St. Clair Creek Restoration Project
Year 5 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: 5 of 7 Year of Data Collection: 2018 Year of Completed Construction: 2014 Submission Date: January 2019
Submitted To:	NC DEQ – Division of Mitigation Services 1652 Mail Service Center Raleigh, NC 27699 NC DEQ Contract ID No. 003986

Mitigation Project Name	St. Clair Creek	County	Beaufort	USACE Action ID	2008-02655
DMS ID	95015	Date Project Instituted	7/18/2011	NCDWR Permit No	2013-0739
River Basin	Tar-Pamlico	Date Prepared	7/10/2018		
Cataloging Unit	03020104				

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Year (Wetland)
Potential Credits (Mitigation Plan)		3,274.000							2.800					
Potential Credits (As-Built Survey)		3,274.000							2.800					
1 (Site Establishment)	N/A	N/A			N/A	N/A	N/A		N/A		N/A		N/A	N/A
2 (Year 0 / As-Built)	30%	982.200			2014	7/21/2014	30%		0.840		30%		2014	7/21/2014
3 (Year 1 Monitoring)	10%	327.400			2015	4/23/2015	10%		0.280		10%		2015	4/23/2015
4 (Year 2 Monitoring)*	5%	163.700			2016	7/8/2016	10%		0.280		15%		2016	7/8/2016
Unreleased stream credits from Year 2 Monitoring	5%	163.700			2016	4/3/2017								
5 (Year 3 Monitoring)	10%	327.400			2017	4/3/2017	15%		0.420		20%		2017	Not released
6 (Year 4 Monitoring)	5%	163.700			2018	4/25/2018	5%		0.140		10%		2018	Not released
7 (Year 5 Monitoring)	10%				2019		15%				15%		2019	
8 (Year 6 Monitoring)	5%				2020		5%				N/A		2020	
9 (Year 7 Monitoring)	10%				2021		10%				N/A		2021	
Stream Bankfull Standard	10%	327.400			2018	4/25/2018	N/A				N/A			
Total Credits Released to Date		2,455.500							1.400					

DEBITS (released credits only)

Ratios			1	1.5	2.5	5	1	3	2	5	1	3	2	5	1	3	2	5
			Stream Restoration	Stream Enhancement I	Stream Enhancement II	Stream Preservation	Riparian Restoration	Riparian Creation	Riparian Enhancement	Riparian Preservation	Nonriparian Restoration	Nonriparian Creation	Nonriparian Enhancement	Nonriparian Preservation	Coastal Marsh Restoration	Coastal Marsh Creation	Coastal Marsh Enhancement	Coastal Marsh Preservation
As-Built Amounts (feet and acres)			3,274.000				2.800											
As-Built Amounts (mitigation credits)			3,274.000				2.800											
Percentage Released			75.000%				50.000%											
Released Amounts (feet / acres)			2,455.500				1.400											
Released Amounts (credits)			2,455.500				1.400											
NCDWR Permit	USACE Action ID	Project Name																
2005-0785	1999-301143	NCDOT TIP R-2510 - Washington Bypass	982.200															
2005-0785	1999-301143	NCDOT TIP R-2510 - Washington Bypass	327.400															
2005-0785	1999-301143	NCDOT TIP R-2510 - Washington Bypass	163.700															
2005-0785	1999-301143	NCDOT TIP R-2510 - Washington Bypass	491.100															
2015-0929	2015-01937	Woolard-McCoy Project					0.250											
2005-0785	1999-301143	NCDOT TIP R-2510 - Washington Bypass	491.100															
Remaining Amounts (feet / acres)			0.000				1.150											
Remaining Amounts (credits)			0.000				1.150											

Contingencies (if any): *7/8/2016 - IRT approved the release of half of the potential stream credits (scheduled release was 10% of the total project) for Monitoring Year 2.

Signature of Wilmington District Official Approving Credit Release

9/6/18
Date

1 - For DMS, no credits are released during the first milestone

2 - For DMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCEEP Portal, provided the following criteria have been met:

1) Approval of the final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan
4) Reciept of necessary DA permit authorization or written DA approval for porjects where DA permit issuance is not required

3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met

Michael Baker
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February 13, 2019

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

Subject: Task 11: Response Letter to DMS review comments regarding the Draft Year 5 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 three hardcopies of the Final Year 5 Monitoring Report along with one CD containing the final digital files for the St. Clair Creek Restoration Project located in Beaufort County, NC. Our responses to your review comments received on January 24, 2019 are provided below:

1. Digital files:
   a. All GIS files have been reviewed and determined to meet DMS requirements.

      Response: Very good.

   b. Please provide Excel files for all tables and graphs as required by contract and as stated in DMS's Format, Data Requirements, and Content Guidance for Electronic Drawings. Submittal included pdf copies.

      Response: Excel files for each table and graph are provided in the final digital e-submission documents found on the enclosed CD.

2. Section 1.0, page 2; Section 2.3.1, page 5; and Appendix C, Table 9c: The report discusses the presence of Loblolly pines throughout the planted area, but none were included in the stem counts in any of the vegetation plots. In addition, the photo log of the veg. plots appears to show pines in some, if not all, of the veg. plots. Please explain and correct as necessary.

   Response: As loblolly pines have been periodically thinned on site throughout the project, and are going to be significantly thinned again this year as stated in the report, Baker did not keep track of loblolly pine in the vegetation plot assessments. Recording their presence did not seem particularly useful as many of the stems present were likely to be gone before the IRT would even receive the report (and in fact, since the vegetation plot photos were taken for this report many pines have already been cut as part of routine maintenance efforts conducted during the final monitoring gauge download later in the year). As such, any conclusions about site conditions derived from any reported pine numbers would likely be misleading. They were considered an issue to be better addressed elsewhere in the report. Baker was not attempting to hide anything from DMS or the IRT and has been upfront about the presence of pines on site. In the future, all pines will be counted and recorded on all vegetation plot and temporary transect assessments. Baker apologizes for any confusion this has caused.

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3. Section 1.0, page 2 and Section 2.1.1, page 3: The report discusses the failure of flow gauge SCFL#4. This gauge has failed 4 out of 5 monitoring years, though barely missing the 30 consecutive days of flow requirement in Year 4 (29 days). Based on this, DMS has the following comments/concerns:
   a. Clarify reason/potential reason for flow gauge SCFL#4 not meeting 30 consecutive days of flow requirements, especially given that this area was impacted by two hurricanes and a wetter than normal summer and fall. Baker needs to be prepared to discuss at the upcoming credit release meeting.

      Response: Baker certainly understands the concern from not meeting the success criteria during such an overall wet year, but the flow gauges on site have always met the criteria in the late winter to early spring when the water table is highest and is contributing some base flow that is supplemented with the rain. In the summer and through the fall, the evapotranspiration rates are very high, the water table plummets, and there is no base flow present – it's all rainfall driven. And it is difficult to achieve 30-days continuous flow on just rainfall alone. So all of the rain from this past fall and winter did not actually contribute much to the continuous flow requirement. Because of that rain we did observe more *total* days of flow on site, just not continuous and unbroken flow. Hurricane Matthew also dropped an extreme amount of rain on site in 2016 without triggering 30-days of continuous flow. Yet all flow gauges on site did meet the criteria earlier that same year in the winter/spring with a high water table and modest rainfall.

   b. DMS believes stream credits are at risk from SCFL#4 to the top of UT2 (±466 lf/credit as measured using GIS) at a minimum. This would put Baker 192 credits below contract for stream which would reduce payments from this point forward to avoid overpayment by DMS. Please concur or offer your explanation for why these are not at risk.

      Response: While Baker understands the concern regarding flow at the top of UT2, we believe that it is nevertheless premature to reduce the expected credits and resulting payment for the project at this time. Flow gauge SCFL#4 need only meet its success criteria once more in the upcoming two monitoring years to have fulfilled its requirement as stated in the mitigation plan (i.e. meeting the success criteria twice in separate years during the monitoring period). It has already met once and come very close on three other occasions.

4. Appendix A, Table 1: Based on comment 3.b. above and Baker's response, Table 1 should be revised to show UT2 Stream as 1,667 SMU and insert a footnote referencing the ±466 SMU as at risk. Also adjust the total stream credits at the top of the table from 3,274 to 2,808 referencing the same footnote.

   Response: As explained above, while Baker understands the concern regarding flow in upper UT2, we believe it is premature to formally reduce the expected SMU credits for the project. As such, we respectfully decline to modify the stream credit totals found in Table 1 at this time.

5. Appendix B, Figure 2: In the figure included in the hardcopy of the report, the colors denoting Flow Gauge Meeting Criteria and Not Meeting Criteria are the same in both the legend and on the map. Please make sure they are different when the final is submitted. Note: the pdf copy submitted electronically does not have this problem.

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Response: We apologize for the misleading and confusing printed color error. This does not appear in our GIS files nor in our pdf copies either and we will make sure that it does not print incorrectly again for the final hardcopies.

6. Appendix D: Flow graphs for SCFL 2, 3, 5, 5, 6 and 7 as well as Figure 5 (rainfall comparison) are missing from the hardcopy of the report. Please make sure to include them in the final report. Note: these graphs and Figure 5 were included in the electronic submittal and pdf copy.

   Response: We apologize for the oversight in failing to include printed copies of all of the flow graphs and rainfall figures in the draft hardcopy report. We will make sure that they are all included in the final reports.

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, PWS

St. Clair Creek Restoration Project
Year 5 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

NC Professional Engineering License # F-1084

Michael Baker
INTERNATIONAL

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APPENDICES

1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 3,274 linear feet of perennial and intermittent headwater stream, 2.8 acres of riparian wetlands, and planted 17.5 acres 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 (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 5 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 5 monitoring, is 616 stems per acre. Thus, the Year 5 data demonstrate that the Site has met the minimum success interim criteria of 260 trees per acre by the end of Year 5.

Throughout the monitoring year, Baker also conducted several temporary vegetation transects in areas outside the permanent vegetation plots to help assess project performance. The transects were measured out in the field as 100 ft long by 12 ft wide (for an area roughly similar to that of the veg plots). Any living stem of an

acceptable species that was at least 2 ft in height was counted. These stem counts were then converted into stems/acre values for comparison to the vegetation success criteria values. There were five transects taken during the Year 5 monitoring season; each one meeting the MY5 success criteria, and with an overall average of 558 stems/acre. The location of the transects and their stems/acre values are shown on the CCPV found in Appendix B.

During Year 5 monitoring, *Pinus taeda* (loblolly pine) seedlings and short saplings were found scattered throughout the riparian buffer of the UT2 restoration area as well as in smaller portions of UT3. It should be noted that the pines do not appear to be suppressing planted species survival or growth as vegetation density appears strong throughout the project, even in areas with pine presence. However, due to IRT concerns, these pines will be treated and heavily thinned during 2019 using hand/power tools and/or chemical applications. The Site will continue to be closely observed for pine growth throughout the remaining monitoring period.

Year 5 wetland groundwater monitoring demonstrated that all 8 groundwater monitoring wells located along UT2 and UT3 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). The Year 5 hydroperiods ranged from 12.8% to 23.4%, with an average of 17.8%. It should be noted that each of the wells passed the success criteria in the spring, prior to Hurricane Florence and all the heavy summer/autumn rains. All wetland restoration well data and reference well data collected during Year 5 monitoring are located in Appendix D.

Additionally, the two groundwater monitoring wells (SCAW9 and SCAW10) installed on 3/16/17 in areas located outside the project's currently approved mitigation plan wetland restoration areas also met the 12% hydroperiod success criteria. 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 (see Figure 2 in Appendix B). Baker is not presenting this information here for formal approval or acceptance, but to simply inform DMS and the IRT of all project activity.

On-site flow through the restored headwater valleys of UT2 and UT3 was recorded in 2018 through the use of six installed pressure transducers as flow gauges. All but one met the success criteria in Year 5 by recording a consecutive flow event of 30 days or longer in 2018. Flow gauge SCFL#4 located at the top of UT-2 did not meet the success criteria, recording its longest single duration flow event of 20 days, though it did record flow for a total of 146 days throughout the monitoring year. Additionally, given the flow success challenges in the upper UT2, a new flow gauge (SCFL#7) was installed approximately halfway between SCFL#4 and SCFL#3 on June 6, 2018 to better locate the point at which 30-day flow events are more consistently achieved. The new flow gauge #7 met the success criteria with 60 days of consecutive flow recorded. All flow gauge success summary data and individual gauge graphs are 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 found in Appendix A). 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.

The growing season for the Beaufort County ends on December 6th, and the year-end well and flow data were collected on January 10, 2019. The visual site assessment data contained in Appendix B were collected in December 2018 and January 2019 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 January 2018 to December 2018 was 70.57 inches, as compared to the Beaufort County WETS table for the same period of 50.03 inches annually, an annual excess of 20.54 inches (see Figure 5 in Appendix D).

Four automated flow gauges (pressure transducers) were originally installed in the UT2 channel along with two flow gauges installed in the UT3 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 for Year 5 indicate that five of the six flow gauges met the minimum consecutive days of surface flow required for success. Gauge SCFL#4 located at the top of UT2 recorded a flow event of 20 days, though did also record flow in 146 total days throughout the monitoring year. Additionally, a new flow gauge (SCFL#7) was installed approximately halfway between SCFL#4 and SCFL#3 on 6/6/18 to better locate the point at which 30-day flow events are more consistently achieved in the upper portion of UT2. This new flow gauge #7 met the success criteria with 60 days of consecutive flow recorded. The complete flow data with individual flow gauge graphs and 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 the stream photo points, wetland wells, and flow gauges are all 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) and the water table monitoring standards follow Technical Note ERDC TN-WRAP-05-2 (USACE 2005).

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 for the Year 5 wetland groundwater monitoring demonstrated that all 8 groundwater monitoring wells located along UT2 and UT3 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). The Year 5 hydroperiods ranged from 12.8% to 23.4%, with an average of 17.8%. Each of the wells passed the success criteria in the spring, prior to Hurricane Florence and all the heavy summer/autumn rains. It should also 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%.

Additionally, during Year 5 monitoring, the on-site wetland reference well SCAWREF2, which is on the downstream portion of UT3, recorded a hydroperiod of 38.2% of the growing season. Unfortunately, the other on-site reference well SCAWREF1 unexpectedly and permanently failed very early in January 2018. It should be noted that these reference wells are located further down valley than the monitoring wells and are much more heavily influenced by backwater from St. Clair Creek. Reference well SCAWREF1 will not be replaced as there is still a remaining reference well on-site installed in a very similar location, and all previous monitoring years' data showed very similar results between the two wells. Thus, reliable reference well data is still being collected for the project. All wetland restoration well data and reference well data collected during Year 5 monitoring are located in Appendix D.

Additionally, another two groundwater monitoring wells (SCAW9 and SCAW10) were installed on March 16, 2017 in areas located outside the project's currently approved mitigation plan wetland restoration areas (see Figure 2 in Appendix B). 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 wells both passed success criteria in Year 5 with hydroperiods of 12.1% and 12.4% respectively.

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 UT2 and UT3 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 UT2 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 UT2 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 UT3 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 5 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 (Lee 2007) and the CVS-NCDMS data entry tool v 2.3.1 (CVS 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.

Complete Year 5 vegetation assessment information is provided in Appendices B and C.

2.3.1 Vegetation Concerns

Following Year 5 monitoring, *Pinus taeda* (loblolly pine) seedlings and short saplings were found scattered throughout the riparian buffer of the UT2 restoration area as well as in smaller portions of UT3. It should be noted that the pines do not appear to be suppressing planted species survival or growth as vegetation density appears strong throughout the project, even in areas with pine presence. However, due to IRT concerns, these pines will be treated and heavily thinned during 2019 using hand/power tools and/or chemical applications. The Site will continue to be closely observed for pine growth throughout the remaining monitoring period. Several photographs of the scattered pines can be found in the Vegetation Problem Area Photolog in Appendix B.

3.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (DMS). CVS-DMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC. 2012.

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

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

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.

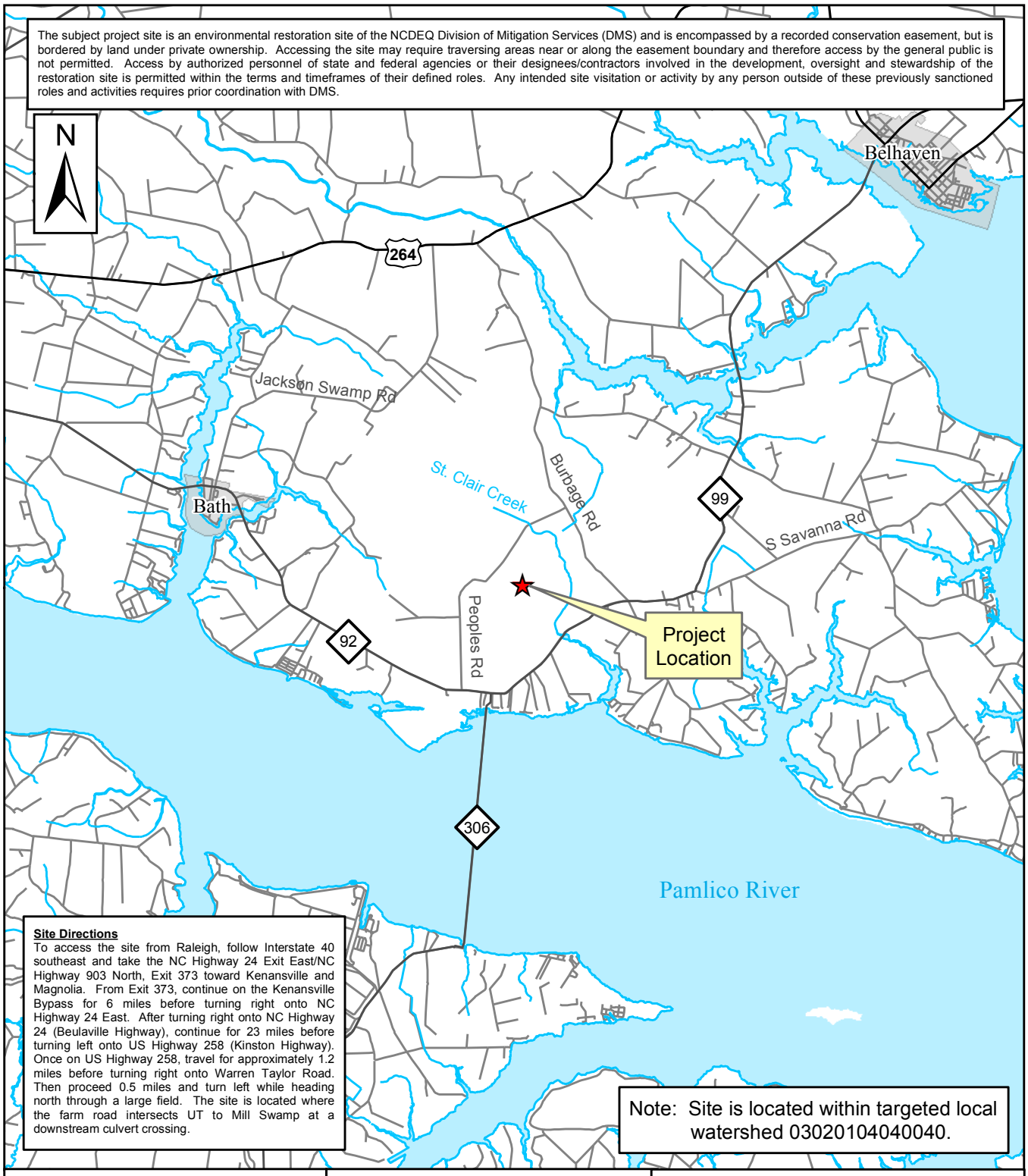
United States Army Corps of Engineers. 1997. Corps of Engineers Wetlands Research Program. Technical Note VN-rs-4.1. Environmental Laboratory. U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS.

____. 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.

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

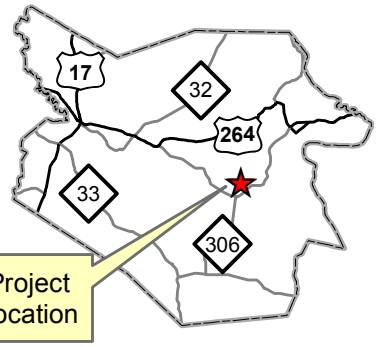


Figure 1
Project Vicinity Map
St. Clair Creek Restoration Site

NCDEQ -
Division of Mitigation Services

Michael Baker
INTERNATIONAL

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	Jan-19	Jan-19
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	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact: Katie McKeithan, Tel. 919-481-5703
Construction Contractor	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 Contact: Bill Wright, Tel. 919-590-5193
Planting Contractor	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 Contact: George Morris, Tel. 919-590-5193
Seeding Contractor	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 Contact: Bill Wright, Tel. 919-590-5193
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	Scott King, Tel. 919-481-5731
Vegetation Monitoring Point of Contact	Scott King, Tel. 919-481-5731
Wetland Monitoring Point of Contact	Scott King, Tel. 919-481-5731

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.

Water Resources
ENVIRONMENTAL QUALITY

PAT MCCRORY
Governor

DONALD R. VAN DER VAART
Secretary

S. JAY ZIMMERMAN
Director

January 7, 2016

Kristin Miguez
DEQ-Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652
(via electronic mail)

DWR# 2013-0739

Re: Site Viability for Buffer Mitigation – St. Clair Creek Headwater Stream Site
off Peoples Road, Bath, NC
Beaufort County

Dear Ms. Miguez,

On October 5, 2015, Katie Merritt, with the Division of Water Resources (DWR), received a request from Jake Byers with Michael Baker Engineering, for a site visit at the St. Clair Creek Restoration Site located off Peoples Road in Bath, NC to determine the potential for Tar-Pamlico Neuse riparian buffer mitigation. On December 3, 2015, Ms. Merritt performed a site assessment of the subject site. Karen Higgins and Mac Haupt with the DWR along with you and Mr. Byers were also present. If approved, mitigating this site could provide riparian buffer mitigation credits within the 8-digit Hydrologic Unit Code 03020104 of the Tar-Pamlico River Basin and as allowed under 15A NCAC 02B .0295 (f).

Ms. Merritt's evaluation of the site as an alternative buffer mitigation option for buffer mitigation pursuant to Rule 15A NCAC 02B .0295 (o) (1) and (2) (effective November 1, 2015) is provided below:

UT2

- UT2 was approved as part of a Coastal Headwater Stream Mitigation Site (DWR# 2013-0739) by the IRT in 2013 and is in its second year of monitoring. A copy of the approved mitigation plan has been provided to the DWR.
- Preliminary site conditions along with the onsite visit in December 2015 suggests that the entire area along UT2 (0-100') is viable for riparian restoration and suitable for buffer mitigation credit at 1:1. Preliminary photos and documentation have been provided to the DWR.
- The buffer must be measured perpendicular to the length of the valley being restored. Approximately 8.35 acres (363,577 ft^2) have been planted and restored. A copy of the proposed restoration site has been provided to DWR.
- An agricultural ditch is present within the proposed riparian restoration and isn't planned to be removed. The presence of this ditch does not comply with the diffuse flow requirement of Rule .0295. However, DMS can apply Clarification Memo #2008-019 to

this project in order to calculate the deduction of buffer credit where diffuse flow cannot be attained.

- According to the St. Clair Creek Restoration Project Year 1 Monitoring Report submitted in April 2015, all 6 vegetative monitoring plots within the riparian areas are meeting the success criteria identified in Rule .0295. A copy of the Year 1 Monitoring Report has been provided to the DWR.
- A conservation easement of the proposed area, dated June 24th, 2013 has been provided to the DWR and is more accurately described as CE-1 and containing 11.55 acres, more or less. The easement document is located in the Beaufort County Register of Deeds, Book 1821, Pages 53-64.

A map showing the project site and the buffer mitigation areas assessed is provided and signed by Ms. Merritt on January 6, 2016. DWR did not assess this site for viability of nutrient offset and therefore only buffer mitigation is approved. DMS shall provide an annual monitoring report to Ms. Merritt for review and approval each year for four more years and until the performance standards have been met. The performance standards for buffer mitigation under Rule .0295 are the following:

(n) (2) (B) - 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 the stems.
(o) (2) –All success criteria specified in the approval of the stream mitigation site by the Division shall be met.

Please provide an As-Built survey verifying the acreage proposed for buffer mitigation credit and a buffer credit ledger for this site to Ms. Merritt within 30 days from receipt of this letter. If you have any questions regarding this correspondence contact Katie Merritt at (919)-807-6371.

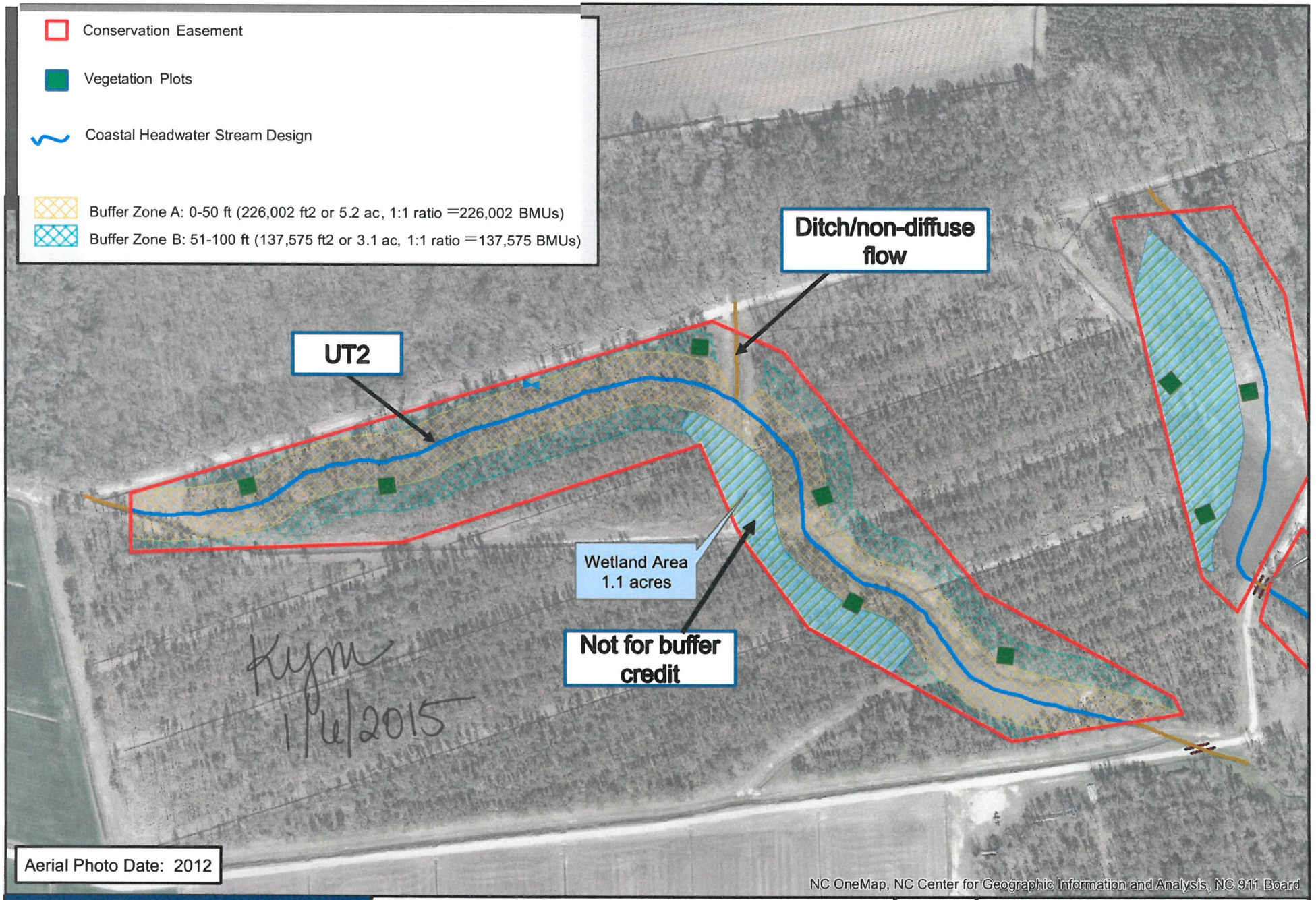
Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 and Buffer Permitting Unit

KAH/*km*
Attachments: Site Aerial Map, DWR Clarification Memo #2008-019

cc:File Copy (Katie Merritt)



Michael Baker INTERNATIONAL

Buffer Asset Map
St. Clair Creek Site
Beaufort County, NC

Michael F. Easley
Governor

William G. Ross, Jr., Secretary
Department of Environment and Natural Resources

Coleen, H. Sullins, Director
Division of Water Quality

August 19, 2008
Buffer Interpretation/Clarification #2008-019

MEMORANDUM

RE: The Division of Water Quality's (DWQ's) stance on whether diffuse flow of stormwater through the newly restored buffers on mitigation sites should be a requirement. Diffuse flow is a requirement for buffer restoration or enhancement in the Neuse River Basin Buffer Rule 15A NCAC 02B.0242(9)(d)(iii), the Tar-Pamlico River Basin Buffer Rule 15A NCAC 02B.0260(9)(d)(iii), and the Catawba River Basin Buffer Rule 15A NCAC 02B.0244 (9)(d)(iii).

Diffuse flow is a requirement for all sites in a buffered basin for buffer mitigation and for for sites providing nutrient offset credit as well.

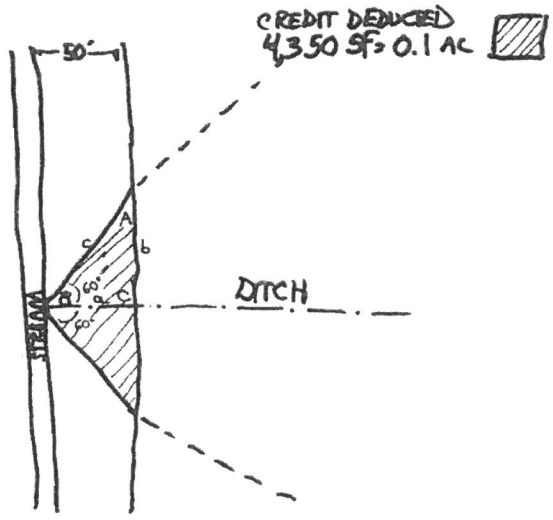
Current Policy: According to the Mitigation rules in the Neuse, Tar-Pamlico and Catawba buffer rules, a grading plan must be provided for buffer mitigation sites. In addition, those rules state that "The site shall be graded in a manner to ensure diffuse flow through the riparian buffer".

Problem: The question has been raised as to whether stormwater carried by lateral ditches that enter buffered streams should provide diffuse flow prior to that stormwater entering the restored buffers.

Solution: The Neuse, Tar-Pamlico and Catawba buffer rules with respect to buffer mitigation sites contain a very clear requirement that states that diffuse flow of stormwater must be maintained through the buffer. Unless otherwise approved by DWQ, all buffer mitigation sites must provide diffuse flow of stormwater from ditches and similar conveyances through the restored buffer.

Where such diffuse flow cannot be attained and where DWQ agrees that such treatment is not possible, deduction of buffer credit will be calculated as follows:

SCENARIO 1



401 Wetlands Certification Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
2321 Crabtree Boulevard, Suite 250, Raleigh, North Carolina 27604
Phone: 919-733-1786 / FAX 919-733-6893 / Internet: http://h2o.enr.state.nc.us/ncwetlands

A, B and C are angles. a, b, and c are distances (lengths)

DWQ believes that using an immediate drainage area extending at a 60-degree angle from the point of discharge to the stream is a reasonable approach to the issue of determining the area which is not draining through the restored buffer. To calculate the area of buffer being "short-circuited" by the ditch, the area of the right triangles shown in the figure above must be determined.

a = 50'
A = 30°
B = 60°

b = a cot A
b = 50 (1.732)
b = 86.6' (87')

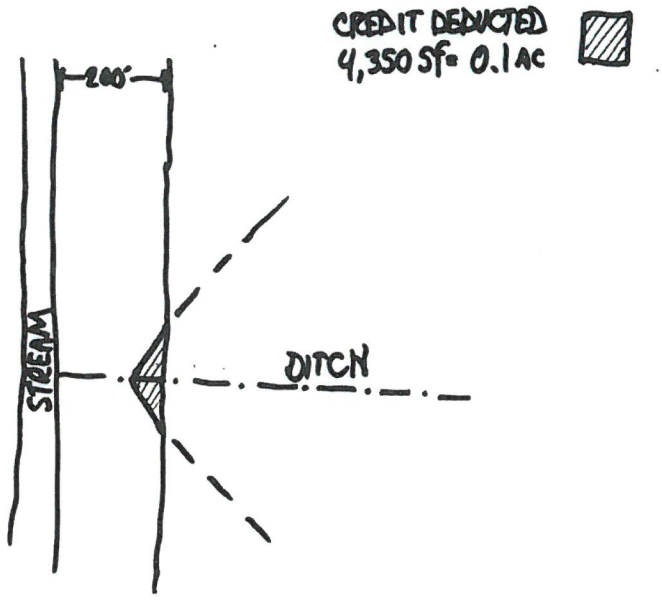
The area to be excluded from credit would be the area of the two right triangles:

Area = (a x b)/2
Area = (50 feet x 87feet)/2
Area = 2,175 SF

Total deducted area = 2,175 x 2 = 4,350 SF or 0.1 acres.

The example shown above assumes a buffer width of 50 feet from the top of bank (riparian buffer mitigation site). For nutrient offset sites, credit can be generated out to 200 feet from the top of bank. The policy applies to sites with larger buffers as follows:

SCENARIO 2



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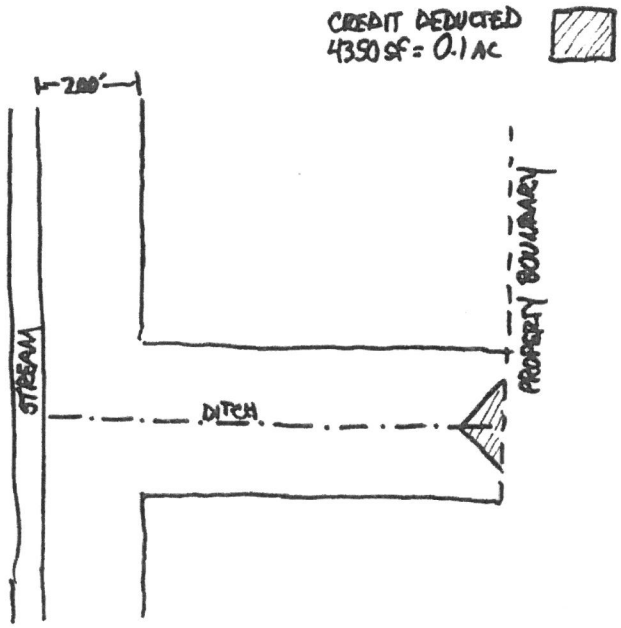
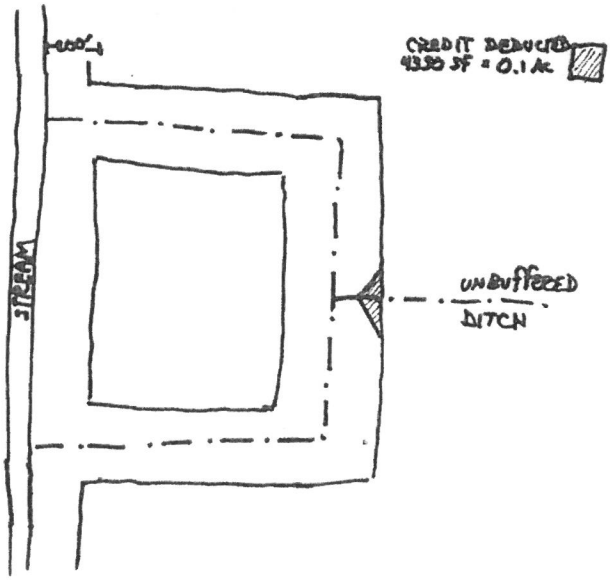
If a ditch leading to a buffered stream is buffered, then no credit is deducted from the stream buffer. If the upstream origin of the ditch is within the buffer, no credit is deducted. If the upstream origin of the ditch is not buffered (e.g. if the ditch begins upstream offsite), the credit deduction is applied to the most upstream portion of the ditch on the property.

SCENARIO 3



Where a network of interconnecting ditches occurs on a site, and all of the ditches are buffered, the only credit deduction would be at the point where an unbuffered ditch enters the project:

SCENARIO 4



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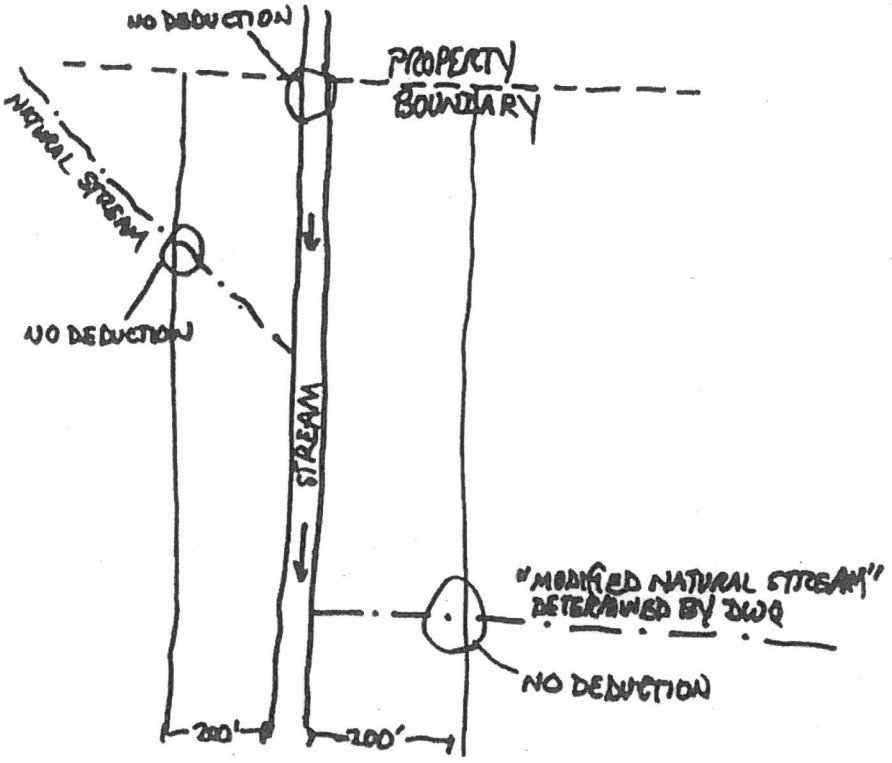
Where a natural stream enters the project site, no deduction of credit will occur. Also, when a natural stream or a modified natural stream flow into a buffered stream, no deduction of credit will occur. The modified natural stream must be subject to the buffer rules, and must be verified to be a modified natural stream (as opposed to a ditch) through an on-site determination by DWQ personnel.

SCENARIO 5



For any additional questions or clarifications on this issue, please contact Eric Kulz or Amy Chapman at (919) 733-1786.

Signature: _____ Date: 8/19/2008

Signature: _____ Date: 8/19/2008

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1650 Mail Service Center, Raleigh, North Carolina 27699-1650
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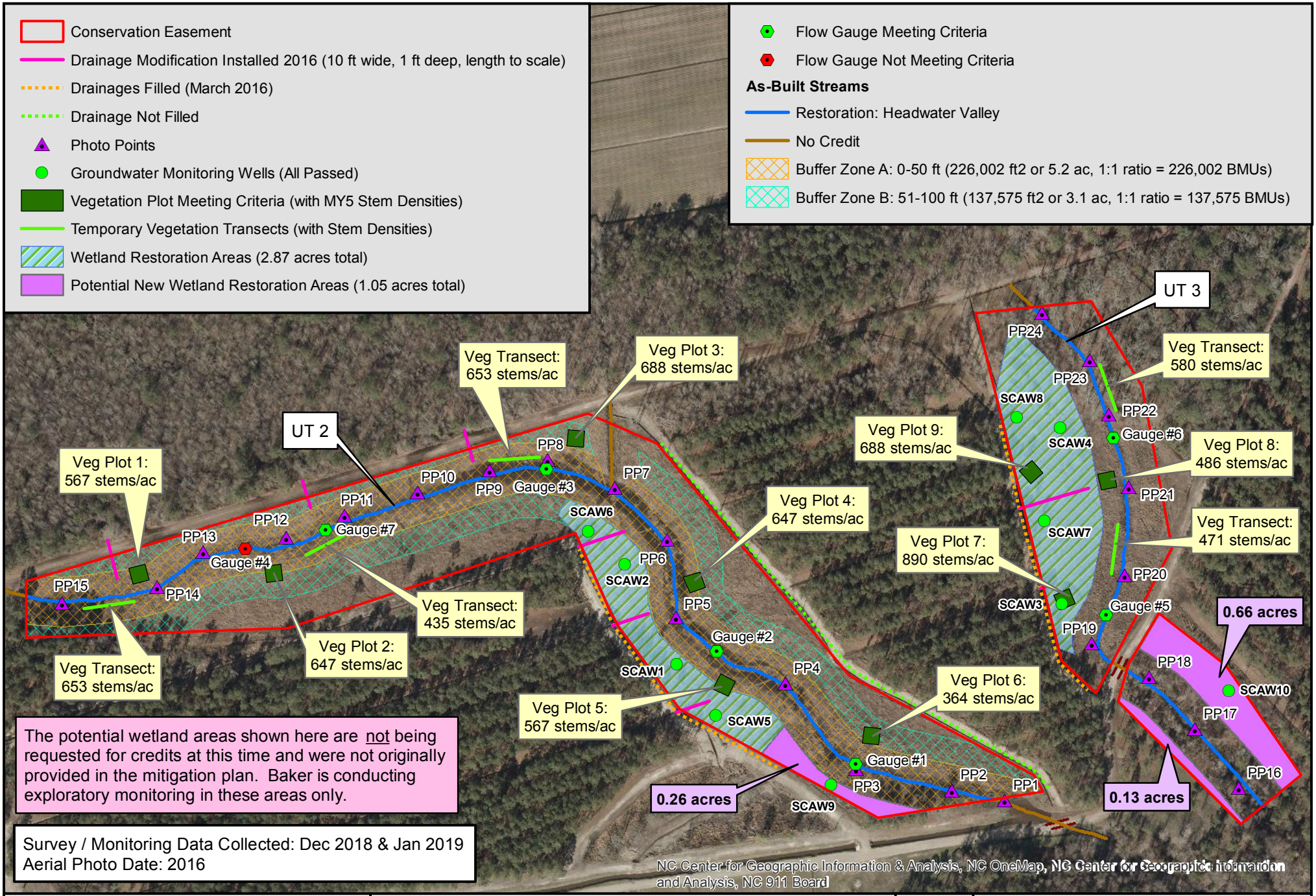
Appendix B

Visual Assessment Data



Michael Baker INTERNATIONAL

0 250 500 Feet

N

NCDEQ - Division of Mitigation Services
Project # 95015

Figure 2
Current Conditions Plan View: MY5
St. Clair Creek Site
Beaufort County, NC

Rev: 14Jan2019

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	Will be treated in 2019 with power tools and/or chemical application.	Photos 1-4 in VPA Photolog

St. Clair Restoration Site – Longitudinal Stream Photo Stations (Jan. 2019)

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 (Jan. 2019)

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 (Jan. 2019)

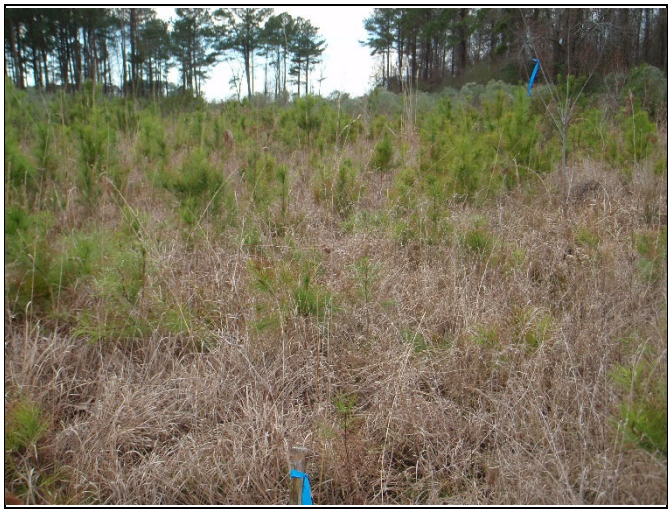


Photo Point 13 – UT2

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 (Jan. 2019)

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 Plot Photos (Dec. 2018)

Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6

St. Clair Restoration Site – Vegetation Plot Photos (Dec. 2018)

Vegetation Plot 7

Vegetation Plot 8

Vegetation Plot 9

St. Clair Restoration Site - Hydrology Monitoring Stations (Jan. 2019)

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 (Jan. 2019)

Supplemental Auto Well – SCAW7

Supplemental Auto Well – SCAW8

Supplemental Auto Well – SCAW9

Supplemental Auto Well – SCAW10

Reference Auto Well – SCREF2

St. Clair Restoration Site - Hydrology Monitoring Stations (Jan. 2019)

Flow Logger (UT2) – SCFL1

Flow Logger (UT2) – SCFL2

Flow Logger (UT2) – SCFL3

Flow Logger (UT2) – SCFL4

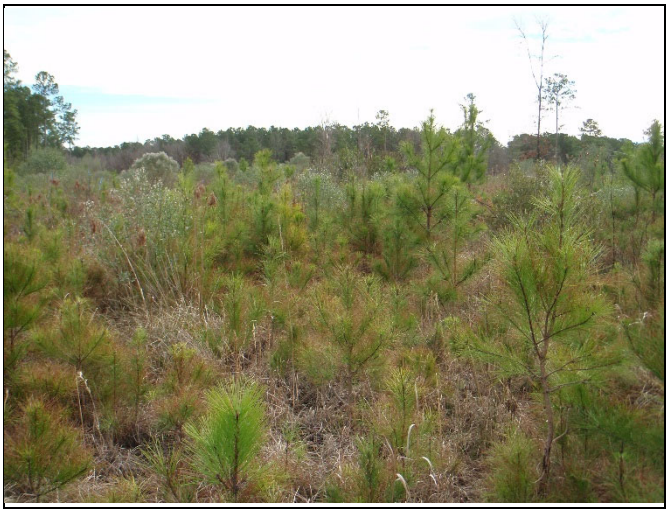
Flow Logger (UT3) – SCFL5

Flow Logger (UT3) – SCFL6

St. Clair Restoration Site - Hydrology Monitoring Stations (Jan. 2019)

Flow Logger (UT2) – SCFL7

St. Clair Restoration Site – Vegetation Problem Areas (Jan. 2019)



Loblolly Pines on UT2

Loblolly Pines on UT2

Loblolly Pines on UT2

Loblolly Pines on UT2

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?	MY5 Planted Density / As-built Planted Stem Density*	Tract Mean
1	Y	567/728	616
2	Y	647/648	
3	Y	688/688	
4	Y	647/728	
5	Y	567/688	
6	Y	364/486	
7	Y	890/1,174	
8	Y	486/728	
9	Y	688/769	

Note: *MY5 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	12/10/18 10:09 AM
database name	MichaelBaker_MY5_2018_StClair_95015.mdb
database location	L:\Projects\125116\Monitoring\Post Restoration\Veg Plots\Year 5_2018
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	4	3	1.33		1					1		2
		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	2	2	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	9	3	3	1		3		5				
		Quercus lyrata	Tree	overcup oak	15	7	2.14	4	2	1		3		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	7	2	3.5	3							4	
TOT:		**15**	**15**	**15**	**137**	**15**		**14**	**16**	**17**	**16**	**14**	**9**	**22**	**12**	**17**

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											
Acer rubrum	red maple					1				1	
Fraxinus pennsylvanica	green ash	2			1			1		1	
Nyssa sylvatica	swamp tupelo		1					4	2		
Quercus laurifolia	laurel oak	1		3		5					
Quercus lyrata	overcup oak	8	2	1		3		3	1	3	
Quercus michauxii	swamp chestnut oak	1	4		4	5	5	8			
Quercus pagoda	cherrybark oak										
Quercus phellos	willow oak			5	1	1	2	3			
Salix nigra	Black nigra		1								
Taxodium distichium	bald cypress		4	3	8		1				
Ulmus americana	American elm	1		4	2		2	4		7	
Shrub Species											
Aronia arbutifolia	Red Chokeberry		4	1						1	
Carpinus caroliniana	American hornbeam		1					1		2	
Clethra alnifolia	coastal sweetpepperbush	1									
Morella cerifera	wax myrtle	2					1		1		
Persea palustris	swamp bay								2	5	
Rhus copallinum	flameleaf sumac			1							
Vaccinium corymbosum	highbush blueberry	1						1	2		
Viburnum dentatum	southern arrowwood	3							4		
											Average Stems Per Acre
Stems Per Plot (December 2018)		20	17	18	16	15	11	25	12	20	
Total Stems/Acre Year 5 (December 2018)		809	688	728	647	607	445	1012	486	809	**692**
Total Stems/Acre Year 4 (October 2017)		1052	1052	809	850	769	405	1133	680	728	**831**
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 (MY5 2018)																									
			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
Acer rubrum	red maple	Tree														1	1											1	1
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																								
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		2	2													1		1				1		1			
Nyssa sylvatica	blackgum	Tree				1		1													4		4	2		2			
Persea palustris	swamp bay	tree																						2		2	4	1	5
Pinus taeda	loblolly pine	Tree																											
Quercus laurifolia	laurel oak	Tree	1		1				3		3				5		5												
Quercus lyrata	overcup oak	Tree	4	4	8	2		2	1		1				3		3				2	1	3	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																											
Quercus phellos	willow oak	Tree							5		5	1		1	1		1	1	1	2	2	1	3						
Rhus copallinum	flameleaf sumac	shrub								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																											
Ulmus americana	American elm	Tree	1		1				4		4	2		2				1	1	2	4		4				7		7
Unknown		Shrub or Tree																											
Vaccinium corymbosum	highbush blueberry	Shrub	1		1																	1	1	2		2			
Viburnum dentatum	southern arrowwood	Shrub	3		3																			4		4			
Stem count			14	6	20	16	1	17	17	1	18	16	0	16	14	1	15	9	2	11	22	3	25	12	0	12	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			6	2	7	6	1	7	6	1	7	5	0	5	4	1	5	5	2	5	7	2	7	4	0	4	6	3	7
Stems per ACRE			567	243	809	647	40	688	688	40	728	647	0	647	567	40	607	364	81	445	890	121	1,012	486	0	486	688	121	809

Scientific Name	Common Name	Species Type	MY5 (2018)			MY4 (2017)			MY3 (2016)			MY2 (2015)			MY1 (2014)		
			P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer rubrum	red maple	Tree		2	2												
Aronia arbutifolia	Red Chokeberry	Shrub	6		6	6		6	6		6	6		6	6		6
Carpinus caroliniana	American hornbeam	Tree	4		4	3	1	4	4		4	4		4	3		3
Clethra alnifolia	coastal sweetpepperbush	Shrub	1		1	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	5		5	4		4
Liquidambar styraciflua	sweetgum	Tree								7	7						
Morella cerifera	wax myrtle	shrub	2	2	4	1		1	1		1	1		1	1		1
Nyssa sylvatica	blackgum	Tree	7		7	7		7	5		5	7		7	6		6
Persea palustris	swamp bay	tree	6	1	7	6		6	6	2	8	6		6	6		6
Pinus taeda	loblolly pine	Tree								90	90						
Quercus laurifolia	laurel oak	Tree	9		9	8		8	8		8	8		8	14		14
Quercus lyrata	overcup oak	Tree	15	6	21	14	1	15	14		14	14		14	17		17
Quercus michauxii	swamp chestnut oak	Tree	27		27	27		27	26		26	27		27	25		25
Quercus pagoda	cherrybark oak	Tree					1	1		1	1						
Quercus phellos	willow oak	Tree	10	2	12	10		10	12		12	15		15	11		11
Rhus copallinum	flameleaf sumac	shrub		1	1												
Salix nigra	black willow	Tree		1	1					1	1						
Taxodium distichum	bald cypress	Tree	16		16	16		16	16		16	16		16	19		19
Ulmus alata	winged elm	Tree								2	2						
Ulmus americana	American elm	Tree	19	1	20	19		19	19		19	19		19	21		21
Unknown		Shrub or Tree													5		5
Vaccinium corymbosum	highbush blueberry	Shrub	3	1	4	3		3	3		3	5		5	5		5
Viburnum dentatum	southern arrowwood	Shrub	7		7	8		8	8		8	8		8	6		6
Stem count			137	17	154	134	3	137	135	103	238	143	0	143	152	0	152
size (ares)			9			9			9			9			9		
size (ACRES)			0.22			0.22			0.22			0.22			0.22		
Species count			13	8	18	13	3	14	13	6	18	13	0	13	15	0	15
Stems per ACRE			616	76	692	603	13	616	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 5 (6-Dec-2018)

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	6	**20**	0
2	12	16	0	0	1	**17**	0
3	16	17	0	0	1	**18**	0
4	16	16	0	0	0	**16**	0
5	14	14	0	0	1	**15**	0
6	8	9	0	0	2	**11**	0
7	n/a	22	0	0	3	**25**	0
8	n/a	12	0	0	0	**12**	0
9	n/a	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	243	809	Yes
2	647	40	688	Yes
3	688	40	728	Yes
4	647	0	647	Yes
5	567	40	607	Yes
6	364	81	445	Yes
7	890	121	1012	Yes
8	486	0	486	Yes
9	688	121	809	Yes
Project Avg	**616**	**76**	**692**	**Yes**

Riparian Buffer Vegetation Totals
(per acre)

Plot #	Riparian Buffer Stems[1]	Success Criteria Met?
1	364	Yes
2	486	Yes
3	647	Yes
4	647	Yes
5	567	Yes
6	324	Yes
7*	n/a	n/a
8*	n/a	n/a
9*	n/a	n/a
Project Avg	**506**	**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.

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Appendix D

Hydrologic Data

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

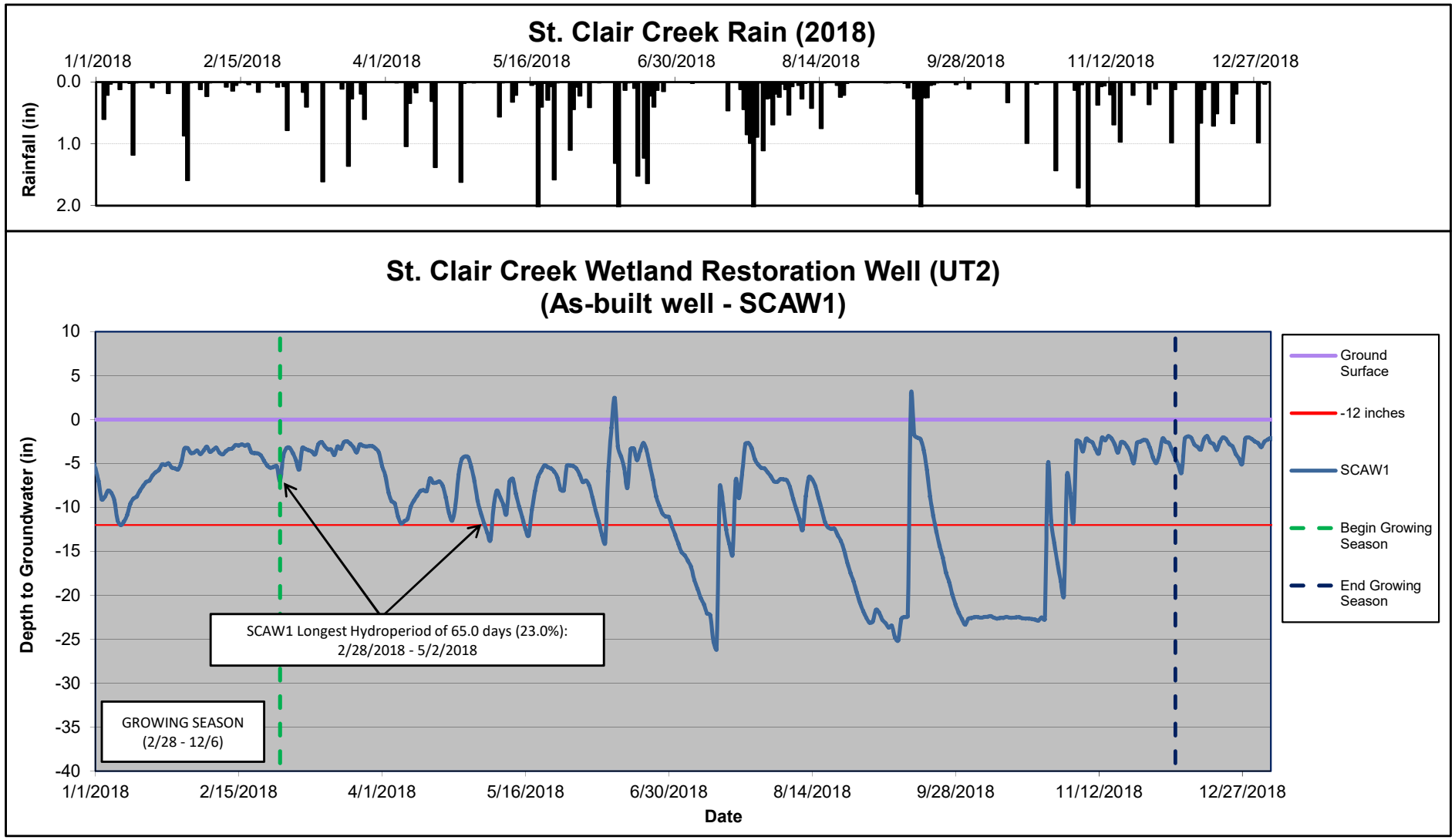
Well ID	Percentage of Consecutive Days <12 inches from Ground Surface[1]					Most Consecutive Days Meeting Criteria[2]					Percentage of Cumulative Days <12 inches from Ground Surface					Cumulative Days Meeting Criteria[3]				
	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)
Wetland Monitoring Wells (Installed September 2013)																				
SCAW1	1.0	12.3	13.1	33.7	23.0	2.8	34.8	37.0	95.0	65	8.5	39.3	61.7	68.1	68.1	24.0	110.8	174.0	192.0	192
SCAW2	3.8	3.3	9.2	10.6	13.1	10.8	9.3	26.0	30.0	37	30.6	16.1	19.9	51.1	59.9	86.3	45.5	56.0	144.0	169
SCAW3	2.3	13.4	9.6	11.0	13.1	6.5	37.8	27.0	31.0	37	9.4	37.5	44.3	26.2	47.2	26.5	105.8	125.0	74.0	133
SCAW4	7.8	12.3	6.0	11.0	22.3	22.0	34.8	17.0	31.0	63	17.3	20.3	35.8	25.9	57.8	48.8	57.3	101.0	73.0	163
Supplemental Wetland Monitoring Wells (Installed April 2016)**																				
SCAW5	--	--	12.8	11.3	23.4	--	--	36.0	32.0	66	--	--	46.8	69.9	68.1	--	--	132.0	197.0	192
SCAW6	--	--	3.9	10.3	12.4	--	--	11.0	29.0	35	--	--	19.9	32.6	53.9	--	--	56.0	92.0	152
SCAW7	--	--	9.6	11.3	22.3	--	--	27.0	32.0	63	--	--	33.0	38.3	55.0	--	--	93.0	108.0	155
SCAW8	--	--	4.6	11.3	12.8	--	--	13.0	32.0	36	--	--	22.0	23.8	50.0	--	--	62.0	67.0	141
Supplemental Wetland Monitoring Wells (Installed March 2017)**																				
SCAW9	--	--	--	9.9	12.1	--	--	--	28.0	34	--	--	--	45.4	55.0	--	--	--	128.0	155
SCAW10	--	--	--	9.9	12.4	--	--	--	28.0	35	--	--	--	28.7	36.5	--	--	--	81.0	103
Reference Wells (Installed Spetember 2013)																				
SCAWREF1	24.8	57.9	40.9	41.1	--	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	38.2	65.5	169.5	123.5	115.3	108	44.5	94.1	76.9	67.1	66.5	125.5	256.5	216.8	189.3	187.5

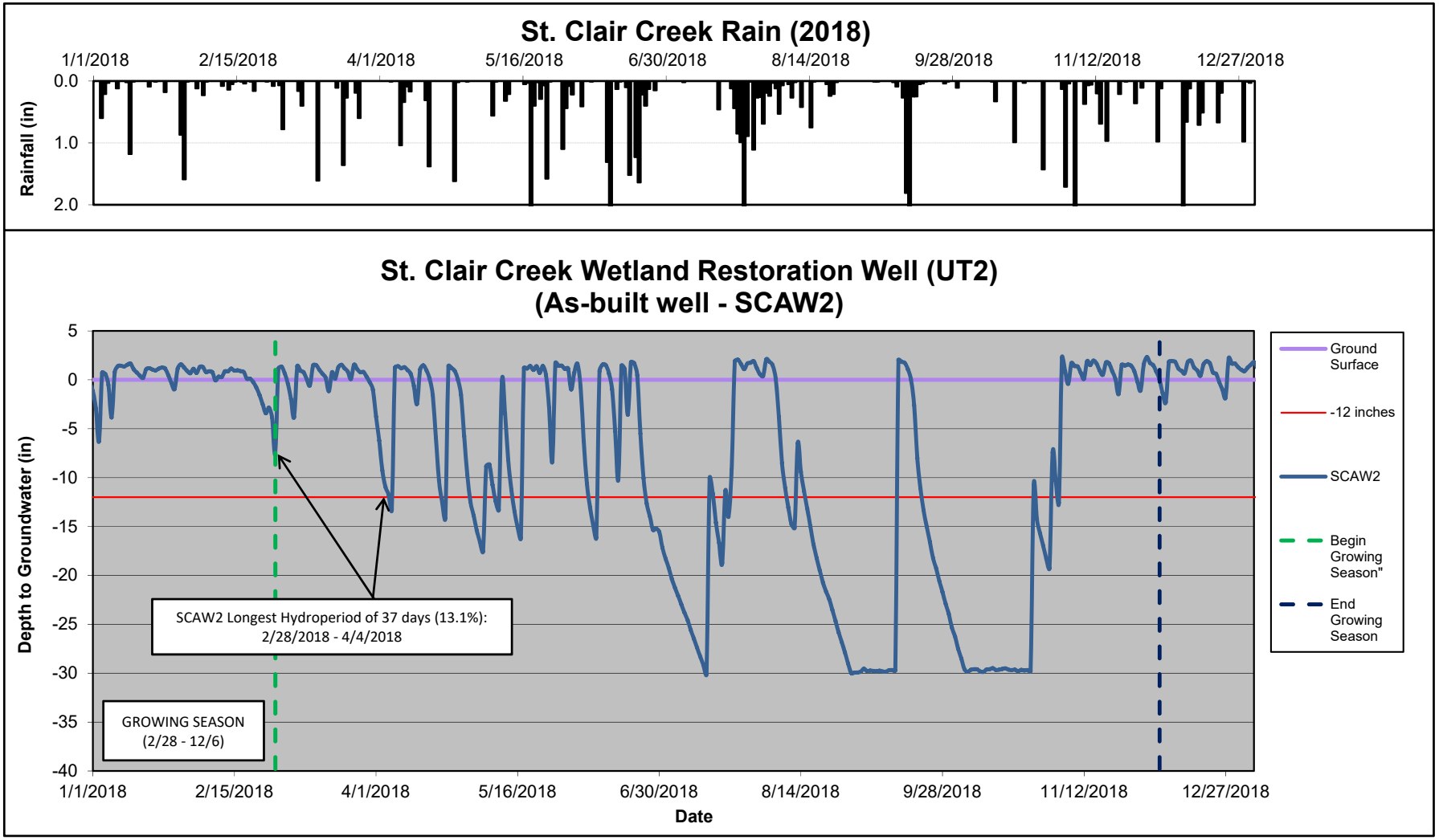
[1]Indicates the percentage of the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.
[2]Indicates the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or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

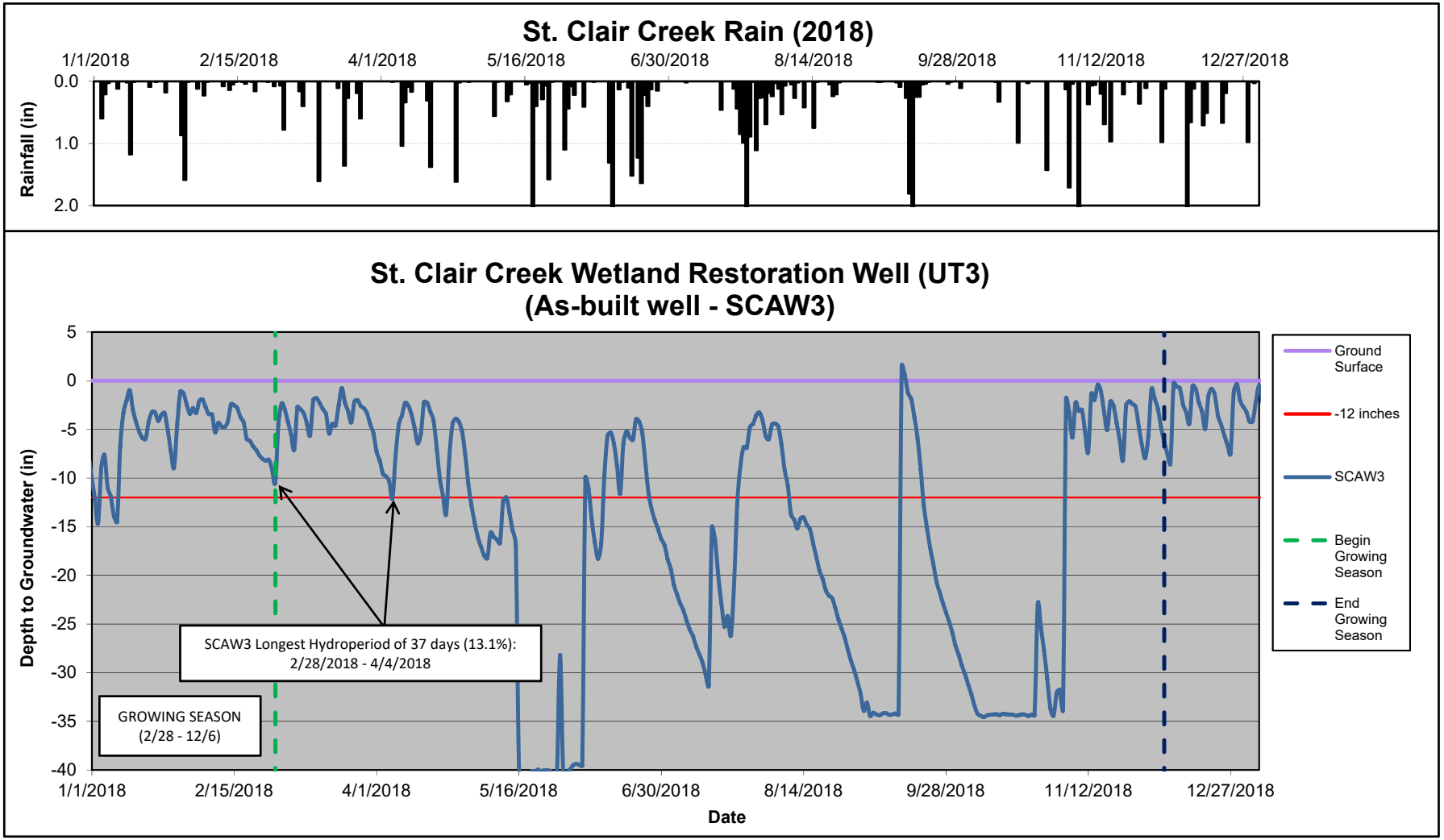
Growing season for Beaufort County is from February 28 to December 6 and is **282** days long. 12% of the growing season is **33.8** days.

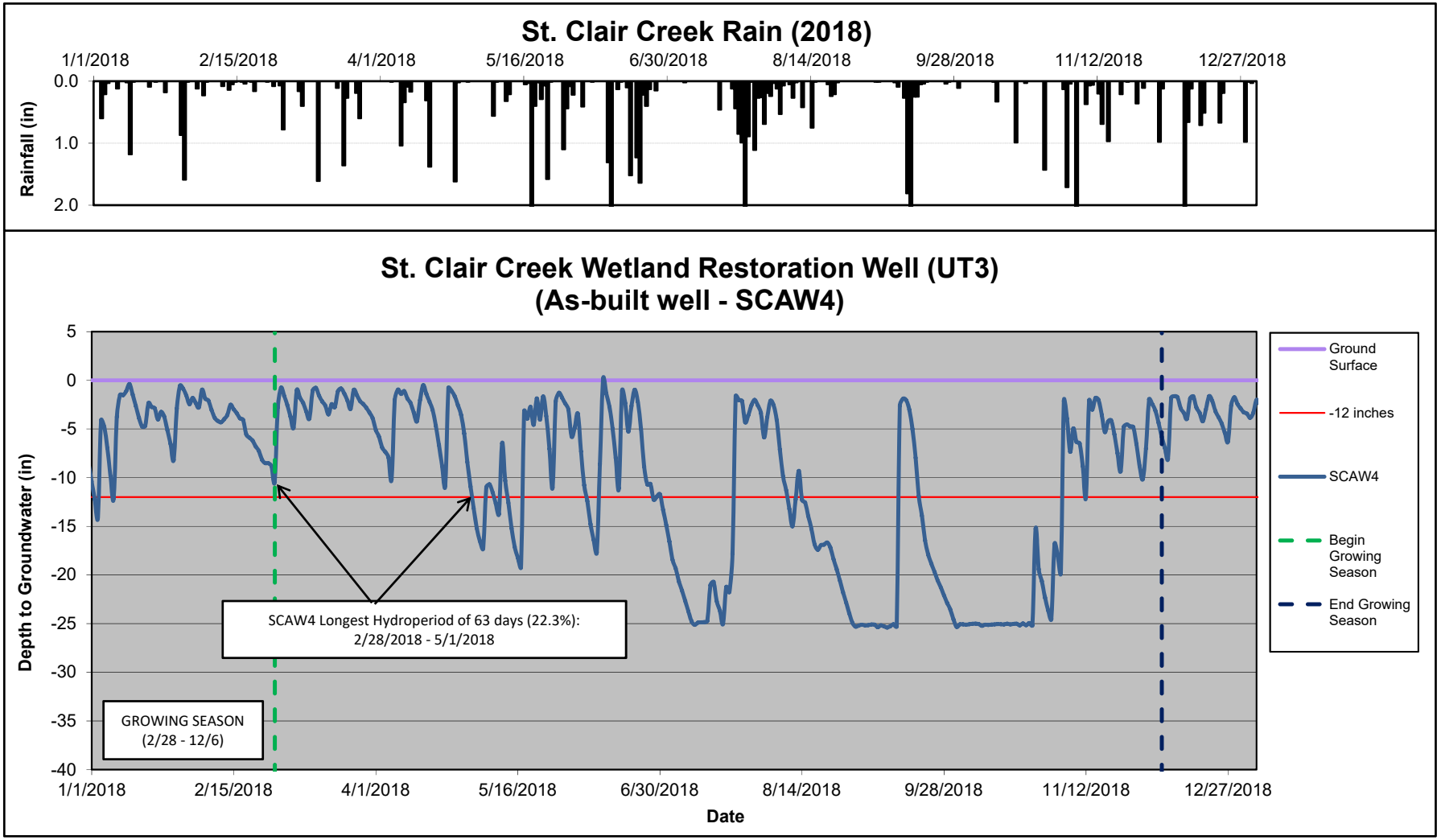
HIGHLIGHTED indicates wells that *did not* meet the success criteria for the most consecutive number of days within the monitored growing season with a water 12 inches or less from the soil surface. Following Year 5 wetland monitoring, all sixteen wells exhibited hyrdroperiods greater than 12% during the 2018 growing season.

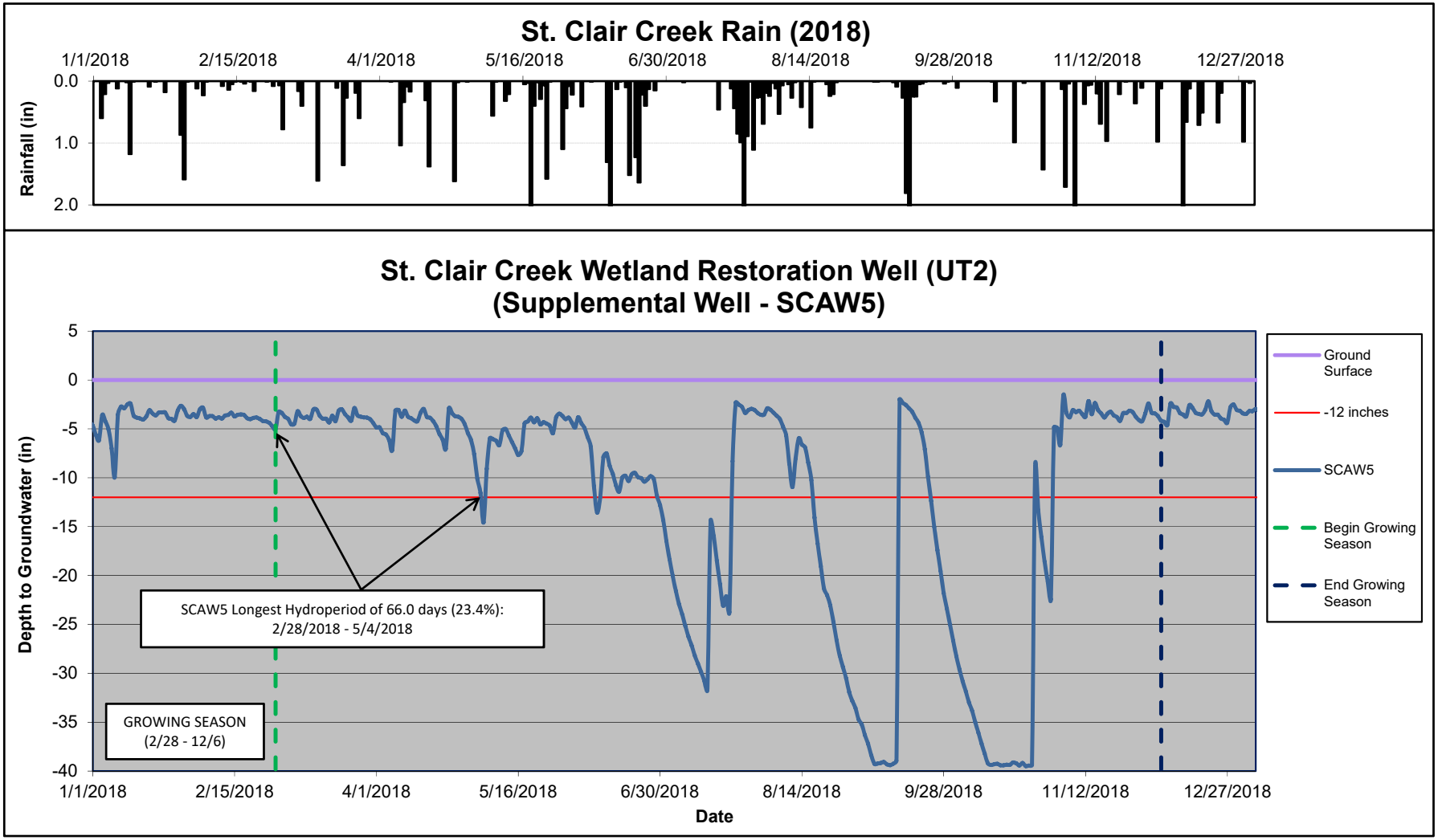
**To gather additional well data in the wetland restoration area, In-Situ groundwater monitoring dataloggers SCAW5 - SCAW 8 were installed in April 2016, several weeks after the growing season had begun. Two additional In-Situ groundwater monitoring dataloggers SCAW9 and SCAW10 were installed in March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

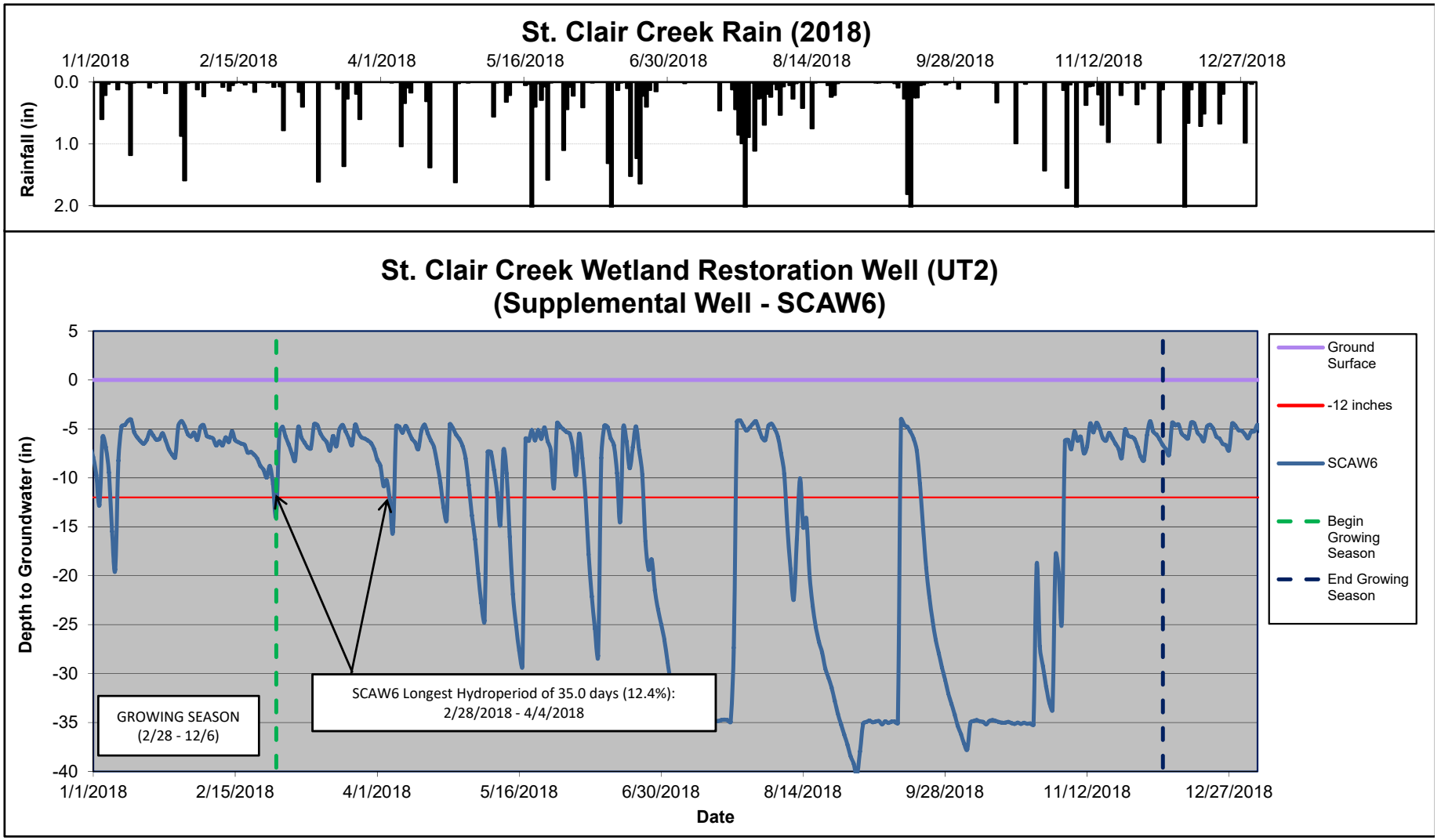

St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
Rainfall (in)
0.0
1.0
2.0
St. Clair Creek Wetland Restoration Well (UT2)
(As-built well - SCAW1)
Depth to Groundwater (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW1 Longest Hydroperiod of 65.0 days (23.0%):
2/28/2018 - 5/2/2018
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW1
Begin Growing Season
End Growing Season
Date

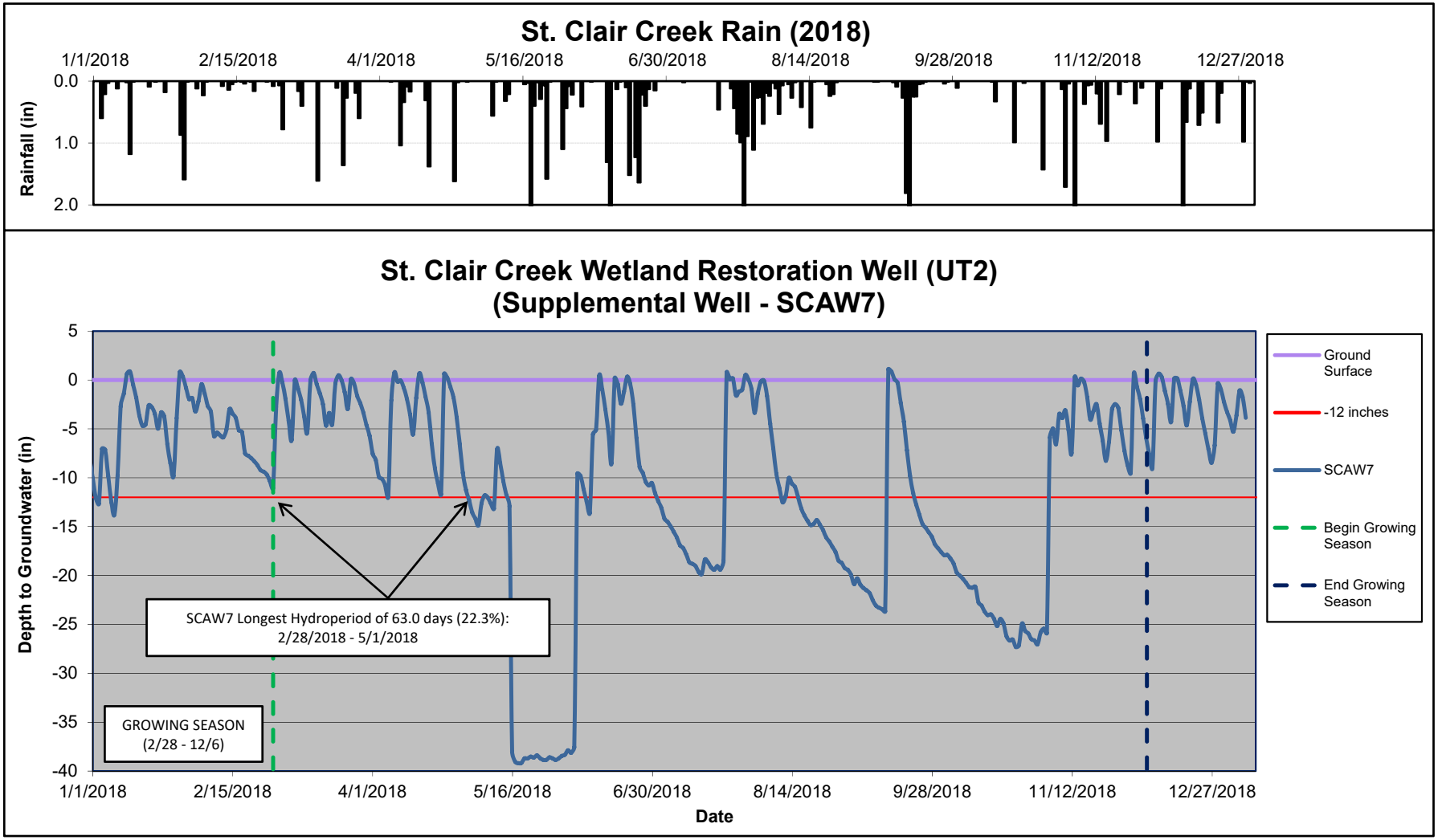

St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
Rainfall (in)
0.0
1.0
2.0
St. Clair Creek Wetland Restoration Well (UT2)
(As-built well - SCAW2)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW2 Longest Hydroperiod of 37 days (13.1%):
2/28/2018 - 4/4/2018
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW2
Begin Growing Season"
End Growing Season
Date

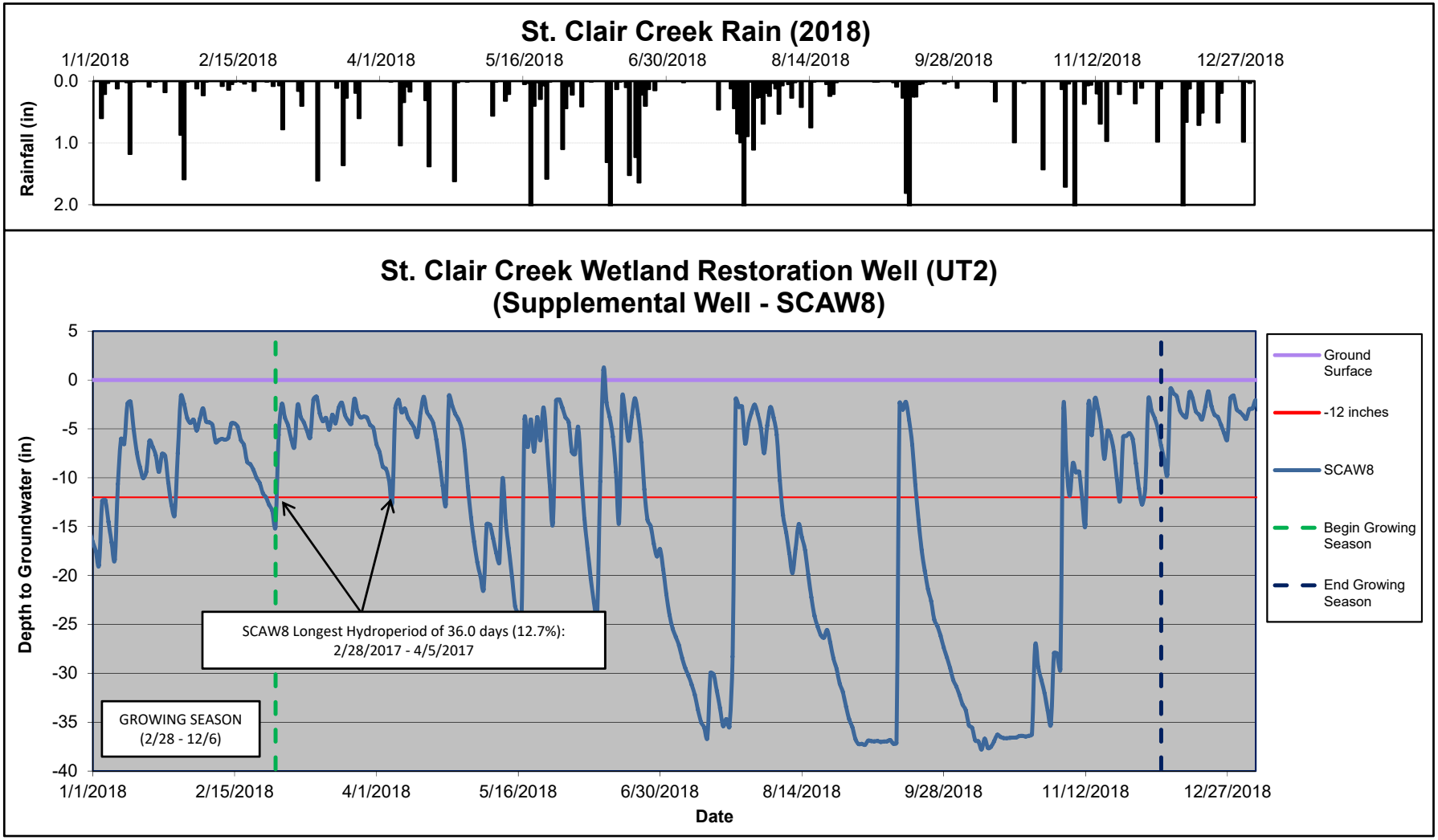

St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
Rainfall (in)
0.0
1.0
2.0
St. Clair Creek Wetland Restoration Well (UT3)
(As-built well - SCAW3)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW3 Longest Hydroperiod of 37 days (13.1%):
2/28/2018 - 4/4/2018
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW3
Begin Growing Season
End Growing Season
Date

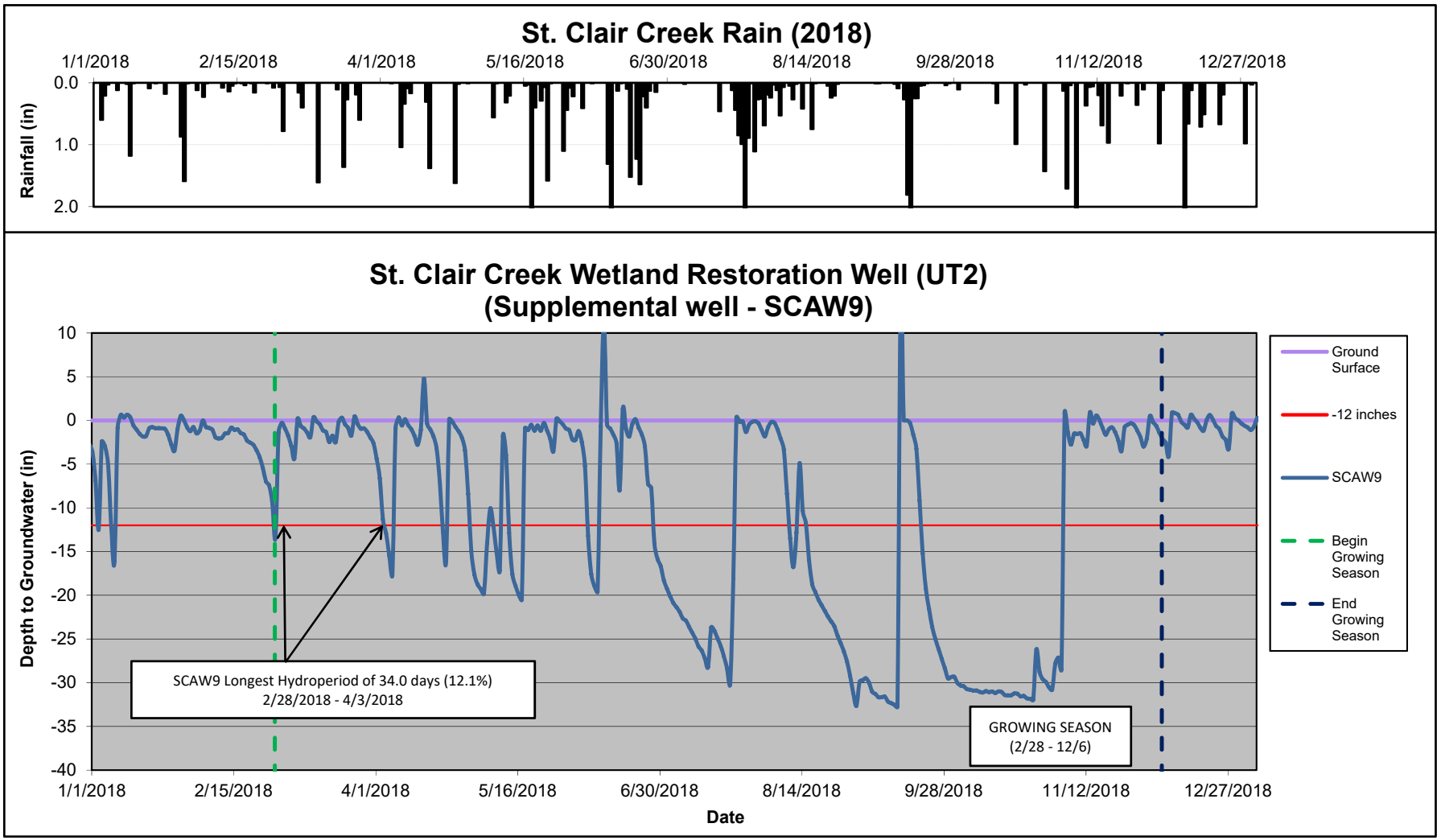

St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
Rainfall (in)
0.0
1.0
2.0
St. Clair Creek Wetland Restoration Well (UT3)
(As-built well - SCAW4)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW4 Longest Hydroperiod of 63 days (22.3%):
2/28/2018 - 5/1/2018
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW4
Begin Growing Season
End Growing Season
Date

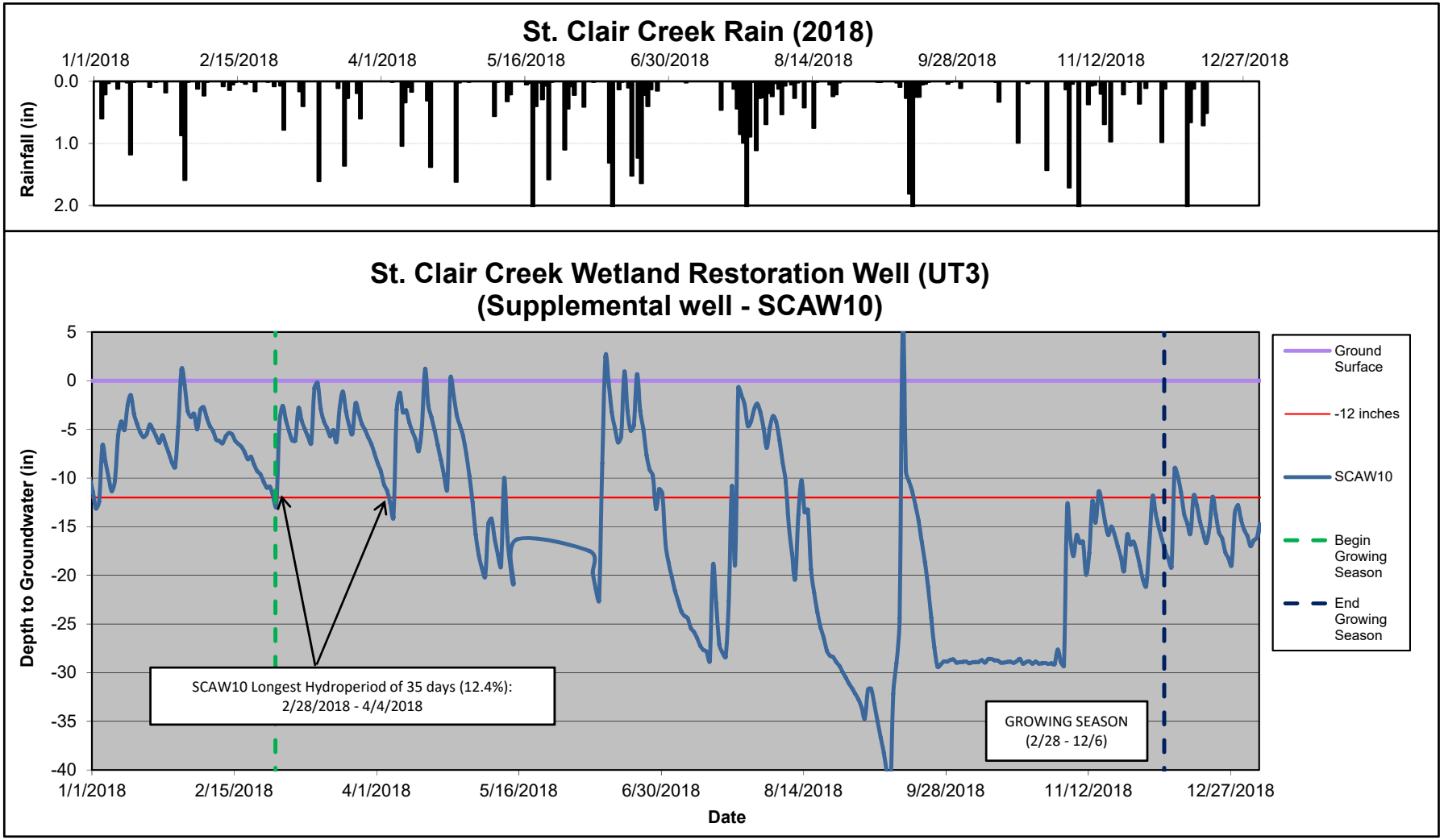

St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
Rainfall (in)
0.0
1.0
2.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW5)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW5 Longest Hydroperiod of 66.0 days (23.4%):
2/28/2018 - 5/4/2018
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW5
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
0.0
1.0
2.0
Rainfall (in)
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW6)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
Depth to Groundwater (in)
GROWING SEASON
(2/28 - 12/6)
SCAW6 Longest Hydroperiod of 35.0 days (12.4%):
2/28/2018 - 4/4/2018
Ground Surface
-12 inches
SCAW6
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
0.0
1.0
2.0
Rainfall (in)
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW7)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
Depth to Groundwater (in)
SCAW7 Longest Hydroperiod of 63.0 days (22.3%):
2/28/2018 - 5/1/2018
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW7
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
Rainfall (in)
0.0
1.0
2.0
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 36.0 days (12.7%):
2/28/2017 - 4/5/2017
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW8
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
Rainfall (in)
0.0
1.0
2.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental well - SCAW9)
Depth to Groundwater (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW9 Longest Hydroperiod of 34.0 days (12.1%)
2/28/2018 - 4/3/2018
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW9
Begin Growing Season
End Growing Season
Date


St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
Rainfall (in)
0.0
1.0
2.0
St. Clair Creek Wetland Restoration Well (UT3)
(Supplemental well - SCAW10)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW10 Longest Hydroperiod of 35 days (12.4%):
2/28/2018 - 4/4/2018
GROWING SEASON
(2/28 - 12/6)
Ground Surface
-12 inches
SCAW10
Begin Growing Season
End Growing Season
Date

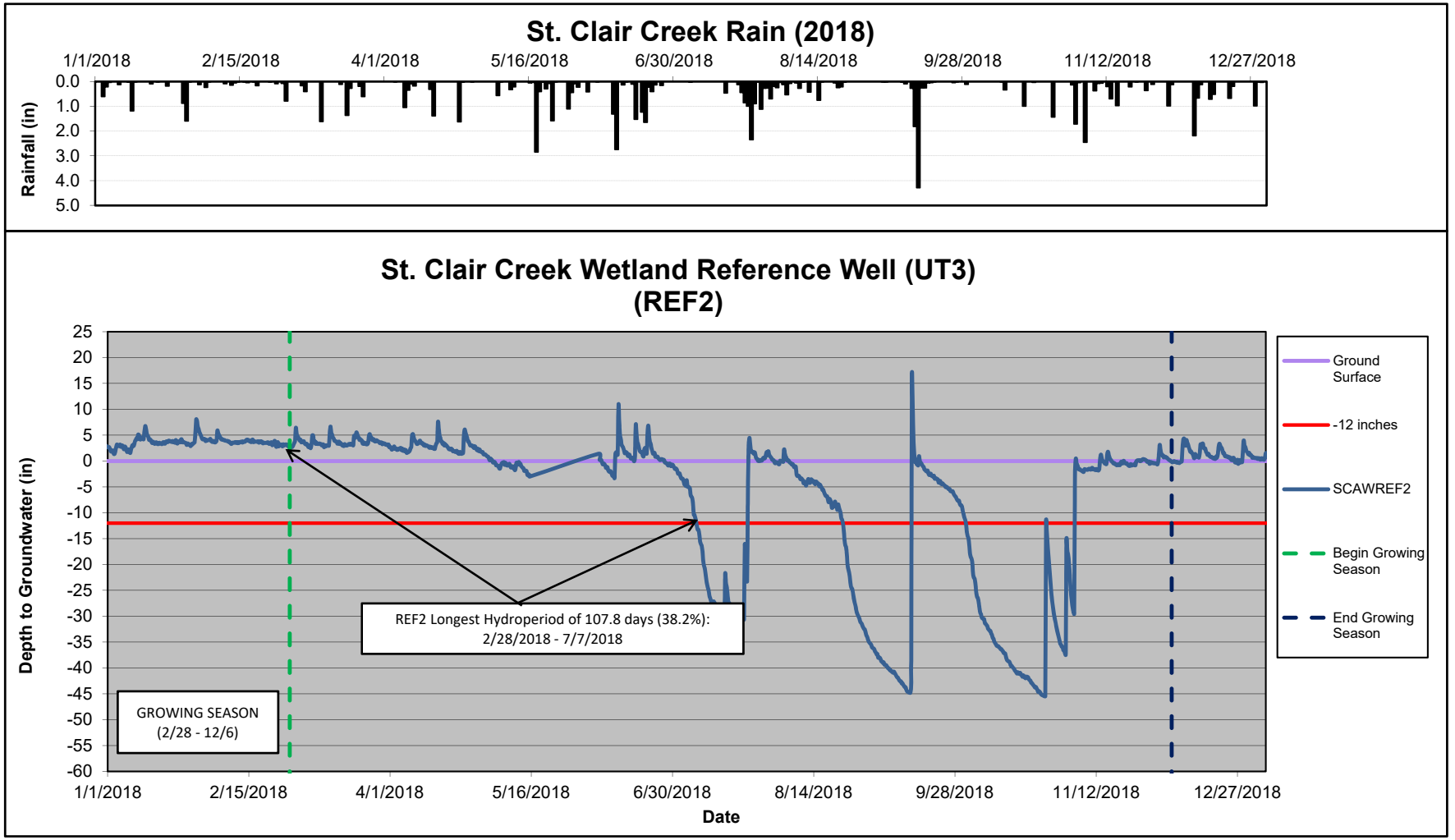

St. Clair Creek Rain (2018)
1/1/2018
2/15/2018
4/1/2018
5/16/2018
6/30/2018
8/14/2018
9/28/2018
11/12/2018
12/27/2018
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
5.0
St. Clair Creek Wetland Reference Well (UT3)
(REF2)
Depth to Groundwater (in)
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
REF2 Longest Hydroperiod of 107.8 days (38.2%):
2/28/2018 - 7/7/2018
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	152			-	206	224	328	363		
SCFL2	64	43	84	60	121			-	201	232	204	270		
SCFL3	61	25	86	35	63			-	174	203	287	328		
SCFL4	24	17	46	29*	20			-	118	124	86	146		
UT3 Flow Gauges (Installed July 17, 2015)														
SCFL5	57	44	62	30	57			NA	174	162	79	214		
SCFL6	5	42	62	30	35			NA	116	180	191	214		
UT2 Flow Gauge (Installed June 6, 2018)[3]														
SCFL7	NA	NA	NA	NA	60			NA	NA	NA	NA	162		

Notes:

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

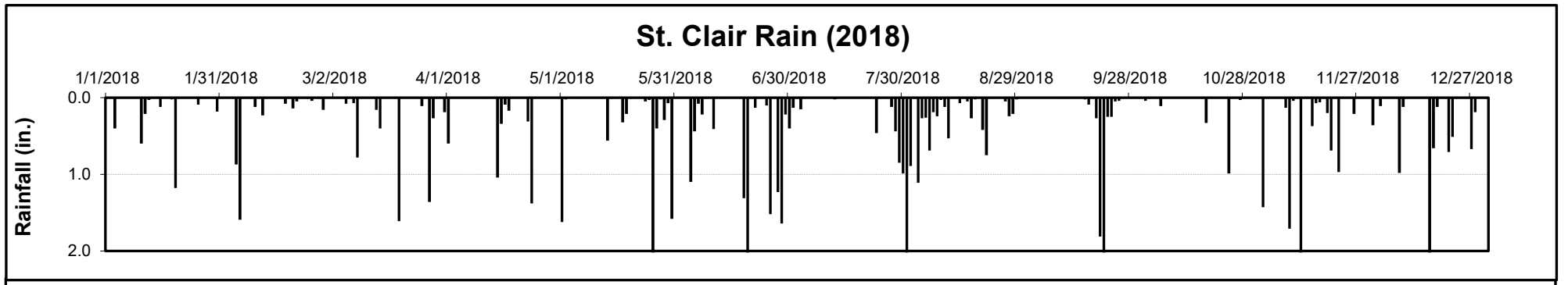
[2]Indicates the number of total number of days within the monitoring year where flow was measured.

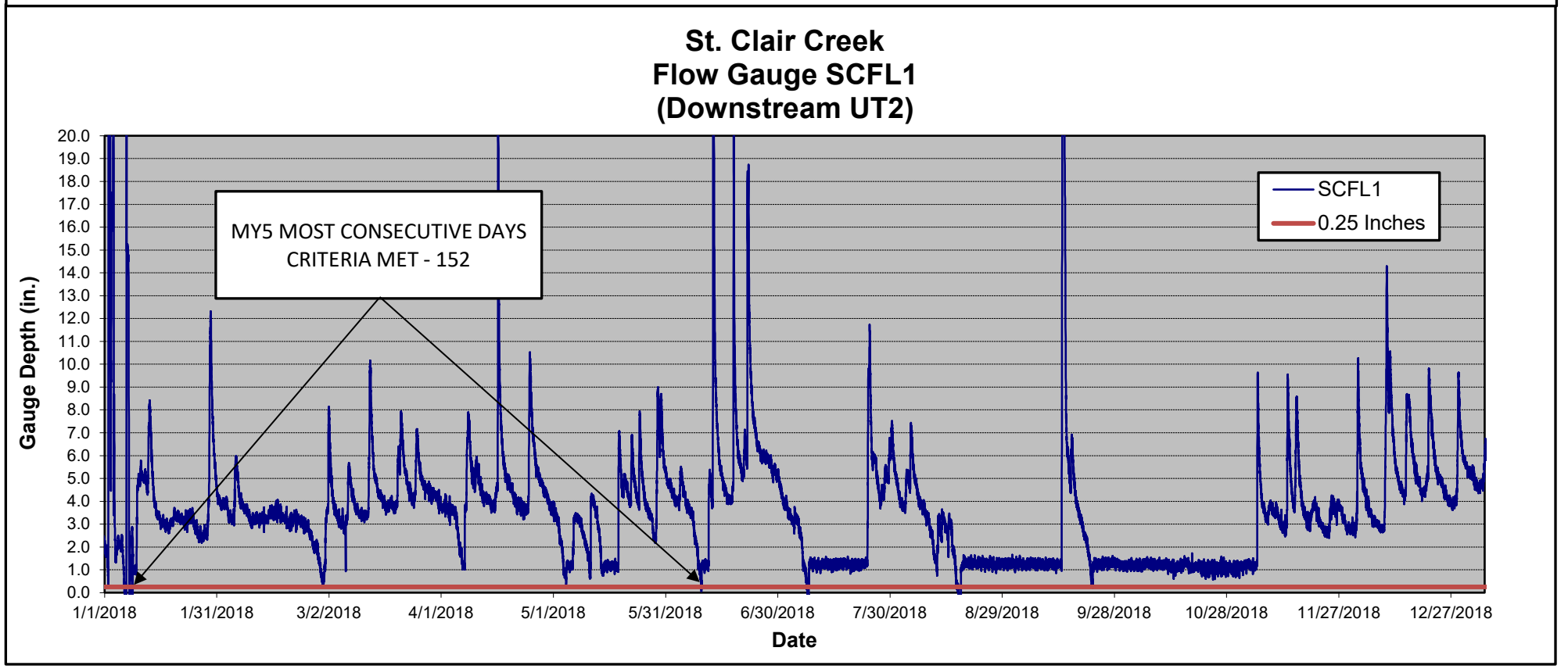
*SCFL4 also recorded a 28-day consecutive flow event in 2017, in addition to the 29-day flow event shown above.

[3]SCFL7 was installed June 6th 2018 to gather additional flow data for upper UT2.

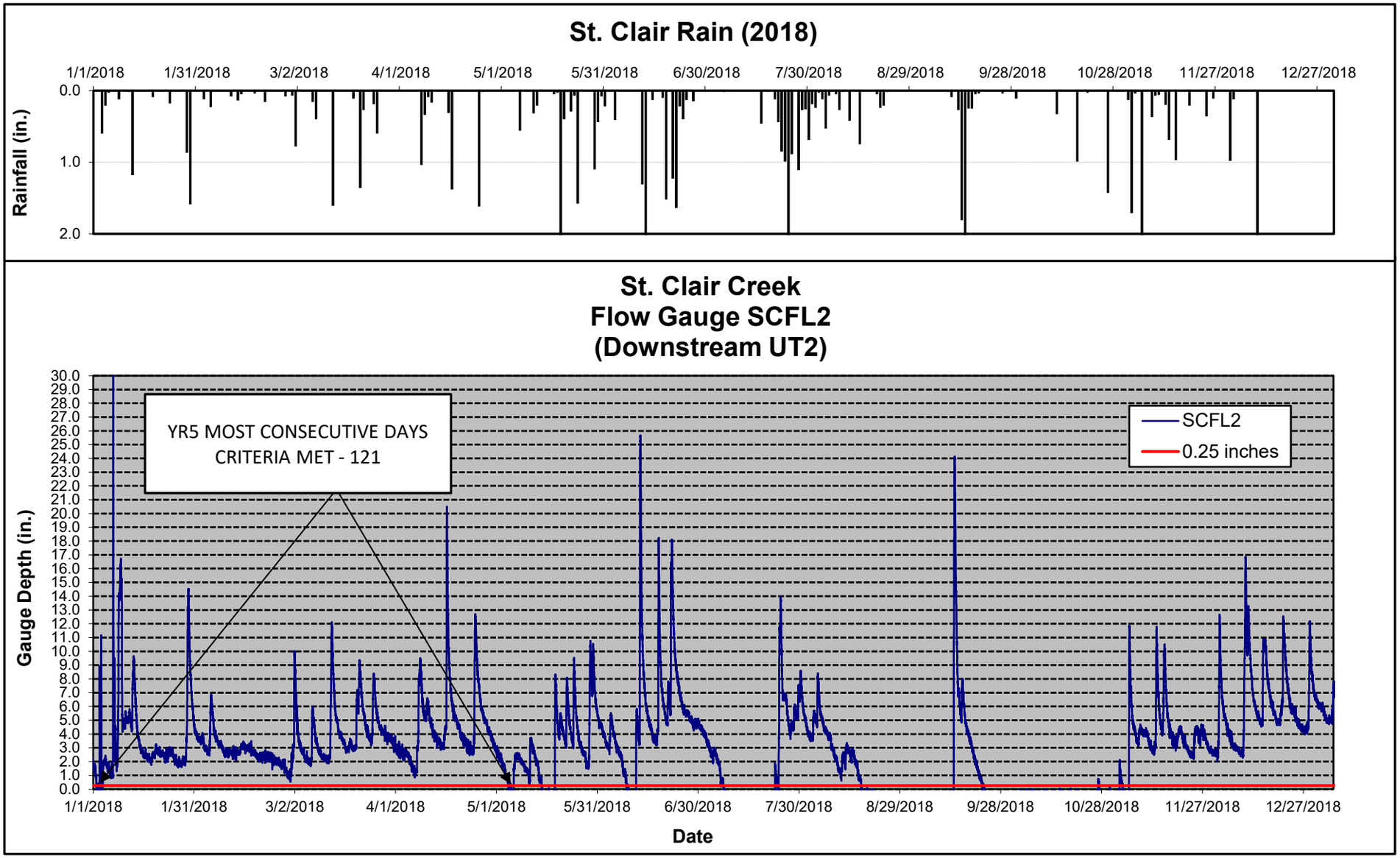
Success Criteria per St. Clair Creek Mitigation Plan: "A surface water flow event will be considered perennial when the flow duration occurs for a minimum of 30 days. Two surface water flow events must be documented within a five-year monitoring period; otherwise, monitoring will continue for seven years 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.

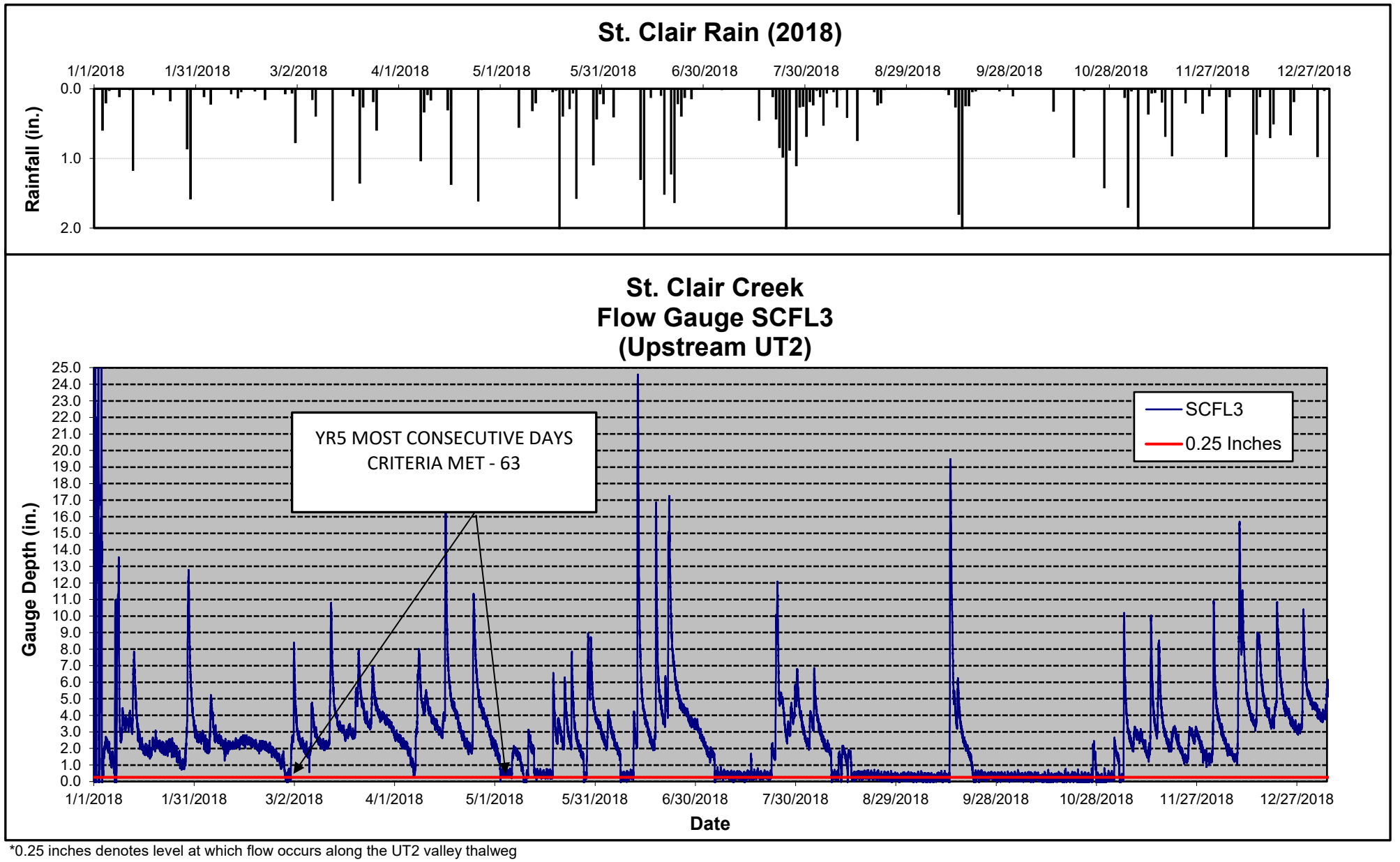




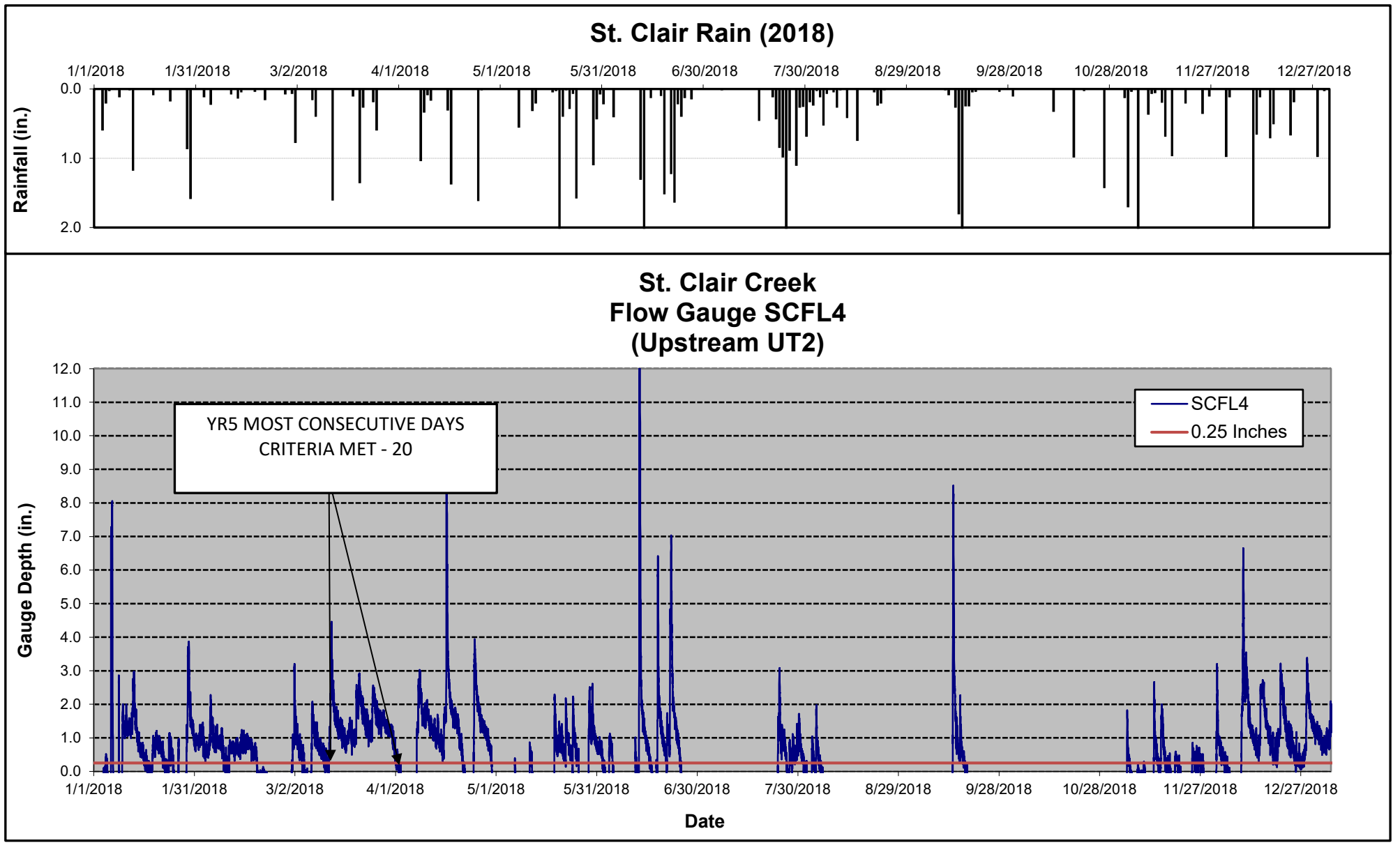
*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg



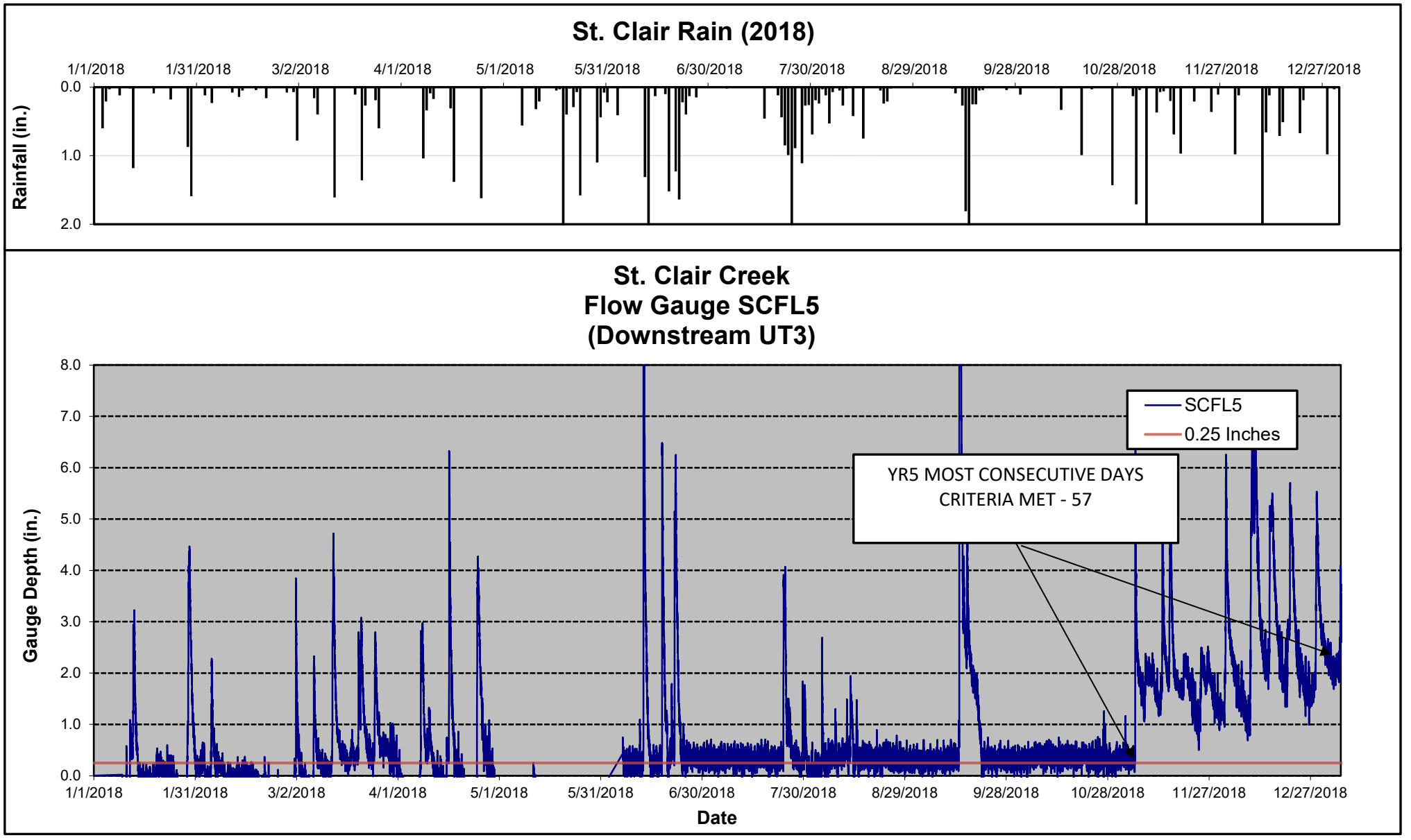
*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg



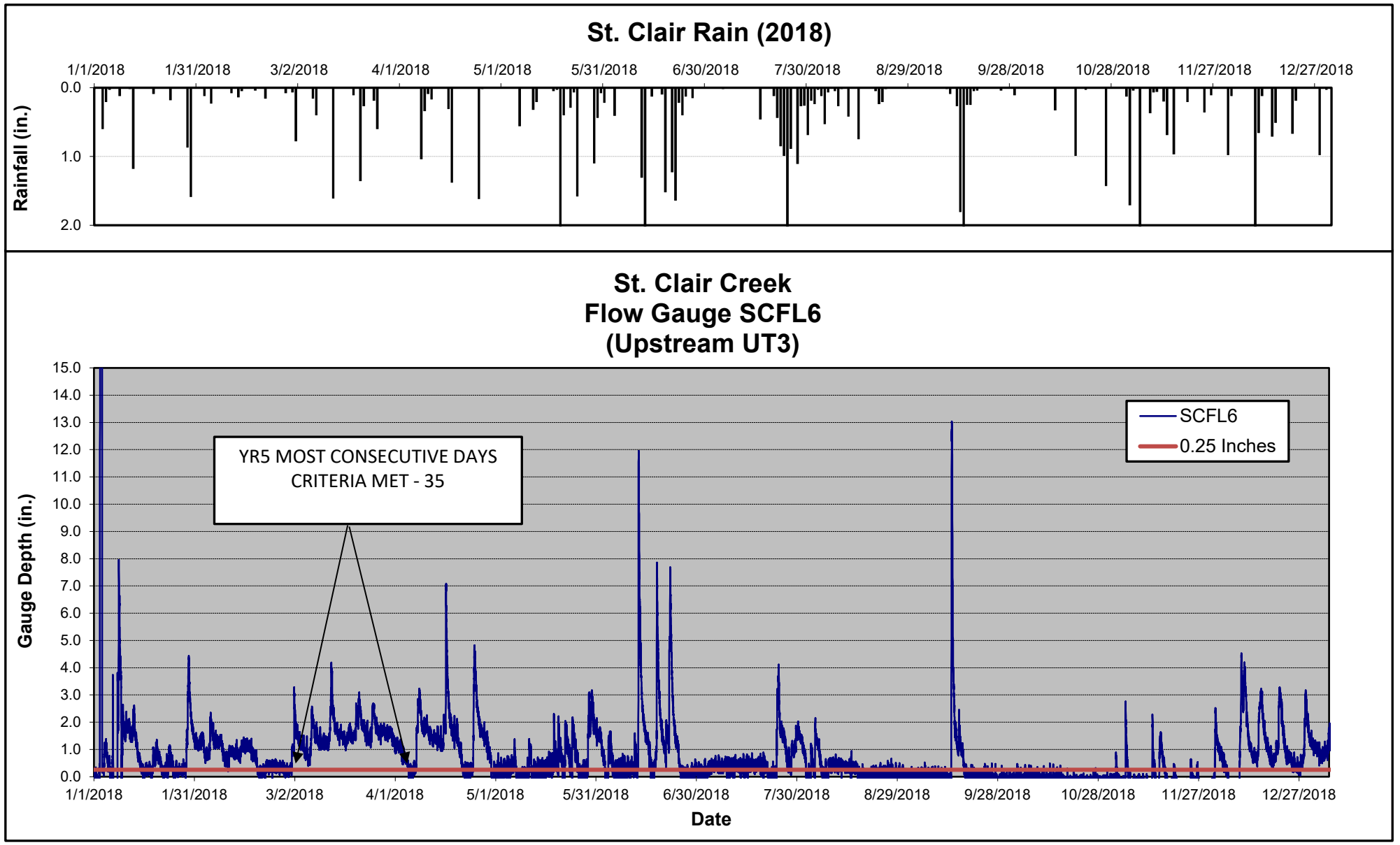
*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg



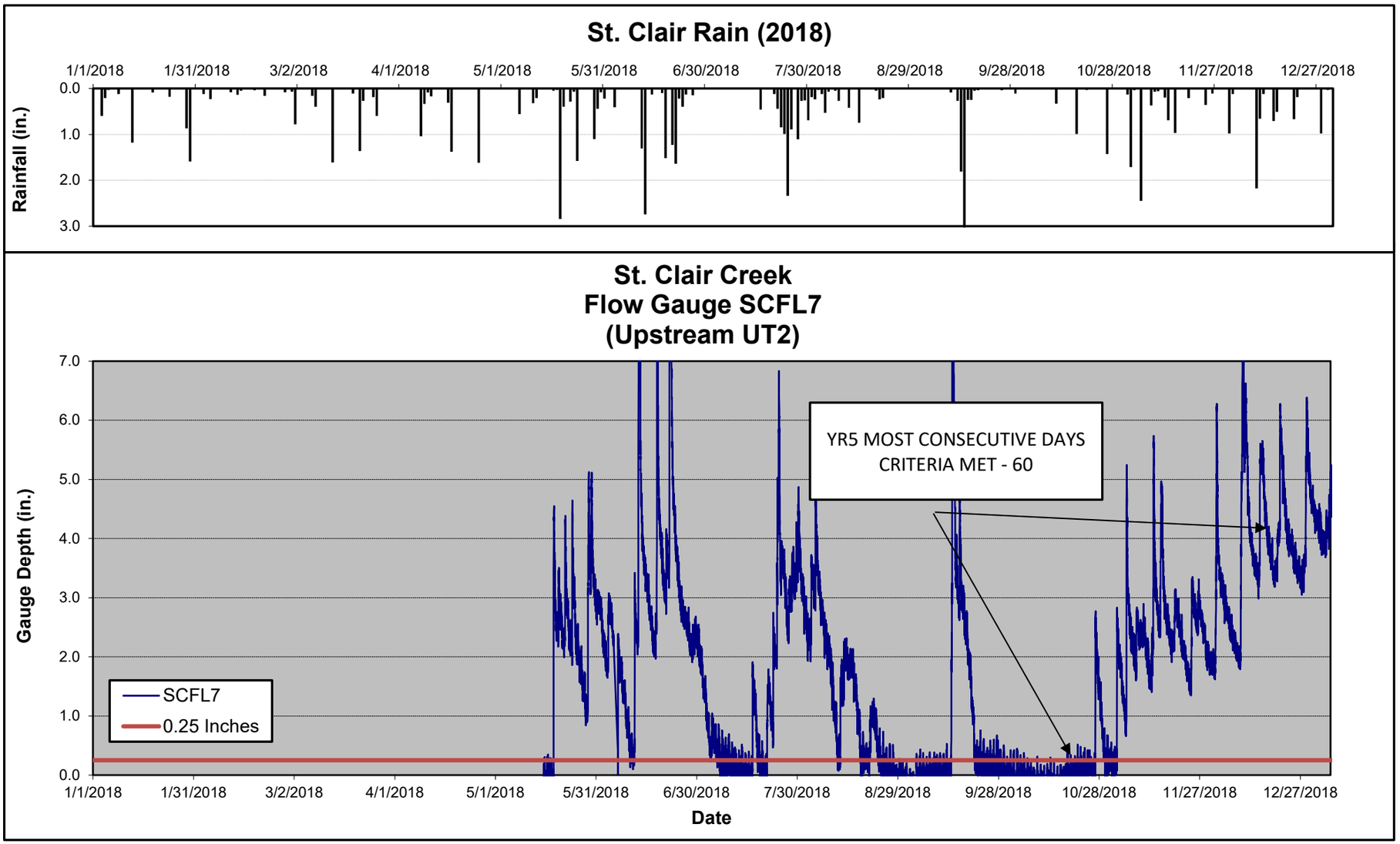
*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg



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



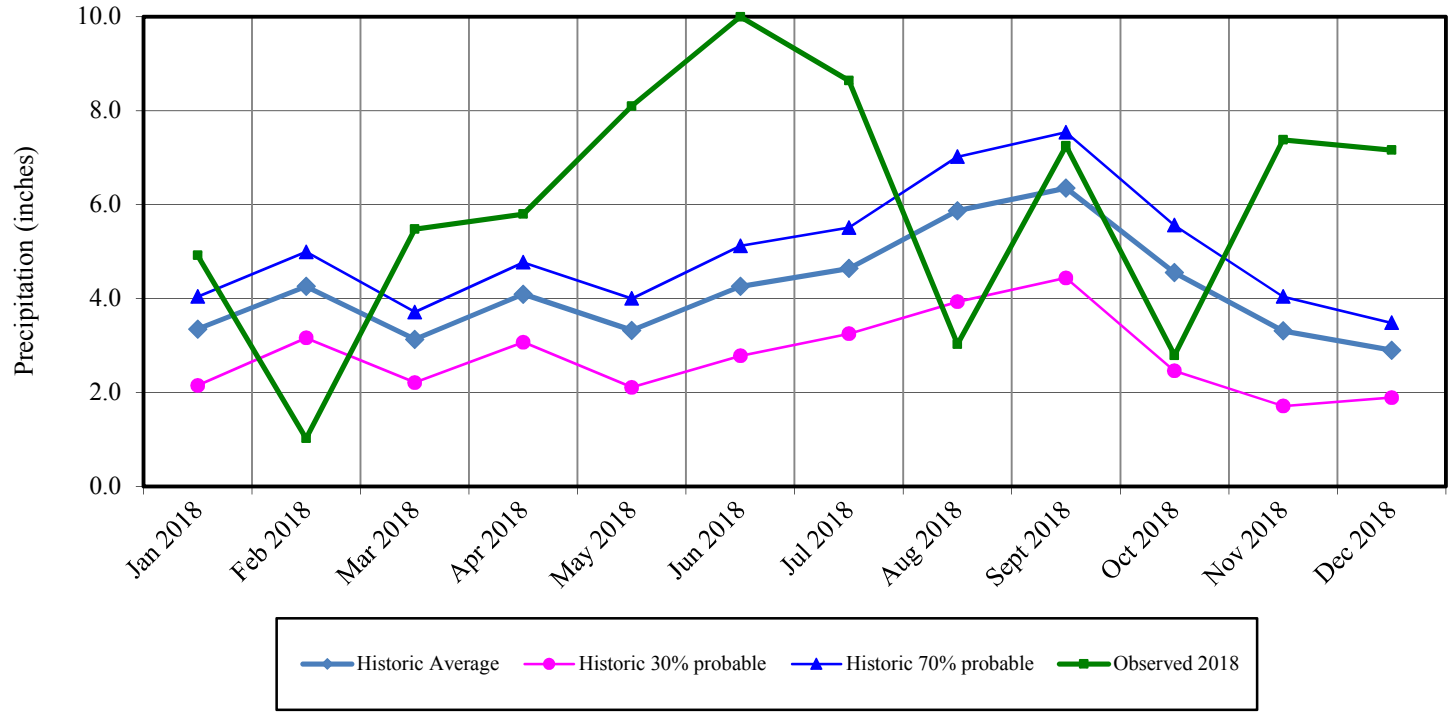
*0.25 inches denotes level at which flow occurs along the UT3 valley thalweg



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

Note: Flow gauge 7 was installed June 6th 2018

Figure 5. Observed Rainfall versus Historic Average
St. Clair Restoration Project (DMS No. 95015) MY5 2018



Note: Beaufort County historic average rainfall is 50.03 in, while observed previous 12 months rainfall total recorded onsite was 70.57 in, an excess of 20.54 in.