YEAR 6 MONITORING REPORT

UT MILLERS CREEK
Duplin County, North Carolina
DMS Project ID No. 95719, Contract No. 5000, USACE Action ID No. SAW-2013-00386
DWR Project No. 13-0187

Prepared for:

NCDEQ Division of Mitigation Services (DMS)
217 West Jones St., Suite 3000A
Raleigh, North Carolina 27603

Construction Completed: February 2015
Visual Assessment Data Collected: May 2020
Submitted: January 2021

Mitigation Project Name	**UT to Millers Creek Site**	**USACE Action ID**	**SAW-2013-00386**
DMS ID	**95719**	**DWR Permit**	**DWR#13-0187**
River Basin	**Cape Fear**	**Date Project Instituted**	**7/18/2011**
Cataloging Unit	**03030006**	**Date Prepared**	**7/14/2020**
County	**Duplin**	**Stream/Wet. Service Area**	**Cape Fear 03030006**

Signature & Date of Official Approving Credit Release

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

2 - For NCDMS projects, the initial credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the IRT by posting it to the DMS portal, provided the following have been met:

1) Approved of 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) Receipt of necessary DA permit authorization or written DA approval for projects 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.

Credit Release Milestone	**Warm Stream Credits**						
Project Credits	**Scheduled Releases %**	**Proposed Releases %**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	812.700	0.000	812.700	2016	3/31/2016
3 - Year 1 Monitoring	10.00%	10.00%	270.900	0.000	270.900	2016	4/26/2016
4 - Year 2 Monitoring	10.00%	10.00%	270.900	0.000	270.900	2017	4/3/2017
5 - Year 3 Monitoring	10.00%	10.00%	270.900	0.000	270.900	2018	4/25/2018
6 - Year 4 Monitoring	5.00%	5.00%	135.450	0.000	135.450	2019	4/26/2019
7 - Year 5 Monitoring	10.00%	10.00%	270.900	0.000	270.900	2020	7/6/2020
8 - Year 6 Monitoring	5.00%					2021	
9 - Year 7 Monitoring	10.00%					2022	
Stream Bankfull Standard	10.00%	10.00%	270.900	0.000	270.900	2017	4/3/2017
			Totals	0.000	2,302.650		

Total Gross Credits	2,709.000
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	2,302.650
Total Percentage Released	85.00%
Remaining Unreleased Credits	406.350

Credit Release Milestone	**Riparian Credits**						
Project Credits	**Scheduled Releases %**	**Proposed Releases %**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	2.400	0.000	2.400	2016	3/31/2016
3 - Year 1 Monitoring	10.00%	10.00%	0.800	0.000	0.800	2016	4/26/2016
4 - Year 2 Monitoring	10.00%	10.00%	0.800	0.000	0.800	2017	4/3/2017
5 - Year 3 Monitoring	15.00%	15.00%	1.200	0.000	1.200	2018	4/25/2018
6 - Year 4 Monitoring	5.00%	5.00%	0.400	0.000	0.400	2019	4/26/2019
7 - Year 5 Monitoring	15.00%	15.00%	1.200	1.200	0.000	2020	7/6/2020
8 - Year 6 Monitoring	5.00%					2021	
9 - Year 7 Monitoring	10.00%					2022	
Stream Bankfull Standard	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Totals	0.000	5.600		

Total Gross Credits	8.000
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	5.600
Total Percentage Released	70.00%
Remaining Unreleased Credits	2.400

Mitigation Project Name	**UT to Millers Creek Site**	**USACE Action ID**	**SAW-2013-00386**
DMS ID	**95719**	**DWR Permit**	**DWR#13-0187**
River Basin	**Cape Fear**	**Date Project Instituted**	**7/18/2011**
Cataloging Unit	**03030006**	**Date Prepared**	**7/14/2020**
County	**Duplin**	**Stream/Wet. Service Area**	**Cape Fear 03030006**

Notes

1/16/2019: During the review of the Year 4 monitoring report, DMS discovered that the schedule of credit release was incorrect from what was approved in the final mitigation plan. The credit release schedule has been adjusted for the unreleased credits after 4/25/2018.

Contingencies (if any)

Project Quantities

Mitigation Type	Restoration Type	Physical Quantity
Warm Stream	Restoration	2,709.000
Riparian	Restoration	8.770

Debits

							Stream Restoration Credits	**Riparian Restoration**
Beginning Balance (mitigation credits)							**2,709.000**	**8.000**
Released Credit							**2,302.650**	**5.600**
Unrealized Credits							**0.000**	**0.000**
Owning Program	**Req. Id**	**TIP #**	**Project Name**	**USACE Permit #**	**DWR Permit #**	**DCM Permit #**		
Statewide Stream & Wetland ILF Program	REQ-005315		The Pork Company S&J Villari Livestock	2010-00917			110.000	
NCDOT Stream & Wetland ILF Program	REQ-005840	R-2303C	NC 24 Improvements - Section C	1992-03237	2012-0240		702.700	
NCDOT Stream & Wetland ILF Program	REQ-005843	R-2303D	NC 24 Improvements - Section D	1992-03237	2012-00240		270.900	
NCDOT Stream & Wetland ILF Program	REQ-005843	R-2303D	NC 24 Improvements - Section D	1992-03237	2012-0240		541.800	
NCDOT Stream & Wetland ILF Program	REQ-006566		SR 1715 - Bridge 300278 - Division 3	2013-01815			72.000	
NCDOT Stream & Wetland ILF Program	REQ-008243	R-2303E	NC 24 Improvements - Section E	1992-03237	2012-0240		334.350	
NCDOT Stream & Wetland ILF Program	REQ-002518	B-3906	B-3906	2001-01309				0.110
NCDOT Stream & Wetland ILF Program	REQ-005082	B-3654	Bridges 29 & 53 on NC 55	2003-00152	2009-0676			0.460
NCDOT Stream & Wetland ILF Program	REQ-005349	B-5116	Bridge 150 on SR 1502	2010-00123				0.200
NCDOT Stream & Wetland ILF Program	REQ-005619	B-4543	Bridge 120 on SR 1558	2010-00334	2012-0219			0.300
NCDOT Stream & Wetland ILF Program	REQ-005841	R-2303C	NC 24 Improvements - Section C	1992-03237	2012-0240			0.275
NCDOT Stream & Wetland ILF Program	REQ-005841	R-2303C	NC 24 Improvements - Section C	1992-03237	2012-0240			0.800
NCDOT Stream & Wetland ILF Program	REQ-005872	B-5143	Bridge 408 on SR 1105 over Stewart's Creek	2009-00859				0.130
NCDOT Stream & Wetland ILF Program	REQ-005922	B-3152	Bridge 46 on NC 242	2000-01472				0.250
NCDOT Stream & Wetland ILF Program	REQ-006046	R-5526	SR 1841 Improvements - Division 6	2014-00131				0.470
NCDOT Stream & Wetland ILF Program	REQ-006087	B-5117	Bridge 17 over Lake Creek on NC 210	2013-02241				0.210
Total Credits Debited							**2,031.750**	**3.205**
Remaining Available balance (Released credits)							**270.900**	**2.395**

Mitigation Project Name	**UT to Millers Creek Site**	**USACE Action ID**	**SAW-2013-00386**
DMS ID	**95719**	**DWR Permit**	**DWR#13-0187**
River Basin	**Cape Fear**	**Date Project Instituted**	**7/18/2011**
Cataloging Unit	**03030006**	**Date Prepared**	**7/14/2020**
County	**Duplin**	**Stream/Wet. Service Area**	**Cape Fear 03030006**

Remaining Credits (Unreleased credits)	**406.350**	**2.400**

ROY COOPER
Governor

MICHAEL REGAN
Secretary

Mitigation Services
ENVIRONMENTAL QUALITY

January 8, 2021

Via email: Alex DiGeronimo via email adigeronimo@lmgroup.net

Alex DiGeronimo
Land Management Group (for HDR)

Subject: DMS Comments
UT to Millers Creek, Project ID #95719, DMS Contract #5000

Alex,

After receiving the MY6 draft report and a conducting site visit on 1/6/2021, DMS offers the following comments:

1. Page 16, Table 5. Remove scoured / eroding bank from this table if it is no longer an issue on-site.

Digital:

1. Please send the most recent wetland features used in the CCPV. DMS currently has features that accurately represent the total wetland acreage, but the features for Headwater Wetland Restoration and Riparian Wetland Restoration – Pines are not segmented.
2. Include the hydric soils shapefile if possible.
3. If applicable, include a feature documenting the scour that was indicated in the visual assessment table in the CCPV and submit the feature.
4. Submit the data used to create the groundwater gauge figures and precipitation figure.

Please call if you have any questions about these comments and insert the responses after your cover page to the report. Thanks for your work,

Lindsay Crocker, DMS

Prepared by:

LMG
LAND MANAGEMENT GROUP
a DAVEY company

Land Management Group

on behalf of:

HDR Engineering
555 Fayetteville Street, Suite 900
Raleigh, North Carolina 27601
919.232.6600
919.232.6642 (fax)

I HEREBY CERTIFY THAT THE DOCUMENT CONTAINED HEREIN, UT MILLERS CREEK YEAR 6 MONITORING REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

SIGNED SEALED AND DATED THIS 11TH DAY OF JANUARY 2021.

NORTH CAROLINA PROFESSIONAL SEAL 050744 ENGINEER ALEX D DiGERONIMO

Alex D. DiGeronimo, PE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 PROJECT SUMMARY

The following report summarizes the vegetation establishment, stream stability, and wetland hydrology for Year 6 monitoring for the UT Millers Creek Site (hereafter referred to as the "Site") in Duplin County, North Carolina.

1.1 Goals and Objectives

The primary goals of the UT Millers Creek stream and wetland mitigation project focus on:

- Reducing stressors to water quality
- Providing and enhancing flood attenuation
- Restoring and enhancing aquatic, semi-aquatic and riparian habitat, and
- Restoring and enhancing habitat connectivity with adjacent natural habitats.

The following objectives accomplish the goals listed above:

1. Removing stressors to water quality and increasing attenuation is directly tied to:
    a. Restoration of the formerly deeply incised and entrenched UT as a Priority I (PI) restoration where bankfull and larger flows access the historic floodplain allowing nutrients, sedimentation, trash, and debris from upstream urban runoff to settle from floodwaters.
    b. Restoration of the UT as PI restoration allows the Site to mitigate flood flows by reconnecting bankfull and higher flows to its historic floodplain.
    c. Restoration of the riparian buffers and wetlands adjacent to the UT (i.e. restoration of an existing pond and ditch back to riparian wetlands) allows floodwaters to attenuate, in turn reducing stressors from upstream impacts.
    d. Restoration of wetland hydrology within the riparian buffer supports hydrophytic vegetation, which assists in the uptake, storage and fixation of nutrients and sedimentation from overbank flows. Adjacent low quality pine plantations were removed and planted with native hydrophytic vegetation.
2. Restoring and enhancing aquatic, semi-aquatic and terrestrial habitat is directly tied to:
    a. Introduction of woody materials such as planted vegetation, log sills, soil lifts and toe wood to the restored channel. Woody materials will promote shading, bed form diversity and foraging opportunities for aquatic organisms, benthic macroinvertebrates, and fish.
    b. Restoration of native vegetation to the stream channel banks and the adjacent riparian corridor has diversified flora and provides an abundance of available foraging and cover habitat for amphibians, reptiles, mammals, and birds.
    c. Restoration of wetland hydrology and introducing floodwaters back to the historic floodplain provides a diversity of habitats for semi-aquatic flora and fauna that may have not been seen on the Site since before anthropogenic disturbances.
3. Habitat restoration and connectivity can be directly tied to:
    a. The removal of existing pine plantations and replanting of native vegetation.
    b. The restored community ensures a protected habitat corridor between the Site and the downstream mature riparian buffers and upland habitats.

1.2 Success Criteria

Monitoring of restoration efforts will be performed until success criteria are fulfilled. Monitoring includes stream channel/hydraulics, wetland hydrology, and vegetation. Year 6 Monitoring consists of hydrology monitoring, stream and wetland visual monitoring and vegetation visual monitoring. In general, the restoration success criteria, and required remediation actions, are based on the Stream Mitigation Guidelines (USACE et al. 2003) and the Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for stream and/or Wetland Mitigation (NCEEP 2011). Project success criteria are further detailed in the Baseline Monitoring Document & As-Built Baseline Report (ICA 2015).

1.3 Background Summary

The North Carolina Department of Environmental and Natural Resources Department of Mitigation Services (DMS) contracted ICA Engineering, Inc. (ICA) to restore 2,625 linear feet of the Unnamed Tributary to Millers Creek (UT) and 4.5 acres of riparian wetlands within the Site to assist in fulfilling stream mitigation goals in the watershed (Table 1 and Table 4). The Site is located approximately one-half (0.5) mile west of Magnolia in Duplin County, North Carolina and contains an unnamed tributary to Millers Creek and associated restored riparian wetlands (Figure 1). The Site is located within DMS Targeted Local Watershed Catalogue Unit (CU) 03030006. The Site is comprised of one property owned by William Jeffrey Hatcher and wife Susan King Hatcher (PIN # 247100987405). Additional information concerning project history is presented in Table 2.

1.4 Visual Vegetation Assessment

Visual assessment of on-site vegetation suggests that planted stems are performing well across the Site. Stems in Plots 3 and 6 have demonstrated steady growth over the past year; however, they are still not expected to meet the Year 7 requirement of a 10 foot average height. Overall, the planted stems in these two plots appear to have high vigor and it is expected that they will make it to maturity.

The area previously noted as having low stem density between stations 33+60 – 36+00 has seen an increase in volunteers and steady growth of planted stems. While the density of stems in this area has increased, plant growth remains stunted most likely due to poor soil quality. Photos of this area are presented in Figures 3.3.

1.5 Visual Stream Stability

The UT remains stable and functioning as designed. Bank erosion noted in Year 4 and 5 at stations 30+00 and 31+50 have stabilized due to increased herbaceous vegetation along the banks. Photos of these areas are presented in Figure 3.1 and 3.2.

Based on the measurement collected at the downstream crest gauge, the Site has experienced at least one bankfull flow during the monitoring period. The crest gauge located at the upstream extent of the project experienced insect damage and is unreadable. It is worth noting that the Site had reached its stream hydraulics performance standard of two bankfull events over the 7 year monitoring period by the second year of monitoring.

Bank pins were inspected on-site and showed no signs of bank erosion over the course of the monitoring period.

1.6 Surface Water and Groundwater Hydrology

The Site has experienced several bankfull flows throughout the monitoring period. Bankfull event documentation can be found in Appendix C.

Based upon the Final Mitigation Plan, the hydrologic criteria for restored wetlands at the Site are as follows (based upon the corresponding landscape position and wetland community type):

a. For the **riparian bottomland hardwood forest community**, the hydrologic criterion will be the establishment of a static water table at, or within, 12 inches of the soil surface for a minimum of 12.5 percent of the growing season, equivalent to 38 days based upon hydrologic monitoring undertaken from Feb 1st through Nov 30th of each monitoring year.
b. For the **headwater riparian community (zero-order geomorphic position)**, the hydrologic criterion will be the establishment of a static water table at, or within, 12 inches of the soil surface for a minimum of 10 percent of the growing season, equivalent to 30 days based upon hydrologic monitoring undertaken from Feb 1st through Nov 30th of each monitoring year.

The UT Millers site exhibits a range of hydrologic conditions characteristic of small stream swamp wetland community types of the inner Coastal Plain of North Carolina. Several of the groundwater gauges documented elevated groundwater levels at or near the soil surface for extended periods of time during the growing season. In addition, portions of the site exhibited intermittent to prolonged periods of surface inundation. This most likely is attributed to the increased amount of rain the Site has experienced over the past year. It is worth noting that the Site exceeded the 70th percentile for monthly precipitation totals during the months of February, April, August, October, and November. Refer to the attached gauge hydrographs depicting recorded groundwater and surface water levels from February 1 through November 30.

All of the groundwater gauges located on the mitigation site exhibit hydrology indicative of jurisdictional wetlands (i.e. hydroperiods greater than 5% of the growing season), and all six gauges exceeded the minimum success criteria as outlined above. While the specific durations of wetland hydrology at each gauge varied across the site, each gauge displayed prolonged wetland hydroperiods throughout the growing season.

The summary of hydroperiods for each gauge is presented in Table 8 and gauge locations are depicted in Figure 2.1.

2.0 METHODOLOGY

Groundwater hydrology was monitored using six automated gauges (RDS, Inc. WM-20s) located within the riparian wetland restoration areas. Two reference gauges were installed: one in a Headwater Riparian Wetland and one in a Bottomland Hardwood Wetland. Gauges were installed in accordance with installation methods outlined in the Wetlands Regulatory Assistance Program (WRAP) Technical Note 00-02 (Sprecher, 2000). Water levels were recorded once daily, and the data was downloaded every two months.

3.0 REFERENCES

ICA Engineering, Inc. As-Built Monitoring Document & As-Built Baseline Report for UT Millers Creek Full Delivery Site. 2015.

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm).

Mecklenburg, Dan. 2006. The Reference Reach Spreadsheet Version 4.3L. 2006. Ohio Department of Natural Resources. Division of Soil and Water. (http://www.dnr.state.oh.us/tabid/9188/default.aspx)

NCEEP. Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for stream and/or Wetland Mitigation. 2011.

Sprecher, S. W. (2000). "Installing Monitoring Wells/Piezometers in Wetlands," ERDC TN-WRAP-00-02, U.S. Army Research and Development Center, Vicksburg, MS.

US Army Corps of Engineers Wilmington District. Stream Mitigation Guidelines. 2003

Weakley, Alan S. 2011. Flora of the Southern and Mid-Atlantic States (online). Available: http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2011-May-nav.pdf [May 15, 2011]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

APPENDICES

Appendix A. Project Vicinity Map and Background Tables

LMG
LAND MANAGEMENT GROUP
a DAVEY company

Vicinity Map

UT to Millers Creek Mitigation Site, Duplin County, NC

0 750 1,500 3,000 4,500 6,000 Feet

1 inch = 2,000 feet

Figure 1

Table 1. Project Components and Mitigation Credits
UT to the Millers Creek, Duplin County
DMS Project ID No. 95719

Mitigation Credits									
	Stream (SMU)		Riparian Wetland (WMU)		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE	--	--	--
Totals	2,709		8.00						

Project Components							
Project Component or Reach ID	Stationing/ Location	Existing Footage/ Acreage	Approach (PI, PII, etc.)	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio	SMU or WMU
UT Millers Creek	10+13 – 37+22	2,100	PI	Restoration	2,709	1:1	2,709
Drained Wetland (Headwater)	NA	1.22	NA	Restoration	1.22	1:1	1.22
Drained Wetland (Pines)	NA	3.78	NA	Restoration	3.78	1:1	3.78
Drained Wetland (Mature Woods)	NA	2.55	NA	Restoration	2.55	1.25:1	2.04
Drained Wetland (Berm/Spoil Along UT)	NA	0.45	NA	Restoration	0.45	1:1	0.45
Pond	NA	0.77	NA	Restoration	0.77	1.5:1	0.51
TOTAL	NA	2,100/8.77	PI/NA	Restoration	2,709/8.77	1 – 1.5:1	2,709/8.00

Component Summation						
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	2,709	8.77				

BMP Elements			
Element	Location	Purpose/Function	Notes
Forested Buffer	UT Millers buffer	Buffer to protect stream	Filter nutrients and provide cover, foraging areas, habitat, woody debris, and wildlife

Table 2. Project Activity and Reporting History UT to Millers Creek (DMS Project ID No. 95719)		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Restoration Plan	Aug-13	Sep-14
Final Design – Construction Plans	Sep-14	Sep-14
Construction	3-Nov-14	23-Jan-15
Temporary S&E Mix Applied to Entire Project Area	---	23-Jan-15
Permanent Seed Mix Applied to Entire Project Area	---	23-Jan-15
Bare Root, Containerized, and B&B plantings for Entire Project Area	---	10-Mar-15
Mitigation Plan/As-built (Year 0 Monitoring-Baseline)	Mar-15	Apr-15
Year 1 Monitoring	Oct-15	Dec-15
Year 2 Monitoring	Nov-16	Feb-17
Year 3 Monitoring	Nov-17	Jan-18
Year 4 Monitoring	Dec-18	Jan-19
Year 5 Monitoring	Oct-19	Jan-20
Year 6 Monitoring	May-20	Dec-20
Year 7 Monitoring		

Table 3. Project Contacts Table UT to Millers Creek (DMS Project ID No. 95719)	
Designer Primary project design POC	Land Management Group, Inc 3101 Poplarwood Court, Suite 120 Raleigh, North Carolina 27604 Kevin Williams (919) 810-6525
Construction Contractor Construction Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Planting Contractor Planting Contractor POC	River Works, Inc. 6105 Chapel Hill Road Raleigh, NC 27607 Phillip Todd (919) 582-3574
Seeding Contractor Seeding Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Seed Mix Sources	Green Resources – Triangle Office
Nursery Stock Suppliers	1) ArborGen 2) Mellow Marsh Farm, Inc. 3) Foggy Mountain Nursery (live stakes)
Monitoring Performers	HDR|ICA 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601 Alex DiGeronimo (LMG) (843) 830-1536
Stream Monitoring POC	HDR|ICA 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601 Alex DiGeronimo (LMG) (843) 830-1536
Vegetation Monitoring POC	Land Management Group, Inc 3805 Wrightsville Avenue, Suite 15 Wilmington, NC 28403 Kim Williams (910) 452-0001 x 1908

Table 4. Project Information UT to Millers Creek (DMS Project ID No. 95719)	
Project Information	
Project Name	UT to Millers Creek Stream and Wetland Mitigation Site
Project County	Duplin
Project Area (acres)	15.944 AC
Project Coordinates	34.894467,-78.067625
Project Watershed Summary Information	
Physiographic Region	Coastal Plain
Ecoregion	Southeastern Plains
Project River Basin	Cape Fear
USGS 8-digit HUC	3030006
USGS 14-digit HUC	3030006110040
NCDWQ Subbasin	03-06-19
Project Drainage Area	250 AC
Watershed Land Use	Cultivated, Southern Yellow Pine, Bottomland Forest / Hardwood Swamps

Reach Summary Information	
Parameters	**UT to Millers Creek**
Restored length	2,709 linear feet
Drainage Area	250 AC.
NCDWQ Index Number	36
NCDWQ Classification	C, Sw
Valley Type/Morphological Description	X/Existing G/5/Restored E5
Dominant Soil Series	Bibb sandy loam and Torhunta fine sandy loam (USDA/NRCS records). Cape Fear, Rains, Plummer, Rutlege and Lynn Haven Soil series (additional series mapped by LMG)
Drainage Class	Poorly and very poorly
Soil Hydric Status	Bibb sandy loam (hydric) Torhunta mucky fine sandy loam (hydric)
Slope	0.0016
FEMA Classification	Zone X
Native Vegetation Community	Mixed stand of hardwoods and pine
Percent Composition of Exotic Invasives	<5%

Wetland Summary Information			
Parameters	**Wetland 1**	**Wetland 2**	**Wetland 3**
Size of Wetland (acres)	0.21	0.12	0.59
Wetland Type (non-riparian riverine or riparian non-riv	Riparian Non-Riverine	Riparian Non-Riverine	Riparian Non-Riverine
Mapped Soil Series	BbA	ToA	BnB
Drainage class	Poorly Drained	Very Poorly Drained	Moderately Well Drained
Soil Hydric Status	Hydric	Hydric	Partially Hydric
Source of Hydrology	Groundwater	Groundwater	Groundwater
Hydrologic Impairment	Stream Incision	Stream Incision	Stream Incision/Beavers
Native vegetation community	Forested	Forested	Emergent
Percent composition of exotic invasion vegetation	0	0	0

Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**
Waters of the U.S. –Sections 404 and 401	Yes	Yes	Restoration Plan/NW 27
Endangered Species Act	No	Yes	NCNHP/USFWS
Historic Preservation Act	No	Yes	NCSHPO
CZMA/CAMA	No	Yes	--
FEMA Floodplain Compliance	Yes	Yes	HECRAS
Essential Fisheries Habitat	No	N/A	--

Appendix B. Visual Assessment Data

LMG
LAND MANAGEMENT GROUP
a DAVEY company

Current Condition Plan View - Year 6

UT Millers Creek, Duplin County, North Carolina

0 87.5 175 350 525 700 Feet

NC Environmental Quality

N E S W

Figure 2.1

Table 5: Visual Stream Morphology Stability Assessment
Reach ID: UT Millers Creek
Assessed Length: 2,709 FT

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	N/A	N/A			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	5	5			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	61	61			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	57	57			100%			
		2. Thalweg centering at downstream of meander (Glide)	57	57			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	N/A	N/A	N/A
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	N/A	N/A	N/A
				Totals	0	0	100%	N/A	N/A	N/A
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	12	12			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	12	12			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	12	12			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	12	12			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	12	12			100%			

Table 6 Vegetation Condition Assessment

Planted Acreage **12.35**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.05 acres	polygons filled with orange dots and x's	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.	.1 acres	Pink dots	0	0.0	0.0%
			Total			
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	.1 acres	Pattern and Color	0	0.0	0.0%
			Cumulative Total			

Easement Acreage **15.94**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	N/A	N/A	N/A
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	N/A	N/A	N/A

Figure 3.1. Problem Area Photo

3.1 Erosion at 30+00

3.2 Erosion at 31+50

3.3 Right overbank area near STA 35+00

Appendix C. Hydrologic Data

Table 7. Verification of Bankfull Events

Date	Crest Gauge Info		Gauge Reading (ft)	Gauge Elevation (ft)	Crest Elevation (ft)	Bankfull Elevation (ft)	Height above Bankfull (ft)
	Site	Sta.					
7/14/2015	2	37+03	2.29	107.16	109.45	107.71	1.74
7/14/2015	2	37+03	2.29	107.16	109.45	107.71	1.74
10/19/2015	1	10+62	1.50	111.46	112.96	112.07	0.89
4/27/2016	1	10+62	1.88	111.46	113.34	112.07	1.26
4/27/2016	2	37+03	3.70	107.16	110.87	107.71	3.15
10/10/2016	1	10+62	2.79	111.46	114.25	112.07	2.18
10/10/2016	2	37+03	3.43	107.16	110.59	107.71	2.88
10/10/2016	N/A	Approx 20+00	Visual	Visual	Visual	Visual	Visual
1/17/2017	1	10+62	2.29	111.46	113.75	112.07	1.68
1/17/2017	2	37+03	3.13	107.16	110.29	107.71	2.58
4/26/2017	1	10+62	2.00	111.46	113.46	112.07	1.39
4/26/2017	2	37+03	4.06	107.16	111.22	107.71	3.51
3/13/2018	1	10+62	3.58	111.46	115.04	112.07	2.97
3/13/2018	2	37+03	3.58	107.16	110.74	107.71	3.03
9/12/2018	1	10+62	4.5	111.46	115.96	112.07	3.89
9/12/2018	2	37+03	4.0	107.16	111.16	107.71	3.45
3/29/2019	1	10+62	2.42	111.46	113.88	112.07	1.81
3/29/2019	2	37+03	1.50	107.16	108.66	107.71	0.95
10/17/2019	1	10+62	2.25	111.46	113.71	112.07	1.64
10/17/2019	2	37+03	1.42	107.16	108.58	107.71	0.87
5/12/2020	1	10+62	Insect Damage	111.46	N/A	112.07	N/A
5/12/2020	2	37+03	2.31	107.16	109.47	107.71	1.76

Figures 4.1 - 4. 2. Crest Gauge Photos

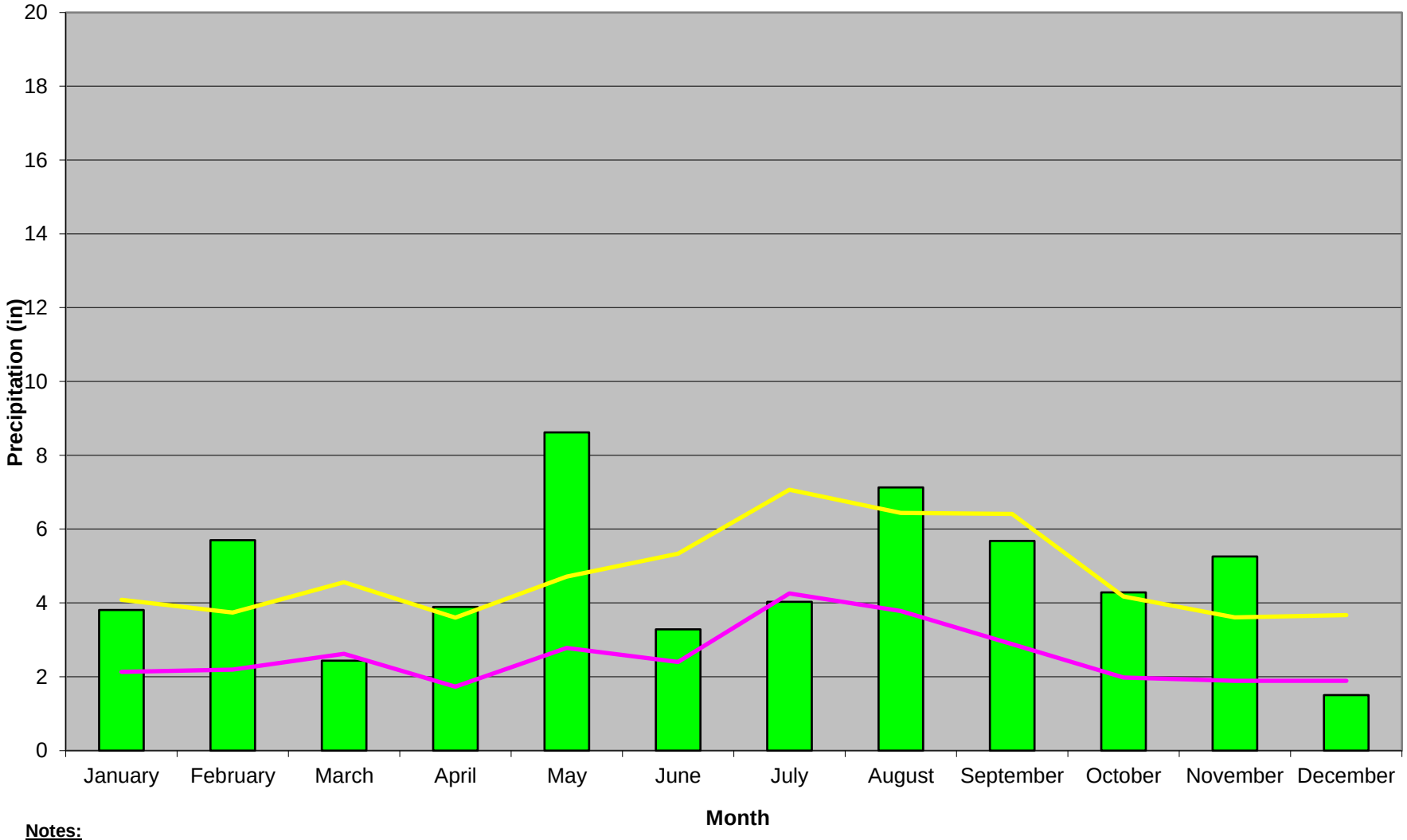
4.1 Crest Gauge 1 (5/12/2020)

4.2 Crest Gauge 2 (5/12/2020)

Table 8. Summary of Gauge Hydrologic Data

Gauge Number	Wetland Community Type	Target Hydroperiod	Percentage of Growing Season Year 1	Longest Number Of Consecutive Days Meeting Wetland Hydrology Criteria During Year 1 Growing Season	Percentage of Growing Season Year 2	Longest Number Of Consecutive Days Meeting Wetland Hydrology Criteria During Year 2 Growing Season	Percentage of Growing Season Year 3	Longest Number Of Consecutive Days Meeting Wetland Hydrology Criteria During Year 3 Growing Season	Percentage of Growing Season Year 4	Longest Number Of Consecutive Days Meeting Wetland Hydrology Criteria During Year 4 Growing Season	Percentage of Growing Season Year 5	Longest Number Of Consecutive Days Meeting Wetland Hydrology Criteria During Year 5 Growing Season	Percentage of Growing Season Year 6	Longest Number Of Consecutive Days Meeting Wetland Hydrology Criteria During Year 6 Growing Season
1	Riparian Bottomland Hardwood	12.5%	43	130	23	69	7.6	23	13	40	30	90	21	64
2	Riparian Bottomland Hardwood	12.5%	53	161	49	149	43.6	132	52	155	36	109	60	181
3	Riparian Bottomland Hardwood	12.5%	10	30	21	65	5.6	17	12.5	38	28	86	21	65
4	Headwater Riparian (Zero Order)	10%	70	212	100	304	52.5	159	54	162	45	137	100	304
5	Riparian Bottomland Hardwood	12.5%	32	97	49	149	49.2	149	52	155	37	112	100	304
6	Riparian Bottomland Hardwood	12.5%	52	158	48	146	51.5	156	54	162	39	117	100	304
Reference	Headwater Riparian (Zero Order)	10%	39	118	46	141	17.8	54	47	142	35	105	52	157
Reference	Riparian Bottomland Hardwood	12.5%	36	108	26	79	26.1	79	35	106	29	88	29	89

Figure 5. Monthly Precipitation Data



Notes:

1. Precipitation data obtained from on-site rain gauge (collected through December 8).

2. 30th and 70th percentiles calculated from long-term climatic data 1984-2013 (www.wcc.nrcs.usda.gov)

Figure 6.1: Reference: Zero-Order Wetland Gauge (EBDE114)

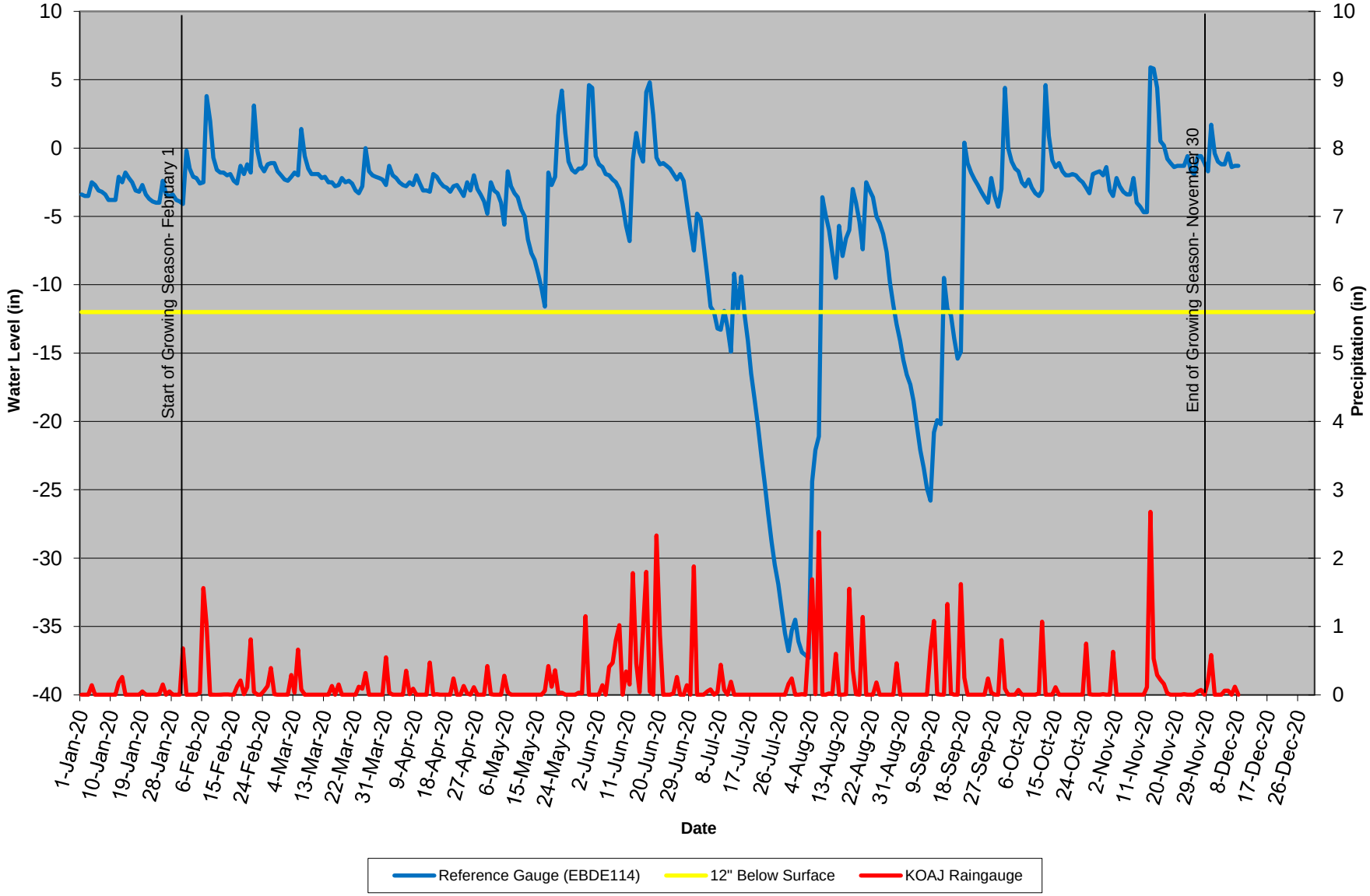


Figure 6.2: Reference: Second-Order Wetland Gauge (14EB20BB)

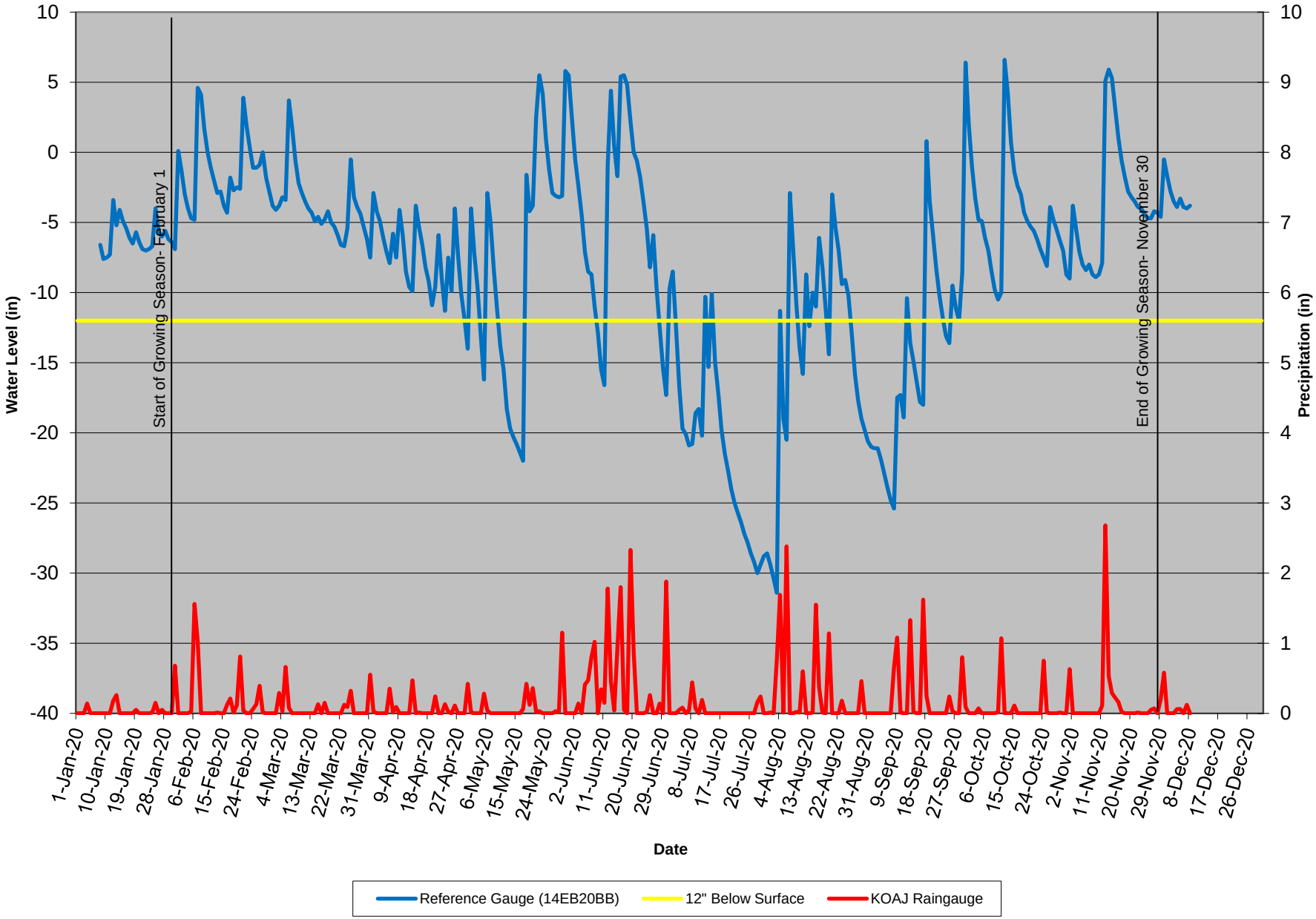


Figure 6.3: Wetland Gauge 1

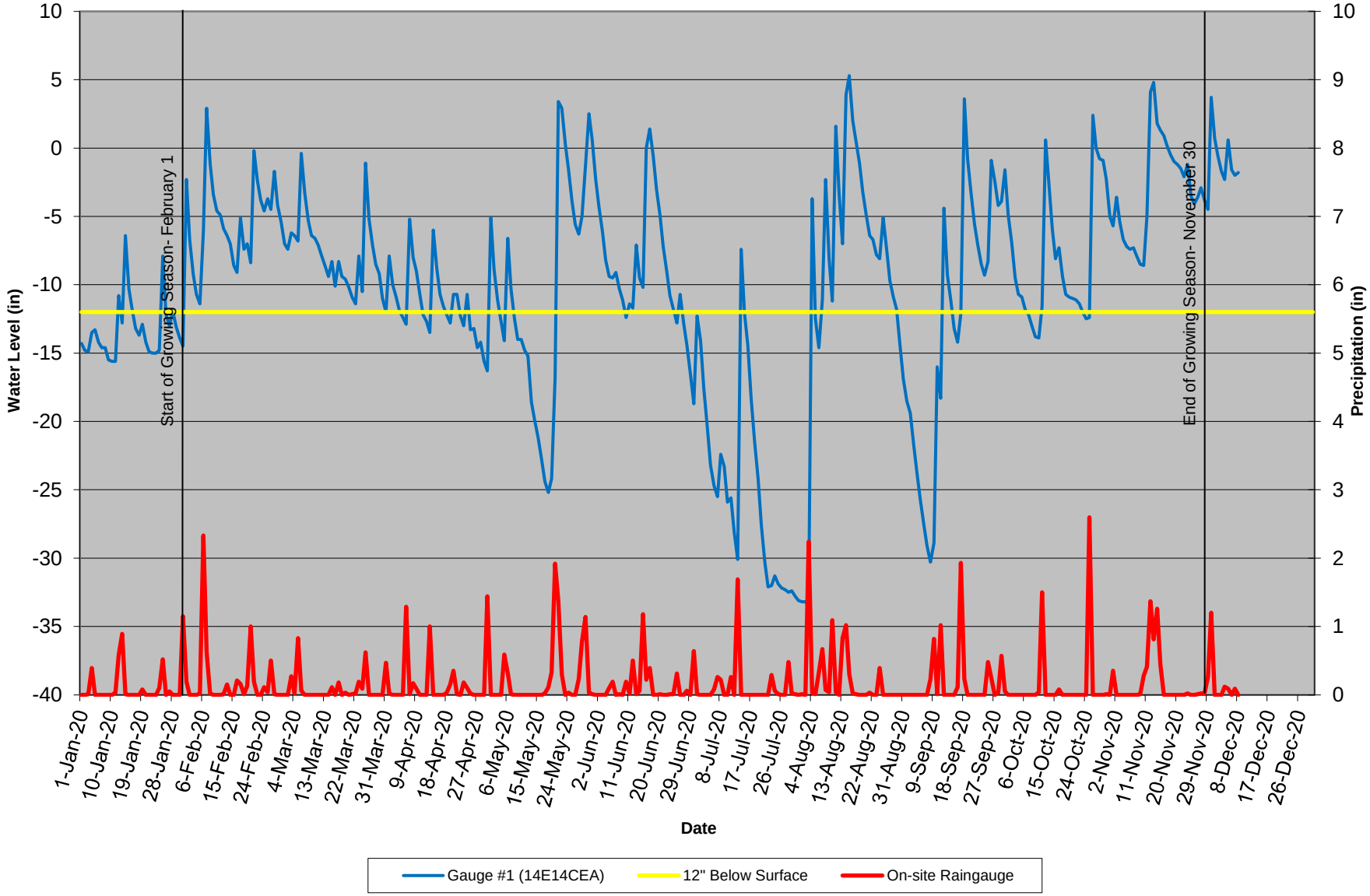


Figure 6.4: Wetland Gauge 2

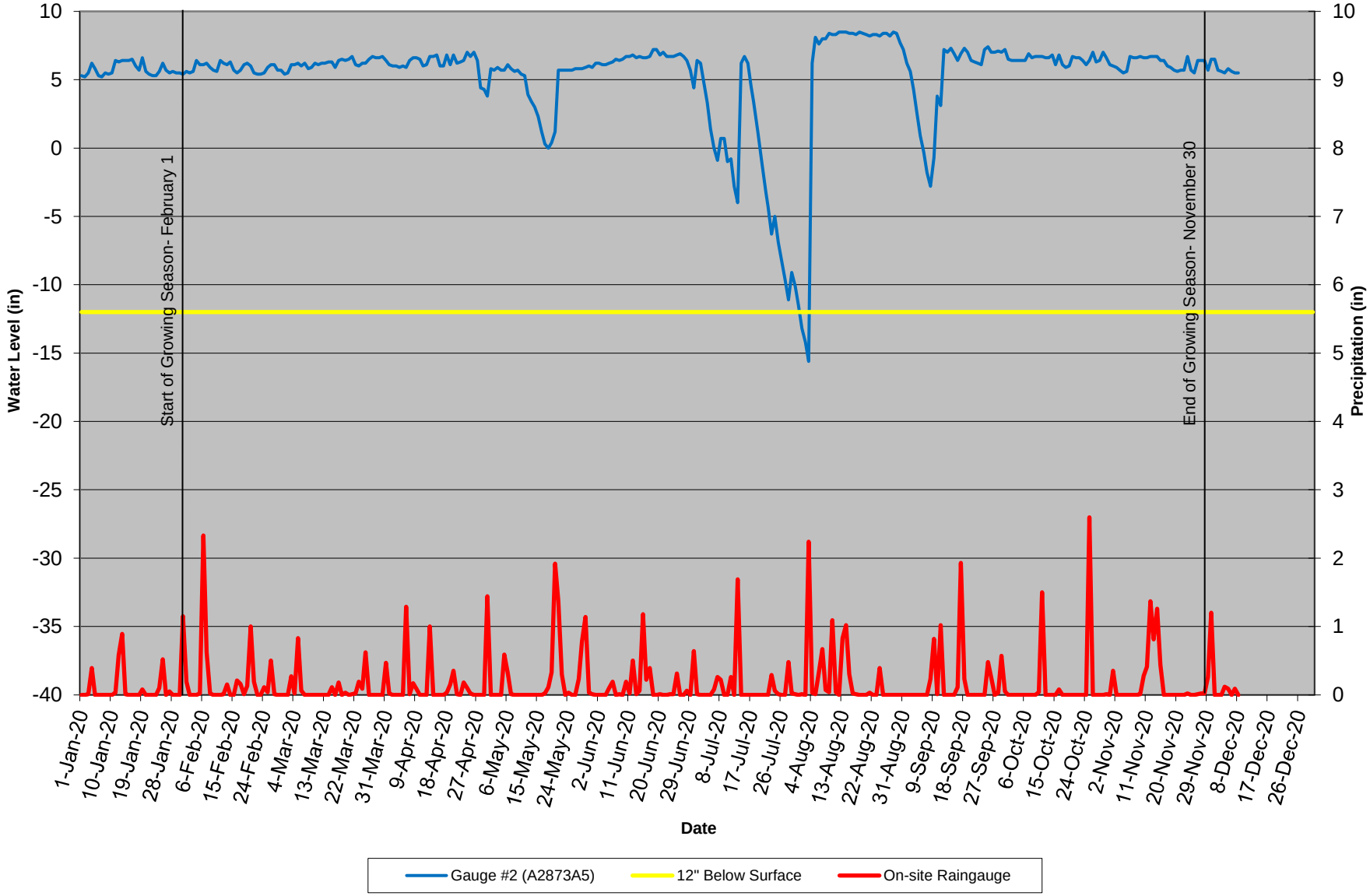


Figure 6.5: Wetland Gauge 3

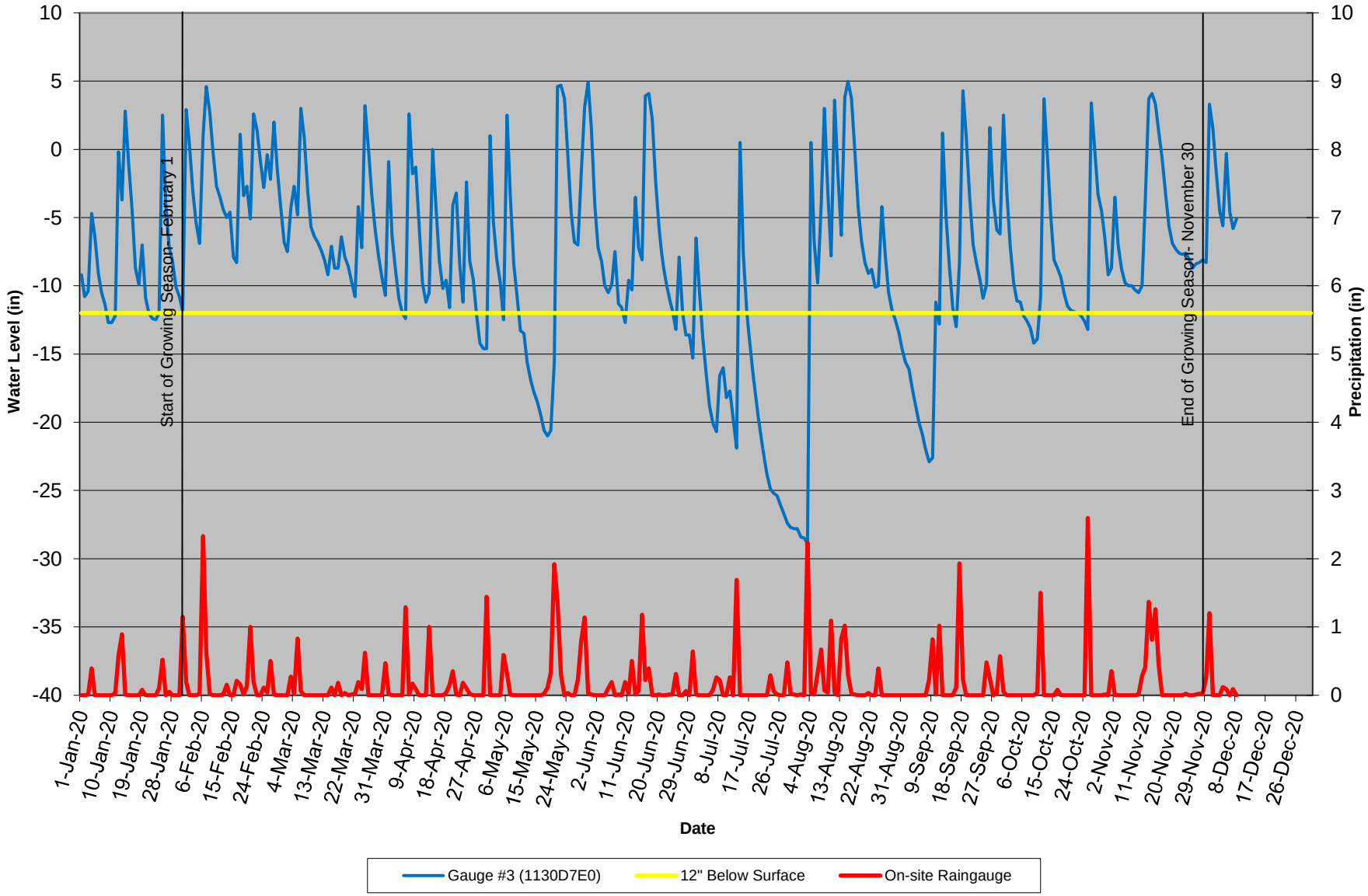


Figure 6.6: Wetland Gauge 4

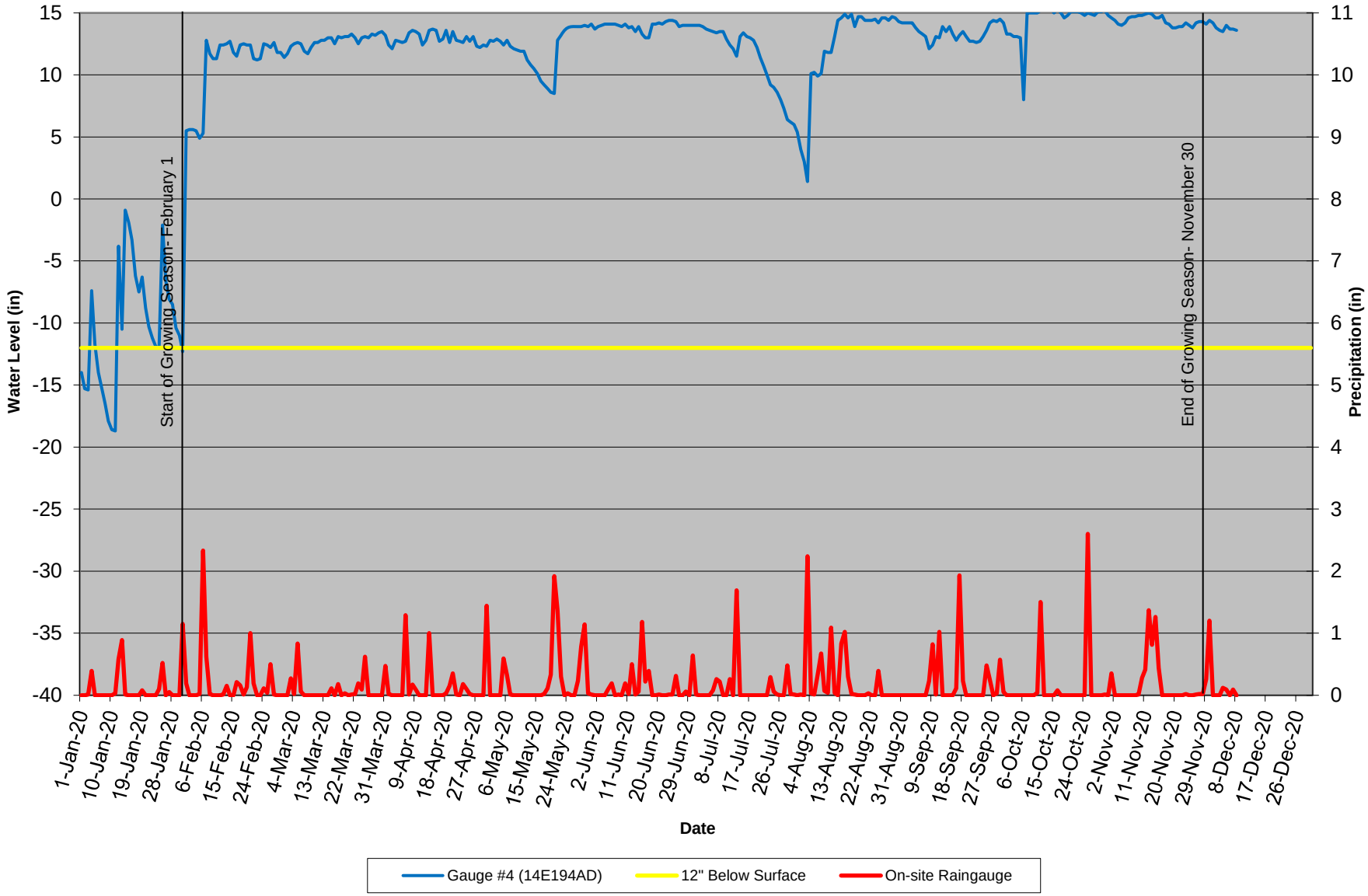


Figure 6.7: Wetland Gauge 5

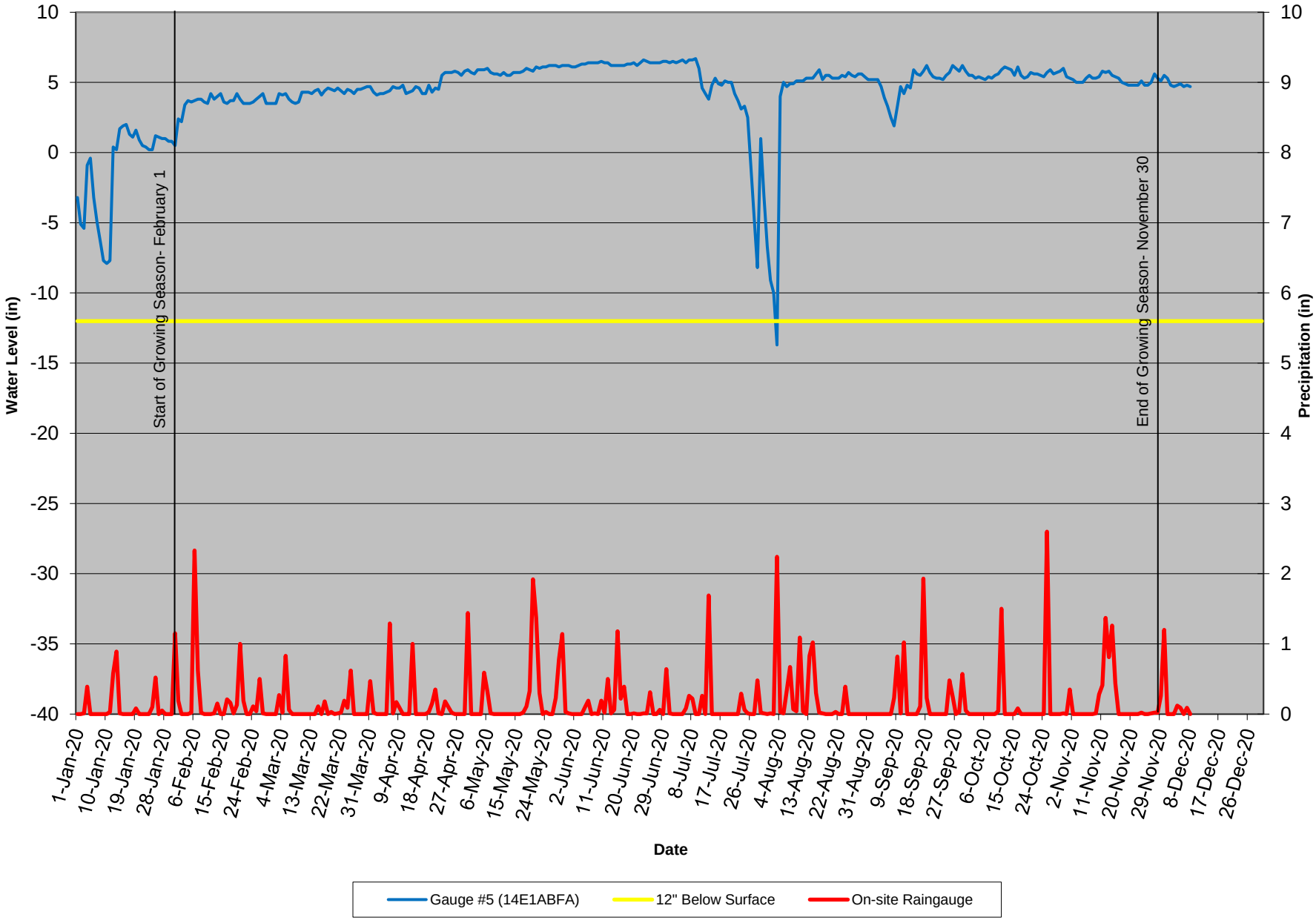
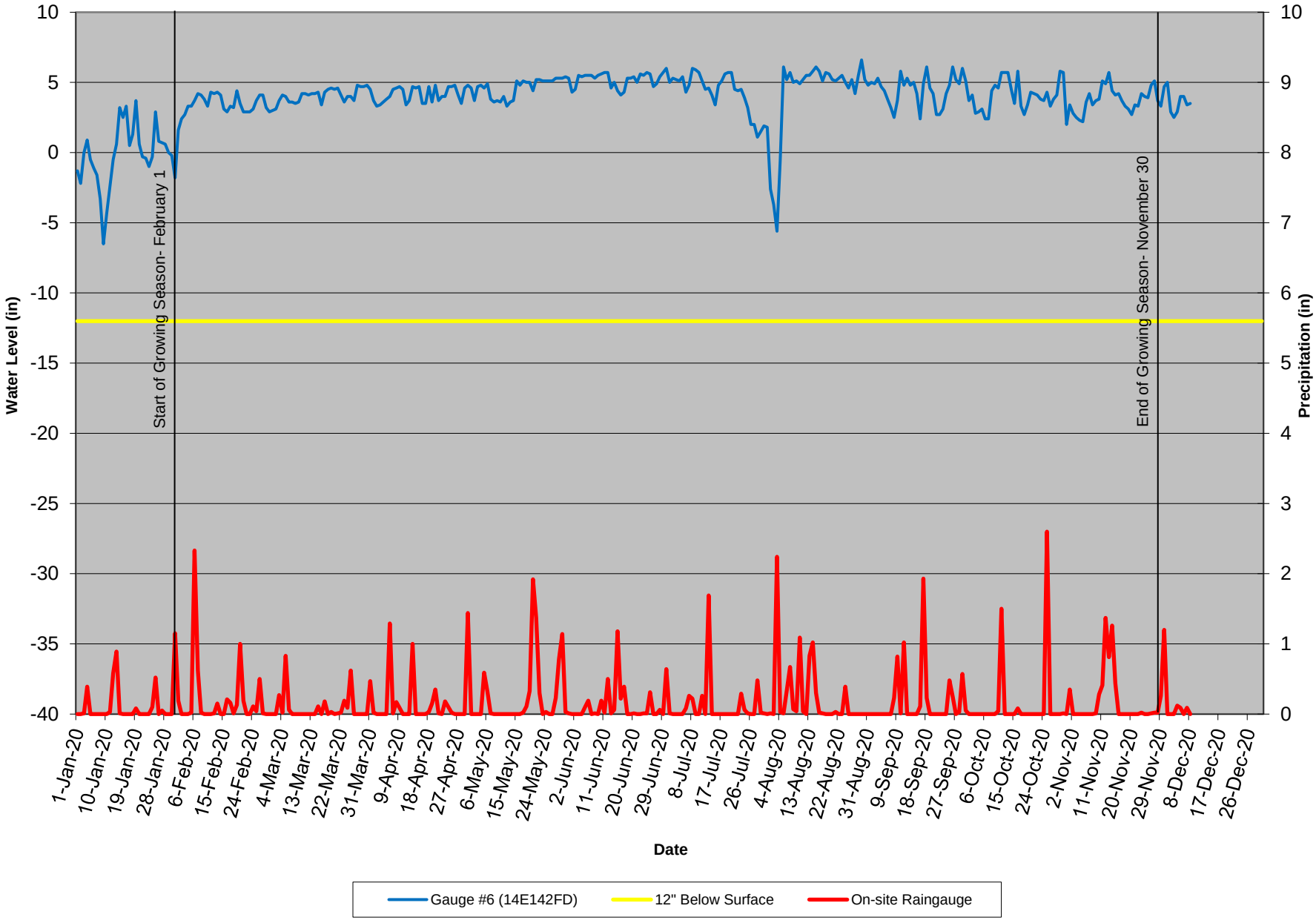


Figure 6.8: Wetland Gauge 6



Supplement Hydrology Table Provided by DMS: UT to Millers Creek #95719

These tables are provided for the IRT and to illustrate differences in growing season day methods in relation to project success criteria.
Approved Mitigation Plan lists 2/1-11/30 for documenting project success.

Gauge Number	Success Hydroperiod	USED FOR MY6--2/1/-11/30 303 days		3/1/-11/11 255 days		3/19/-11/11 237 days	
	%	Consecutive Days	% of growing season	Consecutive Days	% of growing season	Consecutive Days	% of growing season
1	12.5	64	21%	36	14%	24	10%
2	12.5	181	60%	153	60%	134	57%
3	12.5	65	21%	37	15%	26	11%
4	10	304	100%	255	100%	237	100%
5	12.5	304	100%	255	100%	237	100%
6	12.5	304	100%	255	100%	237	100%

Gauge Number	Success Hydroperiod	USED FOR MY5--2/1/-11/30 303 days		3/1/-11/11 255 days		3/19/-11/11 237 days	
	%	Consecutive Days	% of growing season	Consecutive Days	% of growing season	Consecutive Days	% of growing season
1	12.5	90	30%	62	24%	43	18%
2	12.5	109	36%	81	32%	62	26%
3	12.5	86	28%	58	23%	39	16%
4	10	137	45%	109	43%	90	38%
5	12.5	112	37%	84	33%	65	27%
6	12.5	117	39%	89	35%	42	18%

Gauge Number	Success Hydroperiod	USED FOR MY4--2/1/-11/30 303 days		3/1/-11/11 255 days		3/19/-11/11 237 days	
	%	Consecutive Days	% of growing season	Consecutive Days	% of growing season	Consecutive Days	% of growing season
1	12.5	40	13%	40	16%	27	11%
2	12.5	155	51%	127	50%	108	46%
3	12.5	38	13%	38	15%	20	8%
4	10	162	53%	133	52%	114	48%
5	12.5	155	51%	127	50%	108	46%
6	12.5	162	53%	134	53%	115	49%

Gauge Number	Success Hydroperiod	USED FOR MY3--2/1/-11/30 303 days		3/1/-11/11 255 days		3/19/-11/11 237 days	
	%	Consecutive Days	% of growing season	Consecutive Days	% of growing season	Consecutive Days	% of growing season
1	12.5	23	8%	23	9%	23	10%
2	12.5	135	45%	107	42%	88	37%
3	12.5	17	6%	17	7%	17	7%
4	10	159	52%	131	51%	112	47%
5	12.5	149	49%	121	47%	102	43%
6	12.5	156	51%	128	50%	109	46%

Gauge Number	Success Hydroperiod	USED FOR MY2--2/1/-11/30 303 days		3/1/-11/11 255 days		3/19/-11/11 237 days	
	%	Consecutive Days	% of growing season	Consecutive Days	% of growing season	Consecutive Days	% of growing season
1	12.5	69	23%	50	20%	50	21%
2	12.5	149	49%	149	58%	149	63%
3	12.5	65	21%	37	15%	18	8%
4	10	304	100%	255	100%	237	100%
5	12.5	149	49%	130	51%	130	55%
6	12.5	146	48%	131	51%	131	55%

Gauge Number	Success Hydroperiod	USED FOR MY1--2/1/-11/30 303 days		3/1/-11/11 255 days		3/19/-11/11 237 days	
	%	Consecutive Days	% of growing season	Consecutive Days	% of growing season	Consecutive Days	% of growing season
1	12.5	130	43%	102	40%	83	35%
2	12.5	161	53%	133	52%	114	48%
3	12.5	30	10%	17	7%	17	7%
4	10	212	70%	184	72%	165	70%
5	12.5	97	32%	78	31%	78	33%
6	12.5	158	52%	130	51%	111	47%

Meeting success criteria
Not meeting success criteria

Mitigation Services
ENVIRONMENTAL QUALITY

PAT MCCRORY
Governor

DONALD R. VAN DER VAART
Secretary

January 8, 2021

MEMORANDUM FOR THE RECORD

Subject: UT to Millers Creek Hydric Soils Evaluation

1. A hydric soils evaluation was conducted January 6, 2021 by Jeremiah Dow and Lindsay Crocker, DMS. Map of the soil boring locations is attached.
2. Site soils are loamy sands and sandy loams, composed of recently formed alluvium from previous coastal plan deposition likely during Cretaceous times (USDA NRCS 2006). Site evaluation consisted of primarily Typic Fluvaqents or Typic Humaquepts, potentially matching the Rutlege or Torhunta series. These are classified as mineral-organic soils of the Coastal Plains containing umbric epipedons, very poorly drained, with loamy particle classes. Soils are masked with black organic accumulation, presenting hydric indicators that occur when aerobic microbes are not present to utilize carbon compounds and resulting in accumulation of organic carbon material. These conditions occurred here due to historic floodplain saturation (as indicated in pre-mitigation plan investigations), and current anaerobic conditions from inundation in the profile.
3. The primary indicator at this site utilized was S7 (Dark Surface), other indicators may include S8, S9, and/or A11. S7 requires a layer 4" thick, starting within the first 6" of the surface with a matrix 3 or less and chroma 1 or less. The material looks 100% masked without a hand lens, and at least 70% masked with a hand lens.
4. The areas shown with a green pin indicated masking >70%, although some areas were close to that level. Areas in red, did not qualify for that criteria, and the areas shown as orange were marginal. The soils were consistent throughout the eastern and southwest portions of the site, but there was greater clay content and some depletions on the western part of the site. Additionally, areas around the pond were mixed up, likely due to the fill removal that occurred during restoration.
5. At the time of the evaluation, the headwater wetland, pond, and other lower floodplain elevations were inundated. There were many areas outside of the credit areas that appeared inundated. The hydric soil boundary extended beyond creditable areas in numerous locations.

UT to Millers Creek

1/8/2021

Representative Soil boring 1 (Eastern floodplain)

A 0-18” 10YR 2/1 Loamy Sand, 80% coated grains, granular very friable non sticky, non-plastic

Eg 19-30” 2.5Y 5/1 Sand, granular, very friable non sticky, non-plastic

Bg 30-48”+ 2.5 Y 4/2 Loamy sand, subangular blocky, friable non sticky non-plastic

Representative Soil boring 2 (Southwestern floodplain)

A1 0-13” 10YR 2/5 Loamy sand, 70% coated grains, granular friable non-sticky, non-plastic

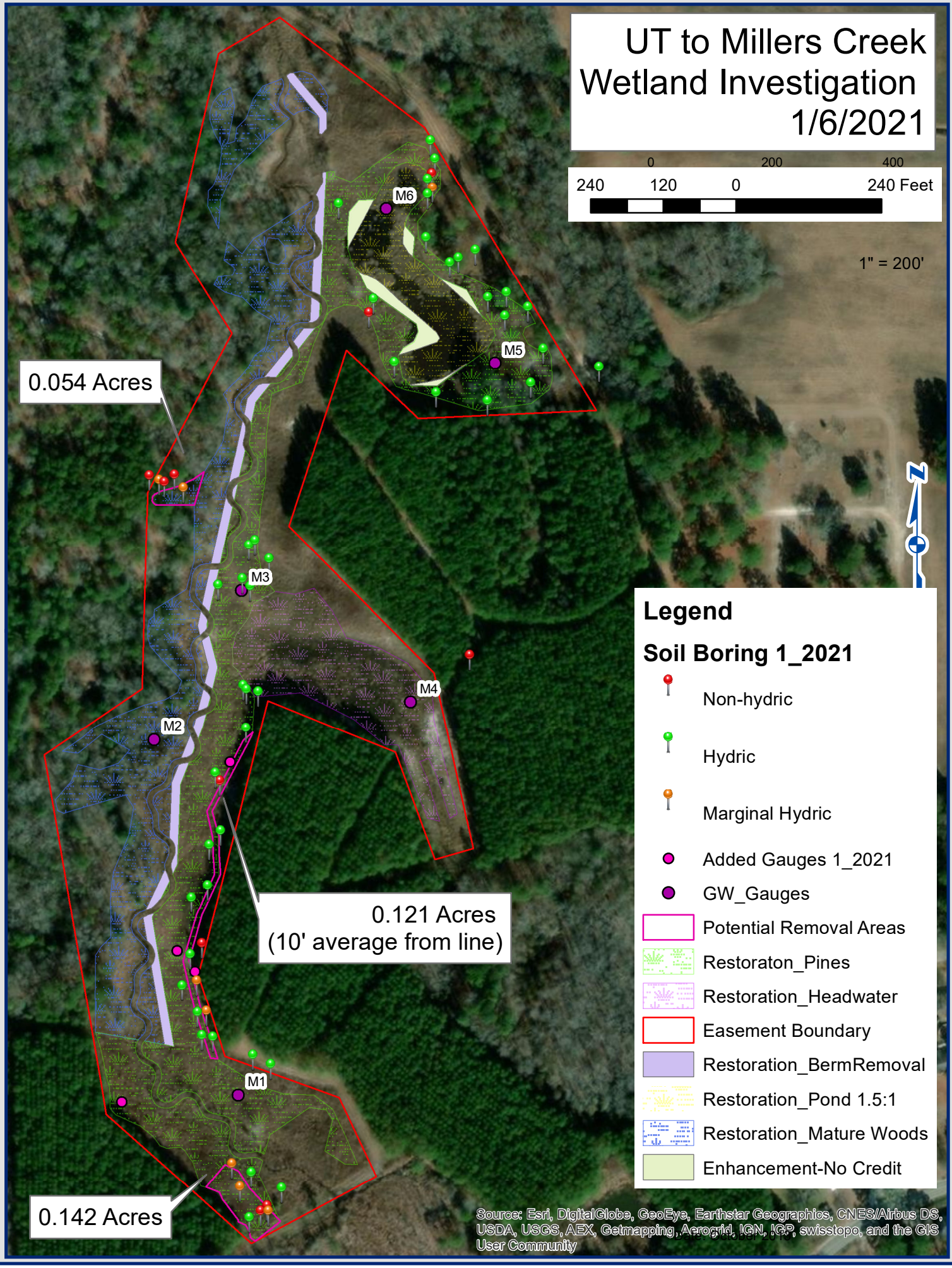
A2 13-17” 10 YR 5/2 Sandy loam, 60% coated grains, friable, non-sticky, non-plastic

BEg 17-44” 2.5Y 4/2 Sandy loam, organic stains on root channels, granular, very friable, non-sticky, non-plastic

Btg 44”+ 10 YR 3/2, sandy clay loam, massive, friable, moderately sticky, slightly plastic

Spagnum moss common on-site in the inundated, and hydric soil areas.

Typical example of dark surface; observe organic coating on hands.


UT to Millers Creek
Wetland Investigation
1/6/2021
0
200
400
240
120
0
240 Feet
1" = 200'
M6
M5
M3
M4
M2
M1
0.054 Acres
0.121 Acres
(10' average from line)
0.142 Acres
N
Legend
Soil Boring 1_2021
Non-hydric
Hydric
Marginal Hydric
Added Gauges 1_2021
GW_Gauges
Potential Removal Areas
Restoraton_Pines
Restoration_Headwater
Easement Boundary
Restoration_BermRemoval
Restoration_Pond 1.5:1
Restoration_Mature Woods
Enhancement-No Credit
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community