St. Clair Creek Restoration Project
Year 3 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: 3 of 7 Year of Data Collection: 2016 Year of Completed Construction: 2014 Submission Date: January 2017
Submitted To:	NC DEQ – Division of Mitigation Services 1625 Mail Service Center Raleigh, NC 27699 NC DEQ Contract ID No. 003986

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Report Prepared and Submitted by Michael Baker International

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Michael Baker
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APPENDICES

1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 3,274 linear feet (LF) of perennial and intermittent 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 3 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 3 monitoring, is 607 stems per acre. The Year 3 data demonstrate that the Site has met the minimum success interim criteria of 320 trees per acre by the end of Year 3.

Following Year 2 monitoring, *Pinus taeda* (loblolly pine) was documented in the area of UT2. The loblolly pines were short but had the potential to pose a future threat to the survival of planted species installed during the construction phase. To prevent this nuisance species from affecting the planted stems, a thinning and

removal effort took place in March 2016, which targeted the loblolly pine. The methods used were hand/power tools and chemical applications.

Additionally, during the fall of Year 3 monitoring, loblolly pine was still documented in the area of UT2 as well as the UT3 area. The loblolly pines are dispersed across both reaches of the site. This nuisance species still has the potential to pose a future threat to the survival of planted species installed during the construction phase. Additional treatment of the loblolly pines are once again planned for treatment in during Year 4/2017. The methods to be used for treatment will again be hand/power tools and chemical applications.

In the fall of 2015, the restoration site landowner cut a network of drainage ditches adjacent to the easement boundaries of both UT2 and UT3 (shown as dashed green lines on Figure 3). The landowner implemented a plan to re-cut pre-existing lateral drainage ditches that joined a new deeper ditch that directly abuts the Site's conservation easements. These new ditches were cut on the eastern and western boundary of UT2 as well as the western boundary of UT3. The landowner cut the ditches with the intent to drain water away from his pine plantation that abuts both easement boundaries on the west and east. Additionally, the property and farm access road that lies to the north of the Site was also retaining water and needed to drain across the northern road into the conservation easement to prevent hydrologic trespass.

To remedy this ditching impact as described above, a proposed work plan described in Section 2.2.1 took place in three different locations: (1) The northern conservation easement boundary of UT 2 along the existing farm road, (2) the western conservation easement boundary of UT2 along the wetland restoration area, and (3) along the western conservation easement boundary of UT3 along the wetland restoration area.

To provide additional groundwater data during the monitoring period, four new monitoring wells were installed in April 2016, which is approximately 2 months after the beginning of the growing season. These four additional wells are providing additional wetland success data, as well as collecting groundwater levels adjacent to the areas where the additional ditching repairs took place. These four new wells were installed as shown in Figure 2.

Year 3 wetland groundwater monitoring demonstrated that 2 of 8 groundwater monitoring wells located along UT2 and UT3 exhibited water levels within 12 inches of the ground surface that was greater than 12 percent of the growing season. The eight on-site wetland monitoring wells demonstrated consecutive hydroperiods, which ranged from 3.9 to 13.1 percent of the growing season. The growing season for Beaufort County is from February 28 to December 6 (282 days). Additionally, during Year 3 monitoring, the on-site wetland reference wells, which are on the downstream portions of UT3, demonstrated consecutive hydroperiods, which ranged from 40.9 to 43.8percent of the growing season. It should be noted that the placement of the reference wells is further down valley then the monitoring wells and is more heavily influenced by backwater from St. Clair Creek.

On-site flow through the restored headwater valleys of UT2 and UT3 was recorded throughout 2016 by the use of pressure transducers. All six flow gauges installed on the Site recorded flow in 2016. The flow gauges documented flow through the headwater valleys during Year 3, which ranged from 45.6 to 85.7 consecutive days. It is noted that the flow gauges demonstrated similar flow events relative to rainfall events on site as demonstrated in the gauge graphs 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. No additional vegetation monitoring plots

are required to monitor buffer success as the existing monitoring plots serve to monitor the success of the vegetation of the headwater coastal plain stream and the 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 3 well and flow data were collected December 2016. All visual site assessment data contained in Appendix B were collected in October and 2016.

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 period of January 2016 through November 2016 was 44.91 inches, as compared to the Beaufort County WETS table for the same period of 46.68 inches annually.

Four automated flow gauges (pressure transducers) were installed in the UT2 channel as well as two flow gauges installed in the UT3 channel. The gauges were installed approximately 500 feet apart within the restored systems to document flow duration. Success criteria are considered to have been met if 30 consecutive days of flow were observed at any point during the monitoring year. Results indicate that all six flow gauges met the minimum consecutive days of surface flow required for success during Year 3. The complete flow data and observed rainfall graphs for each gauge, along with the flow gauge success summary Table 11 are 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, and flow gauges are located in Appendix B.

2.2 Wetland Assessment

Wetland monitoring is assessed by the use of eight automated groundwater-monitoring stations that are installed following construction in the UT2 and UT3 wetland restoration areas, as well as two additional reference wells installed in the downstream portion of the UT3 wetland restoration area. Installation of these groundwater monitoring stations follow Corps of Engineers Wetlands Research Program Technical Note VN-rs-4.1 (USACE 1997).

As described in Section 2.2.1, to provide additional groundwater data during the monitoring period, four new monitoring wells were installed at the beginning of the growing season in April 2016. These four additional wells provide additional wetland success data, as well as collect groundwater levels adjacent to the areas where the additional ditching repairs will take place. The four new wells installed as shown in Figure 2.

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 is saturated within 12 inches of the soil surface for a consecutive number of days equal to a minimum of 12% of the growing season (34 consecutive days at this site). Results indicate that only monitoring wells 1 and 5 met the minimum saturation success criteria (both adjacent to UT2). As-built monitoring wells 2, 3, 4 and supplemental monitoring wells 6, 7, 8 did not meet success during Year 3. It should be noted that wells 5 through 8 were installed between April 23rd and April 29th, thus missing collecting groundwater data for 55 to 61 days of the early growing season when groundwater levels are typically at their highest. The rainfall graphs should also be closely reviewed in Appendix D. Very little rain fell at the Site during the critical periods of early spring and late fall. The total rainfall for the year is not far from the historical average but the rain came in large quick events, which did not allow for slow and steady infiltration and groundwater recharge. Restoration well data and reference well data collected during Year 3 monitoring are located in Appendix D.

2.2.1 Wetland Concerns

Ditching

In the fall of 2015, the restoration site landowner cut a network of drainage ditches adjacent to the easement boundaries of both UT2 and UT3 (See Figure 3). The landowner implemented a plan to re-cut pre-existing ditches that joined a new deeper ditch that directly abuts the Site's conservation easements. These new ditches were cut on the eastern and western boundary of UT2 as well as the western boundary of UT3. The landowner cut the ditches with the intent to drain water away from his pine plantation that abuts both easement boundaries on the west and east. Additionally, the property and farm access road that lies to the north of the Site is also retaining water and needs to drain across the northern road into the conservation easement to prevent hydrologic trespass.

The work described above was designed and implemented without first consulting Baker. The ditches were first discovered during fall monitoring in fall 2015.

To remedy the potential impacts of the new ditch network on restored wetland functions, Baker implemented a work plan to alleviate the hydrologic trespass outside of the conservation easement and

filled the new ditches so wetland hydrology would be unimpaired. The proposed work took place in March 2016 in three different locations (Figure 3). (1) The northern conservation easement boundary of UT 2 along the existing farm road, (2) the western conservation easement boundary of UT2 along the wetland restoration area, and (3) along the western conservation easement boundary of UT3 along the wetland restoration area.

Location (1): Work in this area consisted of connecting existing shallow drainage ditches from an adjacent property across the farm road into the conservation easement of UT2. A shallow ditch (1' deep by 2' wide) was cut through the farm road and then filled with rip rap outside of the easement to allow water to filter through the rock (French drain) and move across the road, but also allows the landowner to cross easily. Once the rock-filled ditch reaches the conservation easement boundary, a shallow, wide, flat depression (10' wide by 1' deep with a 0% slope) was excavated to tie these depressions into the existing ground elevations within the conservation easement. The locations shown as pink lines on Figure 3 are to scale (length) and are aligned as such to utilize the existing drainage paths as discovered during a field visit for storm event. It was observed during Year 3 monitoring that flow now diffuses through these depressions. These areas within the conservation easement were seeded and re-planted with bare-root trees.

Location (2): Work in this area consisted of excavating shallow and wide depressions through the wetland restoration polygon along UT 2 to connect and help drain the existing lateral ditches outside the conservation easement that were plugged during construction. The depressions constructed are approximately 10' wide and 1' deep. The depression depth of 1’ was measured down from the existing ground surface inside the wetland area at the conservation easement boundary with the intent to prevent hydrologic trespass within the landowner's existing pine timber. The depression bottoms are significantly higher than the existing lateral ditch bottoms within the timber. The depressions are essentially a zero slope and rely on the hydraulic head from the groundwater within the timber to promote flow. The depressions were excavated inside the conservation easement only as far as needed to tie into the existing ground elevations. The constructed lengths of these depressions are shown to scale in Figure 3. The required excavations are shallower as the depressions get closer to the stream valley. In addition, the excavated ditch adjacent to the conservation easement was filled. This is shown as a green dashed line on the attached figure. The small amount of flow that this depression receives flows diffusely as observed during Year 3 monitoring. The disturbed areas within the conservation easement were seeded and re-planted with bare-root trees.

Location (3): Work in this area will consisted of removing a small (~5' wide) plug that separated the newly excavated ditch along UT3 (dashed green line in Figure 3) and existing small depressions within the conservation easement. These depressions were likely old remnant ditches excavated many years before the current conditions. These depressions are vegetated and shallow which serves to prevent hydrologic trespass in the timber areas outside the conservation easement between UT 2 and UT 3.

Additionally, at the time of construction it was determined based on field observations that an additional shallow ditch would need to be excavated to 151 feet through the wetland restoration polygon (Ditch 5) along UT 3 to connect and help drain the existing lateral ditches outside the conservation easement that were plugged during construction. The depressions constructed are approximately 10' wide and 1' deep. Little to no grading will be required inside the conservation easement along UT 3 except Ditch 5.

In addition, the excavated ditch adjacent to the conservation easement was filled. Construction of the proposed activities as described above was implemented in Year 3 (March 2016).

Logging Issues and Additional Monitoring Wells

It is noted that in the spring of 2015 three wetland restoration wells (SCAW1, SCAW2 and SCAW4) had accumulated bentonite/mud in the bottom of the well casings. A thick, gooey material was found to be clogging the water pressure sensors located in the bottom of the pressure transducers. This accumulation of material was suspected to be the likely the cause for the observed erroneous water levels recorded in the well casings. To verify groundwater depths and check for logger accuracy, manual groundwater measurements were recorded during three site visits and compared to datalogger readings in the appropriate date/time windows. The manual measurements were then used to determine if there were any significant differences in the recorded groundwater levels. After comparing the data, it was found that three wetland restoration loggers had errors in depth other than what was recorded manually. To correct this issue, all well casings, including SCAW3 were pumped to clear excess bentonite/mud that had built up and to prevent further buildup on the pressure sensors. The on-site reference wells were not pumped during this time. Additionally, links in the suspension chains from which the loggers hang in the well casings were also removed so the chain would be shorter. This was an effort to raise the loggers off the bottom of the well casings as to be above the bentonite/mud buildup. Subsequent to these adjustments, all on-site well data loggers now are free of bentonite and the atmospheric pressure hole is clear of any obstructions.

As stated in Section 2.2, four new (supplemental) monitoring wells were installed in April /2016. These additional wells will provide additional wetland success data, as well as collect groundwater levels in the areas adjacent to where the additional ditching repairs have taken take place. These four new wells were installed as shown in the CCPV (Figure 2).

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. The sizes of individual quadrants are 100 square meters for woody tree species.

Year 3 vegetation assessment information is provided in Appendix B and C.

2.3.1 Vegetation Concerns

Following Year 2 monitoring, *Pinus taeda* (loblolly pine) was documented in the area of UT2. The loblolly pines were short but had the potential to pose a future threat to the survival of planted species installed during the construction phase. To prevent this nuisance species from affecting the planted stems, a thinning and removal effort took place in March 2016 and targeted the loblolly pine. The methods used were hand/power tools and chemical applications.

Additionally, during the fall of Year 3 monitoring, *Pinus taeda* (loblolly pine) was still documented in the area of UT2 as well as the UT3 area. The loblolly pines were noted to be widely dispersed across both reaches of the site. This nuisance species still poses a future threat to the survival of planted species installed during the construction phase. Additional treatment of the loblolly pines are once again planned for treatment in during Year 4/2017. The methods to be used will be hand/power tools and chemical applications.

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.

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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.

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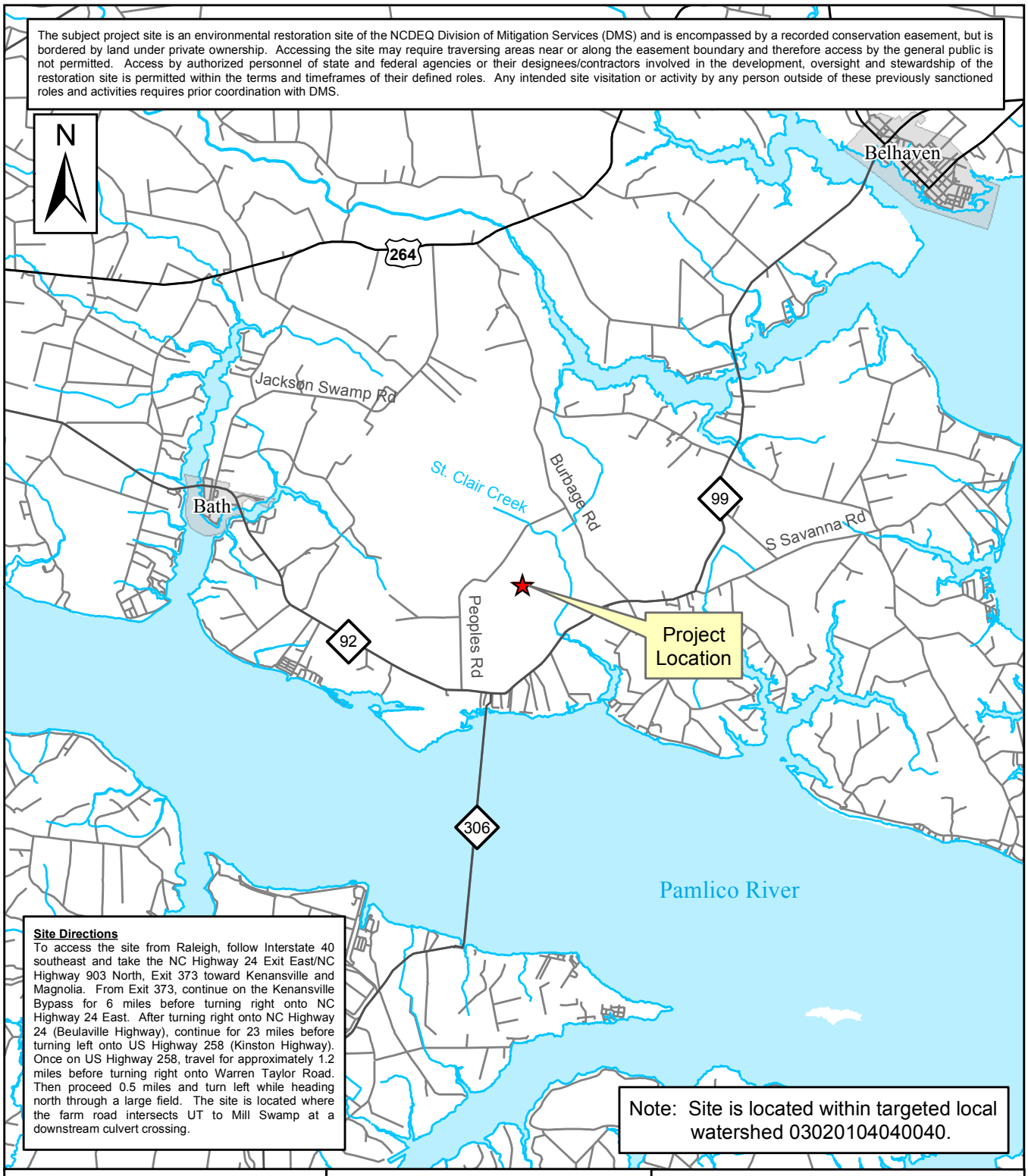
____. 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

____. 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

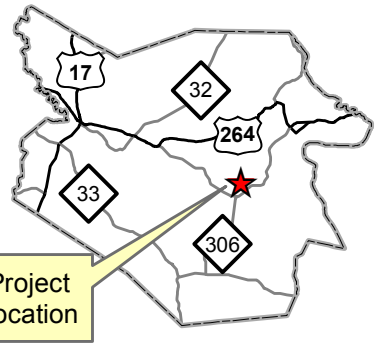


Figure 1
Project Vicinity Map
St. Clair Creek Restoration Site

NCDEQ -
Division of Mitigation Services

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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	N/A	N/A
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. 919-259-4814
Construction Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Phillip Todd, Tel. 919-582-3575
Planting Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Phillip Todd, Tel. 919-582-3575
Seeding Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Phillip Todd, Tel. 919-582-3575
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	8000 Regency Parkway, Suite 600 Cary, NC 27518
	Contact:
Stream Monitoring Point of Contact	Jacob Byers, Tel. 919-259-4814
Vegetation Monitoring Point of Contact	Jacob Byers, Tel. 919-259-4814
Wetland Monitoring Point of Contact	Jacob Byers, Tel. 919-259-4814

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

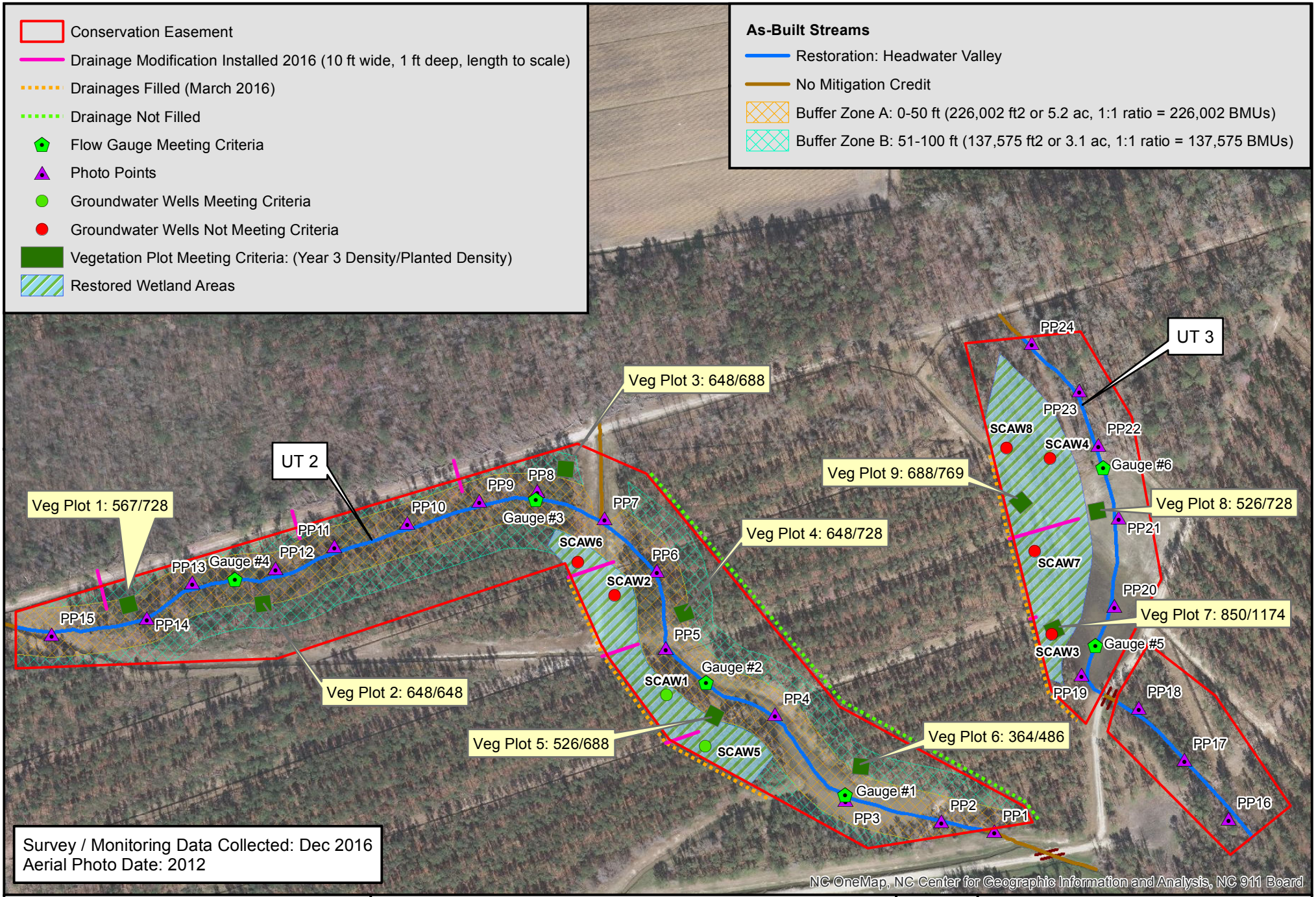
Project Information		
Project Name	St. Clair Creek Restoration Project	
County	Beaufort	
Project Area (acres)	17.5	
Project Coordinates (latitude and longitude)	35.452835 N, -76.76726215 W	
Watershed Summary Information		
Physiographic Province	Outer Coastal Plain	
River Basin	Tar-Pamlico	
USGS Hydrologic 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

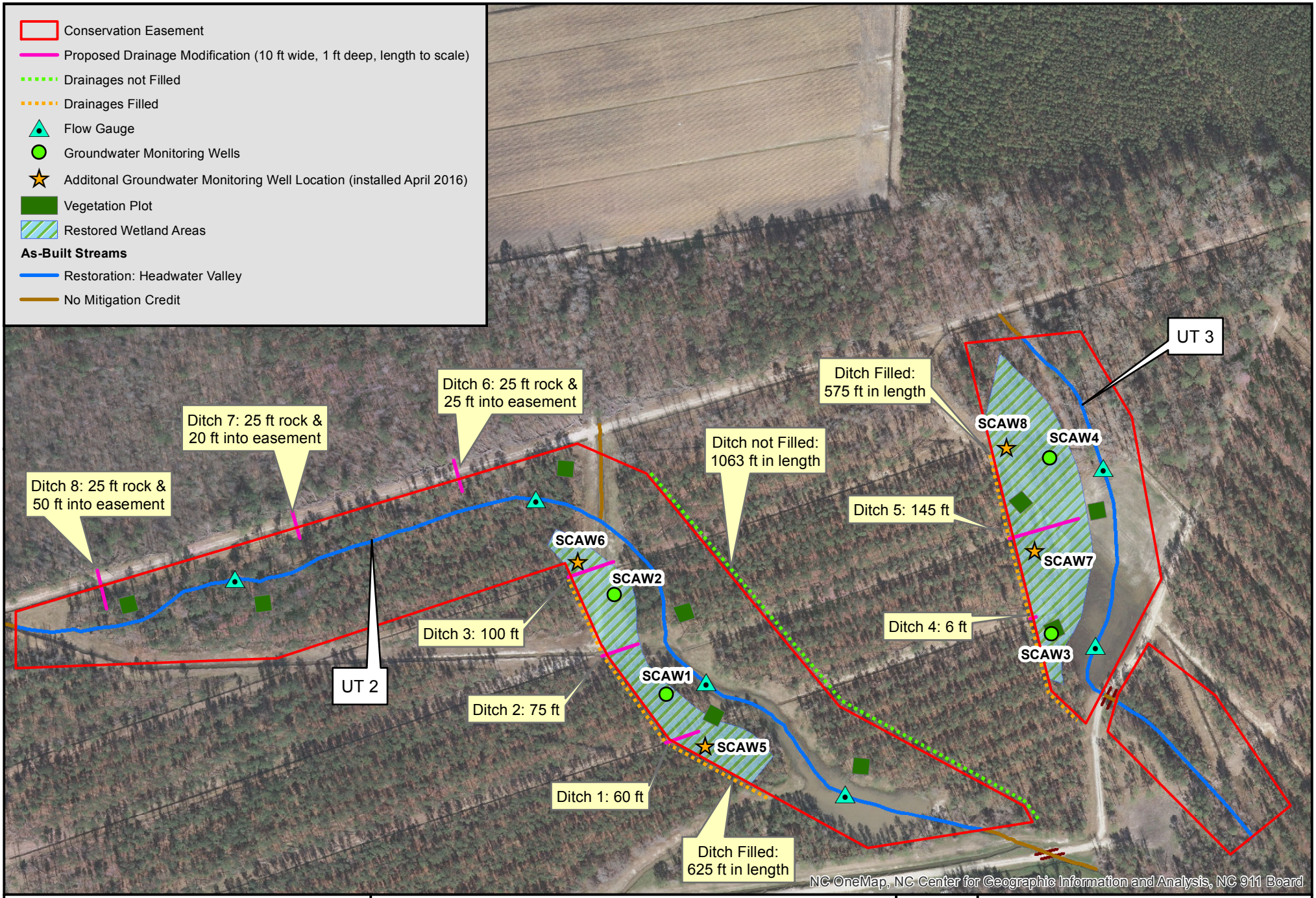
0 250 500 Feet

N

NCDEQ - Division of Mitigation Services
Project # 95015

Figure 2
Current Condition Plan View - MY3
St. Clair Creek Site
Beaufort County, NC

Rev: 28Mar2016



Michael Baker INTERNATIONAL

0 250 500 Feet

N

DEQ - Division of Mitigation Services
Project # 95015

Figure 3
Ditch Modification Map
St. Clair Creek Site
Beaufort County, NC

Rev: 23Jan2017

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	0	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 of points (if too small to render as polygons at map scale)	1000 ft²	NA	0	0.00	0.0%
6. Easement Encroachment Areas	Areas of 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
5. Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale)	1000 ft²	NA	0	0.00	0.0%
6. Easement Encroachment Areas	Areas of 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	Photo Number
Loblolly Pine (*Pinus taeda)*	Veg Plots 1, 2, 3, 4, 6, 7, 8, 9	Post-restoraton seed source	VP1, VP2. VP3, VP4, VP6, VP7, VP8, VP9

St. Clair Restoration Site – Longitudinal Stream Photo Stations

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

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

Photo Point 13 – UT2

Photo Point 14 – UT2

Photo Point 15 – UT2

Photo Point 16 – UT3

Photo Point 17 – UT3

Photo Point 18 – UT3

St. Clair Restoration Site – Longitudinal Stream Photo Stations

Photo Point 19 – UT3

Photo Point 20 – UT3

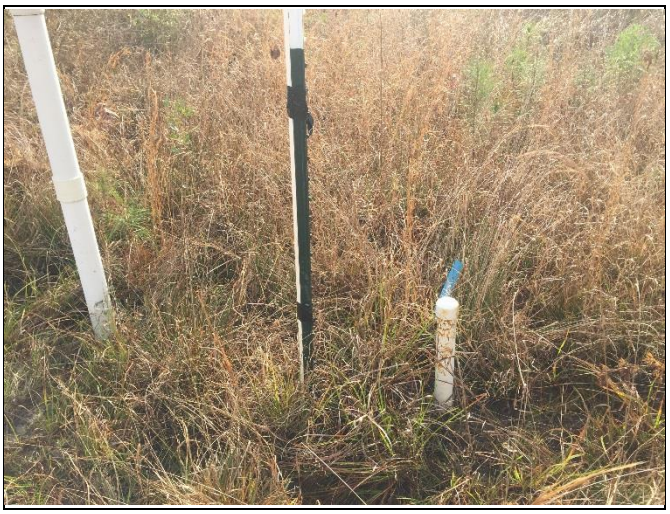
Photo Point 21 – UT3

Photo Point 22 – UT3

Photo Point 23 – UT3

Photo Point 24 – UT3

St. Clair Restoration Site - Hydrology Monitoring Stations



Auto Well – SCAW1, December 13, 2016

Auto Well – SCAW2, December 13, 2016

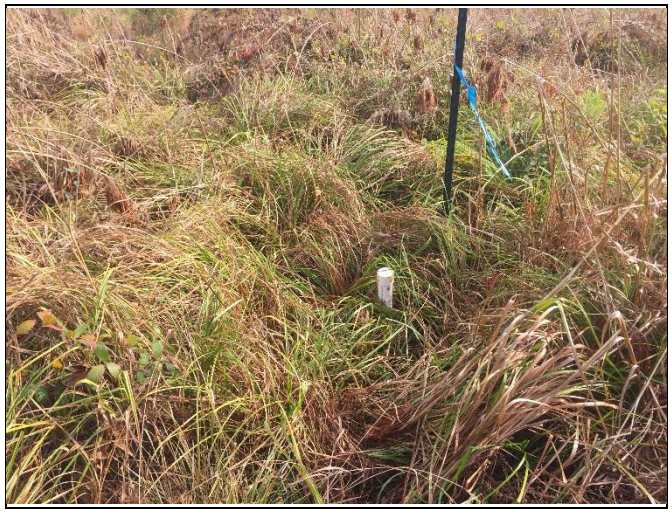
Auto Well – SCAW3, December 13, 2016

Auto Well – SCAW4, December 13, 2016

Supplemental Auto Well – SCAW5,
December 13, 2016

Supplemental Auto Well – SCAW6,
December 13, 2016

St. Clair Restoration Site - Hydrology Monitoring Stations



Supplemental Auto Well – SCAW7,
December 13, 2016

Supplemental Auto Well – SCAW8,
December 13, 2016

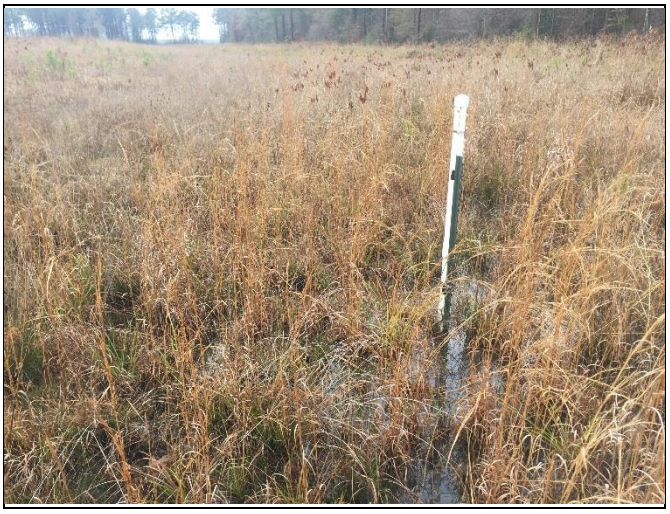
Reference Auto Well – SCREF1,
December 13, 2016

Reference Auto Well – SCREF2,
December 13, 2016

Flow Logger (UT2) – SCFL1, December 13, 2016
flow present

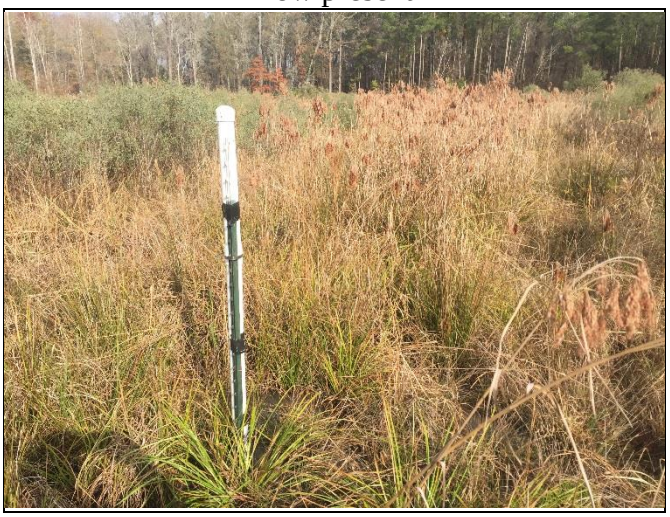
Flow Logger (UT2) – SCFL2, December 13, 2016
flow present

St. Clair Restoration Site - Hydrology Monitoring Stations



Flow Logger (UT2) – SCFL3, December 13, 2016
flow present

Flow Logger (UT2) – SCFL4, December 13, 2016
no flow present



Flow Logger (UT3) – SCFL5, December 13, 2016
slight flow present

Flow Logger (UT3) – SCFL6, December 13, 2016
no flow present

On-site rain gauge - adjacent to SCAW1,
December 13, 2016

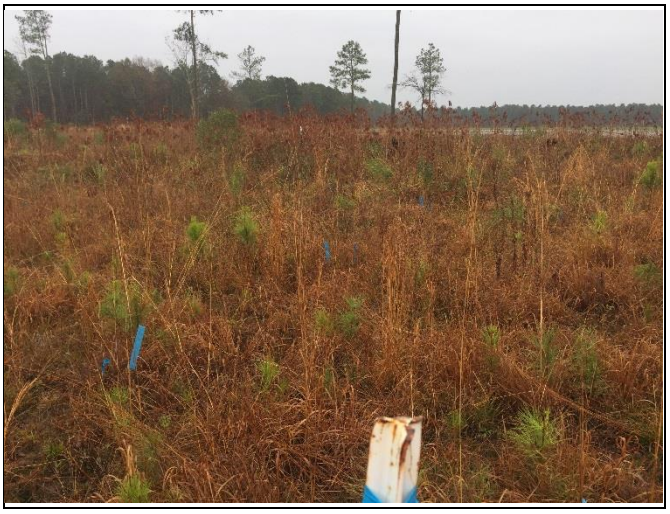
St. Clair Restoration Site – Vegetation Plot Photo Stations

Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

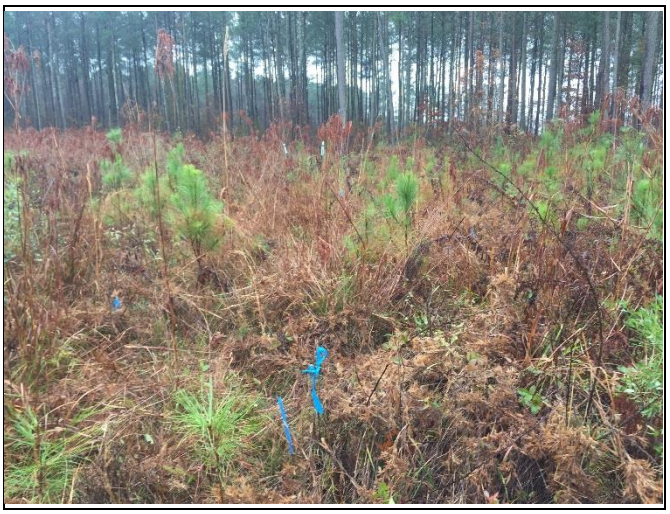
Vegetation Plot 4



Vegetation Plot 5

Vegetation Plot 6

St. Clair Restoration Site – Vegetation Plot Photo Stations



Vegetation Plot 7

Vegetation Plot 8

Vegetation Plot 9

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?	YR3 Planted Density / As-built Planted Stem Density*	Tract Mean
1	Y	567/728	607
2	Y	648/648	
3	Y	648/688	
4	Y	648/728	
5	Y	526/688	
6	Y	364/486	
7	Y	850/1174	
8	Y	526/728	
9	Y	688/769	

Note: *YR3 Planted Density / As-built Planted Stem Density - reflects the changes in stem density based on the density of stems at the time of the As-built survey and the current total density of stems .

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

Report Prepared By	Dwayne Huneycutt
Date Prepared	12/19/2016 9:39
database name	MichaelBaker_2016_StClair_95015.mdb
database location	L:\Monitoring\Veg Plot Info\CVS Data Tool\St Clair
computer name	CARYLRELLISON3
file size	50040832

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:3	plot 95015-01-0002-year:3	plot 95015-01-0003-year:3	plot 95015-01-0004-year:3	plot 95015-01-0005-year:3	plot 95015-01-0006-year:3	plot 95015-01-0007-year:3	plot 95015-01-0008-year:3	plot 95015-01-0009-year:3
		Aronia arbutifolia	Shrub	Red Chokeberry	6	3	2		4					1		1
		Carpinus caroliniana	Shrub Tree	American hornbeam	4	3	1.33		1					1		2
		Clethra alnifolia	Shrub	coastal sweetpepperbush	2	2	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	5	3	1.67		1					3	1	
		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	26	6	4.33	1	4		4	5	5	7		
		Quercus phellos	Tree	willow oak	12	6	2			5	1	2	1	2	1	
		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**	**135**	**15**		**14**	**16**	**16**	**16**	**13**	**9**	**21**	**13**	**17**

Table 9b. Stem Count for Each Species 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					3	1		
Quercus michauxii	swamp chestnut oak	1	4		4	5	5	7			
Quercus laurifolia	laurel oak	1		3		4					
Quercus lyrata	overcup oak	4	2	1		2		2	1	2	
Quercus phellos	willow oak			5	1	2	1	2	1		
Taxodium distichium	bald cypress		4	3	8		1				
Ulmus americana	American elm	1		4	2		1	4		7	
Shrub Species											
Clethra alnifolia	sweet pepperbush	1							1		
Carpinus caroliniana	ironwood		1					1		2	
Magnolia virginiana	sweetbay magnolia										
Persea palustris	swamp bay								2	4	
Callicarpa americana	beautyberry										
Cornus foemina	swamp dogwood										
Morella cerifera	wax Myrtle								1		
Vaccinium corymbosum	blueberry	1							2		
Viburnum dentatum	arrowwood	3					1		4		
Rosa palustris	swamp rose										
Ilex glabra	inkberry										
Aronia arbutifolia	chokeberry		4					1		1	
Stems Per Plot (December 2016)		14	16	16	16	13	9	21	13	17	Average Stems Per Acre
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

Scientific Name	Common Name	Species Type	Current Plot Data (MY3 2016)																									
			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		
			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				2		2
Clethra alnifolia	coastal sweetpepperbush	Shrub	1		1																			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																	2	2		4	4					1	1
Morella cerifera	wax myrtle	shrub																						1		1			
Nyssa sylvatica	blackgum	Tree				1		1													3		3	1		1			
Persea	bay	Tree																										2	2
Persea palustris	swamp bay	tree																						2		2	4		4
Pinus Taeda	loblolly pine	Tree		20	20		21	21		4	4		10	10					2	2		25	25		8	8			
Quercus laurifolia	laurel oak	Tree	1		1				3		3				4		4										2		2
Quercus lyrata	overcup oak	Tree	4		4	2		2	1		1				2		2				2		2	1		1			
Quercus michauxii	swamp chestnut oak	Tree	1		1	4		4				4		4	5		5	5		5	7		7						
Quercus pagoda	cherrybark oak	Tree		1	1																								
Quercus phellos	willow oak	Tree							5		5	1		1	2		2	1		1	2		2	1		1			
Salix nigra	black willow	Tree					1	1																					
Taxodium distichum	bald cypress	Tree				4		4	3		3	8		8				1		1									
Ulmus alata	winged elm	Tree											2	2													7		7
Ulmus americana	American elm	Tree	1		1				4		4	2		2				1		1	4		4						
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	21	35	16	22	38	16	4	20	16	12	28	13	0	13	9	4	13	21	29	50	13	8	21	17	3	20
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	2	10	6	2	8	5	1	6	5	2	7	4	0	4	5	2	7	8	2	10	8	1	9	6	2	8
Stems per ACRE			566.6	849.8	1416.4	647.5	890.3	1537.8	647.5	161.9	809.4	647.5	485.6	1133.1	526.1	0.0	526.1	364.2	161.9	526.1	849.8	1173.6	2023.4	526.1	323.7	849.8	688.0	121.4	809.4

Scientific Name	Common Name	Species Type	MY3 (2016)			MY2 (2015)			MY1 (2014)		
			P	V	T	P	V	T	P	V	T
Aronia arbutifolia	Red Chokeberry	Shrub	6		6	6		6	6		6
Carpinus caroliniana	American hornbeam	Tree	4		4	4		4	3		3
Clethra alnifolia	coastal sweetpepperbush	Shrub	2		2	2		2	1		1
Cornus foemina	stiff dogwood	Shrub Tree	0						2		2
Fraxinus pennsylvanica	green ash	Tree	5		5	5		5	4		4
Liquidambar styraciflua	sweetgum	Tree	0	7	7						
Morella cerifera	wax myrtle	shrub	1		1	1		1	1		1
Nyssa sylvatica	blackgum	Tree	5		5	7		7	6		6
Persea	bay	Tree	0	2	2						
Persea palustris	swamp bay	tree	6		6	6		6	6		6
Pinus Taeda	loblolly pine	Tree	0	90	90						
Quercus laurifolia	laurel oak	Tree	10		10	8		8	14		14
Quercus lyrata	overcup oak	Tree	12		12	14		14	17		17
Quercus michauxii	swamp chestnut oak	Tree	26		26	27		27	25		25
Quercus pagoda	cherrybark oak	Tree	0	1	1						
Quercus phellos	willow oak	Tree	12		12	15		15	11		11
Salix nigra	black willow	Tree	0	1	1						
Taxodium distichum	bald cypress	Tree	16		16	16		16	19		19
Ulmus alata	winged elm	Tree	7	2	9						
Ulmus americana	American elm	Tree	12		12	19		19	21		21
Unknown		Shrub or Tree	0						5		5
Vaccinium corymbosum	highbush blueberry	Shrub	3		3	5		5	5		5
Viburnum dentatum	southern arrowwood	Shrub	8		8	8		8	6		6
Stem count			135	103	238	143	0	143	152	0	152
size (ares)			9			9			9		
size (ACRES)			0.22			0.22			0.22		
Species count			23	6	21	15	0	15	17	0	17
Stems per ACRE			607.0	463.1	1070.2	643.0	0.0	643.0	683.5	0.0	683.5

Color for Density
Exceeds requirements by 10%

Color for Volunteers

P = Planted
V = Volunteers
T = Total

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

Year 3 (13-Dec-2016)

Vegetation Plot Summary Information

Plot #	Riparian Buffer Stems[1]	Stream/ Wetland Stems[2]	Live Stakes	Invasives	Volunteers[3]	Total[4]	Unknown Growth Form
1	14	14	0	0	21	**35**	0
2	16	16	0	0	22	**38**	0
3	16	16	0	0	4	**20**	0
4	16	16	0	0	12	**28**	0
5	13	13	0	0	0	**13**	0
6	9	9	0	0	4	**13**	0
7	21	21	0	0	29	**50**	0
8	13	13	0	0	8	**21**	0
9	17	17	0	0	3	**20**	0

Wetland/Stream Vegetation Totals

(per acre)

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
1	567	850	1416	Yes
2	647	890	1538	Yes
3	647	162	809	Yes
4	647	486	1133	Yes
5	526	0	526	Yes
6	364	162	526	Yes
7	850	1174	2023	Yes
8	526	324	850	Yes
9	688	121	809	Yes
Project Avg	**607**	**463**	**1070**	**Yes**

Riparian Buffer Vegetation Totals

(per acre)

Plot #	Riparian Buffer Stems[1]	Success Criteria Met?
1	14	Yes
2	16	Yes
3	16	Yes
4	16	Yes
5	13	Yes
6	9	Yes
Project Avg	**566**	**Yes**

Stem Class	Characteristics
[1]Buffer Stems	Native planted hardwood trees. Does NOT include shrubs. 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 Restoration Project: DMS 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[1]			Cumulative Days Meeting Criteria[3]		
	Year 3 (2016)	Year 2 (2015)	Year 1 (2013)	Year 3 (2016)	Year 2 (2015)	Year 1 (2013)	Year 3 (2016)	Year 2 (2015)	Year 1 (2013)	Year 3 (2016)	Year 2 (2015)	Year 1 (2013)
Wetland Monitoring Wells (Installed September 2013)												
SCAW1	13.1	12.3	1.0	37.0	34.8	2.8	61.7	39.3	8.5	174.0	110.8	24.0
SCAW2	9.2	3.3	3.8	26.0	9.3	10.8	19.9	16.1	30.6	56.0	45.5	86.3
SCAW3	9.6	13.4	2.3	27.0	37.8	6.5	44.3	37.5	9.4	125.0	105.8	26.5
SCAW4	6.0	12.3	7.8	17.0	34.8	22.0	35.8	20.3	17.3	101.0	57.3	48.8
Supplemental Wetland Monitoring Wells (Installed April 2016)												
****SCAW5**	12.8	--	--	36.0	--	--	46.8	--	--	132.0	--	--
****SCAW6**	3.9	--	--	11.0	--	--	19.9	--	--	56.0	--	--
****SCAW7**	9.6	--	--	27.0	--	--	33.0	--	--	93.0	--	--
****SCAW8**	4.6	--	--	13.0	--	--	22.0	--	--	62.0	--	--
Reference Wells (Installed September 2013)												
SCAWREF1	40.9	57.9	24.8	115.3	163.3	70.0	77.9	93.7	46.4	219.8	264.3	130.8
SCAWREF2	43.8	60.1	27.0	123.5	169.5	65.5	76.9	94.1	44.5	216.8	265.5	125.5

Notes:

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

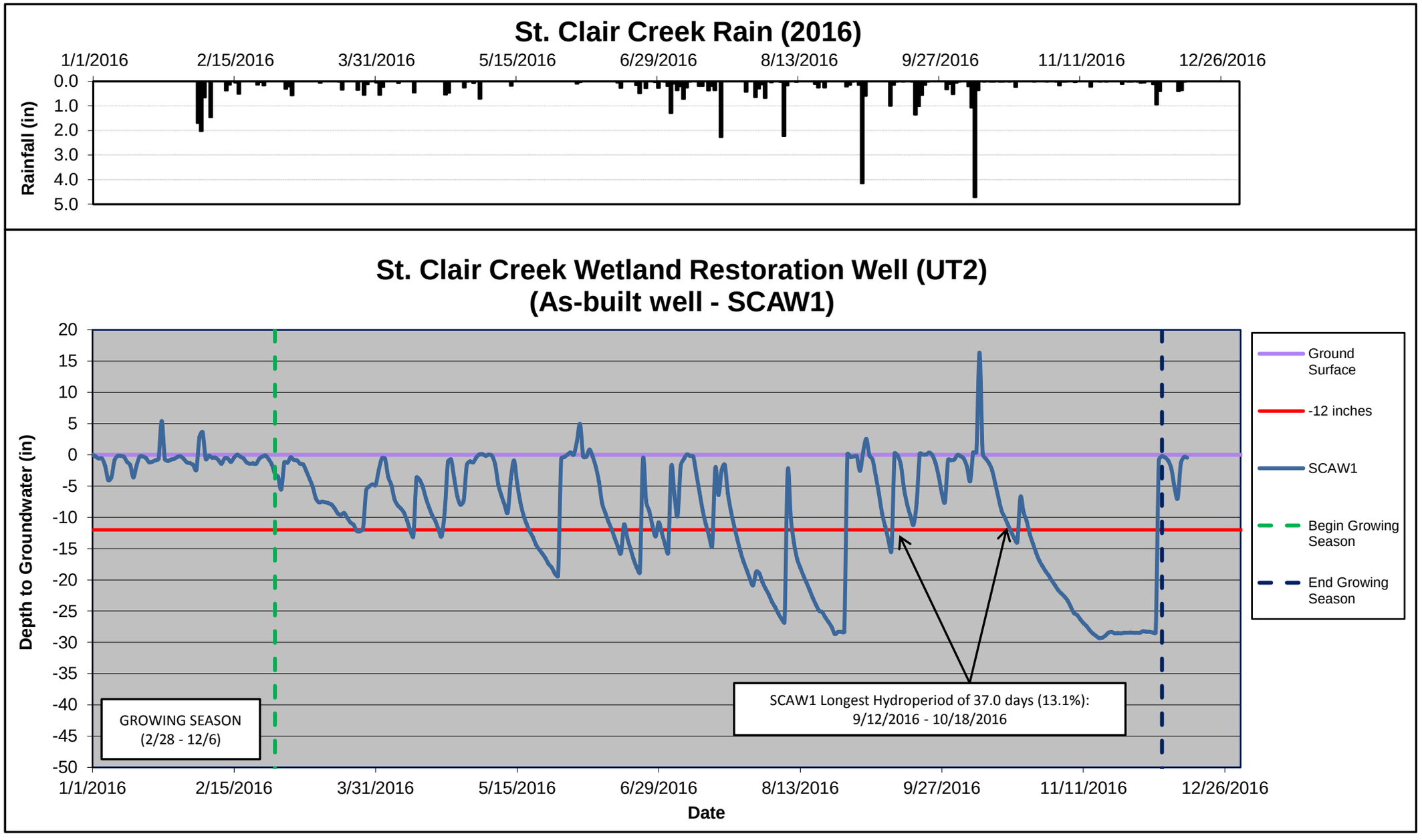
[2]Indicates the most consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

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

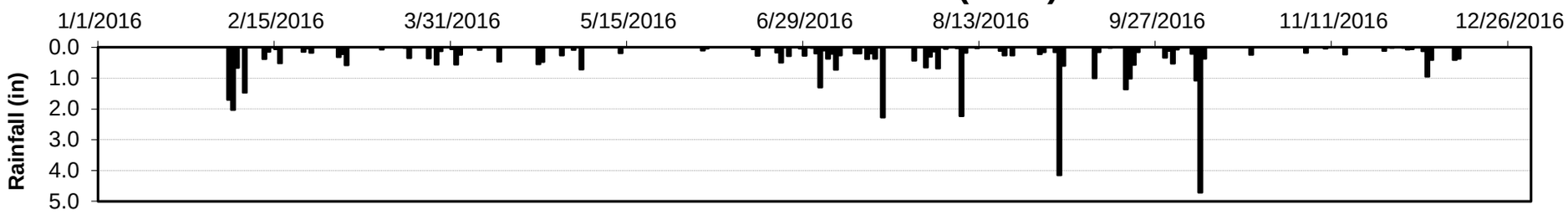
Growing season for Beaufort County is from February 28 to December 6 and is **282** days long. 12% of the growing season is **33.8** days.

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. Following Year 3 wetland monitoring, two of eight wells exhibited hyrdroperiods greater than 12% during the 2016 growing season. These wells will be observed closely throughout monitoring Year 4.

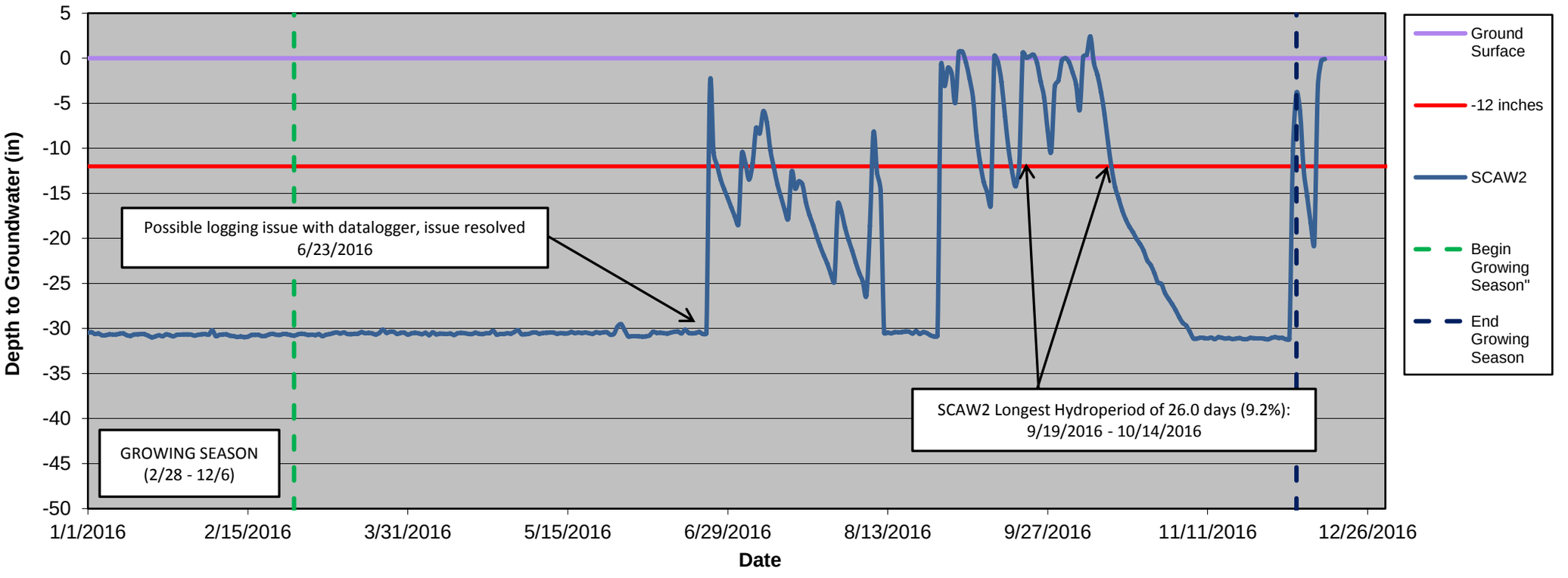
**To gather additional well data in the wetland restoration area, In-Situ groundwater monitoring dataloggers SCAW5 - SCAW 8 were installed in April 2017. The installation of the additional dataloggers was completed during the 2016 spring wet season when groundwater levels are normally closer to the ground surface.

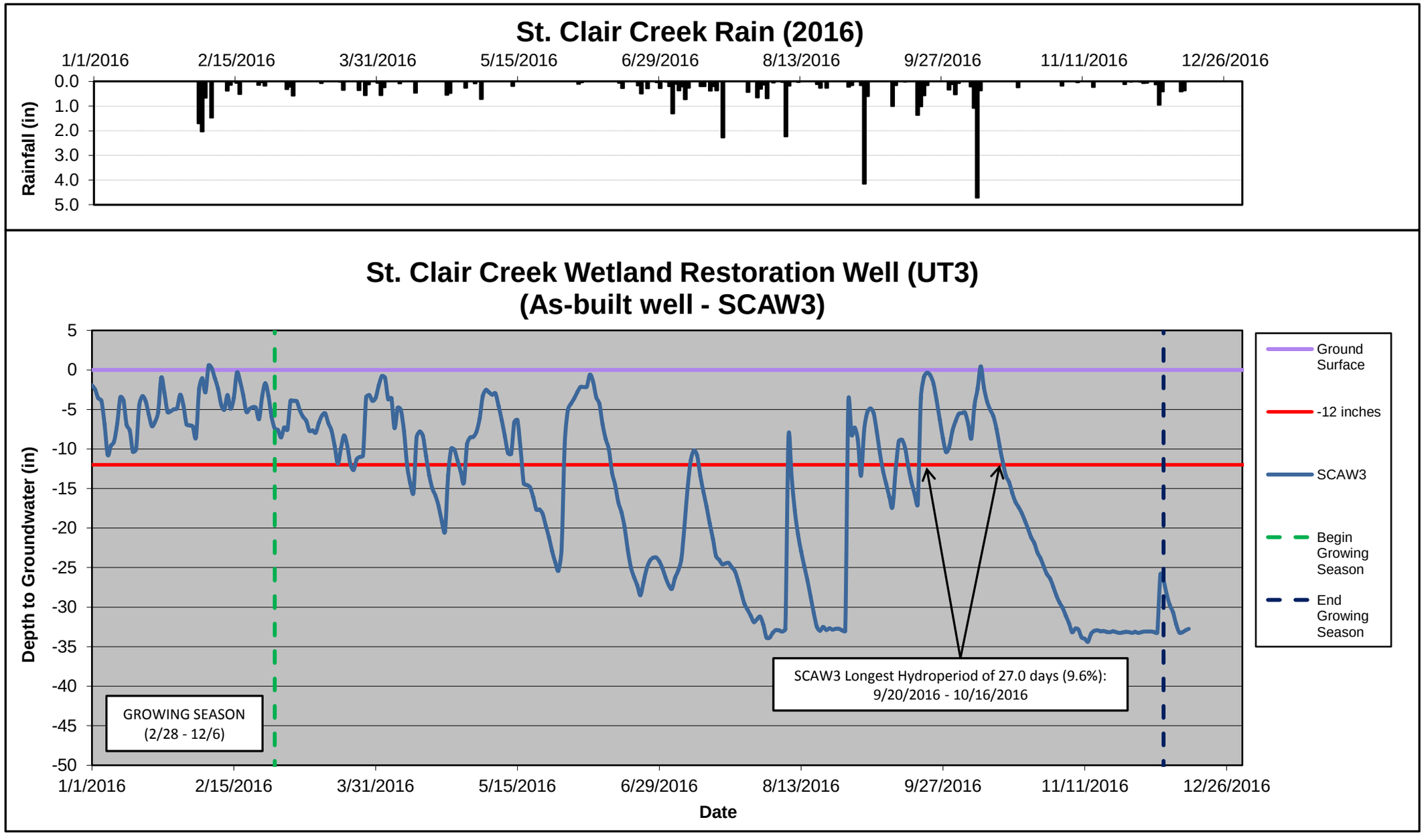

St. Clair Creek Rain (2016)
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
St. Clair Creek Wetland Restoration Well (UT2)
(As-built well - SCAW1)
Depth to Groundwater (in)
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Ground Surface
-12 inches
SCAW1
Begin Growing Season
End Growing Season
GROWING SEASON
(2/28 - 12/6)
SCAW1 Longest Hydroperiod of 37.0 days (13.1%):
9/12/2016 - 10/18/2016
Date

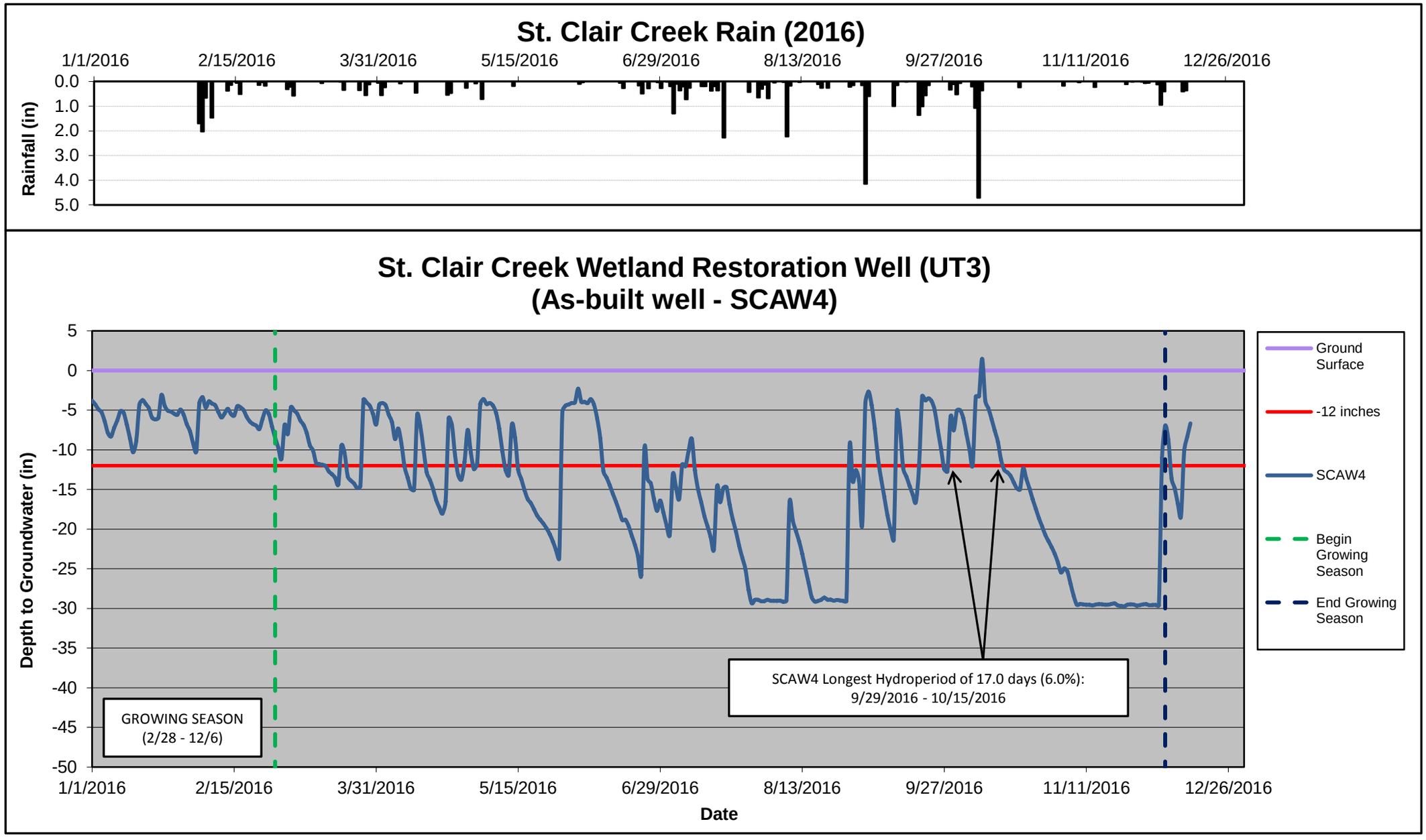
St. Clair Creek Rain (2016)

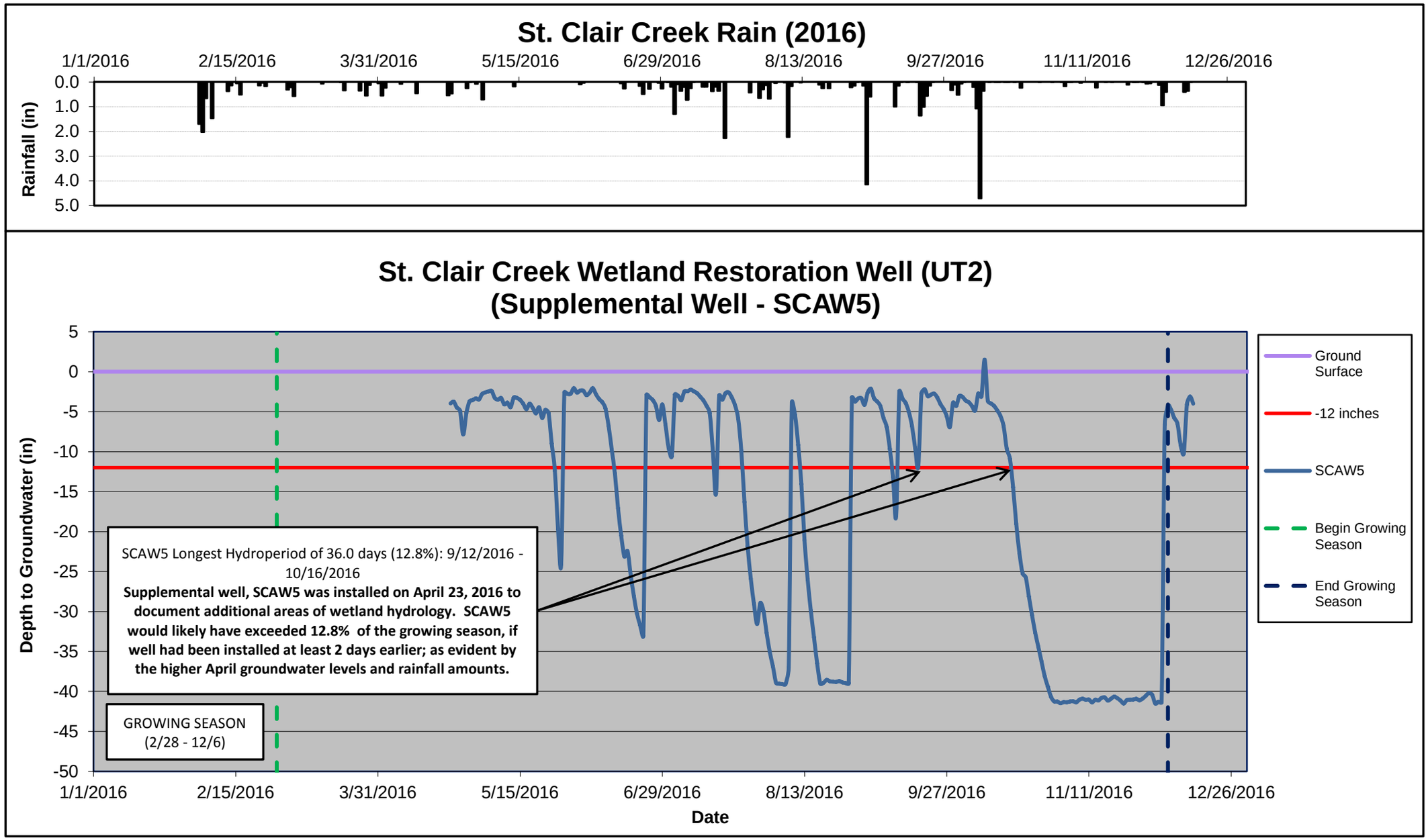


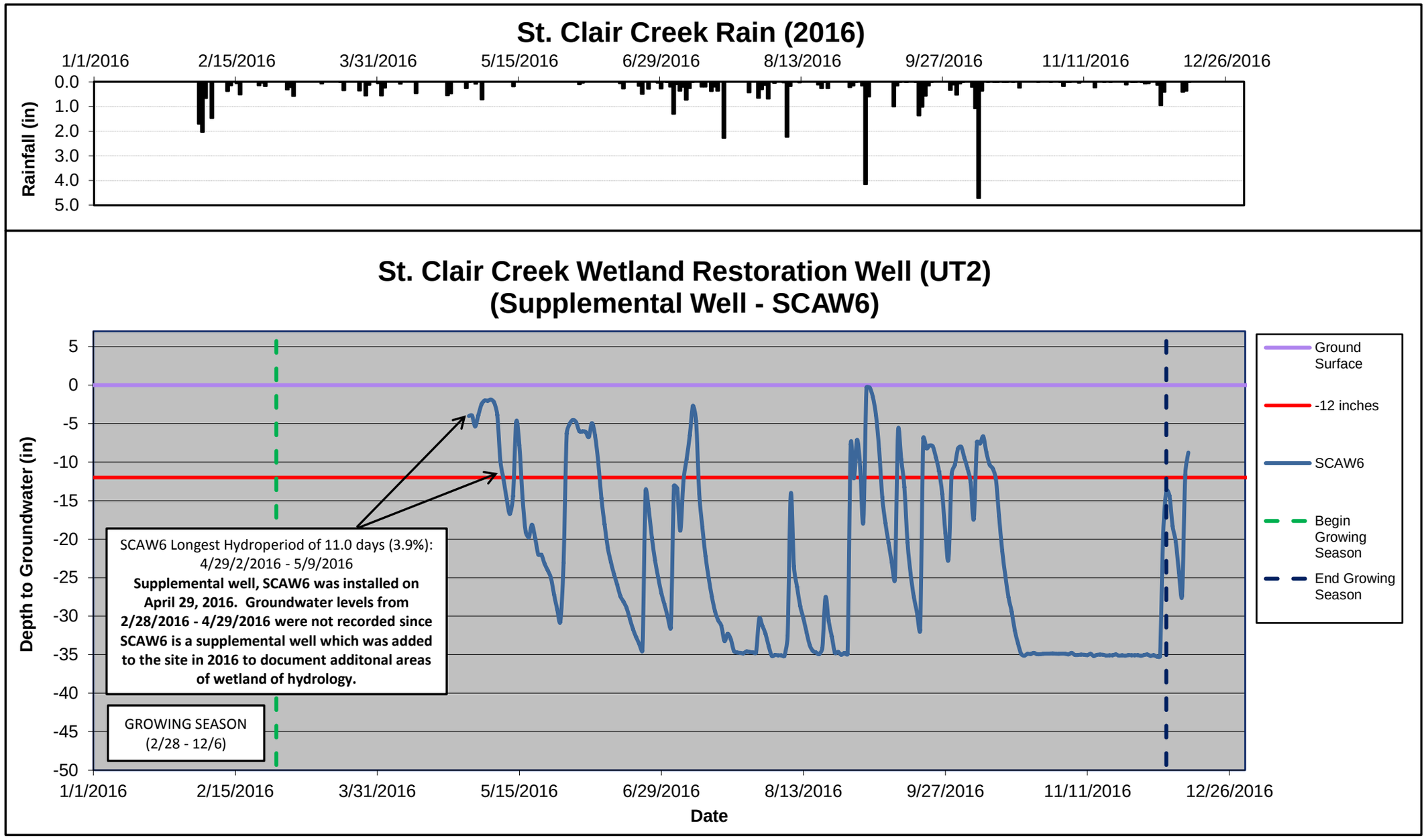
St. Clair Creek Wetland Restoration Well (UT2)
(As-built well - SCAW2)

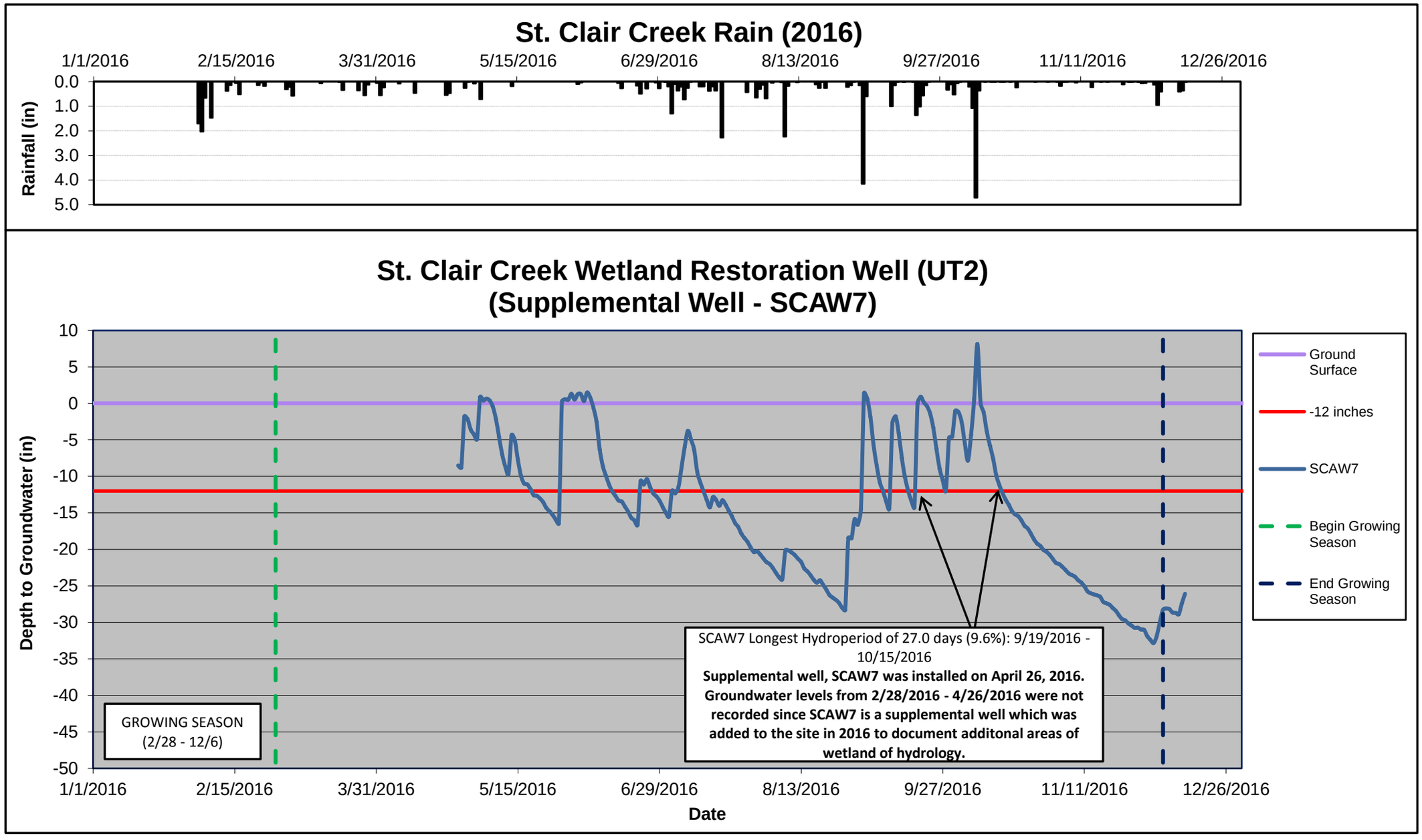


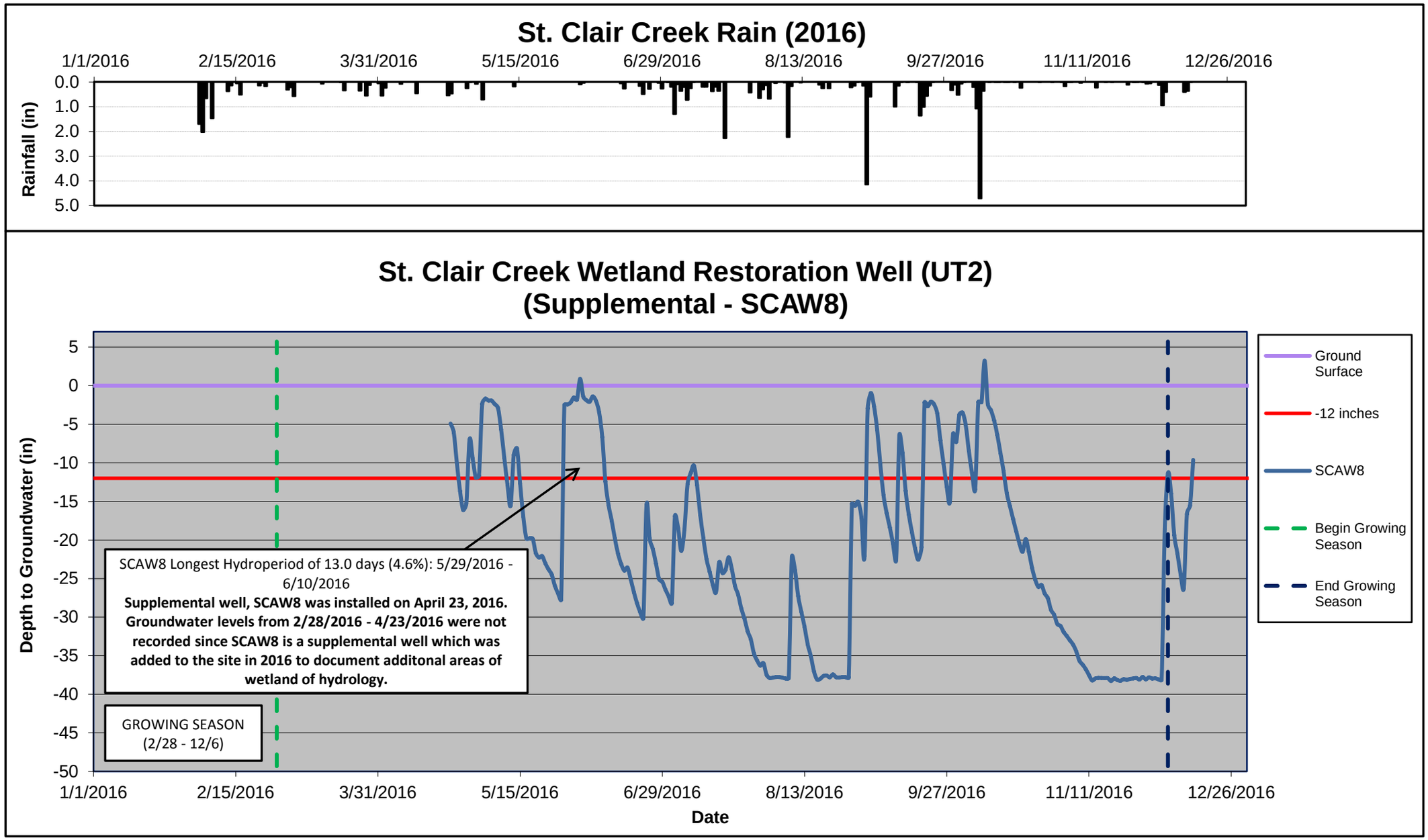

St. Clair Creek Rain (2016)
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT3)
(As-built well - SCAW3)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Ground Surface
-12 inches
SCAW3
Begin Growing Season
End Growing Season
GROWING SEASON
(2/28 - 12/6)
SCAW3 Longest Hydroperiod of 27.0 days (9.6%):
9/20/2016 - 10/16/2016
Date

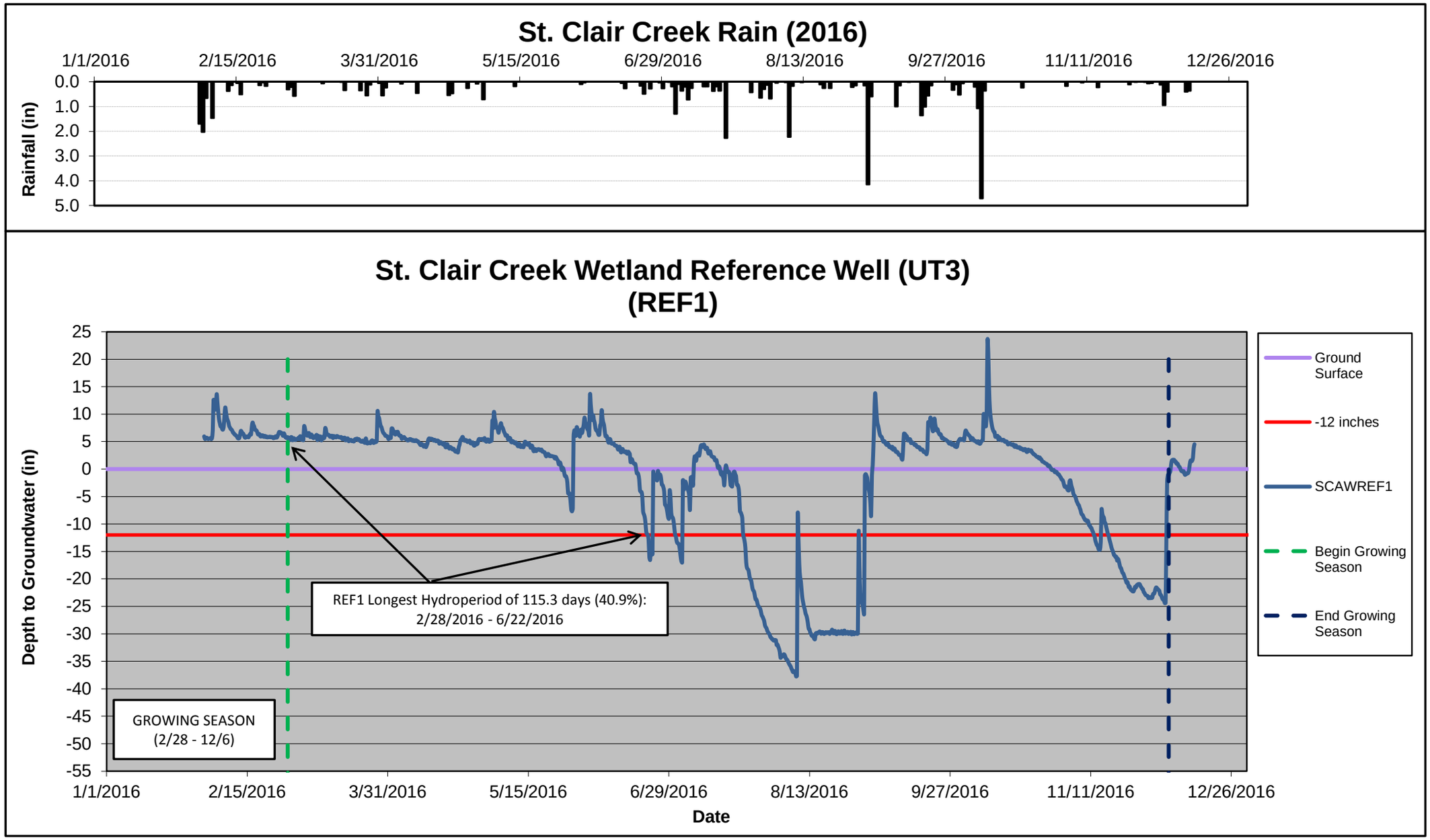

St. Clair Creek Rain (2016)
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT3)
(As-built well - SCAW4)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Ground Surface
-12 inches
SCAW4
Begin Growing Season
End Growing Season
GROWING SEASON
(2/28 - 12/6)
SCAW4 Longest Hydroperiod of 17.0 days (6.0%):
9/29/2016 - 10/15/2016
Date


St. Clair Creek Rain (2016)
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
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
-45
-50
Ground Surface
-12 inches
SCAW5
Begin Growing Season
End Growing Season
SCAW5 Longest Hydroperiod of 36.0 days (12.8%): 9/12/2016 - 10/16/2016
Supplemental well, SCAW5 was installed on April 23, 2016 to document additional areas of wetland hydrology. SCAW5 would likely have exceeded 12.8% of the growing season, if well had been installed at least 2 days earlier; as evident by the higher April groundwater levels and rainfall amounts.
GROWING SEASON
(2/28 - 12/6)
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
Date


St. Clair Creek Rain (2016)
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
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
-45
-50
SCAW6 Longest Hydroperiod of 11.0 days (3.9%):
4/29/2/2016 - 5/9/2016
Supplemental well, SCAW6 was installed on April 29, 2016. Groundwater levels from 2/28/2016 - 4/29/2016 were not recorded since SCAW6 is a supplemental well which was added to the site in 2016 to document additonal areas of wetland of hydrology.
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW6
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2016)
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
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)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Ground Surface
-12 inches
SCAW7
Begin Growing Season
End Growing Season
GROWING SEASON
(2/28 - 12/6)
SCAW7 Longest Hydroperiod of 27.0 days (9.6%): 9/19/2016 - 10/15/2016
Supplemental well, SCAW7 was installed on April 26, 2016. Groundwater levels from 2/28/2016 - 4/26/2016 were not recorded since SCAW7 is a supplemental well which was added to the site in 2016 to document additonal areas of wetland of hydrology.
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
Date


St. Clair Creek Rain (2016)
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental - SCAW8)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Ground Surface
-12 inches
SCAW8
Begin Growing Season
End Growing Season
SCAW8 Longest Hydroperiod of 13.0 days (4.6%): 5/29/2016 - 6/10/2016
Supplemental well, SCAW8 was installed on April 23, 2016. Groundwater levels from 2/28/2016 - 4/23/2016 were not recorded since SCAW8 is a supplemental well which was added to the site in 2016 to document additonal areas of wetland of hydrology.
GROWING SEASON
(2/28 - 12/6)
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
Date


St. Clair Creek Rain (2016)
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
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 115.3 days (40.9%):
2/28/2016 - 6/22/2016
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAWREF1
Begin Growing Season
End Growing Season
Date

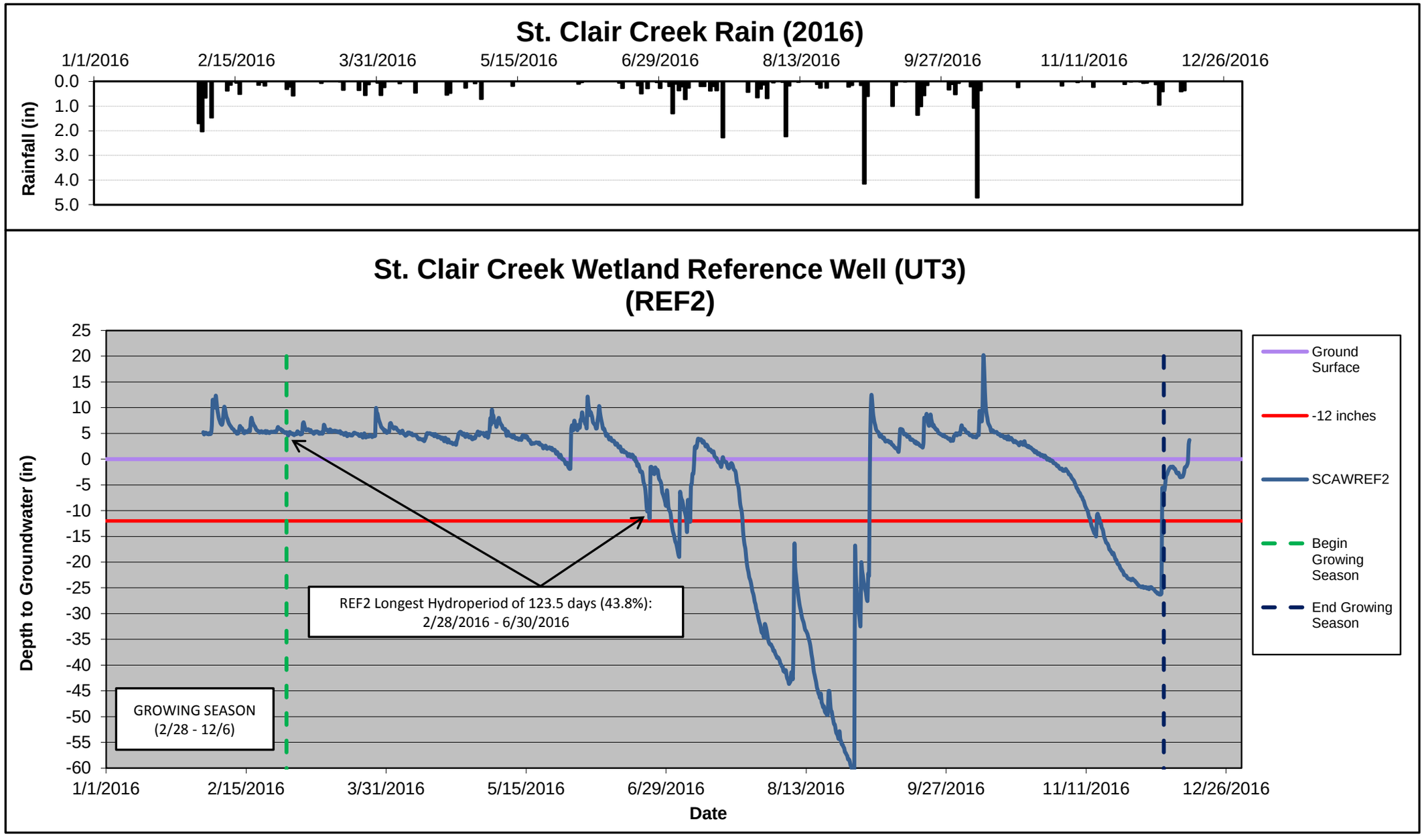

St. Clair Creek Rain (2016)
1/1/2016
2/15/2016
3/31/2016
5/15/2016
6/29/2016
8/13/2016
9/27/2016
11/11/2016
12/26/2016
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Reference Well (UT3)
(REF2)
Depth to Groundwater (in)
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
REF2 Longest Hydroperiod of 123.5 days (43.8%):
2/28/2016 - 6/30/2016
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAWREF2
Begin Growing Season
End Growing Season
Date

Figure 6. St. Clair Restoration Project
DMS Project No. 95015
Year 3/2016 Observed Rainfall versus Historic Average

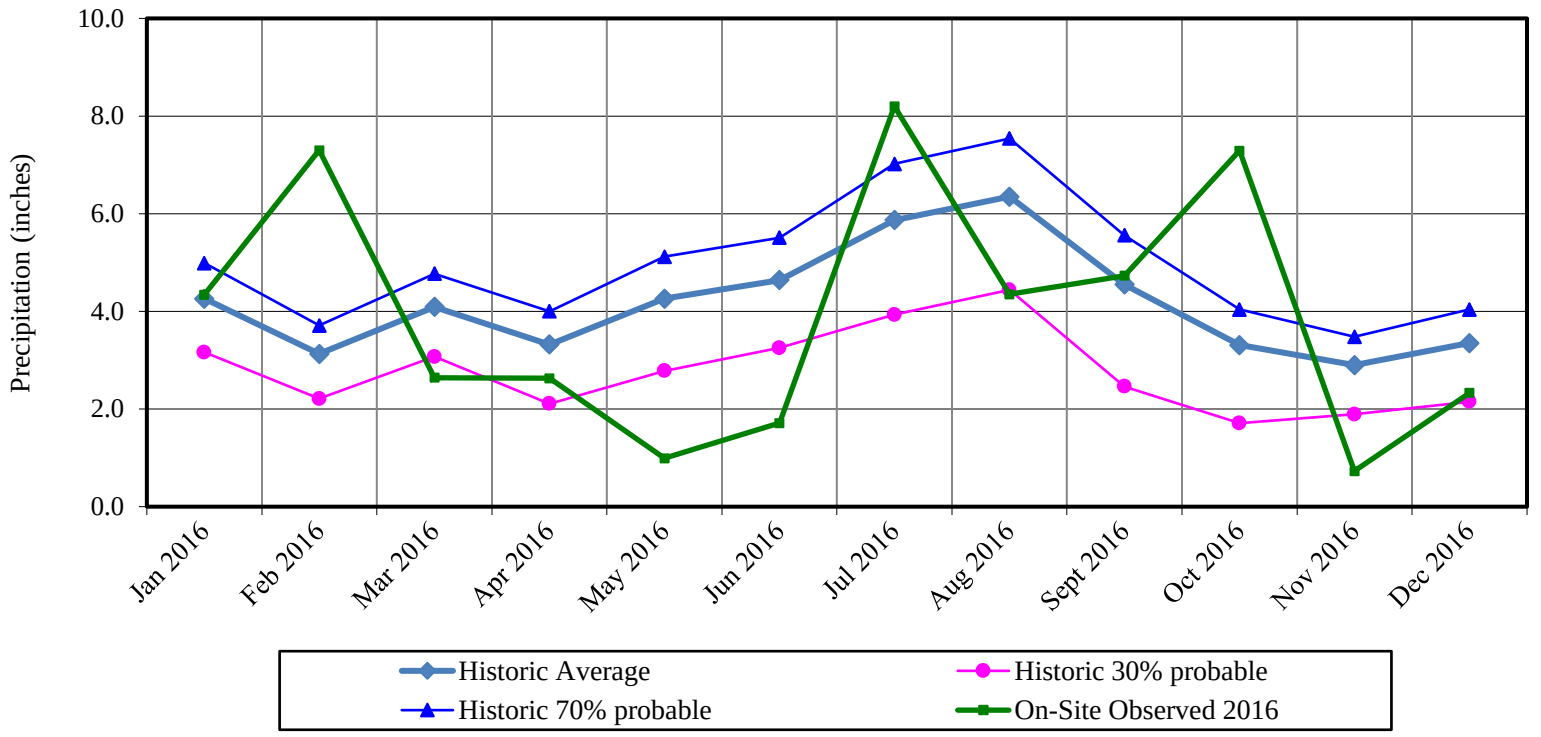


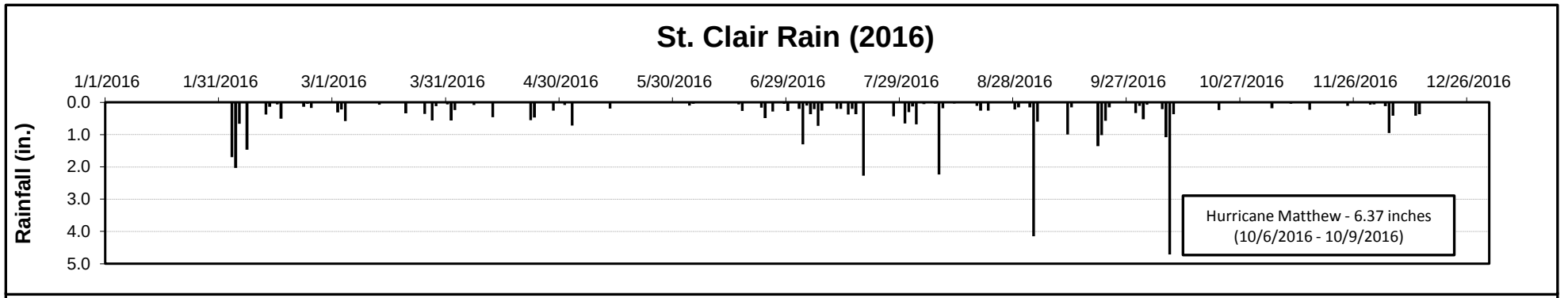
Table 11. St. Clair Creek Flow Gauge Success (Year 3)		
St. Clair Creek Restoration Project: DMS Project ID No. 95019		
Gauge ID	**Consecutive Days Meeting Criteria[1]**	**Cumulative Days Meeting Criteria[2]**
UT2 Flow Gauges		
SCFL1	83.0	223.6
SCFL2	84.0	231.6
SCFL3	85.7	202.6
SCFL4	45.6	123.7
UT3 Flow Gauges		
SCFL5	61.1	162.0
SCFL6	61.2	179.5

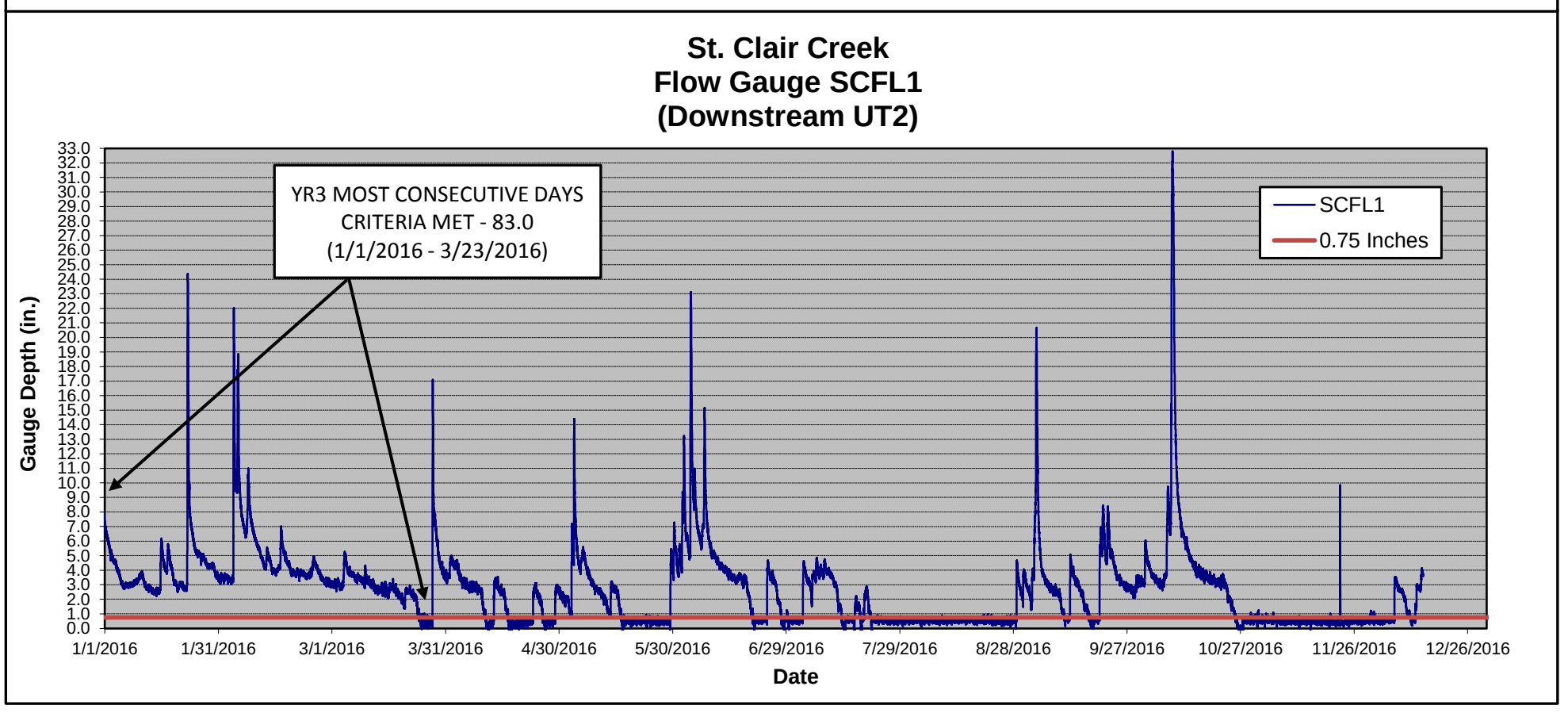
Notes:

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

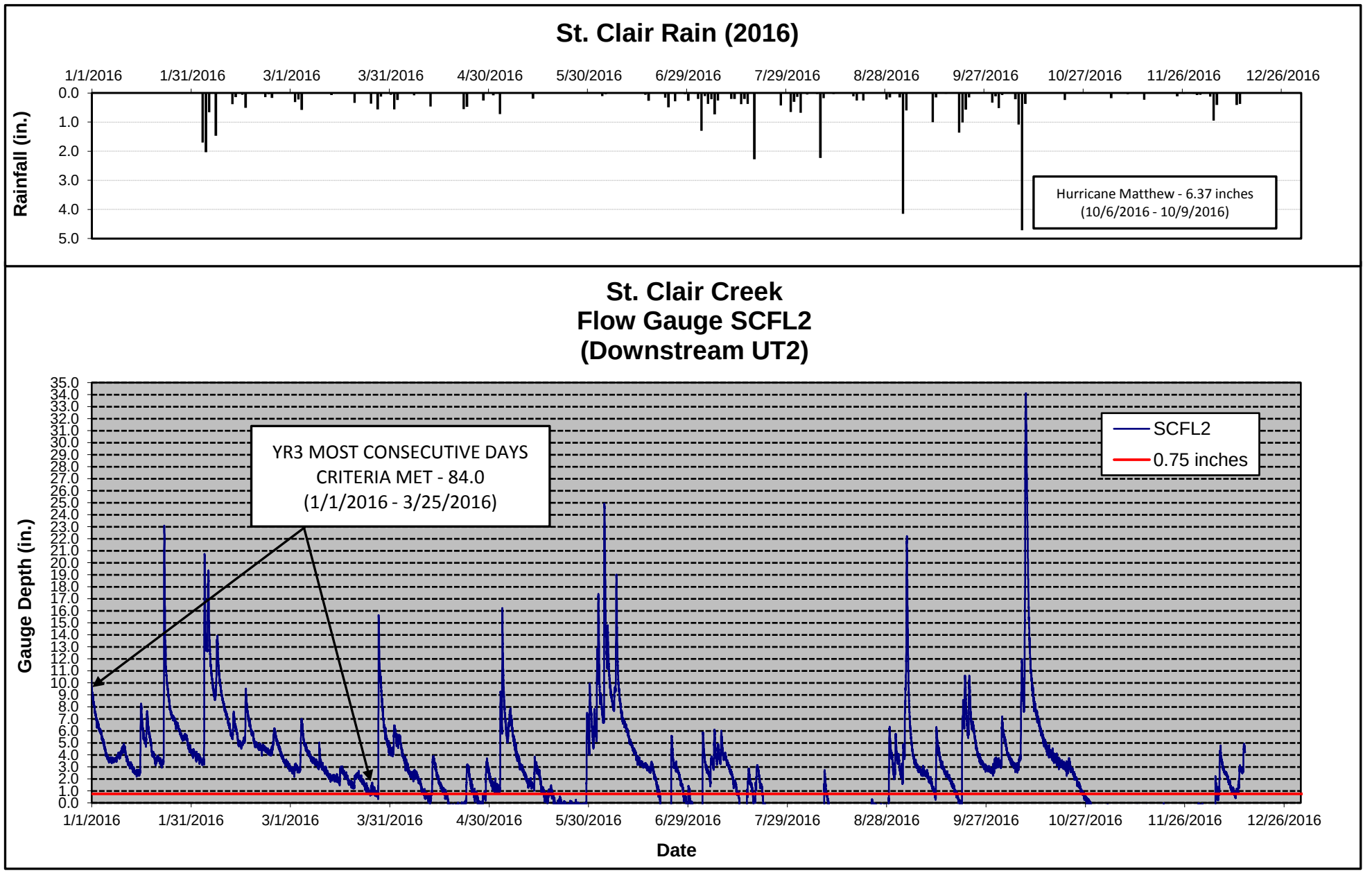
[2]Indicates the number of **cumulative** days within the monitoring year where flow was measured.

Flow success criteria for the Site is stated as: A surface water flow event will be considered perennial when the flow duration occurs for a minimum of 30 days.

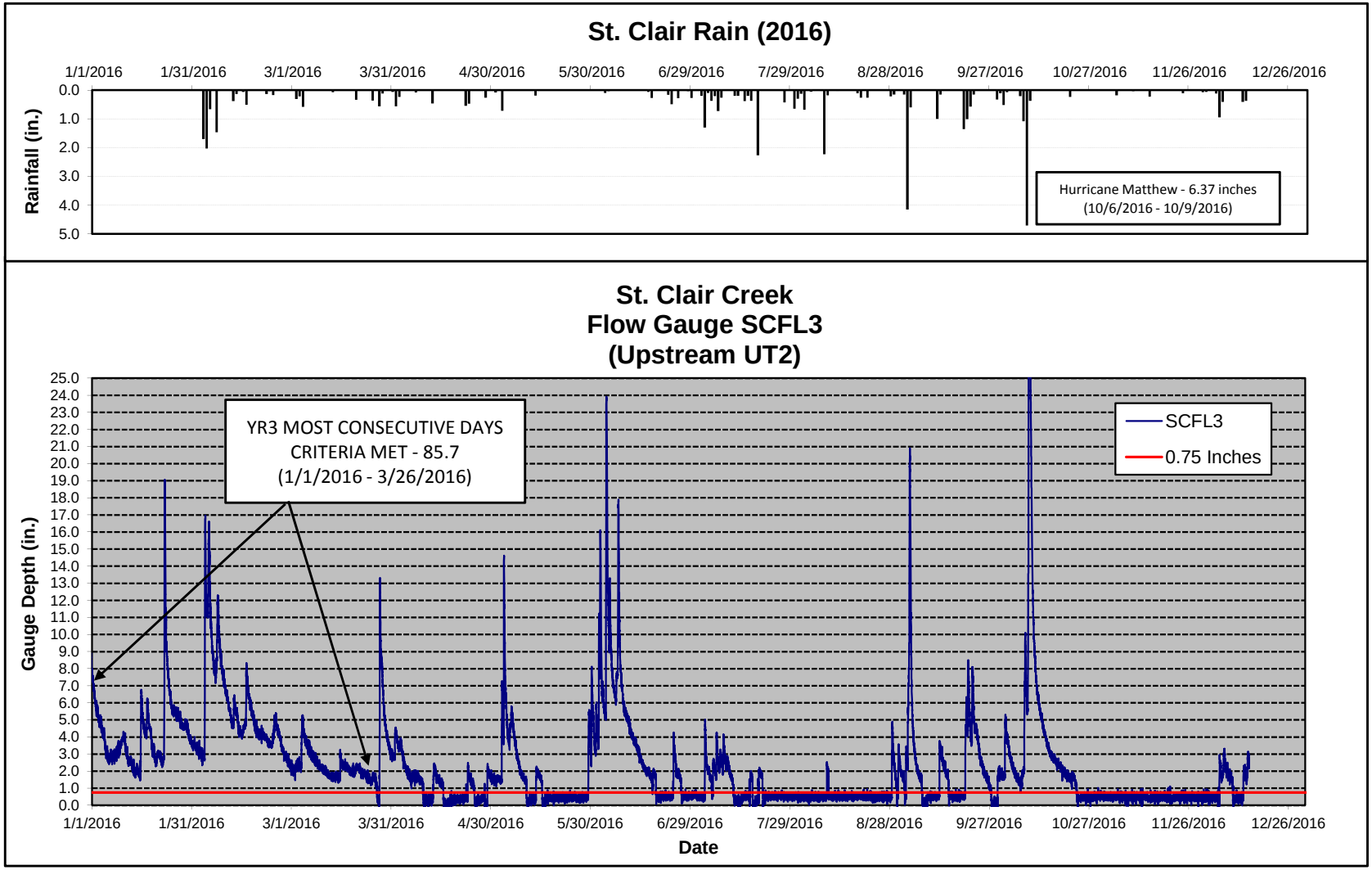




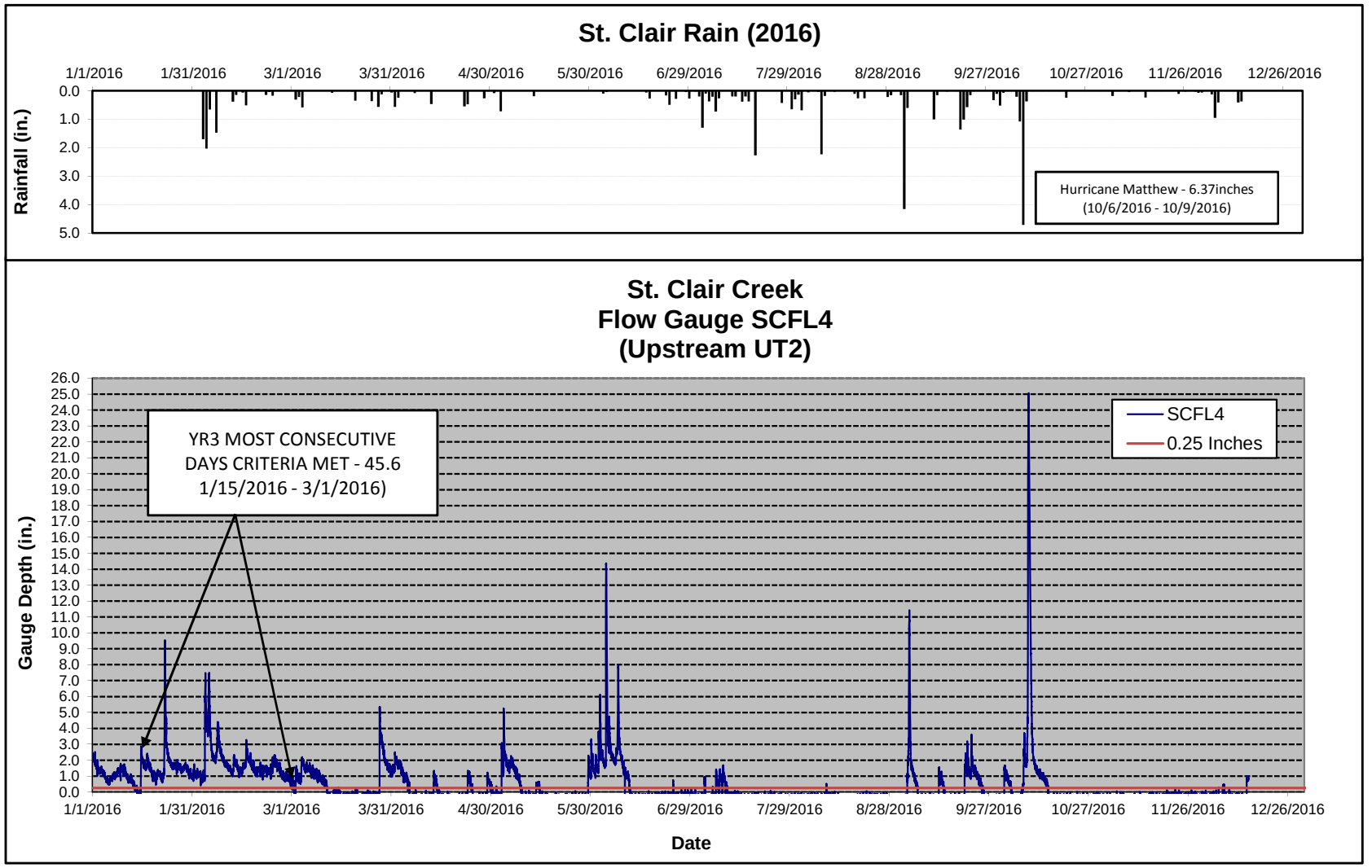
*0.75 inches denotes level at which flow occurs along the UT2 valley thalweg



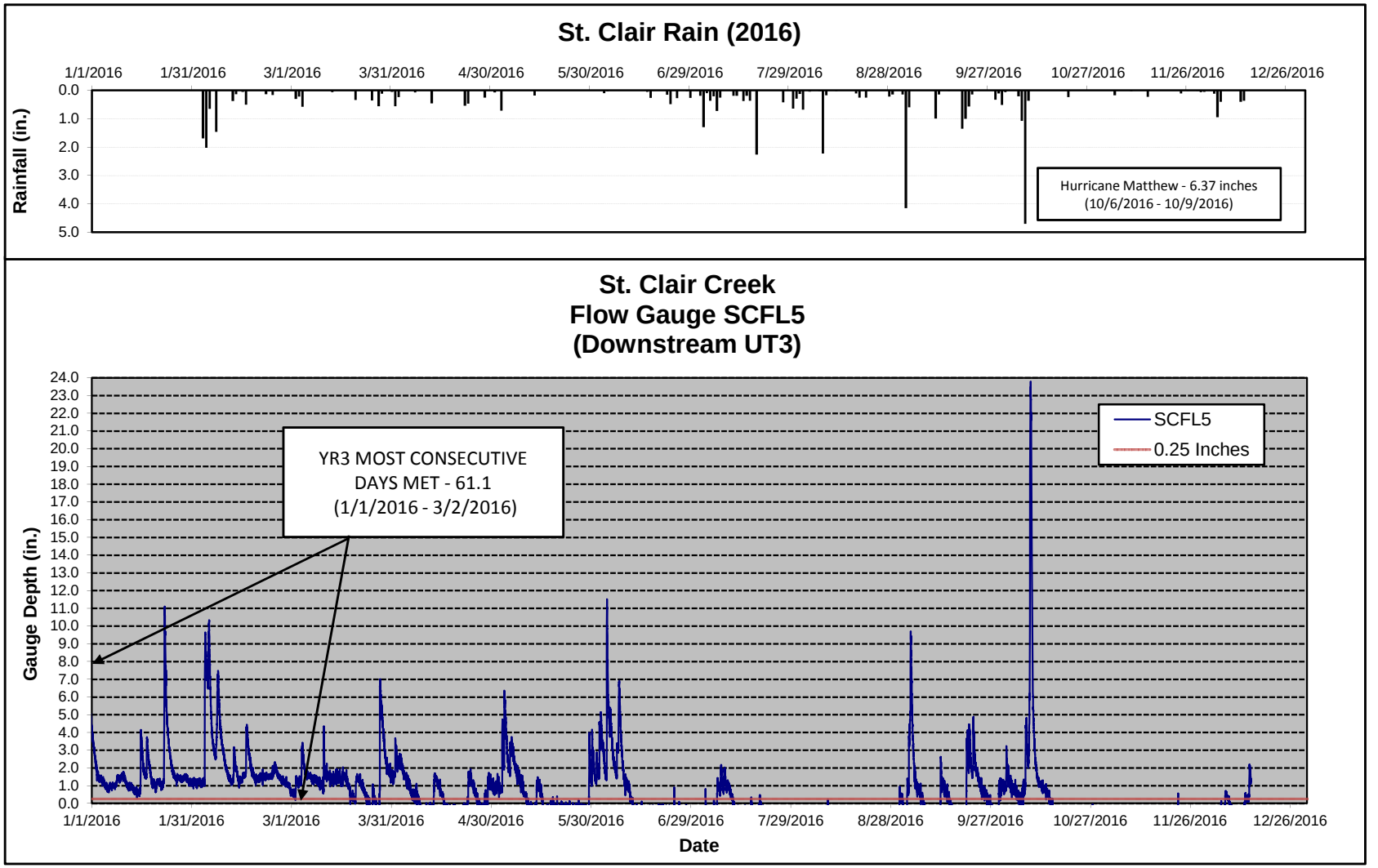
*0.75 inches denotes level at which flow occurs along the UT2 valley thalweg



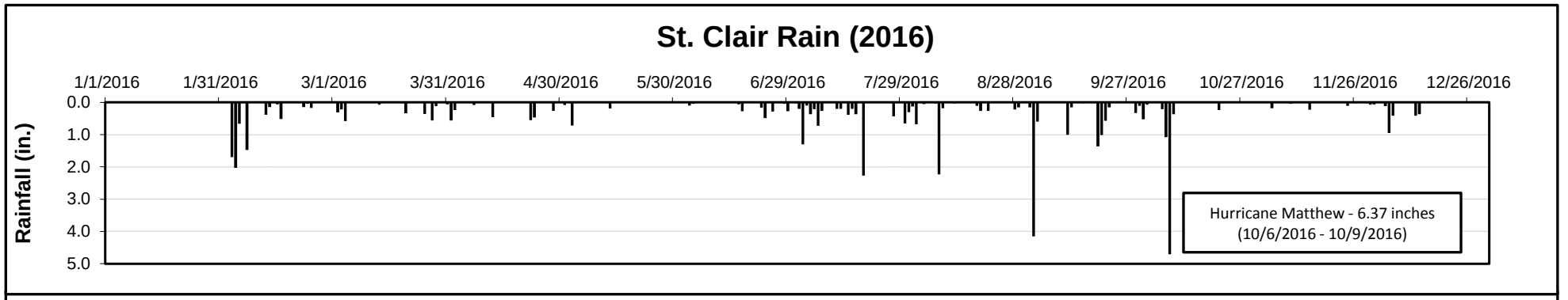
*0.75 inches denotes level at which flow occurs in the vicinity of the SCFL3 valley thalweg

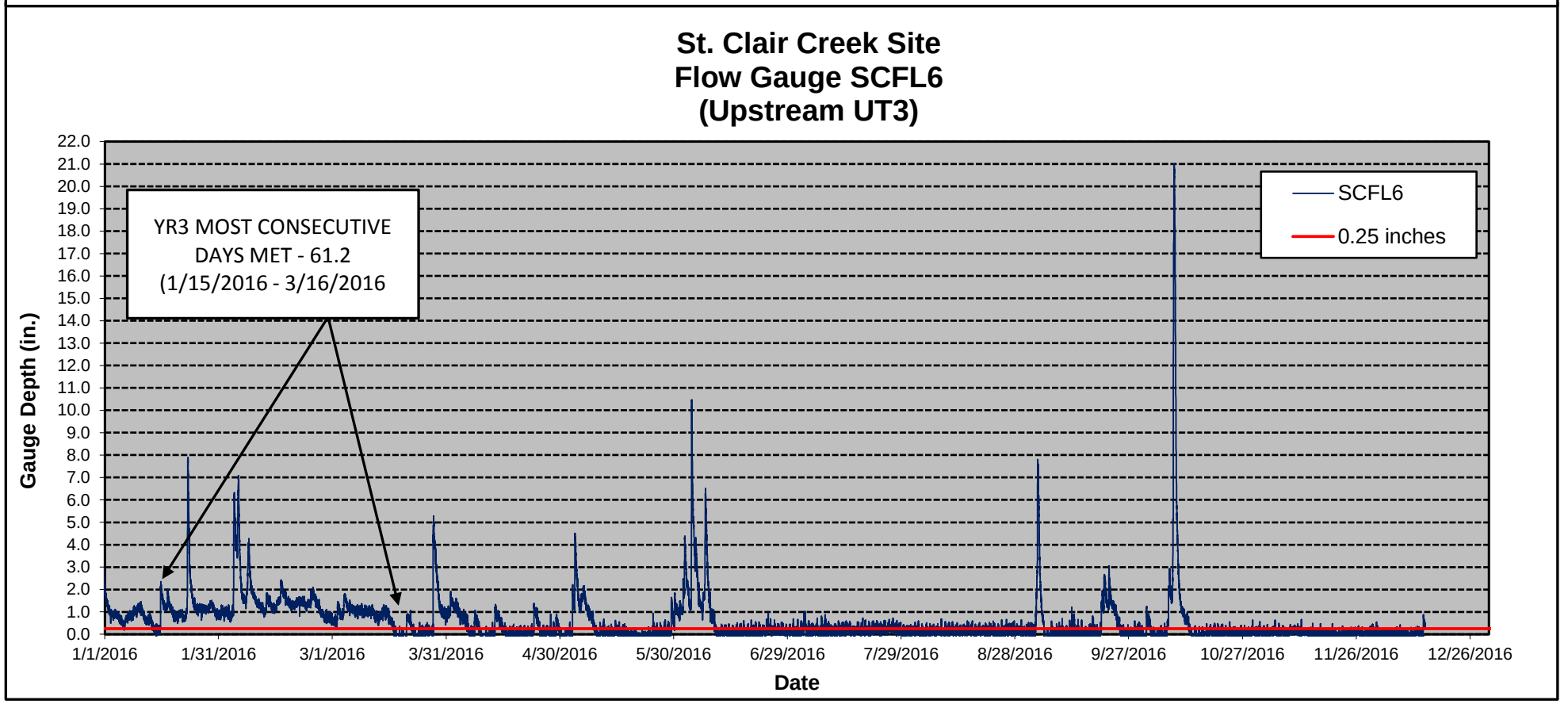


*0.25 inches denotes level at which flow occurs in the vicinity of the SCFL1 valley thalweg



*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