St. Clair Creek Restoration Project
Year 4 Final Monitoring Report

Beaufort County, North Carolina

DMS Project ID No. 95015

DWR Project #13-0739, Beaufort County

USACE Action ID: 2008-02655

Tar-Pamlico River Basin: 03020104-040040

Project Info:	Monitoring Year: 4 of 7 Year of Data Collection: 2017 Year of Completed Construction: 2014 Submission Date: January 2018
Submitted To:	NC DEQ – Division of Mitigation Services 1652 Mail Service Center Raleigh, NC 27699 NC DEQ Contract ID No. 003986

Michael Baker
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February 6, 2018

Jeff Schaffer
Project Manager
NCDEQ Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Subject: Task 10: Response Letter to DMS review comments regarding the Draft Year 4 Monitoring Report for the St. Clair Creek Restoration Project (#95015)
Beaufort County, North Carolina, Cape Fear Basin – CU#03020104
DMS No. 95015, Baker No. 125116

Dear Mr. Schaffer,

Please find enclosed the Final Year 4 Monitoring Report and our responses to your review comments received on January 29, 2018 regarding the St. Clair Creek Restoration Project located in Beaufort County, NC. We have also provided the final digital files and required documentation in response to the referenced review comments below:

1. Digital drawings: Digital files for each asset listed in Table 1 were provided in CADD but were not formatted or attributed as required in the EEP/DMS digital drawing guidance. The stream centerlines for example were submitted as a highly segmented polyline and were devoid of attributes such as reach ID. DMS would prefer to receive shapefiles for all of the features in the digital drawings requirements, but at a minimum, each asset (as listed in table 1 of the monitoring report) and each monitoring feature must be provided as a discreet, properly attributed polyline/polygon as required by contract and stated in table 2 of DMS's Format, Data Requirements, and Content Guidance for Electronic Drawings Submitted to EEP version 1.0 (03/27/08).

Response: The GIS shapefiles for the project were reformatted as requested.

2. Executive Summary, sentence 1 paragraph 1: Report states that Baker restored 3,274 lf of perennial and intermittent stream. This should say headwater streams.

Response: Report has been revised as requested.

3. Section 2.1.1: Clarify reason/potential reason for flow gauge SCFL#4 not meeting 30 consecutive days of flow requirements and be prepared to discuss at the upcoming credit release meeting. For example, was it due to lower than normal precipitation?

Response: Flow gauge SCFL#4 recorded separate 29-day and 28-day flow events, but did not meet success criteria of 30-days during the year. The overall rainfall for the site was below the Beaufort County historic average with a 1.7" deficit, and all of the flow gauges experienced reduced duration consecutive-day flow events this monitoring year as compared to last year. However, as

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shown in Table 11 the total cumulative days of flow remained substantial for each gauge (even increasing from previous years in four of the six gauges). As such, it is believed that the specific rainfall distribution pattern observed in 2017 is likely why the consecutive-day values are reduced. In particular, a January where virtually all the rainfall fell in the first week, followed by an extraordinarily dry February (well below the historic 30% probable average) appears to have reduced the number and duration of flow events during the exact time of year where they are generally more prevalent and longer lasting. This late winter to early spring time period is when the site tends to be the wettest and the flow gauges have previously met their success criteria. This discussion was added to the text.

4. Appendix C, Table 9d:
   a. Riparian Buffer Vegetation Totals table:
      (1) the report states that Plot 6 met success but "just barely". Given that Baker is claiming riparian buffer credit based on the most recent buffer rules, 15A NCAC 02B .0295, this plot is more than "barely meeting" based on 15A NCAC 02B .0295(n)(2)(B).
      (2) Clarify how Baker arrived at the 324 Riparian Buffer Stems for plot 6 when all other references to planted stem counts in plot 6 come in at 364.
   b. Footnote 1: Based on the most recent buffer rules, specifically 15A NCAC 02B .0295(n)(2)(B), the final performance standard shall include a minimum of four native hardwood tree species or four native hardwood tree and native shrub species, where no one species is greater than 50 percent of stems. Therefore, this footnote can be revised similar to "Native planted hardwood stems including trees and shrubs. No pines. No vines."

Response: The data presented in Appendix C, Table 9d come directly from the CVS program output, and the riparian buffer sub-table plot stem numbers appear to differ from the veg plot stem numbers reported elsewhere due to CVS having removed the shrub species from the totals. However, as DMS points out the recent buffer rule guidance does state that tree and shrub species may be used so Baker has revised the plot stem totals accordingly. Similarly, the blue color-coded success rating and 'Yes, barely' terminology used in that sub-table were also taken directly from the CVS output. They have been revised as well to reflect the new stem numbers. The first footnote for Table 9c has also been revised as recommended.

If you have any questions or require additional information, please feel free to contact me at 919-481-5731 or via email at Scott.King@mbakerintl.com.

Sincerely,

Scott King, LSS

St. Clair Creek Restoration Project
Year 4 Final Monitoring Report

Beaufort County, North Carolina

DMS Project ID No. 95015

Tar-Pamlico River Basin: 03020104-040040

Report Prepared and Submitted by Michael Baker International

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1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 3,274 linear feet (LF) of perennial and intermittent headwater stream, 2.8 acres (AC) of riparian wetlands, and planted 17.5 acres (AC) of native riparian vegetation within the entire conservation easement along two unnamed tributaries (UT2 and UT3) to St. Clair Creek in Beaufort County, North Carolina (NC) (Figure 1). The St. Clair Creek Restoration Project (Site) is located in Beaufort County, approximately five miles east of the Town of Bath. The Site is located in the NC Division of Water Resources (NCDWR) subbasin 03-03-07 and the NC Department of Environmental Quality (NC DEQ) Division of Mitigation Services (DMS) Targeted Local Watershed (TLW) 03020104-040040 of the Tar-Pamlico River Basin. The project involved the restoration of a Coastal Plain Headwater Small Stream Swamp system (NC WAM 2010, Schafale and Weakley 1990) from impairments within the project area due to past agricultural conversion and silviculture.

The primary restoration goals of the project were to improve ecological functions to the impaired areas within the Tar-Pamlico River Basin as described below:

- Create geomorphically stable conditions along the unnamed tributaries across the project,
- Implement agricultural BMPs to reduce nonpoint source inputs to the downstream estuary,
- Protect and improve water quality by reducing nutrient and sediment inputs,
- Restore stream and wetland hydrology by connecting historic flow paths and promoting natural flood processes, and
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.

To accomplish these goals, the following objectives were identified:

- Restore existing channelized streams by restoring the relic headwater valley and allowing diffuse flow, providing the streams access to their floodplains,
- Increase aquatic habitat value by allowing natural microtopography to form,
- Plant native species riparian buffer vegetation within the headwater valley and floodplain areas, and within the wetland areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, decrease erosion, and shade the stream to decrease water temperature,
- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, and reduction of water temperature, and
- Control invasive species vegetation within the project area and if necessary continue treatments during the monitoring period.

During Year 4 monitoring, the planted acreage performance categories were functioning at 100 percent with no bare areas or low stem density areas to report. The average density of total planted stems, based on data collected from the nine monitoring plots during Year 4 monitoring, is 603 stems per acre. The Year 4 data demonstrate that the Site is on track to meet met the minimum success interim criteria of 260 trees per acre by the end of Year 5.

Following Year 3 monitoring, some *Pinus taeda* (loblolly pine) was found scattered within the UT-2 restoration area as well as portions of UT-3. To further prevent this nuisance species from affecting the planted stems, a thinning and removal effort took place in May 2017. This treatment event targeted the loblolly pine along UT-

2 and UT-3, as well as one small portion of Chinese privet on the upstream portion of UT-2. The methods used were hand/power tools and some chemical applications.

Year 4 wetland groundwater monitoring demonstrated that 1 of 8 groundwater monitoring wells located along UT-2 and UT-3 met the success criteria by recording water levels within 12 inches of the ground surface for a consecutive period greater than 12% of the growing season (33.8 days for the Site). Well #1 located in the wetland area along UT-2 met the criteria with a hydroperiod of 33.7%. However, the remaining seven monitoring wells all saw substantial increases from their Year 3 results with hydroperiods ranging from 10.6% to 11.3%, most missing the success criteria by only a day or two. All wetland restoration well data and reference well data collected during Year 4 monitoring are located in Appendix D.

Additionally, on March 16, 2017 another two groundwater monitoring wells (SCAW9 and SCAW10) were installed in areas located outside the project's currently approved mitigation plan wetland restoration areas (see Figure 2: CCPV). Please note these areas are not being requested for any credits of any kind at this time. Given the project's challenging history regarding the meeting of wetland well success criteria, Baker is simply conducting exploratory monitoring in potential future wetland restoration areas. The three potential areas total 1.1 acres and are all located outside the 50 ft buffer from the stream channel but within the conservation easement. Baker is not presenting this information here for formal approval or acceptance, but simply wished to inform DMS and the IRT of all project activity. These two new wells were installed a little over two weeks after the start of the growing season in 2017 but both still achieved 28 days of consecutive water levels within 12 inches of ground surface (for 9.9% of the growing season). It is anticipated they will meet the success criteria in the future.

On-site flow through the restored headwater valleys of UT-2 and UT-3 was recorded throughout 2017 by the use of six installed pressure transducers. All but one of which met the success criteria by recording a flow event of 30-days or longer in 2017. During 2017, flow gauge SCFL#4 located at the top of UT-2 recorded its longest single duration flow event of 29-days, though it also recorded a second event of 28-days. It was noted that the flow gauges demonstrated similar flow events relative to rainfall events on site as demonstrated in the gauge graphs found in Appendix D.

In addition, currently contracted riparian buffer credits have been included as part of the project as referenced by the "Site Viability for Buffer Mitigation" memo from Karen Higgins (NCDWR) dated January 7, 2016 and included as an asset in this report. As part of the St. Clair Creek Restoration project, Riparian Buffer credits in excess of the contracted 6.8 acres (296,208 square feet) will be provided. Monitoring for success of riparian buffers will continue to follow the existing vegetation monitoring protocol and success criteria as stated in the approved mitigation plan for stream and wetland vegetation success. Only vegetation plots 1-6 are located within the approved buffer credit areas and no additional vegetation monitoring plots are required to monitor buffer success as these existing plots serve to monitor the success of the vegetation of the headwater coastal plain stream and the associated riparian buffer.

Summary information/data related to the Site 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 and in the Mitigation Plan available on the North Carolina Division of Mitigation Services (NCDMS) website. All raw data supporting the tables and figures in the Appendices are available from NCDMS upon request.

2.0 METHODOLOGY

The seven-year monitoring plan for the Site includes criteria to evaluate the success of the stream, wetland and vegetation components of the project. The methodology and report template used to evaluate these components adheres to the NCDMS monitoring guidance document dated November 7, 2011, which will continue to serve as the template for subsequent monitoring years. The specific locations of monitoring features, such as vegetation plots, flow gauges and wells are shown on the CCPV sheets found in Appendix B.

Since the growing season for the Beaufort County ends on December 6th, the year-end well and flow data were collected on December 15, 2017. The visual site assessment data contained in Appendix B were collected in April, October, and December 2017 as noted.

2.1 Stream Assessment – Reaches UT2 and UT3

The UT2 and UT3 mitigation approach involved the restoration of historic flow patterns and flooding functions in a multi-thread headwater stream system, monitoring efforts will focus on visual observations to document stability and the use of water level monitoring gauges to document saturation and flooding functions. The methods used and any related success criteria are described below for each parameter. Monitoring efforts focus on visual observations and in-channel flow gauges/pressure transducers to document stream success.

As-built Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the As-built Survey. This survey system collects point data with an accuracy of less than one tenth of a foot.

2.1.1 Hydrology

Total observed area rainfall for the previous 12-month period from December 2016 through November 2017 was 48.32 inches, as compared to the Beaufort County WETS table for the same period of 50.03 inches annually, a deficit of 1.71 inches.

Four automated flow gauges (pressure transducers) were installed in the UT-2 channel along with two flow gauges installed in the UT-3 channel. The gauges were installed approximately 500 feet apart within the restored systems to document flow duration. Annual success criteria are considered to have been met if 30 consecutive days of flow were observed at any point during the monitoring year. As stated in the mitigation plan, final flow success is achieved when two such 30-day flow events have been documented in separate monitoring years. Results indicate that five of the six flow gauges met the minimum consecutive days of surface flow required for success during Year 4. Gauge SCFL#4 located at the top of UT-2 recorded flow events of 29-day and 28-day durations, but did not meet the 30-day criteria during the year. The overall rainfall for the site was below the Beaufort County historic average with a 1.7” deficit, and all of the flow gauges experienced reduced duration consecutive-day flow events this monitoring year as compared to last year. However, as shown in Table 11 the total cumulative days of flow remained substantial for each gauge (even increasing from previous years in four of the six gauges). As such, it is believed that the specific rainfall distribution pattern observed in 2017 is likely why the consecutive-day values are reduced. In particular, a January where virtually all the rainfall fell in the first week, followed by an extraordinarily dry February (well below the historic 30% probable average) appears to have reduced the number and duration of flow events during the exact time of year where they are generally more prevalent and longer lasting. This late winter to early spring time period is when the site tends to be the wettest and the flow gauges have previously met their success criteria.

Note that flow gauge SCFL#5 located on the bottom of UT-3 did meet the success criteria early in 2017, but experienced a malfunction in early May and did not record data from that point forward. It has since been reprogrammed and reset and is now operating correctly. It will be very closely observed in the coming monitoring year. The complete flow data and observed rainfall graphs for each flow gauge, along with the flow gauge success summary Table 11 are all located in Appendix D.

2.1.2 Photographic Documentation

The reaches were photographed longitudinally beginning at the downstream end of both reaches, moving upstream to the beginning of each reach. Photographs were taken looking upstream at delineated locations throughout the restored stream valley. Points were close enough together to provide an overall view of the reach lengths and valley crenulations. Photographs of photo points, wetland wells, flow gauges, and the rainfall gauge are located in Appendix B.

2.2 Wetland Assessment

Wetland monitoring is conducted using eight automated groundwater-monitoring stations that are installed within the UT-2 and UT-3 wetland restoration areas, as well as two additional reference wells installed in the downstream portion of the UT-3 wetland restoration area. Installation of these groundwater monitoring stations follow Corps of Engineers Wetlands Research Program Technical Note VN-rs-4.1 (USACE 1997).

The automated loggers are programmed to collect data to document groundwater levels in the restored wetland areas. The success criteria for wetland hydrology are considered to have been met when the site has groundwater within 12 inches of the soil surface for a consecutive number of days equal to a minimum of 12% of the growing season. For Beaufort County, the growing season is from February 28 to December 6 (282 days), so 12% is a minimum of 33.8 consecutive days for the Site. Results indicate that only monitoring well #1 fully met this success criteria in Year 4 with a recorded hydroperiod of 33.7%. However, the remaining wells all saw substantial increases from their Year 3 results with hydroperiods ranging from 10.6% to 11.3%, most missing the success criteria by only a day or two. It should be noted that while the success criteria stated in the mitigation plan for wetland hydroperiod is 12%, the October 24, 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update document states that for the Tomotley soils series which is mapped on the project site, the wetland hydroperiod range is 10% to 12%. All wells for Monitoring Year 4 fell within this range. Additionally, during Year 4 monitoring, the on-site wetland reference wells, which are on the downstream portion of UT-3, demonstrated consecutive hydroperiods of 40.9% and 41.0% of the growing season. It should be noted that the placement of the reference wells is further down valley than the monitoring wells and is much more heavily influenced by backwater from St. Clair Creek. All wetland restoration well data and reference well data collected during Year 4 monitoring are located in Appendix D.

The total annual rainfall on the Site was just below average, with a deficit of 1.7” as recorded by the onsite rain gauge (see Figure 5 in Appendix D). February was the driest month in 2017, which likely impacted the initial groundwater depths at the very start of the growing season, typically the time of year when the groundwater depth is closer to the surface, and typically when the wells are expected to meet their success criteria.

Additionally, on March 16, 2017 another two groundwater monitoring wells (SCAW9 and SCAW10) were installed in areas located outside the project’s currently approved mitigation plan wetland restoration areas (see Figure 2: CCPV). Please note these areas are not being requested for any credits of any kind at this time. Given the project’s challenging history regarding the meeting of wetland well success criteria, Baker is simply conducting exploratory monitoring in potential future wetland restoration areas. The three potential areas total 1.1 acres and are all located outside the 50 ft buffer from the stream channel but within the conservation easement. Baker is not presenting this information here for formal approval or acceptance, but simply wished to inform DMS and the IRT of all project activity. These two new wells were installed a little over two weeks

after the start of the growing season in 2017 but both still achieved 28 days of consecutive groundwater levels within 12 inches of ground surface (for 9.9% of the growing season). It is anticipated they will meet the success criteria in the future.

2.2.1 Wetlands Modifications Review

A brief summary of previous wetlands modifications is presented here as a review of relevant project history. A more detailed description of this work was presented in the Year 3 report.

In the fall of 2015, the restoration site landowner cut a network of drainage ditches adjacent to the easement boundaries of both UT-2 and UT-3 with the intent to drain water away from his nearby pine plantation. The work was implemented without the knowledge of Baker and was discovered in the fall of 2015 during monitoring activities. To help remedy the situation, Baker oversaw three areas of drainage modifications to the project in March of 2016: 1) Three French drains were installed under the farm road along the northern portion of UT-2 and were linked to wide, shallow swales cut into the buffer to reconnect water flow from the adjacent landowner's field that routinely ponded water behind the road. 2) The drainage ditch running parallel to the easement boundary along the western portion of UT-2 was filled, and three wide, shallow swales were cut to connect the existing drainages within the pine plantation to the project wetlands and buffer. 3) The drainage ditch running parallel to the easement boundary along the western edge of UT-3 was filled, and a shallow swale was cut to connect drainage from the pine plantation into an existing shallow depression located within the existing wetland.

It was observed during the Year 4 monitoring that diffuse flow does now move through all of the installed swales, and all remain stable and vegetated. Additional groundwater monitoring wells 5-8 were installed in April of 2016 specifically to observe the wetland restoration areas potentially affected by these modifications. The locations of this previous work are provided in Figure 2 located in Appendix B.

2.3 Vegetation Assessment

In order to determine if the criteria are achieved, vegetation-monitoring quadrants were installed and are monitored across the restoration site in accordance with the CVS-NCDMS Protocol for Recording Vegetation, Version 4.1 (2007) and the CVS-NCDMS data entry tool v 2.3.1 (2012). The vegetation monitoring plots are a minimum of 2 percent of the planted portion of the Site with nine plots established randomly within the Site's planted riparian buffer areas per Monitoring Levels 1 and 2. The sizes of individual quadrants are 100 square meters for woody tree species.

Year 4 vegetation assessment information is provided in Appendix B and C.

2.3.1 Vegetation Concerns

Following Year 3 monitoring, loblolly pine *(Pinus taeda)* seedlings were discovered scattered throughout the buffer of Reach UT-2 and a portion of UT-3. To prevent this nuisance species from affecting the planted stems, a thinning and removal effort took place in May of 2017 targeting the loblolly pines. The methods used were hand/power tools and some chemical application. A previous thinning effort had been conducted on UT-2 in March of 2016. During project monitoring work in October 2017, some small pines were still found scattered throughout the Site, but in clearly reduced numbers and sizes. The Site will be closely observed for pine growth throughout the remaining monitoring period. Additionally, a small area of Chinese privet (*Ligustrum sinense)* was treated on the upstream portion of UT-2 in May 2017 as well. The Vegetation Problem Area photolog found in Appendix B provides several before/after photographs of some of the treated areas.

3.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (NCDMS). 2007. CVS-NCDMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-NCDMS Protocol for Recording Vegetation, Version 4.1.

North Carolina Division of Mitigation Services. 2011. Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation. November 7, 2011.

Rosgen, D. L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, Third Approximation. North Carolina Natural Heritage Program. Division of Parks and Recreation, NC DEQ. Raleigh, NC.

United States Army Corps of Engineers. 1997. Corps of Engineers Wetlands Research Program. Technical Note VN-rs-4.1. Environmental Laboratory. U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS.

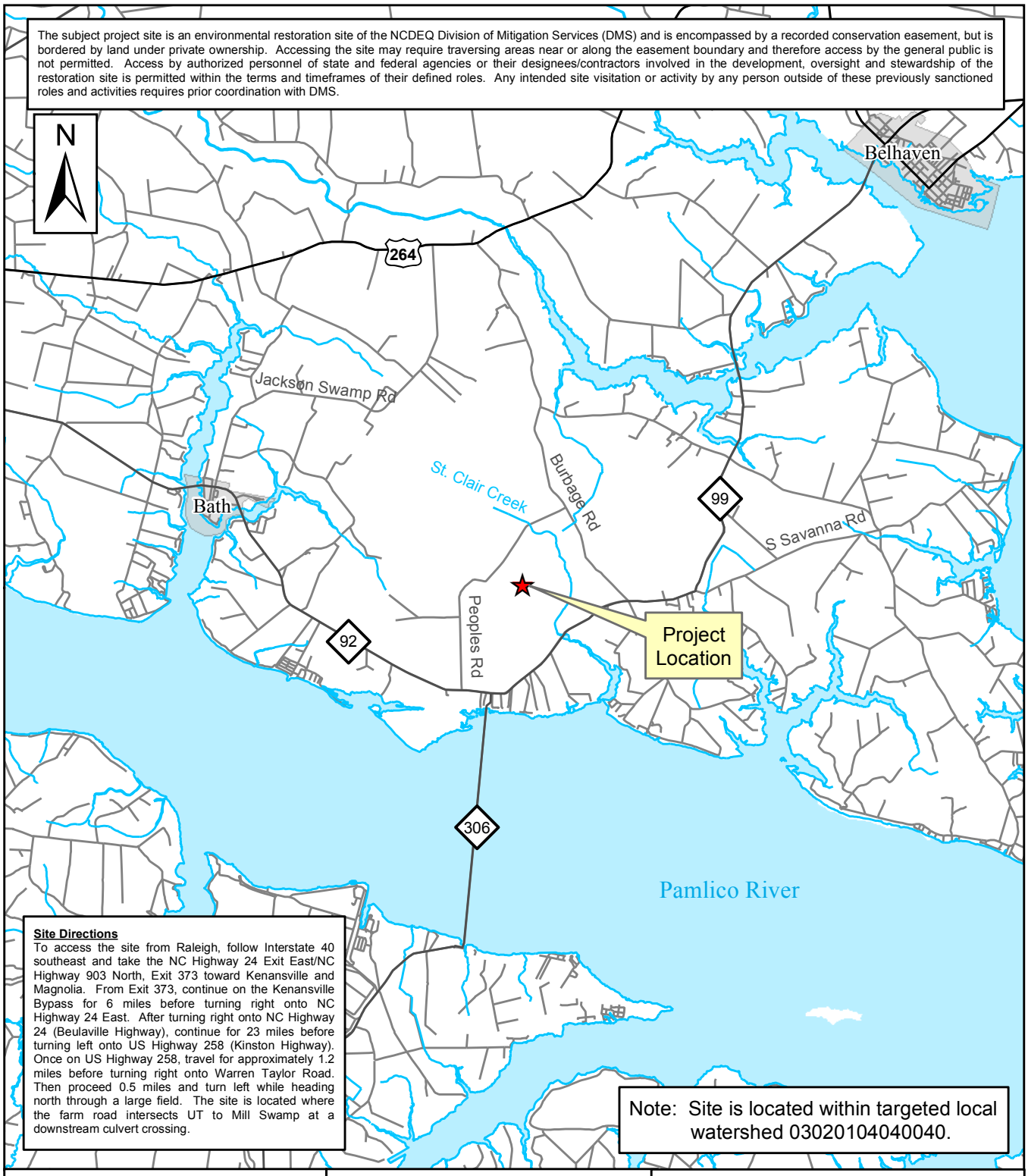
____. 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

____. 2003. Stream Mitigation Guidelines, April 2003, U.S. Army Corps of Engineers. Wilmington District.

Appendix A

Project Vicinity Map and Background Tables

The subject project site is an environmental restoration site of the NCDEQ 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 activity by any person outside of these previously sanctioned roles and activities requires prior coordination with DMS.



Site Directions
To access the site from Raleigh, follow Interstate 40 southeast and take the NC Highway 24 Exit East/NC Highway 903 North, Exit 373 toward Kenansville and Magnolia. From Exit 373, continue on the Kenansville Bypass for 6 miles before turning right onto NC Highway 24 East. After turning right onto NC Highway 24 (Beulaville Highway), continue for 23 miles before turning left onto US Highway 258 (Kinston Highway). Once on US Highway 258, travel for approximately 1.2 miles before turning right onto Warren Taylor Road. Then proceed 0.5 miles and turn left while heading north through a large field. The site is located where the farm road intersects UT to Mill Swamp at a downstream culvert crossing.

Note: Site is located within targeted local watershed 03020104040040.

Beaufort County

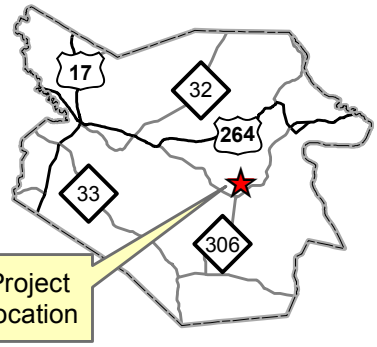


Figure 1
Project Vicinity Map
St. Clair Creek Restoration Site

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0 0.5 1 2 3
Miles

Table 1. Project Components and Mitigation Credits
St. Clair Creek Restoration Project: DMS Project No ID. 95015

Mitigation Credits							
	Stream	**Riparian Wetland**		**Non-riparian Wetland**		**Buffer**	**Nitrogen Nutrient Offset**	**Phosphorus Nutrient Offset**
Type	R	R	RE					
Totals	3,274 SMU	2.8 WMU	0			363,577 BMU		

Project Components						
Project Component or Reach ID	**Stationing/ Location**	**Existing Footage/ Acreage**	**Approach**	**Restoration/ Restoration Equivalent**	**Restoration Footage or Acreage**	**Mitigation Ratio**
UT2 Stream	12+64 – 34+00	2,660 LF	Headwater Restoration	2,133 SMU	2,133 LF	1:1
UT3 Stream	10+66 – 22+82	1,075 LF	Headwater Restoration	1,141 SMU	1,141 LF	1:1
UT2 Wetland	See plan sheets	0.0 AC	Restoration	1.1 WMU	1.1 WMU	1:1
UT3 Wetland	See plan sheets	0.0 AC	Restoration	1.7 WMU	1.7 WMU	1:1
UT2 Buffer	12+64 – 34+00	NA	Restoration	363,577 BMU	8.3 AC	1:1

Component Summation						
Restoration Level	**Stream (LF)**	**Riparian Wetland (AC)**		**Non-riparian Wetland (AC)**	**Buffer (ft^2) / (AC)**	**Upland (AC)**
		Riverine	Non-Riverine			
Restoration	3,274	2.8				
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						
Buffer Zone A: 0-50 ft					226002 / 5.2	
Buffer Zone B: 51-100 ft					137575 / 3.1	

BMP Elements			
Element	Location	Purpose/Function	Notes

BMP Elements: BR= Bioretention Cell; SF= Sand Filter; SW= Stormwater Wetland; WDP= Wet Detention Pond; DDP= Dry Detention Pond; FS= Filter Strip; S= Grassed Swale; LS= Level Spreader; NI=Natural Infiltration Area

Table 2. Project Activity and Reporting History
St. Clair Creek Restoration Project: DMS Project No ID. 95015

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Mitigation Plan Prepared	N/A	N/A	Jul-13
Mitigation Plan Amended	N/A	N/A	Sep-13
MItigation Plan Approved	N/A	N/A	Oct-13
Final Design – (at least 90% complete)	N/A	N/A	Nov-13
Construction Begins	N/A	N/A	Dec-13
Temporary S&E mix applied to entire project area	N/A	N/A	N/A
Permanent seed mix applied to entire project area	N/A	N/A	Mar-14
Planting of live stakes	N/A	N/A	N/A
Planting of bare root trees	N/A	N/A	Apr-14
End of Construction	N/A	N/A	Apr-14
Survey of As-built conditions (Year 0 Monitoring-baseline)	N/A	May-14	Jun-14
Year 1 Monitoring	Nov-14	Dec-14	Dec-14
Year 2 Monitoring	Nov-15	Nov-15	Mar-16
Year 3 Monitoring	Nov-16	Dec-16	Jan-17
Year 4 Monitoring	Nov-17	Dec-17	Jan-18
Year 5 Monitoring	Nov-18	N/A	N/A
Year 6 Monitoring	Nov-19	N/A	N/A
Year 7 Monitoring	Nov-20	N/A	N/A

Table 3. Project Contacts Table St. Clair Creek Restoration Project: DMS Project ID No. 95015	
Designer	
Michael Baker International	797 Haywood Road, Suite 201 Asheville, NC 28806 Contact: Jacob Byers, Tel. 828-412-6101
Construction Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Tel. 919-582-3574
Planting Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Tel. 919-582-3574
Seeding Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Tel. 919-582-3574
Seed Mix Sources	Green Resources, Tel. 336-855-6363
Nursery Stock Suppliers	Mellow Marsh Farm, 919-742-1200 ArborGen, 843-528-3204 Superior Tree, 850-971-5159
Monitoring Performers	
Michael Baker International	797 Haywood Road, Suite 201 Asheville, NC 28806
	Contact:
Stream Monitoring Point of Contact	Jacob Byers, Tel. 828-412-6101
Vegetation Monitoring Point of Contact	Jacob Byers, Tel. 828-412-6101
Wetland Monitoring Point of Contact	Jacob Byers, Tel. 828-412-6101

Table 4. Project Attributes
St. Clair Creek Restoration Project: DMS Project ID No. 95015

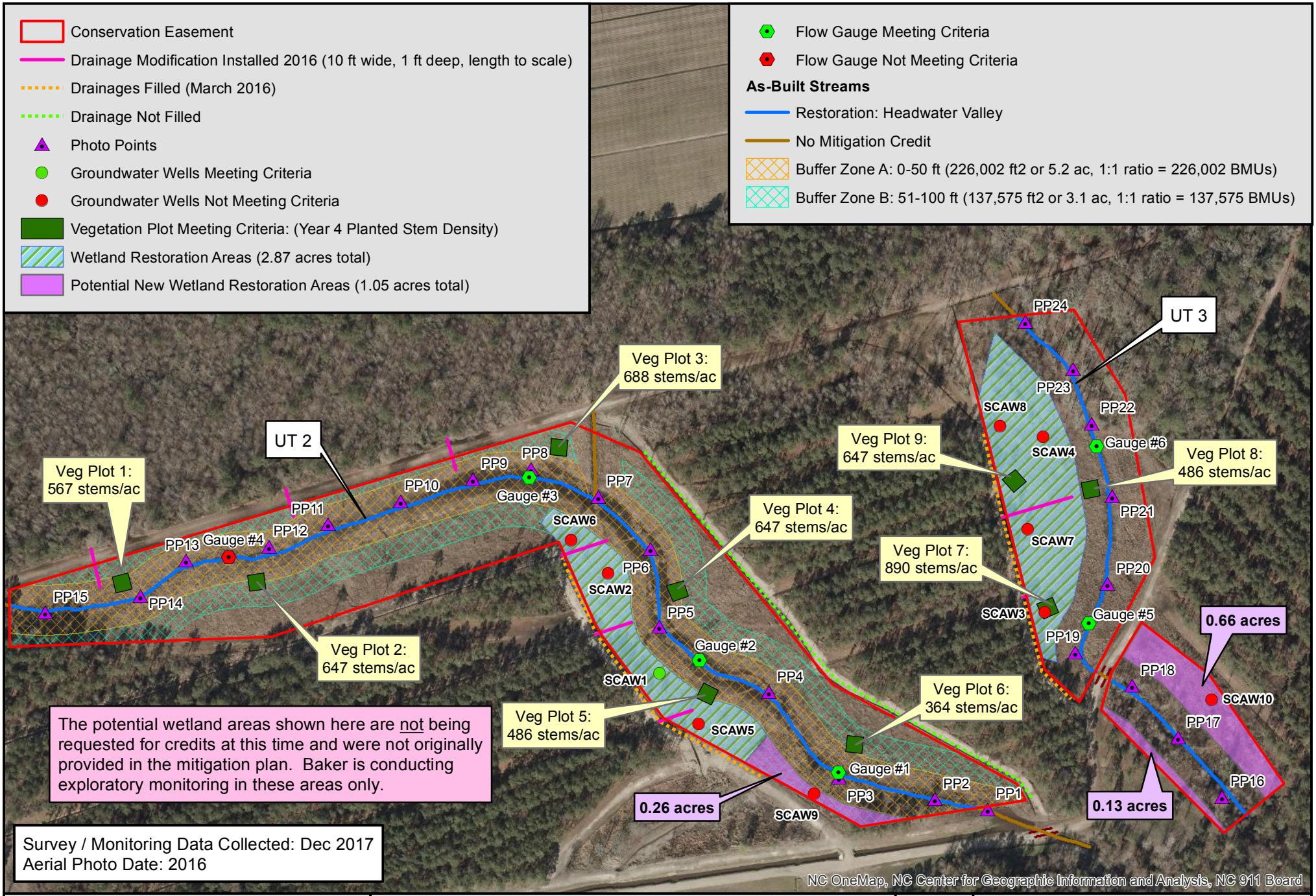
Project Information		
Project Name	St. Clair Creek Restoration Project	
County	Beaufort	
Project Area (acres)	17.5	
Project Coordinates (latitude and longitude)	35.452835 N, -76.76726215 W	
Watershed Summary Information		
Physiographic Province	Outer Coastal Plain	
River Basin	Tar-Pamlico	
USGS Hydrologic Unit 8-digit and 14-digit	03020104 / 03020104040040	
DWQ Sub-basin	03 03 07	
Project Drainage Area (AC)	89 (UT2), 30 (UT3)	
Project Drainage Area Percentage of Impervious Area	<1%	
CGIA Land Use Classification	3.02, Passively Managed Forest Stands, 2.01.01.07, Annual Row Crop Rotation;	
Stream Reach Summary Information		
Parameters	**Reach UT2**	**Reach UT3**
Length of Reach (LF)	2,133 (proposed) 2,660 (existing)	1,141 (proposed) 1,075 (existing)
Valley Classification (Rosgen)	X	X
Drainage Area (AC)	89	30
NCDWQ Stream Identification Score	36	20
NCDWQ Water Quality Classification	C; Sw, NSW	C; Sw, NSW
Morphological Description (Rosgen stream type)*	Channelized Headwater System (Perennial)	Channelized Headwater System (Intermittent)
Evolutionary Trend **	Restored G	Restored G
Underlying Mapped Soils	To, Hy, Ro	To, At
Drainage Class	Very poorly drained, poorly drained	Poorly drained, somewhat poorly drained
Soil Hydric Status	Hydric	Hydric
Average Channel Slope (ft/ft)	0.0006	0.0009
FEMA Classification	SFHA, AE	SFHA, AE
Native Vegetation Community	Coastal Plain Small Stream Swamp	Coastal Plain Small Stream Swamp
Percent Composition of Exotic/Invasive Vegetation	<5%	<5%
Wetland Summary Information		
Parameters	**Wetland Along UT2**	
Size of Wetland (AC)	1.1	
Wetland Type	Riparian Riverine	
Mapped Soil Series	To – Tomotley fine sandy loam	
Drainage Class	Poorly drained	
Soil Hydric Status	Hydric	
Source of Hydrology	Groundwater	
Hydrologic Impairment	Disconnected floodplain from ditches, lowered water table	
Native Vegetation Community	Coastal Plain Small Stream Swamp	
Percent Composition of Exotic/Invasive Vegetation	<5%	
Parameters	**Wetland Along UT3**	
Size of Wetland (AC)	1.7	
Wetland Type	Riparian Riverine	
Mapped Soil Series	To – Tomotley fine sandy loam	
Drainage Class	Poorly drained	
Soil Hydric Status	Hydric	
Source of Hydrology	Groundwater	
Hydrologic Impairment	Disconnected floodplain from ditches, lowered water table	
Native Vegetation Community	Coastal Plain Small Stream Swamp	
Percent Composition of Exotic/Invasive Vegetation	<5%	

Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation****
Waters of the United States – Section 404	Yes	Yes	(Appendix B)
Waters of the United States – Section 401	Yes	Yes	(Appendix B)
Endangered Species Act	No	N/A	Categorical Exclusion (Appendix B)
Historic Preservation Act	No	N/A	Categorical Exclusion (Appendix B)
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion (Appendix B)
FEMA Floodplain Compliance	Yes	Yes	(Appendix B)
Essential Fisheries Habitat	No	N/A	Categorical Exclusion (Appendix B)
Notes:			

* Due to its channelized nature, the stream would most appropriately be classified as a Rosgen G stream type but use of this classification system on this channel is questionable due to its highly altered state. ** Supporting documentation is including in the approved Final Mitigation Plan.

Appendix B

Visual Assessment Data



Michael Baker INTERNATIONAL

0 250 500 Feet

N

NCDEQ - Division of Mitigation Services
Project # 95015

Figure 2
Current Conditions Plan View: MY4
St. Clair Creek Site
Beaufort County, NC

Rev: 20Oct2017

Table 5a. Visual Stream Morphology Stability Assessment
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Reach ID: UT2

Assessed Length (LF): 2,133

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	NA	NA						
	3. Meander Pool Condition	1. Depth	NA	NA						
		2. Length	NA	NA						
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	NA	NA						
		2. Thalweg centering at downstream of meander bend (Glide)	NA	NA						
		3. Thalweg centering along valley	Yes	2,133 LF						
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	2,133	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	2,133	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	2,133	100%
		Totals			0	0	100%	0	2,133	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	NA	NA						
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	NA	NA						
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	NA	NA						
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	NA	NA						
	4. Habitat	Pool forming structures maintaining - Max Pool Depth	NA	NA						

Table 5a. Visual Stream Morphology Stability Assessment
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Reach ID: UT3

Assessed Length (LF): 1,141

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	NA	NA						
	3. Meander Pool Condition	1. Depth	NA	NA						
		2. Length	NA	NA						
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	NA	NA						
		2. Thalweg centering at downstream of meander bend (Glide)	NA	NA						
		3. Thalweg centering along valley	Yes	1,141 LF						
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	1,141	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	1,141	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	1,141	100%
		Totals			0	0	100%	0	1,141	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	NA	NA						
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	NA	NA						
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	NA	NA						
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	NA	NA						
	4. Habitat	Pool forming structures maintaining - Max Pool Depth	NA	NA						

Table 5b. Stream Problem Areas
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Feature Issue	Station Number	Suspected Cause	Photo Number
None Observed	--	--	--

Table 6a. Vegetation Conditions Assessment
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Reach ID: UT2

Planted Acreage: 11.6

Vegetation Category	Defintions	Mapping Threshold (acres)	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover both woody and herbaceous material.	0.1	NA	0	0.00	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	NA	0	0.00	0.0%
			Total	**0**	**0.00**	**0.0%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25	NA	0	0.00	0.0%
			Cumulative Total	**0**	**0.00**	**0.0%**

Easement Acreage:

Vegetation Category	Defintions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
5. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	NA	0	0.00	0.0%
6. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	none	NA	0	0.00	0.0%

Table 6a. Vegetation Conditions Assessment
St. Clair Restoration Project: EEP Project ID No. 95015

Reach ID: UT3

Planted Acreage: 5.9

Vegetation Category	Defintions	Mapping Threshold (acres)	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover both woody and herbaceous material.	0.1	NA	0	0.00	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	NA	0	0.00	0.0%
			Total	**0**	**0.00**	**0.0%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25	NA	0	0.00	0.0%
			Cumulative Total	**0**	**0.00**	**0.0%**

Easement Acreage:

Vegetation Category	Defintions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	NA	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	none	NA	0	0.00	0.0%

Table 6b. Vegetation Problem Areas
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Feature Issue	Station Number	Suspected Cause	Resolution	Photo Number
Loblolly Pine (*Pinus taeda)*	Scattered throughout buffer on UT-2	Post-restoraton seed source	Treated in March 2016 - hand/power tools and chemical application Treated again in May 2017- hand/power tools and chemical application	Photos 1-4 in VPA Photolog
Chinese Privet (*Ligustrum sinense*)	UT-2: 12+00 to 13+00	Post-restoraton seed source	Treated in May 2017- hand/power tools and chemical application	Photos 5-6 in VPA Photolog

St. Clair Restoration Site – Longitudinal Stream Photo Stations (April 2017)

Photo Point 1 – UT2

Photo Point 2 – UT2

Photo Point 3 – UT2

Photo Point 4 – UT2

Photo Point 5 – UT2

Photo Point 6 – UT2

St. Clair Restoration Site – Longitudinal Stream Photo Stations (April 2017)

Photo Point 7 – UT2

Photo Point 8 – UT2

Photo Point 9 – UT2

Photo Point 10 – UT2

Photo Point 11 – UT2

Photo Point 12 – UT2

St. Clair Restoration Site – Longitudinal Stream Photo Stations (April 2017)

Photo Point 13 – UT2

Photo Point 14 – UT2

Photo Point 15 – UT2

Photo Point 16 – UT3

Photo Point 17 – UT3

Photo Point 18 – UT3 (Dec 2017)

St. Clair Restoration Site – Longitudinal Stream Photo Stations (April 2017)

Photo Point 19 – UT3

Photo Point 20 – UT3

Photo Point 21 – UT3

Photo Point 22 – UT3

Photo Point 23 – UT3

Photo Point 24 – UT3

St. Clair Restoration Site – Vegetation Plots (October 2017)

Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6

St. Clair Restoration Site – Vegetation Plots (October 2017)

Vegetation Plot 7

Vegetation Plot 8

Vegetation Plot 9

St. Clair Restoration Site - Hydrology Monitoring Stations (December 2017)

Auto Well – SCAW1

Auto Well – SCAW2

Auto Well – SCAW3

Auto Well – SCAW4

Supplemental Auto Well – SCAW5

Supplemental Auto Well – SCAW6

St. Clair Restoration Site - Hydrology Monitoring Stations (December 2017)

Supplemental Auto Well – SCAW7

Supplemental Auto Well – SCAW8

Supplemental Auto Well – SCAW9

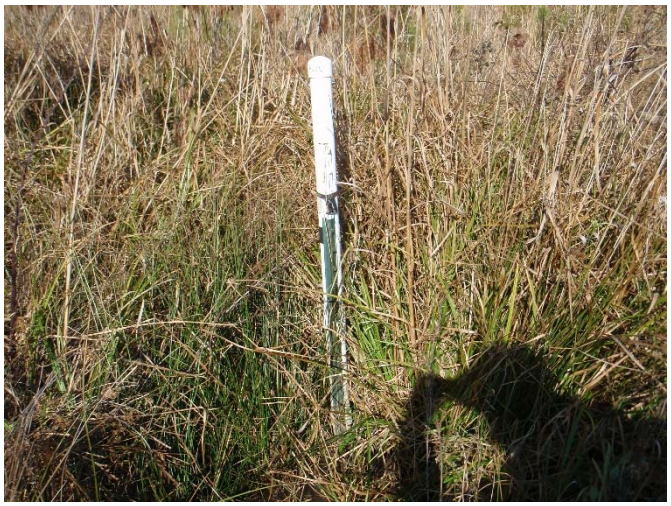
Supplemental Auto Well – SCAW10

Reference Auto Well – SCREF1

Reference Auto Well – SCREF2

St. Clair Restoration Site - Hydrology Monitoring Stations (December 2017)

Flow Logger (UT2) – SCFL1



Flow Logger (UT2) – SCFL2

Flow Logger (UT2) – SCFL3

Flow Logger (UT2) – SCFL4

Flow Logger (UT3) – SCFL5

Flow Logger (UT3) – SCFL6

St. Clair Restoration Site - Hydrology Monitoring Stations (December 2017)

On-site rain gauge - adjacent to SCAW1

St. Clair Restoration Site – Vegetation Problem Areas (Treated in May 2017)

Loblolly Pines on UT2 (April 2017)

Loblolly Pines on UT2 (Dec. 2017)

Loblolly Pines on UT2 (April 2017)

Loblolly Pines on UT2 (Dec. 2017)

Chinese privet on UT2 (Dec. 2016)

Chinese Privet on UT2 (Dec. 2017)

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Plot ID	Vegetation Survival Threshold Met?	MY4 Planted Density / As-built Planted Stem Density*	Tract Mean
1	Y	567/728	603
2	Y	647/648	
3	Y	688/688	
4	Y	647/728	
5	Y	486/688	
6	Y	364/486	
7	Y	890/1,174	
8	Y	486/728	
9	Y	647/769	

Note: *MY4 Planted Density / As-built Planted Stem Density - reflects the changes in stem density based on the current total density of planted stems as compared to the original planted stem density from the As-built conditions.

Table 8. CVS Vegetation Metadata
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Report Prepared By	Scott King
Date Prepared	1/8/2018 13:28
database name	MichaelBaker_MY4_2017_StClair_95015.mdb
database location	L:\Projects\125116\Monitoring\Post Restoration\Veg Plots\Year 4_2017
computer name	CARYLSKING
file size	47316992

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------

Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------

Project Code	95015
project Name	St Clair Creek Restoration Project
Description	
River Basin	Tar-Pamlico
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	9

Table 9a. CVS Stem Count of Planted Stems by Plot and Species
St. Clair Creek Restoration Project: DMS Project ID No. 95015

	Comment	Species	SpType	CommonName	Total Planted Stems	# plots	avg# stems	plot 95015-01-0001-year:4	plot 95015-01-0002-year:4	plot 95015-01-0003-year:4	plot 95015-01-0004-year:4	plot 95015-01-0005-year:4	plot 95015-01-0006-year:4	plot 95015-01-0007-year:4	plot 95015-01-0008-year:4	plot 95015-01-0009-year:4
		Aronia arbutifolia	Shrub	Red Chokeberry	6	3	2		4	1						1
		Carpinus caroliniana	Shrub Tree	American hornbeam	3	3	1		1					1		1
		Clethra alnifolia	Shrub	coastal sweetpepperbush	1	1	1	1								
		Fraxinus pennsylvanica	Tree	green ash	5	4	1.25	2			1			1		1
		Morella cerifera	Shrub Tree	wax myrtle	1	1	1								1	
		Nyssa sylvatica	Tree	blackgum	7	3	2.33		1					4	2	
		Persea palustris	Tree	swamp bay	6	2	3								2	4
		Quercus laurifolia	Tree	laurel oak	8	3	2.67	1		3		4				
		Quercus lyrata	Tree	overcup oak	14	7	2	4	2	1		2		2	1	2
		Quercus michauxii	Tree	swamp chestnut oak	27	6	4.5	1	4		4	5	5	8		
		Quercus phellos	Tree	willow oak	10	5	2			5	1	1	1	2		
		Taxodium distichum	Tree	bald cypress	16	4	4		4	3	8		1			
		Ulmus americana	Tree	American elm	19	6	3.17	1		4	2		1	4		7
		Vaccinium corymbosum	Shrub	highbush blueberry	3	2	1.5	1							2	
		Viburnum dentatum	Shrub Tree	southern arrowwood	8	3	2.67	3					1		4	
TOT:	**0**	**15**	**15**	**15**	**134**	**15**		**14**	**16**	**17**	**16**	**12**	**9**	**22**	**12**	**16**

Table 9b. Stem Count for All Species (Planted and Volunteer) Arranged by Plot
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Botanical Name	Common Name	Plots									
		1	2	3	4	5	6	7	8	9	
Tree Species											
Fraxinus pennsylvanica	green ash	2			1			1		1	
Nyssa sylvatica	swamp tupelo		1					4	2		
Pinus taeda	loblolly pine	12	10	3	5	6		4	2		
Quercus laurifolia	laurel oak	1		3		4					
Quercus lyrata	overcup oak	4	2	1		2		2	1	3	
Quercus michauxii	swamp chestnut oak	1	4		4	5	5	8			
Quercus pagoda	cherrybark oak						1				
Quercus phellos	willow oak			5	1	2	1	3	1		
Taxodium distichium	bald cypress		4	3	8		1				
Ulmus americana	American elm	1		4	2		1	4		7	
Shrub Species											
Aronia arbutifolia	Red Chokeberry		4	1				1		1	
Carpinus caroliniana	American hornbeam		1					1		2	
Clethra alnifolia	coastal sweetpepperbush	1							1		
Morella cerifera	wax myrtle								1		
Persea palustris	swamp bay								2	4	
Vaccinium corymbosum	highbush blueberry	1							2		
Viburnum dentatum	southern arrowwood	3					1		5		
Stems Per Plot (October 2017)		26	26	20	21	19	10	28	17	18	Average Stems Per Acre
Total Stems/Acre Year 4 (October 2017)		1052	1052	809	850	769	405	1133	688	728	**832**
Total Stems/Acre Year 3 (December 2016)		567	648	648	648	526	364	850	526	688	**607**
Total Stems/Acre Year 2 (November 2015)		607	648	648	648	526	405	1012	607	688	**643**
Total Stems/Acre Year 1 (December 2014)		688	648	648	648	648	445	1052	648	728	**683**
Total Stems/ Acre for Year 0 As-Built (Baseline Data)		728	648	688	728	688	486	1174	728	769	**737**

Table 9c. Yearly Density Per Plot
St. Clair Creek Restoration Project: DMS Project ID No. 95015

			Current Plot Data (MY4 2017)																									
			95015-01-0001			95015-01-0002			95015-01-0003			95015-01-0004			95015-01-0005			95015-01-0006			95015-01-0007			95015-01-0008			95015-01-0009		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Aronia arbutifolia	Red Chokeberry	Shrub				4		4	1		1																1		1
Carpinus caroliniana	American hornbeam	Tree				1		1													1		1				1	1	2
Clethra alnifolia	coastal sweetpepperbush	Shrub	1		1																								
Cornus foemina	stiff dogwood	Shrub Tree																											
Fraxinus pennsylvanica	green ash	Tree	2		2							1		1							1		1				1		1
Liquidambar styraciflua	sweetgum	Tree																											
Morella cerifera	wax myrtle	shrub																						1		1			
Nyssa sylvatica	blackgum	Tree				1		1													4		4	2		2			
Persea palustris	swamp bay	tree																						2		2	4		4
Pinus taeda	loblolly pine	Tree		12	12		10	10		3	3		5	5		6	6					4	4		2	2			
Quercus laurifolia	laurel oak	Tree	1		1				3		3				4		4												
Quercus lyrata	overcup oak	Tree	4		4	2		2	1		1				2		2				2		2	1		1	2	1	3
Quercus michauxii	swamp chestnut oak	Tree	1		1	4		4				4		4	5		5	5		5	8		8						
Quercus pagoda	cherrybark oak	Tree																	1	1									
Quercus phellos	willow oak	Tree							5		5	1		1	1		1	1		1	2		2						
Salix nigra	black willow	Tree																											
Taxodium distichum	bald cypress	Tree				4		4	3		3	8		8				1		1									
Ulmus alata	winged elm	Tree																											
Ulmus americana	American elm	Tree	1		1				4		4	2		2				1		1	4		4				7		7
Unknown		Shrub or Tree																											
Vaccinium corymbosum	highbush blueberry	Shrub	1		1																			2		2			
Viburnum dentatum	southern arrowwood	Shrub	3		3													1		1				4		4			
		Stem count	14	12	26	16	10	26	17	3	20	16	5	21	12	6	18	9	1	10	22	4	26	12	2	14	16	2	18
		size (ares)	1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	8	1	9	6	1	7	6	1	7	5	1	6	4	1	5	5	1	6	7	1	8	6	1	7	6	2	6
		Stems per ACRE	567	486	1,052	647	405	1,052	688	121	809	647	202	850	486	243	728	364	40	405	890	162	1,052	486	81	567	647	81	728

			MY4 (2017)			MY3 (2016)			MY2 (2015)			MY1 (2014)		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T
Aronia arbutifolia	Red Chokeberry	Shrub	6		6	6		6	6		6	6		6
Carpinus caroliniana	American hornbeam	Tree	3	1	4	4		4	4		4	3		3
Clethra alnifolia	coastal sweetpepperbush	Shrub	1		1	2		2	2		2	1		1
Cornus foemina	stiff dogwood	Shrub Tree										2		2
Fraxinus pennsylvanica	green ash	Tree	5		5	5		5	5		5	4		4
Liquidambar styraciflua	sweetgum	Tree					7	7						
Morella cerifera	wax myrtle	shrub	1		1	1		1	1		1	1		1
Nyssa sylvatica	blackgum	Tree	7		7	5		5	7		7	6		6
Persea palustris	swamp bay	tree	6		6	6	2	8	6		6	6		6
Pinus taeda	loblolly pine	Tree		42	42		90	90						
Quercus laurifolia	laurel oak	Tree	8		8	8		8	8		8	14		14
Quercus lyrata	overcup oak	Tree	14	1	15	14		14	14		14	17		17
Quercus michauxii	swamp chestnut oak	Tree	27		27	26		26	27		27	25		25
Quercus pagoda	cherrybark oak	Tree		1	1		1	1						
Quercus phellos	willow oak	Tree	10		10	12		12	15		15	11		11
Salix nigra	black willow	Tree					1	1						
Taxodium distichum	bald cypress	Tree	16		16	16		16	16		16	19		19
Ulmus alata	winged elm	Tree					2	2						
Ulmus americana	American elm	Tree	19		19	19		19	19		19	21		21
Unknown		Shrub or Tree										5		5
Vaccinium corymbosum	highbush blueberry	Shrub	3		3	3		3	5		5	5		5
Viburnum dentatum	southern arrowwood	Shrub	8		8	8		8	8		8	6		6
		Stem count	134	45	179	135	103	238	143	0	143	152	0	152
		size (ares)	9			9			9			9		
		size (ACRES)	0.22			0.22			0.22			0.22		
		Species count	15	4	17	15	6	20	15	0	15	17	0	17
		Stems per ACRE	603	202	805	607	463	1,070	643	0	643	683	0	683

Color Key for Stem Density
Exceeds requirements by 10%

Color for Volunteers

P = Planted
V = Volunteer
T = Total

Table 9d. Vegetation Summary and Totals
St. Clair Creek Restoration Project: DMS Project ID No. 95015

St Clair Creek Restoration Project (#95015)
Year 4 (19-Oct-2017)

Vegetation Plot Summary Information

Plot #	Riparian Buffer Stems[1]	Stream/ Wetland Stems[2]	Live Stakes	Invasives	Volunteers[3]	Total[4]	Unknown Growth Form
1	9	14	0	0	12	26	0
2	12	16	0	0	10	26	0
3	16	17	0	0	3	20	0
4	16	16	0	0	5	21	0
5	12	12	0	0	6	18	0
6	8	9	0	0	1	10	0
7	n/a	22	0	0	4	26	0
8	n/a	12	0	0	2	14	0
9	n/a	16	0	0	2	18	0

Wetland/Stream Vegetation Totals
(per acre)

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
1	567	486	1052	Yes
2	647	405	1052	Yes
3	688	121	809	Yes
4	647	202	850	Yes
5	486	243	728	Yes
6	364	40	405	Yes
7	890	162	1052	Yes
8	486	81	567	Yes
9	647	81	728	Yes
Project Avg	**603**	**202**	**805**	**Yes**

Riparian Buffer Vegetation Totals
(per acre)

Plot #	Riparian Buffer Stems[1]	Success Criteria Met?
1	567	Yes
2	647	Yes
3	688	Yes
4	647	Yes
5	486	Yes
6	364	Yes
7*	n/a	n/a
8*	n/a	n/a
9*	n/a	n/a
Project Avg	**567**	**Yes**

*These plots are not located in areas receiving riparian buffer credits

Stem Class	Characteristics
[1]Buffer Stems	Native planted hardwood stems including trees and native shrub species. No pines. No vines.
[2]Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
[3]Volunteers	Native woody stems. Not planted. No vines.
[4]Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Appendix D

Hydrologic Data

Table 10. Wetland Restoration Area Well Success
St. Clair Creek Restoration Project: Project ID No. 95015

Well ID	Percentage of Consecutive Days <12 inches from Ground Surface[1]				Most Consecutive Days Meeting Criteria[2]				Percentage of Cumulative Days <12 inches from Ground Surface				Cumulative Days Meeting Criteria[3]			
	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)
Wetland Monitoring Wells (Installed September 2013)																
SCAW1	1.0	12.3	13.1	33.7	2.8	34.8	37.0	95.0	8.5	39.3	61.7	68.1	24.0	110.8	174.0	192.0
SCAW2	3.8	3.3	9.2	10.6	10.8	9.3	26.0	30.0	30.6	16.1	19.9	51.1	86.3	45.5	56.0	144.0
SCAW3	2.3	13.4	9.6	11.0	6.5	37.8	27.0	31.0	9.4	37.5	44.3	26.2	26.5	105.8	125.0	74.0
SCAW4	7.8	12.3	6.0	11.0	22.0	34.8	17.0	31.0	17.3	20.3	35.8	25.9	48.8	57.3	101.0	73.0
Supplemental Wetland Monitoring Wells (Installed April 2016)**																
SCAW5	--	--	12.8	11.3	--	--	36.0	32.0	--	--	46.8	69.9	--	--	132.0	197.0
SCAW6	--	--	3.9	10.3	--	--	11.0	29.0	--	--	19.9	32.6	--	--	56.0	92.0
SCAW7	--	--	9.6	11.3	--	--	27.0	32.0	--	--	33.0	38.3	--	--	93.0	108.0
SCAW8	--	--	4.6	11.3	--	--	13.0	32.0	--	--	22.0	23.8	--	--	62.0	67.0
Supplemental Wetland Monitoring Wells (Installed March 2017)**																
SCAW9	--	--	--	9.9	--	--	--	28.0	--	--	--	45.4	--	--	--	128.0
SCAW10	--	--	--	9.9	--	--	--	28.0	--	--	--	28.7	--	--	--	81.0
Reference Wells (Installed Spetember 2013)																
SCAWREF1	24.8	57.9	40.9	41.0	70.0	163.3	115.3	115.8	46.4	93.7	77.9	70.1	130.8	264.3	219.8	197.8
SCAWREF2	27.0	60.1	43.8	40.9	65.5	169.5	123.5	115.3	44.5	94.1	76.9	67.1	125.5	256.5	216.8	189.3

[1]Indicates the percentage of the single greatest consecutive number of days within the monitored growing season with a water 12 inches or less from the soil surface.

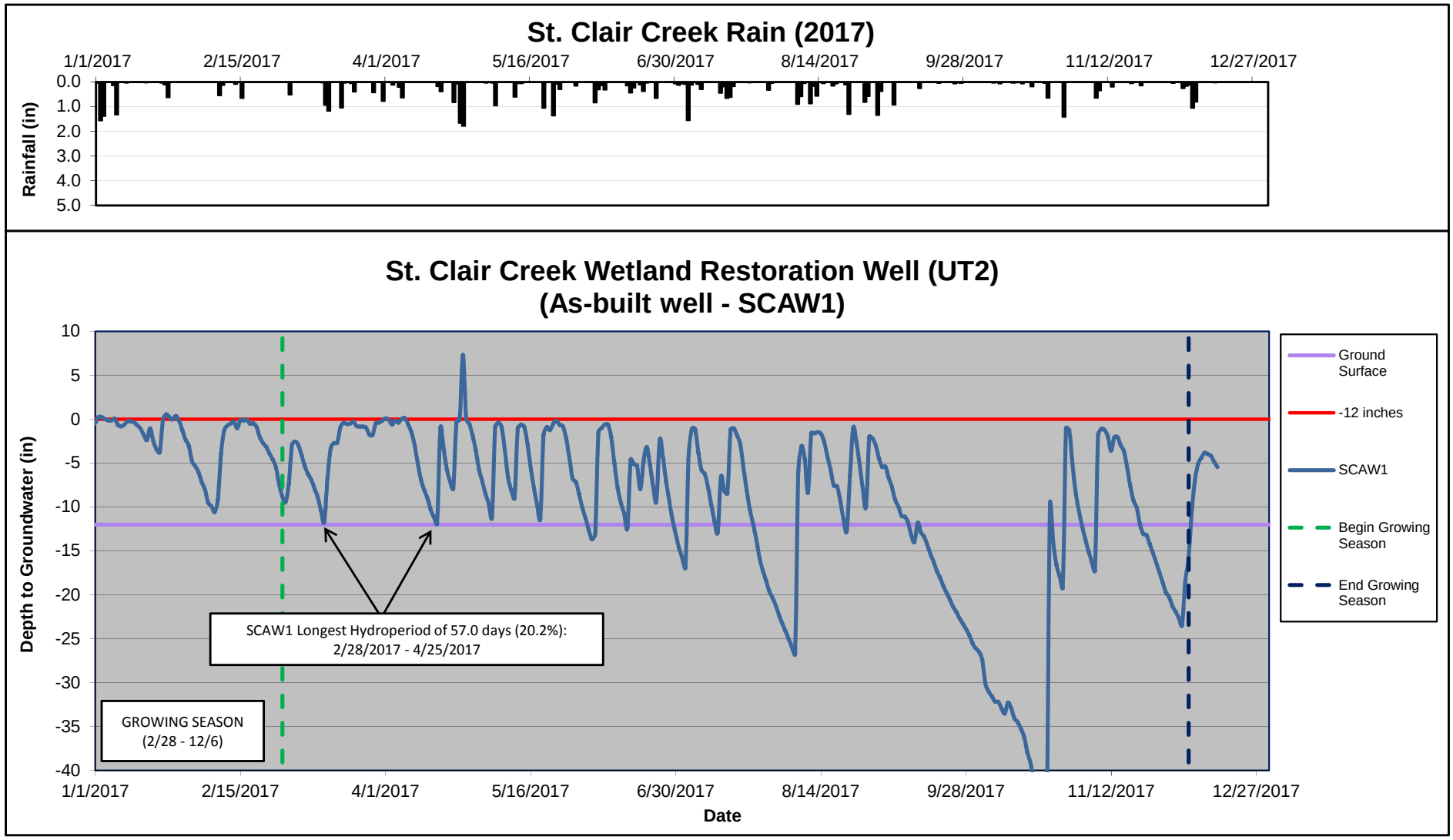
[2]Indicates the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

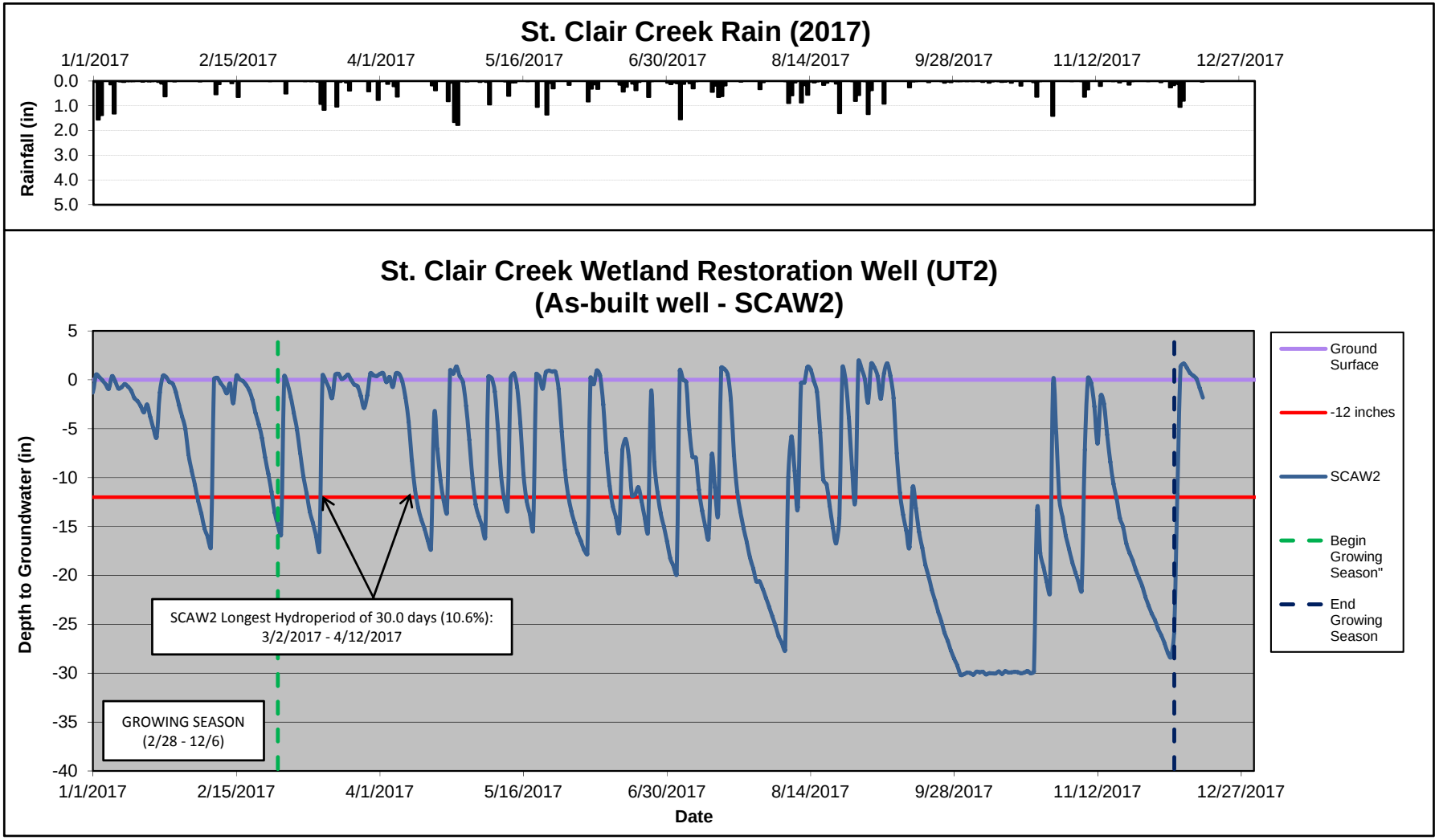
[3]Indicates the total number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

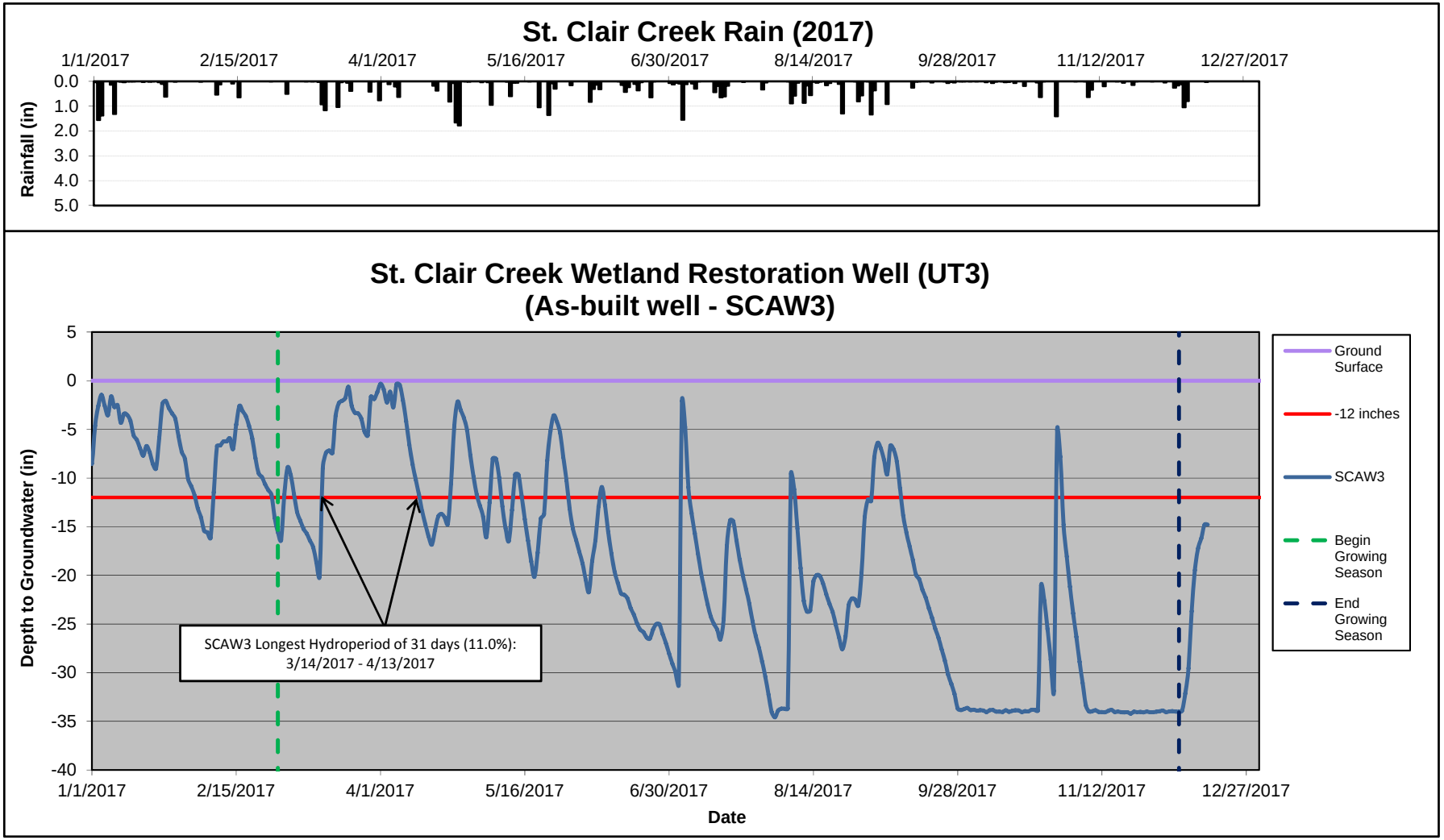
Growing season for Beaufort County is from February 28 to December 6 and is **282** days long. 12% of the growing season is **33.8** days.

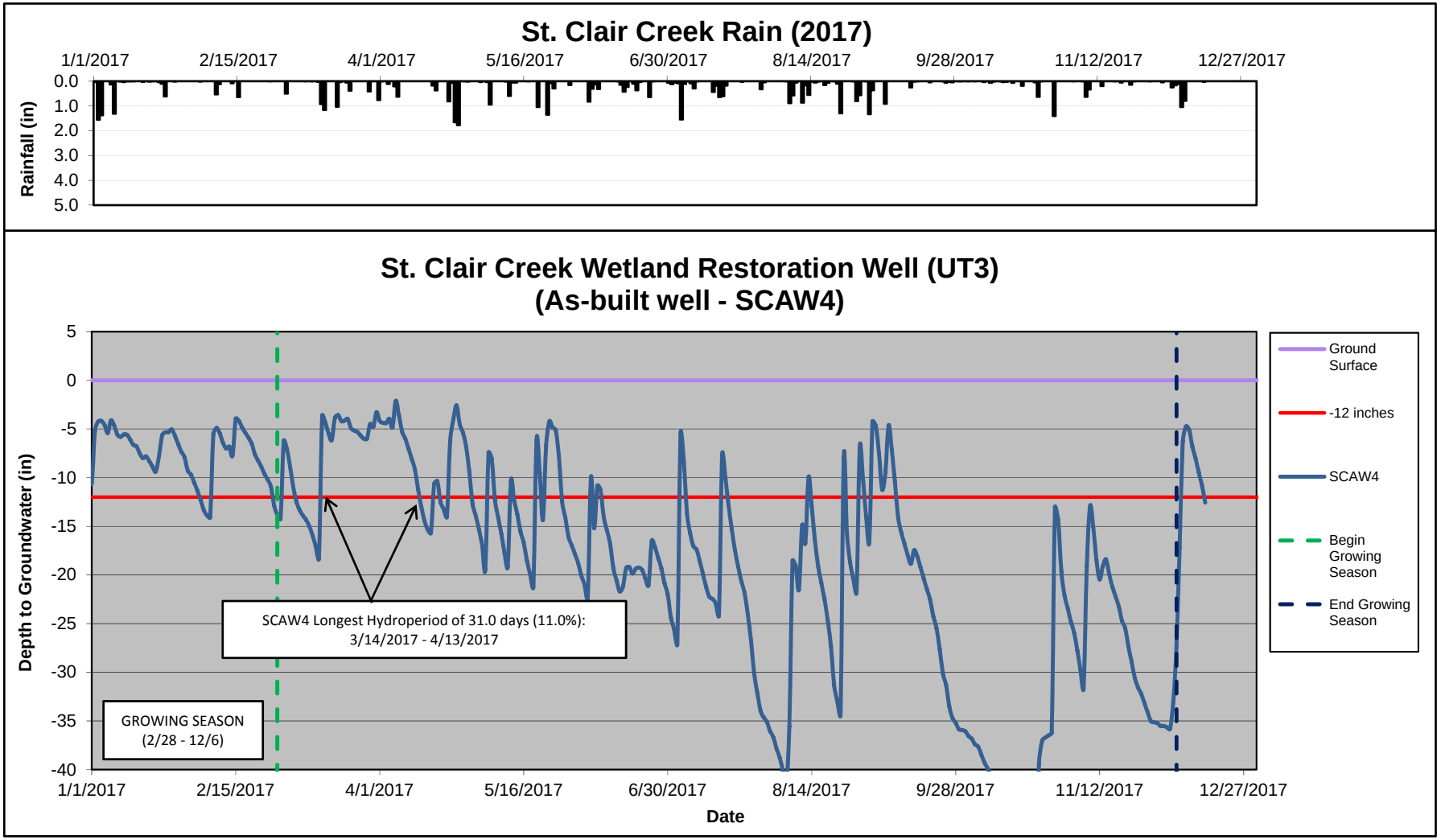
HIGHLIGHTED indicates wells that *did not* to meet the success criteria for the most consecutive number of days within the monitored growing season with a water 12 inches or less from the soil surface.

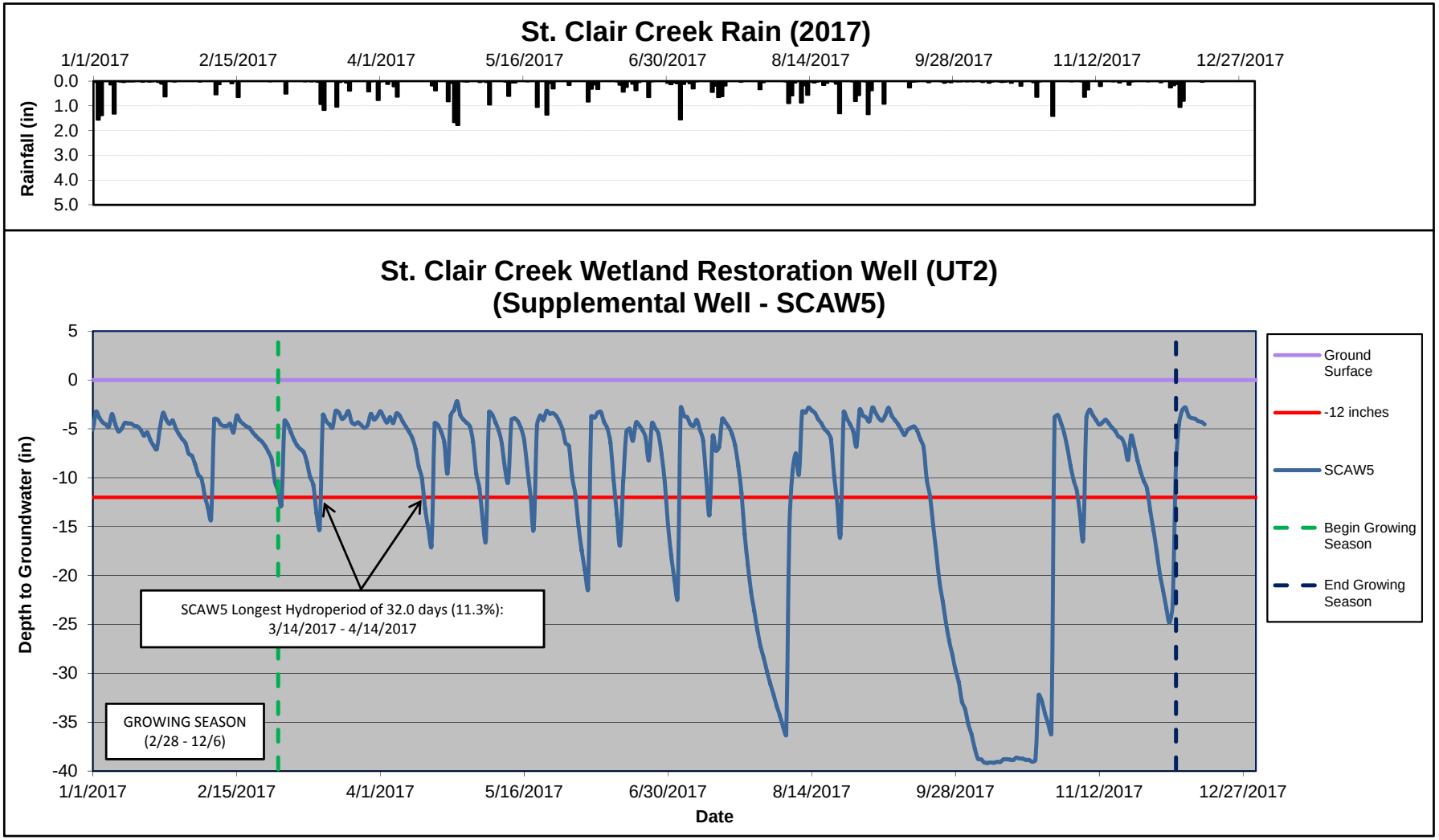
**To gather additional well data in the wetland restoration area, In-Situ groundwater monitoring dataloggers SCAW5 - SCAW 8 were installed in April 2016, several weeks after the growing season had begun. Two additional In-Situ groundwater monitoring dataloggers SCAW9 and SCAW10 were installed in March 2017, just over two weeks past the start of the growing season in 2017.

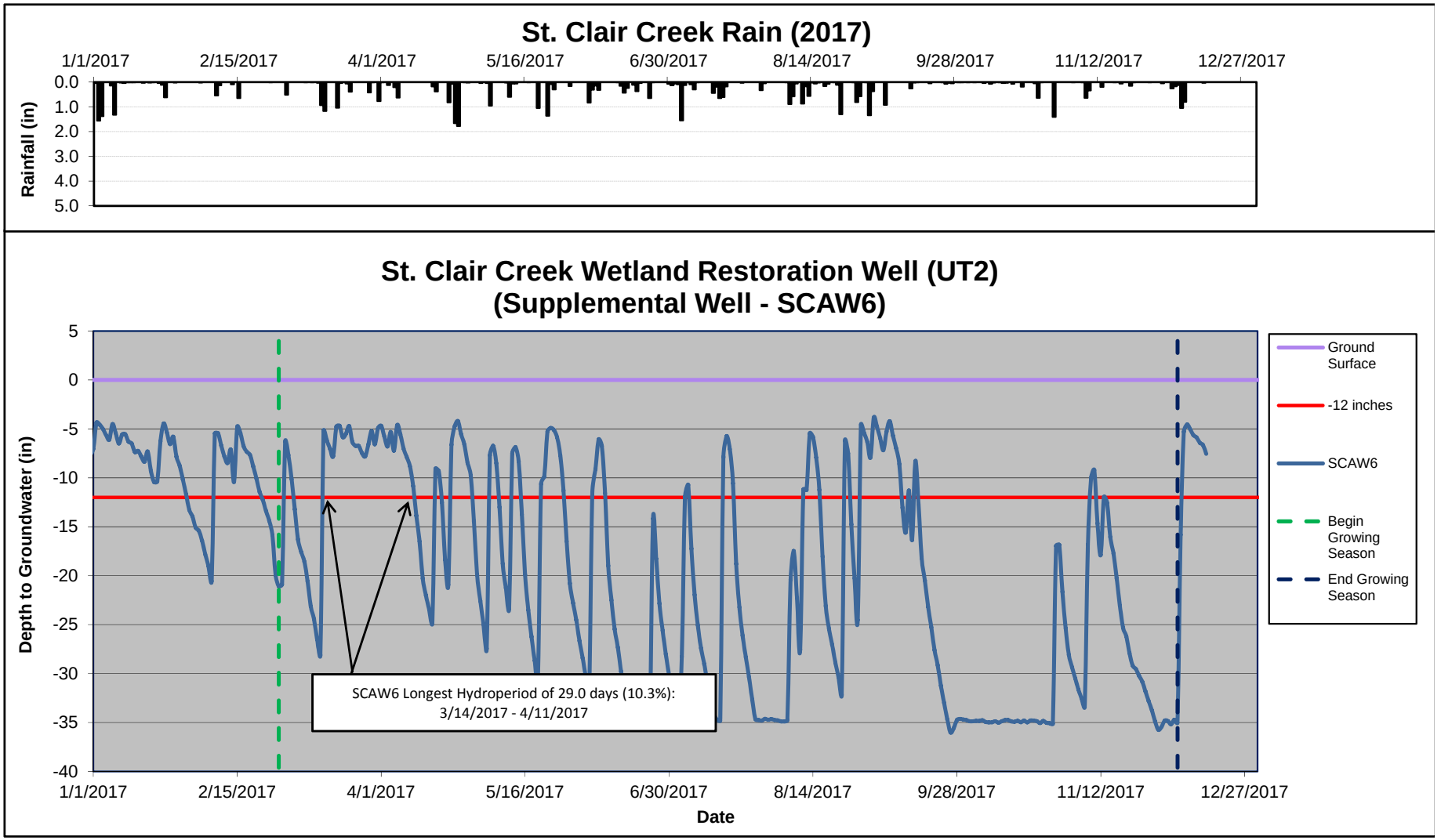

St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT2)
(As-built well - SCAW1)
Depth to Groundwater (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW1 Longest Hydroperiod of 57.0 days (20.2%):
2/28/2017 - 4/25/2017
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW1
Begin Growing Season
End Growing Season
Date

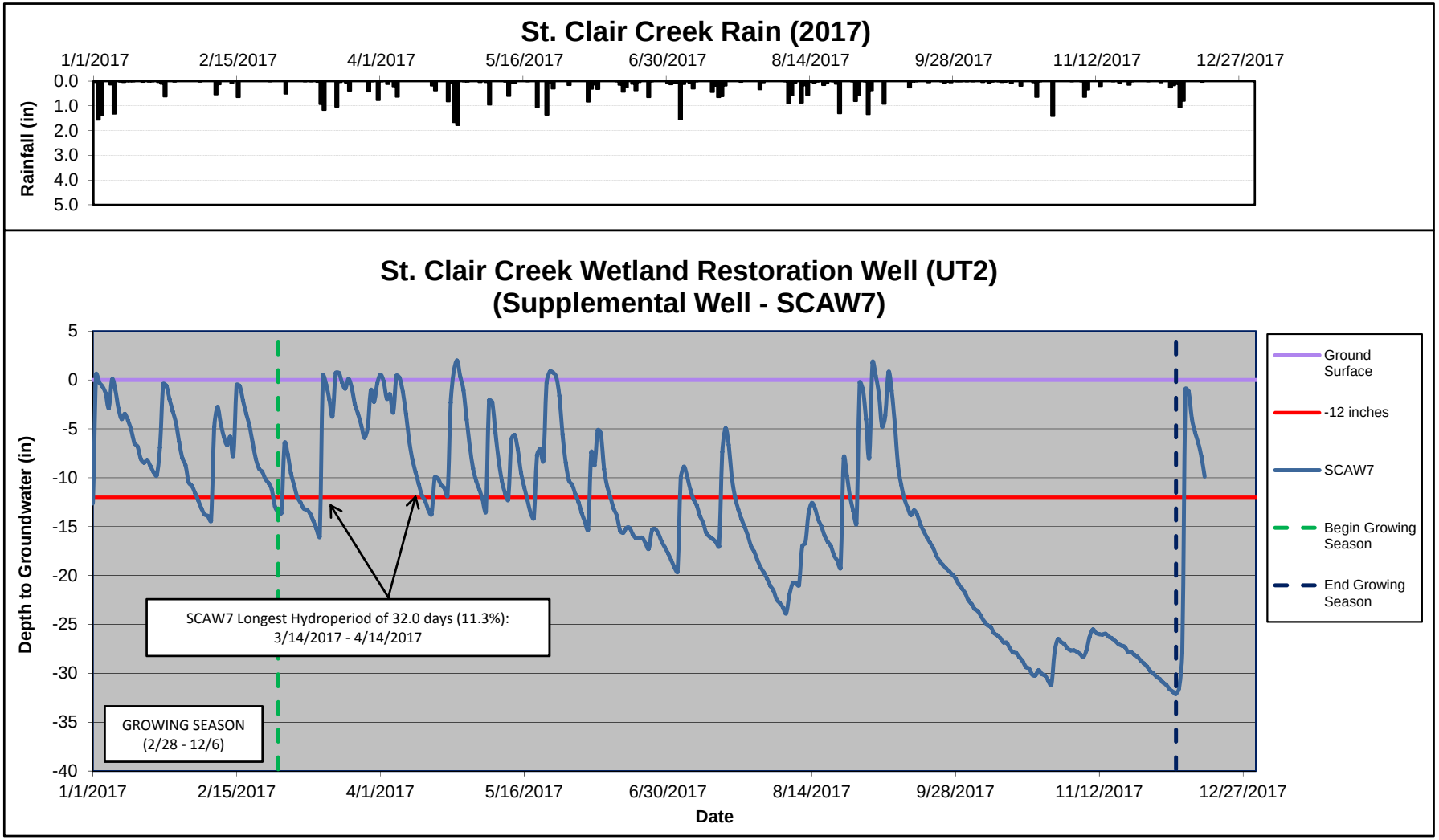

St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT2)
(As-built well - SCAW2)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW2 Longest Hydroperiod of 30.0 days (10.6%):
3/2/2017 - 4/12/2017
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW2
Begin Growing Season"
End Growing Season
Date

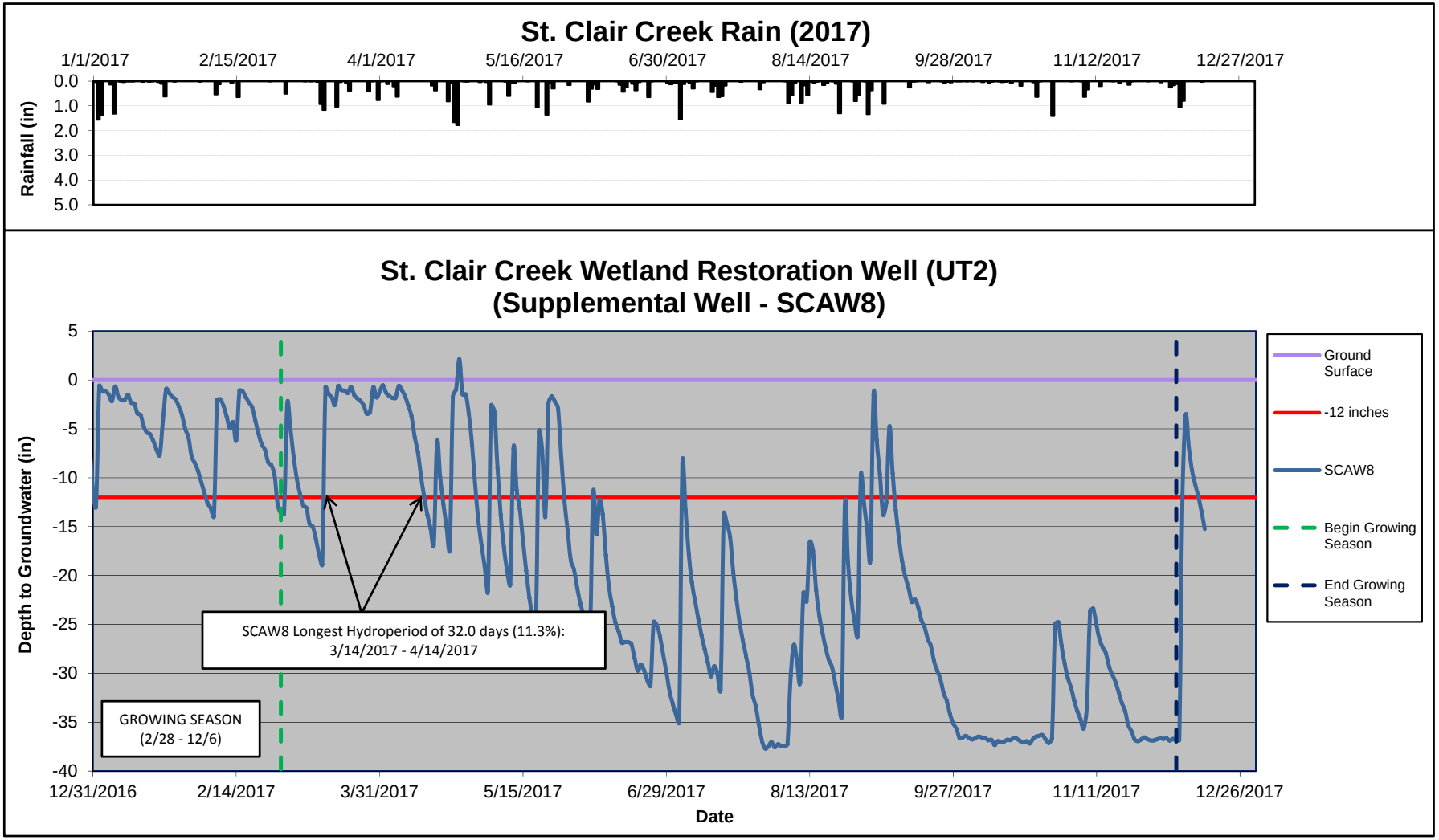

St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT3)
(As-built well - SCAW3)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW3 Longest Hydroperiod of 31 days (11.0%):
3/14/2017 - 4/13/2017
Ground Surface
-12 inches
SCAW3
Begin Growing Season
End Growing Season
Date

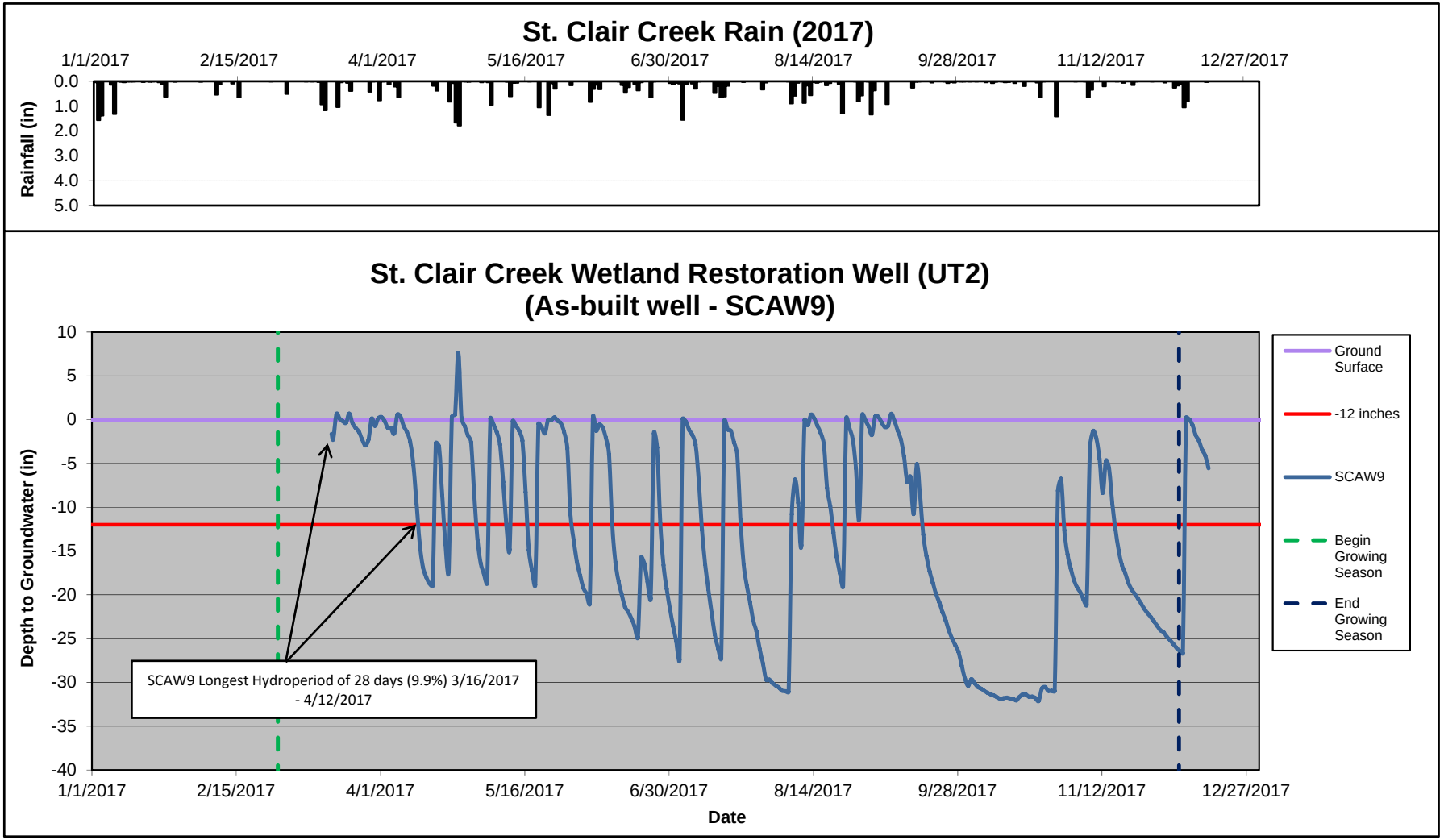

St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT3)
(As-built well - SCAW4)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW4 Longest Hydroperiod of 31.0 days (11.0%):
3/14/2017 - 4/13/2017
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW4
Begin Growing Season
End Growing Season
Date

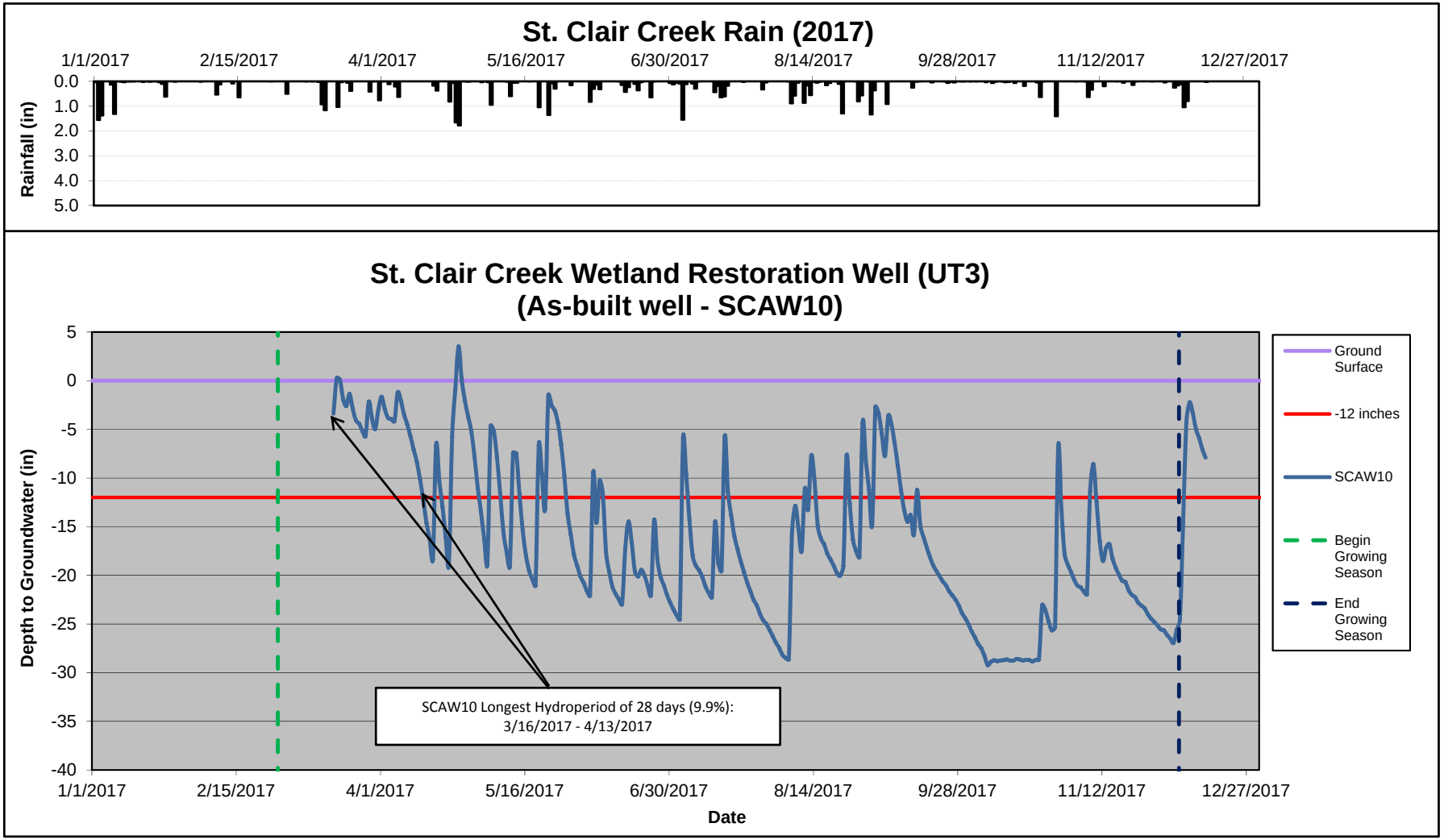

St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW5)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW5 Longest Hydroperiod of 32.0 days (11.3%):
3/14/2017 - 4/14/2017
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW5
Begin Growing Season
End Growing Season
Date

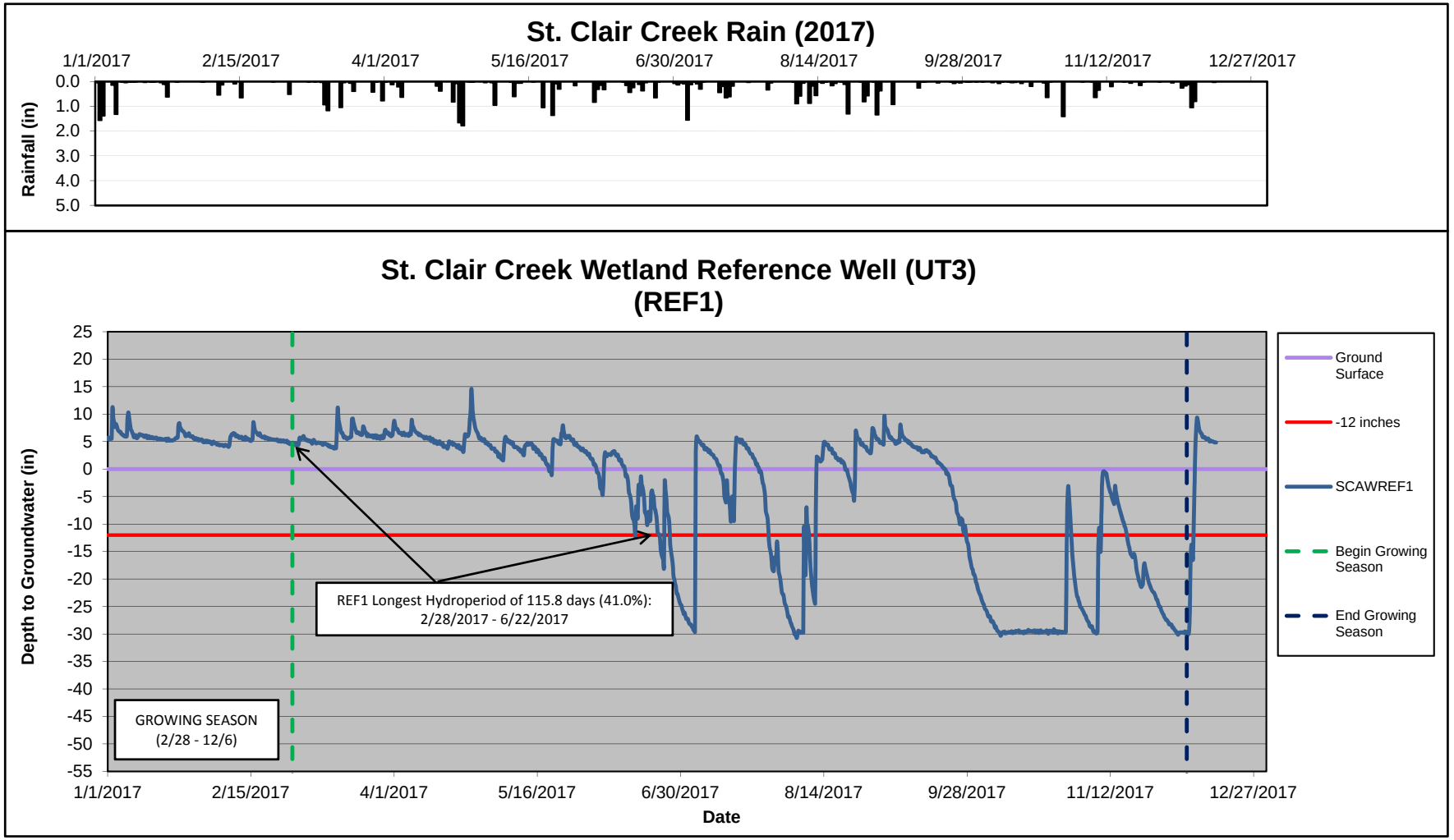

St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW6)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW6 Longest Hydroperiod of 29.0 days (10.3%):
3/14/2017 - 4/11/2017
Ground Surface
-12 inches
SCAW6
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW7)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW7 Longest Hydroperiod of 32.0 days (11.3%):
3/14/2017 - 4/14/2017
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW7
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW8)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW8 Longest Hydroperiod of 32.0 days (11.3%):
3/14/2017 - 4/14/2017
GROWING SEASON
(2/28 - 12/6)
12/31/2016
2/14/2017
3/31/2017
5/15/2017
6/29/2017
8/13/2017
9/27/2017
11/11/2017
12/26/2017
Date
Ground Surface
-12 inches
SCAW8
Begin Growing Season
End Growing Season


St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT2)
(As-built well - SCAW9)
Depth to Groundwater (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW9 Longest Hydroperiod of 28 days (9.9%) 3/16/2017 - 4/12/2017
Ground Surface
-12 inches
SCAW9
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT3)
(As-built well - SCAW10)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW10 Longest Hydroperiod of 28 days (9.9%):
3/16/2017 - 4/13/2017
Ground Surface
-12 inches
SCAW10
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Reference Well (UT3)
(REF1)
Depth to Groundwater (in)
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
REF1 Longest Hydroperiod of 115.8 days (41.0%):
2/28/2017 - 6/22/2017
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAWREF1
Begin Growing Season
End Growing Season
Date

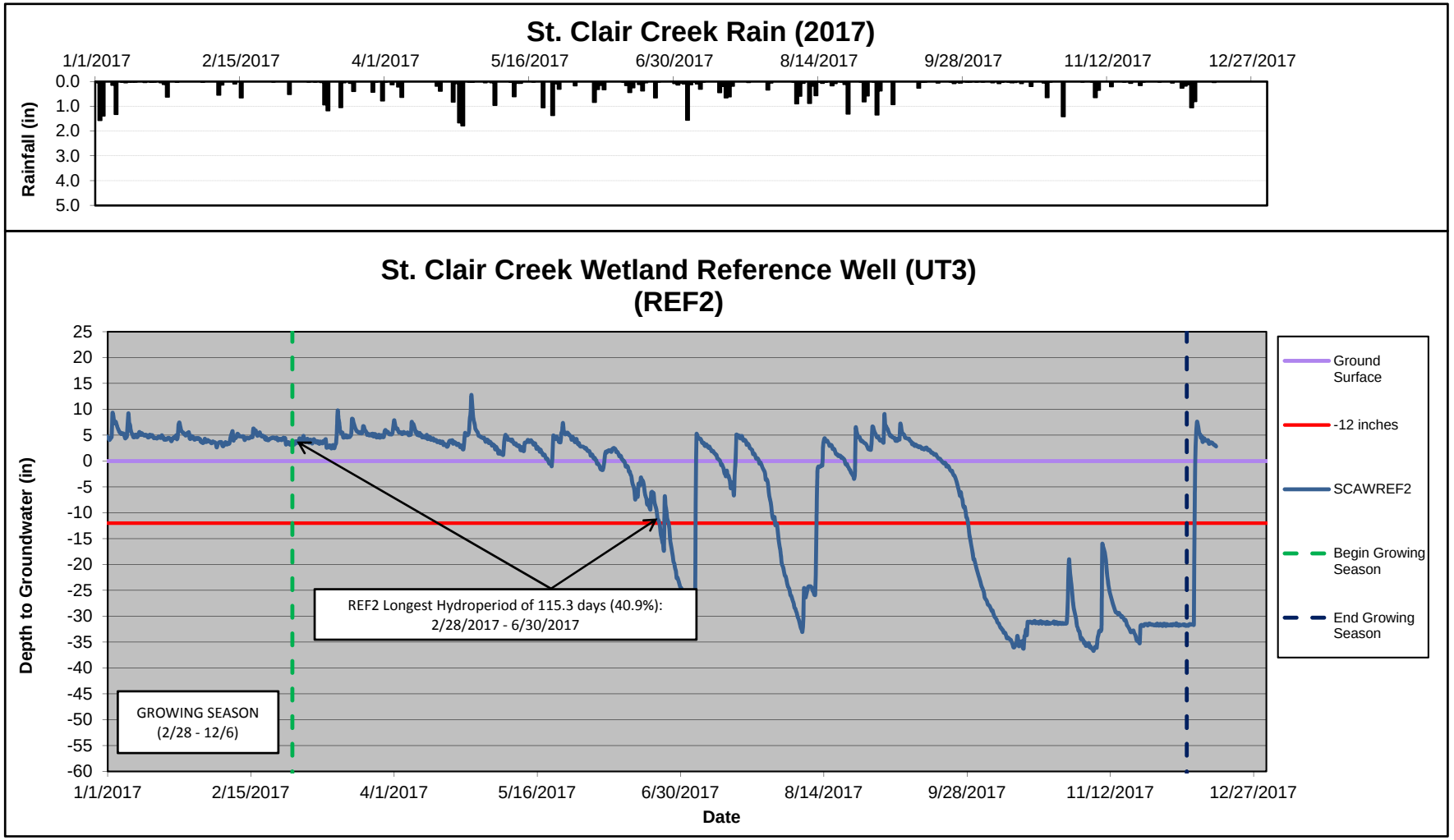

St. Clair Creek Rain (2017)
1/1/2017
2/15/2017
4/1/2017
5/16/2017
6/30/2017
8/14/2017
9/28/2017
11/12/2017
12/27/2017
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Reference Well (UT3)
(REF2)
Depth to Groundwater (in)
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
REF2 Longest Hydroperiod of 115.3 days (40.9%):
2/28/2017 - 6/30/2017
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAWREF2
Begin Growing Season
End Growing Season
Date

Table 11. Flow Gauge Success
St. Clair Restoration Project: DMS Project ID No. 95019

Flow Gauge ID	Most Consecutive Days Meeting Criteria[1]							Cumulative Days Meeting Criteria[2]						
	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 6 (2019)	Year 7 (2020)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 6 (2019)	Year 7 (2020)
UT2 Flow Gauges (Installed March 21, 2014)														
SCFL1	71	43	83	63				NA	206	224	328			
SCFL2	64	43	84	60				NA	201	232	204			
SCFL3	61	25	86	35				NA	174	203	287			
SCFL4	24	17	46	29*				NA	118	124	86			
UT3 Flow Gauges (Installed July 17, 2015)														
SCFL5	57	44	62	30				NA	174	162	79			
SCFL6	5	42	62	30				NA	116	180	191			

Notes:

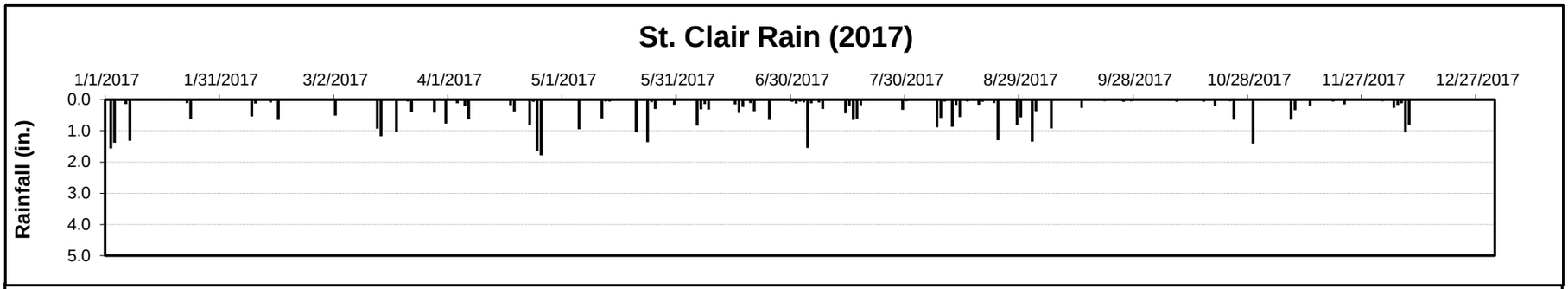
[1]Indicates the single greatest number of consecutive days within the monitoring year where flow was measured.

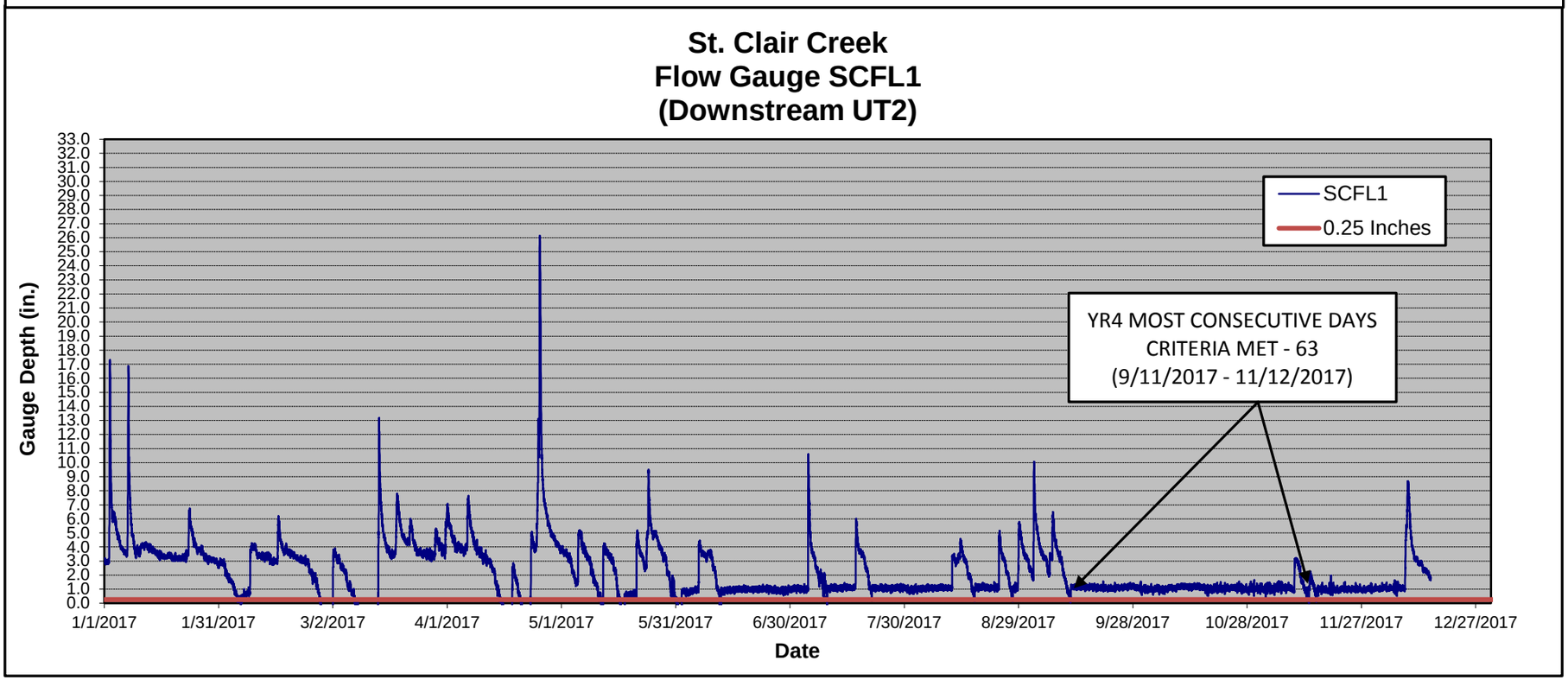
[2]Indicates the number of total number of days within the monitoring year where flow was measured.

*SCFL4 also recorded a 28-day consecutive flow event in 2017, in addition to the 29-day flow event listed above.

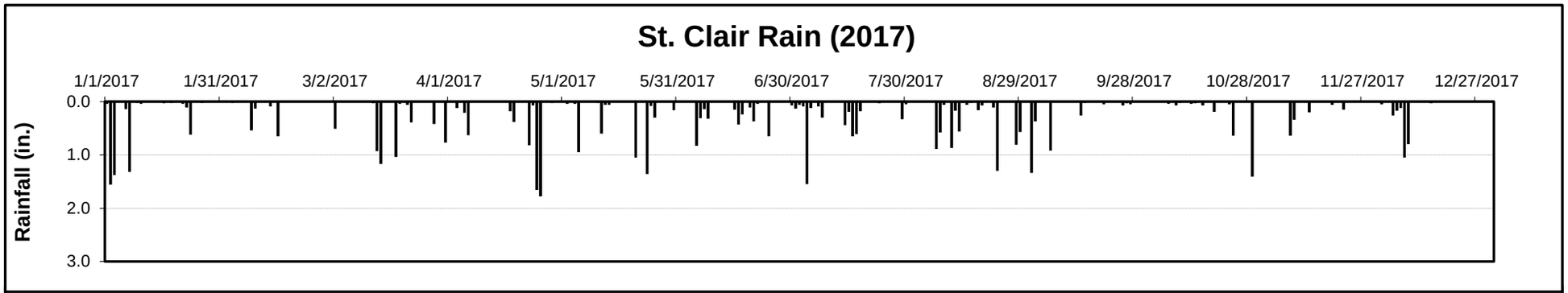
Success Criteria per St. Clair Creek Mitigation Plan: "A surface water flow event will be considered perennial when the flow duration occurs for a minimum of 30 days. Two surface water flow events must be documented within a five-year monitoring period; otherwise, monitoring will continue for seven years or until two flow events have been documented in separate years. The automated gauges should document the occurrence of extended periods of shallow surface ponding, indicative of flow.."

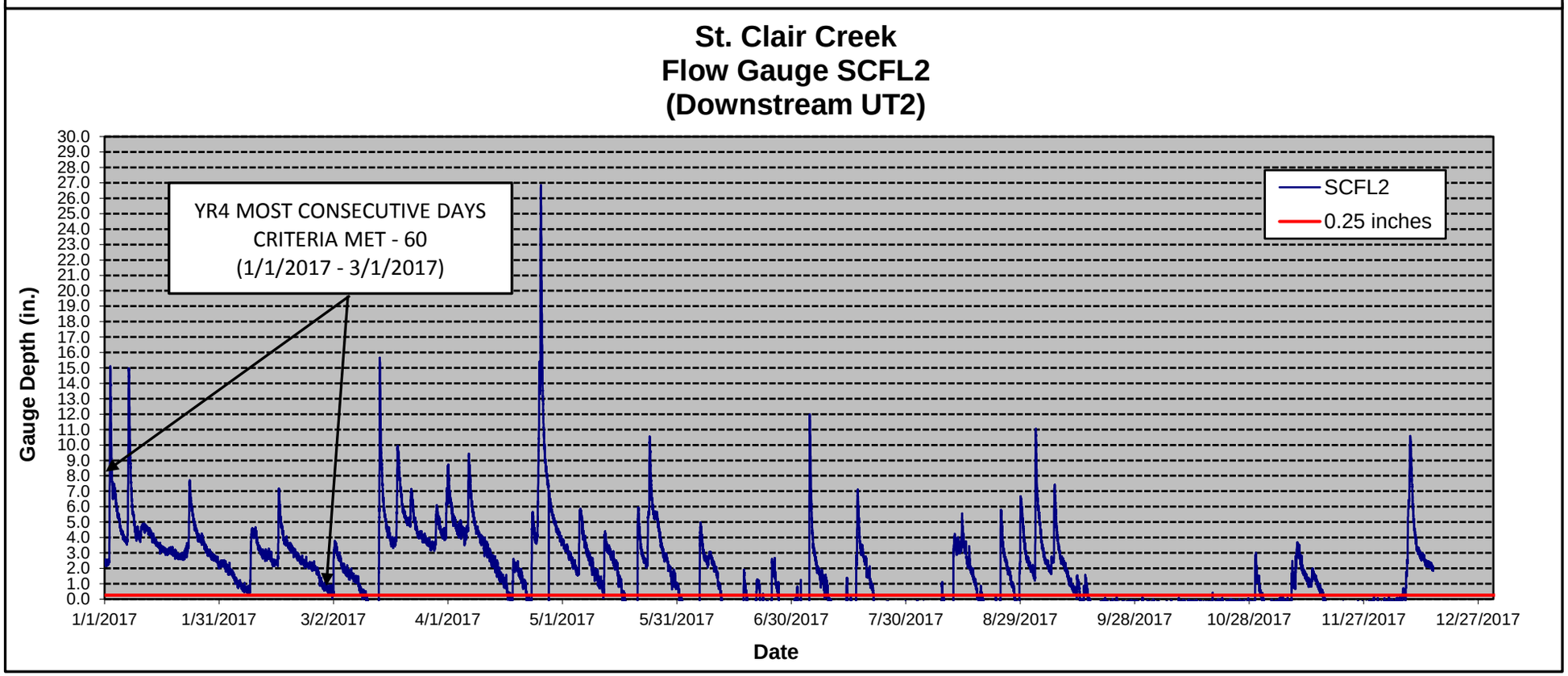
Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.25 inches.



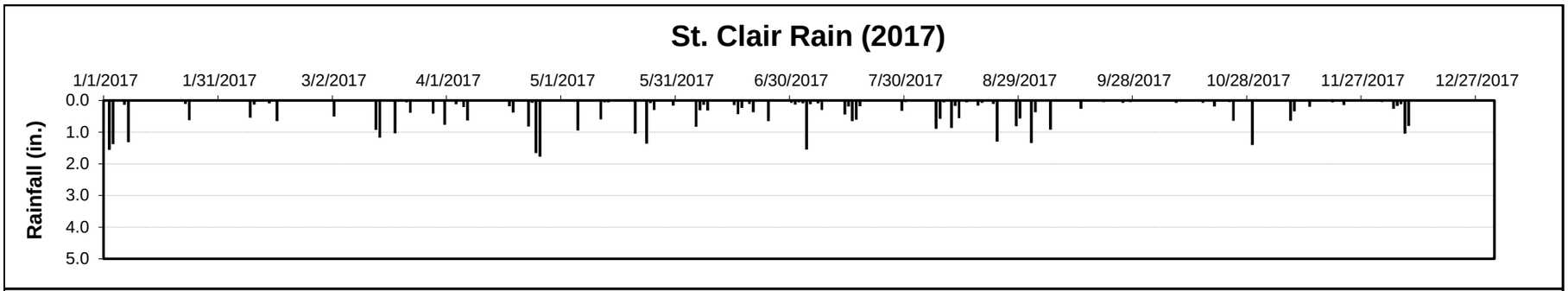


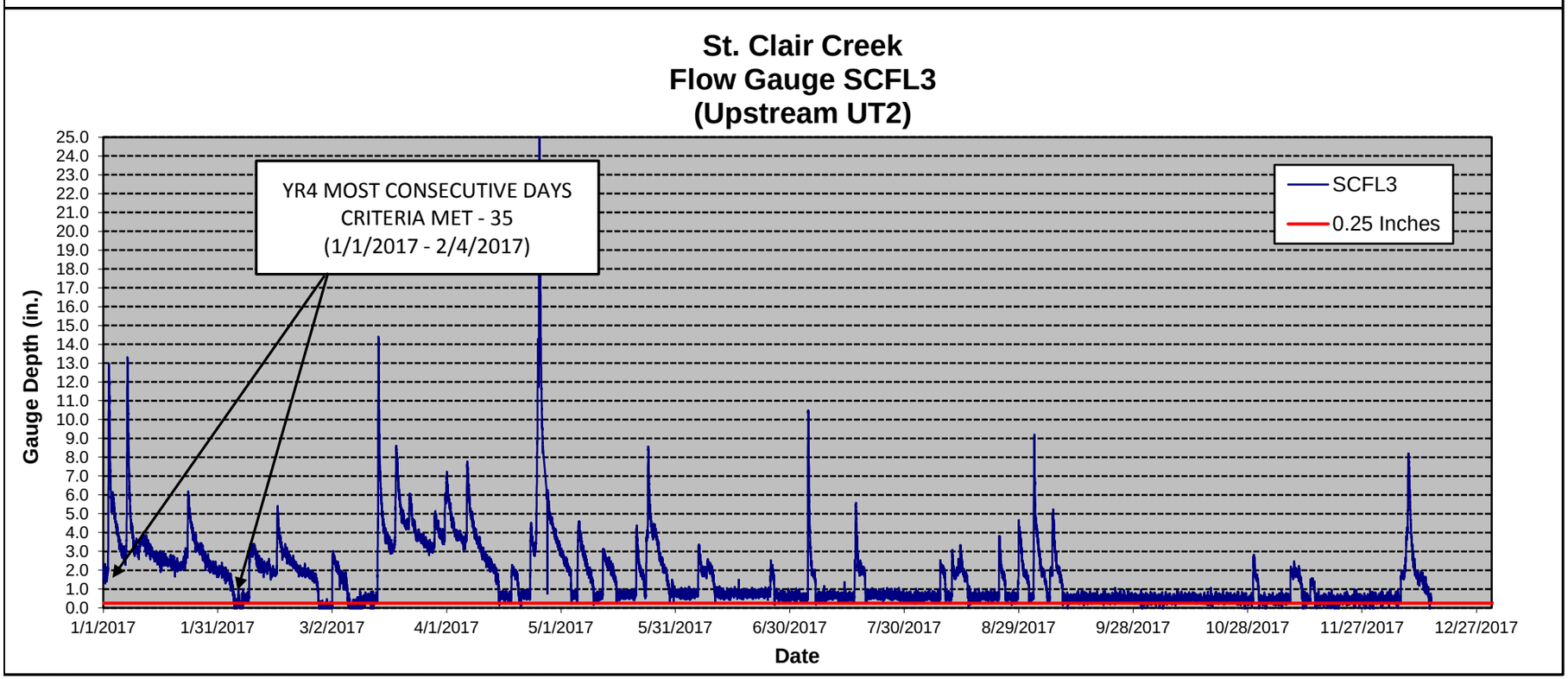
*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg



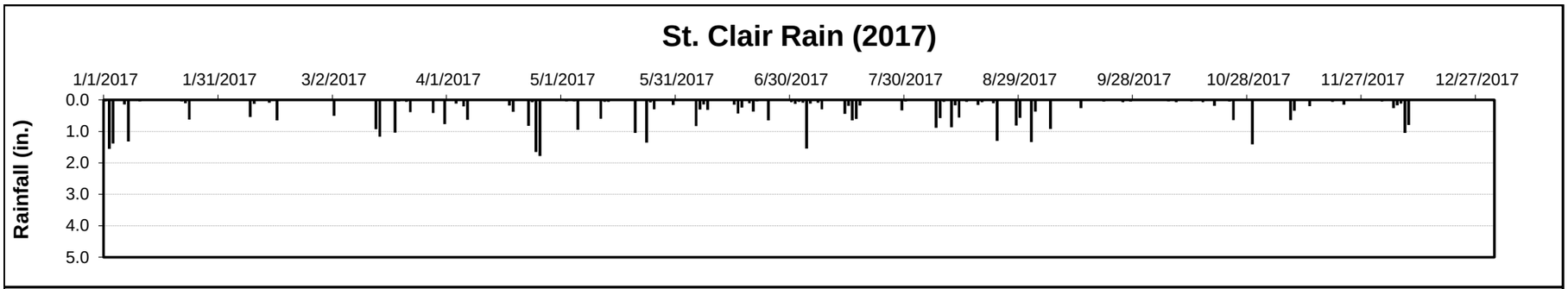


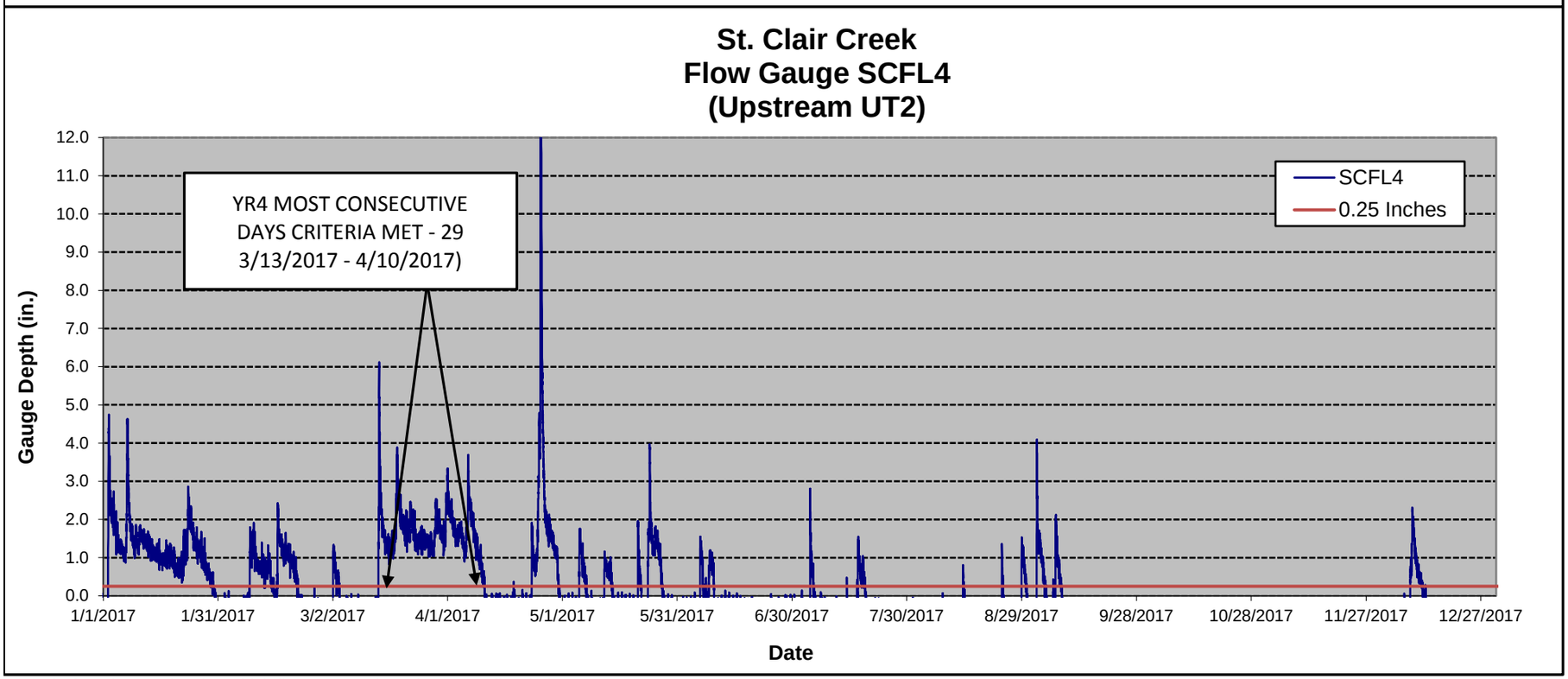
*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg



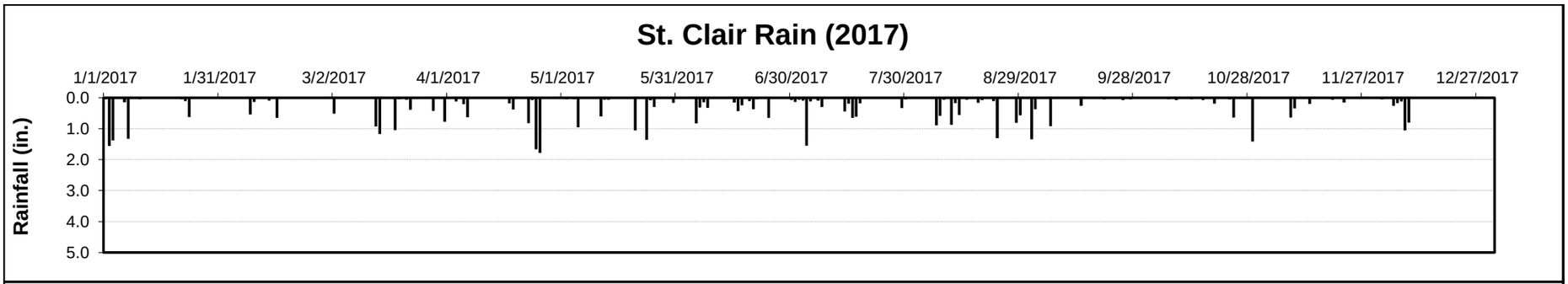


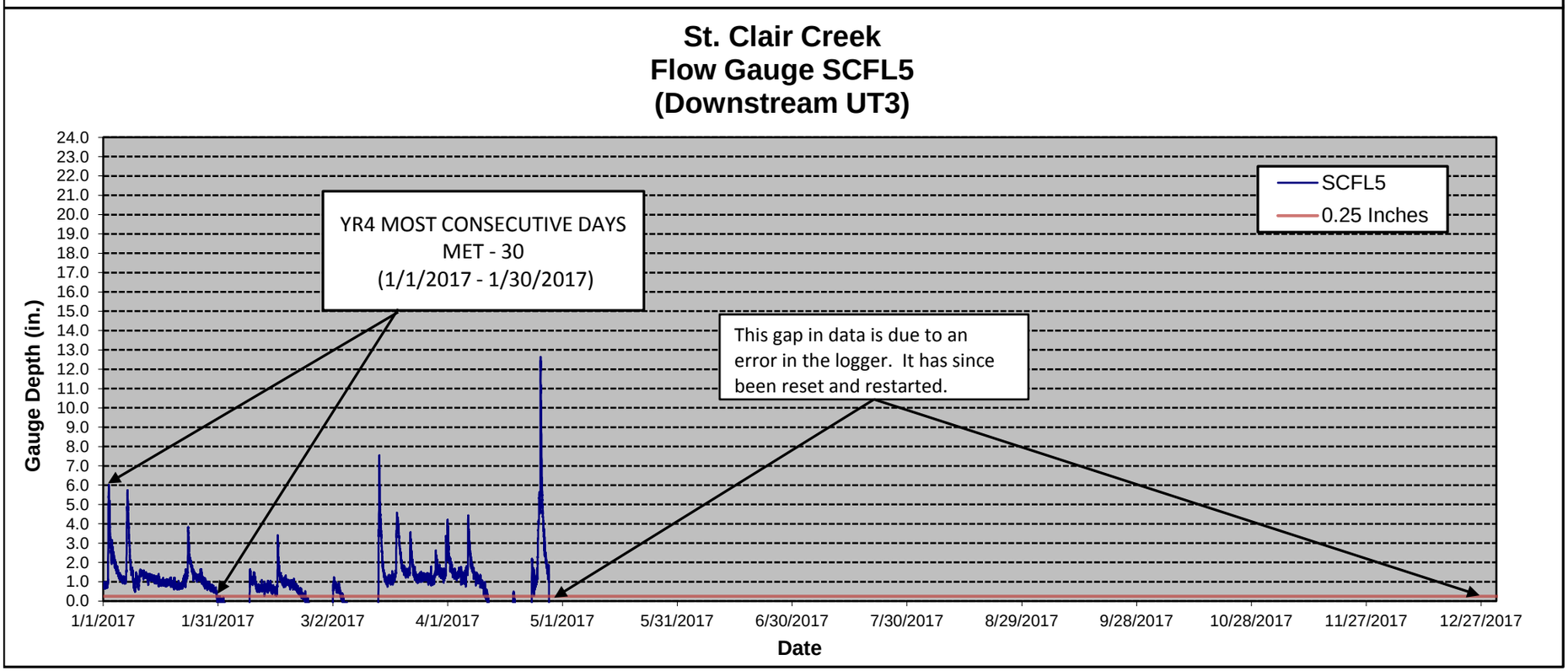
*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg



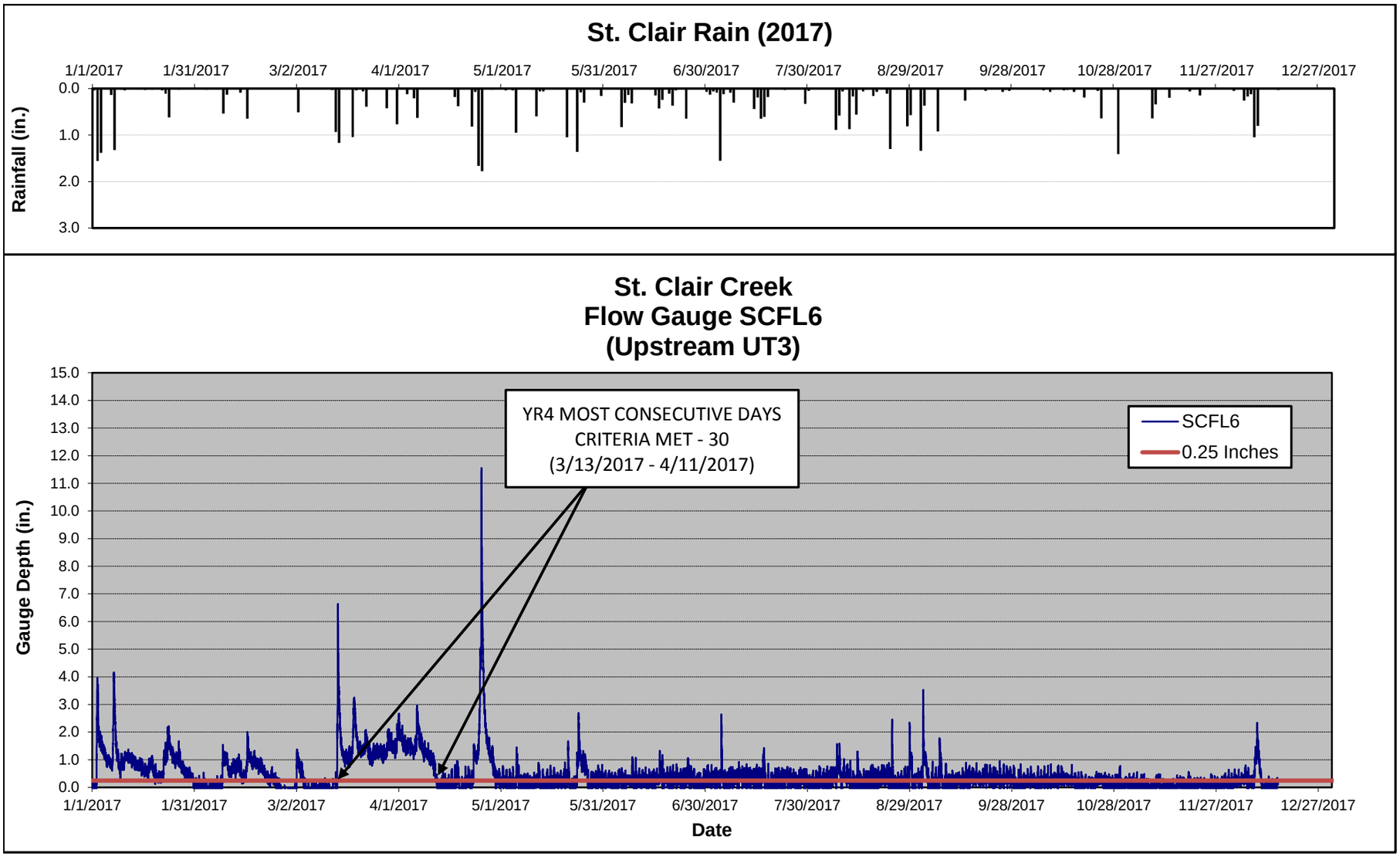


*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg



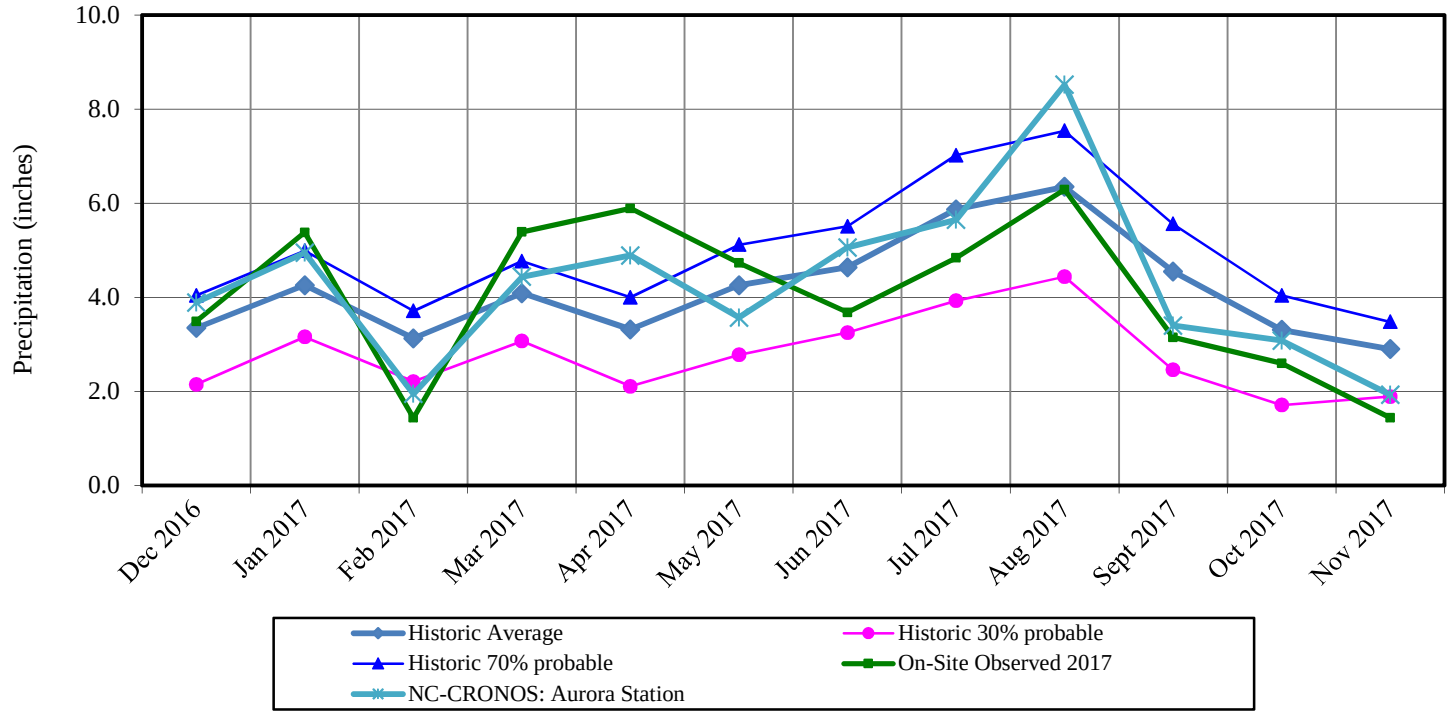


*0.25 inches denotes level at which flow occurs along the UT3 valley thalweg



*0.25 inches denotes level at which flow occurs along the UT3 valley thalweg

Figure 5. St. Clair Restoration Project
DMS Project No. 95015
Year 4 (2017) Observed Rainfall versus Historic Average



Note: Beaufort County historic average rainfall is 50.03 in, while observed previous 12 months rainfall total recorded onsite was 48.32 in, a deficit of 1.71 in.