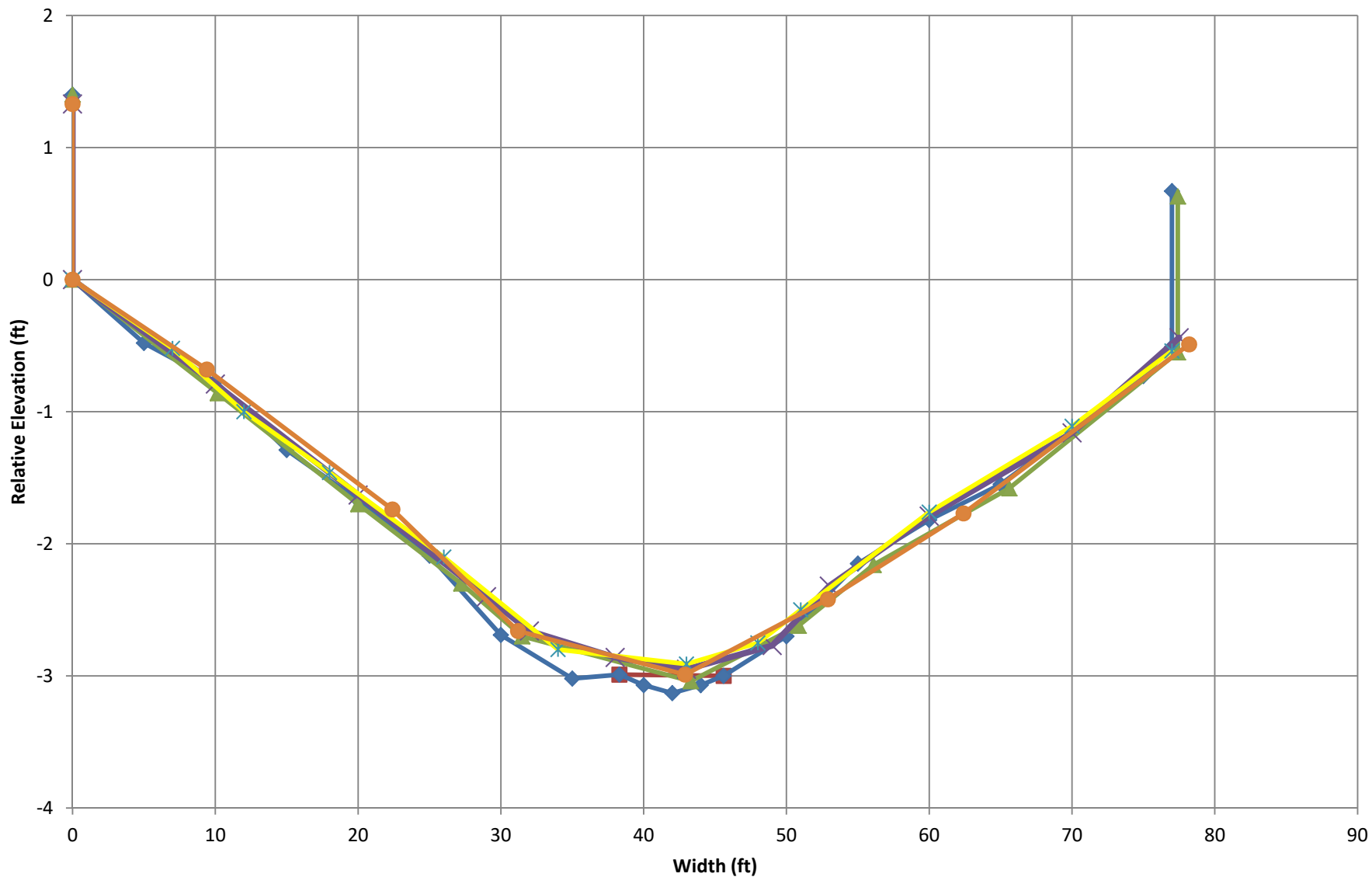
Stream Geomorphology

Watts / UT to Little River - XS 1 MY4



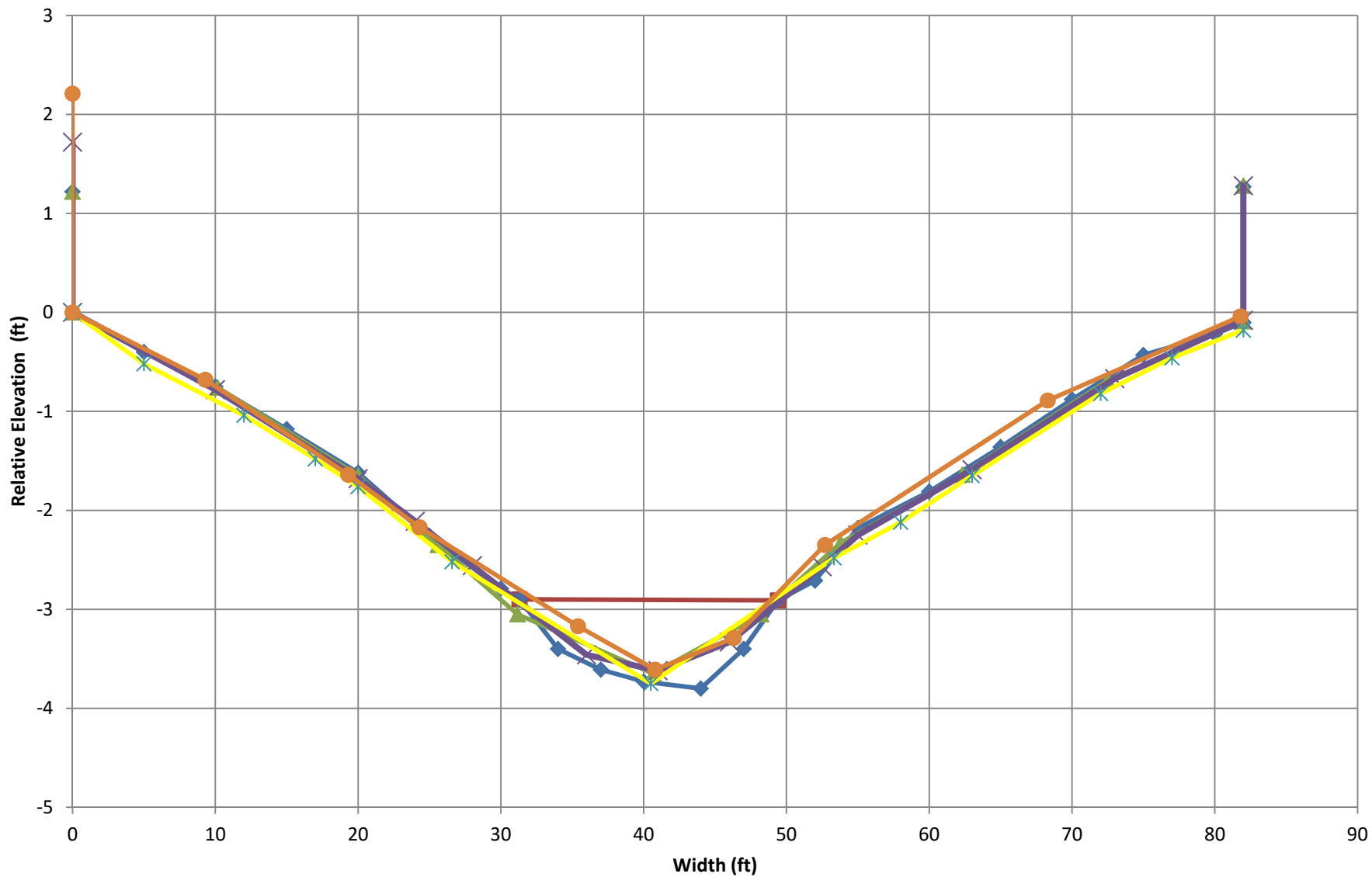
Legend: Water Surface Baseline (red square), XS1 Baseline (blue diamond), XS1 MY1 (green triangle), XS1 MY2 (purple cross), XS1 MY3 (yellow asterisk), XS1 MY4 (orange circle)

Watts / UT to Little River - XS 2 MY4



Water Surface Baseline XS2 Baseline XS2 MY1 XS2 MY2 XS2 MY3 XS2 MY4

Watts / UT to Little River - XS 3 MY4



Water Surface Baseline XS3 Baseline XS3 MY1 XS3 MY2 XS3 MY3 XS3 MY4

Stream Formation Photos MY 4



Flow path near in channel pressure transducer (PT)
3-15-2018



Flow Path upstream of PT 3-15-2018

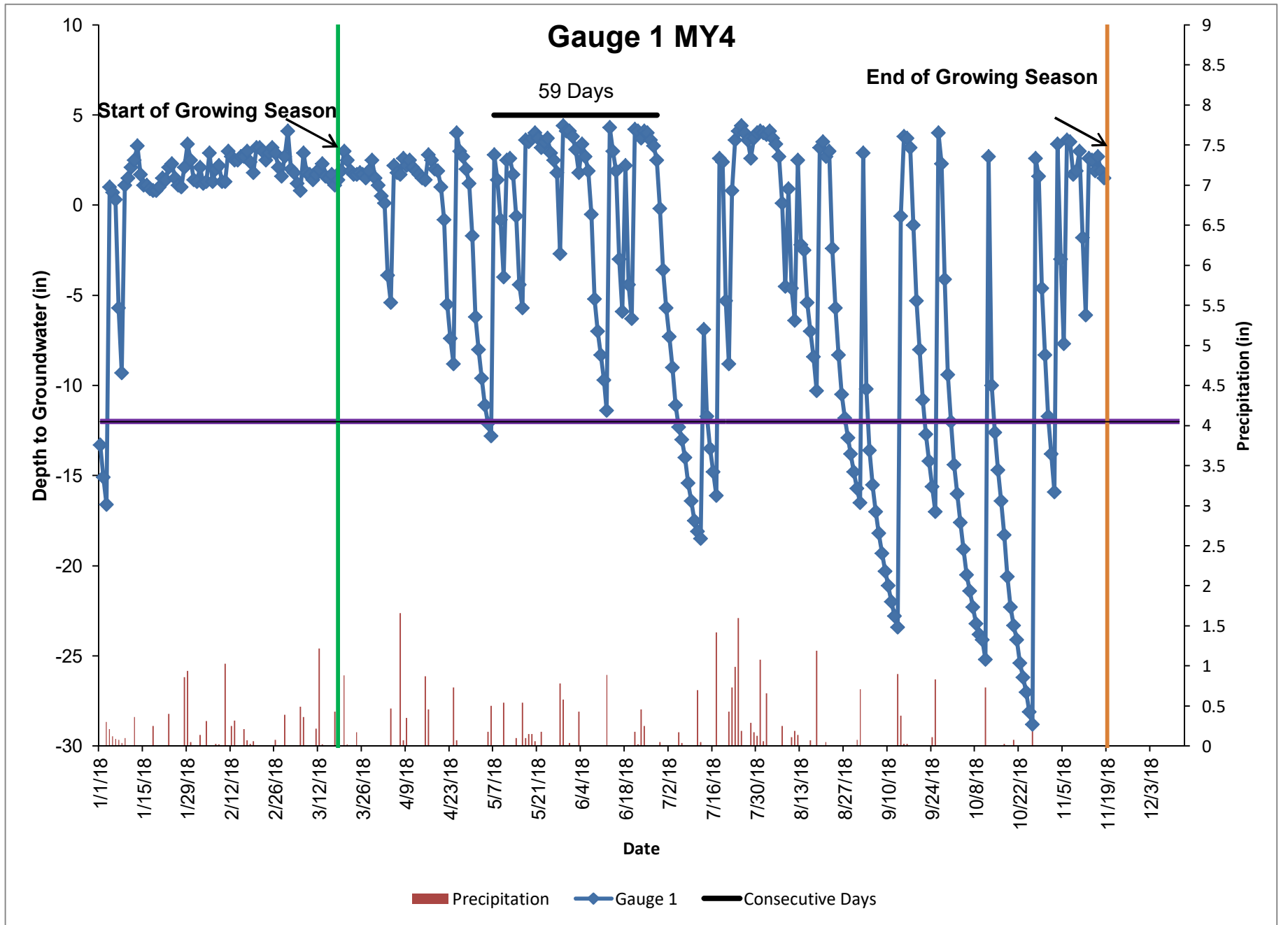


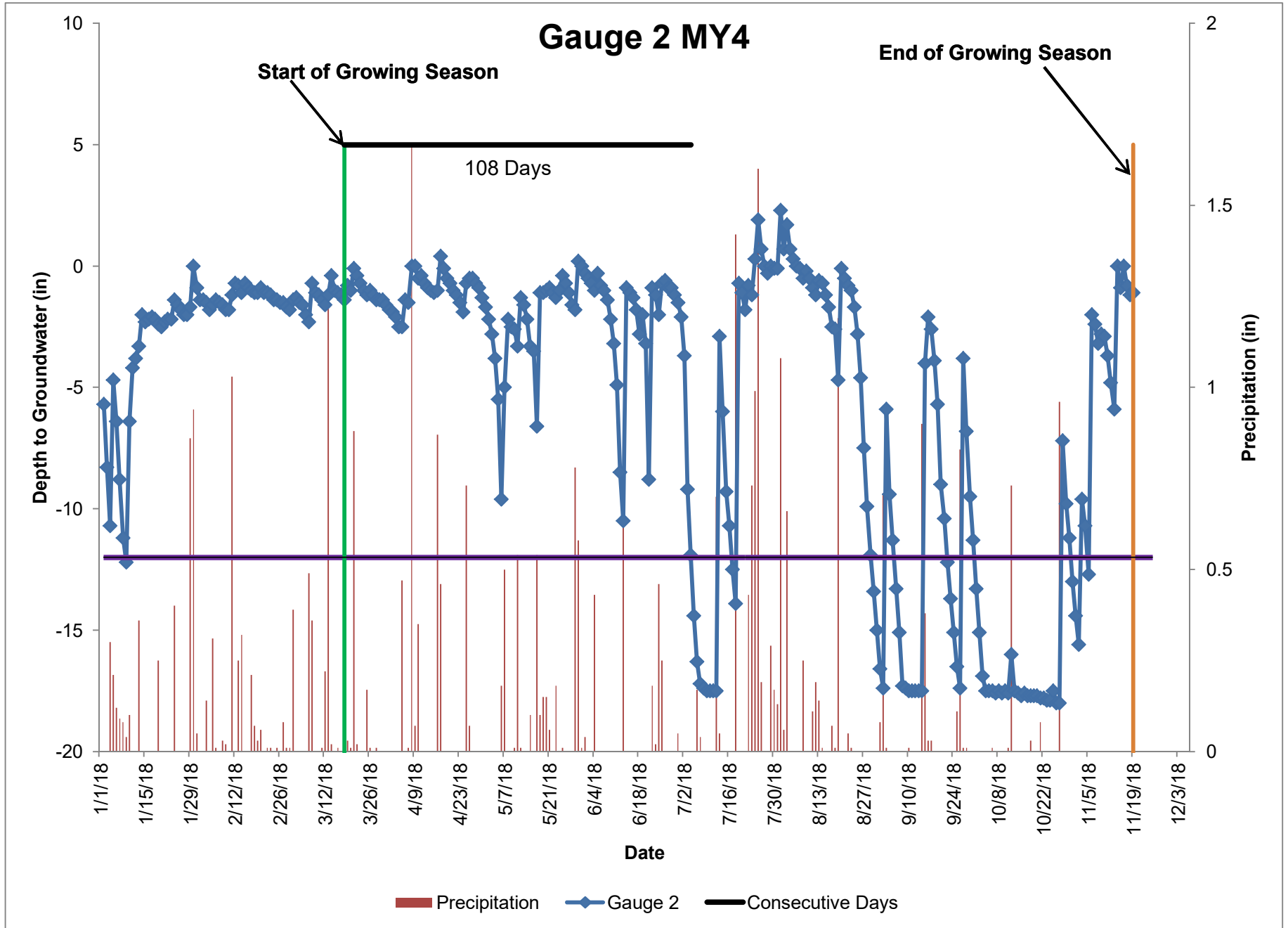
Upstream portion: Evidence of flow 3-15-2018

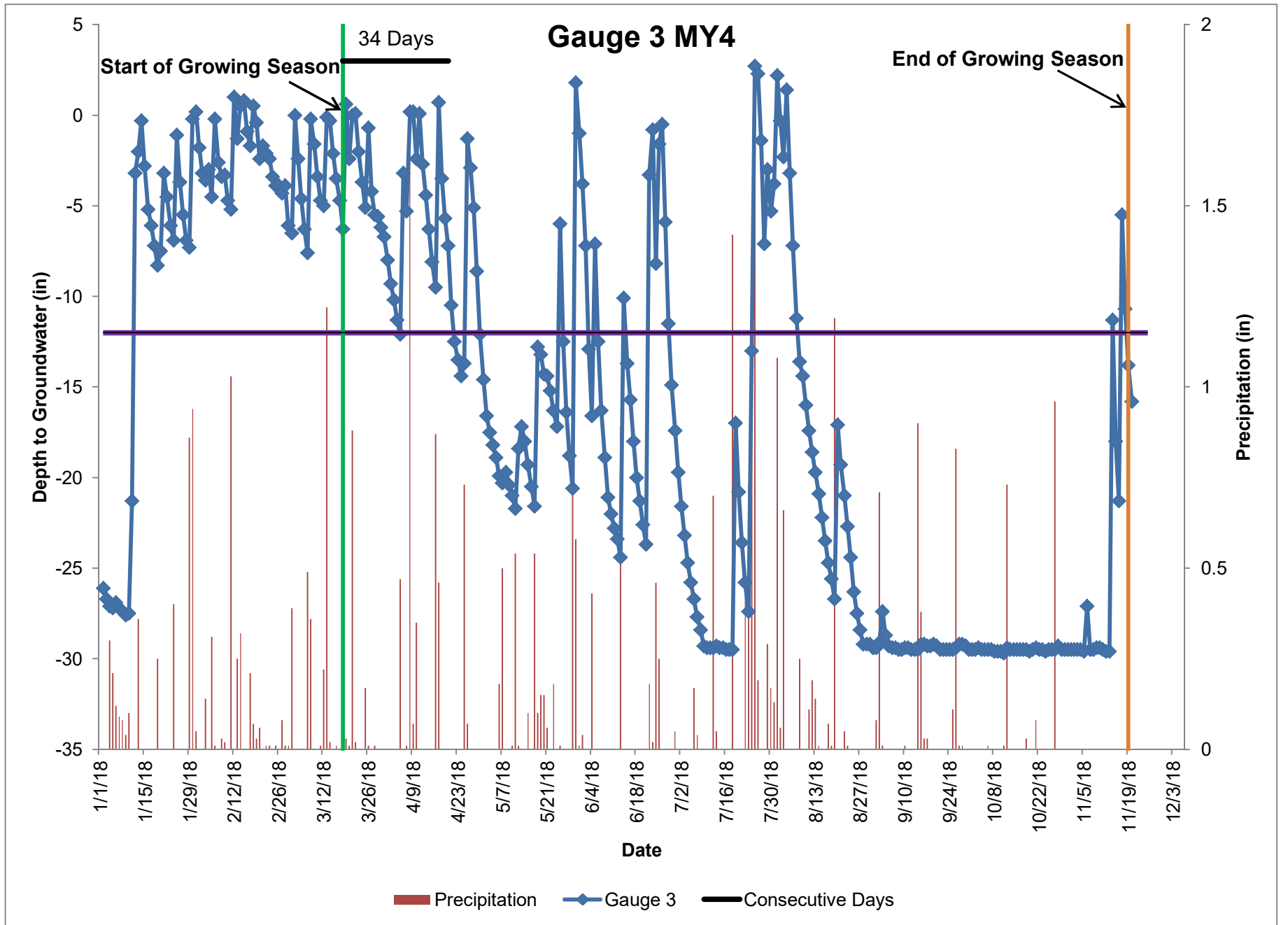


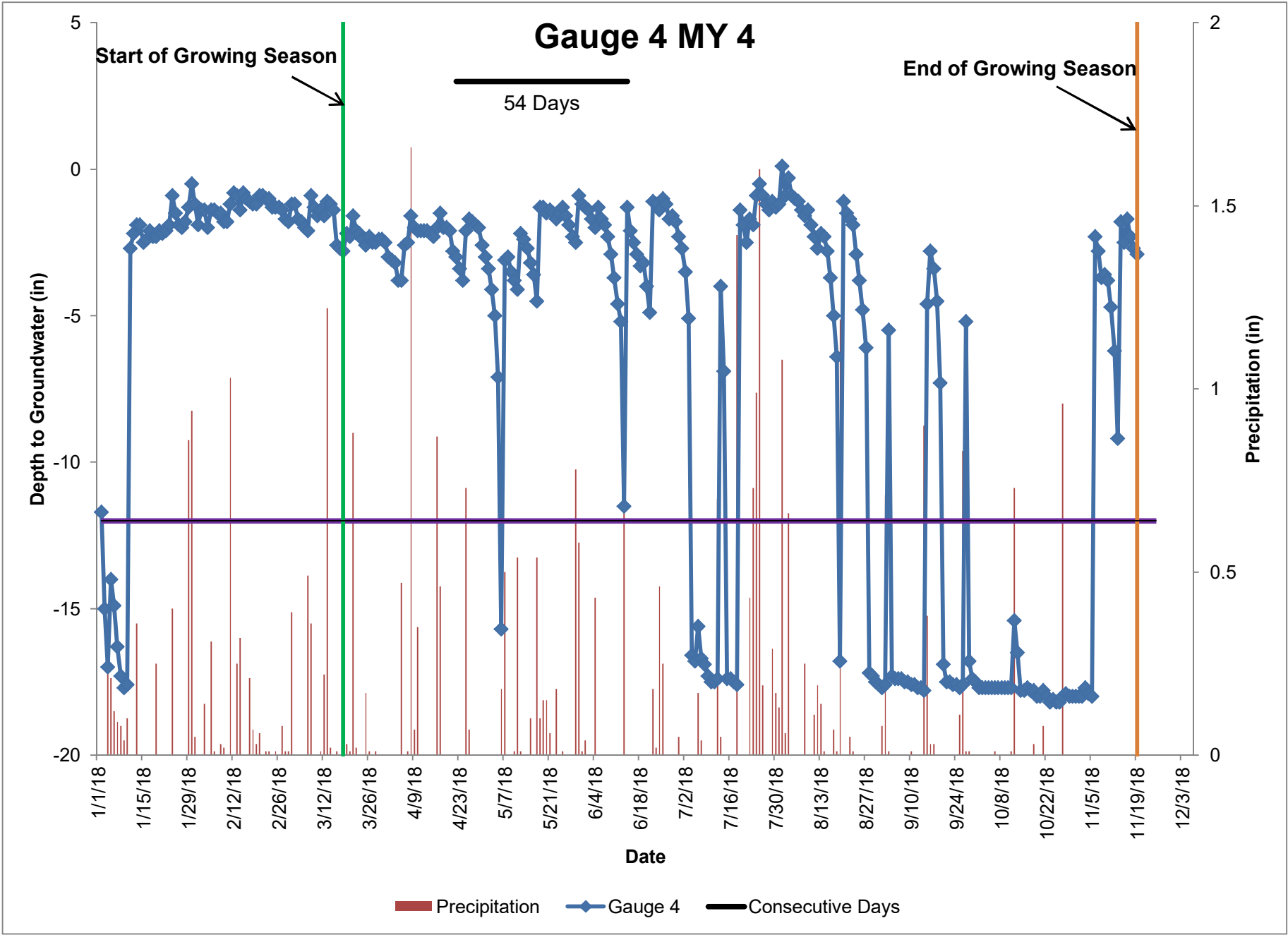
Upstream portion: Evidence of flow 3-15-2018

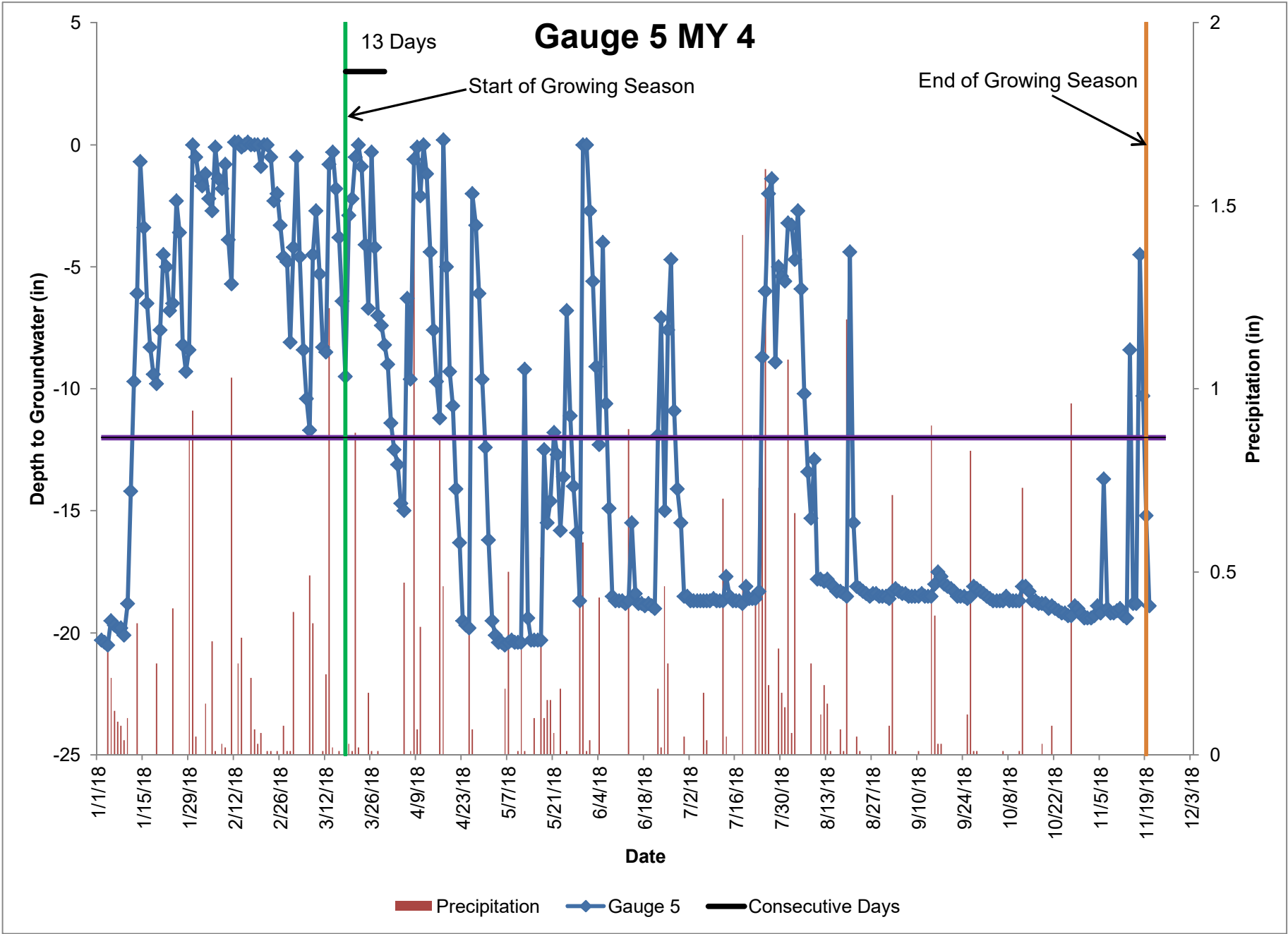
Appendix E
Hydrology Data

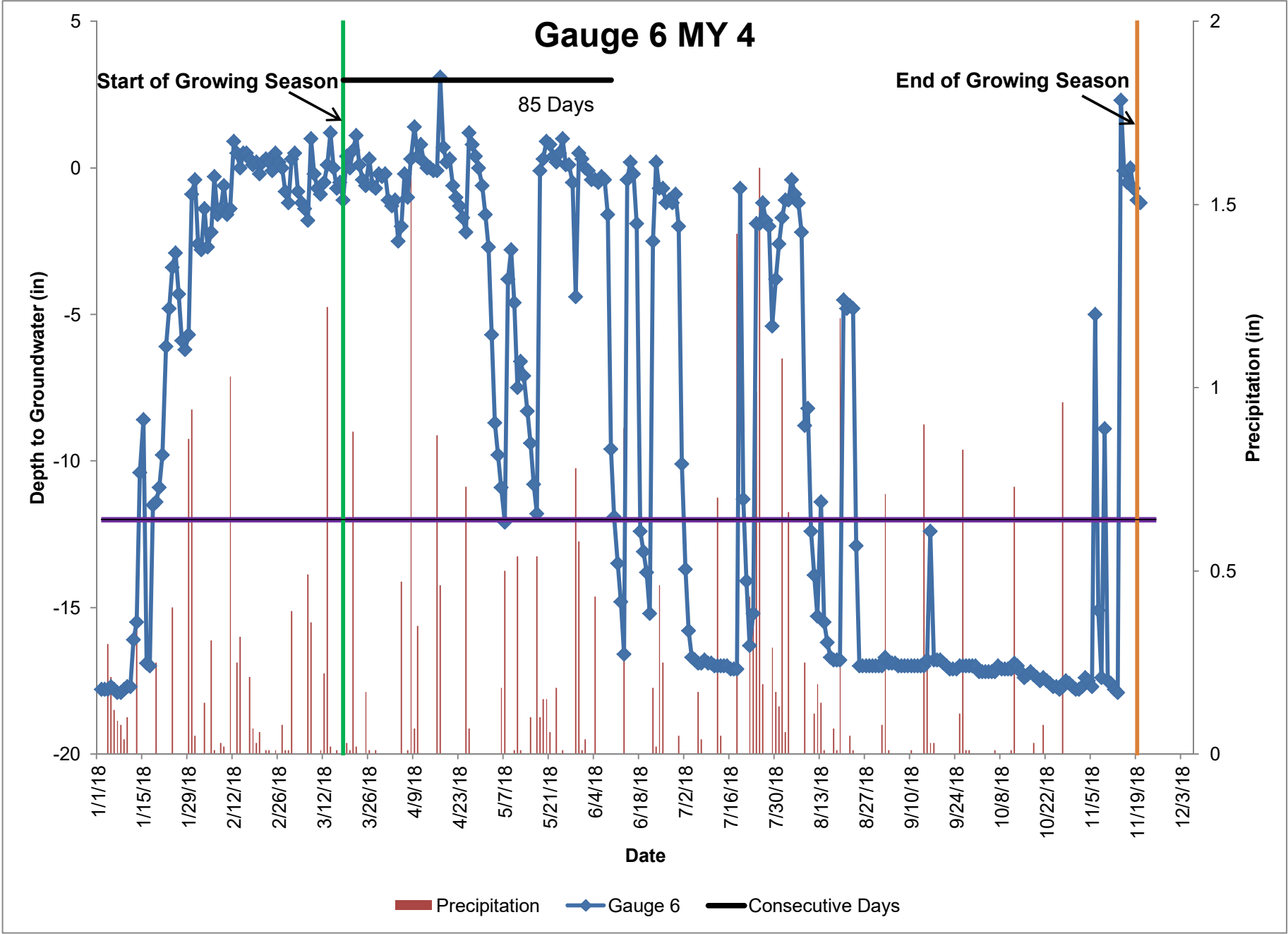


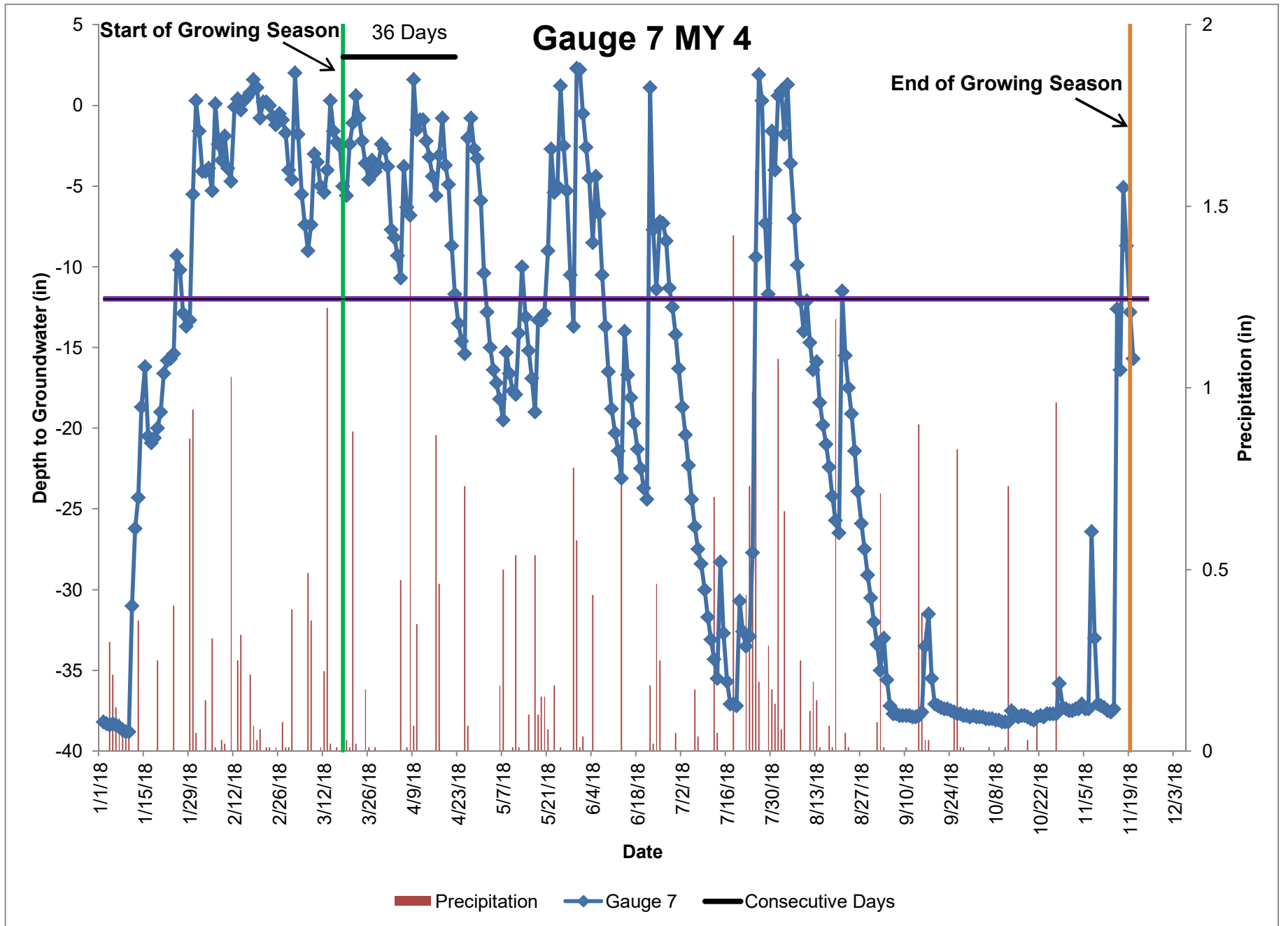


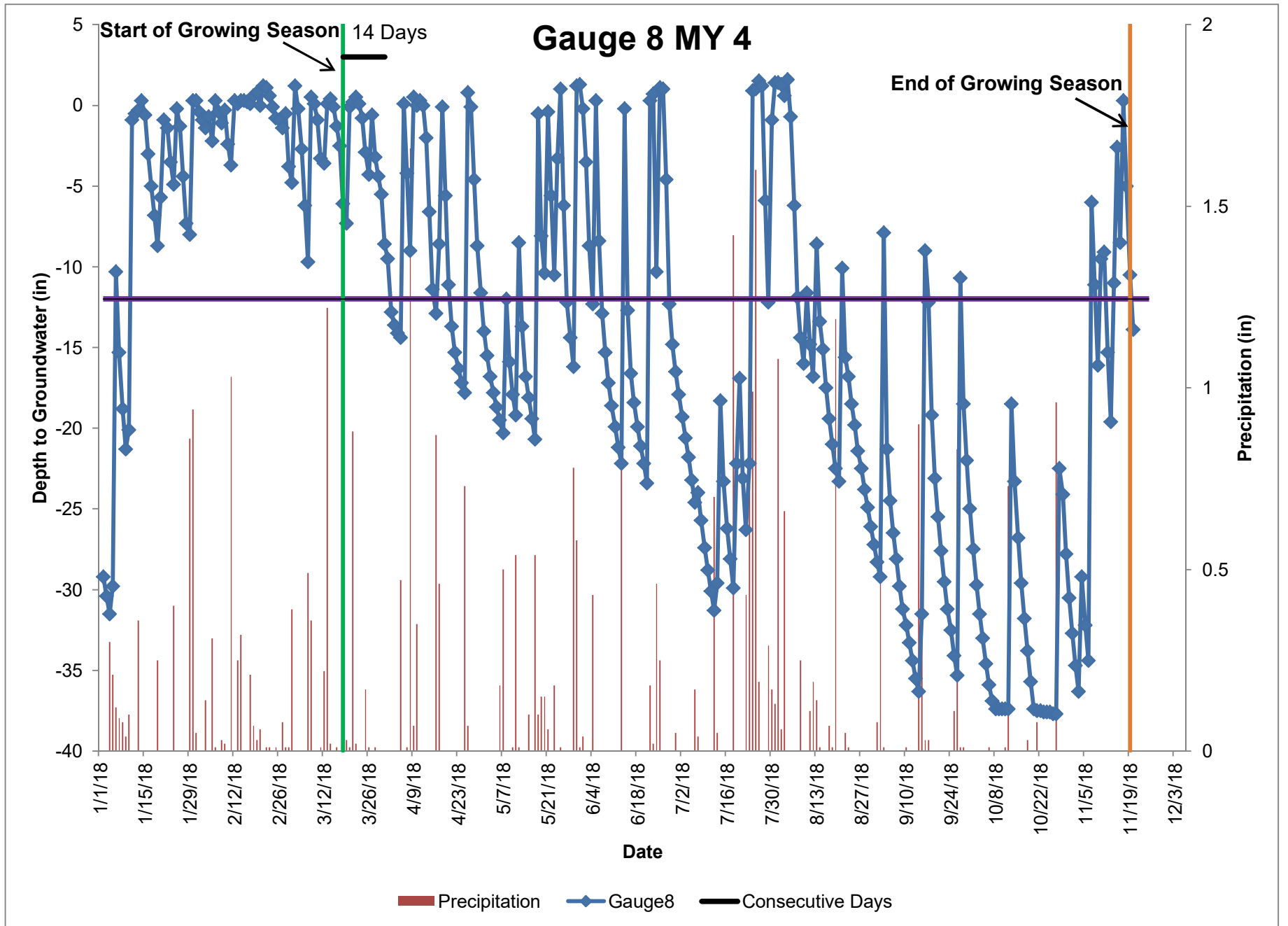


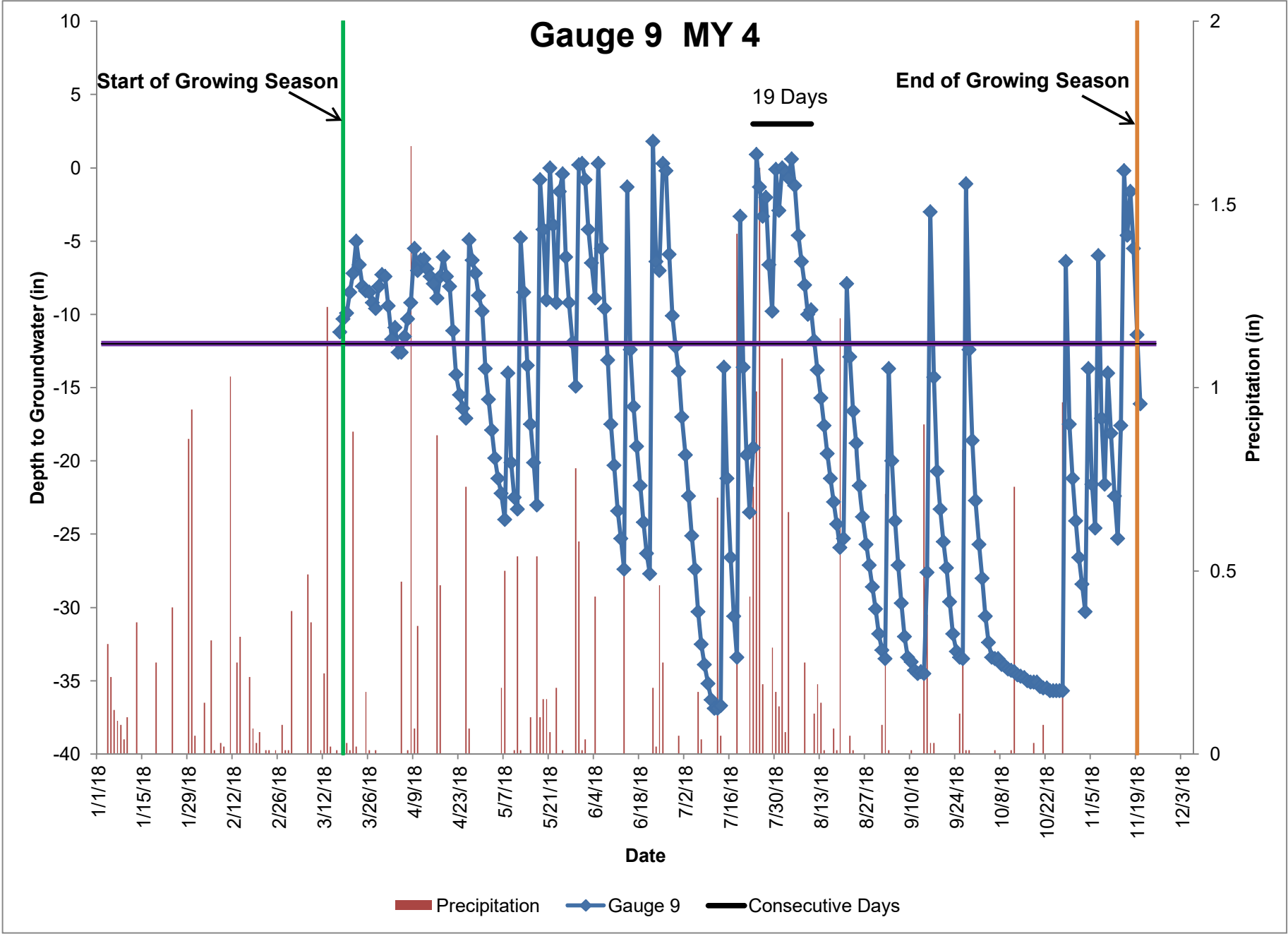












Gauge 10 MY 4

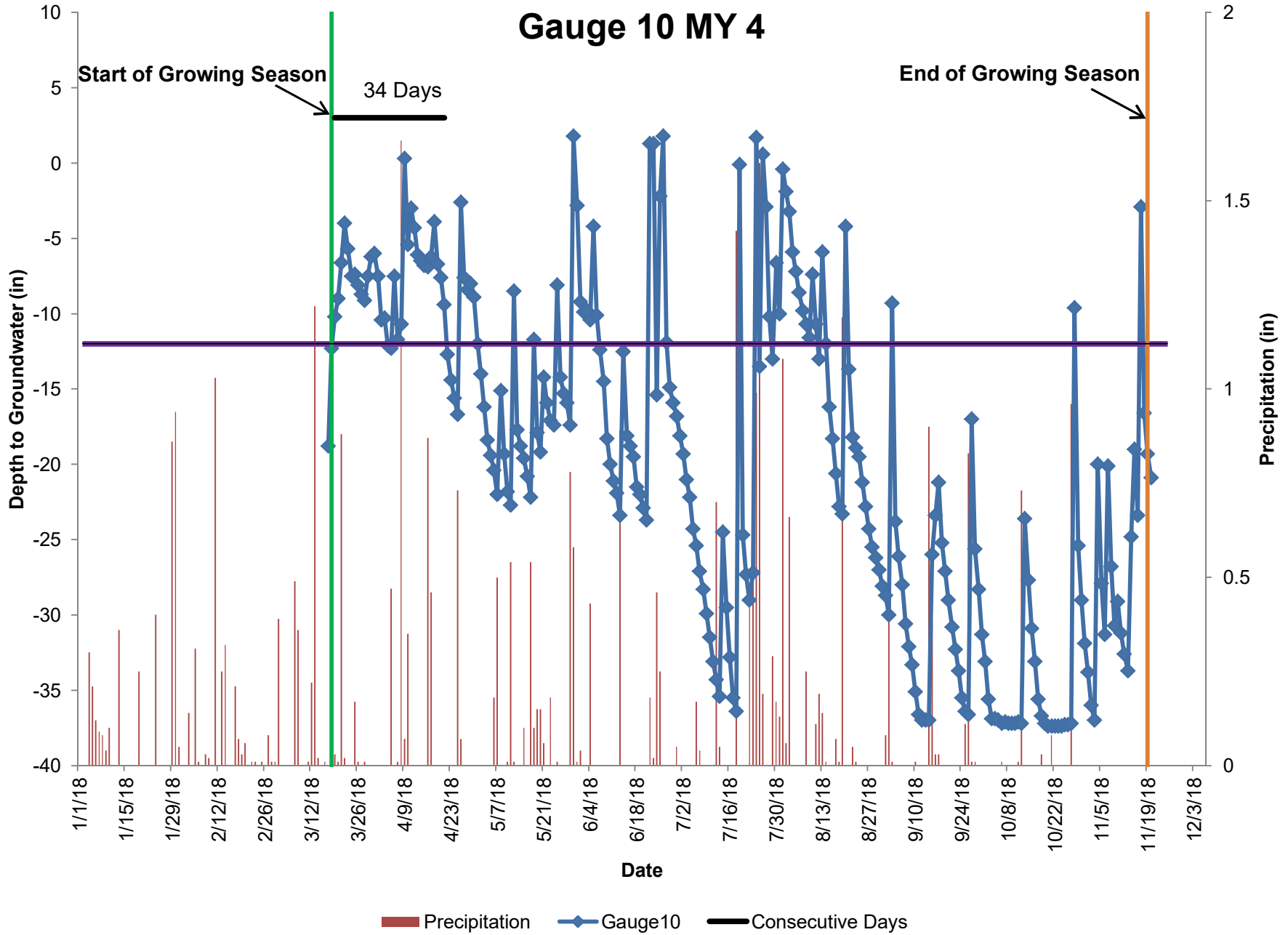
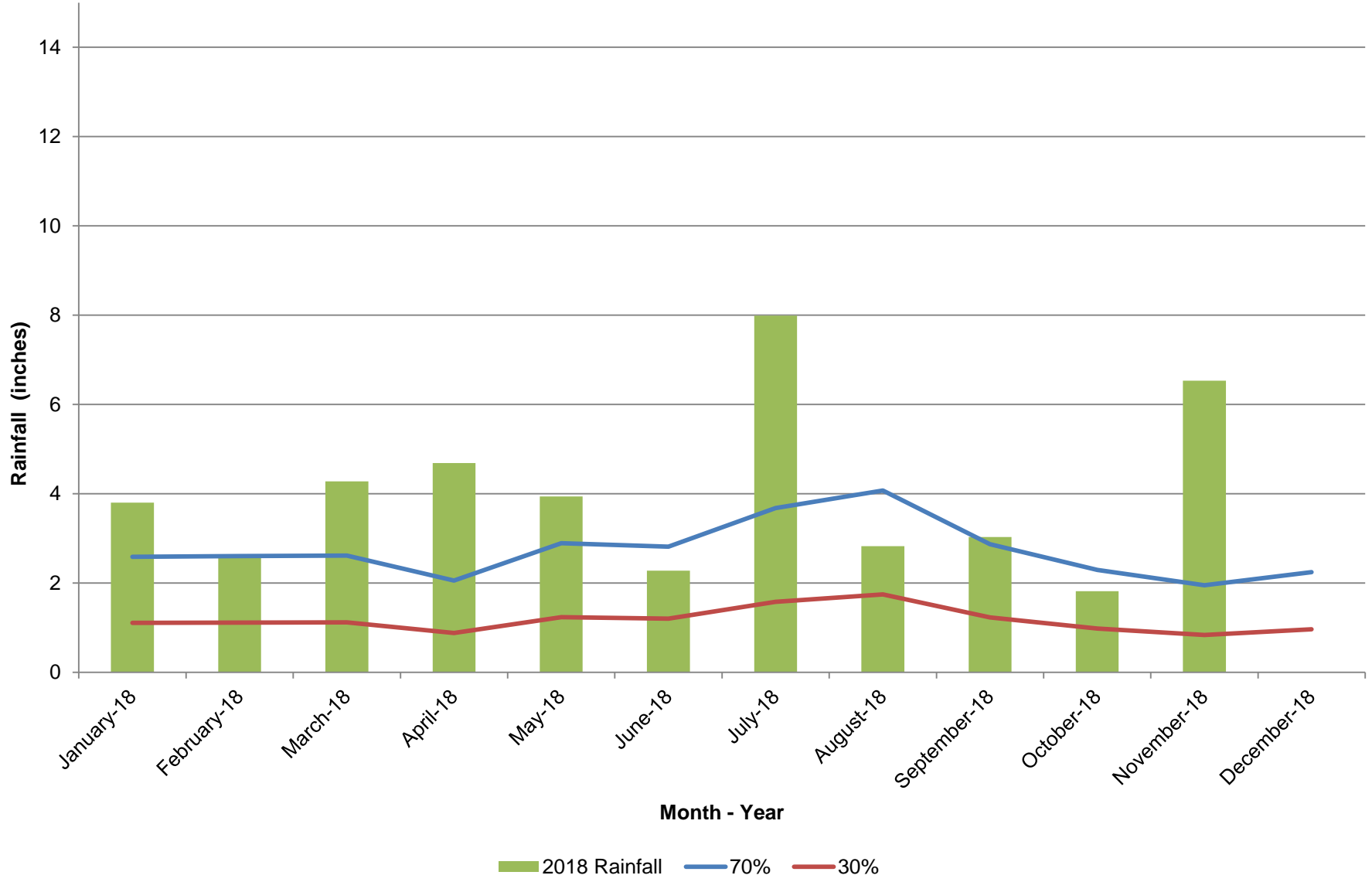


Table 10	Wetland Hydrology Attainment Table Watts Stream and Wetland Restoration DMS #413				
	Greater than 8% Continuous Saturation				
Gauge #	MY- 1 2015	MY- 2 2016	MY- 3 2017	MY- 4 2018	MY- 5 2019
1	Yes/25 10.2%	Yes/54 21.9%	Yes/53 21.5%	Yes/59 24.0%	
2	Yes/63 25.6%	Yes/65 26.4%	Yes/130 52.8%	Yes/108 43.9%	
3	No/7 2.8%	No/12 4.9%	No/12 4.9%	Yes/34 13.8%	
4	Yes/71 28.9%	Yes/46 18.7%	Yes/54 22.0%	Yes/54 22.0%	
5	No/8 3.3%	No/10 4.1%	No/9 3.7%	No/13 5.3%	
6	Yes/25 10.2%	Yes/61 24.8%	Yes/26 10.6%	Yes/85 34.6%	
7			No/11 4.5%	Yes/36 14.6%	
8			No/8 3.3%	No/14 5.7%	
9				No/19 7.7%	
10				Yes/34 13.8%	

Growing season is assumed to be 246 days.

Watts Property Monitoring Year 4 2018 Monthly Precipitation Data 30/70 Graph



Headwater Channel Depth Pressure Transducer Data MY 4

