

Annual Monitoring Report

Monitoring Year 6 of 7

FINAL

Cochran Branch Stream and Wetland Restoration Site

NCDMS Contract No.: 004947

NCDMS Project No.: 95720

USACE Permit Action ID: SAW-2013-00280

DWR Project No.: 13-0188

Macon County, NC

Data Collection Complete: October 2020



Prepared for:

Division of Mitigation Services

North Carolina Department of Environment and Natural Resources

1652 Mail Service Center

Raleigh, NC 27699-1652

December 2020

Mitigation Project Name Cochran Branch
 DMS ID 95720
 River Basin Little Tennessee
 Cataloging Unit 06010202
 County Macon

USACE Action ID 2013-00280
 DWR Permit 2013-0188
 Date Project Instituted 10/29/2012
 Date Prepared 4/21/2020
 Stream/Wet. Service Area Little Tennessee 06010202

Handwritten Signature: Todd J. [unclear] 9/21/2020

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	Cold Stream 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%	546.000	0.000	546.000	2015	10/1/2015
3 - Year 1 Monitoring	10.00%	10.00%	182.000	0.000	182.000	2016	4/25/2016
4 - Year 2 Monitoring	10.00%	10.00%	178.300	14.800	163.500	2017	10/20/2017
5 - Year 3 Monitoring	10.00%	10.00%	178.300	0.000	178.300	2018	4/25/2018
6 - Year 4 Monitoring	5.00%	5.00%	89.150	0.000	89.150	2019	4/26/2019
7 - Year 5 Monitoring	10.00%	10.00%	49.750	0.000	49.750	2020	4/21/2020
8 - Year 6 Monitoring	5.00%					2021	
9 - Year 7 Monitoring	10.00%					2022	
Stream Bankfull Standard	10.00%	10.00%	178.300	0.000	178.300	2017	10/20/2017
Totals					1,387.000		

Total Gross Credits	1,783.000
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	1,387.000
Total Percentage Released	85.00%
Remaining Unreleased Credits	396.000

Credit Release Milestone	Riparian 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	2019	N/A
2 - Year 0 / As-Built	30.00%	30.00%	1.288	0.000	1.289	2015	10/1/2015
3 - Year 1 Monitoring	10.00%	10.00%	0.430	0.000	0.430	2016	4/25/2016
4 - Year 2 Monitoring	10.00%	10.00%	0.430	0.000	0.430	2017	10/20/2017
5 - Year 3 Monitoring	10.00%	10.00%	0.430	0.000	0.430	2018	4/25/2018
6 - Year 4 Monitoring	10.00%	10.00%	0.430	0.000	0.430	2019	4/26/2019
7 - Year 5 Monitoring	10.00%	10.00%	0.430	0.000	0.430	2020	4/21/2020
8 - Year 6 Monitoring	10.00%					2021	
9 - Year 7 Monitoring	10.00%					2022	
Stream Bankfull Standard	.00%	N/A	N/A	N/A	N/A	N/A	N/A
Totals					3.439		

Total Gross Credits	4.295
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	3.439
Total Percentage Released	80.00%
Remaining Unreleased Credits	0.856

Mitigation Project Name Cochran Branch
DMS ID 95720
River Basin Little Tennessee
Cataloging Unit 06010202
County Macon

USACE Action ID 2013-00280
DWR Permit 2013-0188
Date Project Instituted 10/29/2012
Date Prepared 4/21/2020
Stream/Wet. Service Area Little Tennessee 06010202

10/20/2017: Adjustment required due to IRT concerns on how the as-built credits were calculated.

Contingencies (if any)

Project Quantities

Mitigation Type	Restoration Type	Physical Quantity
Cold Stream	Restoration	1,783.000
Riparian	Restoration	4.240
Riparian	Enhancement	0.110

Debits

							Stream Restoration Credits	Riparian Restoration	Riparian Restoration Equivalent Credits
Beginning Balance (mitigation credits)							1,783.000	4.240	0.055
Released Credits							1,387.000	3.395	0.044
Unrealized Credits							0.000	0.000	0.000
Owning Program	Req. Id	TIP #	Project Name	USACE Permit #	DWR Permit #	DCM Permit #			
Statewide Stream & Wetland ILF Program	REQ-005232		Macon County Airport Runway Extension	2009-00321	1993-0501		89.150		
Statewide Stream & Wetland ILF Program	REQ-005232		Macon County Airport Runway Extension	2009-00321	1993-0501		546.000		
Statewide Stream & Wetland ILF Program	REQ-005232		Macon County Airport Runway Extension	2009-00321	1993-0501		182.000		
Statewide Stream & Wetland ILF Program	REQ-005232		Macon County Airport Runway Extension	2009-00321	1993-0501		341.800		
Statewide Stream & Wetland ILF Program	REQ-005232		Macon County Airport Runway Extension	2009-00321	1993-0501		178.300		
Statewide Stream & Wetland ILF Program	REQ-005233		Macon County Airport Runway Extension	2009-00321	1993-0501			0.424	
Statewide Stream & Wetland ILF Program	REQ-005233		Macon County Airport Runway Extension	2009-00321	1993-0501			1.272	
Statewide Stream & Wetland ILF Program	REQ-005233		Macon County Airport Runway Extension	2009-00321	1993-0501			0.424	
Statewide Stream & Wetland ILF Program	REQ-005233		Macon County Airport Runway Extension	2009-00321	1993-0501			0.424	
Statewide Stream & Wetland ILF Program	REQ-005233		Macon County Airport Runway Extension	2009-00321	1993-0501			0.424	
Statewide Stream & Wetland ILF Program	REQ-005233		Macon County Airport Runway Extension	2009-00321	1993-0501				0.006
Statewide Stream & Wetland ILF Program	REQ-005233		Macon County Airport Runway Extension	2009-00321	1993-0501				0.022
Statewide Stream & Wetland ILF Program	REQ-005233		Macon County Airport Runway Extension	2009-00321	1993-0501				0.006
Statewide Stream & Wetland ILF Program	REQ-005233		Macon County Airport Runway Extension	2009-00321	1993-0501				0.006
Total Credits Debited							1,337.250	2.968	0.040
Remaining Available balance (Released credits)							49.750	0.427	0.004
Remaining Credits (Unreleased credits)							396.000	0.845	0.011



3600 Glenwood Avenue, Suite 100
Raleigh, NC 27612

Corporate Headquarters
6575 West Loop South, Suite 300
Bellaire, TX 77401
Main: 713.520.5400

December 15, 2020

Paul Wiesner
NC DEQ Division of Mitigation Services
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

RE: Cochran Branch Stream and Wetland Restoration Site: MY5 Monitoring Report
(NCDMS ID 95720)

Listed below are comments provided by DMS on November 24, 2020 regarding the Cochran Branch Stream and Wetland Restoration Site: Year 6 Monitoring Report and RES' responses.

General: RES should discuss and coordinate with the IRT before completing additional herbicidal treatment of the vegetation along Parrish Branch during monitoring year 7 (2021). The IRT may request that the site be unmaintained in the final year of monitoring. The draft report notes that Parrish branch is no longer considered a problem area and Table 5 currently indicates that no significant aggradation was observed on the reach in MY6. As a reminder, at the April 2020 IRT credit release meeting, the IRT requested a site visit in late fall/ winter 2020/ 2021 to observe Parrish Branch during the dormant season.

[RES plans to discuss herbicidal treatment of vegetation in Parrish Branch with the IRT during the requested early 2020 site visit.](#)

General: Please confirm that the conservation easement signage marking the site was assessed and repaired as necessary during MY6 (2020). Please include report text as necessary.

[Conservation easement signage was assessed during annual monitoring and no repairs were deemed necessary. RES will assess the easement signage again in MY7 and ensure the site is properly marked prior to closeout. This has been added to the report.](#)

CCPV Map (Figure 2) & Table 6: No invasive areas are shown on the CCPV map or reported in Table 6. Please confirm that current invasives on the site are beneath the mapping threshold (1,000 SqF) or revise the CCPV map and table as necessary.

[RES did not observe any areas of invasives larger than the mapping threshold.](#)

Table 9 – Planted Stem Count Totals: The table indicates that no volunteer stems were identified in the vegetation plots during MY6 (2020). Please confirm or update the report as necessary.

[RES did not record any volunteer species during vegetation monitoring in MY6.](#)

Digital Support File Comments:

- Last year DMS requested shapefiles that accurately represented Cochran Branch, and the design shapefiles were provided. However; these shapefiles characterize Cochran Branch as



being 1446 ft compared to the 1387 ft reported in the asset table. If possible, please provide DMS with shapefiles that accurately represent the linear feet reported in the asset table. The stream shapefile that has the accurate linear feet is included with the support files. The 59-foot difference was due to a utility easement at the top of Cochran Branch where no credit is received.

- Please include photos from permanent stations as JPEGs in the final digital submission. Done.

**Cochran Branch
Macon County, North Carolina
DMS Project ID 95720**

**Little Tennessee River Basin
HUC 06010202040020**

Prepared by:



**Resource Environmental Solutions, LLC
3600 Glenwood Avenue, Suite 100
Raleigh, NC 27612
919-209-1061**

Contents

1.0 Project Summary.....	3
1.1. Goals and Objectives	3
1.2. Success Criteria.....	3
1.3. Project Setting and Background.....	5
1.4. Project Performance.....	5
2.0 Methods	7
3.0 References.....	8

Appendix A. General Tables and Figures

Table 1. Project Components and Mitigation Credits
Table 2. Project Activity and Reporting History
Table 3. Project Contacts
Table 4. Project Information
Figure 1. Project Vicinity Map

Appendix B. Visual Assessment Data

Figure 2. Current Conditions Plan View Map (CCPV)
Table 5. Visual Stream Morphology Stability Assessment
Table 6. Vegetation Condition Assessment
Stream Photos
Vegetation Plot Photos

Appendix C. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Summary
Table 8. CVS Vegetation Plot Metadata
Table 9. Planted and Total Stem Counts (Species by Plot)

Appendix D. Stream Geomorphology Data

Table 10. Morphological Parameters Summary Data
Table 11a. Dimensional Morphology Summary
Table 11b. Stream Reach Data Summary
Cross Section Plots
Table 12. Pebble Count Data Summary
MY5 Stream Reach Substrate Composition Charts
Table 13. Bank Pin Array Summary Data

Appendix E. Hydrology Data

Table 14. Documentation of Geomorphological Significant Flow Events
Table 15. Rainfall Summary
Table 16. Wetland Hydrology Attainment Data
2020 Groundwater Monitoring Gauge Hydrographs

Appendix E. MY4 IRT Credit Release Site Visit Memo

1.0 PROJECT SUMMARY

1.1. Goals and Objectives

The overall goals address the stressors identified in the TLW and include the following:

- Improve water quality within the restored channel reaches and downstream watercourses by reducing sediment and nutrient inputs and increasing dissolved oxygen levels
- Improve local aquatic and terrestrial ecological function through increased stream shading, habitat complexity, and availability of organic/woody material
- Improve aquatic and benthic habitat and associated streambed form
- Improve site hydrology, wetland functions, and attenuation of flood flows
- Provide riparian area and wetland restoration with a native plant community
- Protect the site from future land impacts

The specific project objectives that are intended to target the above goals include the following:

- Implement Priority I and II restoration of 1,783 feet of stream and rehabilitation/re-establishment of 4.35 acres of wetlands
- Implement appropriate changes in dimension, pattern and/or profile to establish geomorphically stable conditions within the project reaches
- Modify degraded stream channels to enable proper sediment transport capacity and improved streambed form
- Integrate in-stream structures and native bank vegetation
- Re-grade the floodplain to remove drainage ditches, spoil berms, and overburden soil
- Plant native woody and herbaceous riparian vegetation within a minimum width of 30 feet from the edge of the restored channels and throughout the restored wetland area
- Eradicate invasive, exotic or undesirable plant species
- Install livestock exclusion fencing
- Establish a permanent conservation easement

1.2. Success Criteria

1.2.1. Morphological Parameters and Channel Stability

Restored and enhanced streams are in compliance with the standards set forth in the USACE 2003 Stream Mitigation Guidelines and the “Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for Stream and Wetland Mitigation” dated November 7, 2011. Restored and enhanced streams should demonstrate morphologic stability to be considered successful. Stability does not equate to an absence of change, but rather to sustainable rates of change or stable patterns of variation. Restored streams often demonstrate some level of initial adjustment in the several months that follow construction and some change/variation subsequent to that is also to be expected. However, the observed change should not be unidirectional such that it represents a robust trend. If some trend is evident, it should be very modest or indicate migration to a stable form.

Dimension - Cross-section measurements should indicate little change from the as-built cross-sections. If changes do occur, they will be evaluated to determine whether the adjustments are associated with increased stability or whether they indicate movement towards an unstable condition.

Pattern and Profile - Visual inspection of the pattern and profile should indicate stability with little deviation from as-built conditions for the restored stream. Pool depths may vary from year to year, but the majority should maintain depths sufficient to be observed as distinct features. The pools should maintain their depth with flatter water surface slopes,

while the riffles should remain shallower and steeper. Pattern and profile measurements will not be collected unless conditions seem to indicate that a detectable and detrimental change appears to have occurred.

Substrate - Calculated D_{50} and D_{84} values should indicate coarser size class distributions of bed materials in riffles and finer size class distributions in pools. The majority of riffle pebble counts should indicate maintenance or coarsening of substrate size class distributions. Generally, it is anticipated that the bed material will coarsen over time.

Sediment Transport - Depositional features should be consistent with a stable stream that is effectively managing its sediment load. Point bar and inner berm features, if present, should develop without excessive encroachment of the channel. Isolated development of robust (i.e. comprised of coarse material and/or vegetated actively diverting flow) mid-channel or lateral bars will be acceptable. Likewise, development of a higher number of mid-channel or lateral bars that are minor in terms of their permanency such that profile measurements do not indicate systemic aggradation will be acceptable, but trends in the development of robust mid-channel or alternating bar features will be considered a destabilizing condition and may require intervention or have success implications.

1.2.2. Surface Water Hydrology

Monitoring of stream surface water stages should indicate recurrence of bankfull flow on average every 1 to 2 years. At a minimum, throughout the monitoring period, the surface water stage should achieve bankfull or greater elevations at least twice. The bankfull events must occur during separate monitoring years.

1.2.3. Groundwater Hydrology

The USACE defines minimum hydrology for jurisdictional wetlands to be saturation within 12 inches of the surface for at least 5% of the growing season if soils and vegetation meet jurisdictional criteria. Given that hydric soils are present throughout the restoration area but that wetland vegetation will be newly established, it is reasonable to set the minimum hydrology threshold slightly above the jurisdictional minimum threshold. As such, the minimum performance standard is set to provide saturated soils within 12 inches of the surface for at least eight percent (8%) of the growing season under average climatic conditions. The reference wetland site used up through 2017 was the NCDMS Cat Creek Stream and Wetland Restoration Site – NCDMS Project # 71 – located east of Franklin in Macon County, NC. In January 2018, RES made a site visit to Cat Creek to replace the wetland reference gauge, but it was determined that it was no longer a representative reference gauge due to its location in a beaver pond. Because of the continued success of the wetland gauges on the Cochran Branch Site (including those gauges outside of the wetland crediting area), RES deemed it unnecessary to find a new location for the reference gauge. The growing season for the site was based on the Natural Resource Conservation Service (NRCS) WETS dataset for Macon County (<http://agacis.rcc-acis.org/37113/wets>). The Macon County dataset is based on a site with elevations roughly the same as the project site. According to NRCS, the growing season for Macon County is defined to be the period with a 50% probability that the daily minimum temperature is higher than 28°F. At the project site, this period extends from April 16th to October 19th for a total of 187 days. Based on this, wetland hydrology success will be achieved if the water table is within 12 inches of the soil surface for one or more periods of at least 15 consecutive days during the growing season.

1.2.4. Vegetation

Riparian vegetation monitoring shall be conducted for a minimum of seven years to ensure that success criteria are met per USACE guidelines. Accordingly, success criteria will consist of a minimum survival of 260 planted stems per acre by the end of the Year 5 monitoring period and a minimum of 210 planted stems per acre at the end of Year 7. If monitoring indicates either that the specified survival rate is not being met or the development of detrimental conditions (i.e., invasive species, diseased vegetation), appropriate corrective actions will be developed and implemented. Additionally, planted vegetation must average 8 feet in height in each plot at year 7 (as defined in the USACE 2003). If this performance standard is met by year 5 and stem density is trending toward success (i.e., no less than 260 five-year old stems/acre) monitoring of vegetation on the site may be terminated provided written approval is given by the USACE in consultation with the North Carolina Interagency Review Team (NCIRT).

1.3. Project Setting and Background

The Cochran Branch Mitigation Project (The Site) is located approximately 6 miles northwest of Franklin, North Carolina at latitude 35°12'52" N and longitude 83°29'20" W. The Site encompasses approximately 10 acres of agricultural land and consists of two streams, Cochran Branch and Parrish Branch, along with 4.35 acres of wetlands on the Cochran Branch floodplain. The Site lies within the Little Tennessee River Watershed N.C. Division of Water Resources (DWR) sub-basin 04-04-01 and local HUC 06010202040020. The project is located within the NCDMS Iotla Creek targeted local watershed (TLW) and within the Franklin to Fontana local watershed plan (LWP). Cochran Branch drains to Burningtown Creek approximately 0.5 miles downstream of the project. Burningtown Creek is classified as B;Tr by NCDEQ.

Following 2016 monitoring the NCIRT requested a review of the differential between the Approved Mitigation Plan and Baseline Monitoring Report. The table below details the discrepancies by reach. The cause of increased baseline SMUs is survey methodology (thalweg vs. centerline) as well as construction field adjustments. The Mitigation Plan lengths were based on centerline. Wetland credits are unchanged from Mitigation Plan to Baseline Monitoring Report.

Reach	Mitigation Type*	Proposed Length (LF)	Mitigation Ratio	Proposed SMUs	Baseline SMUs
Cochran Branch	P1 Restoration	1,387	1:1	1,387	1,418
Parrish Branch	P1 Restoration	396	1:1	396	402
Total		1,783		1,783	1,820

*P1=Priority 1

**The contracted amount of credits for this Site was 1,756 SMUs

1.4. Project Performance

Monitoring Year 6 (MY6) data was completed in October 2020. Monitoring activities included visual assessment of all reaches and the surrounding easement, collection of images at eight permanent photo stations, and inventory of eight permanent vegetation monitoring plots. Monitoring activities also included stream monitoring consisting of the three cross-sections on Parrish Branch. Per the Approved Mitigation Plan, stream geomorphology monitoring was not required for MY6, however, RES wanted to present any changes to Parrish Branch post channel vegetation spraying. Conservation easement signage was assessed, and no repairs were deemed necessary. RES will assess the easement signage again in MY7 and ensure the site is properly marked prior to closeout

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly Restoration Plan) documents available on the NCDMS website (<https://deq.nc.gov/about/divisions/mitigation-services/dms-projects>). All raw data supporting the tables and figures in the appendices is available from DMS upon request.

1.4.1. Vegetation

Visual assessment of vegetation outside of the monitoring plots (**Appendix B; Table 6**) indicates that the herbaceous vegetation is becoming well established throughout the project. Treatments of Chinese privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*) have been effective along the boundary of the easement. A few multiflora rose patches were treated throughout the easement in July 2020.

Monitoring of the eight permanent vegetation plots was completed in October 2020. Summary tables and photographs associated with MY6 monitoring are located in Appendix C. MY6 monitoring data indicates that all plots met interim success criteria of 210 planted stems per acre. Planted stem densities among plots ranged from 243 to 688 planted stems per acre with an annual mean of 420 planted stems per acre across all plots. A total of 11 species were documented within the plots. The average tree height observed was 5.9 feet. Some of the wetland area plots (especially Plot 8) are showing below average stem heights for MY6. RES believes this is due to the short growing season and year-round high-water table which is more conducive to mountain bog and fen community.

1.4.2. Stream Geomorphology

Visual assessment of the stream channel was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation. In April 2019 and July 2020, RES treated the vegetation in Parrish Branch with aquatic safe herbicide. The goal was to remove the wetland vegetation that was growing in the channel and causing aggradation. During the October field work and on the cross-section plots (**Appendix D**), it was apparent that the herbicidal treatment of the vegetation in Parrish Branch was effective and will be performed again in 2021. RES also heavily livestocked the banks of the reach in 2020 to further discourage channel vegetation growth. Parrish Branch visual assessments and cross section plots confirm that this reach is no longer a problem area in MY6. Additional photos of Parrish Branch were added to Appendix B.

Geomorphic data for MY6 was collected in October 2020 only on Parrish Branch. Summary tables and cross-section plots related to stream morphology are located in Appendix D. For the Cochran Branch reach, cross-sectional overlays showed minimal dimensional change between MY4 and MY5 data collection efforts. As for the Parrish Branch, between MY5 and MY6, it appears aggradation and channel formation has improved for XS7 and 8 and there was some aggradation on XS9 but a defined channel is still present on the overlay plot (**Appendix B; Table 11a**). RES plans to treat the aquatic vegetation again in MY7 to continue to help move sediment properly through this reach. In MY5, all measurements are based on fixed baseline cross sectional area; therefore, bankfull elevation was adjusted for each cross-section to achieve a cross-sectional area equivalent to the reported baseline cross-sectional area. None of the riffle cross sections exceeded a 1.2 BHR.

Substrate monitoring was performed during MY5. Pebble count d50 was medium gravel for Cochran Branch, and sand for Parrish Branch. The channel substrate will be monitored again in MY7 to document shifts in particle size distributions.

The bank pin arrays indicate that no erosion is taking place in the meanders during MY5 and will be reported again in MY7 (**Appendix D; Table 12**).

1.4.3. Groundwater and Stream Hydrology

During MY6, eight of the eight groundwater monitoring wells met the 8 percent hydroperiod success criteria (**Appendix E; Table 16**). All well hydroperiods were 77 percent of the growing season. Due to barometric pressure gauge failure, data for the first 44 days of the growing season were missed.

At least two bankfull events were observed in MY6. The crest gauge on Cochran Branch had a water mark that was 1.92 feet high and Parrish Branch had a water mark that was 1.33 feet high. Photos of the crest gauges are in Appendix E.

2.0 METHODS

This report presents the results of the Monitoring Year 6 (MY6) visual, hydrologic, morphological, and vegetation data. Permanent photo station photos were collected in October 2020. Additional photos of vegetation or stream problem areas were taken as needed.

Geomorphic measurements were taken during low flow conditions using a Topcon GTS-312 Total Station. Three-dimensional coordinates associated with cross-section data was collected in the field and geo-referenced (NAD83 State Plane feet FIPS 3200). Morphological data was collected at 9 cross-sections. Survey data was imported into CAD, ArcGIS®, and Microsoft Excel® for data processing and analysis. Channel substrate was characterized using a Wolman Pebble Count as outlined in Harrelson et al. (1994) and processed using Microsoft Excel.

Vegetation success is being monitored at eight permanent monitoring plots. Vegetation monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data is processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with rebar and photos of each plot taken from the origin each monitoring year.

Precipitation data was collected using an Onset HOBO Data Logging Rain Gauge. Groundwater for hydrologic success of restored wetlands was monitored using eight HOBO U20 Water Level Loggers. An additional logger was installed on site, above ground, for use as a barometric reference. Data loggers collected depth to groundwater daily and all data were processed using HOBOWare and analyzed using Microsoft Excel. Bankfull events were documented with two crest gauges, one each being located on Cochran Branch and Parrish Branch. During quarterly visits to the site, the height of the corkline was recorded.

3.0 REFERENCES

- Environmental Banc & Exchange, LLC. 2014. Cochran Branch, Final Mitigation Plan, Macon County, North Carolina. NCEEP Project No. 95720
- Harrelson, Cheryl, C. Rawlins and J. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. Gen. Tech. Rep. RM-245. Rocky Mountain Forest and Range Experiment Station. USDA Forest Service. Fort Collins, Colorado
- Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. <http://cvs.bio.unc.edu/methods.htm>; accessed November 2008.
- USACE (U.S. Army Corps of Engineers). 2003. Stream Mitigation Guidelines. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, North Carolina Wildlife Resources Commission, North Carolina Department of Environment and Natural Resources-Division of Water Quality. Wilmington District.

Appendix A
General Tables and Figures

Table 1. Project Components and Mitigation Credits
Cochran Stream and Wetland Restoration Project

Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen	Phosphorous Nutrient Offset
	R	RE	R	RE	R	RE		Nutrient Offset	
Type	R	RE	R	RE	R	RE			
Totals	1,783		4,240	0.055			-	-	-
Project Components									
Project Component -or- Reach ID	Stationing/Location		Existing Footage/Acreage		Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage ¹	Mitigation Ratio	
Cochran Branch	100+60 - 115+05		1,332		PI	R	1,387	1:1	
Parrish Branch	200+15 - 204+11		232		PII	R	396	1:1	
Wetland Area 1			-		Re-Est.	R	3.33	1:1	
Wetland Area 1			0.88		Re-Hab.	R	0.82	1:1	
Wetland Area 2			0.11		Enh.	RE	0.11	2:1	
Wetland Area 3			-		Re-Est.	R	0.09	1:1	
Component Summation									
Restoration Level	Stream ¹	Riparian Wetland		Non-riparian Wetland	Buffer	Upland			
	(linear feet)	(acres)		(acres)	(square feet)	(acres)			
		Riverine	Non-Riverine						
Restoration	1,783	-	4.24	-	-	-	-	-	-
Enhancement	-	-	0.11	-	-	-	-	-	-
Enhancement I	-	-	-	-	-	-	-	-	-
Enhancement II	-	-	-	-	-	-	-	-	-
Creation	-	-	-	-	-	-	-	-	-
Preservation	-	-	-	-	-	-	-	-	-
Preservation	-	-	-	-	-	-	-	-	-
BMP Elements									
Element ²	Location	Purpose/Function			Notes				
FB	Entire Site	Protect Stream							

¹Restoration footage accounts for no credits in crossings, exclusions, and powerline ROWs.

²BR = 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; FB = Forested Buffer

Note: Stream credit calculations were originally calculated along the as-built thalweg. Based on the April 3, 2017 IRT Credit Release Meeting, these stream credits have been reverted back to the amounts in the IRT approved mitigation plan.

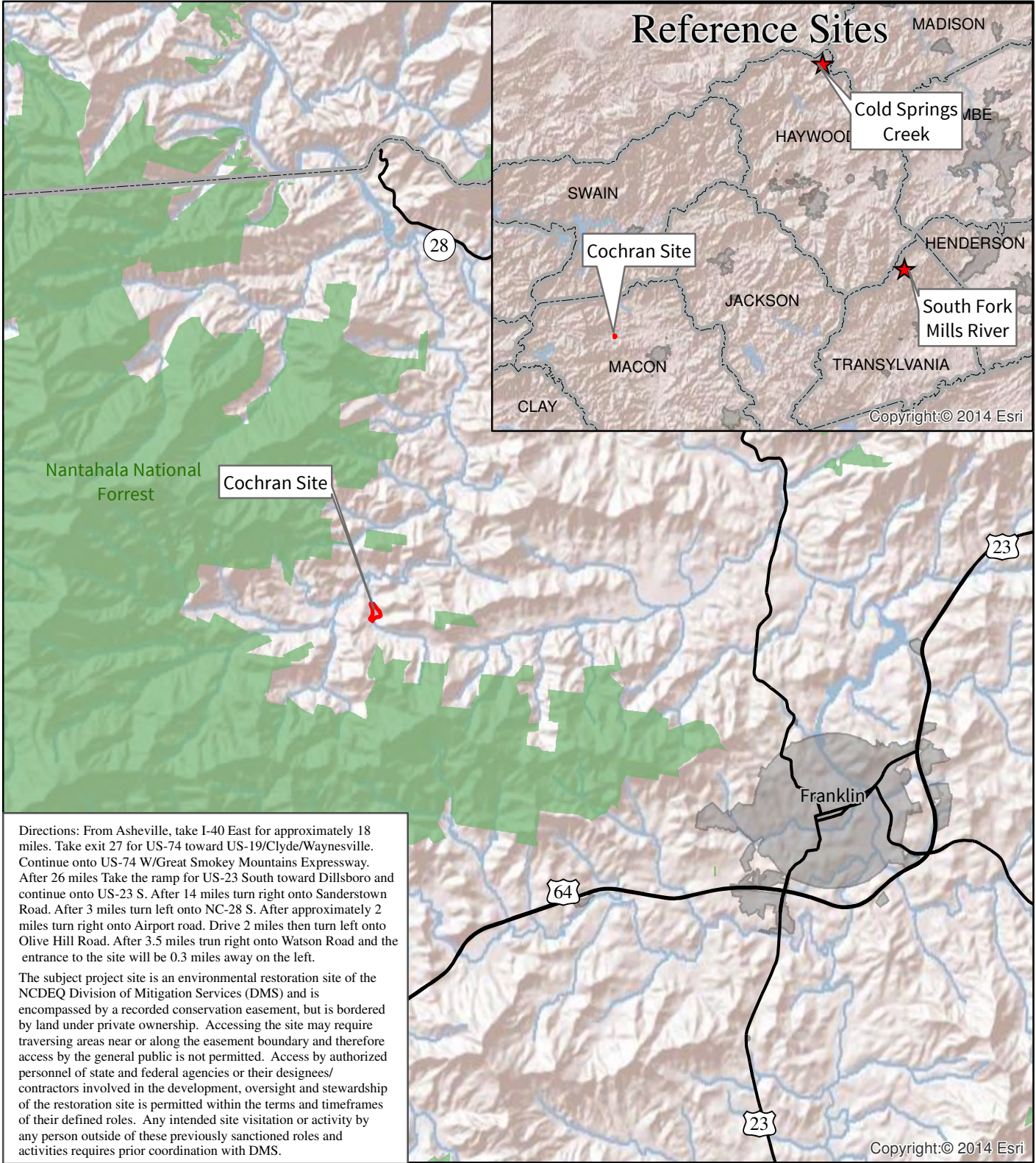
**Table 2. Project Activity and Reporting History
Cochran Stream and Wetland Restoration Project**

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	Aug - 2014	Sept - 2014
Final Design - Construction Plans	Oct - 2014	Oct - 2014
Construction	N/A	May - 2015
Permanent Seed Mix Applied	May - 2015	May - 2015
Live Stake and Bare Root Plantings	May - 2015	May - 2015
Baseline Monitoring Document (Year 0 Monitoring - Baseline)	Jun - 2015	Aug - 2015
Invasive-Exotic Vegetation Treatment	-	Jun - 2015
Year 1 Monitoring	Dec - 2015	Jan - 2016
Invasive-Exotic Vegetation Treatment	-	Feb - 2016
Invasive-Exotic Vegetation Treatment	-	Jun - 2016
Year 2 Monitoring	Mar - 2016	Nov - 2016
Year 3 Monitoring	Stream: Oct - 2017	Jan - 2018
	Vegetation: Oct - 2017	
Invasive-Exotic Vegetation Treatment	-	July - 2018
Year 4 Monitoring	Stream: Oct - 2018	Jan - 2019
	Vegetation: Oct - 2018	
Parrish Branch Channel Vegetation Treatment & Buffer Planting	-	April - 2019
Year 5 Monitoring	Stream: Oct - 2019	Jan - 2020
	Vegetation: Oct - 2019	
Parrish Branch Supplemental Livestaking	-	Jul - 2020
Channel Vegetation & Invasive-Exotic Vegetation Treatment	-	Jul - 2020
Year 6 Monitoring	Stream: Oct - 2019	Nov - 2020
	Vegetation: Oct - 2019	
Year 7 Monitoring		

Table 3. Project Contacts	
Cochran Stream and Wetland Restoration Project	
Prime Contractor	Resource Environmental Solutions, LLC 3600 Glenwood Ave, Suite 100 Raleigh, North Carolina 27612 Daniel Ingram (919) 209-1056
Designer	Wolf Creek Engineering 12 1/2 Wall Street Suite C Asheville, North Carolina 28801 S. Grant Ginn (828) 449-1930
Construction Contractor	Northstate Environmental 2889 Lowery Street Winston Salem, North Carolina 27101 Darrell Westmoreland (336) 725-2010
Seeding Contractor	Northstate Environmental 2889 Lowery Street Winston Salem, North Carolina 27101 Darrell Westmoreland (336) 725-2010
Planting Contractor	Resource Environmental Solutions, LLC 3600 Glenwood Ave, Suite 100 Raleigh, North Carolina 27612 David Godley (919) 209-1053
As-built Surveys	Kee Mapping and Surveying PO Box 2566 Asheville, North Carolina 28802 Phillip B. Key (828) 575-9021
Seeding Mix Source	Northstate Environmental 2889 Lowery Street Winston Salem, North Carolina 27101 Darrell Westmoreland (336) 725-2010
Bare Root Seedlings	Arborgen 5594 Highway 38 South Blenheim, SC 29516 (843)528-9669
	North Carolina Forestry Claridge Nursery 762 Claridge Nursery Road Goldsboro, North Carolina 27530 (919) 731-7988
Live Stakes	Foggy Mountain Nursery 2251 Ed Little Road Creston, North Carolina 28643 (336) 384-5323
Monitoring Performers (MY0-MY2) 2015 - 2016	Equinox Environmental 37 Haywood St. Asheville, North Carolina 28802 Drew Alderman (828) 253-6856
Monitoring Performers (MY3+) 2017+	Resource Environmental Solutions, LLC 3600 Glenwood Ave, Suite 100 Raleigh, North Carolina 27612 Ryan Medric (919) 741-6268
Exotic Invasive Vegetation Treatment Contractor	Resource Environmental Solutions, LLC 3600 Glenwood Ave, Suite 100 Raleigh, North Carolina 27612 Brian Hockett (919) 209-1061

Table 4. Project Baseline Information and Attributes

Project Information					
Project Name	Cochran Branch				
County	Macon County				
Project Area (acres)	10.06				
Project Coordinates (latitude and longitude)	35°12'52.03" N, 83°29'20.10" W				
Project Watershed Summary Information					
Physiographic Province	Blue Ridge				
River Basin	Little Tennessee				
USGS Hydrologic Unit 8-digit	06010203	USGS Hydrologic Unit 14-Digit	6010202040020		
DWQ Sub-basin	40-04-01				
Project Drainage Area (acres)	811				
Project Drainage Area Percentage of Impervious Area	<5%				
CGIA Land Use Classification	2.01.03 Hay and Pasture Land				
Reach Summary Information					
Parameters	Cochran Branch	Parrish Branch			
Length of reach (linear feet)	1332	232			
Valley classification (Rosgen)	II	II			
Drainage area	1.25	0.11			
NCDWQ stream identification score	48	40			
NCDWQ Water Quality Classification	B, Tr	B, Tr			
Morphological Description (stream type) (Rosgen)	G4	G4			
Evolutionary trend (Rosgen)	G → F → C → E	G → F → B			
Underlying mapped soils	NkA	NkA, ScC			
Drainage class	Verry Poorly Drained	Verry Poorly Drained, Mod Well Drained			
Soil Hydric status	Hydric	Hydric, Non-Hydric			
Slope	0.7%	4.2%			
FEMA classification	N/A	N/A			
Native vegetation community	Agricultural	Agricultural			
Percent composition of exotic invasive vegetation	6%	0%			
Wetland Summary Information					
Parameters	A	B	C	D	E
Area (Acres)	4.24	0.11			
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian Non-Riverine	Riparian Non-Riverine			
Mapped Soil Series	NkA	NkA			
Drainage class	Verry Poorly Drained	Verry Poorly Drained			
Soil Hydric Status	Hydric	Hydric			
Source of Hydrology	Groundwater	Groundwater			
Previous Hydrologic Impairment	Dredging/Ditching	Dredging/Ditching			
Native vegetation community	Montane Alluvial Forest	Montane Alluvial Forest			
Percent composition of exotic invasive vegetation	0%	0%			
Regulatory Considerations					
Regulation	Applicable?	Resolved?	Supporting Documentation		
Waters of the United States – Section 404	Yes	Yes	PCN 27 (SAW-2013-00280)		
Waters of the United States – Section 401	Yes	Yes	401 Certification (DWR#-13-0188)		
Endangered Species Act	No	Yes	ERTR		
Historic Preservation Act	No	Yes	ERTR		
Coastal Zone Management Act (CZMA) Coastal Area Management Act (CAMA)	No	N/A			
FEMA Floodplain Compliance	N/A	N/A			
Essential Fisheries Habitat	N/A	N/A			



Directions: From Asheville, take I-40 East for approximately 18 miles. Take exit 27 for US-74 toward US-19/Clyde/Waynesville. Continue onto US-74 W/Great Smokey Mountains Expressway. After 26 miles Take the ramp for US-23 South toward Dillsboro and continue onto US-23 S. After 14 miles turn right onto Sanderstown Road. After 3 miles turn left onto NC-28 S. After approximately 2 miles turn right onto Airport road. Drive 2 miles then turn left onto Olive Hill Road. After 3.5 miles turn right onto Watson Road and the entrance to the site will be 0.3 miles away on the left.

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.

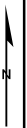
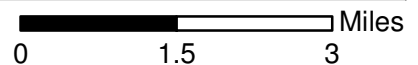


Figure 1: Vicinity Map

Cochran Branch
Project No. 95720

Macon County, North Carolina

Notes: Conservation Easement from Key Mapping & Survey, P.A.



Appendix B
Visual Assessment Data

**Table 5. Visual Stream Morphology Stability Assessment
Cochran Stream and Wetland Restoration Project - Cochran Branch
Assessed Length 1,418 feet**

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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	23	23		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	23	23		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	23	23		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	23	23		100%				
2. Thalweg centering at downstream of meander bend (Glide).		23	23	100%						
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	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%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	0	0	100%
Totals					0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	23	23			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	23	23			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	23	23			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	23	23			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	23	23			100%			

**Table 5 Cont'd. Visual Stream Morphology Stability Assessment
Cochran Stream and Wetland Restoration Project - Parrish Branch
Assessed Length 402 feet**

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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	22	22		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	22	22		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	22	22		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	22	22		100%				
		2. Thalweg centering at downstream of meander bend (Glide).	22	22		100%				
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.				0	0	100%	0	0
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	0	0	100%
	Totals					0	0	100%	0	0
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	19	19			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	19	19			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	19	19			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	19	19			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	19	19			100%			

**Table 6. Vegetation Condition Assessment
Cochran Stream and Wetland Restoration Project**

Planted Acreage : 10.05					
Vegetation Category	Definitions	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	N/A	0	0.00	0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	N/A	0	0.00	0%
Totals			0	0.00	0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	N/A	0	0.00	0%
Cumulative Totals			0	0.00	0%
Easement Acreage : 10.05					
Vegetation Category	Definitions	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).	N/A	0	0.00	0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	N/A	0	0.00	0%

N/A - Item does not apply.

Cochran Branch MY6 2020 Photo Station Photos



Cochran Branch Reach 1a – Permanent Photo Station 1
Station 101+33 – Downstream
October 27, 2020



Cochran Branch Reach 1a – Permanent Photo Station 1
Station 101+33 – Upstream
October 27, 2020

Cochran Branch MY6 2020 Photo Station Photos



Cochran Branch – Permanent Photo Station 2
East 95°
October 27, 2020



Cochran Branch – Permanent Photo Station 3
Station 108+87 – Upstream
October 27, 2020

Cochran Branch MY6 2020 Photo Station Photos



Parrish Branch – Permanent Photo Station 3
Station 108+87 – Downstream
October 27, 2020



Cochran Branch – Permanent Photo Station 4
South Southeast 160°
October 27, 2020

Cochran Branch MY6 2020 Photo Station Photos



Cochran Branch – Permanent Photo Station 5
Southeast 150°
October 27, 2020



Cochran Branch – Permanent Photo Station 6
Station 114+62 – Upstream 186°
October 27, 2020

Cochran Branch MY6 2020 Photo Station Photos



Parrish Branch – Permanent Photo Station 7
Station 200+25 – Downstream
October 27, 2020



Parrish Branch – Permanent Photo Station 8
Southwest 225°
October 27, 2020

Cochran Branch MY6 2020 Photo Station Photos



Cochran & Parrish Branch – Drone Photo
January 2020



Parrish Branch – General Photo
October 27, 2020

Cochran Branch MY6 2020 Photo Station Photos



Parrish Branch – General Photo
October 27, 2020



Parrish Branch – General Photo
October 27, 2020

Cochran Branch MY6 2020 Vegetation Plot Photos



Cochran - Vegetation Monitoring Plot 1
October 27, 2020



Cochran - Vegetation Monitoring Plot 2
October 27, 2020

Cochran Branch MY6 2020 Vegetation Plot Photos



Cochran - Vegetation Monitoring Plot 3
October 27, 2020



Cochran - Vegetation Monitoring Plot 4
October 27, 2020

Cochran Branch MY6 2020 Vegetation Plot Photos



Cochran - Vegetation Monitoring Plot 5
October 27, 2020



Cochran - Vegetation Monitoring Plot 6
October 27, 2020

Cochran Branch MY6 2020 Vegetation Plot Photos



Cochran - Vegetation Monitoring Plot 7
October 27, 2020



Cochran - Vegetation Monitoring Plot 8
October 27, 2020

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Summary

Plot #	Planted Stems/Acre	Volunteer Stems/Acre	Total Stems/Acre	Success Criteria Met?	Average Planted Stem Height (ft)
1	283	0	283	Yes	6.0
2	688	0	688	Yes	5.1
3	324	0	324	Yes	6.0
4	445	0	445	Yes	4.0
5	526	0	526	Yes	7.8
6	445	0	445	Yes	11.3
7	243	0	243	Yes	4.4
8	405	0	405	Yes	2.0
Project Avg	420	0	420	Yes	5.9

**Table 8: CVS Vegetation Plot Metadata
Cochran Branch Stream and Wetland Restoration Site**

Report Prepared By	Emily Ulman
Date Prepared	10/29/2020 13:38
database name	Cochran_MY6_2020.mdb
database location	C:\Users\eulman\Dropbox (RES)\@RES Projects\North Carolina\Cochran Branch\Monitoring\Monitoring Data\MY6_2020\Vegetation Data
computer name	D4V0KGH2
file size	61775872
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	95720
project Name	Cochran Branch Stream and Wetland
Description	
River Basin	Little Tennessee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	8

Table 9. Planted Total Stem Counts (Species by Plot)

			Current Plot Data (MY6 2020)																							
Scientific Name	Common Name	Species Type	95720-01-0001			95720-01-0002			95720-01-0003			95720-01-0004			95720-01-0005			95720-01-0006			95720-01-0007			95720-01-0008		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree																								
Acer rubrum var. rubrum	red maple	Tree	1	1	1																					
Alnus	alder	Shrub																								
Alnus serrulata	hazel alder	Shrub				3	3	3																		
Betula nigra	river birch	Tree	1	1	1	2	2	2							2	2	2				1	1	1			
Cephalanthus occidentalis	common buttonbush	Shrub							1	1	1															
Diospyros virginiana	common persimmon	Tree																		1	1	1	5	5	5	
Fraxinus pennsylvanica	green ash	Tree																								
Liriodendron tulipifera	tuliptree	Tree																	1	1	1					
Liriodendron tulipifera var. yellow	Tulip-tree, Yellow P	Tree										3	3	3				8	8	8						
Nyssa sylvatica	blackgum	Tree																								
Platanus occidentalis	American sycamore	Tree																1	1	1						
Platanus occidentalis var. sycamore	Sycamore, Plane-tre	Tree	2	2	2	10	10	10	4	4	4	7	7	7	10	10	10				4	4	4			
Quercus	oak	Tree																								
Quercus alba	white oak	Tree																						2	2	2
Quercus michauxii	swamp chestnut oak	Tree	2	2	2				2	2	2				1	1	1							1	1	1
Quercus nigra	water oak	Tree																								
Quercus phellos	willow oak	Tree	1	1	1	1	1	1				1	1	1				1	1	1				2	2	2
Quercus rubra var. rubra	northern red oak	Tree																								
Salix nigra	black willow	Tree				1	1	1	1	1	1															
Sambucus canadensis	Common Elderberry	Shrub																								
Unknown		Shrub or Tree																								
Stem count			7	7	7	17	17	17	8	8	8	11	11	11	13	13	13	11	11	11	6	6	6	10	10	10
size (ares)			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		
Species count			5	5	5	5	5	5	4	4	4	3	3	3	3	3	3	4	4	4	3	3	3	4	4	4
Stems per ACRE			283	283.3	283.3	688	688	688	324	323.7	323.7	445	445.2	445.2	526	526.1	526.1	445	445.2	445.2	243	242.8	242.8	405	404.7	404.7

¹PnoLS: No livestakes included in tally; P-all: All planted stems included in tally; T: Total stems including recruitment.

Table 9. Planted Total Stem Counts (Species by Plot)

Scientific Name	Common Name	Species Type	Annual Means																				
			MY6 (2020)			MY5 (2019)			MY4 (2018)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree						2						3									
Acer rubrum var. rubrum	red maple	Tree	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7	1	1	1	4	4	4
Alnus	alder	Shrub									5												
Alnus serrulata	hazel alder	Shrub	3	3	3	3	3	8						3			4						
Betula nigra	river birch	Tree	6	6	6	6	6	6	6	6	6	8	8	8	12	12	12	14	14	14	16	16	16
Cephalanthus occidentalis	common buttonbush	Shrub	1	1	1	1	1	1	1	1	7				1	1	1						
Diospyros virginiana	common persimmon	Tree	6	6	6	7	7	7	6	6	6	7	7	7	8	8	8						
Fraxinus pennsylvanica	green ash	Tree																1	1	1	2	2	2
Liriodendron tulipifera	tuliptree	Tree	1	1	1	1	1	1			3												
Liriodendron tulipifera var. yellow	Tulip-tree, Yellow P	Tree	11	11	11	11	11	11	13	13	13	13	13	13	6	6	6	10	10	10	27	27	27
Nyssa sylvatica	blackgum	Tree													1	1	1						
Platanus occidentalis	American sycamore	Tree	1	1	1	1	1	1															
Platanus occidentalis var. sycamore	Sycamore, Plane-tree	Tree	37	37	37	37	37	37	38	38	38	36	36	36	39	39	39	45	45	45	48	48	48
Quercus	oak	Tree							1	1	1	1	1	1	2	2	2	23	23	23	38	38	38
Quercus alba	white oak	Tree	2	2	2	2	2	2	3	3	3	4	4	4	4	4	4						
Quercus michauxii	swamp chestnut oak	Tree	6	6	6	7	7	7	9	9	9	9	9	9	13	13	13	9	9	9	11	11	11
Quercus nigra	water oak	Tree										1	1	1	1	1	1	3	3	3			
Quercus phellos	willow oak	Tree	6	6	6	7	7	7	10	10	10	13	13	13	19	19	19	9	9	9	8	8	8
Quercus rubra var. rubra	northern red oak	Tree																			1	1	1
Salix nigra	black willow	Tree	2	2	2	2	2	2			4			4			7			4			
Sambucus canadensis	Common Elderberry	Shrub															2						
Unknown		Shrub or Tree																			1	1	1
Stem count			83	83	83	86	86	93	88	88	106	93	93	103	107	107	126	115	115	119	156	156	156
size (ares)			8			8			8			8			8			8					
size (ACRES)			0.20			0.20			0.20			0.20			0.20			0.20					
Species count			13	13	13	13	13	14	10	10	13	10	10	13	12	12	15	9	9	10	10	10	10
Stems per ACRE			420	419.9	419.9	435	435	470.4	445	445.2	536.2	470	470.4	521	541	541.3	637.4	582	581.7	602	789	789.1	789.1

¹PnoLS: No livestock included in tally; P-all: All planted stems included in tally; T: Total stems including recruitment.

Appendix D
Stream Geomorphology Data

Table 10. Baseline Stream Data Summary
Cochran Stream and Wetland Restoration Project - Cochran Branch 1a (379 feet)

Parameter	Regional Curve			Pre-Existing Condition							Reference Reach Data						Design			As-Built / Baseline ¹					
Dimension & Substrate - Riffle	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N	
Bankfull Width (ft)	-	-	18.9	9.0	10.0	10.0	11.0	1.4	2	23.4	24.7	-	24.7	-	-	-	14.7	-	-	-	-	-	-	-	
Floodprone Width (ft)				12.0	18.5	18.5	25.0	9.2	2	43.0	48.0	-	52.0	-	-	-	-	-	-	-	-	-	-	-	
Bankfull Mean Depth (ft)	-	-	1.3	0.9	1.0	1.0	1.1	0.1	2	1.3	1.4	-	1.5	-	-	-	0.9	-	-	-	-	-	-	-	
Bankfull Max Depth (ft)				1.2	1.3	1.3	1.5	0.2	2	1.8	1.8	-	2.2	-	-	-	1.13	-	-	-	-	-	-	-	
Bankfull Cross Sectional Area (ft ²)			21.5	9.6	9.8	9.8	10.0	0.3	2	33.4	33.4	-	34.6	-	-	-	12.7	-	-	-	-	-	-	-	
Width/Depth Ratio				8.4	10.3	10.3	12.1	2.6	2	15.8	18.3	-	18.4	-	-	-	17.0	-	-	-	-	-	-	-	
Entrenchment Ratio				1.3	1.8	1.8	2.3	0.7	2	1.7	1.9	-	2.1	-	-	-	5.4	-	-	-	-	-	-	-	
Bank Height Ratio				0.9	1.5	1.5	2.0	0.8	2	1.0	1.2	-	1.3	-	-	-	-	-	-	-	-	-	-	-	
d50 (mm)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Profile																									
Riffle Length (ft)				-	-	-	-	-	-	20.0	29.0	-	40.0	-	-	-	-	10.9	20.4	18.8	31.7	8.6	7		
Riffle Slope (ft/ft)				-	-	-	-	-	-	0.015	0.023	-	0.028	-	-	0.009	0.017	0.025	0.007	0.017	0.021	0.025	0.007	7	
Pool Length (ft)				-	-	-	-	-	-	6.0	18.0	-	42.0	-	-	-	-	5.3	10.7	8.7	21.6	5.5	7		
Pool Max Depth (ft)				-	-	-	-	-	-	2.3	2.3	-	2.3	-	-	-	-	2.0	2.4	2.4	3.1	0.4	6		
Pool Spacing (ft)				-	-	-	-	-	-	51.0	87.0	-	113.0	-	-	34.1	45.4	56.8	36.2	48.6	47.6	62.2	9.6	6	
Pattern																									
Channel Belt Width (ft)				-	-	-	-	-	-	-	43.0	-	-	-	-	18.7	24.9	31.2	17.1	27	28.7	33.4	7.4	4	
Radius of Curvature (ft)				-	-	-	-	-	-	44.0	75.0	-	103.0	-	-	25.0	31.0	37.0	24.0	37.6	43.9	44.8	11.8	3	
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	2.6	3.0	3.0	0.8	3	
Meander Wavelength (ft)				-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	73.9	92.8	92.4	116	19.2	5	
Meander Width Ratio				-	-	-	-	-	-	-	1.7	-	-	-	-	-	1.5	-	1.2	1.8	2.0	2.3	0.5	4	
Substrate, Bed and Transport Parameters																									
Ri% / Ru% / P% / G% / S%																								42%/28%/22%/7%/0%	
SC% / Sa% / G% / C% / B% / Be%																									
d16 / d35 / d50 / d84 / d95 / di ^p / di ^{sp} (mm)																									
Reach Shear Stress (Competency) lb/ft ²																									
Max Part Size (mm) Mobilized at Bankfull																									
Stream Power (Transport Capacity) W/m ²																									
Additional Reach Parameters																									
Drainage Area (mi ²)																									
Impervious Cover Estimate (%)																									
Rosgen Classification																									
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)																									
Valley Length (ft)																									
Channel Thalweg Length (ft)																									
Sinuosity																									
Water Surface Slope (ft/ft)																									
Bankfull Slope (ft/ft)																									
Bankfull Floodplain Area (acres)																									
Proportion Over Wide (%)																									
Entrenchment Class (ER Range)																									
Incision Class (BHR Range)																									
BEHI																									
Channel Stability or Habitat Metric																									
Biological or Other																									

¹Reach less than 500 feet and restricted to visual assessment; no cross-sections located in this reach

- Information unavailable.

Non-Applicable.

Table 10 Cont'd. Baseline Stream Data Summary
Cochran Stream and Wetland Restoration Project - Cochran Branch 1b (1,101 feet)

Parameter	Regional Curve			Pre-Existing Condition							Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N	
Bankfull Width (ft)			18.9	7.0	7.9	7.5	9.5	1.2	4	12.0	14.4	-	16.5	-	-	-	14.7	-	14.6	16.6	17.3	17.8	1.77	3	
Floodprone Width (ft)				15.0	16.8	16.0	20.0	2.2	4	60.0	72.5	-	72.5	-	-	-	-	-	135.0	168.5	173.5	197.0	31.3	3	
Bankfull Mean Depth (ft)	-	-	1.3	1.2	1.3	1.3	1.5	0.2	4	-	-	-	-	-	-	0.9	-	0.8	0.8	0.8	1.0	0.11	3		
Bankfull Max Depth (ft)				1.5	1.7	1.7	1.8	0.2	4	19	2.3	-	3.3	-	-	-	1.13	-	1.0	1.2	1.1	1.5	0.24	3	
Bankfull Cross Sectional Area (ft ²)			21.5	8.3	10.5	10.9	12.1	1.6	4	18.2	25.9	-	35.9	-	-	-	12.7	-	11.0	13.7	13.6	16.6	2.78	3	
Width/Depth Ratio				4.7	6.0	5.6	8.1	1.5	4	7.1	8.2	-	10.0	-	-	-	17.0	-	18.1	20.3	19.2	23.4	2.8	3	
Entrenchment Ratio				1.7	2.2	2.2	2.5	0.3	4	4.3	4.9	-	5.5	-	-	-	11.5	-	9.3	10.1	10.0	11.0	0.85	3	
Bank Height Ratio				1.5	1.9	2.0	2.2	0.3	4	0.7	1.1	-	1.6	-	-	-	-	-	1.0	1.0	1.0	1.0	0	3	
d50 (mm)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Profile																									
Riffle Length (ft)				-	-	-	-	-	-	62.6	82.0	-	101.4	-	-	-	-	-	12.4	29.5	33.6	47.0	11.6	17	
Riffle Slope (ft/ft)				-	-	-	-	-	-	0.006	0.006	-	0.007	-	-	0.006	0.008	0.009	0.001	0.006	0.006	0.017	0.004	17	
Pool Length (ft)				-	-	-	-	-	-	13.4	45.1	-	80.3	-	-	-	-	-	16.2	24.1	24.2	31.0	4.6	17	
Pool Max Depth (ft)				-	-	-	-	-	-	0.4	0.5	-	0.6	-	-	-	-	-	2.3	3.1	3.0	4.2	0.5	17	
Pool Spacing (ft)				-	-	-	-	-	-	67.9	84.9	-	101.9	-	-	62.3	74.8	87.3	38.0	60.2	59.5	86.8	15.6	17	
Pattern																									
Channel Belt Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	24.9	49.9	62.3	17.2	33.9	29.0	64.0	13.9	11	
Radius of Curvature (ft)				-	-	-	-	-	-	-	-	-	-	-	-	19.0	25.0	31.0	22.5	29.1	27.4	36.6	5.2	7	
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	1.8	1.7	2.2	0.3	7	
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38.1	130.8	136.9	249.7	58.2	12	
Meander Width Ratio				-	-	-	-	-	-	-	-	-	-	-	-	-	3.2	-	1.0	2.0	1.7	3.9	0.8	11	
Substrate, Bed and Transport Parameters																									
Ri% / Ru% / P% / G% / S%				-							-						50% / 3% / 39% / 8% / 0%								
SC% / Sa% / G% / C% / B% / Be%				-/30% / - / - / - / -							-/9% / - / - / - / -														
d16 / d35 / d50 / d84 / d95 / di ^p / di ^{sp} (mm)				4 / 8 / 11 / 22 / 29 / - / -							7 / 26 / 54 / 68 / 70 / - / -														
Reach Shear Stress (Competency) lb/ft ²				-							-						0.42								
Max Part Size (mm) Mobilized at Bankfull				-							-						45								
Stream Power (Transport Capacity) W/m ²				-							-						1.3								
Additional Reach Parameters																									
Drainage Area (mi ²)				1.20							0.72														
Impervious Cover Estimate (%)				-							-														
Rosgen Classification				G							E4						C4								
Bankfull Velocity (fps)	-			-							-						-								
Bankfull Discharge (cfs)	-			-							-						66.0								
Valley Length (ft)				-							-						989								
Channel Thalweg Length (ft)				-							416.7						1,088								
Sinuosity				-							-						1.1								
Water Surface Slope (ft/ft)				-							-						0.0085								
Bankfull Slope (ft/ft)				-							-						-								
Bankfull Floodplain Area (acres)				-							-						-								
Proportion Over Wide (%)				-							-						-								
Entrenchment Class (ER Range)				-							-						-								
Incision Class (BHR Range)				-							-						-								
BEHI				25.7							-						-								
Channel Stability or Habitat Metric				-							-						-								
Biological or Other				-							-						-								

- Information unavailable.

Non-Applicable.

Table 10 Cont'd. Baseline Stream Data Summary
Cochran Stream and Wetland Restoration Project - Parrish Branch (402 feet)

Parameter	Regional Curve			Pre-Existing Condition							Reference Reach Data						Design			As-Built / Baseline						
Dimension & Substrate - Riffle	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N		
Bankfull Width (ft)	-	-	7.4	3.5	4.1	4.1	4.7	0.8	2	23.4	24.7	-	24.7	-	-	-	5.4	-	4.4	5.2	5.2	5.9	1.06	2		
Floodprone Width (ft)				8.0	8.0	8.0	8.0	0.0	2	43.0	48	-	52.0	-	-	-	-	-	14.2	19.1	19.1	24.0	6.93	2		
Bankfull Mean Depth (ft)	-	-	0.6	0.4	0.5	0.5	0.5	0.1	2	1.3	1.35	-	1.5	-	-	-	0.4	-	0.4	0.4	0.4	0.4	0.03	2		
Bankfull Max Depth (ft)				0.6	0.7	0.7	0.8	0.1	2	1.8	1.8	-	2.2	-	-	-	0.57	-	0.6	0.6	0.6	0.6	0.01	2		
Bankfull Cross Sectional Area (ft ²)			4.0	1.4	1.9	1.9	2.3	0.6	2	33.4	33.4	-	34.6	-	-	-	2.2	-	1.8	2.0	2.0	2.1	0.23	2		
Width/Depth Ratio				8.5	9.0	9.0	9.5	0.7	2	15.8	18.3	-	18.4	-	-	-	13.4	-	10.9	13.8	13.8	16.6	3.99	2		
Entrenchment Ratio				1.6	2.0	2.0	2.3	0.5	2	1.7	1.9	-	2.1	-	-	-	5.6	-	3.2	3.6	3.6	4.0	0.57	2		
Bank Height Ratio				2.3	6.2	6.2	10.0	5.4	2	1.0	1.2	-	1.3	-	-	-	-	-	1.0	1.0	1.0	1.0	0	2		
d50 (mm)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Profile																										
Riffle Length (ft)				-	-	-	-	-	-	20.0	29.0	-	40.0	-	-	-	-	-	6.1	10.0	9.8	15.5	2.3	22		
Riffle Slope (ft/ft)				-	-	-	-	-	-	0.015	0.023	-	0.028	-	-	0.017	0.026	0.035	0.001	0.025	0.023	0.047	0.013	22		
Pool Length (ft)				-	-	-	-	-	-	6.0	18.0	-	42.0	-	-	-	-	-	1.7	5.0	4.5	10.2	2.0	22		
Pool Max Depth (ft)				-	-	-	-	-	-	2.3	2.3	-	2.3	-	-	-	-	-	1.1	1.5	1.5	1.9	0.2	22		
Pool Spacing (ft)				-	-	-	-	-	-	51.0	87.0	-	113.0	-	-	12.4	16.5	20.7	13.5	17.2	15.5	25.2	3.4	21		
Pattern																										
Channel Belt Width (ft)				-	-	-	-	-	-	-	43.0	-	-	-	-	6.4	8.5	10.6	6.9	9.9	9.8	12.6	1.4	14		
Radius of Curvature (ft)				-	-	-	-	-	-	44.0	75.0	-	103.0	-	-	9.0	11.0	13.0	5.8	9.5	8.9	15.3	3.2	8		
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	1.8	1.7	2.9	0.6	8		
Meander Wavelength (ft)				-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	29.1	32.1	31.4	39.7	2.7	15		
Meander Width Ratio				-	-	-	-	-	-	-	1.7	-	-	-	-	-	-	-	2.8	-	1.3	1.9	1.9	2.4	0.3	14
Substrate, Bed and Transport Parameters																										
Ri% / Ru% / P% / G% / S%																								59% / 0% / 29% / 5% / 7%		
SC% / Sa% / G% / C% / B% / Be%																									1% / 10% / 48% / 41% / 0% / 1%	
d16 / d35 / d50 / d84 / d95 / di ^p / di ^{sp} (mm)																									5.2 / 22 / 45 / 130 / 190 / - / -	
Reach Shear Stress (Competency) lb/ft ²																									1.947	
Max Part Size (mm) Mobilized at Bankfull																									0.47	
Stream Power (Transport Capacity) W/m ²																									91	
																									45	
																									-	
Additional Reach Parameters																										
Drainage Area (mi ²)																									0.10	
Impervious Cover Estimate (%)																									2.77	
Rosgen Classification																									-	
Bankfull Velocity (fps)																									G	
Bankfull Discharge (cfs)																									4.5	
Valley Length (ft)																									123.0	
Channel Thalweg Length (ft)																									380.0	
Sinuosity																									400.0	
Water Surface Slope (ft/ft)																									1.1	
Bankfull Slope (ft/ft)																									1.05	
Bankfull Floodplain Area (acres)																									0.033	
Proportion Over Wide (%)																									-	
Entrenchment Class (ER Range)																									0.029	
Incision Class (BHR Range)																									-	
BEHI																									26.6	
Channel Stability or Habitat Metric																									-	
Biological or Other																									-	

- Information unavailable.

Non-Applicable.

**Table 11a. Baseline Morphology & Hydraulic Monitoring Summary
Cochran Stream and Wetland Restoration Project**

Dimension	Cross-Section 1 (Pool) Cochran Branch							Cross-Section 2 (Riffle) Cochran Branch							Cross-Section 3 (Riffle) Cochran Branch							Cross-Section 4 (Pool) Cochran Branch							Cross-Section 5 (Pool) Cochran Branch						
	Base	MY1	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) - Based on AB-XSA ¹	2,156.1	2,156.1	2,156.1	2,156.6	N/A	N/A		2,155.8	2,155.8	2,155.8	2,156.1	2,156.2	N/A		2,152.1	2,152.1	2,152.1	2,152.2	2,152.3	N/A		2,151.9	2,151.9	2,151.9	2,151.9	N/A	N/A		2,149.9	2,149.9	2,149.9	2,149.8	N/A	N/A	
Bankfull Width (ft) ¹	16.7	16.8	20.6	36.3	N/A	N/A		17.3	17.1	16.9	23.4	25.4	N/A		14.6	15.4	15.3	19.3	19.6	N/A		16.2	17.4	16.8	15.3	N/A	N/A		17.0	17.3	16.8	14.0	N/A	N/A	
Floodprone Width (ft) ¹	>217.0	>217.0	>52.5	>52.6	N/A	N/A		>173.5	>173.5	>54.7	>54.6	N/A		>135.0	>135	>59.7	>59.6	>59.7	N/A		>217.5	>217.5	>59.0	>59.0	N/A	N/A		>236.5	>236.5	>52.9	>52.8	N/A	N/A		
Bankfull Mean Depth (ft)	1.6	1.1	0.9	0.8	-	N/A		1.0	0.9	0.8	0.7	-	N/A		0.8	0.7	0.7	0.6	-	N/A		1.9	1.8	1.9	2.0	-	N/A		1.5	1.5	1.5	1.8	-	N/A	
Bankfull Max Depth (ft) ²	3.1	2.6	2.3	2.7	1.9	N/A		1.5	1.4	1.4	1.8	1.6	N/A		1.0	1.1	1.1	1.2	0.9	N/A		3.5	4.3	4.2	4.1	3.9	N/A		3.3	3.4	3.1	3.5	3.6	N/A	
Bankfull Cross Sectional Area (ft ²) ²	27.5	19.2	19.5	27.5	9.7	N/A		16.6	15.2	14.0	16.6	10.2	N/A		11.0	11.3	10.8	11.0	5.7	N/A		31.0	31.3	32.7	31.0	25.2	N/A		25.4	26.4	25.2	25.4	24.5	N/A	
Bankfull Width/Depth Ratio	10.2	14.7	21.8	48.0	-	N/A		18.1	19.2	20.4	33.0	-	N/A		19.2	20.8	21.6	33.9	-	N/A		8.5	9.7	8.6	7.6	-	N/A		11.4	11.4	11.2	7.7	-	N/A	
Bankfull Entrenchment Ratio ¹	>13	>12.9	N/A	N/A	N/A	N/A		>10	>10.2	>3.2	>2.3	>2.2	N/A		>9.3	>8.8	>3.9	>3.1	>3	N/A		>13.4	>12.5	N/A	N/A	N/A	N/A		>13.9	>13.7	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio ¹	1.0	1.0	N/A	N/A	N/A	N/A		1.0	1.0	0.9	<1.0	<1	N/A		1.0	1.0	1.1	<1.0	<1	N/A		1.0	1.0	N/A	N/A	N/A	N/A		1.0	1.0	N/A	N/A	N/A	N/A	
d50 (mm)	-	N/A	N/A	N/A	-	N/A		-	1.4	26	6.7	6.6	N/A		-	28.0	28	7.4	7.7	N/A		-	N/A	N/A	N/A	-	N/A		-	N/A	N/A	N/A	-	N/A	
Dimension	Cross-Section 6 (Riffle) Cochran Branch							Cross-Section 7 (Riffle) Parrish Branch							Cross-Section 8 (Pool) Parrish Branch							Cross-Section 9 (Riffle) Parrish Branch													
	Base	MY1	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY3	MY4	MY5	MY6	MY7							
Bankfull Elevation (ft) - Based on AB-XSA ¹	2149.7	2149.7	2149.7	2149.9	2150.0	N/A		2160.2	2160.2	2160.2	2160.7	2160.9	2161.2		2159.8	2159.8	2159.8	2160.0	N/A	2162.3		2154.6	2154.6	2154.6	2155.0	2155.1	2155.5								
Bankfull Width (ft) ¹	17.8	17.9	15.6	20.6	25.3	N/A		4.4	4.5	3.7	10.5	15.6	2.1		6.8	7.2	8.0	10.9	N/A	2.0		5.9	6.6	5.8	8.6	4.7	3.9								
Floodprone Width (ft) ¹	>197.0	>197.0	>54.5	>54.5	>54.5	N/A		>14.2	>14.2	11.9	24	>26.5	>26.4		>93.7	>93.7	>28.2	>28.1	N/A	N/A		>24.0	>24.0	>29.3	>31.8	>31.5	>32.1								
Bankfull Mean Depth (ft)	0.8	0.8	0.8	0.7	-	N/A		0.4	0.4	0.2	0.2	-	-		0.8	0.8	0.6	0.5	-	-		0.4	0.3	0.3	0.2	-	-								
Bankfull Max Depth (ft) ²	1.1	1.2	1.2	1.5	0.7	N/A		0.6	0.7	0.4	0.3	0.4	0.6		1.8	2.0	1.9	1.0	0.3	0.7		0.6	0.6	0.6	0.8	0.8	0.3								
Bankfull Cross Sectional Area (ft ²) ²	13.6	13.6	12.1	13.6	7.0	N/A		1.8	2.0	0.6	1.8	0.5	1.0		5.2	5.5	5.0	5.2	1.1	0.7		2.1	2.0	2.0	2.1	2.6	0.5								
Bankfull Width/Depth Ratio	23.4	23.4	20.2	31.1	-	N/A		10.9	10.4	23.6	62.5	-	-		9.0	9.6	12.7	22.8	-	-		16.6	21.7	17.0	35.7	-	-								
Bankfull Entrenchment Ratio ¹	>11.0	>11.0	>3.5	>2.7	>2.2	N/A		>3.2	>3.1	3.2	2.3	>1.7	>12.6		>13.7	>12.9	N/A	N/A	N/A	N/A		>4.0	>3.7	>5.1	>3.7	>6.7	>8.3								
Bankfull Bank Height Ratio ¹	1.0	1.0	1.0	<1.0	<1	N/A		1.0	1.0	1.0	<1.0	<1	0.6		1.0	1.0	N/A	N/A	N/A	N/A		1.0	1.0	0.9	1.0	1.1	0.4								
d50 (mm)	-	11.0	24	0.62	12	N/A		-	4.3	1.6	0.062	1.4	-		-	N/A	N/A	N/A	-	-		-	3.9	3.2	0.062	1.4	-								

N/A - Item does not apply.

- Information Unavailable

Note: Starting in MY5, the parameters denoted with ¹ were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with ² were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

**Table 11b cont'd. Monitoring Data - Stream Reach Data Summary
Cochran Stream and Wetland Restoration Project - Parrish Branch (402 feet)**

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5						MY - 6						MY - 7					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	4.4	5.2	5.2	5.9	1.1	2	4.5	5.6	5.6	6.6	1.5	2	-	-	-	-	-	-	3.7	4.8	4.8	5.8	1.5	2	8.6	9.6	9.6	10.5	1.3	2	4.7	10.2	10.2	15.6	7.7	2	2.10	3.00	3.00	3.90	1.30	2.00						
Floodprone Width (ft)	14.2	19.1	19.1	24.0	6.9	2	14.2	19.1	19.1	24.0	6.9	2	-	-	-	-	-	-	11.9	20.6	20.6	29.3	12.3	2	24.0	>27.9	>27.9	>31.8	5.5	2	26.5	29.0	29.0	31.5	3.5	2	26.40	29.30	29.30	4.00	4.00	2.00						
Bankfull Mean Depth (ft)	0.4	0.4	0.4	0.4	0.0	2	0.3	0.4	0.4	0.4	0.1	2	-	-	-	-	-	-	0.2	0.3	0.3	0.3	0.1	2	0.2	0.2	0.2	0.2	0.0	2	-	-	-	-	-	-	-	-	-	-	-	-						
Bankfull Max Depth (ft)	0.6	0.6	0.6	0.6	0.0	2	0.6	0.7	0.7	0.7	0.1	2	-	-	-	-	-	-	0.4	0.5	0.5	0.6	0.1	2	0.3	0.6	0.6	0.8	0.4	2	0.4	0.6	0.6	0.8	0.3	2	0.30	0.50	0.50	0.20	0.20	2.00						
Bankfull Cross Sectional Area (ft ²)	1.8	2.0	2.0	2.1	0.2	2	2.0	2.0	2.0	2.0	0.0	2	-	-	-	-	-	-	0.6	1.3	1.3	2.0	1.0	2	1.8	2.0	2.0	2.1	0.2	2	0.5	1.6	1.6	2.6	1.5	2	0.50	0.80	0.80	0.40	0.40	2.00						
Bankfull Width/Depth Ratio	10.9	13.8	13.8	16.6	4.0	2	10.4	16.1	16.1	21.7	8.0	2	-	-	-	-	-	-	17.0	20.3	20.3	23.6	4.7	2	35.7	49.1	49.1	62.5	19.0	2	-	-	-	-	-	-	-	-	-	-	-	-						
Bankfull Entrenchment Ratio	3.2	3.6	3.6	4.0	0.6	2	3.1	3.4	3.4	3.7	0.4	2	-	-	-	-	-	-	3.2	4.2	4.2	5.1	1.3	2	2.3	>3	>3	>3.7	1.0	2	1.7	4.2	4.2	6.7	3.5	2	8.30	10.50	10.50	3.00	3.00	2.00						
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	0.0	2	1.0	1.0	1.0	1.0	0.0	2	-	-	-	-	-	-	0.9	1.0	1.0	1.0	0.1	2	<1.0	<1.0	<1.0	1.0	0.0	2	1.0	1.1	1.1	1.1	0.1	2	0.40	0.50	0.50	0.60	0.10	2.00						
Profile																																																
Riffle Length (ft)	6.1	10.0	9.8	15.5	2.3	22																																										
Riffle Slope (ft/ft)	0.00	0.025	0.023	0.047	0.013	22																																										
Pool Length (ft)	1.7	5.0	4.5	10.2	2.0	22																																										
Pool Max Depth (ft)	1.1	1.5	1.5	1.9	0.2	22																																										
Pool Spacing (ft)	13.5	17.2	15.5	25.2	3.4	21																																										
Pattern																																																
Channel Belt Width (ft)	6.9	9.9	9.8	12.6	1.4	14																																										
Radius of Curvature (ft)	5.8	9.5	8.9	15.3	3.2	8																																										
Rc: Bankfull Width (ft/ft)	1.1	1.8	1.7	2.9	0.6	8																																										
Meander Wavelength (ft)	29.1	32.1	31.4	39.7	2.7	15																																										
Meander Width Ratio	1.3	1.9	1.9	2.4	0.3	14																																										
Additional Reach Parameters																																																
Rosgen Classification	B																																															
Channel Thalweg Length (ft)	402																																															
Sinuosity (ft)	1.07																																															
Water Surface Slope (Channel) (ft/ft)	0.025																																															
Bankfull Slope (ft/ft)	0.029																																															
Ri% / Ru% / P% / G% / S%	59%	0%	29%	5%	7%																																											

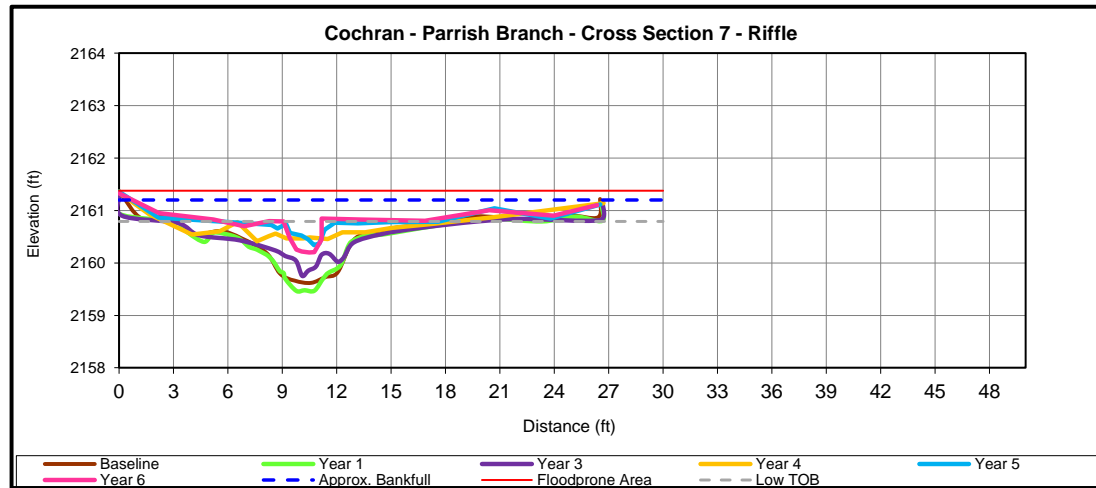
- Information Unavailable
N/A - Information does not apply.
Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step



Upstream



Downstream



Dimension	Cross Section 7 (Riffle)							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) - Based on AB-XSA ¹	2160.2	2160.2	-	2160.2	2160.7	2160.9	2161.2	
Bankfull Width (ft) ¹	4.4	4.5	-	3.7	10.5	15.6	2.1	
Floodprone Width (ft) ¹	>14.2	>14.2	-	11.9	24.0	>26.5	>26.4	
Bankfull Mean Depth (ft)	0.4	0.4	-	0.2	0.2	-	-	
Bankfull Max Depth (ft) ²	0.6	0.7	-	0.4	0.3	0.4	0.6	
Bankfull Cross Sectional Area (ft ²) ²	1.8	2.0	-	0.6	1.8	0.5	1.0	
Bankfull Width/Depth Ratio	10.9	10.4	-	23.6	62.5	-	-	
Bankfull Entrenchment Ratio ¹	>3.2	>3.1	-	3.2	2.3	>1.7	>12.6	
Bankfull Bank Height Ratio ¹	1.0	1.0	-	1.0	<1.0	<1	0.6	

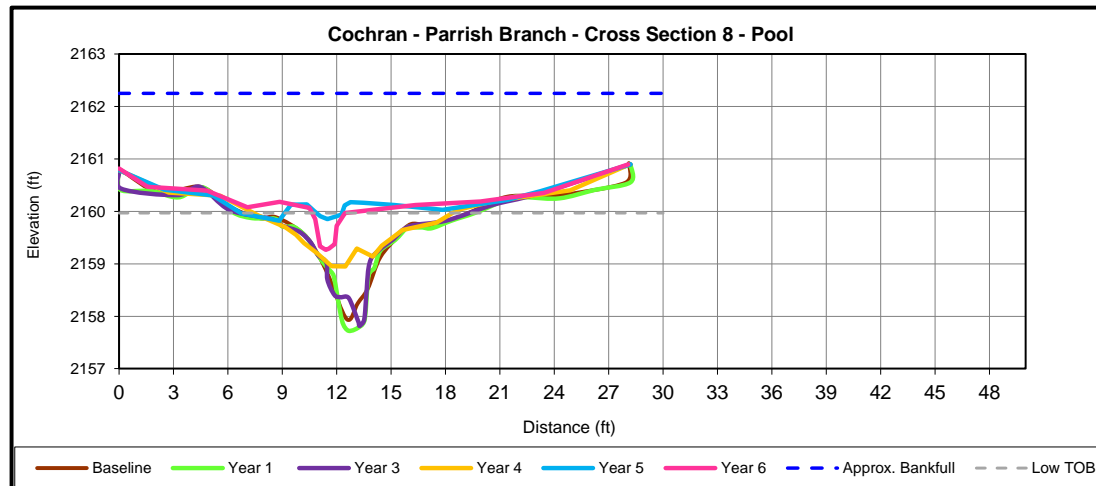
Note: Starting in MY5, the parameters denoted with 1 were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with 2 were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



Dimension	Cross Section 8 (Pool)							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) - Based on AB-XSA ¹	2159.8	2159.8	-	2159.8	2160.0	N/A	2162.3	
Bankfull Width (ft) ¹	6.8	7.2	-	8.0	10.9	N/A	2.0	
Floodprone Width (ft) ¹	>93.7	>93.7	-	>28.2	>28.1	N/A	N/A	
Bankfull Mean Depth (ft)	0.8	0.8	-	0.6	0.5	-	-	
Bankfull Max Depth (ft) ²	1.8	2.0	-	1.9	1.0	0.3	0.7	
Bankfull Cross Sectional Area (ft ²) ²	5.2	5.5	-	5.0	5.2	1.1	0.7	
Bankfull Width/Depth Ratio	9.0	9.6	-	12.7	22.8	-	-	
Bankfull Entrenchment Ratio ¹	>13.7	>12.9	-	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio ¹	1.0	1.0	-	N/A	N/A	N/A	N/A	

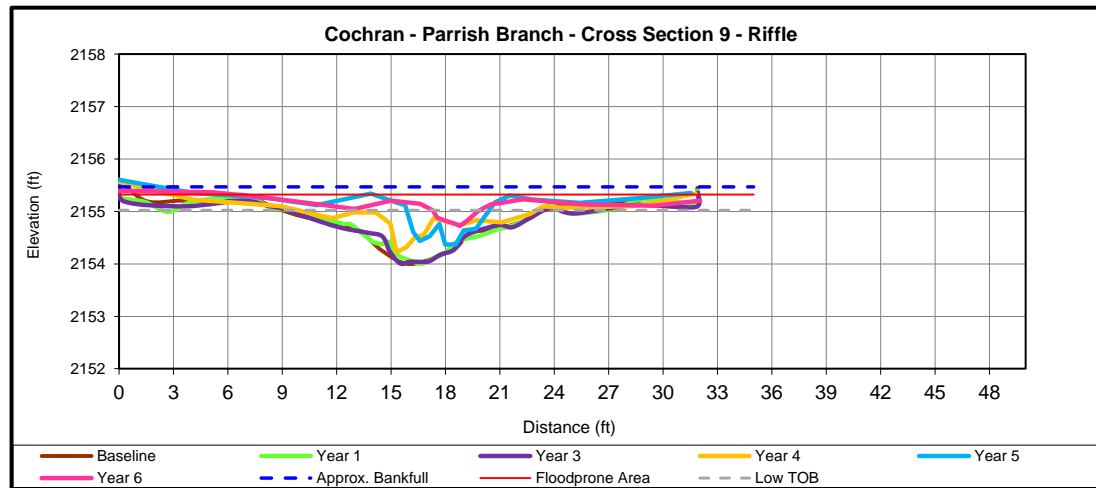
Note: Starting in MY5, the parameters denoted with 1 were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with 2 were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



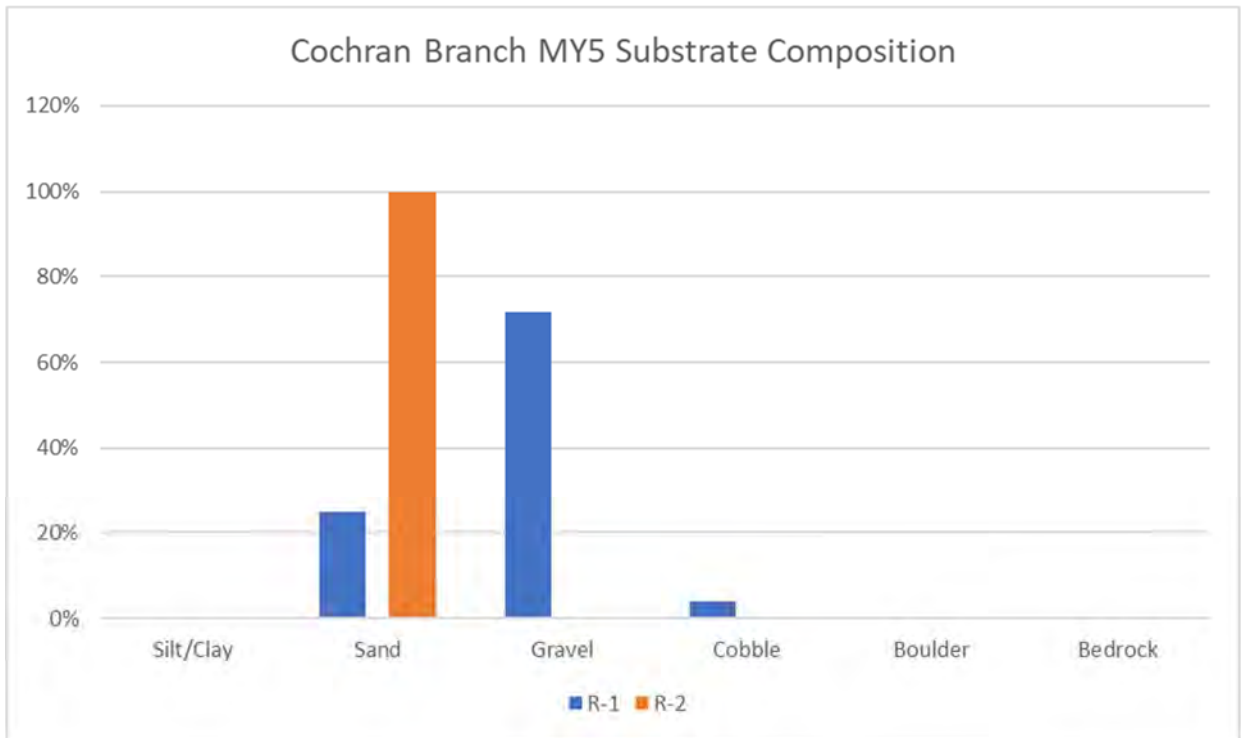
Dimension	Cross Section 9 (Riffle)							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) - Based on AB-XSA ¹	2154.6	2154.6	-	2154.6	2155.0	2155.1	2155.5	
Bankfull Width (ft) ¹	5.9	6.6	-	5.8	8.6	4.7	3.9	
Floodprone Width (ft) ¹	>24.0	>24.0	-	>29.3	>31.8	>31.5	>32.1	
Bankfull Mean Depth (ft)	0.4	0.3	-	0.3	0.2	-	-	
Bankfull Max Depth (ft) ²	0.6	0.6	-	0.6	0.8	0.8	0.3	
Bankfull Cross Sectional Area (ft ²) ²	2.1	2.0	-	2.0	2.1	2.6	0.5	
Bankfull Width/Depth Ratio	16.6	21.7	-	17.0	35.7	-	-	
Bankfull Entrenchment Ratio ¹	>4.0	>3.7	-	>5.1	>3.7	>6.7	>8.3	
Bankfull Bank Height Ratio ¹	1.0	1.0	-	0.9	1.0	1.1	0.4	

Note: Starting in MY5, the parameters denoted with 1 were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with 2 were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

Table 12. Pebble Count Data Summary

Stream Reach	MY1 - 2015		MY3 - 2017		MY4 - 2018		MY5 - 2019	
	Pebble Count		Pebble Count		Pebble Count		Pebble Count	
	D ₅₀ (mm)	D ₈₄ (mm)	D ₅₀ (mm)	D ₈₄ (mm)	D ₅₀ (mm)	D ₈₄ (mm)	D ₅₀ (mm)	D ₈₄ (mm)
R-1	13.5	4.1	26.0	2.4	4.9	0.1	8.8	23.0
R-2	46.3	22.5	64.7	10.0	15.7	0.1	1.4	1.8

MY5 Stream Reach Substrate Composition



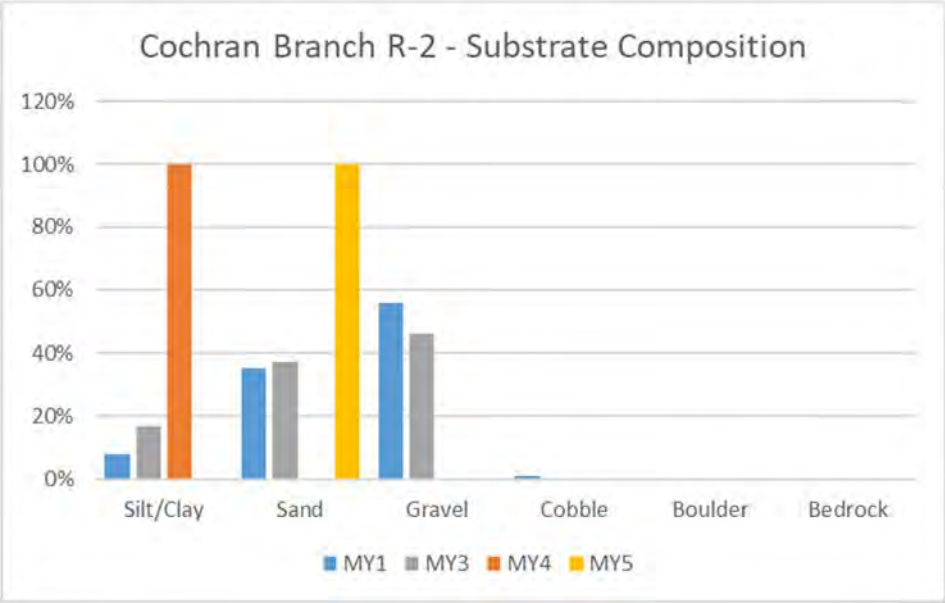
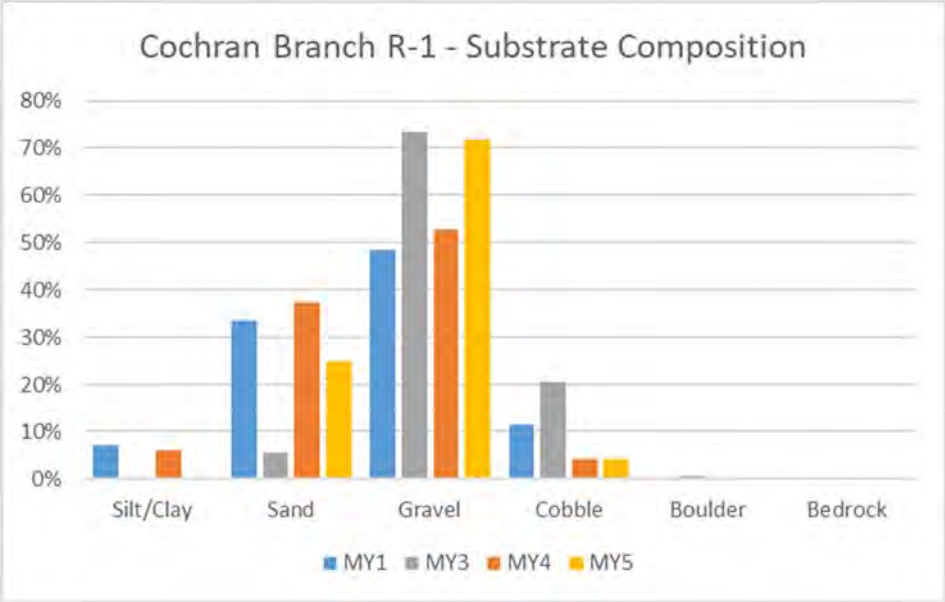


Table 13. Cochran Bank Pin Array Summary

Bank Pin Location	Position	Year 1 Reading (mm)	Year 3 Reading (mm)	Year 4 Reading (mm)	Year 5 Reading (mm)
Cross Section 1	Upstream	0.0	0.0	0.0	0.0
	At Cross Section	0.0	1.0	0.0	0.0
	Downstream	0.0	2.0	0.0	0.0
Cross Section 4	Upstream	0.0	3.0	0.0	0.0
	At Cross Section	0.0	4.0	0.0	0.0
	Downstream	0.0	5.0	0.0	0.0
Cross Section 8	Upstream	0.0	6.0	0.0	0.0
	At Cross Section	0.0	7.0	0.0	0.0
	Downstream	0.0	8.0	0.0	0.0

- Geomorphological data was not collected in MY2

Appendix E

Hydrology Data

Table 15. 2020 Rainfall Summary

Month	Average	Normal Limits		Franklin Station
		30 Percent	70 Percent	
January	5.18	3.78	6.10	6.99
February	4.32	2.94	5.16	9.88
March	5.05	3.60	5.97	5.02
April	4.82	3.64	5.62	9.45
May	4.19	2.90	4.99	6.14
June	4.64	3.32	5.48	3.22
July	4.61	3.33	5.44	3.80
August	4.49	3.21	5.31	6.95
September	4.37	2.74	5.28	6.14
October	2.94	1.26	3.58	7.77
November	4.26	2.70	5.13	---
December	5.49	4.04	6.44	---
Total	54.36	37.46	64.50	65.36

Notes:

CRONOS Database - Franklin (313228)

Table 16. Wetland Hydrology Attainment Data

Summary of Groundwater Monitoring Results Cochran Stream & Wetland Restoration Site							
Gauge ID	Success Criteria Achieved/ Max Consecutive Days During Growing Season Percent						
	Year 1 ¹ (2015)	Year 2 (2016)	Year 3 (2017)	Year 4 (2018)	Year 5 (2019)	Year 6 ³ (2020)	Year 7 (2021)
GW-1 ²	Yes/ 18 10%	Yes/ 40 21.4%	No/2 1%	Gauge malfunction	Yes/ 104.5 56%	Yes/ 143.5 77%	
GW-2	Yes/ 132 71%	Yes/ 187 100%	Yes/ 171.5 92%	Gauge malfunction	Yes/ 187 100%	Yes/ 143.5 77%	
GW-3	Yes/ 132 71%	Yes/ 187 100%	Yes/ 171 91%	Gauge malfunction	Yes/ 187 100%	Yes/ 143.5 77%	
GW-4	Yes/ 132 71%	Yes/ 187 100%	Yes/ 171.5 92%	Yes/ 170 91%	Yes/ 187 100%	Yes/ 143.5 77%	
GW-5	Yes/ 132 71%	Yes/ 187 100%	Yes/ 171.5 92%	Yes/ 169.5 91%	Yes/ 187 100%	Yes/ 143.5 77%	
GW-6	Yes/ 132 71%	Yes/ 187 100%	Yes/ 171.5 92%	Yes/ 169.5 91%	Yes/ 187 100%	Yes/ 143.5 77%	
GW-7	Yes/ 132 71%	Yes/ 187 100%	Yes/ 171.5 92%	Yes/ 169.5 91%	Yes/ 187 100%	Yes/ 143.5 77%	
GW-8 ²	Yes/ 132 71%	Yes/ 187 100%	Yes/ 171.5 92%	Yes/ 169.5 91%	Yes/ 187 100%	Yes/ 143.5 77%	

Hydrology Success Criteria = 8%; Growing season = April 16 - October 19 (187 days)

¹Max consecutive days during growing season limited to 132 days due to shortened growing season. Percent based on full 187 day growing season

²Located outside of wetland crediting area

³Max consecutive days during growing season limited to 144 days due to barometric pressure gauge failure. Percent based on full 187 day growing season

Table 14. Verification of Bankfull Events

Date of Data Collection	Estimated Date of Occurrence	Method	Maximum Bankfull Height (ft)	Photo #
Cochran Branch				
12/29/2015	12/24/2015	Crest Gauge	0.86	MY1
3/24/2016	2/3/2016	Crest Gauge	0.68	MY2
8/17/2016	7/15/2016	Crest Gauge	0.58	MY2
10/3/2017	5/21/2017	Crest Gauge	0.92	MY3
10/27/2020	4/12/2020	Crest Gauge	1.92	1
Parrish Branch				
4/17/2017	4/3/2017	Crest Gauge	0.6	MY3
4/17/2017	2/28/2017	Crest Gauge	0.38	MY3
10/3/2017	5/21/2017	Crest Gauge	0.79	MY3
10/3/2018	8/1/2018	Crest Gauge	1.08	MY4
10/27/2020	4/12/2020	Crest Gauge	1.33	2

Note: Crest gauges malfunctioned in MY5 2019 therefore no bankfull events were recorded

Photo Verification of Bankfull Events

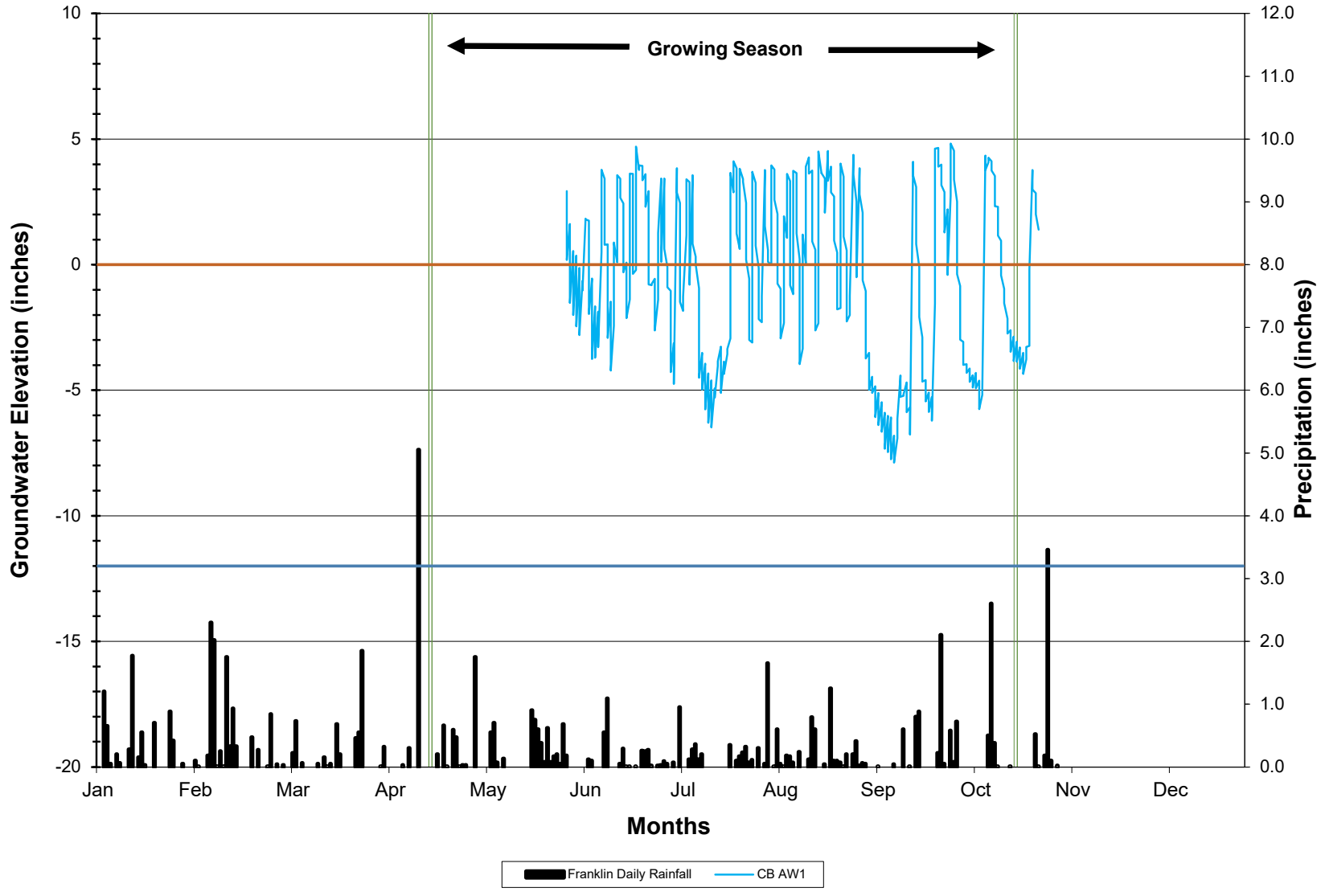


Photo 1 – Cochran Branch – 1.92 ft

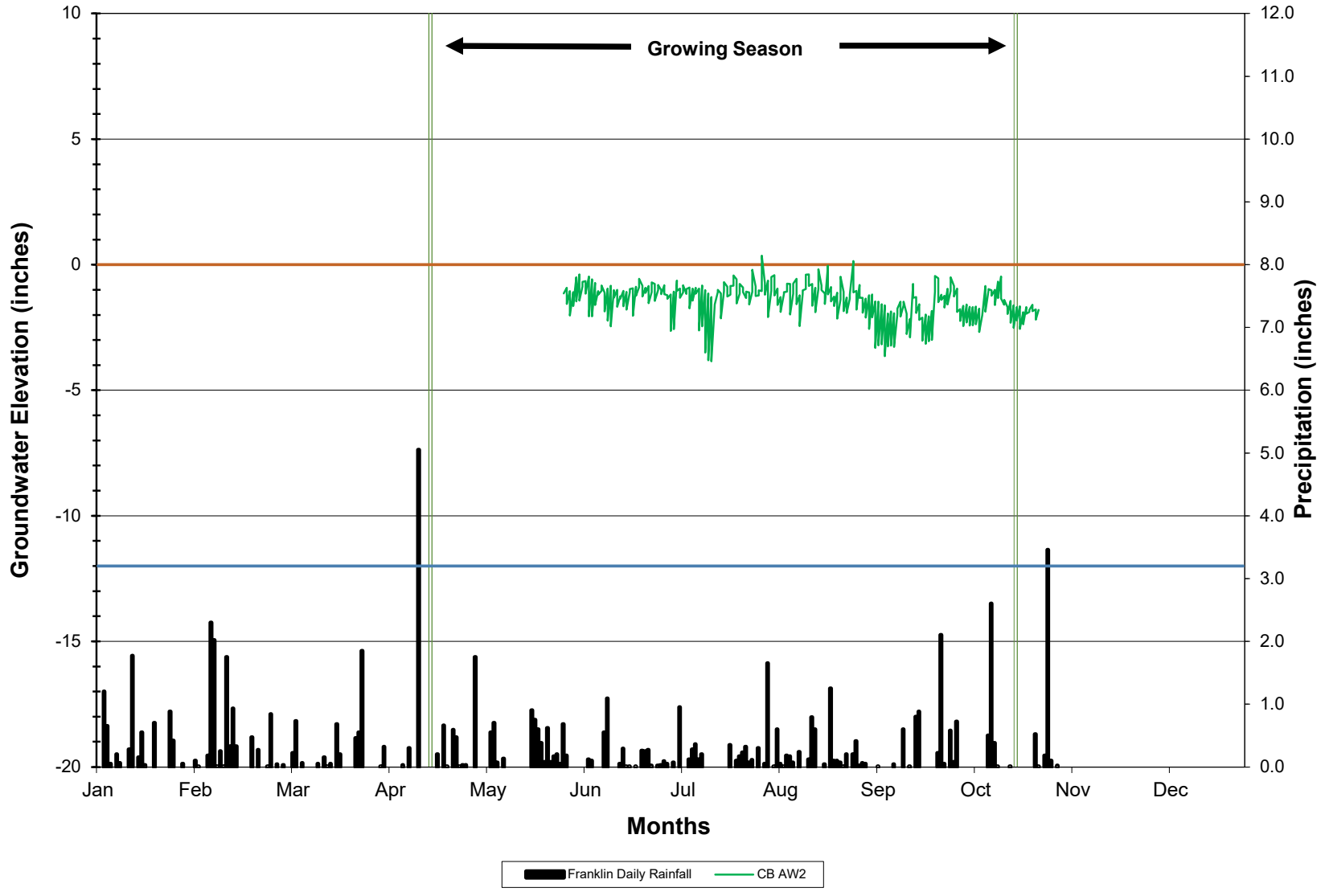


Photo 2 – Parrish Branch – 1.33 ft

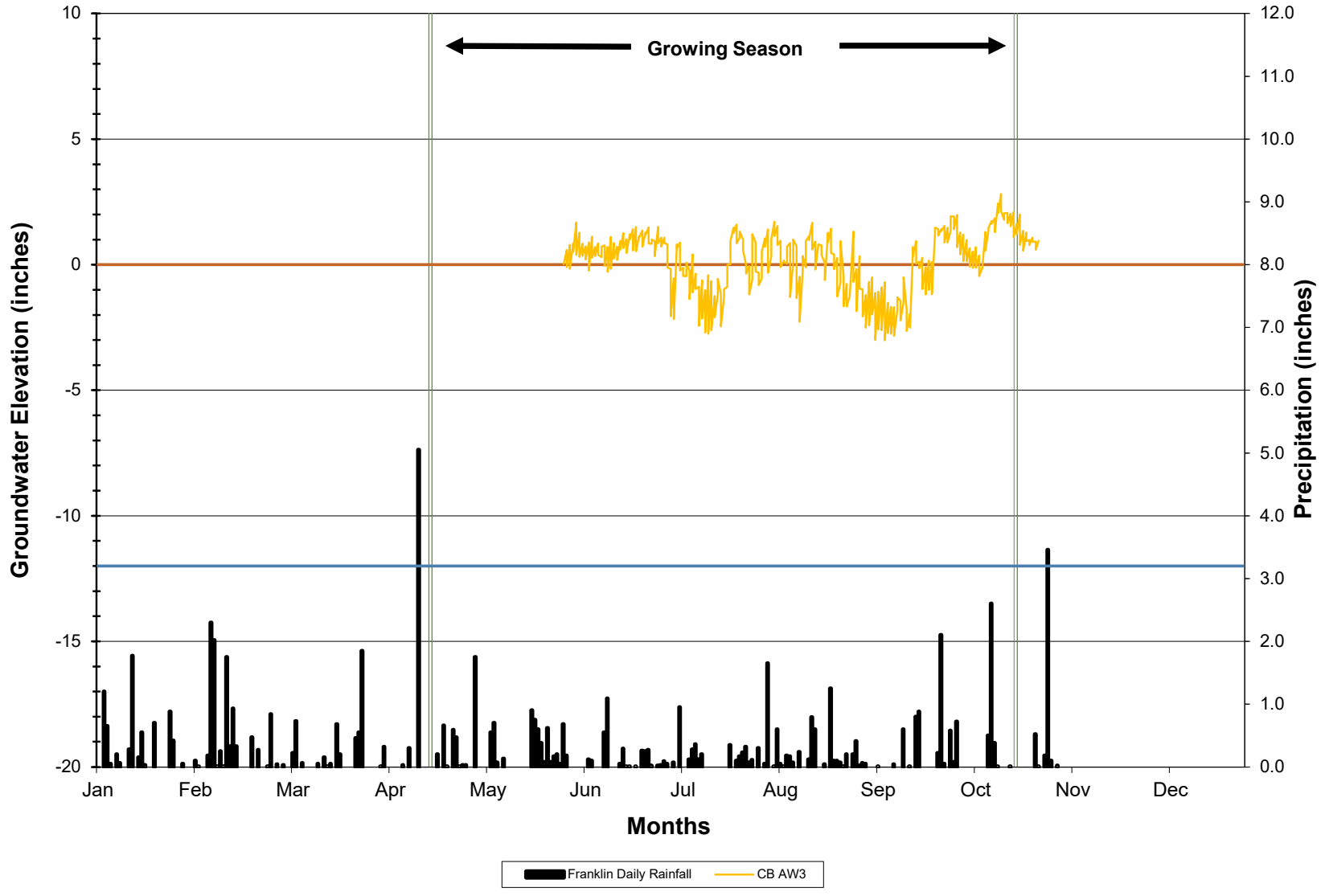
2020 Cochran Branch Groundwater Gauge AW1



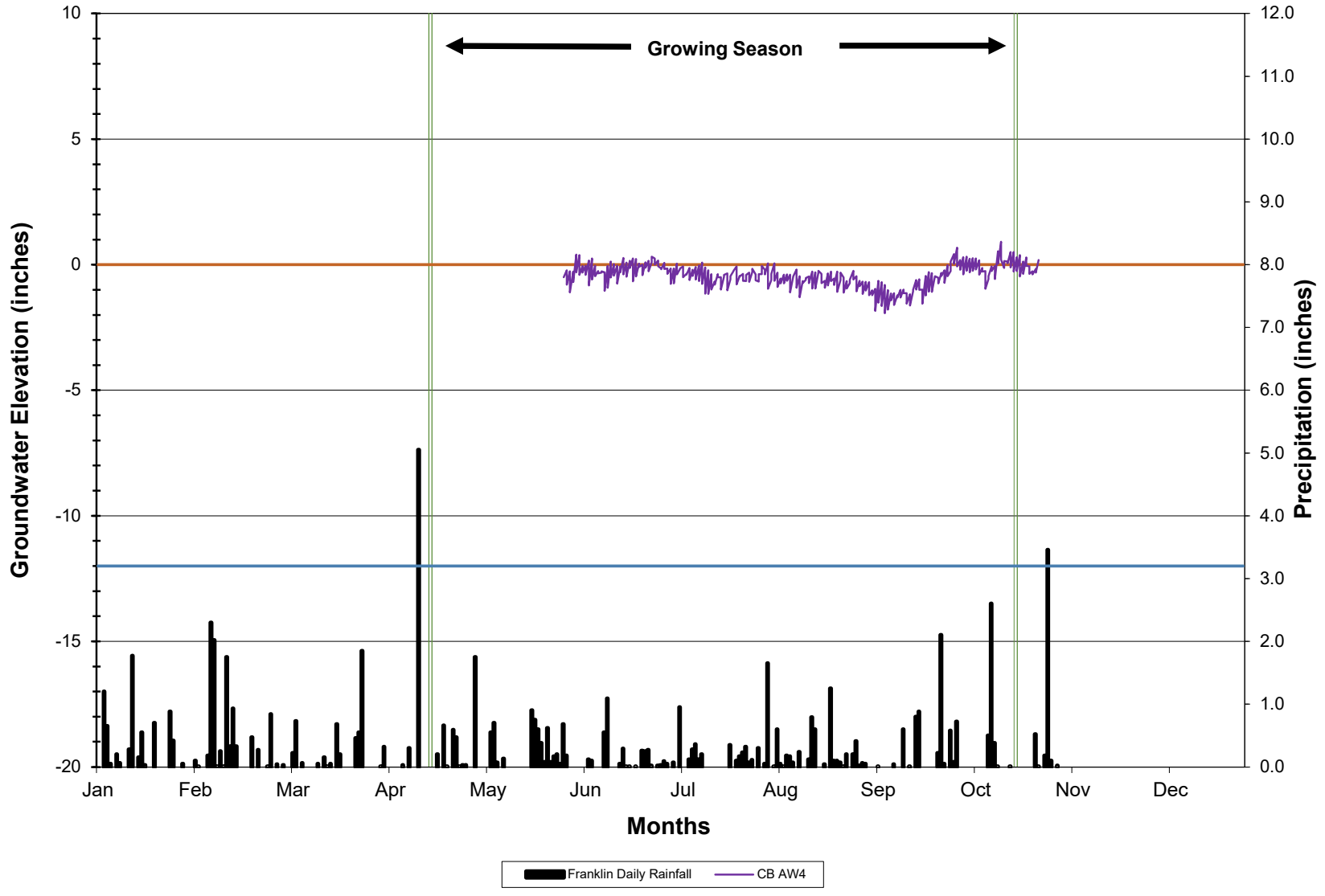
2020 Cochran Branch Groundwater Gauge AW2



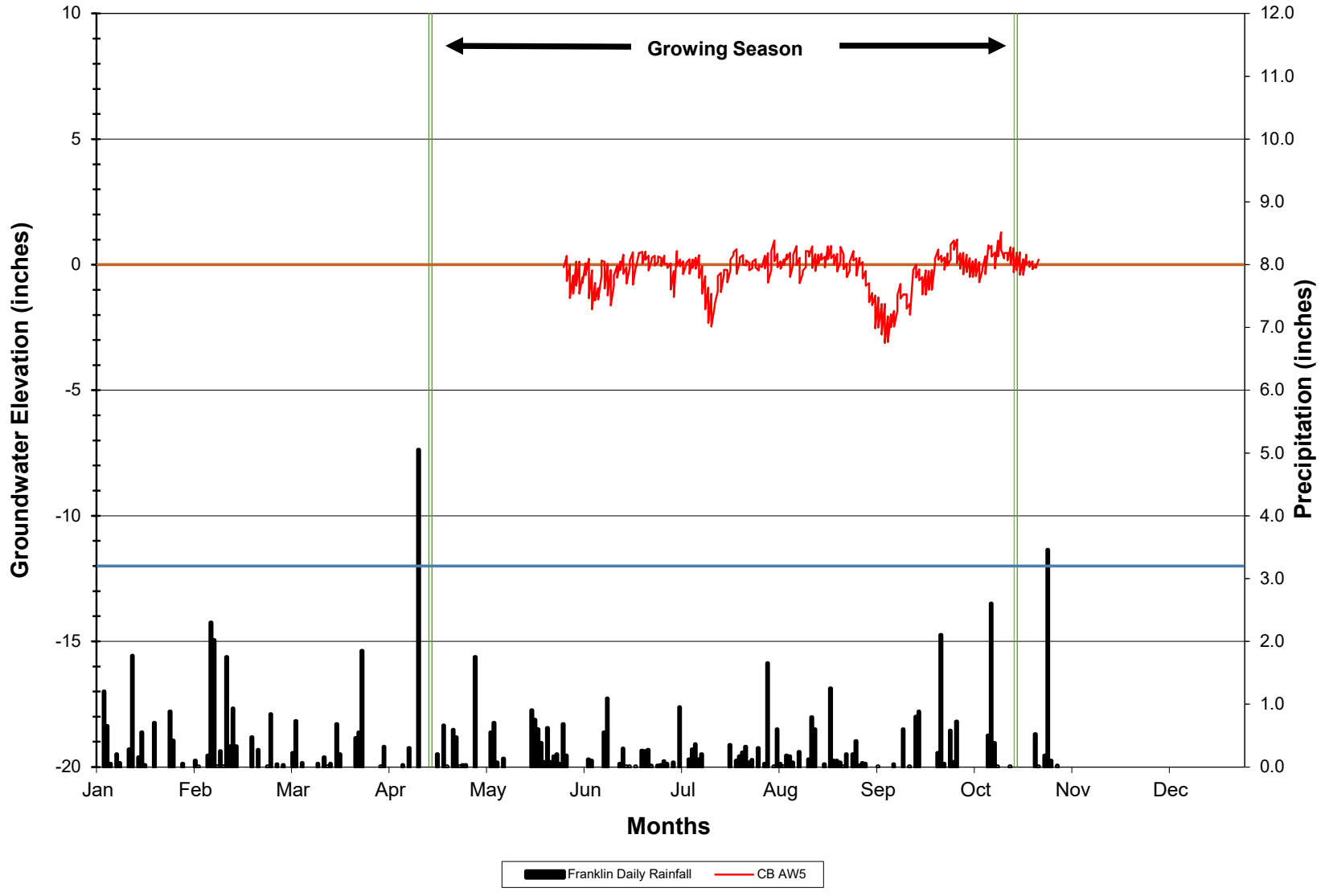
2020 Cochran Branch Groundwater Gauge AW3



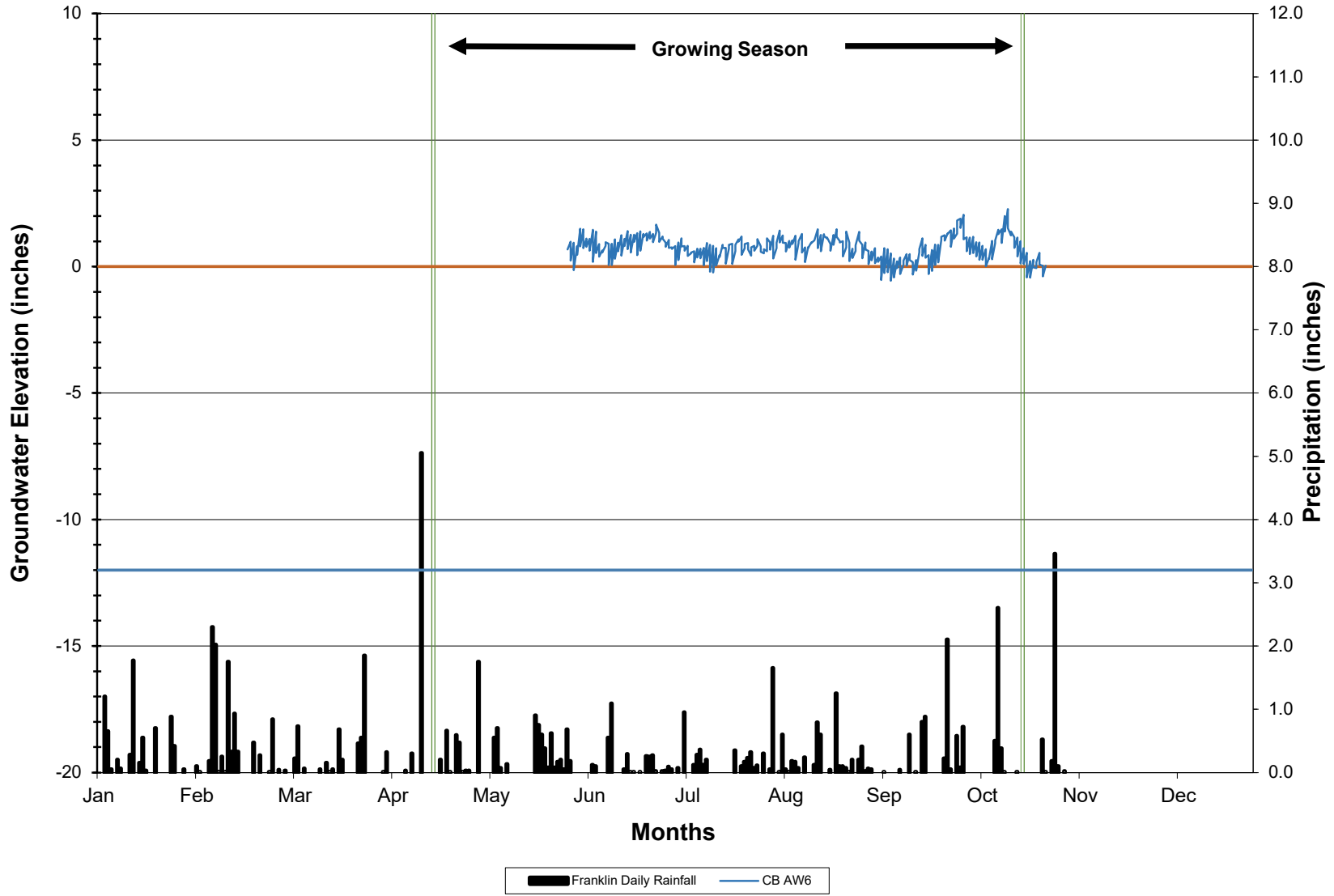
2020 Cochran Branch Groundwater Gauge AW4



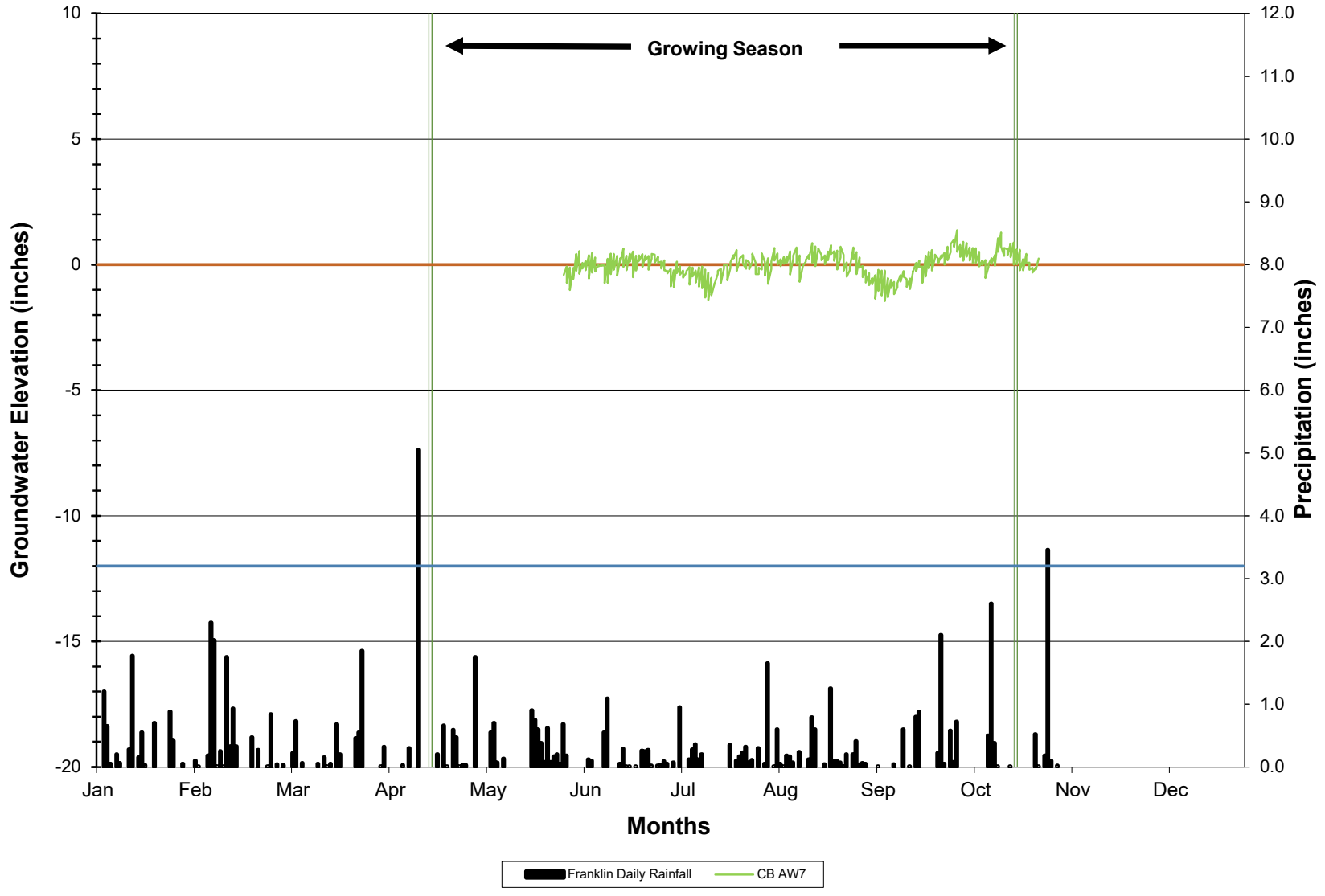
2020 Cochran Branch Groundwater Gauge AW5



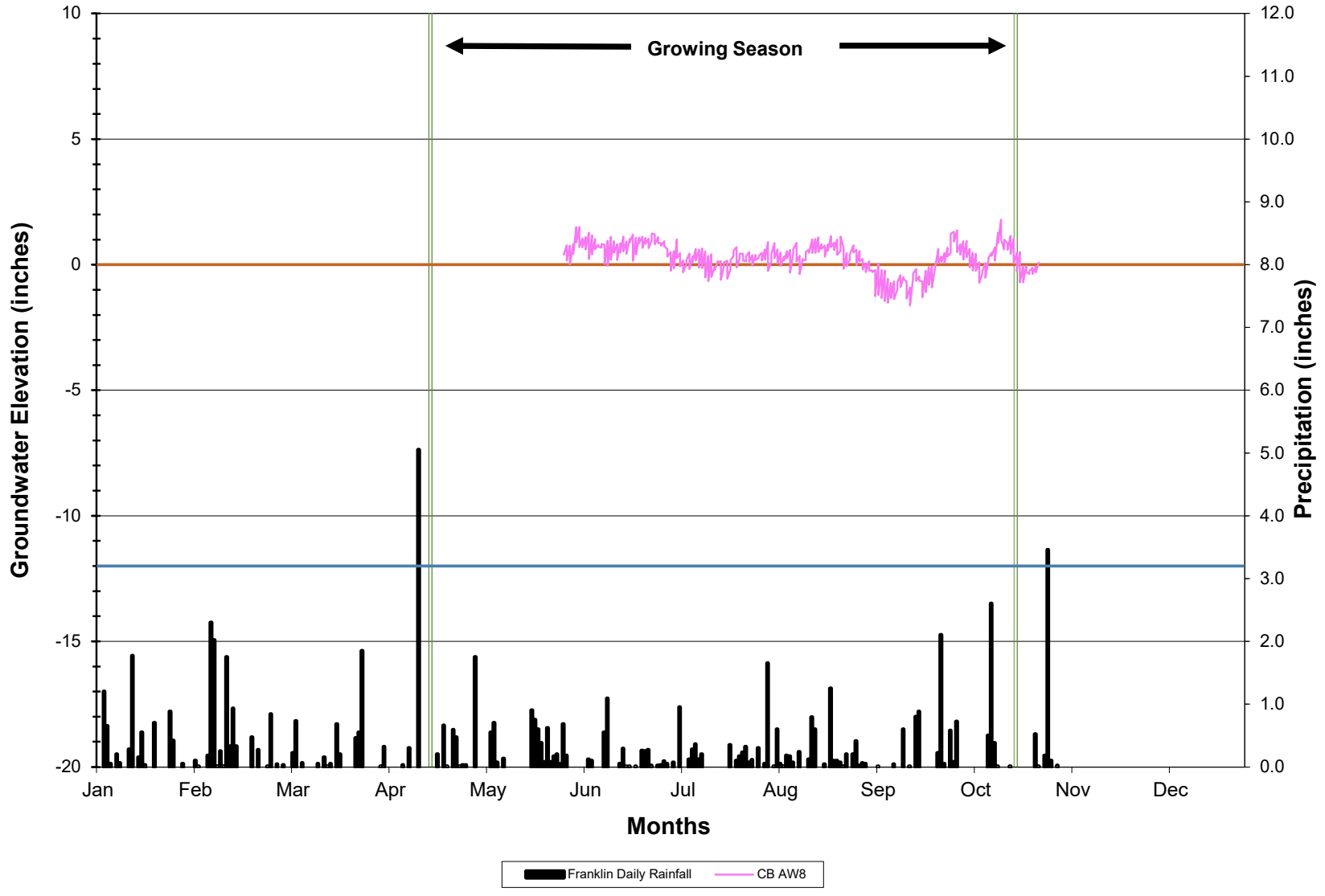
2020 Cochran Branch Groundwater Gauge AW6



2020 Cochran Branch Groundwater Gauge AW7



2020 Cochran Branch Groundwater Gauge AW8



Appendix E
MY4 IRT Credit Release Site Visit Memo

MEMORANDUM



302 Jefferson Street, Suite 110

Raleigh, North Carolina 27605

919.209.1052 tel.

919.829.9913 fax

TO: Paul Wiesner - DMS

FROM: Ryan Medric - RES

DATE: 06/17/2019

RE: Cochran Branch MY4 IRT Credit Release Site Visit

Attendees:

IRT: Todd Tugwell (USACE), Mac Haupt (NCDWR), Erin Davis (NCDWR), David Brown (USACE)

DMS: Paul Wiesner (DMS), Melonie Allen (DMS)

RES: Brad Breslow (RES), Brian Hockett (RES), Aaron Speaks (RES), Ryan Medric (RES)

Date: June 5, 2019

The IRT, DMS, and RES had a site visit at the Cochran Branch Stream Restoration Site to discuss the Monitoring Year 4 (MY4) credit release. The main topic of discussion was the sedimentation and lack of channel defining features on Parrish Branch observed in monitoring reports by RES and DMS. During the site visit, the majority of Parrish Branch had substantial flow contained in a single channel. One section located near cross sections seven and eight, however, had characteristics more like a braided system with water flowing in multiple locations. David Brown (USACE) commented that channelized stream flow was typical of this type of channel during the winter months and dormant season. He suggested the IRT revisit the site in November/December 2020 to get a more representative view of the reach. Also, it was noted during the visit that there was gravel/cobble bed substrate in the channel, but it was buried by a few inches of fine silt/sand.

In April 2019, RES treated the channel vegetation with an aquatic safe herbicide. The IRT was ok with this treatment but was adamant that they did not want to see any digging or raking in the channel. Additionally, Erin Davis (NCDWR) noted multiflora rose scattered in the easement and RES agreed to continue treating the invasive species throughout the site for the remainder of the monitoring period.

The IRT generally agreed that the on-site wetlands and project streams (aside from Parrish Branch) were meeting the established success criteria. They agreed to release MY4 project credits per the credit release schedule established in the approved mitigation plan. The IRT requested that project stream credits released on the site not exceed the stream credits associated with Parrish Branch (396 SMUs). There will be a total of 445.75 unreleased stream credits on the site after the IRT MY4 (2018) credit release approval.