

## **Year 3 of 5 Monitoring Report**

**Five-Mile Branch Stream and Wetland  
Restoration, Iredell County**

**NCDMS IMS ID# 92185  
DEQ Contract # 6036**

**Prepared for:**

**North Carolina Department of  
Environmental Quality, Division of  
Mitigation Services Raleigh, North  
Carolina**



April 2016

## **Year 3 of 5 Monitoring Report**

### **Five-Mile Branch Stream and Wetland Restoration**

NC Engineering License # C-1869

NC Surveying License # C-1869

Prepared for:

NCDEQ-DMS

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Date:

April 2016

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## **1. Project Summary**

### **1.1 Goals and Objectives**

The primary goals of this restoration project focus on the following:

- Increase bank stability, nutrient filtration and aquatic habitat
- Reduce soil disturbance and nutrient inputs to stream
- Improve soil physical and chemical properties in the near term
- Improve hydrologic connectivity with floodplain
- Attenuate site impacts of storm flows
- Restore ground water hydrology to pre-agricultural levels
- Restore wetland and riparian habitat

These goals were accomplished by:

- Establishing a minimum 50-foot buffer consisting of a mix of native species representative of piedmont/mountain bottomland hardwood forest. The planted species were selected by evaluation of adjacent reference sites and reviewing species listed in Classification of Natural Communities of North Carolina: Third Approximation (Schafale and Weakley 1990). A total of 1.9 acres of bottomland hardwood forest were preserved through land ownership or conservation easements. Land preservation reduced soil disturbance and nutrient input to the streams.
- Grading stream banks, installation of in-stream structures, and removal of an adjacent berm increased bank stability, improved in-stream habitat diversity and improved the hydrologic connectivity with the adjacent floodplain. Gently sloped, vegetated, stream banks in conjunction with in-stream structures increased bank stability. The in-stream structures all increased stream habitat diversity by establishing riffle-pool sequences and establishing stable woody debris. Removal of the berm reduced the water surface elevation required to reach the floodplain.
- Fill existing drainage ditches and excavating floodplain pools. Elimination of the drainage ditches and grading the floodplain restored groundwater hydrology to pre-agriculture conditions, in-turn restoring wetlands and riparian habitat.

- Ripping floodplain soil prior to planting to reduce ground compaction caused by past agricultural practice and allowing water infiltration.

## **1.2 Project History**

The Five Mile Branch Mitigation site was selected for stream and wetland restoration originally by the North Carolina Department of Transportation (NCDOT) then transferred to the North Carolina Division of Mitigation Services (NCDMS). The purpose of this restoration project was to restore, enhance and preserve streams and wetlands within the site. Beaver and Fifth creeks are the primary stream within the site. There are five unnamed tributaries that were preserved. The site's original design was developed while the project was under NCDOT auspices and was a very sinuous, priority 2 stream restoration with a great deal of structure, which presented concerns in terms of cost and stability (risk/cost-benefit). The proposed alignment also led to retrospective concerns of hydrologic trespass by NCDOT for the I-40 right of way. Collectively, this prompted an enhancement approach to the stream channel through stabilization, improvement of the profile, and the removal of berms to provide additional floodplain connection. (NCDMS 2013)

The Five Mile Branch Site (site) is east of Statesville in Iredell County, southeast of Interstate 40 (I-40) and northwest of US Route 64 in the South Yadkin Watershed (03040102). The site is in the Township of Cool Springs on the Statesville East, NC, 7.5-minute U.S. Geological Survey (USGS) topographic quadrangle (Figure 1). The Site comprises 12 adjacent parcels totaling approximately 229 acres (92.67 ha). It is bordered to the north by I-40 and to the south, east, and west by various forested, pasture, and residential properties. Swann Road (SR 2167), running north and south, bisects the site. Chimney Lane dead-ends on the site west of Swann Road.

The drainage area at the downstream end of the site (Reach 3) is 26.0 square miles. The drainage area for Beaver Creek (Reach 1) and Fifth Creek (Reach 2) at their confluence just west of Chimney Lane is 10.7 and 13.9 square miles respectively.

The restoration strategy implemented on Beaver and Fifth creeks consisted of Enhancement Level II. Both streams were stabilized in their current locations. Their north banks were re-graded to a flatter slope and boulder grade control structures were installed. No work was performed on the unnamed tributaries. They were preserved through conservation easements or property purchase. Wetland restoration was accomplished by filling in the drainage ditches, grading floodplain pools and replanting with native vegetation. Through these practices 11,676.1 linear feet of stream were

enhanced, 1,537.8 linear feet of stream preserved, 48.7 acres of wetland restored and 1.9 acres of wetlands preserved. The above quantities do not include 919.6 linear feet of stream at the downstream end of the project where there is not ownership of both side of the stream. Due to the near systemic mature of the improvements to the channel cross section and the localized improvements to the profile/in-stream habitat, a credit ratio of 2:1 is being used.

### 1.3 Vegetation

Vegetation monitoring was conducted on June 11<sup>th</sup> and 12<sup>th</sup> 2015. After three growing seasons, three (Plots 4, 6, and 9) of the 23 vegetation plots are meeting the year three success criteria of 320 planted stems per acre. However, including both planted and volunteer woody stems, 18 (Plots 2-12; 15, 17; 19-23) of the 23 plots are far exceeding the success criteria.

The conservation easement is populated with a diverse assemblage of woody volunteers with river birch (*Betula nigra*), silky dogwood (*Cornus amomum*), willow oak (*Quercus phellos*) and cherrybark oak (*Q. pagoda*) having the highest occurrences of planted woody stems. Other planted species include possumhaw (*Ilex decidua*), black walnut (*Juglans nigra*), black gum (*Nyssa sylvatica*), sycamore (*Platanus occidentalis*) and swamp chestnut oak (*Q. michauxii*). Volunteers observed throughout the conservation easement include sweetgum (*Liquidambar styraciflua*), sycamore, box elder (*Acer negundo*), red maple (*Acer rubrum*), river birch, green ash (*Fraxinus pennsylvanica*), tulip poplar (*Liriodendron tulipifera*), Eastern cottonwood (*Populus deltoides*), red elm (*Ulmus rubra*), common elderberry (*Sambucus canadensis*), persimmon (*Diospyros virginiana*) and buttonbush (*Cephalanthus occidentalis*). Additional volunteer woody species observed less frequently include loblolly pine (*Pinus taeda*), Eastern red cedar (*Juniperus virginiana*), pignut hickory (*Carya alba*), and silverling (*Baccharis halimifolia*).

Planted and volunteer woody stem densities are low in Plots 1, 13, 14, 16, and 18; due to mowing in plot 1 and herbaceous cover within plots 13, 14, 16, and 18. Mowing encroachment occurred within Plot 1, resulting in only two woody stems occurring within the plot. Plot 1 was replanted in January 2016 with red maple, sycamore, redbud (*Cercis canadensis*) bare root seedlings. Plot 13 woody stems are low due to a dominant herbaceous layer of Chinese bushclover (*Lespedeza cuneata*) common mugwort (*Artemisia vulgaris*), broomsedge (*Andropogon virginicus*), and tall goldenrod (*Solidago altissima*). Plot 14 is saturated and is located on the edge of a non-tidal freshwater marsh dominated by wetland herbs such as sedges (*Carex* sp.), common

rush (*Juncus effusus*), swamp cutgrass, (*Leersia virginica*), common cattail (*Typha latifolia*), arrowleaf tear-thumb (*Persicaria sagittata*), and Eastern rose-mallow (*Hibiscus moscheutos*). Plot 16 woody stem densities are low due to the dominant layer of herbs such as the Chinese bush clover, tall goldenrod, and deer-tongue (*Dicanthelium clandestinum*). Plot 18 lacks woody stems due soil saturation and herbaceous cover. The herbaceous layer is dominated by bulrush (*Scirpus cyperinus*), false nettle (*Boehmeria cylindrica*), monkey-flower (*Mimulus ringens*), common rush, and arrowleaf tear-thumb. The increase in the number of planted stems between monitoring years is due to stems previously identified as dead resprouting or identify stems that were overlooked in previous years.

Herbaceous vegetation was dense throughout the conservation easement and no bare areas were observed within the floodplain. Some areas along the banks were bare due to erosion. Refer to CCPV map. Routine mowing has stopped in the areas of concern within the conservation easement, both within the vicinity of vegetation plot 1 and the Freeze property. The herbaceous vegetation appears to be recovering.

Invasive vegetation is present throughout the site. Four invasive species of high concern were observed during the year three monitoring season; Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), and tree-of-heaven (*Ailanthus altissima*). Honeysuckle was observed throughout the site. Tree-of-heaven is very sparse throughout the site, less than 10 individuals were observed. However, more stems were observed in the understory within the undisturbed forested community on the south side of the main channel. Chinese privet was mainly observed in areas that were not disturbed during construction.

The location of honeysuckle is not shown on the CCPV. It occur throughout the planted areas of the conservation easement. Depicting it location would cover the majority of the site. The location of well-defined stands of Chinese privet and multiflora rose are depicted in the CCPV.

In January 2016, 100 red maple, 100 sycamore and 100 redbud 1-0 bare root stems were planted in a 0.60 acre mowing encroachment area (near vegetation plot 1). This area required replanting due to a property encroachment (mowing) by the adjacent landowner. DMS resolved the encroachment issue with the adjacent landowner prior to the 2016 planting efforts. The area has also been further delineated with DMS signage to avoid future encroachment.

#### **1.4 Stream**

There were no significant change is the cross section dimensions. The maximum depth of cross section 11 decreased by 0.7 feet. However, it is still deeper than year 1.

Several bank stress areas were again identified in year 2. They are located in the same areas as year 1. There was a minor increase in their length.

The discrepancies between the as-built cross sections and the three following year's cross sections are the result of the as-built cross sections being generated from the surface contours created from the as-built field survey, which was not surveyed by ARCADIS staff. The annual monitoring surveys of the channel were generated using field surveys and accurately represent actual field conditions.

Based on field observations and the insignificant changes in the channels cross sections the project stream banks are stable and functioning properly. Thick stand of vegetation have established on the banks throughout the site. In some areas, sandy sediment has deposited on the banks, further encouraging the establishment of vegetation. Only small areas of localized erosion were observed. These areas were not considered significant but will continue to be assessed during future monitoring events.

Boulders have settled on the arms of three cross vane structures, one structure on each reach (32+20 BVR, 18+70 FTH upstream and 32+50 FTH downstream). The same boulder settled on each structure, an arm boulder near the head of the structure. The structures are still functioning in that they are providing grade control, bank protection and habitat diversity. The only flaw is at low flow the main flow is over the lower portion of the arm and not the head of the structure. These structures will continue to be assessed in future monitoring events.

Ten areas totaling 595 feet of bank erosion were identified during the 2016 monitoring year. These areas lack vegetative cover. It couldn't be determined if the banks lacked vegetation due to scour or if they scoured due to the lack of vegetation. Erosion extend 1-2 feet above the bank toe and were not considered significant. These areas will continue to be assess during future monitoring events.

One bankfull event was recorded on Beaver Creek and Fifth Creek Upstream on March 5, 2015. There was not a bankfull event on Fifth Creek Downstream. The cumulative total for the monitoring period is seven.



### **1.5 Wetland**

Wetland hydrology was monitored for the entire growing season, April 17 – October 17, (USDA 2011) in the Year 3 monitoring term. One gauge (gauge 17) of the 30 on site gauges did not meet the establish success criteria of saturation within 12 inches of the ground surface for 9 consecutive days of the growing season (5% of the 183 day growing season). Two gauges (22 and 23) had ground water within 12 inches of the ground surface for 100% of the growing season. Gauges 2 (5.5%), 7 (6.0%), 18 (6.0%), and 28 (6.0%) barely meet the established success criteria. Remaining gauges ranged between 8.2 and 36.6% of the growing season.

The functionality of the gauges was very unpredictable. Some gauges functioned during one download event, not the next and then functioned properly at the next event. Batteries were replaced and historical data was deleted from most gauges to help improve their functionality. Sometime this was successful. One malfunctioning gauge was replaced (gauge 27) during the 2015 monitoring period. Gauges 2, 13 and 17 malfunctioned during the 2015 monitoring year. There was a gap in the data. For unknown reasons they did not collect data for a random period. They collected data prior to and after this gap. Only gauge 17 did not meet the success criteria and this does not seem to be a result of incomplete data. This gauge is located in a higher area of the site.

### **1.6 Note**

Summary information/data related to the occurrence of such things as beaver or encroachment, and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on DMS's website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

## **2. Methodology**

### **2.1 Vegetation**

Vegetation monitoring followed Carolina Vegetative Survey Level 2. Vegetation monitoring was conducted on June 10 and 11, 2015 and all planted and volunteer stems were tallied.

### **2.2 Stream Hydrology**

Stream water depth was measured and recorded with HOBO® pressure sensor gauges manufactured by onset®. Three HOBO® devices were installed at the Five Mile Branch restoration site, one on Beaver Creek upstream of Chimney Lane, one on Fifth Creek upstream of the confluence with Beaver Creek and one on Fifth Creek downstream of Swann Road. The dataloggers were downloaded periodically during the monitoring period.

### **2.3 Cross Section Surveys**

Cross sectional surveys were conducted by ARCADIS staff on May 14 and 15, 2015 using a Topcon total station. The survey data was imported and plotted using AutoCadd 2013 software

### **2.4 Wetland Hydrology**

Wetland hydrology was monitored using RDS Ecotone® WM Water Level Instruments (gauges). The gauges were programmed to take one reading daily at 8:00 AM EST. Gauges were downloaded using a Meazura™ handheld device manufactured by ACEECA™. Data from the handheld device was then transferred to a Lenovo laptop computer and processed using MicroSoft Excel software.

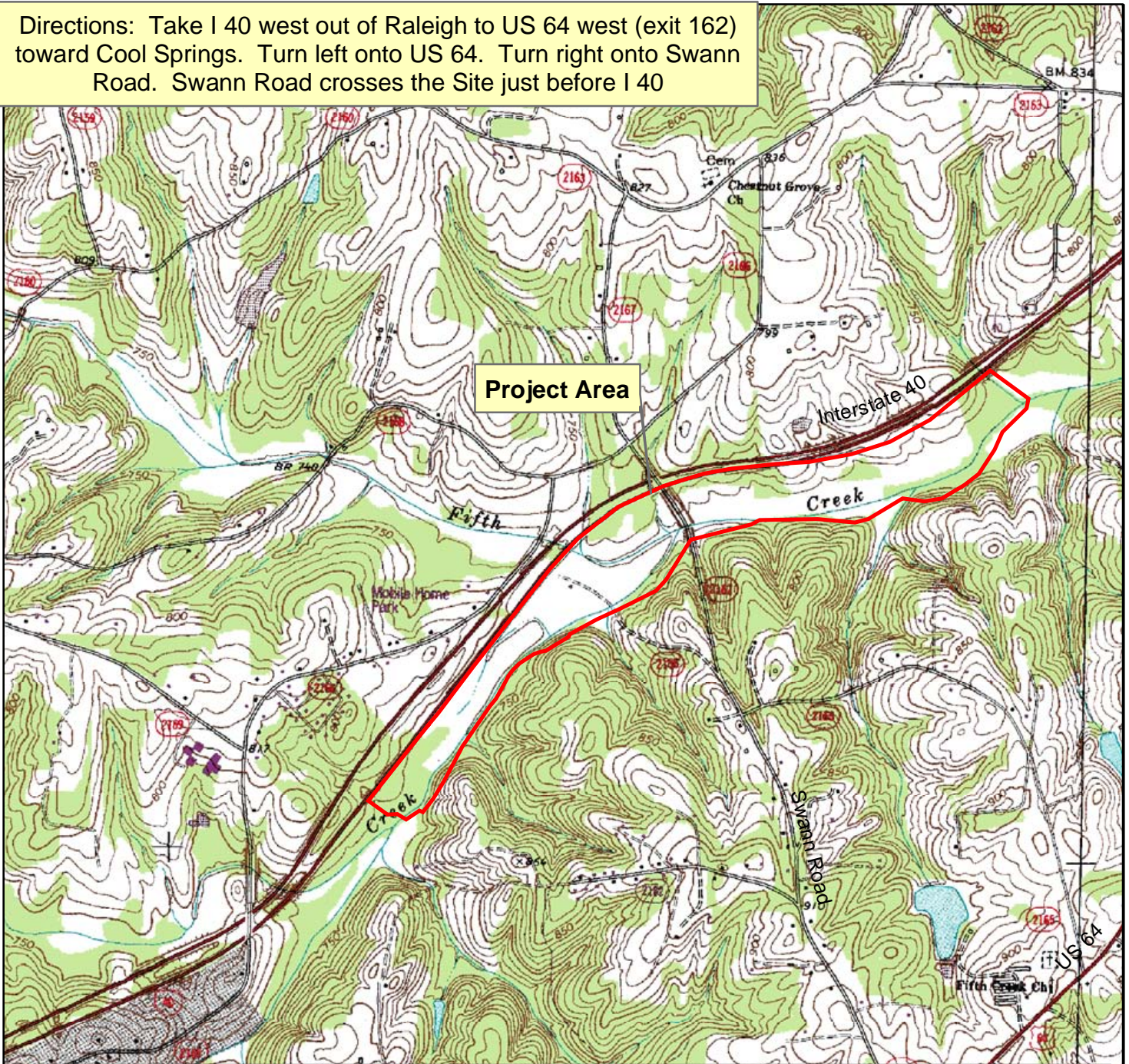
### **3. References**

- Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (<http://cvs.bio.unc.edu/methods.htm>).
- North Carolina Department of Environment and Natural Resources (NCDENR). 2008. Yadkin Pee-Dee River Basinwide Water Quality Plan. Prepared by the North Carolina Division of Water Quality, Water Quality Section.
- North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program (NCDENR) 2014. Annual Monitoring and Closeout Reporting Format, Data Requirements, and Content Guidance, February 2014.
- North Carolina Division of Mitigation Services (NCDMS). 2013. Letter dated February 28, 2013.
- Schafale, M.P., and A. S. Weakley. 1990. Classification of the Natural Communities of North Carolina, A Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, Department of Environment, Health and Natural Resources, Raleigh, NC.
- US Army Corps of Engineers (USACE) 2003. April 2003 Stream Mitigation Guidelines
- United States Department of Agriculture, Natural Resources Conservation Service, 2011 Soil Survey of Iredell County, North Carolina. (Available online at [http://soils.usda.gov/survey/printed\\_surveys/](http://soils.usda.gov/survey/printed_surveys/))

## **Appendix A**

Project Vicinity Map and  
Background Tables

Directions: Take I 40 west out of Raleigh to US 64 west (exit 162) toward Cool Springs. Turn left onto US 64. Turn right onto Swann Road. Swann Road crosses the Site just before I 40



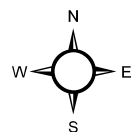
The subject project site is an environmental restoration site of the NCDENR Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activities requires prior coordination with DMS.



0 1,500 3,000 6,000 Feet

SCALE: 1:24,000

Source: USGS Quadrangle Maps Statesville East and Cool Springs, NC



Prepared For

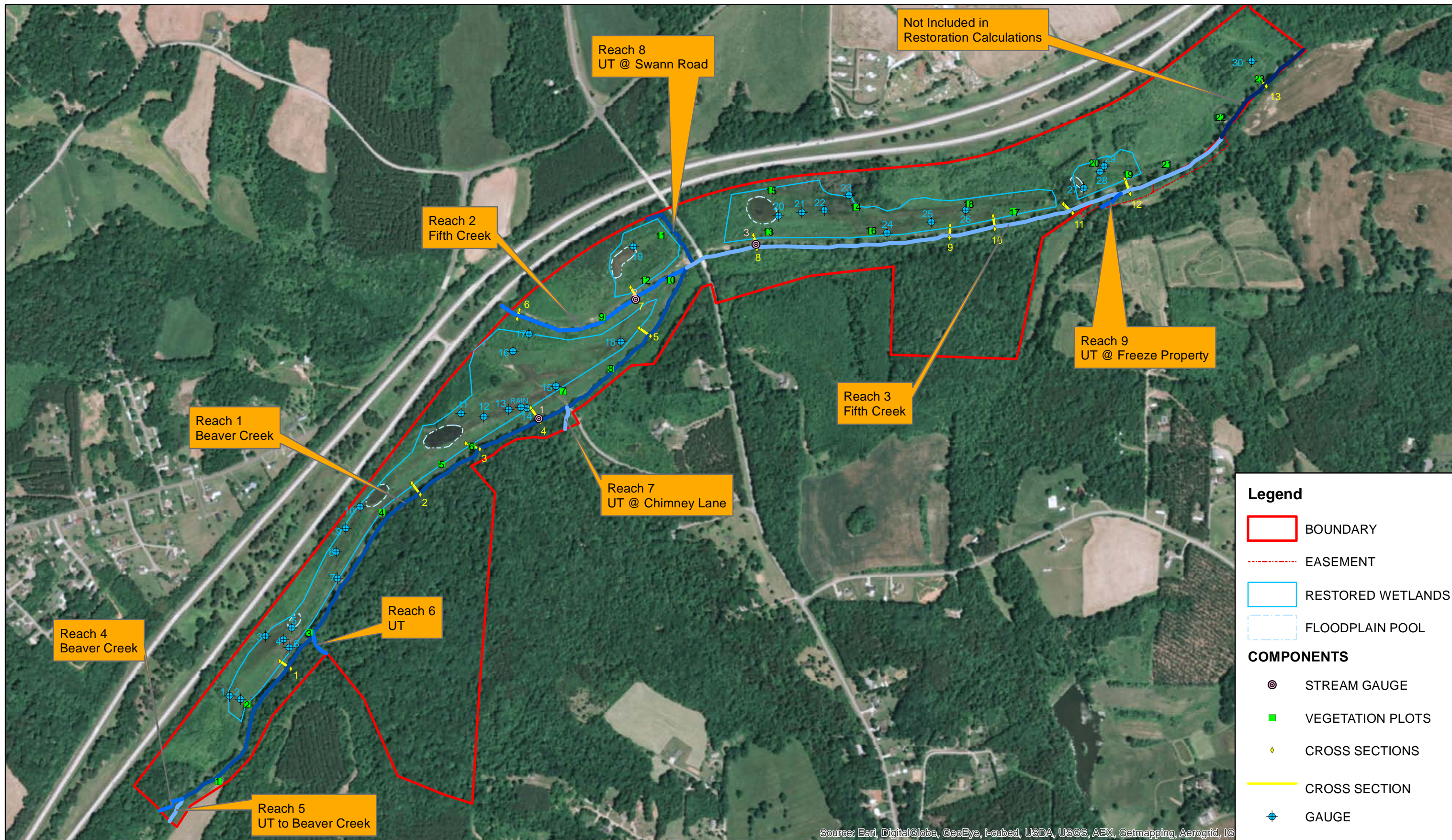


**VICINITY MAP**

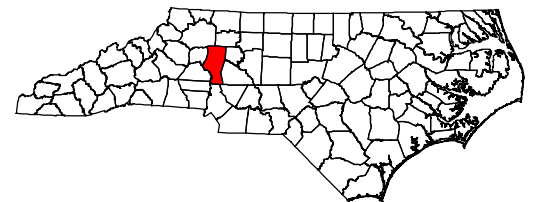
Five Mile Branch  
Stream and Wetland Restoration Site  
Iredell County, North Carolina

Figure No.

1

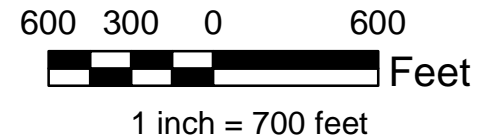


Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IG



**PROJECT COMPONENTS**  
 FIVE MILE BRANCH RESTORATION SITE  
 IREDELL COUNTY, NORTH CAROLINA

Aerial: 2011 Bing Maps Aerial



**Figure No.**  
**2**

**Table 1. Project Components and Mitigation Credits  
Five Mile Branch Stream Restoration, EEP IMS ID# 92185**

Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,924.7	142.5	48.0	0.38	-	-	-	-	-
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	
Reach 1 - Beaver Creek	10+87.03 PRBVR to Fifth Creek		5,794.4		E II	R	5,794.1	2:1**	
Reach 2 - Fifth Creek upstream of Beaver Creek	I-40 to Beaver Creek		1,586.4		E II	R	1,586.4	2:1**	
Reach 3 - Fifth Creek downstream of Beaver Creek	Beaver Creek to 78+60.00 PRFTH		5,215.2		E II	R	4295.6*	2:1**	
Reach 4 - Beaver Creek (Upstream)	Property line to 10+87.03 PRBVR		205.8		Pres.	RE	205.8	10:1	
Reach 5 - UT to Beaver Creek (Upstream)	Property line to Beaver Creek		200.7		Pres.	RE	200.7	10:1	
Reach 6 - UT	Property line to Beaver Creek		203.1		Pres.	RE	203.1	10:1	
Reach 7 - UT at Chimney Lane	Property line to Beaver Creek		173.3		Pres.	RE	173.3	10:1	
Reach 8 - UT at Swann Road	Property line to Fifth Creek		576.0		Pres.	RE	576.0	10:1	
Reach 9 - UT at Freeze Property	Within the Conservation Easement		178.9		Pres.	RE	178.9	10:1	
Wetlands	Throughout the site		48.7		Rest.	R	48.7	1:1	
Wetlands	Throughout the site		1.9		Pres.	RE	1.9	5:1	
Component Summation									
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)			
		Riverine	Non-Riverine						
Restoration	N/A	48.0	N/A	N/A	N/A	N/A			
Enhancement		N/A	N/A	N/A	N/A	N/A			
Enhancement I	N/A								
Enhancement II	11,849.3								
Creation		N/A	N/A	N/A		N/A			
Preservation	1,425.0	1.9	N/A	N/A		N/A			
High Quality Preservation	N/A	N/A	N/A	N/A		N/A			

\* Difference between existing and restoration footage is due to the absence of ownership of both side of the downstream most 919.6 linear feet of stream.

\*\*due to the near systemic nature of the improvement to the channel cross-section and the localized improvements to the profile/in-stream habitat, a credit ratio of 2.0:1.0 is being used.

**Table 2. Project Activity and Reporting History  
Five Mile Branch Stream Restoration, EEP IMS ID# 92185**

<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Restoration Plan	Dec-09	Dec-09
Final Design – Construction Plans	Nov-10	Nov-10
Construction	Apr-11	Apr-12
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	Jun-12	Mar-13
Year 1 Monitoring	Dec-13	Dec-13
Year 2 Monitoring	Oct-14	Dec-14
Year 3 Monitoring	Nov-15	Dec-15
Year 4 Monitoring	-	-
Year 5 Monitoring	-	-



**Table 3. Project Contacts Table  
Five Mile Branch Stream Restoration, EEP IMS ID# 92185**

<b>Designer</b>	ARCADIS G&M of NC, Inc. 801 Corporate Center Dr., Suite 300, Raleigh NC 27607
Primary project design POC	Robert Lepsic 919-415-2278
<b>Construction Contractor</b>	North State Environmental 2889 Lowery Street, Winston Salem, NC 27101
Construction contractor POC	Michael Anderson 336-245-1253
<b>Survey Contractor</b>	North State Environmental 2889 Lowery Street, Winston Salem, NC 27101
Survey contractor POC	David K. Alley, PLS 336-250-9225
<b>Planting Contractor</b>	Southern Garden, Inc. PO Box 808, Apex, NC 27502
Planting contractor POC	Todd Laasko 919-362-1050
<b>Seeding Contractor</b>	Canady's Landscape and Erosion Control 256 Fairview Acres Road, Lexington NC 27295
Contractor point of contact	336-236-1182
<b>Seed Mix Sources</b>	Green Resource, Colfax, NC 27235 336-855-6363
<b>Nursery Stock Suppliers</b>	Foggy Mountain Nursery 336-384-5323 Claridge Nursery 919-731-7988 Brook Run Plantation 434-292-1677
<b>Monitoring Performers</b>	ARCADIS G&M of NC, Inc 801 Corporate Center Dr., Suite 300, Raleigh NC 27607
	Three Oaks Engineering 410-B Millstone Drive, Hillsborough, NC 27278
Stream Monitoring POC	Robert Lepsic 919-415-2278
Vegetation Monitoring POC	Robert Lepsic 919-415-2278
Wetland Monitoring POC	Robert Lepsic 919-415-2278

**Table 4. Attributes**  
**Five Mile Branch Stream Restoration, EEP IMS ID# 92185**

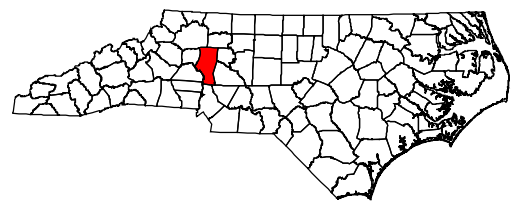
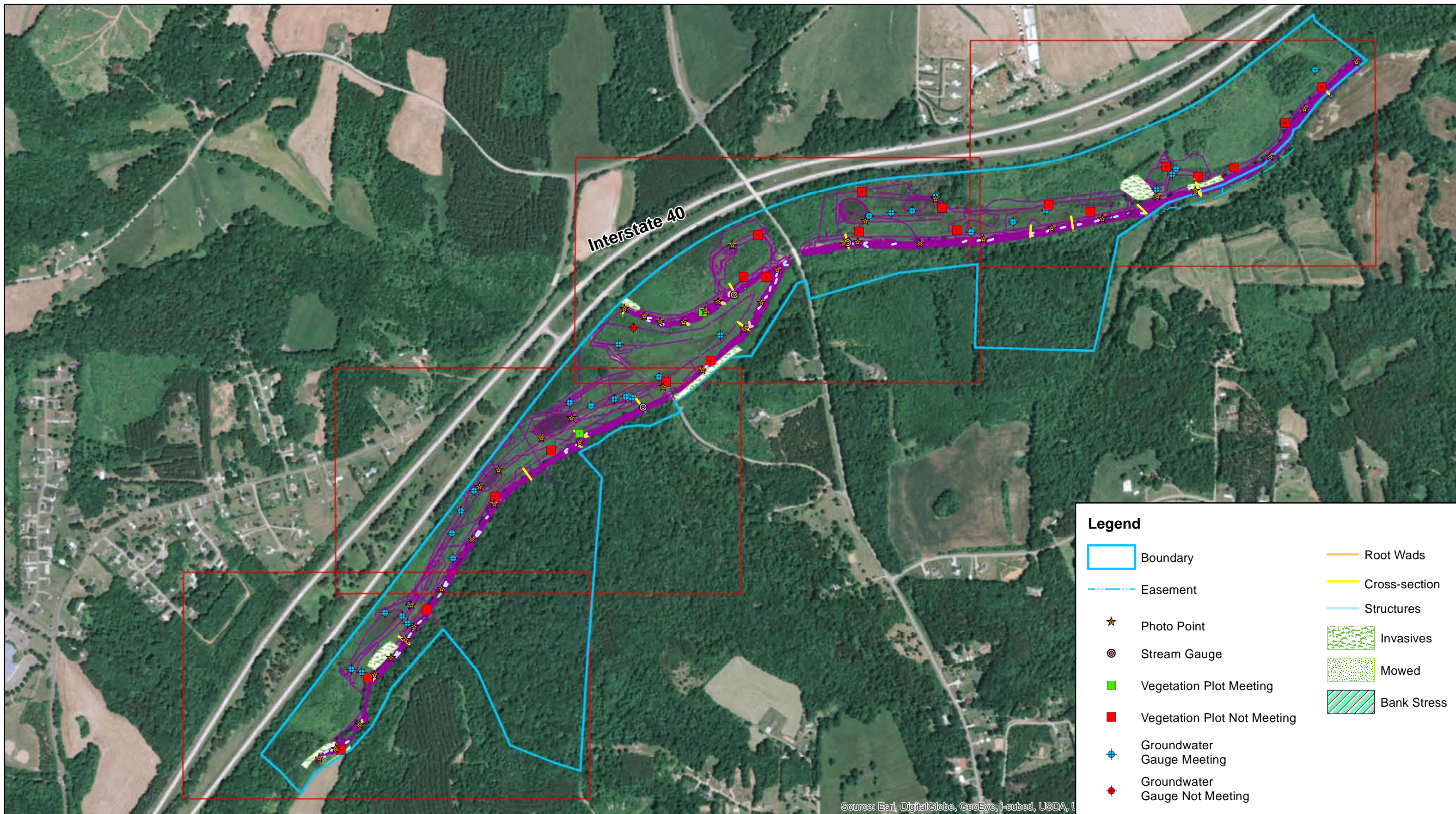
<b>Project Information</b>			
Project Name	Five Mile Branch Stream and Wetland Restoration		
County	Iredell		
Project Area (acres)	229		
Project Coordinates (latitude and longitude)	035° 50' 40.18" N	080° 46' 27.37" W	
<b>Project Watershed Summary Information</b>			
Physiographic Province	Piedmont		
River Basin	Yadkin-Pee Dee		
USGS Hydrologic Unit 8-digit		3040102	
DWQ Sub-basin	03-07-06		
Project Drainage Area (square miles)	26		
Project Drainage Area Percentage of Impervious Area	10-20		
CGIA Land Use Classification	Heavily developed, cultivated, herbaceous and shrubland, forest land, water bodies		
<b>Reach Summary Information</b>			
<b>Parameters</b>	<b>Reach 1</b>	<b>Reach 2</b>	<b>Reach 3</b>
Length of reach (linear feet)	5,794.1	1,586.4	5215.2*
Valley classification	VIII	VIII	VIII
Drainage area (square miles)	10.7	13.9	26.0
NCDWQ stream identification score	12-108-13-1	12-108-13	12-108-13
NCDWQ Water Quality Classification	Class C	Class C	Class C
Morphological Description (stream type)	E5	E5	E5
Evolutionary trend			
Underlying mapped soils	Codorus loam	Codorus loam	Codorus loam
Drainage class	somewhat poorly drained	somewhat poorly drained	somewhat poorly drained
Soil Hydric status	Yes	Yes	Yes
Slope	0-2%	0-2%	0-2%
FEMA classification	Zone AE	Zone AE	Zone AE

Native vegetation community	Bottomland hardwood	Bottomland hardwood	Bottomland hardwood
Percent composition of exotic invasive vegetation	<5	<5	<5
Wetland Summary Information			
Parameters	Wetland 1	Wetland 2	Wetland 3
Size of Wetland (acres)	48.0		
Wetland Type (non-riparian, riparian riverine or riparian non-riparian)	Riparian riverine		
Mapped Soii Series	Codorus loam		
Drainage class	somewhat poorly drained		
Soil Hydric Status	Yes		
Source of Hydrology	groundwater, precipitation and overbank flooding		
Hydrologic Impairment	Ditching		
Native vegetation community	Bottomland hardwood		
Percent composition of exotic invasive vegetation	<5		
Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States — Section 404	Yes	Yes	Restoration Plan
Waters of the United States — Section 401	Yes	Yes	Restoration Plan
Endangered Species Act	Yes	Yes	Restoration Plan
Historic Preservation Act	Yes	Yes	Restoration Plan
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	Restoration Plan
Essential Fisheries Habitat	No	N/A	N/A

\* included 919.6 linear feet of stream at downstream end without State ownership of both sides of stream.

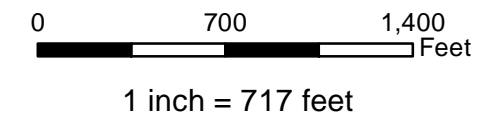
## **Appendix B**

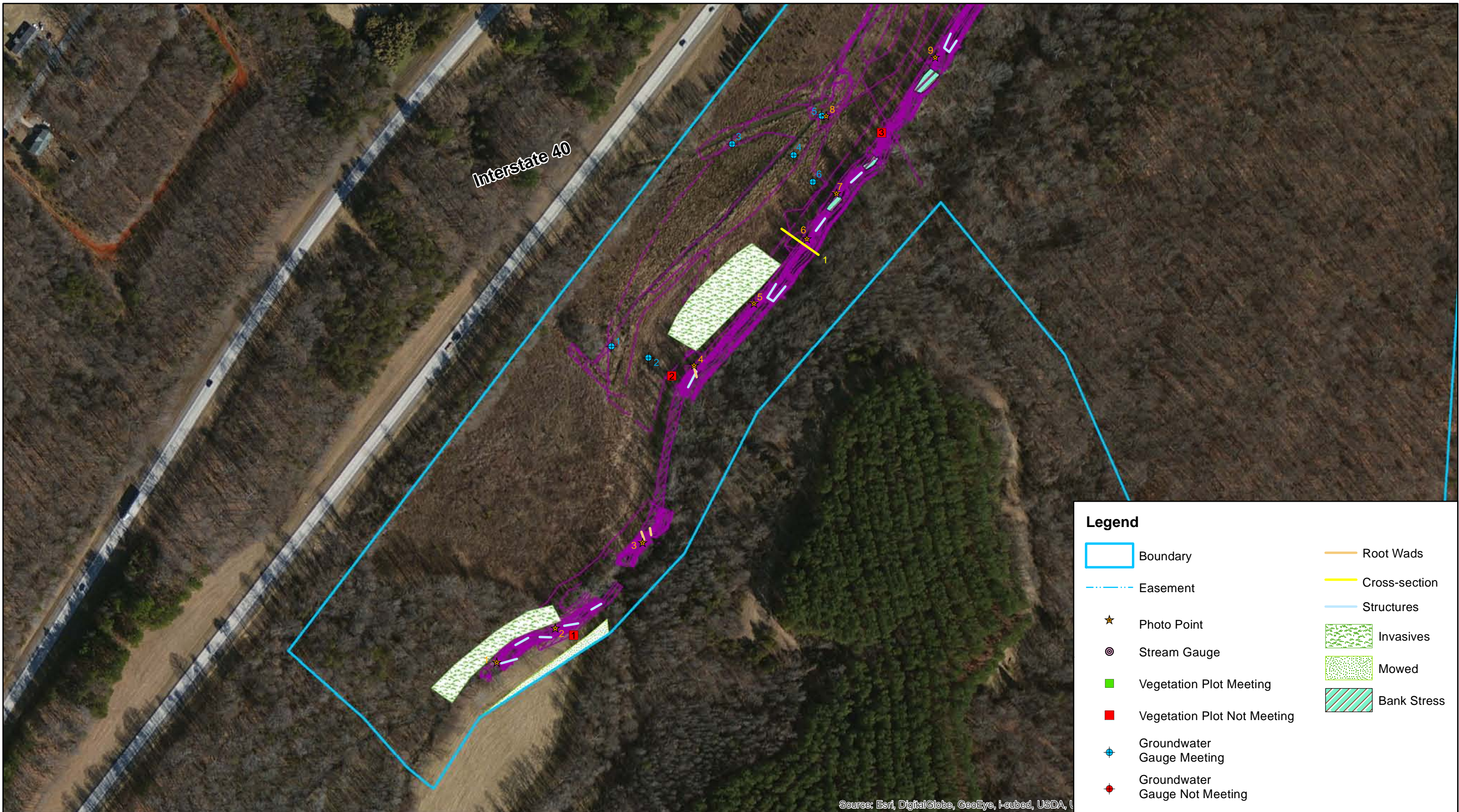
Visual Assessment Data



**STREAM CURRENT CONDITION PLAN VIEW**  
 FIVE MILE BRANCH RESTORATION SITE  
 IREDELL COUNTY, NORTH CAROLINA

Aerial: 2011 Bing Maps Aerial

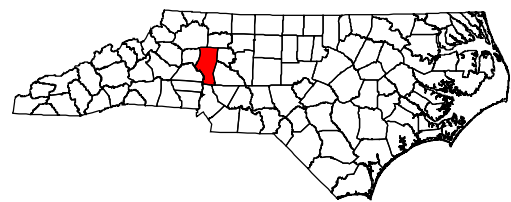




**Legend**

Boundary	Root Wads
Easement	Cross-section
Photo Point	Structures
Stream Gauge	Invasives
Vegetation Plot Meeting	Mowed
Vegetation Plot Not Meeting	Bank Stress
Groundwater Gauge Meeting	
Groundwater Gauge Not Meeting	

Prepared For:



**STREAM CURRENT CONDITION PLAN VIEW**  
 FIVE MILE BRANCH RESTORATION SITE  
 IREDELL COUNTY, NORTH CAROLINA

Aerial: 2011 Bing Maps Aerial

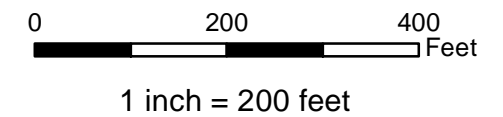
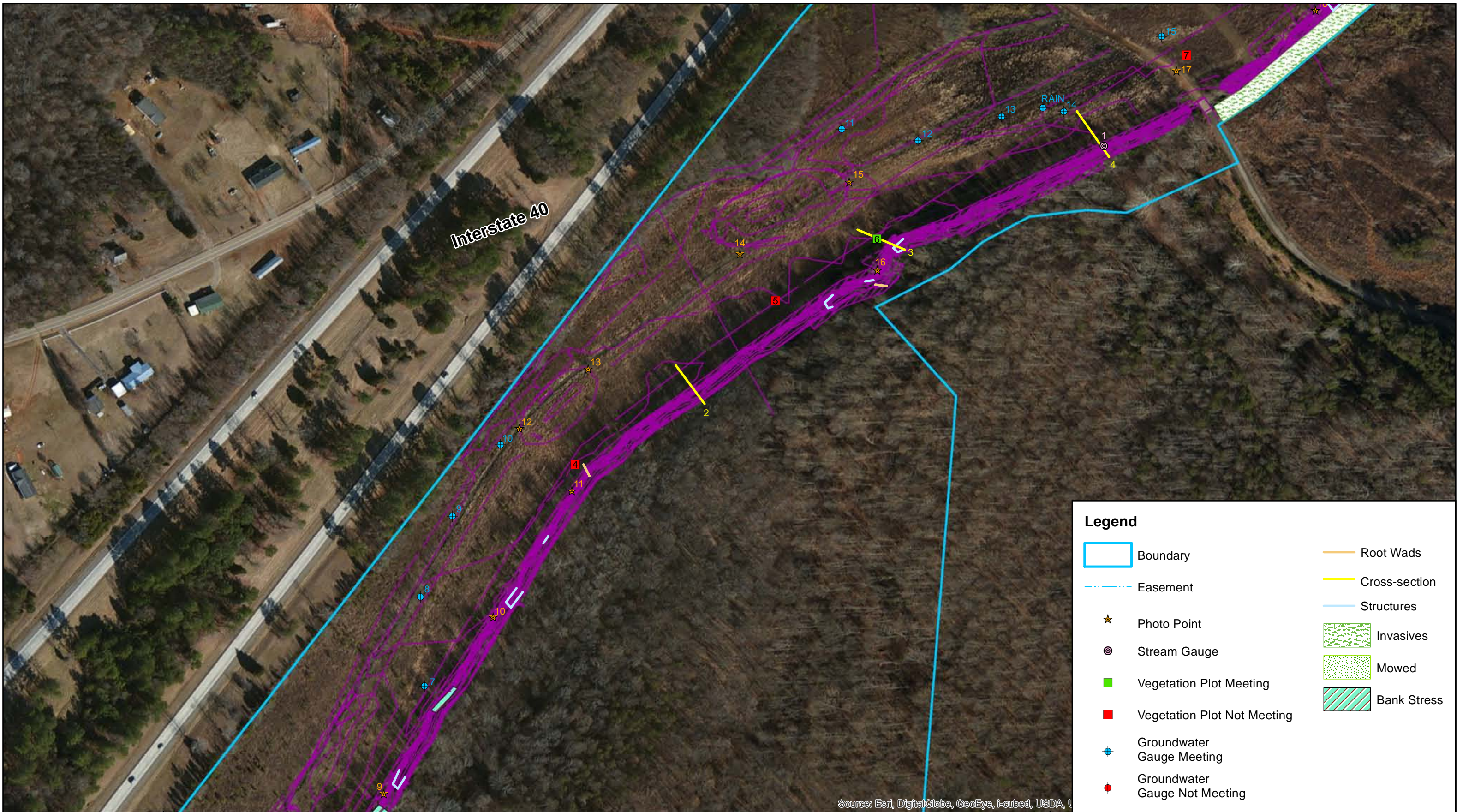
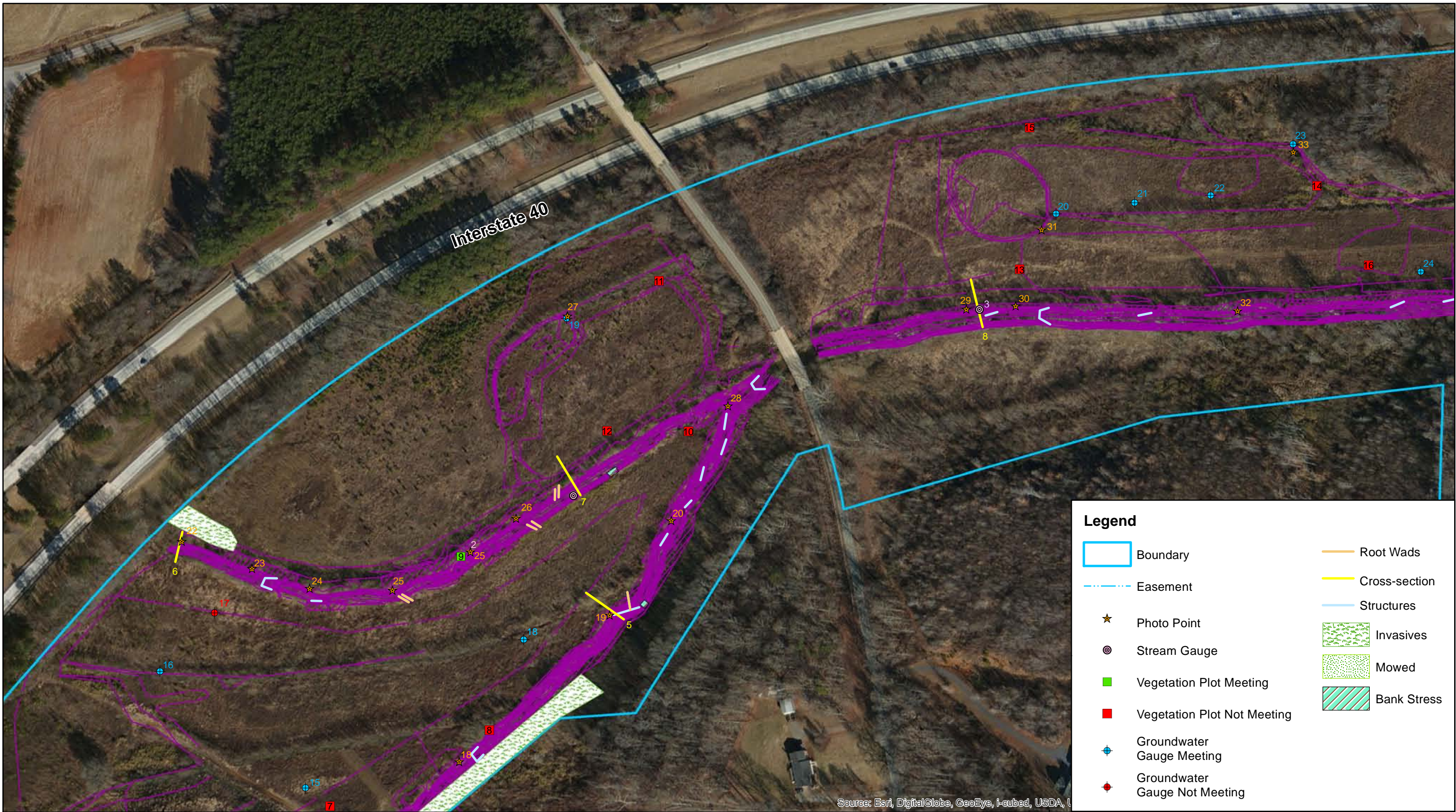


Figure No.  
**3A**

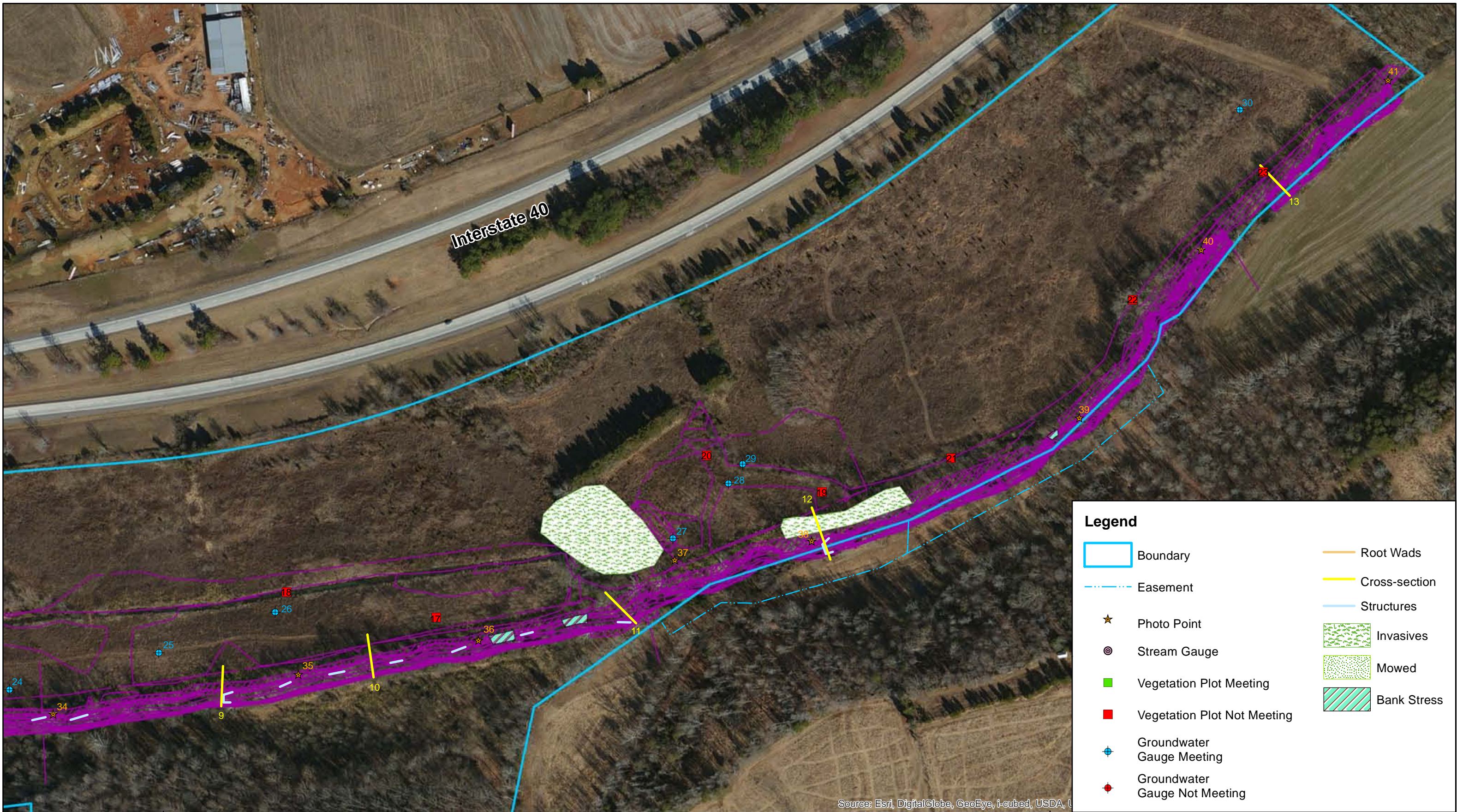


**Legend**

Boundary	Root Wads
Easement	Cross-section
Photo Point	Structures
Stream Gauge	Invasives
Vegetation Plot Meeting	Mowed
Vegetation Plot Not Meeting	Bank Stress
Groundwater Gauge Meeting	
Groundwater Gauge Not Meeting	

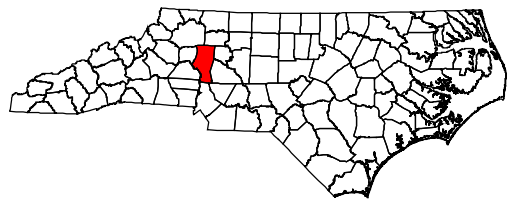






Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, I

Prepared For:



**STREAM CURRENT CONDITION PLAN VIEW**  
 FIVE MILE BRANCH RESTORATION SITE  
 IREDELL COUNTY, NORTH CAROLINA

Aerial: 2011 Bing Maps Aerial

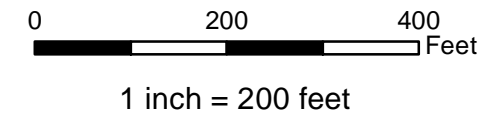


Figure No.

**3D**

Table 5a

Visual Stream Morphology Stability Assessment

Reach ID

Beaver Creek

Assessed Length

5794.1

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not top include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition*	1. Texture/Substrate - Riffle maintains coarser substrate	N/A	N/A			
		3. Meander Pool Condition**	1. Depth Sufficient (Max Pool Depth/Mean Bankfull Depth $\geq 1.5$ )	N/A			
		2. <u>Length</u> sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	N/A	N/A			
	4. Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			
2. Thalweg centering at downstream of meander (Glide)		N/A	N/A				
2. Bank	1. Scoured/Eroding	Bank lacks vegetative cover due to active scour and erosion			6	300	95%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected. Do <u>NOT</u> include undercuts that are stabilized by roots and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
					Totals		
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	23	24			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	4	4			100%
3. Engineered Structures (cont'd.)	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms.	20	20			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. See exhibit describing bank influenced by vane arms.	20	18			90%
	4. Habitat	Pool forming structures maintaining Max Pool Depth/Mean Bankfull Depth ratio > 1.5. Rootwads/logs providing some cover at low flow.	8	8			100%

\* Stream is a sand bed stream. No substrate sorting is occurring

\*\* The stream is not a meandering stream. No meander pools exist.

Table 5b

**Visual Stream Morphology Stability Assessment**

Reach ID

Fifth Creek upstream of Beaver Creek

Assessed Length

1586.4

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not top include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition*	1. Texture/Substrate - Riffle maintains coarser substrate	N/A	N/A			
		3. Meander Pool Condition**	1. Depth Sufficient (Max Pool Depth/Mean Bankfull Depth $\geq 1.5$ )	N/A			
		2. <u>Length</u> sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	N/A	N/A			
	4. Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			
2. Thalweg centering at downstream of meander (Glide)		N/A	N/A				
Totals							
2. Bank	1. Scoured/Eroding	Bank lacks vegetative cover due to active scour and erosion			1	75	95%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected. Do <u>NOT</u> include undercuts that are stabilized by roots and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
Totals					1	75	95%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	5	6			83%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%
3. Engineered Structures (cont'd.)	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms.	3	3			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. See exhibit describing bank influenced by vane arms.	3	3			100%
	4. Habitat	Pool forming structures maintaining Max Pool Depth/Mean Bankfull Depth ratio > 1.5. Rootwads/logs providing some cover at low flow.	5	5			100%

\* Stream is a sand bed stream. No substrate sorting is occurring

\*\* The stream is not a meandering stream. No meander pools exist.

Table 5c

**Visual Stream Morphology Stability Assessment**

Reach ID

Fifth Creek downstream of Beaver Creek

Assessed Length

4295.6

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not top include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition*	1. Texture/Substrate - Riffle maintains coarser substrate	N/A	N/A			
		3. Meander Pool Condition**	1. Depth Sufficient (Max Pool Depth/Mean Bankfull Depth $\geq 1.5$ )	N/A			
		2. <u>Length</u> sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	N/A	N/A			
	4. Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			
2. Thalweg centering at downstream of meander (Glide)		N/A	N/A				
Totals							
2. Bank	1. Scoured/Eroding	Bank lacks vegetative cover due to active scour and erosion			3	220	95%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected. Do <u>NOT</u> include undercuts that are stabilized by roots and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
Totals					3	220	95%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	19	20			95%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			100%
3. Engineered Structures (cont'd.)	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms.	20	20			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. See exhibit describing bank influenced by vane arms.	20	20			100%
	4. Habitat	Pool forming structures maintaining Max Pool Depth/Mean Bankfull Depth ratio > 1.5. Rootwads/logs providing some cover at low flow.	9	9			100%

\* Stream is a sand bed stream. No substrate sorting is occurring

\*\* The stream is not a meandering stream. No meander pools exist.

Table 6

**Vegetation Condition Assessment**  
**Five Mile Branch Stream and Wetland Restoration**

**Planted Acreage**            67.3

<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
1. Bare Areas	Very Limited cover of both woody and herbaceous material.	0.1 acres	None	0	0	0%
2. Low Stem Density Areas*	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	None	0	0.4	<1%
Total					0.38	<1%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	None	0	0	0%
Cumulative Total					0.38	<1%

**Easement Acreage**            229

<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000SF	Grassland/ Green	6	2.87	4.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	None	Open Pasture/Green	1	2.1	3.0%

\* Acreage is combined acreage of 20 vegetation monitoring plots not meeting success criteria.

## **Appendix C**

Vegetation Plot Data



Vegetation Monitoring Plot #1 6/10/2015



Vegetation Monitoring Plot #4 6/11/2015



Vegetation Monitoring Plot #2 6/11/2015



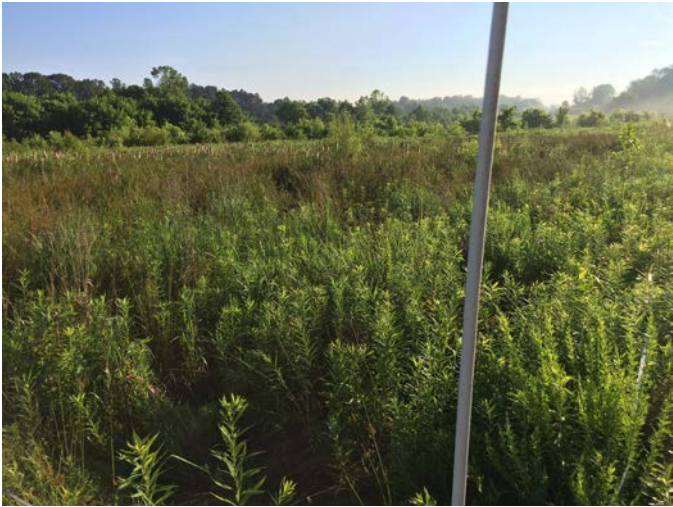
Vegetation Monitoring Plot #5 6/11/2015



Vegetation Monitoring Plot #3 6/11/2015



Vegetation Monitoring Plot #6 6/11/2015



Vegetation Monitoring Plot #7 6/11/2015



Vegetation Monitoring Plot #10 6/12/2015



Vegetation Monitoring Plot #8 6/11/2015



Vegetation Monitoring Plot #11 6/12/2015



Vegetation Monitoring Plot #9 6/12/2015





Vegetation Monitoring Plot #12 6/12/2015



Vegetation Monitoring Plot #14 6/11/2015



Vegetation Monitoring Plot #13 6/12/2015



Vegetation Monitoring Plot #15 6/12/2015



Vegetation Monitoring Plot #16

6/11/2015



Vegetation Monitoring Plot #19

6/11/2015



Vegetation Monitoring Plot #17

6/11/2015



Vegetation Monitoring Plot #20

6/11/2015



Vegetation Monitoring Plot #18

6/11/2015



Vegetation Monitoring Plot #21

6/11/2015



Vegetation Monitoring Plot #22

6/11/2015



Vegetation Monitoring Plot #23

6/11/2015

EEP Project Code 29185. Project Name: Five Mile Branch

Scientific Name	Common Name	Species Type	29185-01-0001			29185-01-0002			29185-01-0003			29185-01-0004			29185-01-0005			29185-01-0006			29185-01-0007			29185-01-0008		
			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 negundo	boxelder	Tree						11			5			18			15			1			4			98
Acer rubrum	red maple	Tree						1														1				
Ailanthus altissima	tree of heaven	Exotic																								
Alnus serrulata	hazel alder	Shrub																								
Asimina triloba	pawpaw	Tree																								
Baccharis halimifolia	eastern baccharis	Shrub																								
Betula nigra	river birch	Tree				1	1	2	3	3	3	1	1	2	1	1	4	2	2	2				2	2	2
Carpinus caroliniana	American hornbeam	Tree										2	2	2												
Carya alba	mockernut hickory	Tree																								
Carya cordiformis	bitternut hickory	Tree																								
Celtis laevigata	sugarberry	Tree																								
Celtis occidentalis	common hackberry	Tree																								
Cephalanthus occidentalis	common buttonbush	Shrub																								
Cornus amomum	silky dogwood	Shrub										3	3	3			2	2	2							
Corylus americana	American hazelnut	Shrub															1	1	1							
Diospyros virginiana	common persimmon	Tree																								
Fraxinus americana	white ash	Tree																								
Fraxinus pennsylvanica	green ash	Tree						1			1					1							2			
Ilex decidua	possumhaw	shrub										1	1	1												
Juglans nigra	black walnut	Tree							1	1	1	1	1	1	1	1	1	1	1							
Juniperus virginiana	eastern redcedar	Tree						1																		
Ligustrum sinense	Chinese privet	Exotic																								
Liquidambar styraciflua	sweetgum	Tree						46			35			47			21			54			3		1	
Liriodendron tulipifera	tuliptree	Tree						1			1															
Morus rubra	red mulberry	Tree																								
Nyssa sylvatica	blackgum	Tree				1	1	1				1	1	1			1	1	1	3	3	3				
Pinus taeda	loblolly pine	Tree																								
Pinus virginiana	Virginia pine	Tree																								
Platanus occidentalis	American sycamore	Tree				1	1	13			40			4			4			3			2	2	2	
Populus deltoides	eastern cottonwood	Tree									1															
Quercus michauxii	swamp chestnut oak	Tree	2	2	2															3	3	3				
Quercus pagoda	cherrybark oak	Tree				2	2	2	3	3	3				2	2	2	4	4	4						
Quercus phellos	willow oak	Tree				2	2	2						1	1	1										
Rosa multiflora	multiflora rose	Exotic									1															
Salix nigra	black willow	Tree																								
Sambucus canadensis	Common Elderberry	Shrub																							5	
Ulmus rubra	slippery elm	Tree									1			2											1	
<b>Stem count</b>			2	2	2	7	7	81	7	7	92	9	9	81	5	5	45	10	10	69	6	6	19	4	4	109
<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>			1	1	1	5	5	11	3	3	11	6	6	10	4	4	7	5	5	8	2	2	7	2	2	6
<b>Stems per ACRE</b>			80.94	80.94	80.94	283.3	283.3	3278	283.3	283.3	3723	364.2	364.2	3278	202.3	202.3	1821	404.7	404.7	2792	242.8	242.8	768.9	161.9	161.9	4411

Current Plot Data (MY3 2015)

Scientific Name	Common Name	Species Type	29185-01-0009			29185-01-0010			29185-01-0011			29185-01-0012			29185-01-0013			29185-01-0014			29185-01-0015			29185-01-0016		
			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 negundo	boxelder	Tree			25			160.6			13			56			1									2
Acer rubrum	red maple	Tree									2															5
Ailanthus altissima	tree of heaven	Exotic			1																					
Alnus serrulata	hazel alder	Shrub																								
Asimina triloba	pawpaw	Tree																								
Baccharis halimifolia	eastern baccharis	Shrub												1												
Betula nigra	river birch	Tree	4	4	4	2	2	2				1	1	1							2	2	3			
Carpinus caroliniana	American hornbeam	Tree																								
Carya alba	mockernut hickory	Tree			1																					
Carya cordiformis	bitternut hickory	Tree																								
Celtis laevigata	sugarberry	Tree																								
Celtis occidentalis	common hackberry	Tree																								
Cephalanthus occidentalis	common buttonbush	Shrub						1															1			
Cornus amomum	silky dogwood	Shrub				1	1	1				1	1	1										1	1	1
Corylus americana	American hazelnut	Shrub																								
Diospyros virginiana	common persimmon	Tree			2			5			1															
Fraxinus americana	white ash	Tree																								
Fraxinus pennsylvanica	green ash	Tree	1	1	1				1	1	11	1	1	1			1						8	1	1	2
Ilex decidua	possumhaw	shrub																								
Juglans nigra	black walnut	Tree	1	1	1	1	1	1				1	1	1												
Juniperus virginiana	eastern redcedar	Tree												1												
Ligustrum sinense	Chinese privet	Exotic																								
Liquidambar styraciflua	sweetgum	Tree			1						13													16		
Liriodendron tulipifera	tuliptree	Tree																								
Morus rubra	red mulberry	Tree																								
Nyssa sylvatica	blackgum	Tree							2	2	2															
Pinus taeda	loblolly pine	Tree			1																					
Pinus virginiana	Virginia pine	Tree																								
Platanus occidentalis	American sycamore	Tree			1	1	1	1			14				1	1	1						3			
Populus deltoides	eastern cottonwood	Tree																								
Quercus michauxii	swamp chestnut oak	Tree				1	1	1																		
Quercus pagoda	cherrybark oak	Tree	5	5	5				1	1	1															
Quercus phellos	willow oak	Tree				1	1	1	3	3	3				2	2	2							1	1	1
Rosa multiflora	multiflora rose	Exotic																								
Salix nigra	black willow	Tree																								
Sambucus canadensis	Common Elderberry	Shrub																			1	1	1			
Ulmus rubra	slippery elm	Tree																								
<b>Stem count</b>			11	11	43	7	7	173.6	7	7	60	4	4	62	3	3	5	0	0	0	3	3	37	3	3	6
<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>			4	4	11	6	6	9	4	4	9	4	4	7	2	2	4	0	0	0	2	2	7	3	3	4
<b>Stems per ACRE</b>			445.2	445.2	1740	283.3	283.3	7024	283.3	283.3	2428	161.9	161.9	2509	121.4	121.4	202.3	0	0	0	121.4	121.4	1497	121.4	121.4	242.8

EEP Project Code 29185. Project Name: Five Mile Branch

Scientific Name	Common Name	Species Type	29185-01-0017			29185-01-0018			29185-01-0019			29185-01-0020			29185-01-0021			29185-01-0022			29185-01-0023			MY3 (2015)			
			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 negundo	boxelder	Tree			1						5						8			1			18			442.6	
Acer rubrum	red maple	Tree									1									1			1			12	
Ailanthus altissima	tree of heaven	Exotic																								1	
Alnus serrulata	hazel alder	Shrub																									
Asimina triloba	pawpaw	Tree																									
Baccharis halimifolia	eastern baccharis	Shrub																								1	
Betula nigra	river birch	Tree			23				2	2	3	2	2	3				1	1	1	1	1	2	25	25	57	
Carpinus caroliniana	American hornbeam	Tree																					2	2	2		
Carya alba	mockernut hickory	Tree																								1	
Carya cordiformis	bitternut hickory	Tree			1																					1	
Celtis laevigata	sugarberry	Tree																									
Celtis occidentalis	common hackberry	Tree			2																					2	
Cephalanthus occidentalis	common buttonbush	Shrub										1	1	8										1	1	10	
Cornus amomum	silky dogwood	Shrub						1							2	2	2						10	10	11		
Corylus americana	American hazelnut	Shrub																					1	1	1		
Diospyros virginiana	common persimmon	Tree									12			1												21	
Fraxinus americana	white ash	Tree																									
Fraxinus pennsylvanica	green ash	Tree							1	1	2													5	5	42	
Ilex decidua	possumhaw	shrub																						1	1	1	
Juglans nigra	black walnut	Tree							1	1	1													7	7	8	
Juniperus virginiana	eastern redcedar	Tree																								2	
Ligustrum sinense	Chinese privet	Exotic																									
Liquidambar styraciflua	sweetgum	Tree									31						46			111			3			428	
Liriodendron tulipifera	tuliptree	Tree																								3	
Morus rubra	red mulberry	Tree																									
Nyssa sylvatica	blackgum	Tree																1	1	1				9	9	9	
Pinus taeda	loblolly pine	Tree																								1	
Pinus virginiana	Virginia pine	Tree																									
Platanus occidentalis	American sycamore	Tree			31						1			1	1	1	4						5	6	6	128	
Populus deltoides	eastern cottonwood	Tree																								1	
Quercus michauxii	swamp chestnut oak	Tree																						6	6	6	
Quercus pagoda	cherrybark oak	Tree																2	2	2				19	19	19	
Quercus phellos	willow oak	Tree													1	1	1						2	2	2	13	
Rosa multiflora	multiflora rose	Exotic																								1	
Salix nigra	black willow	Tree																								1	
Sambucus canadensis	Common Elderberry	Shrub												4											1	1	10
Ulmus rubra	slippery elm	Tree			3				1	1	1													1	1	8	
<b>Stem count</b>			0	0	61	0	0	1	5	5	57	3	3	17	4	4	61	4	4	131	3	3	31	107	107	1244	
<b>size (ares)</b>			1			1			1			1			1			1			1			23			
<b>size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.57			
<b>Species count</b>			0	0	6	0	0	1	4	4	9	2	2	5	3	3	5	3	3	10	2	2	6	15	15	30	
<b>Stems per ACRE</b>			0	0	2469	0	0	40.47	202.3	202.3	2307	121.4	121.4	688	161.9	161.9	2469	161.9	161.9	5301	121.4	121.4	1255	188.3	188.3	2188	

EEP Project Code 29185. Project Name: Five Mile Branch

			Annual Means								
Scientific Name	Common Name	Species Type	MY2 (2014)			MY1 (2013)			MY0 (2012)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree			372			182			1
Acer rubrum	red maple	Tree			24			22			
Ailanthus altissima	tree of heaven	Exotic									
Alnus serrulata	hazel alder	Shrub							2	2	2
Asimina triloba	pawpaw	Tree			1						
Baccharis halimifolia	eastern baccharis	Shrub									
Betula nigra	river birch	Tree	22	22	62	16	16	67	19	19	50
Carpinus caroliniana	American hornbeam	Tree	2	2	4	2	2	2	4	4	4
Carya alba	mockernut hickory	Tree			2						
Carya cordiformis	bitternut hickory	Tree			1						
Celtis laevigata	sugarberry	Tree				4	4	6	5	5	9
Celtis occidentalis	common hackberry	Tree									
Cephalanthus occidentalis	common buttonbush	Shrub	1	1	8			4			
Cornus amomum	silky dogwood	Shrub	11	11	12	7	7	9	12	12	12
Corylus americana	American hazelnut	Shrub	1	1	1						
Diospyros virginiana	common persimmon	Tree			25			11			
Fraxinus americana	white ash	Tree	1	1	1						
Fraxinus pennsylvanica	green ash	Tree	4	4	53	2	2	17	2	2	3
Ilex decidua	possumhaw	shrub	5	5	5	12	12	12	14	14	14
Juglans nigra	black walnut	Tree	6	6	13	3	3	7	15	15	15
Juniperus virginiana	eastern redcedar	Tree			1						
Ligustrum sinense	Chinese privet	Exotic			2						
Liquidambar styraciflua	sweetgum	Tree			615			393			
Liriodendron tulipifera	tuliptree	Tree			2						
Morus rubra	red mulberry	Tree				1	1	1	3	3	3
Nyssa sylvatica	blackgum	Tree	6	6	6	2	2	2	2	2	2
Pinus taeda	loblolly pine	Tree			1						
Pinus virginiana	Virginia pine	Tree			1						
Platanus occidentalis	American sycamore	Tree	6	6	117	6	6	159	5	5	37
Populus deltoides	eastern cottonwood	Tree			1						
Quercus michauxii	swamp chestnut oak	Tree	6	6	6	4	4	4	15	15	15
Quercus pagoda	cherrybark oak	Tree	20	20	20	22	22	24	24	24	24
Quercus phellos	willow oak	Tree	10	10	10	6	6	6	10	10	10
Rosa multiflora	multiflora rose	Exotic									
Salix nigra	black willow	Tree			1						
Sambucus canadensis	Common Elderberry	Shrub			4	3	3	28	5	5	5
Ulmus rubra	slippery elm	Tree	1	1	10						
<b>Stem count</b>			102	102	1381	90	90	956	137	137	206
<b>size (ares)</b>			23			23			23		
<b>size (ACRES)</b>			0.57			0.57			0.57		
<b>Species count</b>			15	15	30	14	14	19	15	15	16
<b>Stems per ACRE</b>			179.5	179.5	2430	158.4	158.4	1682	241.1	241.1	362.5

## **Appendix D**

Stream Survey Data



River Basin:	Catawba
Watershed:	Beaver Creek
XS ID:	X-1 BVR
Drainage Area (sq. mi.)	10.7
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

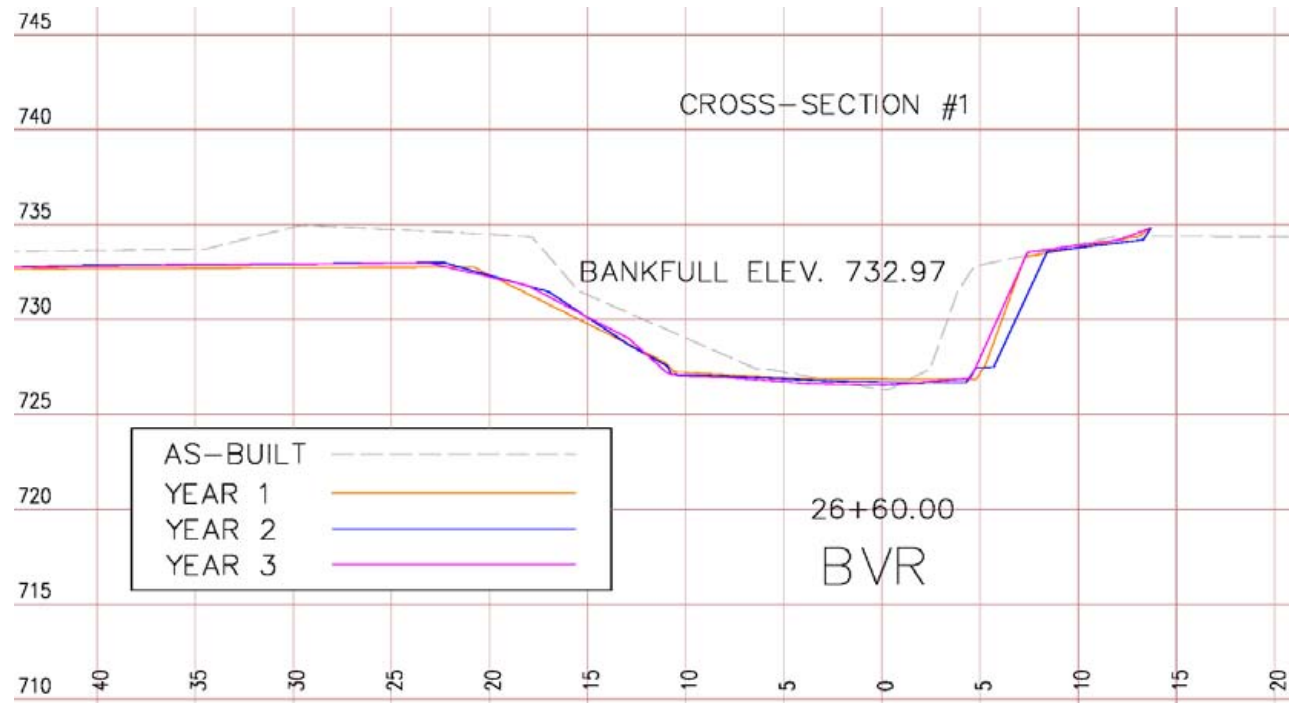
Section 1 Looking downstream



Northing	Easting	Elevation
764421.6773	1472799.805	732.7755
764421.0072	1472800.865	732.4979
764413.4109	1472811.911	732.7271
764404.5325	1472824.248	733.0361
764395.1871	1472837.571	733.218
764387.256	1472849.382	733.3582
764384.4577	1472853.544	732.1731
764381.8686	1472858.039	729.3693
764380.7091	1472859.549	727.5897
764380.3627	1472860.096	727.4105
764378.5214	1472861.613	727.3293
764376.2272	1472865.27	727.0005
764373.9876	1472868.298	726.9099
764371.3298	1472871.777	727.2858
764371.2703	1472871.862	727.4926
764369.2051	1472873.761	733.923
764366.701	1472877.739	734.5951
764366.1339	1472878.666	735.2122

SUMMARY DATA	
Bankfull Elevation:	732.97
Bankfull Cross-Sectional Area:	130.1
Bankfull Width:	30.3
Floodprone Area Elevation:	739.37
Floodprone Width:	200
Max Depth at Bankfull	6.4
Mean Depth at Bankfull	4.3
W/D Ratio	7.0
Entrenchment Ratio:	6.6
Bank Height Ratio:	1.0

Stream Type: E5



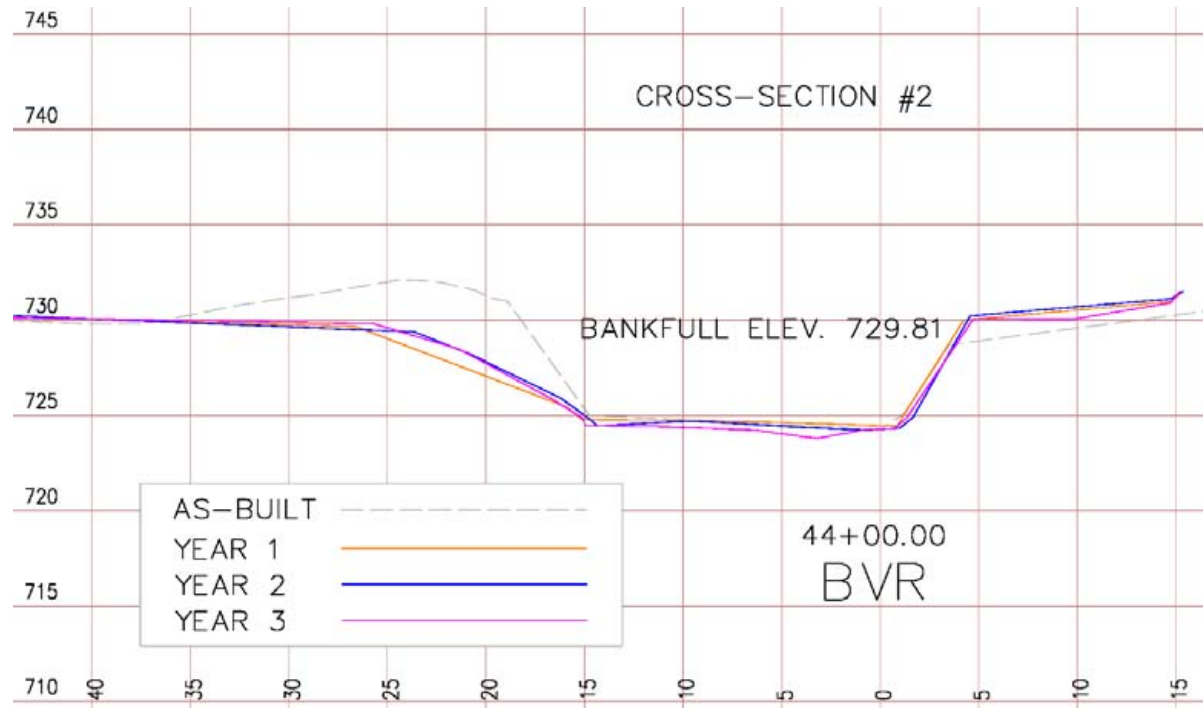
River Basin:	Catawba
Watershed:	Beaver Creek
XS ID:	X-2 BVR
Drainage Area (sq. mi.)	10.7
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

Section 2 Looking downstream

Northing	Easting	Elevation
765773.6335	1473807.071	730.8371
765772.7892	1473807.678	730.5414
765762.8004	1473814.857	730.2358
765749.955	1473826.096	730.6179
765735.1577	1473837.878	730.3702
765722.981	1473846.18	730.1155
765719.2872	1473848.459	728.786
765716.0465	1473851.767	726.2241
765714.6742	1473852.734	725.1442
765714.5367	1473852.721	724.7637
765711.5392	1473855.537	724.7068
765708.1329	1473858.518	724.5184
765705.6479	1473860.352	724.0904
765703.629	1473861.736	724.5499
765702.4784	1473862.635	724.5963
765702.4458	1473863.281	725.1456
765699.7582	1473865.34	730.3574
765695.8034	1473868.505	730.3438
765691.8317	1473871.435	731.1971
765691.4414	1473871.742	731.8134

SUMMARY DATA	
Bankfull Elevation:	729.81
Bankfull Cross-Sectional Area:	108.9
Bankfull Width:	28.6
Floodprone Area Elevation:	735.41
Floodprone Width:	200
Max Depth at Bankfull	5.6
Mean Depth at Bankfull	3.8
W/D Ratio	7.5
Entrenchment Ratio:	7.0
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Beaver Creek
XS ID:	X-3 BVR
Drainage Area (sq. mi.)	10.7
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

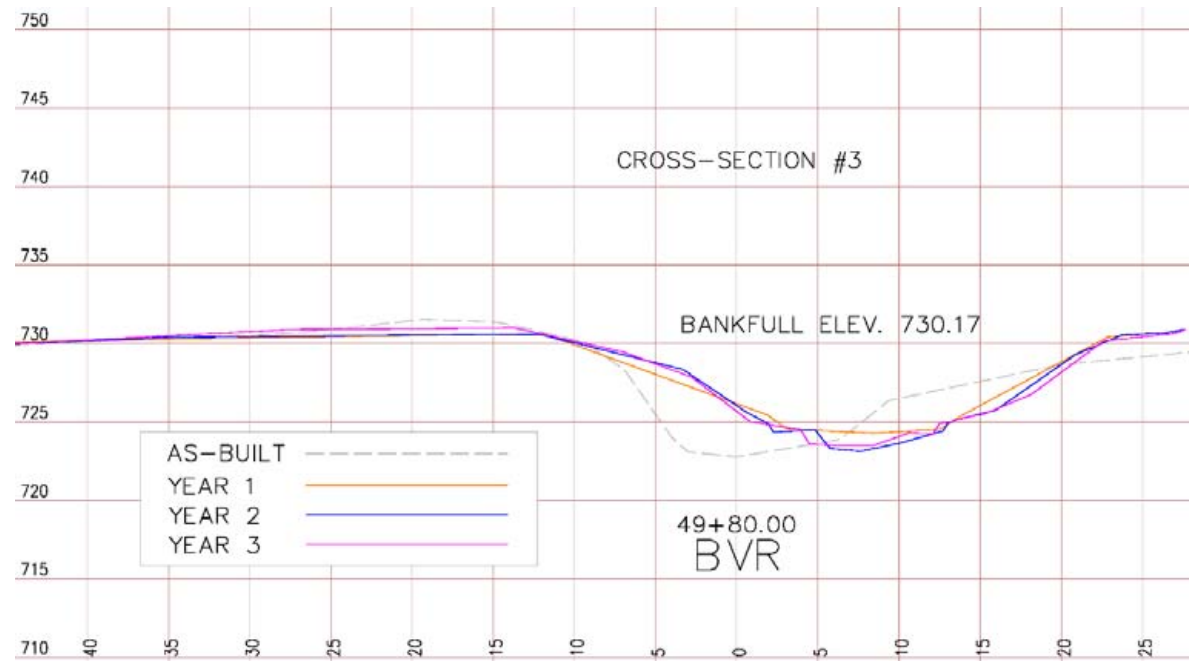
Section 3 Looking downstream



Northing	Easting	Elevation
766078.5517	1474217.357	728.9319
766078.0344	1474218.736	728.5136
766073.2598	1474229.224	728.5421
766066.6317	1474245.17	728.569
766059.8694	1474259.469	729.3671
766053.2485	1474273.708	730.1973
766047.4813	1474286.329	730.3101
766044.717	1474292.468	728.7711
766043.1597	1474296.366	727.1736
766041.1926	1474299.418	724.3227
766040.1251	1474302.317	723.8276
766039.5896	1474302.159	722.8953
766038.7466	1474303.329	722.8303
766037.1592	1474305.28	722.8264
766036.0536	1474307.101	723.6106
766035.1746	1474308.317	723.5552
766034.7801	1474308.393	724.1991
766034.5239	1474308.912	724.2857
766034.5715	1474309.784	724.5813
766034.1983	1474311.069	724.8365
766033.1112	1474313.699	726.0546
766031.5086	1474317.906	729.4914
766029.66	1474321.853	729.9505
766029.1936	1474322.344	730.2105

SUMMARY DATA	
Bankfull Elevation:	730.17
Bankfull Cross-Sectional Area:	137.1
Bankfull Width:	39.9
Floodprone Area Elevation:	737.57
Floodprone Width:	200
Max Depth at Bankfull	7.4
Mean Depth at Bankfull	3.4
W/D Ratio	11.6
Entrenchment Ratio:	5.0
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Beaver Creek
XS ID:	X-4 BVR
Drainage Area (sq. mi.)	10.7
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

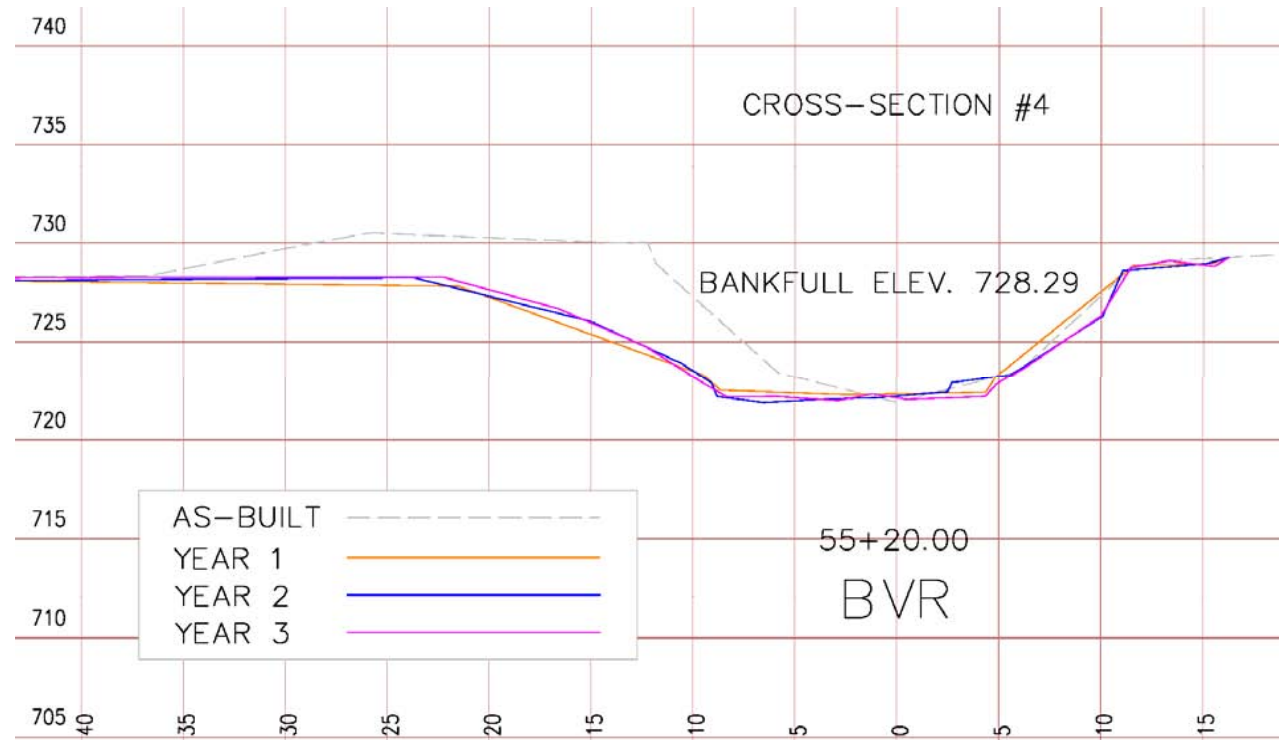
Section 4 Looking downstream



Northing	Easting	Elevation
766346.6997	1474713.492	727.5734
766345.529	1474714.526	727.4247
766337.8795	1474719.977	727.2881
766324.6189	1474729.354	727.1462
766309.0695	1474740.01	727.6699
766294.5654	1474749.35	728.6381
766281.2901	1474759.153	728.7531
766269.1734	1474767.611	728.7626
766264.4438	1474770.719	727.1568
766261.2625	1474773.621	725.2265
766259.2656	1474775.445	723.428
766258.0307	1474775.861	722.6414
766256.002	1474777.288	722.6602
766253.5842	1474778.989	722.4562
766252.032	1474779.602	722.7843
766250.555	1474780.546	722.5142
766247.3614	1474782.6	722.6603
766246.8528	1474782.302	723.32
766246.0737	1474783.239	724.0695
766242.9392	1474785.455	726.7799
766241.6177	1474786.129	729.2499
766240.0674	1474787.229	729.5855
766238.3775	1474788.573	729.2945
766237.7562	1474788.987	729.7508

SUMMARY DATA	
Bankfull Elevation:	728.29
Bankfull Cross-Sectional Area:	135.1
Bankfull Width:	33.3
Floodprone Area Elevation:	734.59
Floodprone Width:	200
Max Depth at Bankfull	6.3
Mean Depth at Bankfull	4.1
W/D Ratio	8.1
Entrenchment Ratio:	6.0
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Beaver Creek
XS ID:	X-5 BVR
Drainage Area (sq. mi.)	10.7
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

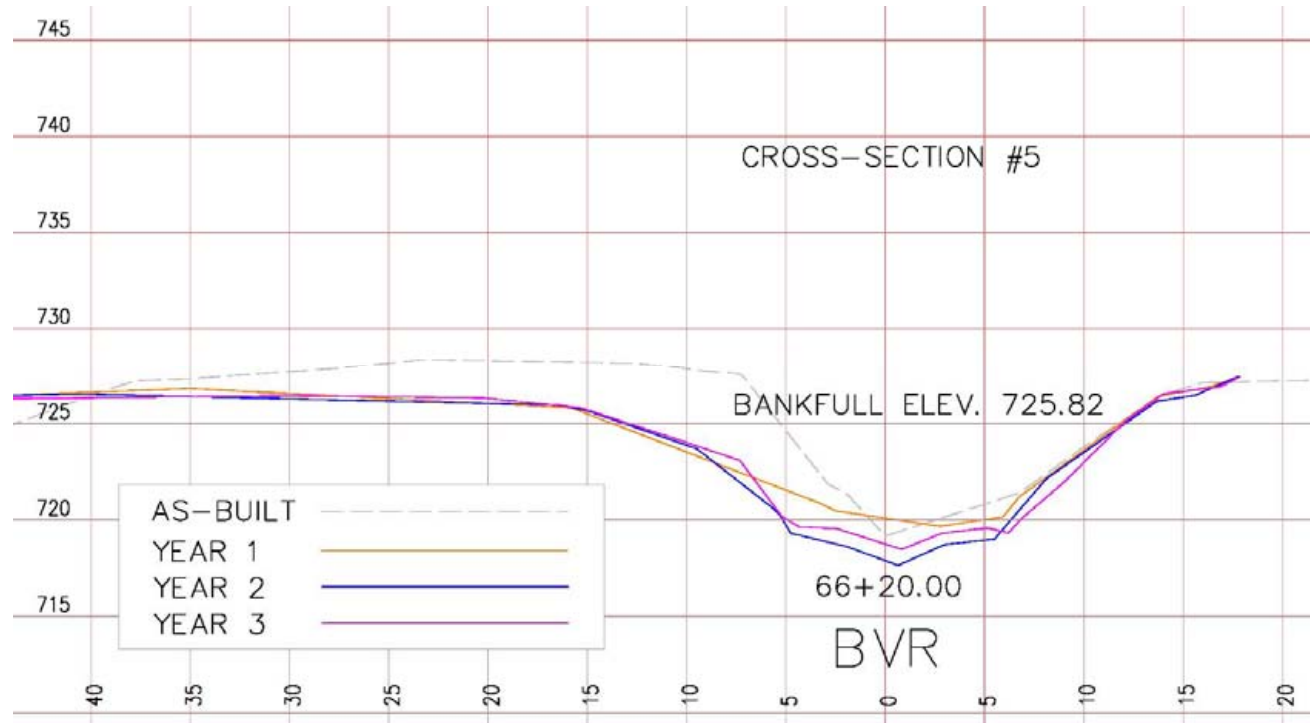
Section 5 Looking downstream



Northing	Easting	Elevation
766934.9485	1475551.34	726.5147
766934.8681	1475551.946	726.4454
766929.309	1475568.16	726.7031
766922.1427	1475584.278	726.8918
766917.9499	1475592.996	726.7812
766916.0815	1475597.572	726.2677
766914.2614	1475602.207	724.5902
766913.724	1475605.207	723.5301
766912.7235	1475607.07	720.6296
766912.0596	1475607.636	720.0885
766911.034	1475609.208	720.0004
766909.4484	1475612.082	718.9299
766908.2119	1475613.712	719.7608
766906.5822	1475615.298	720.0303
766906.043	1475616.21	719.7748
766905.567	1475616.689	720.5384
766904.1249	1475618.228	722.3933
766902.2876	1475620.757	725.5898
766901.3549	1475622.415	726.9891
766899.7312	1475624.808	727.3587
766899.1931	1475625.599	727.8809

SUMMARY DATA	
Bankfull Elevation:	725.82
Bankfull Cross-Sectional Area:	118.5
Bankfull Width:	29.3
Floodprone Area Elevation:	733.22
Floodprone Width:	200
Max Depth at Bankfull	7.4
Mean Depth at Bankfull	4.0
W/D Ratio	7.3
Entrenchment Ratio:	6.0
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Fifth Creek
XS ID:	X-6 FTH U-S
Drainage Area (sq. mi.)	13.9
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

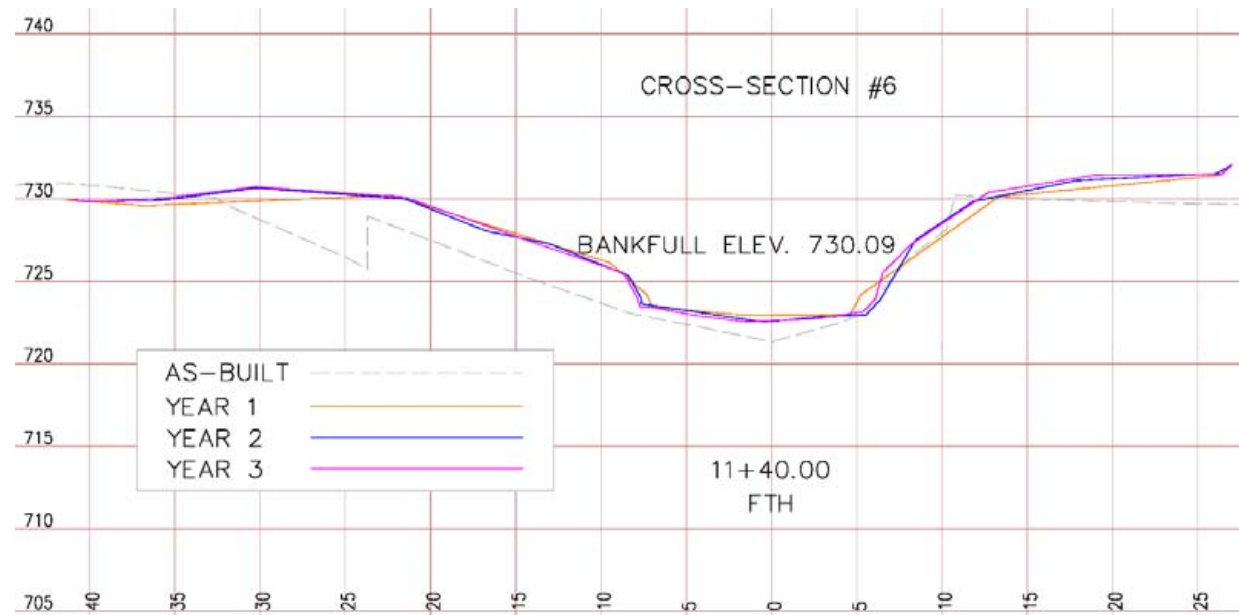
Section 6 Looking downstream



Northing	Easting	Elevation
767093.5733	1474624.936	728.3768
767092.7155	1474624.7	728.2704
767088.4774	1474623.535	728.4713
767083.2125	1474622.089	729.1723
767074.7293	1474619.825	728.5425
767067.8113	1474617.95	725.9306
767062.3298	1474616.565	723.9509
767061.3665	1474616.523	721.9155
767061.5317	1474616.514	722.4583
767060.5323	1474616.326	721.8319
767058.0919	1474615.883	721.3654
767055.2447	1474615.349	720.9908
767051.2141	1474614.749	721.1798
767048.4853	1474614.209	721.6031
767047.8323	1474613.951	722.3584
767047.4191	1474613.77	723.973
767045.8034	1474613.379	725.6862
767041.3966	1474612.285	728.8356
767035.6429	1474609.929	729.8741
767028.3823	1474608.048	729.9491
767027.8935	1474607.921	730.496

SUMMARY DATA	
Bankfull Elevation:	730.09
Bankfull Cross-Sectional Area:	145.3
Bankfull Width:	33.4
Floodprone Area Elevation:	737.49
Floodprone Width:	200
Max Depth at Bankfull	7.4
Mean Depth at Bankfull	4.4
W/D Ratio	7.6
Entrenchment Ratio:	6.0
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Fifth Creek
XS ID:	X-7 FTH U-S
Drainage Area (sq. mi.)	10.7
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

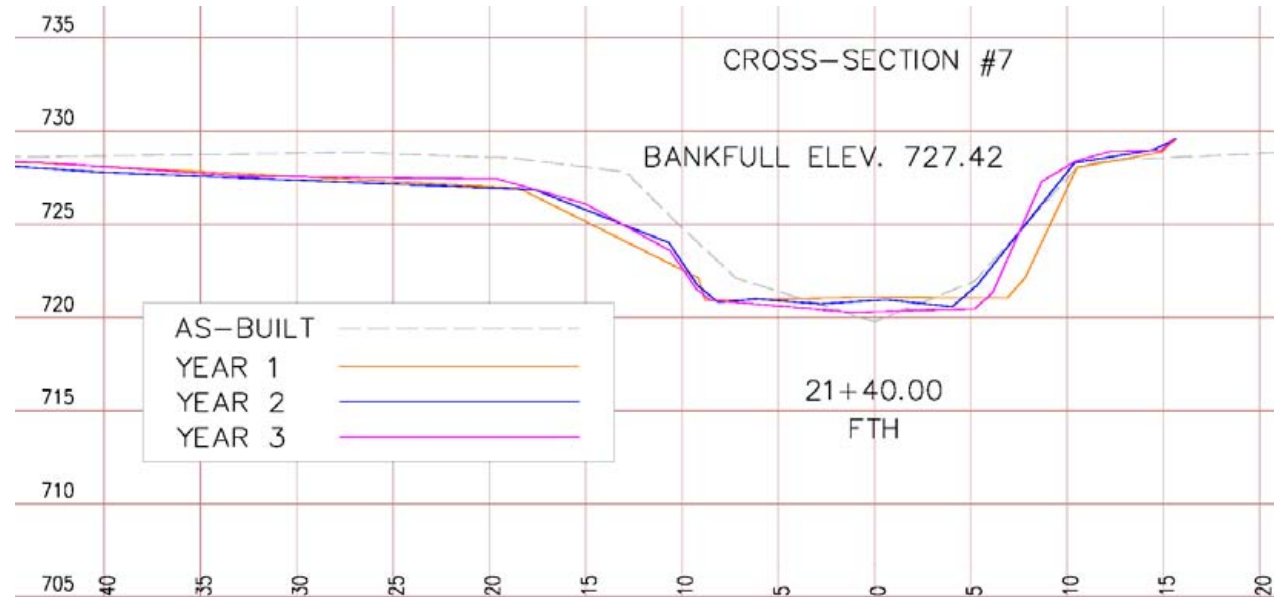
Section 7 Looking downstream



Northing	Easting	Elevation
767265.1125	1475472.87	726.9658
767264.1158	1475473.392	727.0013
767258.3131	1475476.515	726.9745
767248.6326	1475482.354	727.1756
767237.0498	1475489.083	727.5953
767227.3863	1475495.406	727.109
767219.1457	1475500.09	726.4392
767207.4186	1475506.65	726.2694
767203.4971	1475508.947	724.9471
767200.109	1475511.785	722.4123
767199.3069	1475512.88	720.365
767198.5748	1475512.956	719.7696
767195.887	1475514.161	719.5037
767192.2619	1475516.685	719.1091
767188.8325	1475518.791	719.2397
767186.6612	1475519.616	719.2894
767186.1608	1475520.417	720.2023
767183.6927	1475520.959	726.1367
767182.3104	1475522.057	727.224
767180.7237	1475523.042	727.7652
767178.4786	1475524.324	727.8077
767177.9062	1475524.664	728.4311

SUMMARY DATA	
Bankfull Elevation:	727.42
Bankfull Cross-Sectional Area:	119.1
Bankfull Width:	26.1
Floodprone Area Elevation:	734.02
Floodprone Width:	200
Max Depth at Bankfull	6.6
Mean Depth at Bankfull	4.6
W/D Ratio	5.7
Entrenchment Ratio:	7.7
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Fifth Creek
XS ID:	X-8 FTH D-S
Drainage Area (sq. mi.)	26
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

Section 8 Looking downstream

Northing	Easting	Elevation
767665.7104	1476406.533	725.539
767664.7316	1476406.81	725.143
767657.2707	1476409.318	724.6588
767645.4007	1476413.55	724.7989
767630.2509	1476418.499	725.6261
767614.6784	1476422.743	725.4759
767599.9619	1476426.537	725.6376
767596.6021	1476426.832	723.7927
767593.1453	1476427.497	720.7017
767591.9983	1476428.002	719.5906
767591.9821	1476427.939	719.1049
767589.2084	1476429.167	718.7745
767585.9406	1476429.422	718.648
767581.6426	1476429.819	718.2304
767577.2395	1476430.556	718.6645
767572.9553	1476431.167	718.743
767569.763	1476431.302	718.1227
767569.4937	1476430.923	719.5533
767567.1776	1476432.451	725.5953
767563.1425	1476433.53	726.2334
767559.3919	1476434.517	726.4349
767558.4973	1476434.238	726.9218

SUMMARY DATA	
Bankfull Elevation:	726.40
Bankfull Cross-Sectional Area:	188.1
Bankfull Width:	40
Floodprone Area Elevation:	733.70
Floodprone Width:	200
Max Depth at Bankfull	7.3
Mean Depth at Bankfull	5.6
W/D Ratio	6.1
Entrenchment Ratio:	5.9
Bank Height Ratio:	1.0

Stream Type: E5





River Basin:	Catawba
Watershed:	Fifth Creek
XS ID:	X-9 FTH D-S
Drainage Area (sq. mi.)	26
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

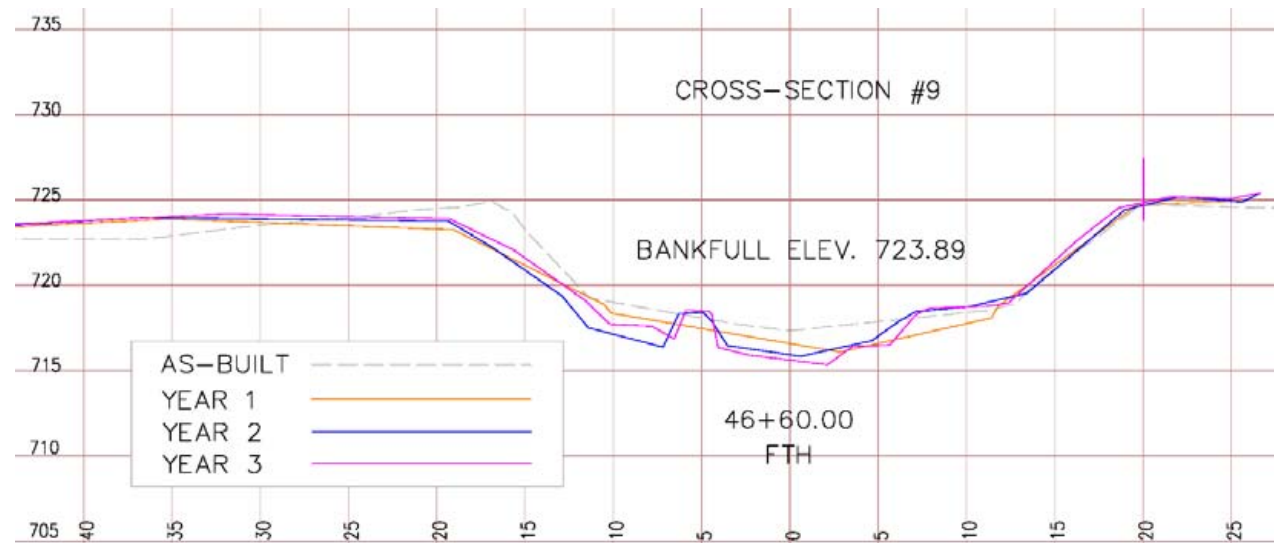
Section 9 Looking downstream



Northing	Easting	Elevation
767737.1606	1477906.656	722.2822
767736.2579	1477906.692	722.1092
767725.1961	1477907.137	722.0192
767713.062	1477907.625	722.7415
767699.8604	1477907.498	723.3925
767687.2608	1477907.003	723.1107
767683.6727	1477906.585	721.295
767679.6009	1477906.94	718.3072
767678.2775	1477906.637	716.9362
767675.8973	1477906.363	716.8086
767674.6282	1477906.235	716.0703
767673.9706	1477906.2	717.7636
767672.6471	1477906.488	717.6685
767672.5538	1477906.566	717.4885
767672.2118	1477906.548	715.5683
767670.5794	1477906.936	715.1338
767666.5381	1477904.903	714.5528
767665.3376	1477905.646	715.6265
767663.2335	1477905.878	715.7099
767661.7606	1477905.976	717.4882
767661.0356	1477906.103	717.8664
767657.5164	1477906.305	718.0101
767656.6788	1477906.801	718.1689
767652.7668	1477906.308	721.8776
767650.4799	1477906.564	723.7363
767647.544	1477906.38	724.4034
767644.1099	1477906.51	724.2817
767643.0587	1477906.508	724.6259

SUMMARY DATA	
Bankfull Elevation:	723.89
Bankfull Cross-Sectional Area:	185.2
Bankfull Width:	36.8
Floodprone Area Elevation:	731.29
Floodprone Width:	200
Max Depth at Bankfull	7.4
Mean Depth at Bankfull	5.0
W/D Ratio	7.4
Entrenchment Ratio:	5.4
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Fifth Creek
XS ID:	X-10 FTH D-S
Drainage Area (sq. mi.)	26
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

Section 10 Looking downstream



Northing	Easting	Elevation
767806.8198	1478232.148	721.897
767805.7199	1478232.297	721.6623
767794.6763	1478233.796	721.7154
767781.827	1478236.147	722.5099
767768.314	1478238.536	722.8395
767754.3743	1478240.181	723.0379
767748.8936	1478241.019	719.2679
767747.5971	1478242.058	717.2492
767746.7696	1478242.335	716.4337
767744.4606	1478243.068	716.4522
767741.0832	1478243.667	716.4544
767735.8151	1478245.531	716.0654
767732.3404	1478246.749	716.6114
767728.918	1478247.693	716.5764
767725.3722	1478248.188	716.6747
767724.8565	1478248.3	717.2679
767721.9397	1478249.243	723.961
767719.0083	1478249.905	724.1992
767714.956	1478250.794	724.1459
767713.8797	1478251.021	724.3456

SUMMARY DATA	
Bankfull Elevation:	723.80
Bankfull Cross-Sectional Area:	177.7
Bankfull Width:	33.3
Floodprone Area Elevation:	730.70
Floodprone Width:	200
Max Depth at Bankfull	6.9
Mean Depth at Bankfull	5.3
W/D Ratio	6.3
Entrenchment Ratio:	6.0
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Fifth Creek
XS ID:	X-11 FTH D-S
Drainage Area (sq. mi.)	26
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

Section 11 Looking downstream



Northing	Easting	Elevation
767900.6523	1478770.228	722.0803
767899.9607	1478770.788	721.7751
767893.42	1478776.072	721.9811
767883.8346	1478784.453	722.1581
767872.9203	1478794.296	721.9673
767863.5954	1478802.554	721.746
767860.7303	1478804.975	719.5904
767858.0041	1478807.144	717.7303
767856.4007	1478808.281	716.643
767855.9738	1478808.595	716.0707
767853.2489	1478810.706	715.9252
767849.979	1478813.464	715.7716
767847.1552	1478815.572	715.1707
767845.2182	1478817.31	715.6244
767842.3557	1478819.74	715.5851
767839.446	1478823.064	715.9516
767839.064	1478823.455	716.3698
767838.3436	1478823.785	718.5011
767837.7733	1478824.275	718.6873
767837.4722	1478825.314	719.6321
767835.6602	1478828.094	721.6896
767832.3092	1478830.916	722.0692
767829.5154	1478833.753	722.9715
767828.9669	1478834.336	723.3442

SUMMARY DATA	
Bankfull Elevation:	722.67
Bankfull Cross-Sectional Area:	172.9
Bankfull Width:	38.1
Floodprone Area Elevation:	729.17
Floodprone Width:	200
Max Depth at Bankfull	6.5
Mean Depth at Bankfull	4.5
W/D Ratio	8.5
Entrenchment Ratio:	5.2
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Fifth Creek
XS ID:	X-12 Fth D-S
Drainage Area (sq. mi.)	26
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

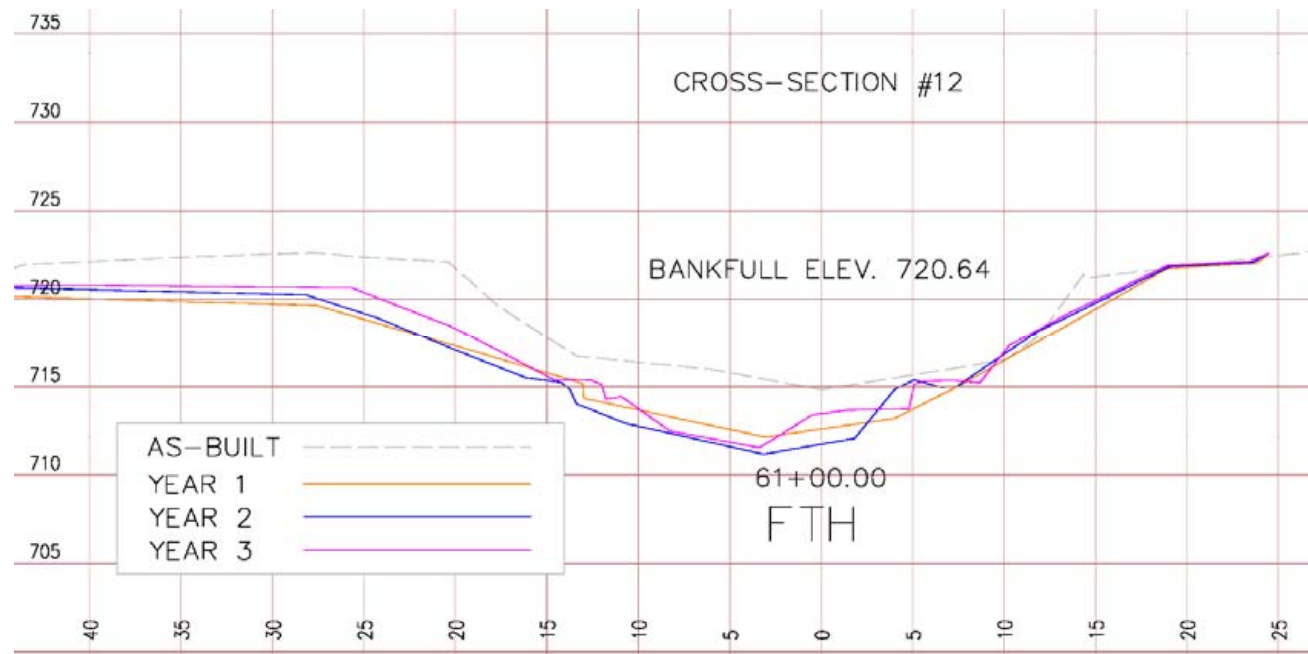
Section 12 Looking downstream



Northing	Easting	Elevation
768097.4647	1479235.298	721.0605
768096.2127	1479235.766	720.6226
768084.7405	1479239.985	720.2923
768070.901	1479244.867	720.271
768055.2301	1479249.441	720.9049
768039.8388	1479254.042	721.3109
768024.7079	1479258.672	721.1622
768019.5554	1479260.483	718.9537
768014.4112	1479262.843	715.8714
768013.9231	1479263.321	715.9218
768012.7194	1479263.839	715.8788
768012.3153	1479264.235	715.6316
768012.112	1479264.305	714.8253
768011.3429	1479264.695	714.9534
768009.1867	1479266.254	712.9949
768004.7606	1479268.299	712.0675
768003.6789	1479268.819	712.8074
768002.3068	1479269.756	713.9061
768000.5889	1479270.665	714.1877
767997.3309	1479271.567	714.2698
767997.1303	1479271.773	715.6677
767996.5471	1479271.986	715.8338
767995.1629	1479272.627	715.870
767993.7194	1479272.664	715.7344
767992.2032	1479273.153	717.8447
767989.3221	1479274.19	719.6056
767983.8432	1479275.244	722.4277
767979.773	1479277.194	722.6485
767978.7308	1479277.223	723.1086

SUMMARY DATA	
Bankfull Elevation:	720.64
Bankfull Cross-Sectional Area:	190.5
Bankfull Width:	40.3
Floodprone Area Elevation:	729.34
Floodprone Width:	200
Max Depth at Bankfull	8.7
Mean Depth at Bankfull	4.7
W/D Ratio	8.6
Entrenchment Ratio:	5.0
Bank Height Ratio:	1.0

Stream Type: E5



River Basin:	Catawba
Watershed:	Fifth Creek
XS ID:	X-13 FTH D-S
Drainage Area (sq. mi.)	26
Date:	5/14/2015
Field Crew:	E. Toler, C. Campbell, R. Lepsic

Section 13 Looking downstream



Northing	Easting	Elevation
768867.6655	1480245.732	718.0172
768866.9735	1480246.266	717.6618
768854.2058	1480258.429	718.0079
768844.4563	1480268.432	719.1774
768833.3214	1480279.036	719.849
768825.1539	1480287.478	719.6215
768823.4114	1480289.281	718.693
768820.9164	1480292.568	715.6589
768820.2474	1480293.631	714.2176
768819.5583	1480293.995	713.4152
768817.9713	1480295.293	713.4817
768815.2454	1480297.992	713.0677
768811.3243	1480302.266	712.9965
768808.8026	1480305.694	713.2168
768805.2713	1480308.706	713.4035
768802.106	1480311.454	713.287
768801.6197	1480311.679	714.2109
768800.0681	1480313.576	716.9144
768797.3514	1480316.509	719.697
768796.0562	1480319.306	720.0754
768794.7318	1480320.1	720.5905

SUMMARY DATA	
Bankfull Elevation:	720.08
Bankfull Cross-Sectional Area:	176.9
Bankfull Width:	38.0
Floodprone Area Elevation:	726.08
Floodprone Width:	200
Max Depth at Bankfull	6.0
Mean Depth at Bankfull	4.7
W/D Ratio	8.1
Entrenchment Ratio:	5.3
Bank Height Ratio:	1.0

Stream Type: E5



**Exhibit Table 10a. Baseline Stream Data Summary**  
**Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 1 Beaver Creek 5,794.1 feet**

Parameter	Gauge <sup>3</sup>	Regional Curve	Pre-Existing Condition							References Reach(es) Data <sup>1</sup>						Design			As-Built / Baseline <sup>2</sup>					
			Equation	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Max	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																								
Bankfull Width (ft)	51.0	41.9*	20.2	26.7	26.3	35.2	4.3	48	N/A	N/A	N/A	N/A	N/A	20.7	27.6	38.8	24.1	29.5	26.3	38.1	7.5	3		
Floodprone Width (ft)			100.0	180.0	-	250.0	-	-	N/A	N/A	N/A	N/A	N/A	100.0	180.0	250.0	-	>200	-	-	0.0	3		
Bankfull Mean Depth (ft)	2.7	2.2*	3.3	4.5	4.5	5.9	0.5	48	N/A	N/A	N/A	N/A	N/A	3.3	4.2	5.0	3.5	4.2	4.4	4.7	0.6	3		
Bankfull Max Depth (ft)	3.3		5.0	6.9	6.9	8.1	0.7	48	N/A	N/A	N/A	N/A	N/A	4.6	5.9	7.2	6.4	6.8	7.0	7.1	4.0	3		
Bankfull Cross Sectional Area (ft <sup>2</sup> )	139.3	92.9**	79.7	119.4	116.9	176.0	22.9	48	N/A	N/A	N/A	N/A	N/A	75.0	115.5	163.2	105.4	121.1	124.5	133.4	14.3	3		
Width/Depth Ratio	18.8		4.4	6.0	5.9	9.1	1.2	48	N/A	N/A	N/A	N/A	N/A	5.1	6.6	9.5	5.5	7.3	5.6	10.9	3.1	3		
Entrenchment Ratio	1.4		4.6	8.2	-	10.9	-	-	N/A	N/A	N/A	N/A	N/A	3.6	6.4	9.0	5.2	7.0	7.6	8.3	1.6	3		
Bank Height Ratio	1.4		1.0	1.2	-	1.5	-	-	N/A	N/A	N/A	N/A	N/A	-	1.0	-	-	1.0	-	-	0.0	3		
d50 (mm)			-	0.2	-	-	-	-	N/A	N/A	N/A	N/A	N/A											
<b>Profile</b>																								
Riffle Length (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-		
Riffle Slope (ft)			0.0	0.0020	0.0014	0.0094	0.003	26	N/A	N/A	N/A	N/A	N/A	0.0	0.0020	0.0094	-	-	-	-	-	-		
Pool Length (ft)			5.5	25.7	19.1	161.9	27.5	34	N/A	N/A	N/A	N/A	N/A	5.5	25.7	161.9	-	-	-	-	-	-		
Pool Max Depth (ft)			4.7	6.7	6.6	7.8	0.9	13	N/A	N/A	N/A	N/A	N/A	4.7	6.7	7.8	4.3	4.3	4.3	4.3	0	2		
Pool Spacing (ft)			20.6	176.7	19.1	748.9	27.5	34	N/A	N/A	N/A	N/A	N/A	20.6	176.7	748.9	-	-	-	-	-	-		
Pool Cross Sectional Area (ft <sup>2</sup> )			80.9	100.6	-	119.8	-	-	N/A	N/A	N/A	N/A	N/A	80.9	100.6	119.8	74.4	40.4	40.4	52.1	16.5	2		
<b>Pattern</b>																								
Channel Beltwidth (ft)			47.0	235.0	-	443.0	-	-	N/A	N/A	N/A	N/A	N/A	47.0	235.0	443.0	47.0	235.0	-	443.0	-	-		
Radius of Curvature (ft)			60.0	3527.0	-	14000.0	-	-	N/A	N/A	N/A	N/A	N/A	60.0	3527.0	14000.0	60.0	3527.0	-	14000.0	-	-		
Rc: Bankfull Width (ft/ft)			2.7	161.8	-	642.2	-	-	N/A	N/A	N/A	N/A	N/A	2.2	127.8	507.2	2.2	127.8	-	507.2	-	-		
Meander Wavelength (ft)			575.0	1380.0	-	2132.0	-	-	N/A	N/A	N/A	N/A	N/A	575.0	1380.0	2132.0	575.0	1380.0	-	2132.0	-	-		
Meander Width Ratio			26.3	63.3	-	97.8	-	-	N/A	N/A	N/A	N/A	N/A	20.8	50.0	77.2	20.8	50.0	-	77.2	-	-		
<b>Substrate, bed and transport parameters</b>																								
Ri% / Ru% / P% / G% / S%																								
SC% / Sa% / G.% / C% / B% / Be%																								
d16 / d35 / d50 / d84 / d95 / di <sup>p</sup> / di <sup>sp</sup> (mm)						> 2.0 mm																		
Reach Shear Stress (competency) lb/ft <sup>2</sup>						0.43									0.35					0.31				
Max part size (mm) mobilized at bankfull						33.0									24.0					22.7				
Stream power (transport capacity) W/m <sup>2</sup>						1.58									1.3					1.29				
<b>Additional Reach Parameters</b>																								
Drainage Area (SM)						10.76																		
Impervious cover estimate (%)						10-20																		
Rosgen Classification		B				E5									E5					E5				
Bankfull Velocity (fps)		3.9	4.1***			3.8									3.7					3.6				
Bankfull Discharge (cfs)		539.9	379.2**			453.7																		
Valley length (ft)						-																		
Channel Thalweg length (ft)						-																		
Sinuosity (ft)						1.07									1.07					1.07				
Water Surface Slope (Channel) (ft/ft)		0.0032				0.0016									0.0016					0.0014				
BF slope (ft/ft)		-				-									-					-				
Bankfull Floodplane Area (acres)						-									-					-				
<b>Additional Reach Parameters</b>																								
Proportion over wide (%)						-																		
Entrenchment Class (ER Range)						-																		
Incision Class (BHR Range)						-																		
BEHI VL% / L% / M% / H% / VH% / E%						-																		
Channel Stability or Habitat Metric						-																		
Biological or Other						-																		

\* NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 1/27/2010

\*\* NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 3/16/2006

\*\*\*Bankfull Discharge/Bankfull Cross Sectional Area

1 A singulare reference stream was not used to design the Enhancement Level II project.

2 As built profile parameters not calculated for Enhancement Level II

**Exhibit Table 10b. Baseline Stream Data Summary**  
**Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 2 Fifth Creek upstream of Beaver Creek 1,586.4 feet**

Parameter	Gauge <sup>3</sup>	Regional Curve	Pre-Existing Condition							References Reach(es) Data <sup>1</sup>					Design			As-Built / Baseline <sup>2</sup>					
			Equation	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Max	Min	Mean	Med	Max	SD
Dimension and Substrate - Riffle																							
Bankfull Width (ft)	51.0	46.0*	23.9	30.7	30.3	40.3	4.8	11	N/A	N/A	N/A	N/A	N/A	N/A	25.1	29.0	33.0	-	24.2	-	-	-	1
Floodprone Width (ft)			-	>200.0	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	>200.0	-	-	>200.0	-	-	-	1
Bankfull Mean Depth (ft)	2.7	2.3*	3.8	4.2	4.2	5.0	0.4	11	N/A	N/A	N/A	N/A	N/A	N/A	3.8	4.1	4.6	-	4.3	-	-	-	1
Bankfull Max Depth (ft)	3.3		6.7	7.8	7.9	9.1	0.6	11	N/A	N/A	N/A	N/A	N/A	N/A	6.4	7.4	8.3	-	7.7	-	-	-	1
Bankfull Cross Sectional Area (ft <sup>2</sup> )	139.3	112.5**	94.0	130.1	128.2	176.4	4.8	11	N/A	N/A	N/A	N/A	N/A	N/A	104.5	119.7	144.7	-	104.2	-	-	-	1
Width/Depth Ratio	18.8		5.3	7.0	7.1	8.4	1.0	11	N/A	N/A	N/A	N/A	N/A	N/A	5.5	7.0	8.6	-	5.6	-	-	-	1
Entrenchment Ratio	1.4		-	6.5	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	6.5	-	-	8.3	-	-	-	1
Bank Height Ratio	1.4		1.1	1.1	-	1.2	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.0	1.0	-	1.0	-	-	-	1
d50 (mm)			-	0.2	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A									
<b>Profile</b>																							
Riffle Length (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-
Riffle Slope (ft)			0.0009	0.0010	0.0010	0.0011	0.0001	2	N/A	N/A	N/A	N/A	N/A	N/A	0.0009	0.0010	0.0011	-	-	-	-	-	-
Pool Length (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	81.2	112.8	144.3	-	-	-	-	-	-
Pool Max Depth (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	7.5	7.8	8.0	-	7.2	-	-	-	1
Pool Spacing (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	272.0	297.0	322.0	-	-	-	-	-	-
Pool Cross Sectional Area (ft <sup>2</sup> )			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	104.5	119.7	144.7	-	136.3	-	-	-	1
<b>Pattern</b>																							
Channel Beltwidth (ft)			48.0	639.0	-	1566.0	-	-	N/A	N/A	N/A	N/A	N/A	N/A	48.0	639.0	1566.0	48.0	639.0	-	1566.0	-	-
Radius of Curvature (ft)			1275.0	2693.0	-	3800.0	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1275.0	2693.0	3800.0	1275.0	2693.0	-	3800.0	-	-
Rc: Bankfull Width (ft/ft)			49.6	104.8	-	147.8	-	-	N/A	N/A	N/A	N/A	N/A	N/A	49.6	104.8	147.8	49.6	104.8	-	147.8	-	-
Meander Wavelength (ft)			4464.0	4618.0	-	4771.0	-	-	N/A	N/A	N/A	N/A	N/A	N/A	4464.0	4618.0	4771.0	4464.0	4618.0	-	4771.0	-	-
Meander Width Ratio			173.7	179.7	-	185.6	-	-	N/A	N/A	N/A	N/A	N/A	N/A	173.7	179.7	185.6	173.7	179.7	-	185.6	-	-
<b>Substrate, bed and transport parameters</b>																							
Ri% / Ru% / P% / G% / S%																		-	-	-	-	-	-
SC% / Sa% / G.% / C% / B% / Be%																							
d16 / d35 / d50 / d84 / d95 / di <sup>P</sup> / di <sup>SP</sup> (mm)																							
Reach Shear Stress (competency) lb/ft <sup>2</sup>																							
Max part size (mm) mobilized at bankfull																							
Stream power (transport capacity) W/m <sup>2</sup>																							
<b>Additional Reach Parameters</b>																							
Drainage Area (SM)																							
Impervious cover estimate (%)																							
Rosgen Classification	B																						
Bankfull Velocity (fps)	3.9	4.1***																					
Bankfull Discharge (cfs)	539.9	466.8**																					
Valley length (ft)																							
Channel Thalweg length (ft)																							
Sinuosity (ft)																							
Water Surface Slope (Channel) (ft/ft)	0.0032																						
BF slope (ft/ft)	-																						
Bankfull Floodplane Area (acres)																							
<b>Additional Reach Parameters</b>																							
Proportion over wide (%)																							
Entrenchment Class (ER Range)																							
Incision Class (BHR Range)																							
BEHI VL% / L% / M% / H% / VH% / E%																							
Channel Stability or Habitat Metric																							
Biological or Other																							

\* NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 1/27/2010

\*\* NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 3/16/2006

\*\*\*Bankfull Discharge/Bankfull Cross Sectional Area

1 A singular reference stream was not used to design the Enhancement Level II project.

2 As built profile parameters not calculated for Enhancement Level II

**Exhibit Table 10c. Baseline Stream Data Summary**  
**Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 3 Fifth Creek downstream of Beaver Creek 5,215.2 feet**

Parameter	Gauge <sup>3</sup>	Regional Curve	Pre-Existing Condition						References Reach(es) Data <sup>1</sup>						Design			As-Built / Baseline <sup>2</sup>					
Dimension and Substrate - Riffle		Equation	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	51	58*	27.9	35.6	34.7	44.1	3.9	27	N/A	N/A	N/A	N/A	N/A	N/A	26.3	33.4	40.8	28.4	34.1	32.2	41.7	6.9	3
Floodprone Width (ft)			250	316.7	-	400.0	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	>200.0	-	-	>200.0	-	-	-	-
Bankfull Mean Depth (ft)	2.7	2.8*	4.5	5.3	5.1	6.8	0.5	27	N/A	N/A	N/A	N/A	N/A	N/A	4.0	4.7	5.7	4.0	4.3	4.1	4.7	0.4	3
Bankfull Max Depth (ft)	3.3		5.8	7.6	7.2	9.3	0.7	27	N/A	N/A	N/A	N/A	N/A	N/A	5.1	6.5	7.8	5.6	6.3	6.3	7.1	0.8	3
Bankfull Cross Sectional Area (ft <sup>2</sup> )	139.3	179.2**	192.6	202.5	175.5	222.2	22	27	N/A	N/A	N/A	N/A	N/A	N/A	120.3	157.8	202.7	115.3	143.5	150.2	165.2	25.6	3
Width/Depth Ratio	18.8		4.7	6.6	6.8	8.2	1.0	25	N/A	N/A	N/A	N/A	N/A	N/A	5.2	7.1	8.8	6.9	8.1	6.9	10.4	2	3
Entrenchment Ratio	1.4		7.1	8.6	-	10.8	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	>6.5	-	4.8	6.0	6.2	7.0	1.1	3
Bank Height Ratio	1.4		1.3	1.5	-	1.7	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	1.0	1.0	1.0	1.0	0	3
d50 (mm)			-	0.2	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A									
<b>Profile</b>																							
Riffle Length (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-
Riffle Slope (ft)			0.0	0.0017	0.002	0.004	0	18	N/A	N/A	N/A	N/A	N/A	N/A	0.0022	0.0026	0.003	-	-	-	-	-	-
Pool Length (ft)			15.2	30	27.5	69.8	15	19	N/A	N/A	N/A	N/A	N/A	N/A	81.2	112.8	144.3	-	-	-	-	-	-
Pool Max Depth (ft)			8	9.4	9.5	11.4	1.1	15	N/A	N/A	N/A	N/A	N/A	N/A	7.5	7.8	8.0	6.1	6.4	6.2	7.0	0.5	3
Pool Spacing (ft)			62.3	256.3	150.6	1206	298	18	N/A	N/A	N/A	N/A	N/A	N/A	272.0	297.0	322.0	-	-	-	-	-	-
Pool Cross Sectional Area (ft <sup>2</sup> )			-	199.0	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	120.3	157.8	202.7	148.3	169.9	152.2	209.2	34.1	3
<b>Pattern</b>																							
Channel Beltwidth (ft)			48	639	-	1556	-	-	N/A	N/A	N/A	N/A	N/A	N/A	48	639	1556	48	639	-	1556	-	-
Radius of Curvature (ft)			1275	2693	-	3800	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1275	2693	3800	1275	2693	-	3800	-	-
Rc: Bankfull Width (ft/ft)			34.7	73.4	-	103.5	-	-	N/A	N/A	N/A	N/A	N/A	N/A	49.6	73.4	113.8	38.2	80.6	-	113.8	-	-
Meander Wavelength (ft)			4464	4618	-	4771	-	-	N/A	N/A	N/A	N/A	N/A	N/A	4464	4618	4771	4464	4618	-	4771	-	-
Meander Width Ratio			121.6	125.8	-	130	-	-	N/A	N/A	N/A	N/A	N/A	N/A	173.7	125.8	46.9	1.4	19.1	-	46.9	-	-
<b>Substrate, bed and transport parameters</b>																							
Ri% / Ru% / P% / G% / S%																							
SC% / Sa% / G.% / C% / B% / Be%																							
d16 / d35 / d50 / d84 / d95 / d <sub>95</sub> / d <sub>95</sub> / d <sub>95</sub> (mm)																							
Reach Shear Stress (competency) lb/ft <sup>2</sup>																							
Max part size (mm) mobilized at bankfull																							
Stream power (transport capacity) W/m <sup>2</sup>																							
<b>Additional Reach Parameters</b>																							
Drainage Area (SM)																							
Impervious cover estimate (%)																							
Rosgen Classification	B																						
Bankfull Velocity (fps)	3.9	4.3***																					
Bankfull Discharge (cfs)	539.9	772.1**																					
Valley length (ft)																							
Channel Thalweg length (ft)																							
Sinuosity (ft)																							
<b>Additional Reach Parameters</b>																							
BF slope (ft/ft)	-																						
Bankfull Floodplane Area (acres)																							
Proportion over wide (%)																							
Entrenchment Class (ER Range)																							
Incision Class (BHR Range)																							
BEHI VL% / L% / M% / H% / VH% / E%																							
Channel Stability or Habitat Metric																							
Biological or Other																							

\* NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 1/27/2010  
 \*\* NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 3/16/2006  
 \*\*\*Bankfull Discharge/Bankfull Cross Sectional Area  
 1 A singular reference stream was not used to design the Enhancement Level II project.  
 2 As built profile parameters not calculated for Enhancement Level II



**Exhibit Table 11a. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Section)  
Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 1 Beaver Creek 5794.1 feet**

Dimension and substrate	Cross Section 1 (Riffle)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							Cross Section 4 (Riffle)							Cross Section 5 (Pool)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Based on fixed baseline bankfull elevation</b>																																			
Bankfull Width (ft)	26.3	27.9	30.5	30.3				38.1	30.7	27.7	28.6			28.7	34.2	39.9	37.8			24.1	31.8	34.6	33.3			52.1	28.8	29.8	29.3						
Floodprone Width (ft)	200.0	200.0	200.0	200.0				200.0	200.0	200.0	200.0			200.0	200.0	200	200.0			200.0	200.0	200.0	200.0			200.0	200.0	200.0	200.0						
Bankfull Mean Depth (ft)	4.7	4.4	4.4	4.3				3.5	3.7	3.8	3.8			2.6	3.7	3.4	3.7			4.4	3.7	3.9	4.1			1.8	3.6	4.3	4.0						
Bankfull Max Depth (ft)	7.1	5.9	6.3	6.4				6.4	5.2	5.2	5.6			4.3	6.1	7.4	7.0			7.0	5.5	6.4	6.3			4.3	6.1	8.3	7.4						
Bankfull Cross Sectional Area (ft <sup>2</sup> )	124.5	123.7	134.0	130.1				133.4	115.0	103.9	108.9			74.4	125.8	137.1	138.1			105.4	117.4	134.8	135.1			95.3	102.6	127.5	118.5						
Bankfull Width/Depth Ratio	5.6	6.3	6.9	7.0				10.9	8.3	7.4	7.5			11.0	9.2	11.6	10.2			5.5	8.6	8.9	8.1			28.9	10.8	7.0	7.3						
Bankfull Entrenchment Ratio	7.6	7.2	6.6	6.6				5.2	6.5	7.2	7.0			7.0	5.8	5.0	5.3			8.3	6.3	5.8	6.0			3.8	6.9	6.7	6.0						
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0						
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )		219	218	208					226	218	225				235.0	169	179				213	217.0	167.6				156	177	168						
d50 (mm)	0.2							0.2						0.2						0.2						0.2									
	<b>Cross Section # (##)</b>							<b>Cross Section # (##)</b>							<b>Cross Section # (##)</b>							<b>Cross Section # (##)</b>							<b>Cross Section # (##)</b>						
<b>Based on fixed baseline bankfull elevation</b>	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )																																			
d50 (mm)																																			

**Exhibit Table 11b. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters -- Cross Section)**  
**Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 2 Fifth Creek upstream of Beaver Creek 1,586.4**

Dimension and substrate	Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section # (##)							Cross Section # (##)							Cross Section # (##)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Based on fixed baseline bankfull elevation</b>																																			
Bankfull Width (ft)	34.2	32.3	34.1	33.4				24.2	28.5	26.9	26.1																								
Floodprone Width (ft)	200.0	200.0	200.0	200.0				200.0	200.0	200.0	200.0																								
Bankfull Mean Depth (ft)	4.0	4.6	4.3	4.4				4.3	4.5	4.2	4.6																								
Bankfull Max Depth (ft)	7.2	7.2	7.5	7.4				7.7	6.0	6.1	6.6																								
Bankfull Cross Sectional Area (ft <sup>2</sup> )	136.3	147.6	146.2	145.3				104.2	127.2	112.4	119.1																								
Bankfull Width/Depth Ratio	8.6	7.0	8.0	7.6				5.6	6.3	6.4	5.7																								
Bankfull Entrenchment Ratio	5.8	6.2	5.9	6.0				8.3	7.0	7.4	7.7																								
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0																								
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )		203	197	142					247	232.0	229.3																								
d50 (mm)	0.2							0.2																											
	Cross Section # (##)							Cross Section # (##)							Cross Section # (##)							Cross Section # (##)							Cross Section # (##)						
<b>Based on fixed baseline bankfull elevation</b>	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )																																			
d50 (mm)																																			

**Exhibit Table 11c. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Section)**  
**Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 3 Fifth Creek downstream of Beaver Creek 5,215.2**

Dimension and substrate	Cross Section 8 (Riffle)							Cross Section 9 (Pool)							Cross Section 10 (Riffle)							Cross Section 11 (Riffle)							Cross Section 12 (Pool)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Based on fixed baseline bankfull elevation</b>																																			
Bankfull Width (ft)	32.2	34.5	34.0	33.7				33.7	36.8	37.6	36.8			28.4	34.0	34.1	33.3			41.7	34.9	38.2	38.1			36.6	43.0	44.1	40.3						
Floodprone Width (ft)	200.0	200.0	200.0	200.0				200.0	200.0	200.0	200.0			200.0	200.0	200.0	200.0			200.0	200.0	200.0	200.0			200.0	200.0	200.0	200.0						
Bankfull Mean Depth (ft)	4.7	4.9	5.1	5.6				4.4	4.5	5.0	5.0			4.1	4.8	5.3	5.3			4.0	4.9	4.1	4.5			4.2	4.3	4.9	4.7						
Bankfull Max Depth (ft)	7.1	6.8	6.9	7.3				6.1	7.2	7.9	7.4			5.6	5.9	6.7	6.9			6.3	5.7	7.2	6.5			6.2	7.5	9.1	8.7						
Bankfull Cross Sectional Area (ft <sup>2</sup> )	150.2	170.2	174.5	188.1				148.3	166.8	189.8	185.2			115.3	162.8	182.2	177.7			165.1	170.7	155.9	172.9			152.2	183.2	216.6	190.5						
Bankfull Width/Depth Ratio	6.9	7.0	6.6	6.1				7.7	8.2	7.4	7.4			6.9	7.1	6.4	6.3			10.4	7.1	9.4	8.5			8.8	10.0	9.0	8.6						
Bankfull Entrenchment Ratio	6.2	5.8	5.9	5.9				5.9	5.4	5.3	5.4			7.0	5.9	5.9	6.0			4.8	5.7	5.2	5.2			5.5	4.7	4.5	5.0						
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0						
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )		284	271	279					248	246	236				229	228	215				285	268	252				376	322	293.0						
d50 (mm)	0.2							0.2						0.2						0.2						0.2									
	Cross Section 13 (Pool)							Cross Section # (##)							Cross Section # (##)							Cross Section # (##)													
<b>Based on fixed baseline bankfull elevation</b>	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	40.1	42.1	38.9	38.0																															
Floodprone Width (ft)	200.0	200.0	200.0	200.0																															
Bankfull Mean Depth (ft)	5.2	4.9	4.6	4.7																															
Bankfull Max Depth (ft)	7.0	6.7	6.4	6.0																															
Bankfull Cross Sectional Area (ft <sup>2</sup> )	209.2	206.4	180.3	176.9																															
Bankfull Width/Depth Ratio	7.7	8.6	8.4	8.1																															
Bankfull Entrenchment Ratio	5.0	4.8	5.1	5.3																															
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0																															
<b>Based on current/developing bankfull feature</b>																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft <sup>2</sup> )																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft <sup>2</sup> )		246	240	238																															
d50 (mm)	0.2																																		

**Exhibit Table 12a. Monitoring Data - Stream Reach Data Summary**  
**Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 1 Beaver Creek 5,794.1 feet**

Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5					
	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n
<b>Dimension and Substrate - Riffle only</b>																																				
Bankfull Width (ft)	24.1	29.5	26.3	38.1	7.5	3	27.9	30.1	30.7	31.8	2.0	3	27.7	30.9	30.5	34.6	3.6	3	28.6	30.7	30.3	33.3	2.4	3												
Floodprone Width (ft)	200	200	200	200	0.0	3	200	200.0	200	200	0.0	3	200	200	200	200	0.0	3	200	200	200	200	0.0	3												
Bankfull Mean Depth (ft)	3.5	4.2	4.4	4.7	0.6	3	3.7	3.9	3.7	4.4	0.4	3	3.8	4.0	3.9	4.4	0.3	3	3.8	4.1	4.1	4.3	0.3	3												
<sup>1</sup> Bankfull Max Depth (ft)	6.4	6.8	7.0	7.1	4.0	3	5.2	5.5	5.5	5.9	0.4	3	5.1	5.9	6.3	6.4	0.7	3	5.6	6.1	6.3	6.4	0.4	3												
Bankfull Cross Sectional Area (ft <sup>2</sup> )	105.4	121.1	124.5	133.4	14.3	3	115	118.7	117.4	123.7	4.5	3	103.9	124.2	134	134.8	17.6	3	108.9	124.7	130.1	135.1	13.9	3												
Width/Depth Ratio	5.5	7.3	5.6	10.9	3.1	3	6.3	7.7	8.3	8.6	1.3	3	6.9	7.7	7.4	8.9	1.0	3	7.0	7.5	7.5	8.1	0.6	3												
Entrenchment Ratio	5.2	7.0	7.6	8.3	1.6	3	6.3	6.7	6.5	7.2	0.5	3	5.8	6.5	6.6	7.2	0.7	3	6.0	6.5	6.6	7.0	0.5	3												
<sup>1</sup> Bank Height Ratio	1	1	1	1	0	3	1	1	1	1	0	3	1	1	1	1	0	3	1	1	1	1	0	3												
<b>Profile</b>																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max depth (ft)																																				
Pool Spacing (ft)																																				
<b>Pattern</b>																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
<b>Additional Reach Parameters</b>																																				
Rosgen Classification	E5						E5						E5						E5																	
Channel Thalweg length (ft)	2,794						2,794						2,794						2794.1																	
Sinuosity (ft)																																				
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)																																				
<sup>3</sup> Ri% / Ru% / P% / G% / S%																																				
<sup>3</sup> SC% / Sa% / G% / C% / B% / Be%																																				
<sup>3</sup> d16 / d35 / d50 / d84 / d95 /																																				
<sup>2</sup> % of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.

2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

4. = Of value/needed only if the n exceeds 3

Exhibit Table 12b. Monitoring Data - Stream Reach Data Summary																																						
Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 2 Fifth Creek upstream of Beaver Creek 1,586.4 feet																																						
Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5							
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n		
Bankfull Width (ft)	-	24.2	-	-	-	1	-	28.5	-	-	-	1	-	26.9	-	-	-	1	-	26.1	-	-	-	1														
Floodprone Width (ft)	-	>200.0	-	-	-	1	-	200	-	-	-	1	-	200	-	-	-	1	-	200	-	-	-	1														
Bankfull Mean Depth (ft)	-	4.3	-	-	-	1	-	4.5	-	-	-	1	-	4.2	-	-	-	1	-	4.6	-	-	-	1														
<sup>1</sup> Bankfull Max Depth (ft)	-	7.7	-	-	-	1	-	6.0	-	-	-	1	-	6.1	-	-	-	1	-	6.6	-	-	-	1														
Bankfull Cross Sectional Area (ft <sup>2</sup> )	-	104.2	-	-	-	1	-	127.2	-	-	-	1	-	112.4	-	-	-	1	-	119.1	-	-	-	1														
Width/Depth Ratio	-	5.6	-	-	-	1	-	6.3	-	-	-	1	-	6.4	-	-	-	1	-	5.7	-	-	-	1														
Entrenchment Ratio	-	8.3	-	-	-	1	-	7.0	-	-	-	1	-	7.4	-	-	-	1	-	7.7	-	-	-	1														
<sup>1</sup> Bank Height Ratio	-	1	-	-	-	1	-	1	-	-	-	1	-	1	-	-	-	1	-	1	-	-	-	1														
<b>Profile</b>																																						
Riffle Length (ft)																																						
Riffle Slope (ft/ft)																																						
Pool Length (ft)																																						
Pool Max depth (ft)																																						
Pool Spacing (ft)																																						
<b>Pattern</b>																																						
Channel Beltwidth (ft)																																						
Radius of Curvature (ft)																																						
Rc:Bankfull width (ft/ft)																																						
Meander Wavelength (ft)																																						
Meander Width Ratio																																						
<b>Additional Reach Parameters</b>																																						
Rosgen Classification	E5						E5						E5						E5																			
Channel Thalweg length (ft)	1,586						1,586						1,586						1586.4																			
Sinuosity (ft)																																						
Water Surface Slope (Channel) (ft/ft)																																						
BF slope (ft/ft)																																						
<sup>3</sup> Ri% / Ru% / P% / G% / S%																																						
<sup>3</sup> SC% / Sa% / G% / C% / B% / Be%																																						
<sup>3</sup> d16 / d35 / d50 / d84 / d95 /																																						
<sup>2</sup> % of Reach with Eroding Banks																																						
Channel Stability or Habitat Metric																																						
Biological or Other																																						

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.

2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

4. = Of value/needed only if the n exceeds 3

**Exhibit Table 12c. Monitoring Data - Stream Reach Data Summary**  
**Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 3 Fifth Creek downstream of Beaver Creek 5,215.2 feet**

Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5					
	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n
<b>Dimension and Substrate - Riffle only</b>																																				
Bankfull Width (ft)	28.4	34.1	32.2	41.7	6.9	3	34	34.5	34.5	34.9	0.5	3	34	35.4	34.1	38.2	2.4	3	33.3	35.0	33.7	38.1	2.7	3												
Floodprone Width (ft)	200	200	200	200	0	3	200	200.0	200	200	0.0	3	200	200	200	200	0.0	3	200.0	200.0	200.0	200.0	0.0	3												
Bankfull Mean Depth (ft)	4	4.3	4.1	4.7	0.4	3	4.8	4.9	4.9	4.9	0.1	3	4.1	4.9	5.1	5.3	0.7	3	4.5	5.1	5.3	5.6	0.6	3												
<sup>1</sup> Bankfull Max Depth (ft)	5.6	6.3	6.3	7.1	0.8	3	5.7	6.1	5.9	6.8	0.6	3	6.6	6.9	6.9	7.2	0.3	3	6.5	6.9	6.9	7.3	0.4	3												
Bankfull Cross Sectional Area (ft <sup>2</sup> )	115.3	143.5	150.2	165.2	25.6	3	162.8	167.9	170.2	170.7	4.4	3	155.9	170.9	174.5	182.2	13.5	3	172.9	179.6	177.7	188.1	7.8	3												
Width/Depth Ratio	6.9	8.1	6.9	10.4	2	3	7	7.1	7.1	7.1	0.1	3	6.4	7.5	6.6	9.4	1.7	3	6.1	7.0	6.3	8.5	1.3	3												
Entrenchment Ratio	4.8	6	6.2	7	1.1	3	5.7	5.8	5.8	5.9	0.1	3	5.2	5.7	5.9	5.9	0.4	3	5.2	5.7	5.9	6.0	0.4	3												
<sup>1</sup> Bank Height Ratio	1	1	1	1	0	3	1	1	1	1	0	3	1	1	1	1	0	3	1	1	1	1	0	3												
<b>Profile</b>																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max depth (ft)																																				
Pool Spacing (ft)																																				
<b>Pattern</b>																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
<b>Additional Reach Parameters</b>																																				
Rosgen Classification	E5						E5						E5						E5																	
Channel Thalweg length (ft)	5,215						5,215						5,215						5,215.2																	
Sinuosity (ft)																																				
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)																																				
<sup>3</sup> Ri% / Ru% / P% / G% / S%																																				
<sup>3</sup> SC% / Sa% / G% / C% / B% / Be%																																				
<sup>3</sup> d16 / d35 / d50 / d84 / d95 /																																				
<sup>2</sup> % of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.

- 1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
- 2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
- 3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
- 4. = Of value/needed only if the n exceeds 3

## **Appendix E**

Hydrology Data

Table 12. Verification of Bankfull Events  
 Five Mile Branch Stream and Wetland Restoration  
 NCEEP # 92185

Date of Data Collection	Date of Occurance	Method	Greater than Qb <sub>kf</sub> stage	Notes
5/30/2012	Unknown	Debris on floodplain	Y	
10/8/2013	7/6/2013	On-site transducer/data logger	Y	
10/8/2013	7/27/2013	On-site transducer/data logger and silt inside of rain gauge. 3.71 inches of rain.	Y	
12/5/2013	11/27/2013	On-site transducer/data logger	Y	
7/18/2014	1/11/2014	On-site transducer/data logger	Y	Beaver Creek, Fifth Creek Upstream and Fifth Creek Downstream
7/18/2014	1/11/2014	On-site transducer/data logger	Y	Beaver Creek
7/18/2014	1/11/2014	On-site transducer/data logger	Y	Beaver Creek
4/17/2015	3/15/2015	On-site transducer/data logger	Y	Beaver Creek and Fifth Creek Upstream



Five Mile Branch 30-70 Percentile Graph for Rainfall 2006-2015

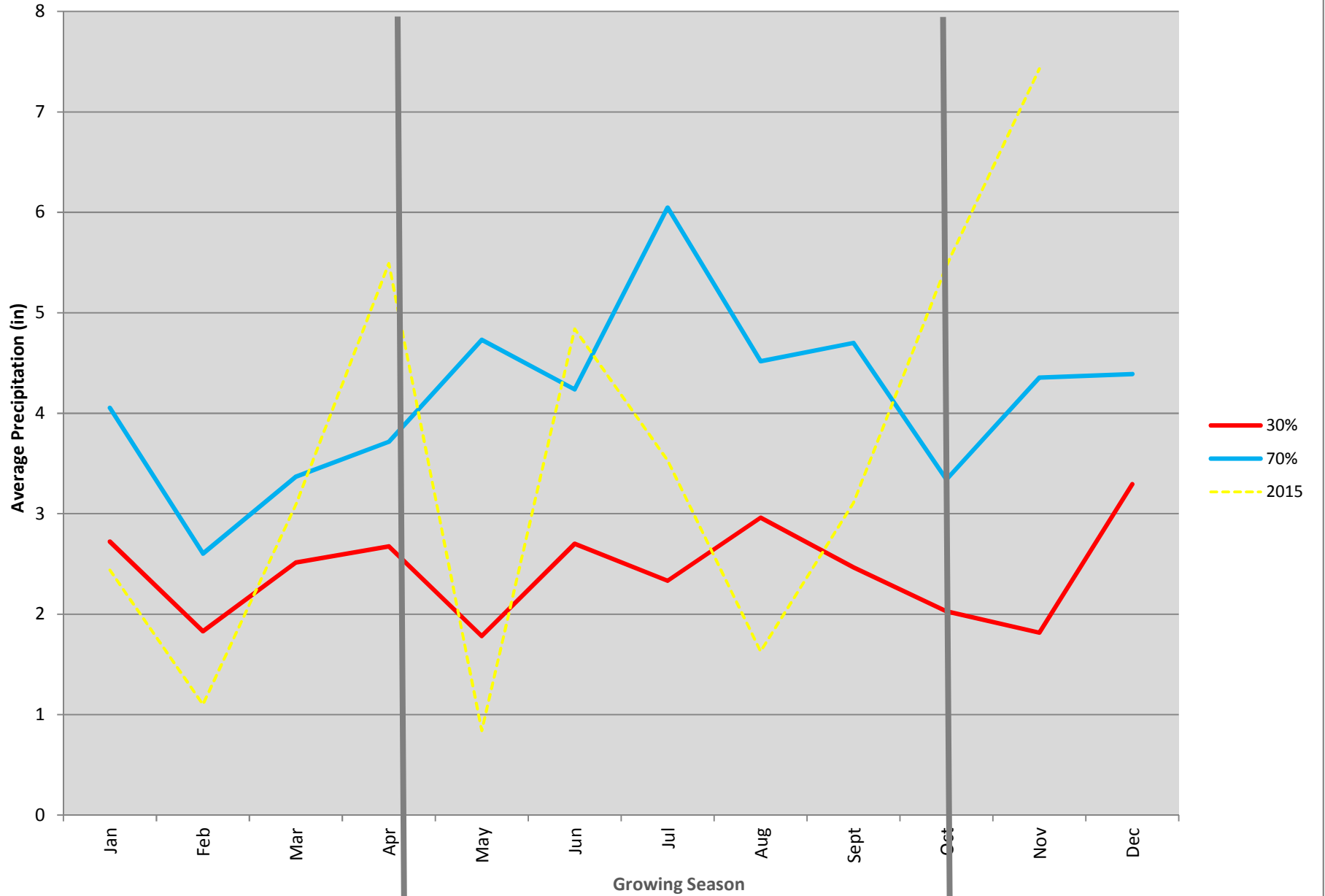


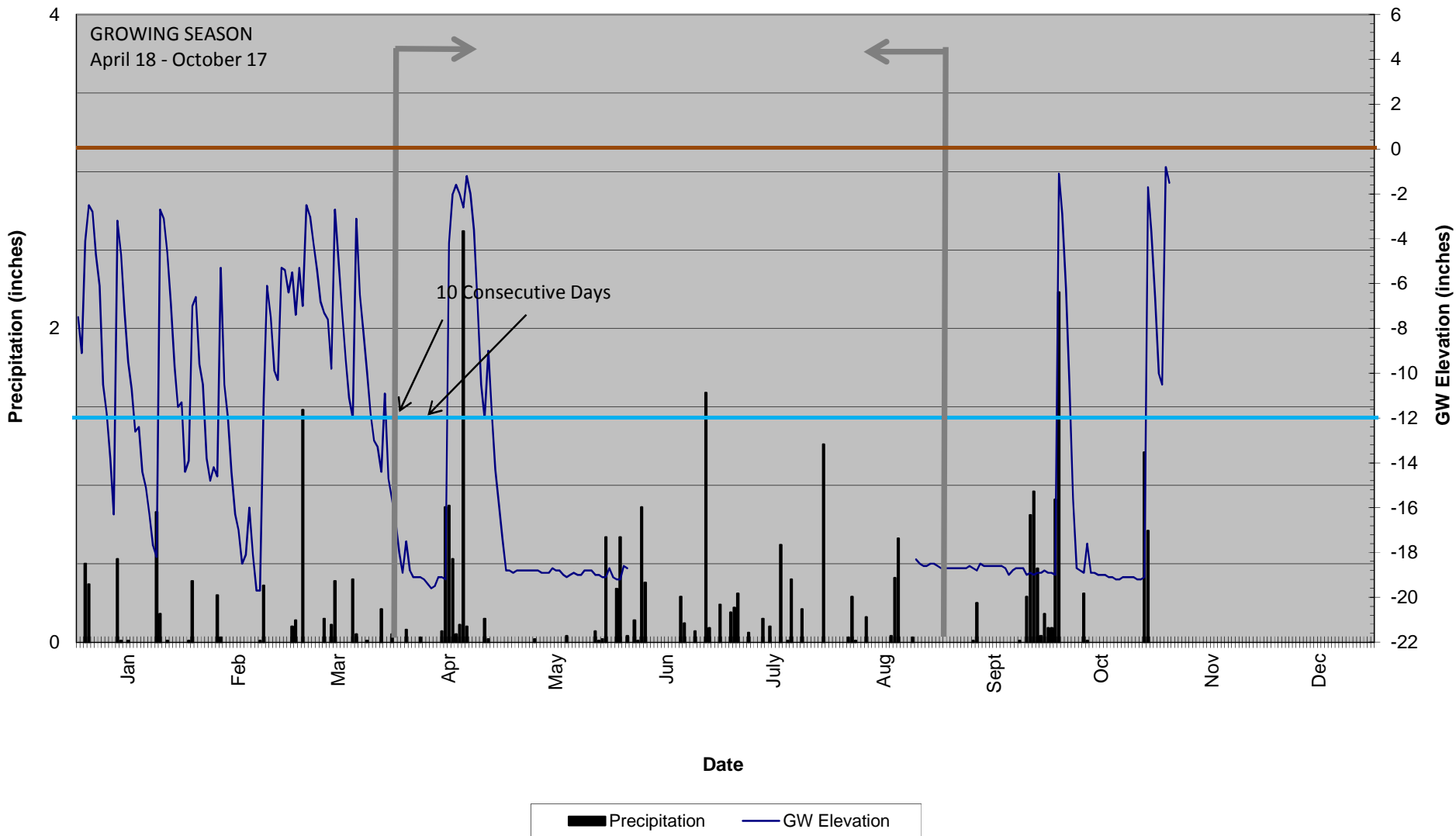
Table 14. Groundwater Gauge Downloading History  
 Five Mile Branch Stream and Wetland Restoration  
 NCEEP # 92185

Number	Initial Gauge Serial Number	Download Event Date											
		3/20/2013	4/3/2013	5/29/2013	6/4/2013	8/20/2013	12/5/2013	12/15/2013	7/18/2014	10/17/2014	4/17/2015*	8/28/2015	11/4/2015
1	13D4B648	ok	ok	Failed	No attempt.	ok	Replaced with EBD3010.	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data.	No attempt due to weather.	ok
2	14E14322	Reprogrammed due to inconsistent logging interval.	Replaced with 12D4C9D8.	ok	No attempt.	ok	failed	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data. Replaced battery.	No attempt due to weather.	OK. Missing 6/5 - 8/24 data.
3	1314FC9A	Failed	ok	ok	No attempt.	Failed	Replaced with 13152502.	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data.	No attempt due to weather.	ok
4	13D49A3B	ok	ok	ok	No attempt.	ok	ok	No attempt.	Ok. Replaced battery. Deleted old data.	ok	OK. Deleted old data.	No attempt due to weather.	ok
5	14E16DC9	ok	ok	ok	No attempt.	ok	ok	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data. Replaced battery.	No attempt due to weather.	OK. Missing 6/5 - 6/12 data.
6	14E1A3C5	Reprogrammed due to not downloading.	ok	ok	No attempt.	Failed	ok	No attempt.	Ok. Replaced battery. Deleted old data.	ok	OK. Deleted old data.	No attempt due to weather.	ok
7	13D4CA32	ok	ok	ok	No attempt.	ok	ok	No attempt.	Replaced with 1314FC9A	Partial data	OK. Deleted old data.	No attempt due to weather.	ok
8	13D49BC4	ok	ok	ok	No attempt.	ok	ok	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data.	No attempt due to weather.	ok
9	136B6377	ok	ok	ok	No attempt.	Failed	Replaced with EBD20B9.	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data.	No attempt due to weather.	ok
10	13D4B632	ok	ok	ok	No attempt.	ok	ok	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data.	No attempt due to weather.	ok
11	14E178FC	ok	ok	ok	No attempt.	Failed	Replaced with EBD074F.	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data. Replaced battery.	No attempt due to weather.	ok
12	14E13DAE	ok	ok	ok	No attempt.	ok	ok	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data.	No attempt due to weather.	OK. Missing 6/5 - 6/11 data.
13	13D4A9D9	ok	ok	ok	No attempt.	ok	ok	No attempt.	Ok. Reprogrammed. Deleted old data.	ok	OK. Deleted old data. Replaced battery.	ok	Wrong logging dates. Reprogrammed.
14	13D4C9C5	ok	ok	ok	No attempt.	Failed	ok	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data. Replaced battery.	ok	ok
15	A28B85B	ok	ok	ok	No attempt.	No attempt due to malfunctioning handheld.	No attempt.	No attempt.	Ok. Replaced battery. Deleted old data.	failed	OK. Deleted old data.	ok	ok
16	11312B9E	ok	Failed	ok	No attempt.	No attempt due to malfunctioning handheld.	No attempt. Submerged	No attempt.	Replaced with EBCFF2F	Partial data	OK. Deleted old data.	No attempt due to weather.	ok
17	14E16DE5	ok	ok	ok	No attempt.	No attempt due to malfunctioning handheld.	ok	No attempt.	Ok. Replaced battery. Deleted old data.	Partial data	OK. Deleted old data. Replaced battery.	No attempt due to weather.	OK. No data after 6/27. Reprogrammed.
18	13153397	Failed	Replaced with 13D493A9.	No attempt due to accident.	No attempt. Could not locate.	No attempt due to malfunctioning handheld.	ok	No attempt.	OK. Deleted old data.	ok	OK. Deleted old data.	No attempt due to weather.	ok
19	14E15453	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	Replaced with 13D4B648	Partial data	OK. Deleted old data.	ok	OK. Missing 10/29 - 11/7 data.
20	9DE6C32	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	OK. Deleted old data.	ok	OK. Deleted old data.	ok	ok
21	9DE6D1F	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	Failed	ok	OK. Deleted old data.	ok	ok
22	EBD1038	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	OK. Deleted old data.	ok	OK. Deleted old data.	ok	ok
23	13D4B61D	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	OK. Deleted old data.	ok	OK. Deleted old data.	ok	ok
24	A287DCE	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	OK. Deleted old data.	ok	OK. Deleted old data.	ok	ok
25	13D4B624	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	OK. Deleted old data.	ok	OK. Deleted old data.	ok	ok
26	EBD6BE	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	OK. Deleted old data.	ok	OK. Deleted old data.	ok	ok
27	14E13D38	Reprogrammed due to no data.	ok	No attempt due to accident.	Reprogrammed due to inconsistent logging interval.	No attempt due to malfunctioning handheld.	No attempt.	ok	Failed	Partial data	Replaced with 136B1CB7	ok	ok
28	14E1973F	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	Failed	Partial data	OK. Deleted old data.	ok	ok
29	14E177C0	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok	OK. Deleted old data.	ok	OK. Deleted old data.	ok	ok
30	13D4CA00	ok	ok	No attempt due to accident.	No attempt.	No attempt due to malfunctioning handheld.	No attempt.	ok	OK. Deleted old data.	ok	OK. Deleted old data.	ok	ok
RAIN	13D4BAF9	ok	ok	ok full of ants	No attempt.	Failed. Silt in gauge from flooding.	Failed	Failed	No attempt. Wasp nest on gauge.	No attempt	No attempt	No attempt	No attempt

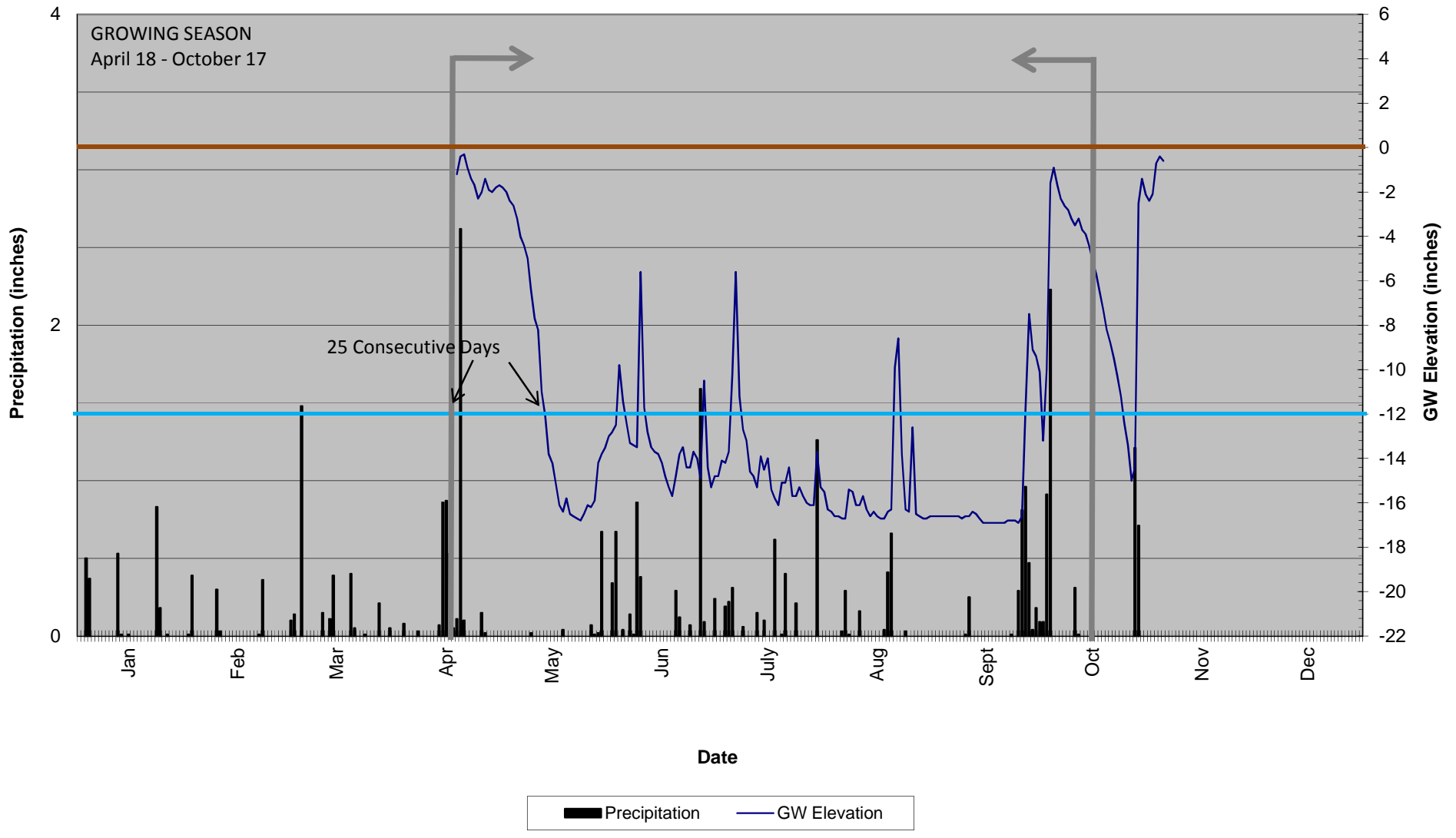
\* Batteries replaced in several gauges.



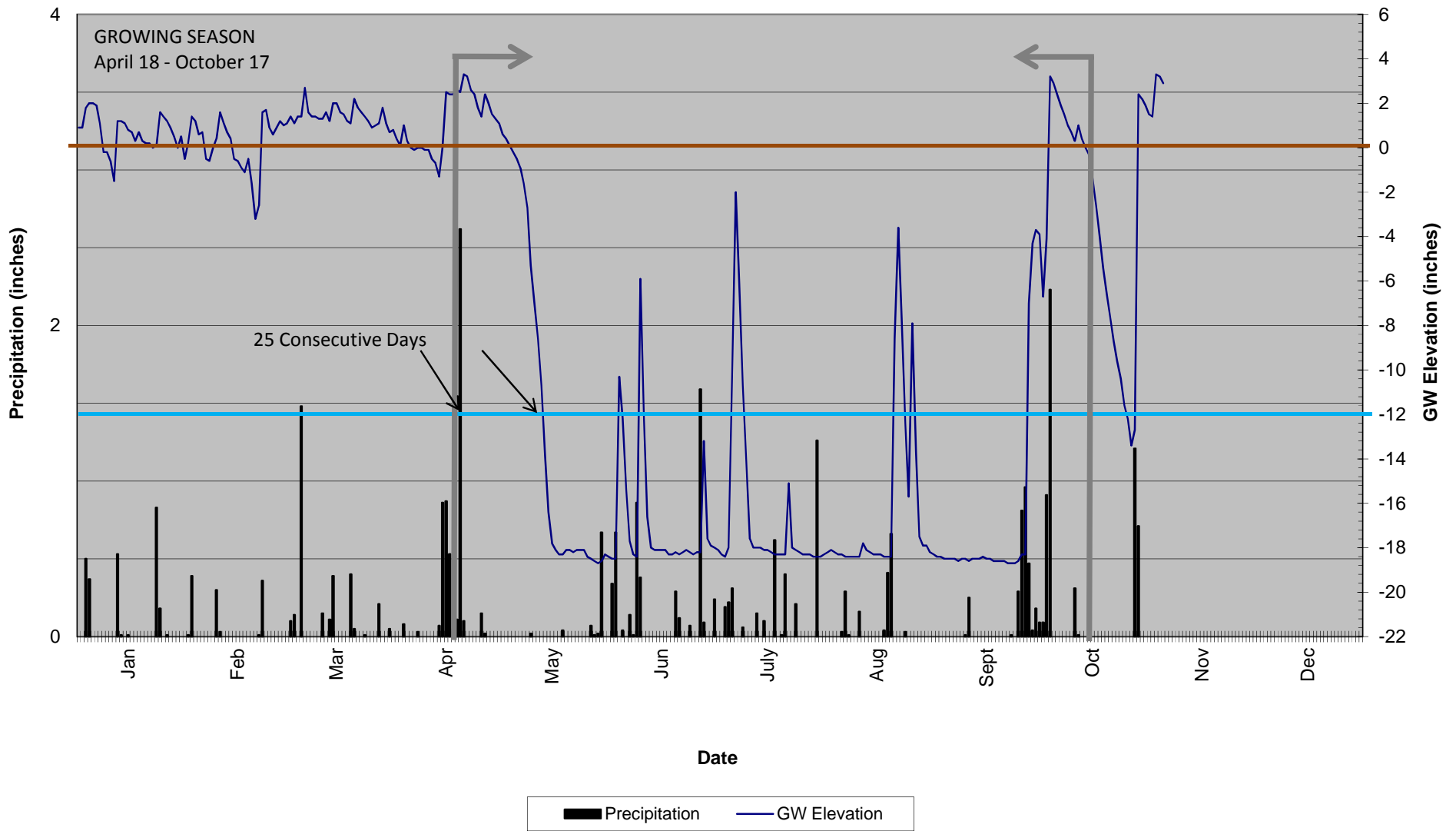
### Five Mile Branch Gauge #2 13D4C9D8



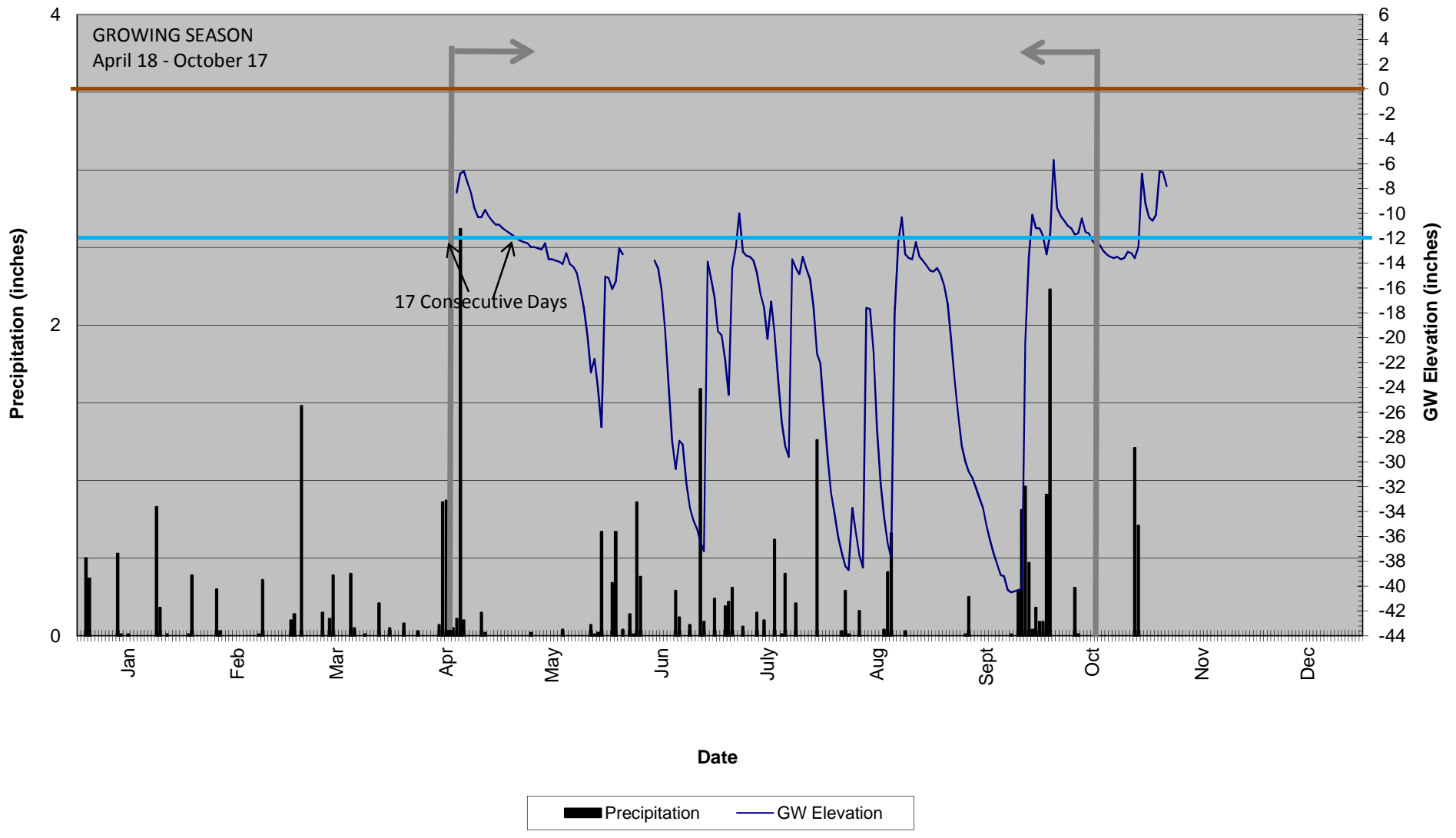
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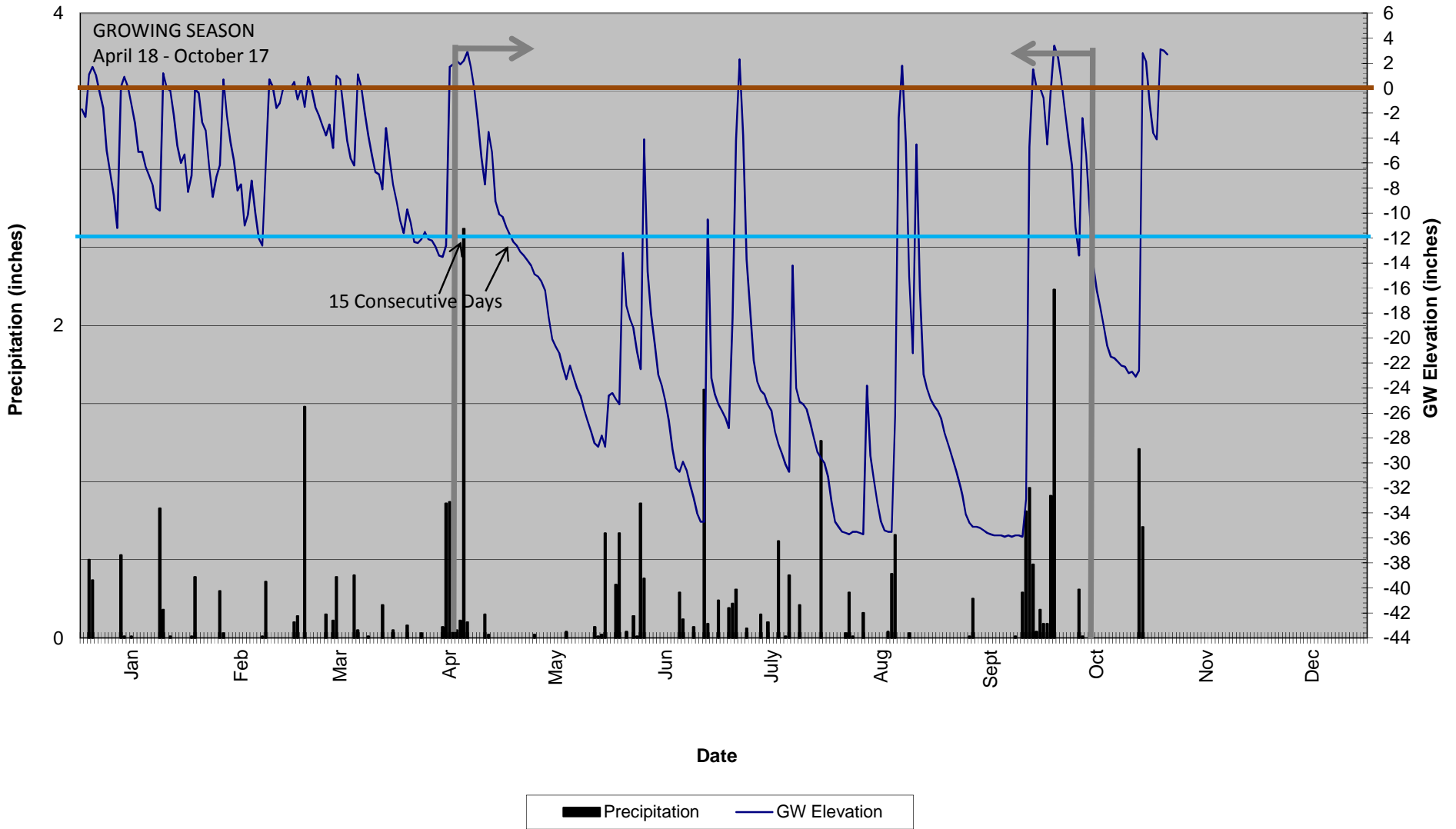
### Five Mile Branch Gauge #4 13D49A3B



### Five Mile Branch Gauge #5 14E16DC9

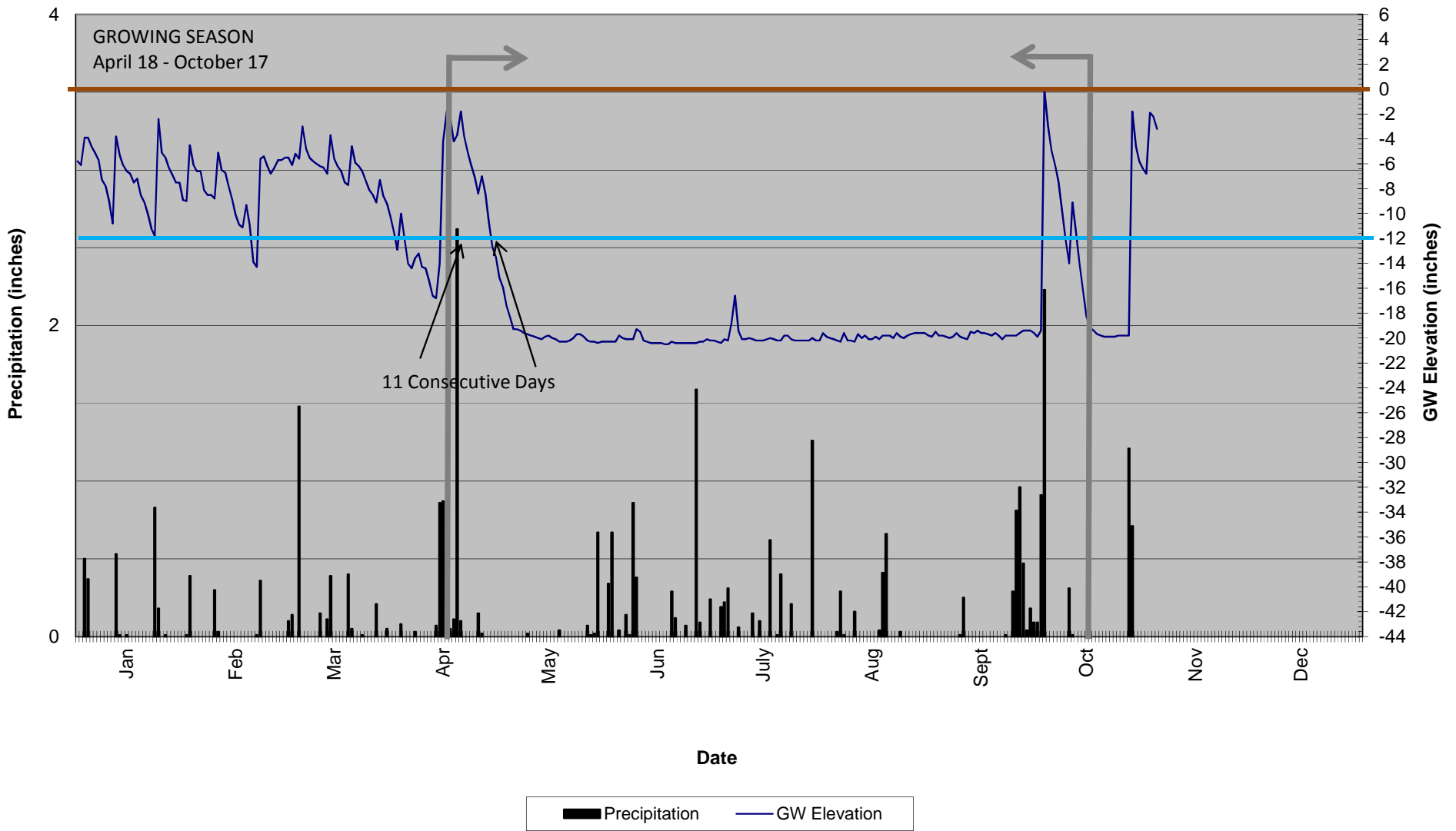


### Five Mile Branch Guage #6 14E1A3C5

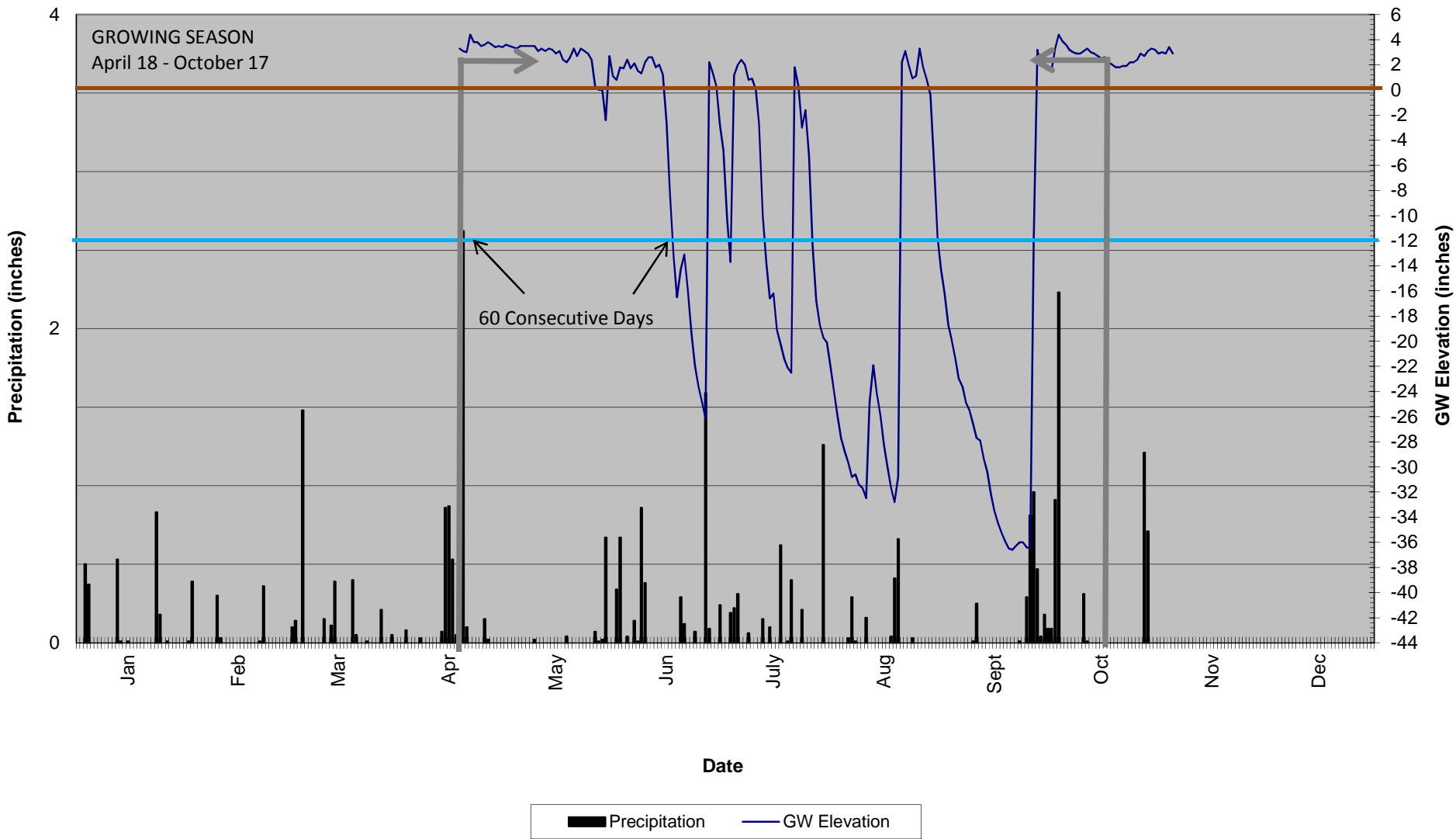




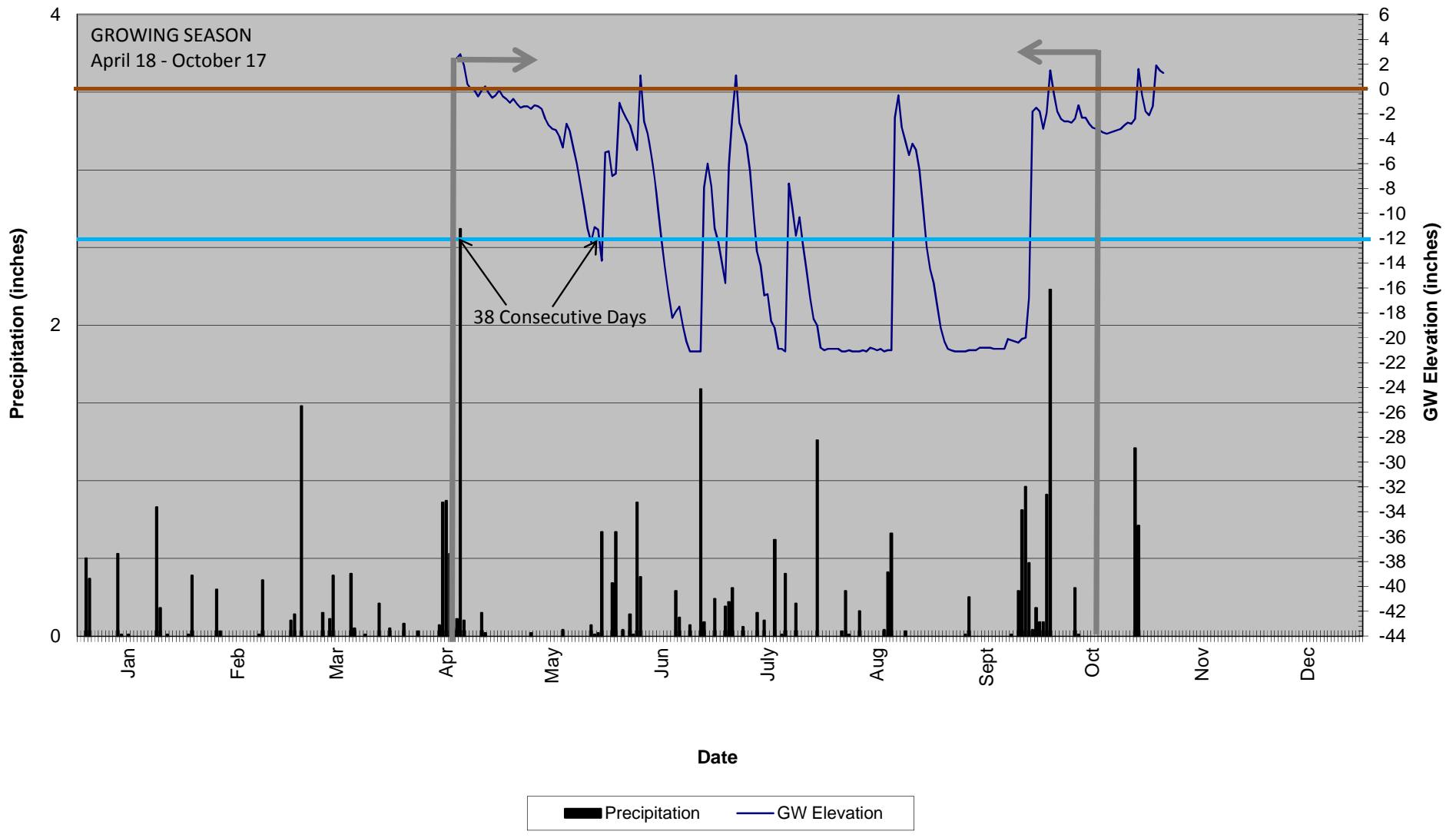
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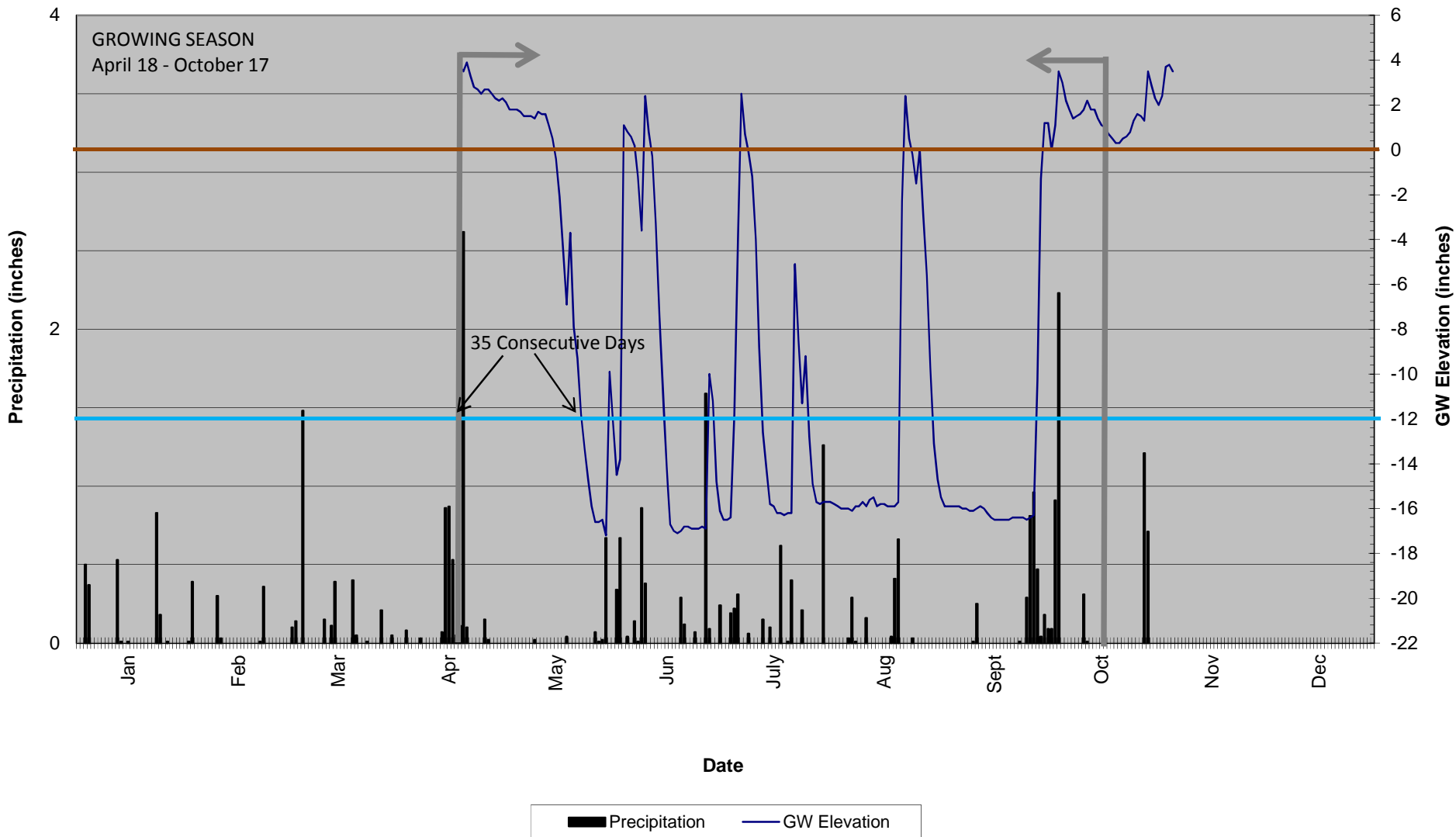
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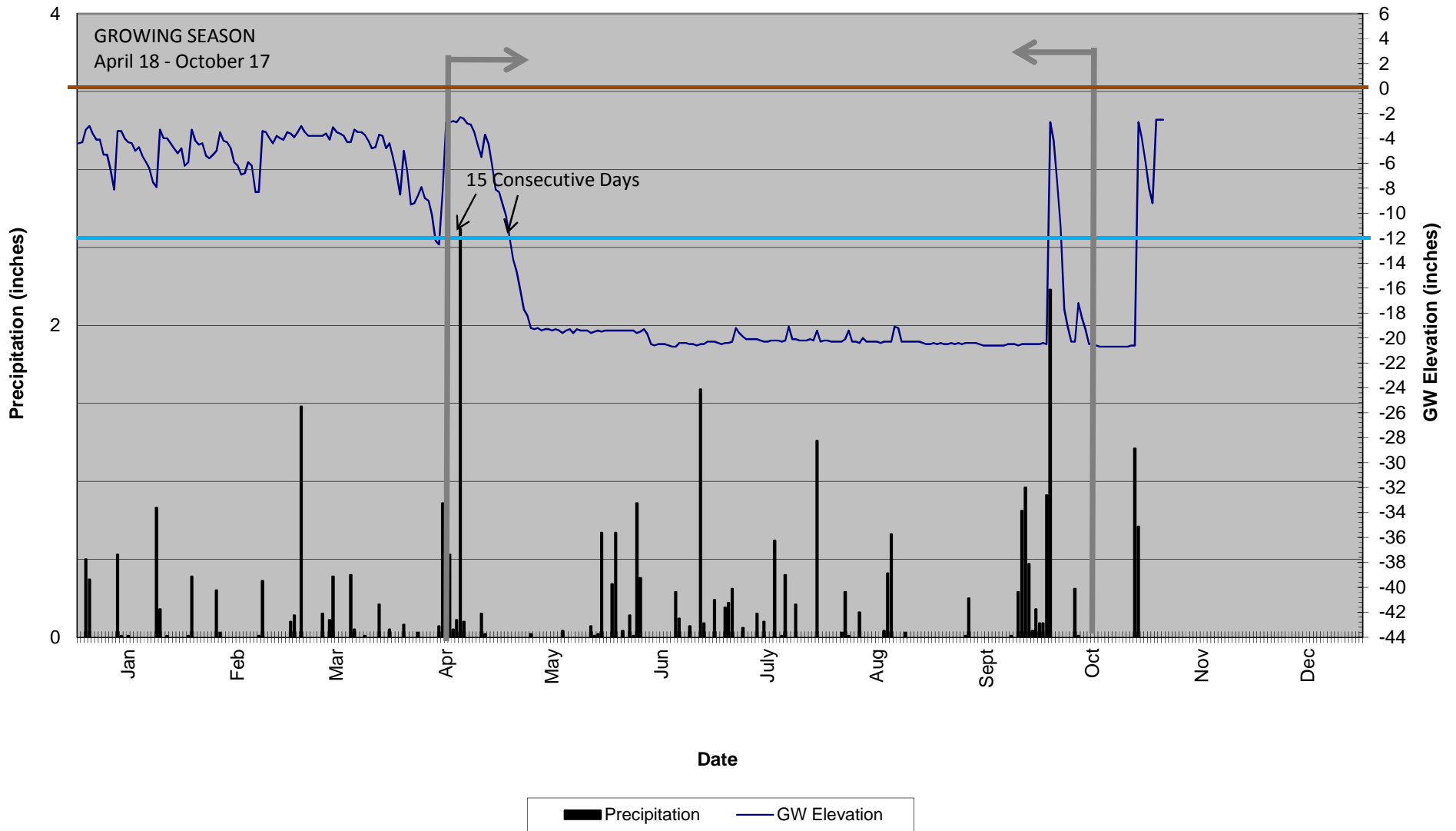
### Five Mile Branch Gauge #9 EBD20B9



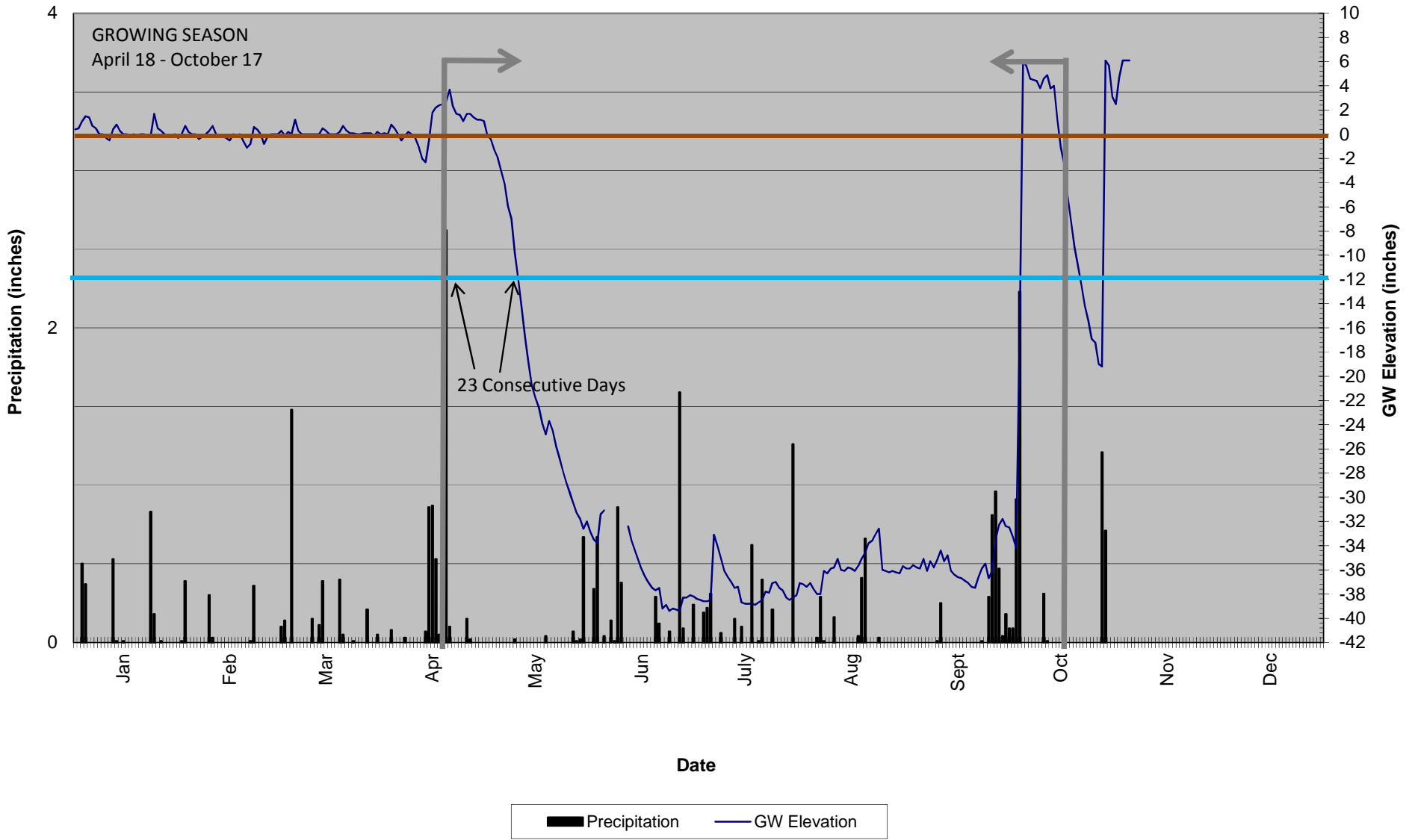
### Five Mile Branch Gauge #10 13D4B632



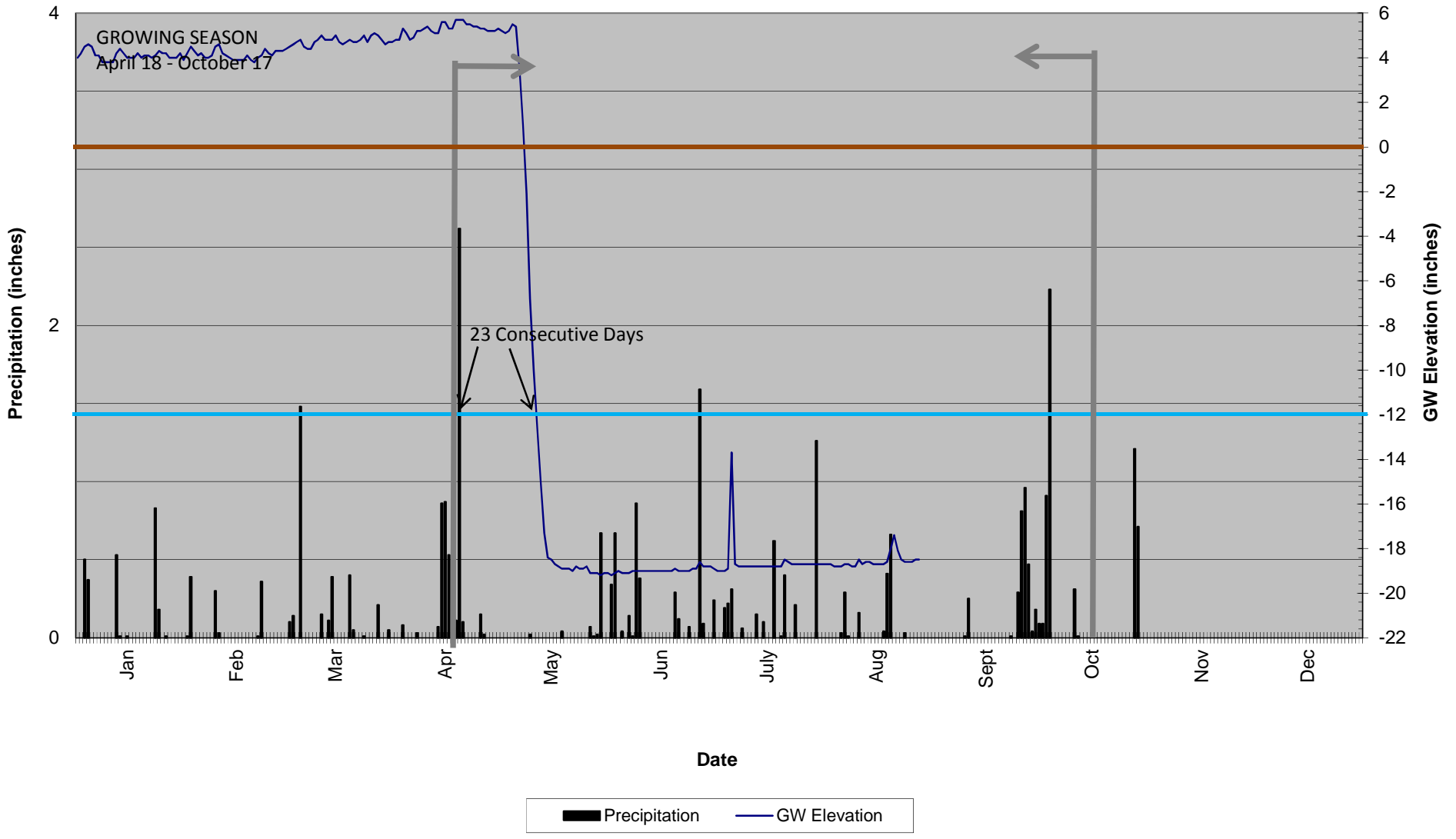
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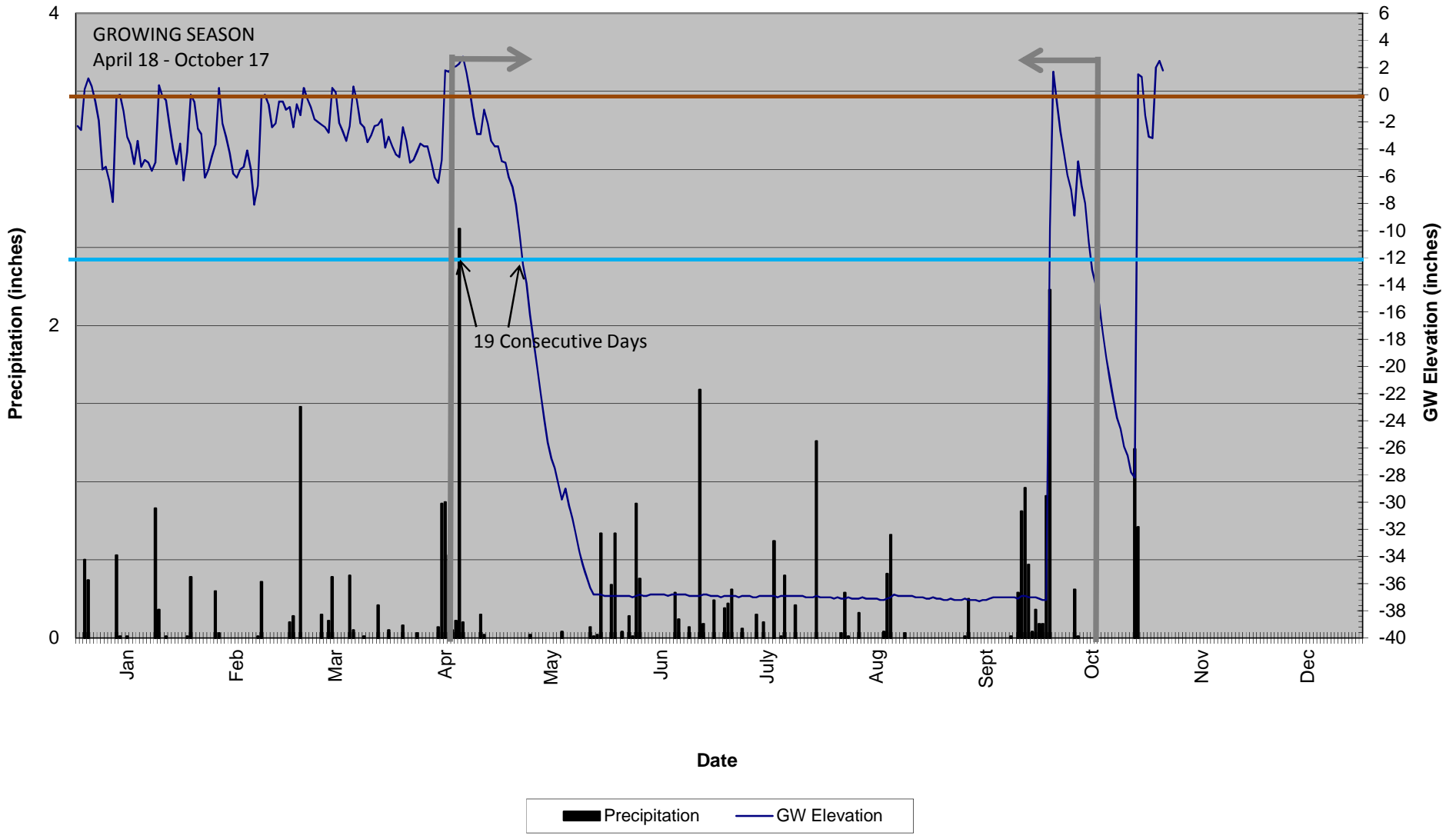
### Five Mile Branch Gauge #12 14E13DAE



### Five Mile Branch Gauge #13 13D4A9D9

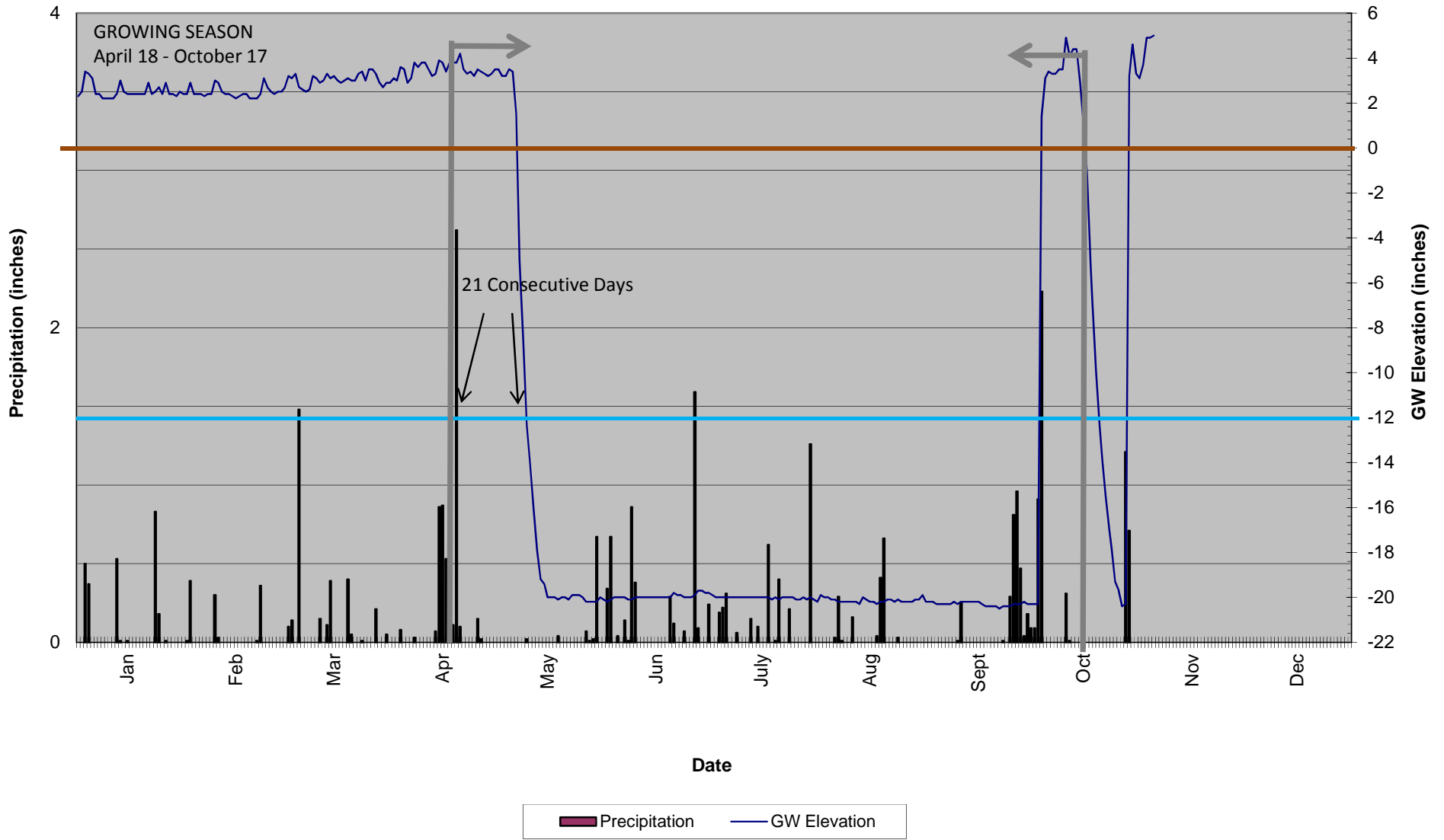


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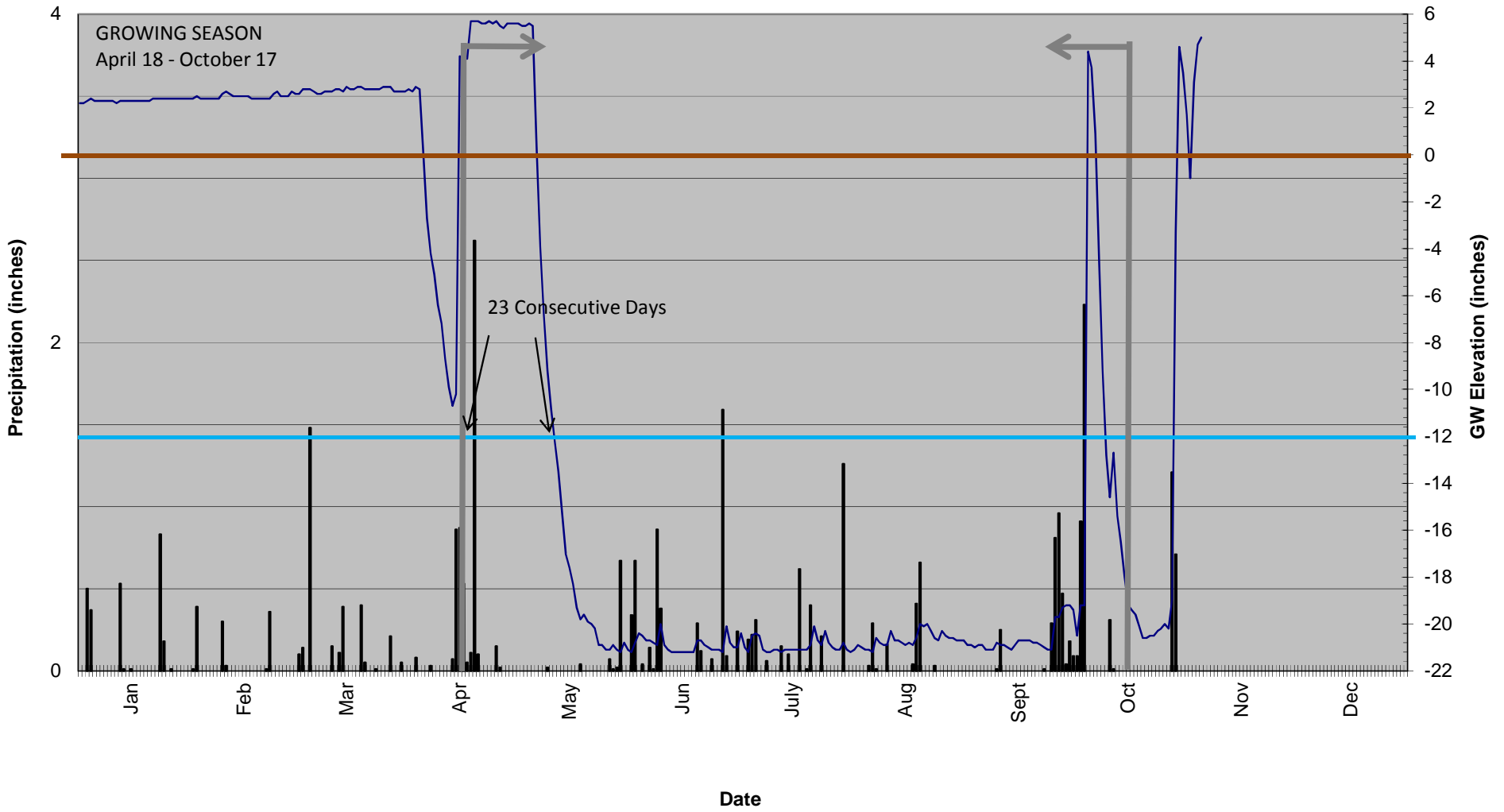




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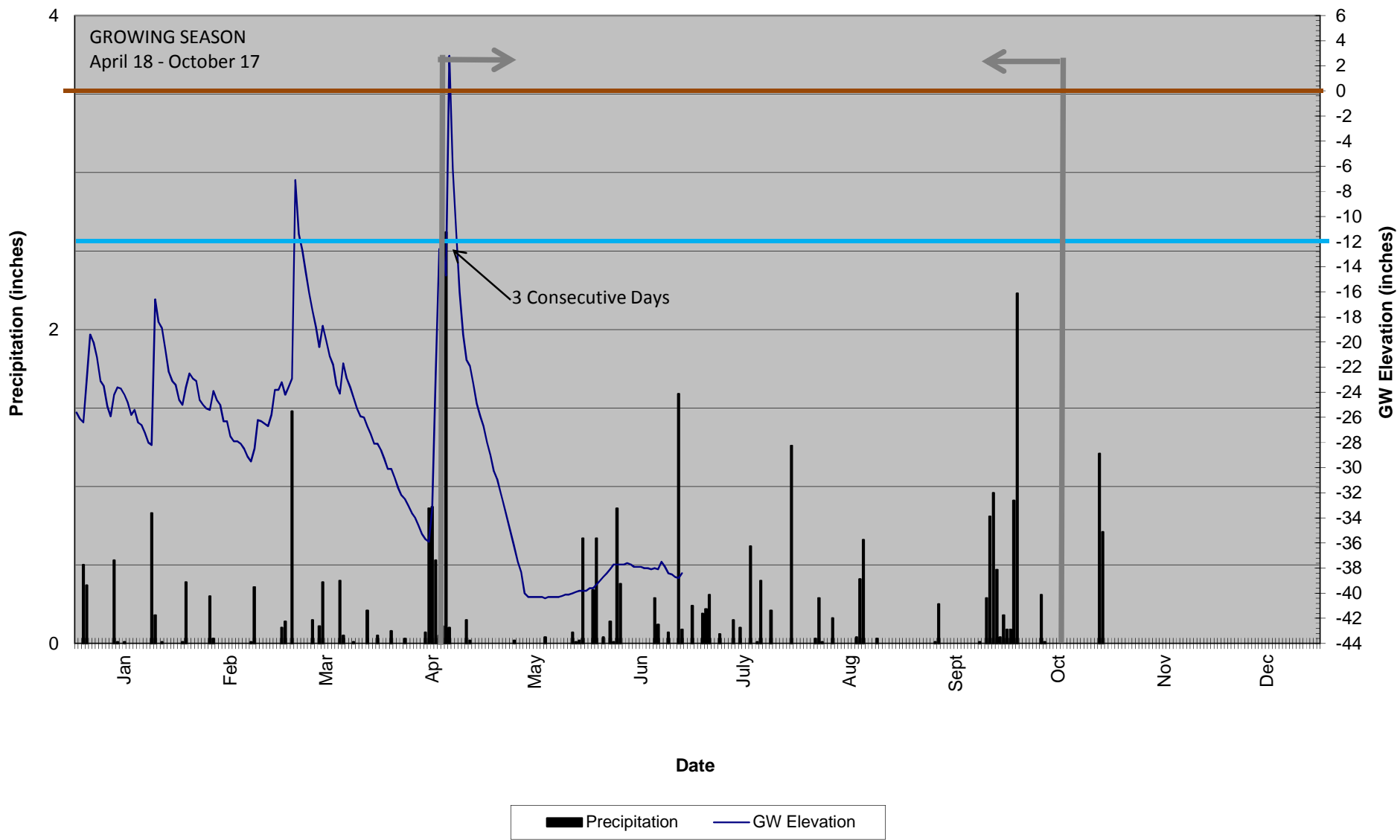


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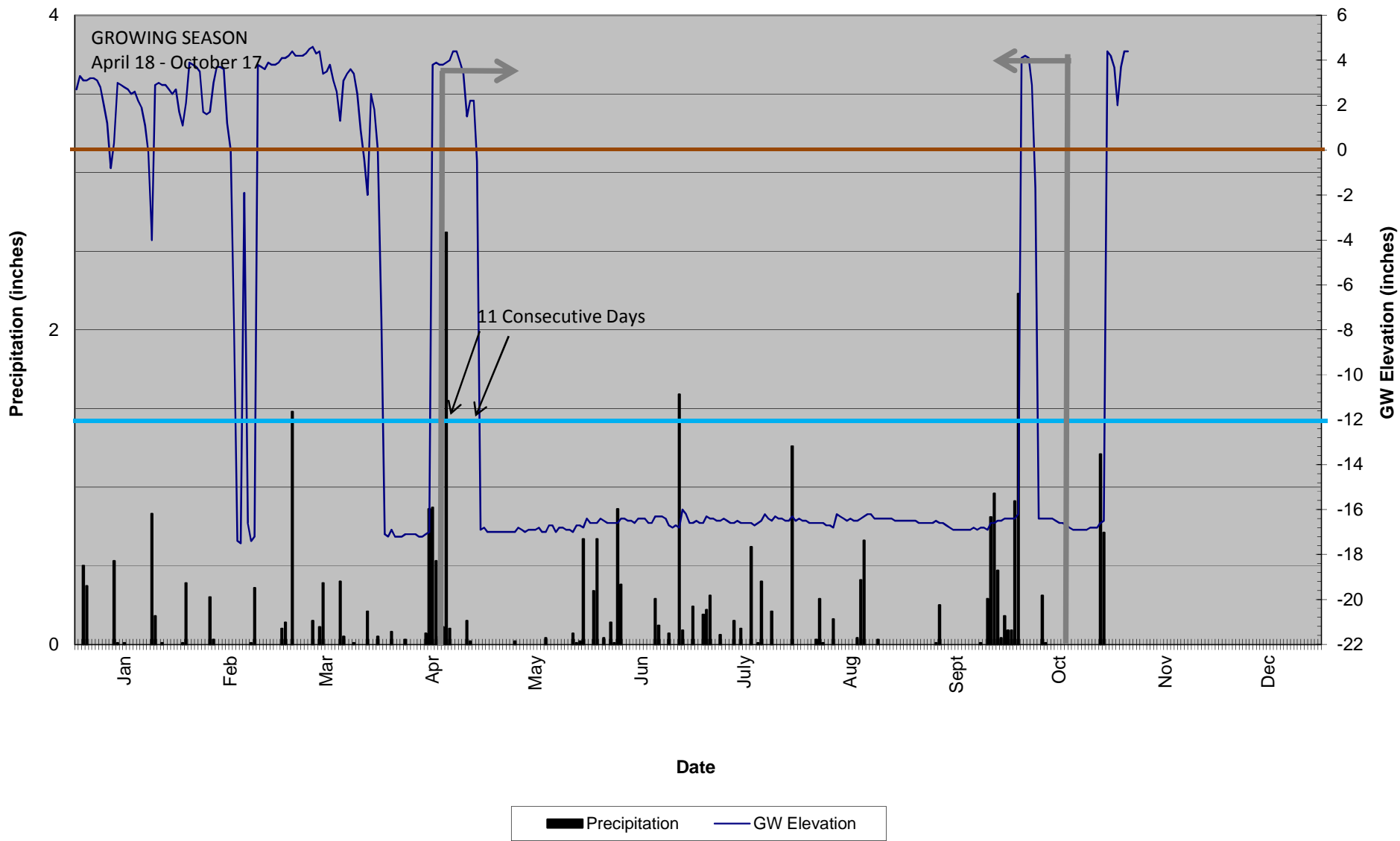


■ Precipitation    — GW Elevation

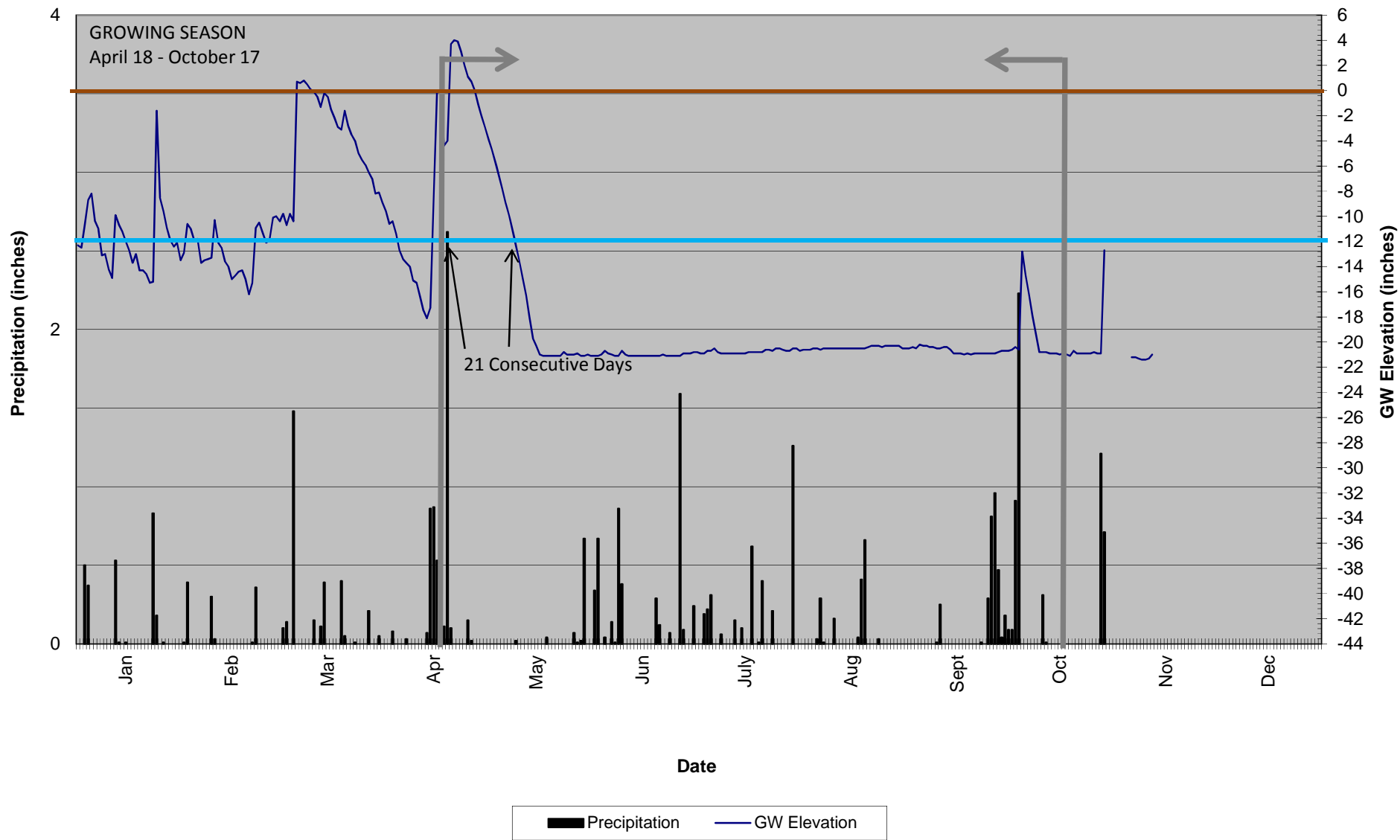
### Five Mile Branch Gauge #17 14E16DE5



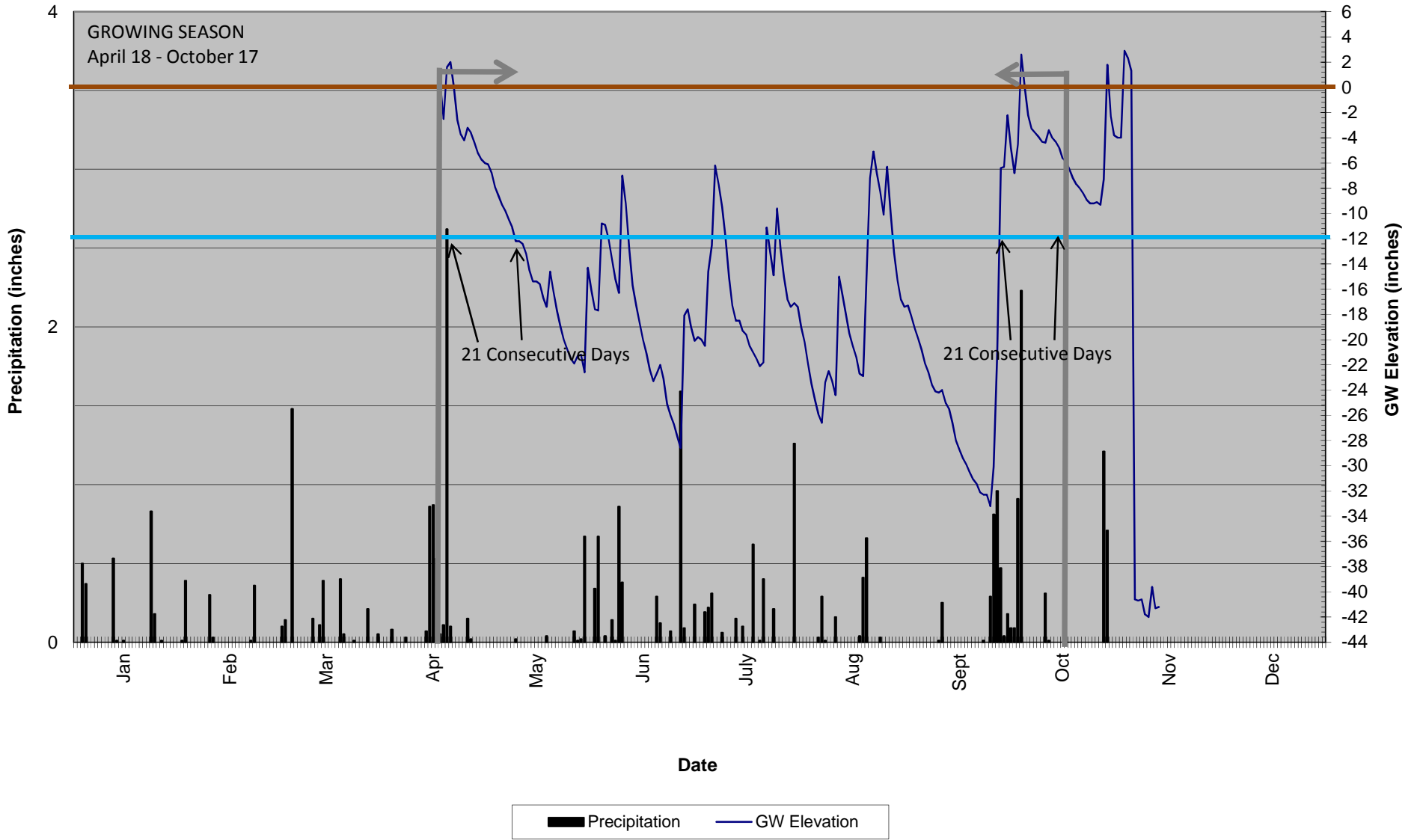
### Five Mile Branch Gauge #18 13D493A9



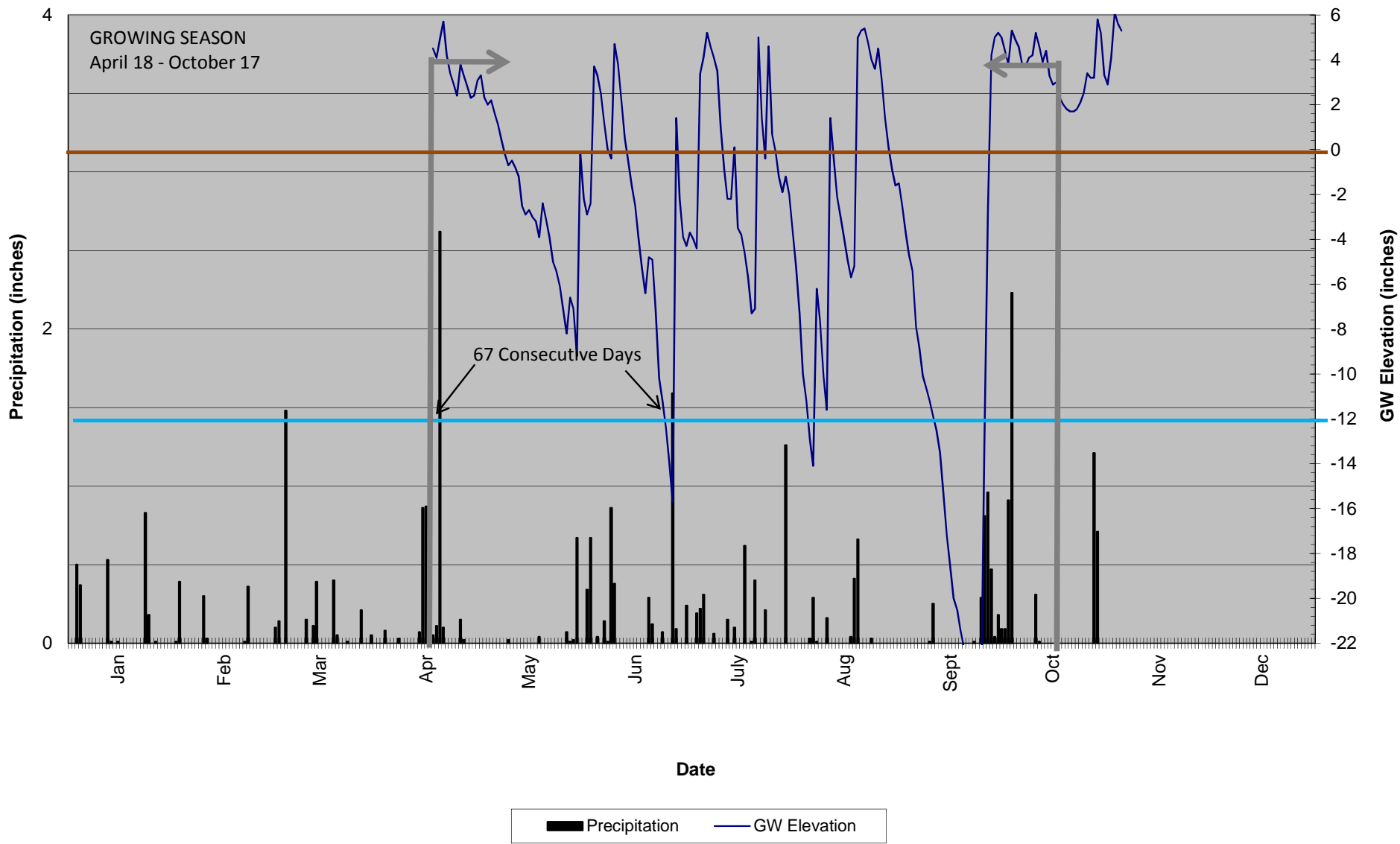
### Five Mile Branch Gauge #19 14D4B648



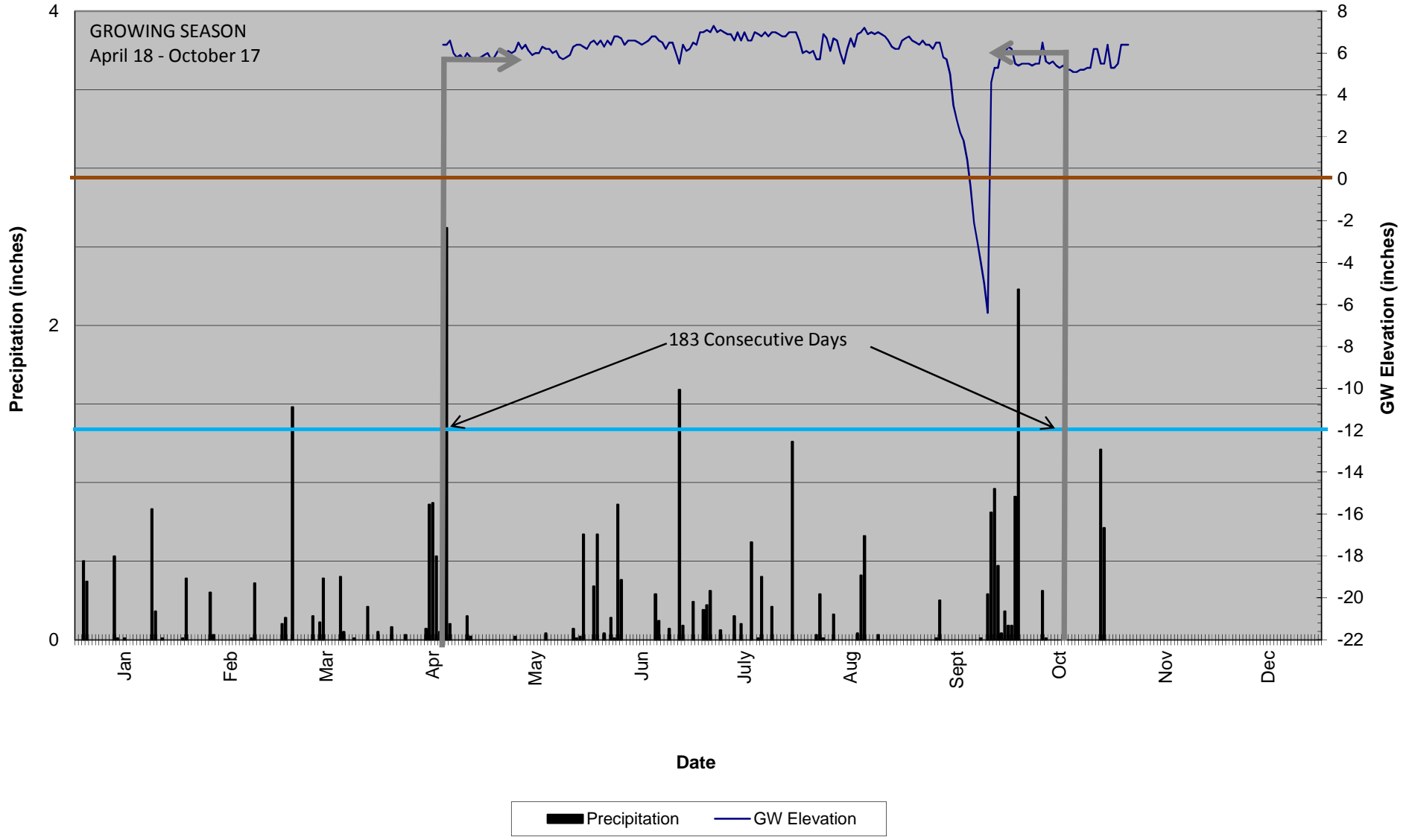
### Five Mile Branch Gauge #20 9DE6C32



### Five Mile Branch Gauge #21 9DE6D1F

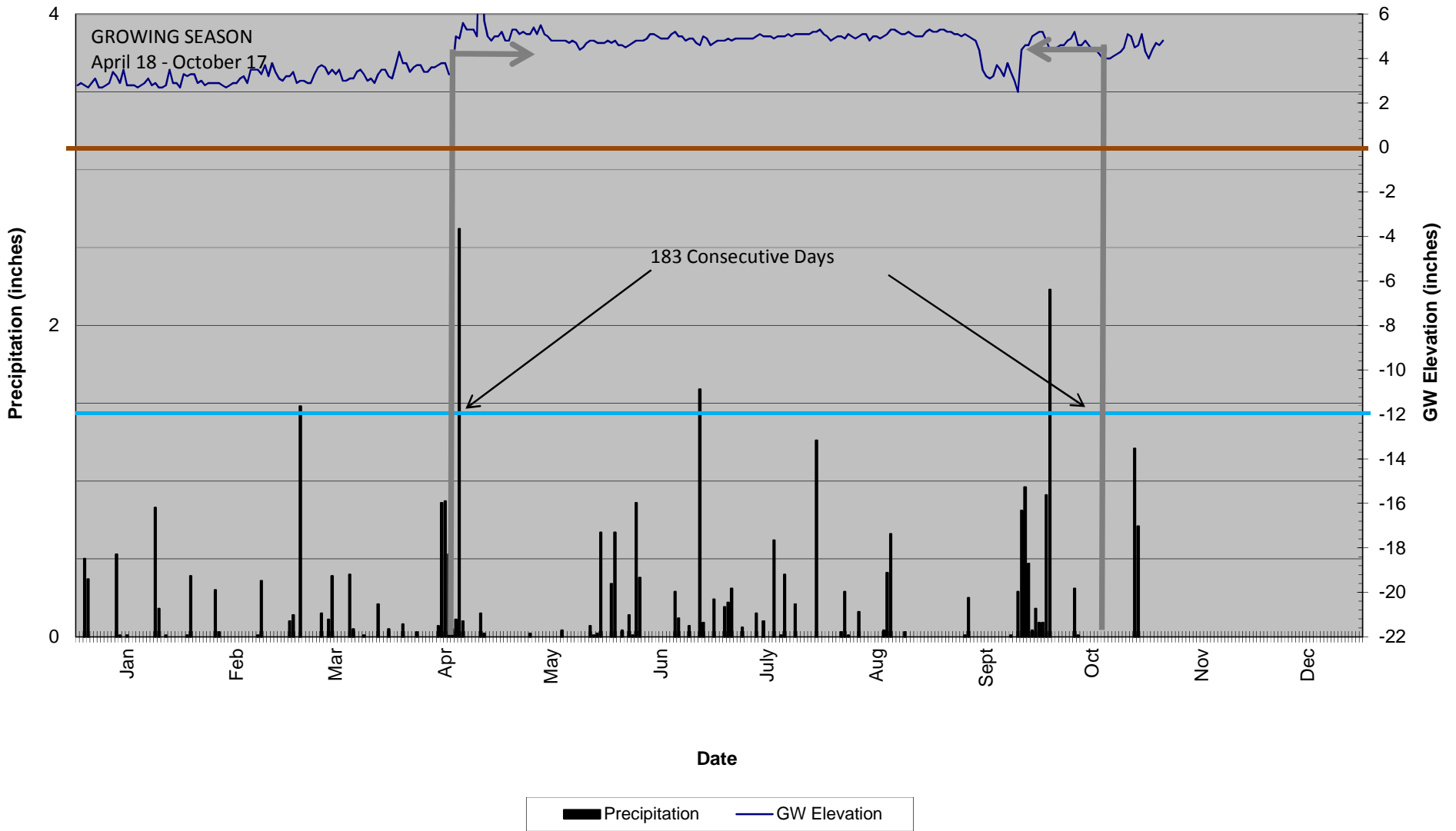


### Five Mile Branch Gauge #22 EBD1038

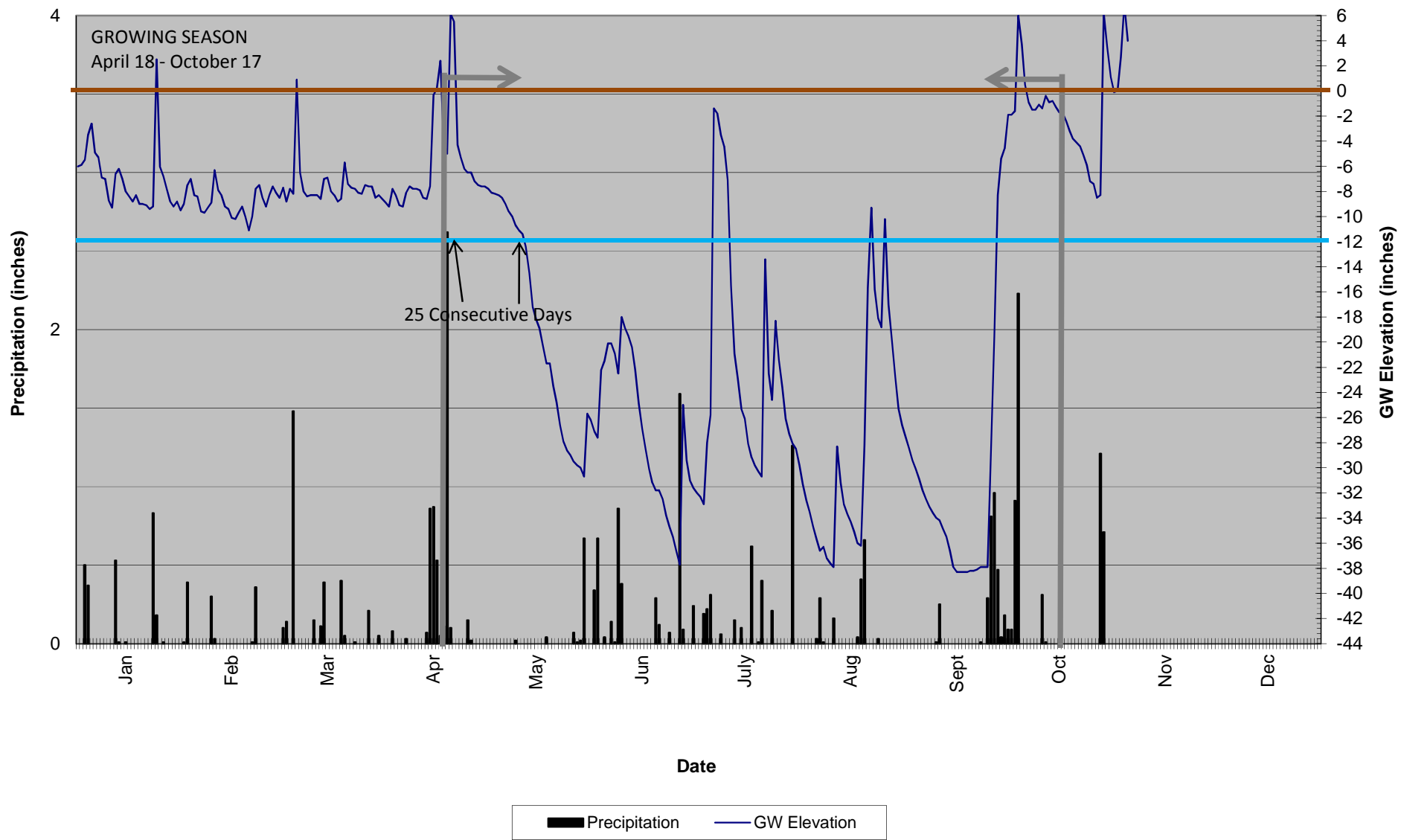




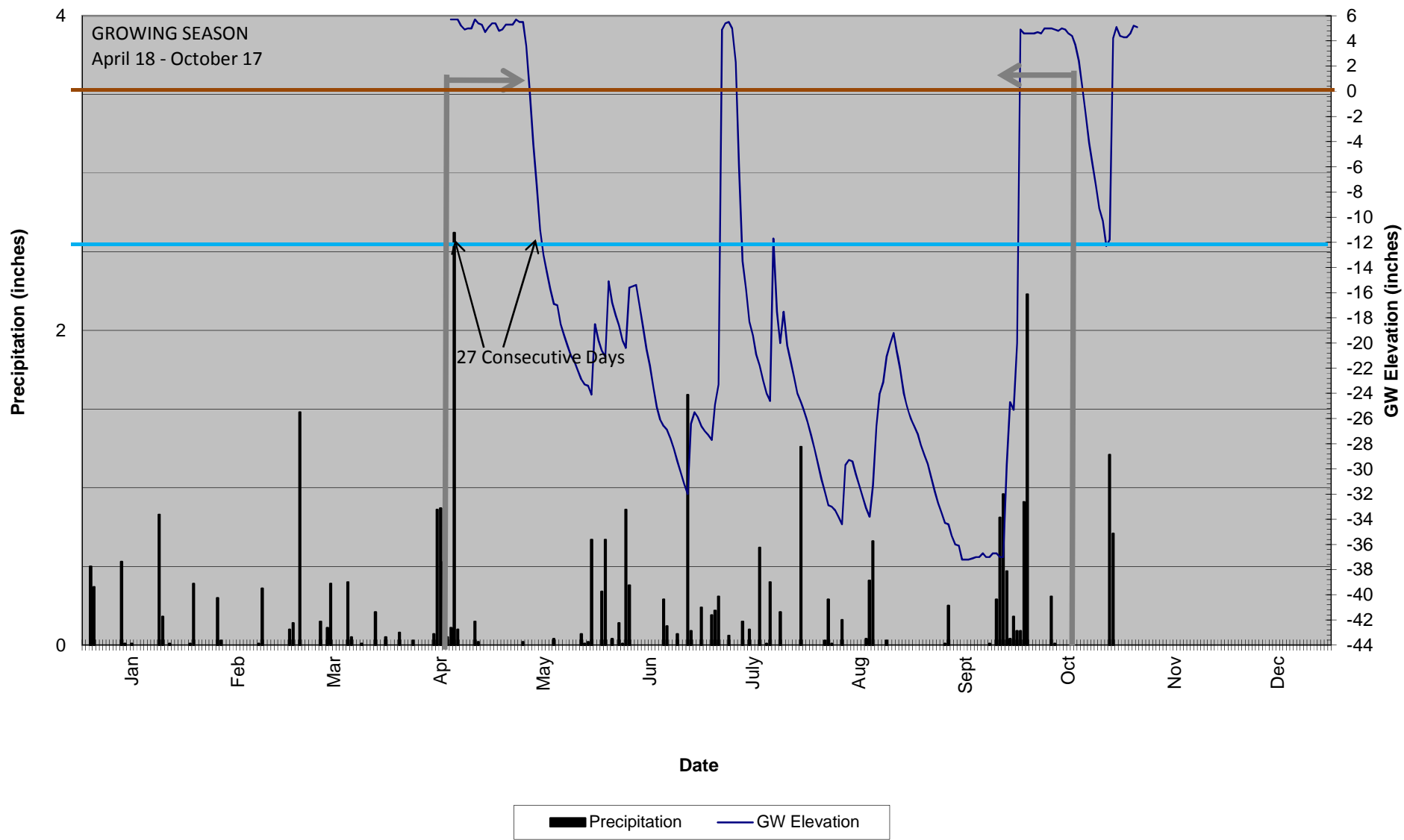
### Five Mile Branch Gauge #23 13D4B61D



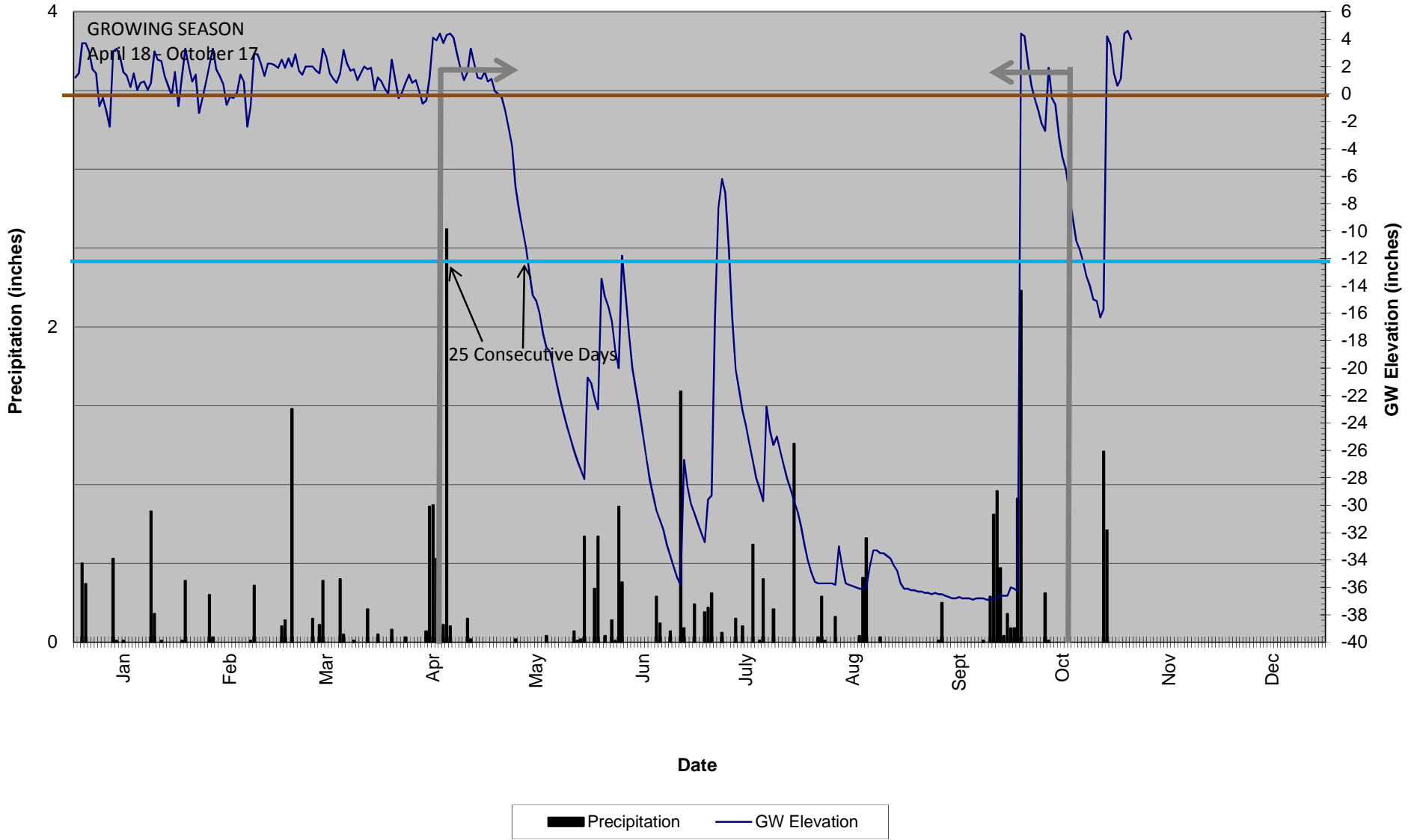
### Five Mile Branch Gauge #24 A287DCE



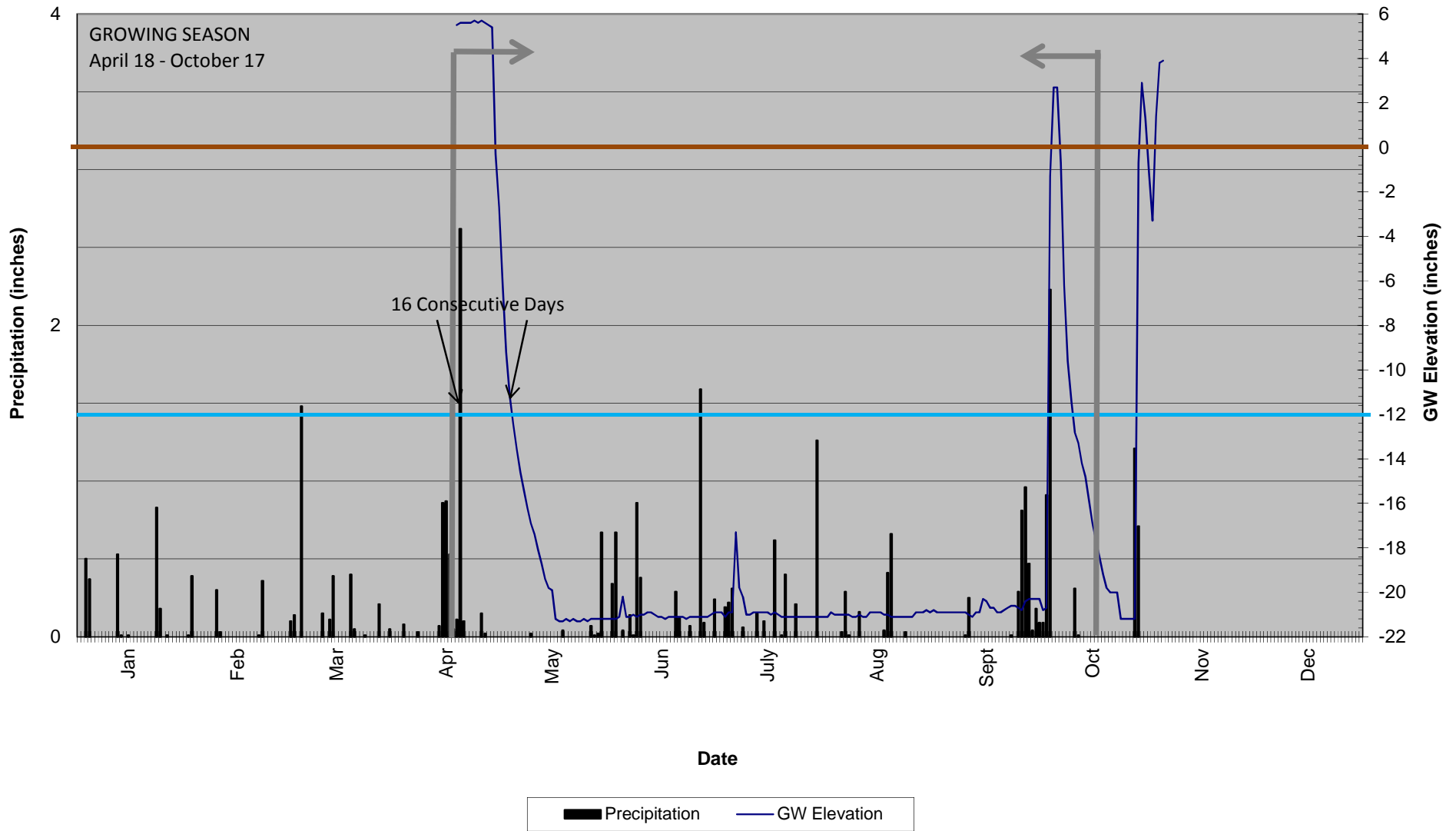
### Five Mile Branch Gauge #25 13D4B624



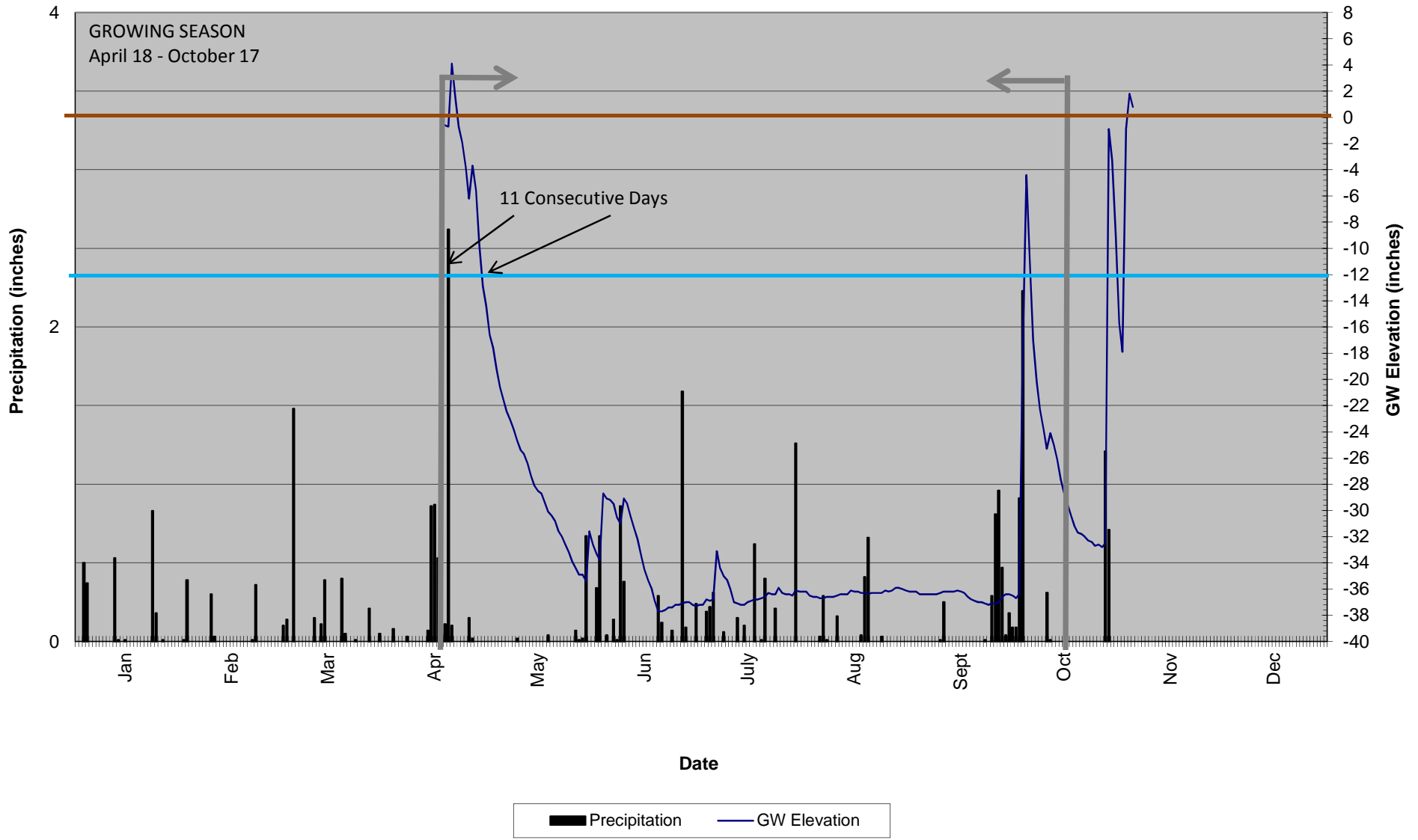
### Five Mile Branch Gauge #26 EBDD6BE



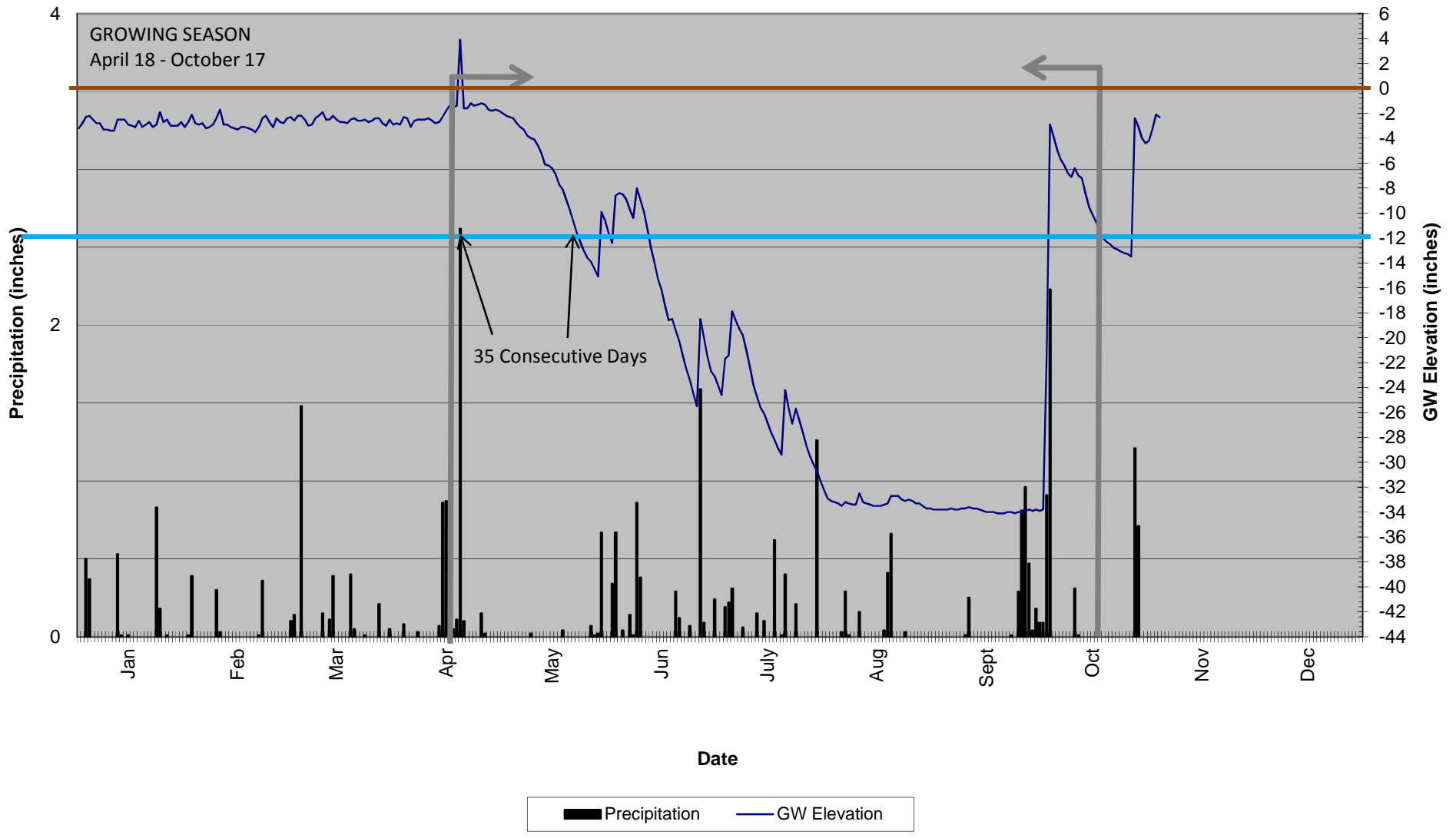
### Five Mile Branch Gauge #27 136B1CB7



### Five Mile Branch Gauge #28 14E1973F



### Five Mile Branch Gauge #29 14E177C0



### Five Mile Branch Gauge #30 13D4CA00

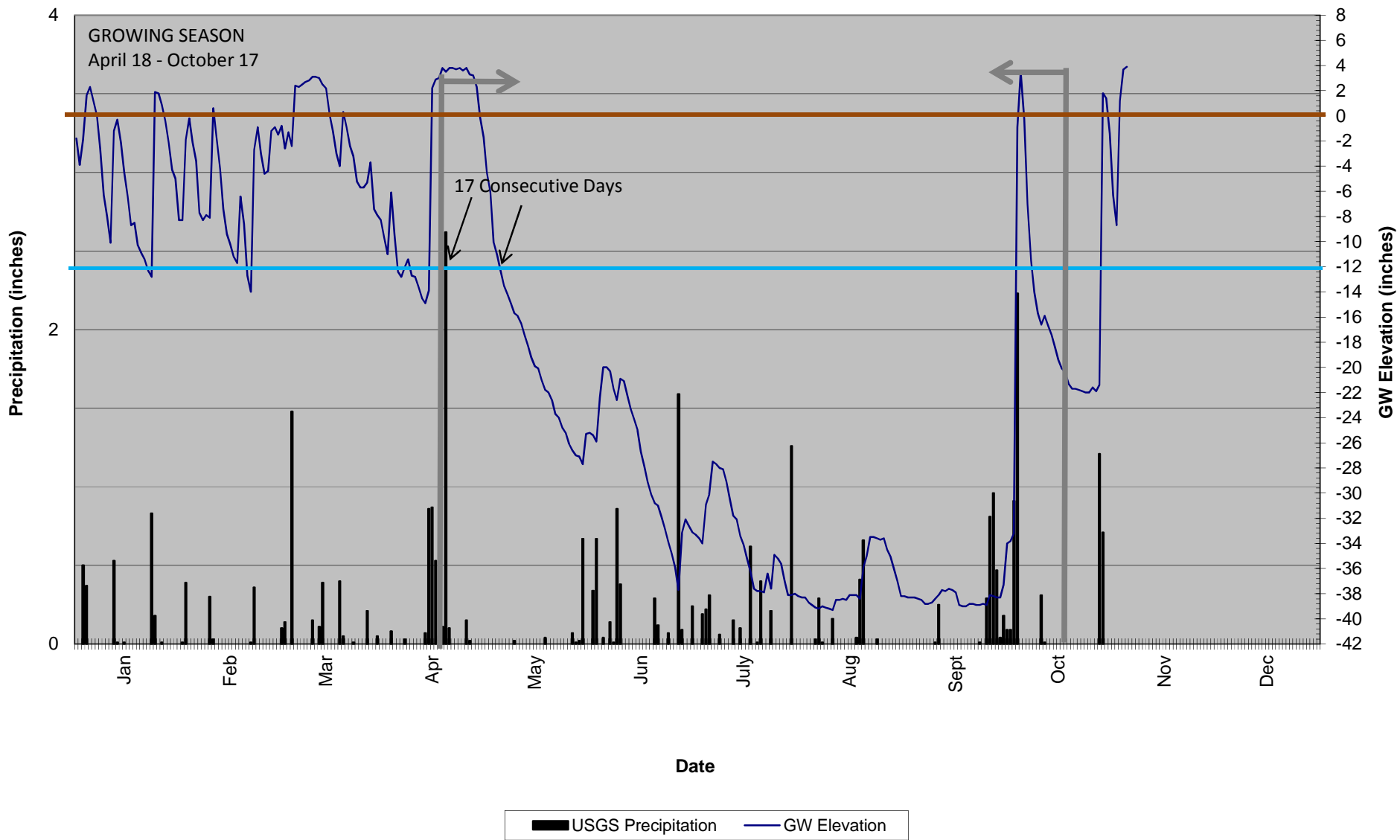




Table 13. Wetland Gauge Attainment Data  
 Five Mile Branch Stream and Wetland Restoration  
 NCEEP # 92185

Gauge	Max Consecutive Hydroperiod: Saturation within 12 Inches of Soil Surface (Percent of Growing Season) WETS Station: USGS 354822080521501 Growing Season: April 18 - Oct 17					Mean
	Year 1 (2013)	Year 2 (2014)	Year 3 (2015)	Year 4 (2016)	Year 5 (2017)	
1	68.3	36.1	32.8			45.7
2	23.0	3.8	5.5			10.8
3	23.0	13.1	13.7			16.6
4	54.1	13.1	13.7			27.0
5	48.6	8.7	9.3			22.2
6	16.9	7.7	8.2			10.9
7	16.4	3.0	6.0			8.5
8	100.0	42.1	32.8			58.3
9	22.4	33.9	20.7			25.7
10	100.0	33.3	19.1			50.8
11	16.4	11.5	8.2			12.0
12	42.6	20.8	12.6			25.3
13	44.3	19.7	12.6			25.5
14	37.2	10.9	10.4			19.5
15	23.0	0.0	11.5			11.5
16	23.5	0.0	12.6			12.0
17	2.2	0.0	1.6			1.3
18	9.8	8.2	6.0			8.0
19	34.4	0.0	11.4			15.3
20	20.8	14.2	11.4			15.5
21	100.0	42.1	36.6			59.6
22	100.0	100.0	100.0			100.0
23	100.0	100.0	100.0			100.0
24	16.9	13.7	13.7			14.8
25	53.6	27.9	14.7			32.1
26	54.6	20.8	13.7			29.7
27	16.4	0.0	8.7			8.4
28	7.7	8.2	6.0			7.3
29	67.2	34.4	19.1			40.2
30	20.2	10.9	9.3			13.5

Annual Precip			
Total	39.0	33.5	45.4
WETS 30th Percentile	31.8	32.0	32.8
WETS 70th Percentile	40.4	40.2	41.1
Normal	Y	Y	H

## **Appendix F**

Photographs

Beaver Creek



Photo Point 1. Boulder Vane 08/13/15



Photo Point 3. Looking downstream 08/13/15



Photo Point 1. Looking downstream 08/13/15



Photo Point 4. Floodplain looking east 08/13/15



Photo Point 2. Looking downstream 08/13/15



Photo Point 4. Boulder Vane 08/13/15

Beaver Creek



Photo Point 5. Cross Vane 08/13/15



Photo Point 7. Floodplain looking east 08/13/15



Photo Point 6. Boulder Vane 08/13/15



Photo Point 7. Floodplain looking west 08/13/15

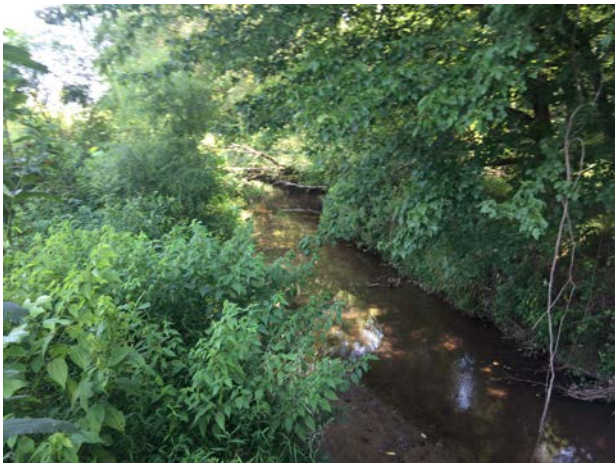


Photo Point 7. Boulder Vane 08/13/15



Photo Point 8. Floodplain pool looking east 08/13/15

Beaver Creek



Photo Point 9. Beaver dam at Cross Vane 08/13/15



Photo Point 10. Floodplain looking west 08/13/15



Photo Point 10. Cross Vane 08/13/15



Photo Point 11. Looking downstream 08/13/15



Photo Point 10. Floodplain looking east 08/13/15



Photo Point 12. Floodplain looking west 08/13/15

Beaver Creek



Photo Point 12. Floodplain pool looking east 08/13/15



Photo Point 14. Floodplain pool looking east 08/13/15



Photo Point 13. Floodplain pool looking west 08/13/15



Photo Point 15. Floodplain pool looking west 08/13/15



Photo Point 13. Floodplain looking east 08/13/15



Photo Point 15. Floodplain looking east 08/13/15

Beaver Creek



Photo Point 16. Looking downstream 08/13/15



Photo Point 17. Floodplain looking north 08/13/15



Photo Point 16. Looking upstream 08/13/15



Photo Point 17. Floodplain looking east 08/13/15



Photo Point 17. Floodplain looking west 08/13/15



Photo Point 18. Cross Vane 08/13/15

Beaver Creek



Photo Point 19. Boulder Vanes 08/13/15



Photo Point 20. Looking downstream 08/13/15



Photo Point 20. Looking upstream 08/13/15



Fifth Creek Upstream of Beaver Creek



Photo Point 21. Rootwads 08/13/15



Photo Point 23. Boulder Vane 08/13/15



Photo Point 21. Looking downstream 08/13/15



Photo Point 23. Fallen tree location 08/13/15



Photo Point 22. Cross Vane 08/13/15



Photo Point 24. Rootwads 08/13/15

Fifth Creek Upstream of Beaver Creek



Photo Point 24. Looking downstream 08/13/15



Photo Point 26. Rootwads 08/13/15



Photo Point 25. Cross Vane 08/13/15



Photo Point 26. Floodplain looking downstream 08/13/15



Photo Point 25. Cross Vane. Left arm scour. 08/13/15



Photo Point 27. Floodplain pool looking west 08/13/15

Fifth Creek Upstream of Beaver Creek



Photo Point 28. Floodplain looking west 08/13/15

Fifth Creek Downstream of Beaver Creek



Photo Point 28. Confluence looking east 08/13/15



Photo Point 30. Cross Vane with beaver dam 08/13/15



Photo Point 29. Looking downstream 08/13/15



Photo Point 31. Floodplain pool looking northwest 08/13/15



Photo Point 29. Floodplain looking east 08/13/15



Photo Point 31. Floodplain looking east 08/13/15

Fifth Creek Downstream of Beaver Creek



Photo Point 32. Looking downstream 08/13/15



Photo Point 34. Boulder Vane 08/13/15



Photo Point 33. Floodplain looking west 08/13/15



Photo Point 35. Boulder Vane 08/13/15



Photo Point 34. Boulder Vane 08/13/15



Photo Point 35. Boulder Vane 08/13/15

Fifth Creek Downstream of Beaver Creek



Photo Point 36. Looking downstream 8/28/15



Photo Point 37. Floodplain looking east 8/28/15



Photo Point 36. Looking upstream 8/28/15



Photo Point 38. Cross Vane 8/28/15



Photo Point 37. Floodplain pool looking north 8/28/15



Photo Point 38. Looking south 8/28/15

Fifth Creek Downstream of Beaver Creek



Photo Point 39. Looking upstream 8/28/15



Photo Point 40 Cross Vane 8/28/15



Photo Point 39. Looking downstream 8/28/15



Photo Point 40. Looking downstream 8/28/15



Photo Point 39. Floodplain looking east 8/28/15



Photo Point 41. Floodplain looking west 8/28/15