

Annual Monitoring Report

Monitoring Year 2 of 7

FINAL

Cochran Stream and Wetland Restoration Site

NCDMS Contract No.: 004947

NCDMS Project No.: 95720

Macon County, NC

Data Collected: March 2016 – October 2016

Date Submitted: November 2016



Submitted to:

North Carolina Division of Mitigation Services

NCDEQ-DMS, 1652 Mail Service Center Raleigh NC 27699-1652

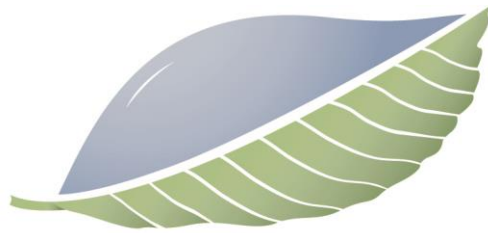
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1.0 PROJECT SUMMARY

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 1,882 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. In the event of non-typical years of climatic conditions, groundwater monitoring data should demonstrate similar hydro-periods when compared to reference wetland groundwater data. The reference wetland site will be the NCDMS Cat Creek Stream and Wetland Restoration Site – NCDMS Project # 71 – located east of Franklin in Macon County, NC. 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.

1.4. Project Performance

Monitoring Year 2 (MY2) data was collected from March through October 2016. 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.

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 (<http://portal.NCDEQ.org/web/eep>). 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. Populations of Chinese privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*) were treated during February and June 2016 with good efficacy. Follow-up treatments will be performed as needed during future monitoring years.

Monitoring of the permanent vegetation plots (n = 8; VP) was completed during Junes 2016. Summary tables and photographs associated with MY2 monitoring are located in Appendix C. MY2 monitoring data indicates that all but VP-6 are on track to meet the MY3 interim success criteria of 320 planted stems per acre. Planted stem densities among plots ranged from 121 to 688 planted stems per acre with an annual mean of 541 planted stems per acre across all plots. A total of 12 species were documented within the plots. When volunteer stems are included, the mean annual total stems per acre rose to 607 and ranged between 243 and 728 stems per acre. The lack of success in VP-6 can likely be attributed to the

location of this plot on top of a small knoll, where it is generally dryer, followed by a dry summer. Additionally, vegetation within and surrounding the plot is dominated by fescue (*Festuca* spp.). This area will be replanted during the early part of 2017.

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. No indication of instability was observed during visual assessment and all structures are functioning as designed (Appendix A Figure 2 and Appendix B Table 5). Of note, a small 8 to 10 inch rainbow trout was found in one of the lower pools located within Cochran Branch.

Stream geomorphic data, including cross-sections, pebble counts, and bank pin arrays were not collected during monitoring year 2 activities per the monitoring guidance and schedule stated in the Mitigation Plan and As-Built Baseline Documents. This data will be collected in monitoring year 3 and documented in the MY3 report.

1.4.3. Groundwater and Stream Hydrology

During MY2, all eight of the groundwater monitoring wells met the 8% hydroperiod success criteria (Appendix E Table 13), even though dry conditions persisted at the Site. Hydroperiods among the monitoring wells ranged from 21.4% to 100%, with total number of consecutive days within 12 inches of the soil surface ranging from 40 to 187. Groundwater monitoring well number 1, located just outside of the wetland re-establishment area, also met success criteria with a hydroperiod of 21.4%.

Two bankfull events occurred on Cochran Branch (mainstem) during 2016, one each during March and August. These events measured 0.68 and 0.58 feet above bankfull (Appendix E Table 12). These are the second and third bankfull events recorded on Cochran Branch since project completion.

2.0 METHODS

This report presents the results of the Monitoring Year 2 (MY2) visual, hydrologic, and vegetation data and the Monitoring Year 1 (MY) morphological data collection. Permanent photo station photos were collected during the initial visual assessment; during leaf-off conditions. Additional photos of vegetation or stream problem areas were taken as needed.

Geomorphic measurements were taken during low flow conditions using a Nikon® NPR 332 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 8 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 and cross-referenced with known bankfull elevations at each crest gauge.

3.0 REFERENCES

Environmental Banc & Exchange, LLC. 2014. Cochran Branch, Final Mitigation Plan, Macon County, North Carolina. NCEEP Project No. 95720

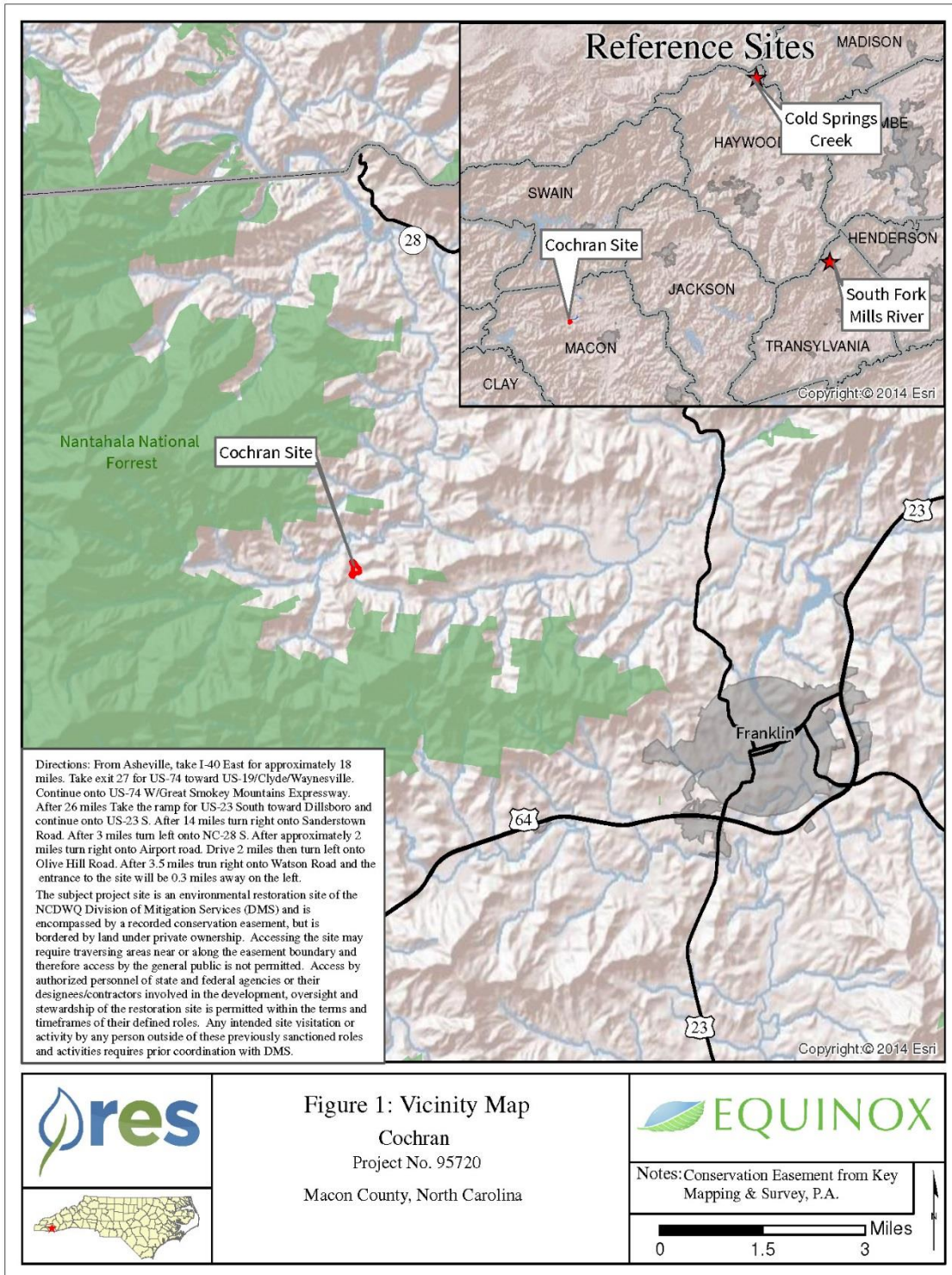
Harrelson, Cheryl, C. Rawlins and J. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. Gen. Tech. Rep. RM-245. Rocky Mountain Forest and Range Experiment Station. USDA Forest Service. Fort Collins, Colorado

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.

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Appendix A
General Tables and Figures



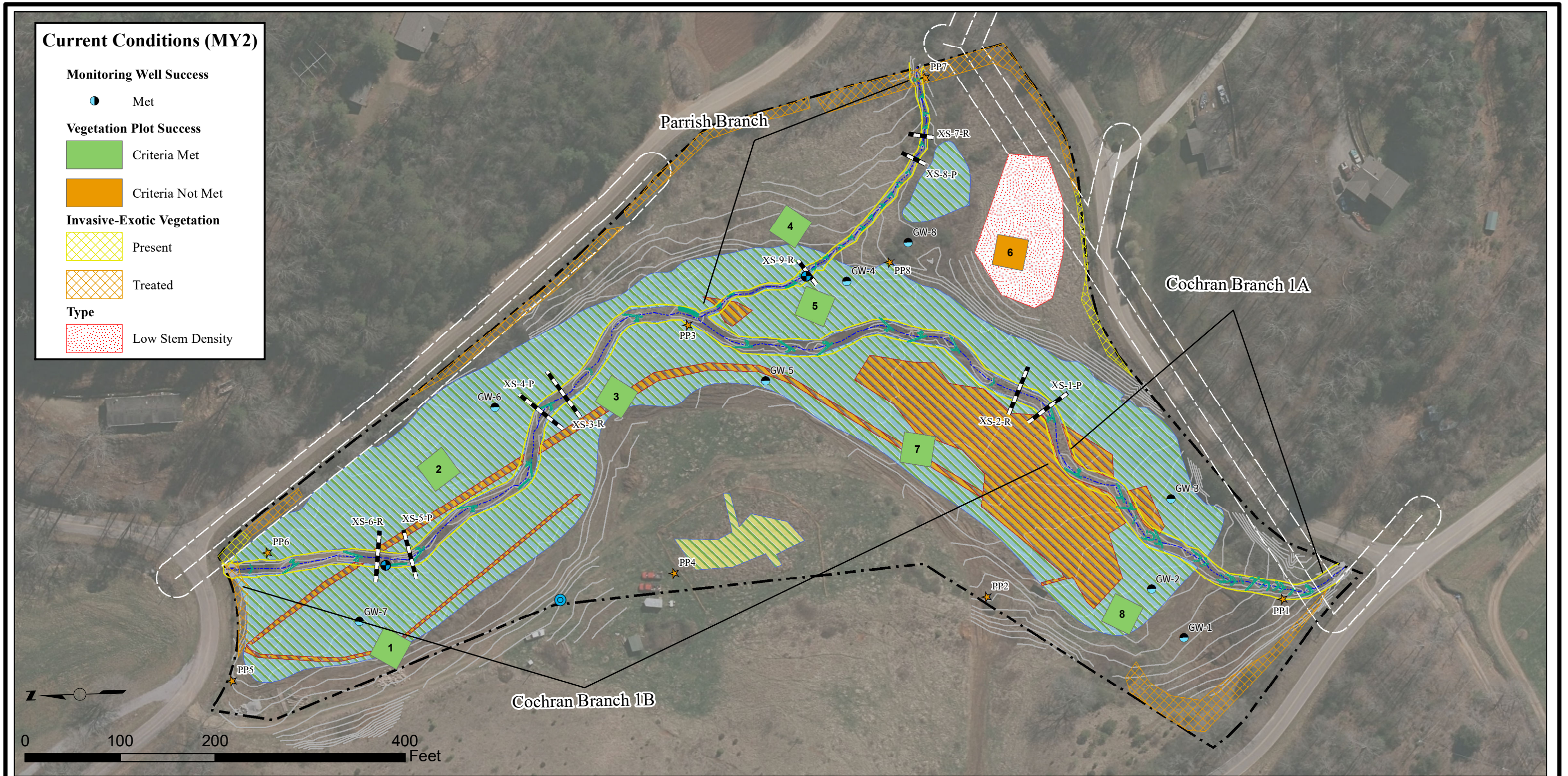


Figure 2. Cochran Branch Stream and Wetland Restoration Project - Monitoring Year 1
 Current Conditions Plan View
 Macon County, NC
 NCDMS Contract No. 004370
 NCDMS Project No.: 95720
 October 2016

| | | | | |
|--|---|--|--|---|
| <ul style="list-style-type: none"> Crest Gauge Rain Gauge Photo Points Cross-Section | <ul style="list-style-type: none"> Thalweg (As-Built) Top of Bank Duke ROW Contour Easement | <p>Wetland Type</p> <ul style="list-style-type: none"> Enhancement Re-establishment Re-habilitation | <ul style="list-style-type: none"> Hook-Log Run Hook Run Log Vane with Hook Log Sill | <ul style="list-style-type: none"> Boulder Shelf Brush Toe Armored Riffle |
|--|---|--|--|---|

Notes:
 1) This is not a survey and should not be construed as such.
 2) Baseline Data Provided by Kee Mapping
 3) Orthoimagery provided by NCOneMap (2010)

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| Table 1. Project Components and Mitigation Credits | | | | | | | | | |
|--|---------------------|------------------|--------------------------|-------------------------|--|---|------------------|-----------------|-----------------|
| Cochran Stream and Wetland Restoration Project | | | | | | | | | |
| Mitigation Credits | | | | | | | | | |
| | Stream | | Riparian Wetland | | Non-riparian Wetland | | Buffer | Nitrogen | Phosphorous |
| | R | RE | R | RE | R | RE | | Nutrient Offset | Nutrient Offset |
| Totals | 1,820 | | 4.24 | 0.06 | | | - | - | - |
| 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 | | 1332 | PI | R | 1,418 | 1:1 | | |
| Parrish Branch | 200+15 - 204+11 | | 232 | PII | R | 402 | 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 | 1,820 | - | 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

**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 | | |
| Year 4 Monitoring | | |
| Year 5 Monitoring | | |
| Year 6 Monitoring | | |
| Year 7 Monitoring | | |

| Table 3. Project Contacts | |
|--|---|
| Cochran Stream and Wetland Restoration Project | |
| Prime Contractor | Resource Environmental Solutions, LLC 302 Jefferson Street; Suite 110 Raleigh, North Carolina 27605 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 302 Jefferson Street; Suite 110 Raleigh, North Carolina 27605 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 |

| 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 | | | |

Appendix B
Visual Assessment Data

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**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 \geq 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 \geq 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 \geq 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 | 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. | 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 NOT exceed 15%. | 19 | 19 | | | 100% | | | |
| | 4. Habitat | Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio \geq 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 | 1 | 0.25 | 2% |
| Totals | | | 1 | 0.25 | 2% |
| 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 | | | 1 | 0.25 | 2% |
| 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). | Cross Hatch (Red - Dense/Yellow - Present) | 9 | 0.40 | 3% |
| 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 Reach 1a – Permanent Photo Station 1
Station 101+33 - Downstream



Cochran Branch Reach 1a – Permanent Photo Station 1
Station 101+33 – Upstream



Cochran Branch – Permanent Photo Station 2
East 95°



Cochran Branch – Permanent Photo Station 2
South 186°



Cochran Branch – Permanent Photo Station 3
Station 108+87 – Upstream



Parrish Branch – Permanent Photo Station 3
Station 108+87 – Upstream



Cochran Branch – Permanent Photo Station 4
South Southeast 160°



Cochran Branch – Permanent Photo Station 5
Southeast 150°



Cochran Branch – Permanent Photo Station 6
Station 114+62 – Upstream 186°



Parrish Branch – Permanent Photo Station 7
Station 200+25 – Upstream 276°



Parrish Branch – Permanent Photo Station 8
Southeast 135°



Parrish Branch – Permanent Photo Station 8
Southwest 225°

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Appendix C
Vegetation Plot Data

| Table 7. Vegetation Plot Criteria Attainment | | |
|---|------------------------------------|------------|
| Cochran Stream and Wetland Restoration Project | | |
| Vegetation Plot ID | Vegetation Survival Threshold Met? | Tract Mean |
| 1 | Yes | 88% |
| 2 | Yes | |
| 3 | Yes | |
| 4 | Yes | |
| 5 | Yes | |
| 6 | No | |
| 7 | Yes | |
| 8 | Yes | |

| Table 8. CVS Vegetation Plot Metadata Cochran Stream and Wetland Restoraion Project | |
|--|---|
| Report Prepared By | Drew Alderman |
| Date Prepared | 6/9/2016 10:34 |
| database name | RES_95720_2016_A_Cochran_MY2.mdb |
| database location | Z:\ES\NRI&M\EBX Monitoring\Cochran\MY2 -2016\Data\Veg |
| computer name | FIELD-PC |
| file size | 60854272 |
| 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 | |
| length(ft) | |
| stream-to-edge width (ft) | |
| area (sq m) | |
| Required Plots (calculated) | |
| Sampled Plots | 8 |

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| Table 9. Total Planted Stem Counts (Stems By Plot) Cochran Stream and Wetland Restoration project | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--------------------------------------|---------------|------------------------------|-------|-----|--------|-------|-----|--------|-------|-----|--------|-------|-----|--------|-------|-----|--------|-------|-----|--------|-------|-----|--------|-------|---|
| Scientific Name | Common Name | Species Type | Current Plot Data (MY2 2016) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | | Plot 8 | | |
| | | | 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 |
| <i>Acer rubrum var. rubrum</i> | Red Maple | Tree | 1 | 1 | 2 | | | | | | | | | | | | | | | | | | | | | |
| <i>Alnus serrulata</i> | Hazel Alder | Shrub | | | | | | | | | | | 3 | | | | | | | | | | | | | |
| <i>Betula nigra</i> | River Birch | Tree | 1 | 1 | 1 | 4 | 4 | 4 | 2 | 2 | 2 | | | | 2 | 2 | 2 | | | | 3 | 3 | 3 | | | |
| <i>Cephalanthus occidentalis</i> | Common Buttonbush | Shrub | | | | | | | 1 | 1 | 1 | | | | | | | | | | | | | | | |
| <i>Diospyros virginiana</i> | Common Persimmon | Tree | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 7 | | |
| <i>Fraxinus pennsylvanica</i> | Green Ash | Tree | | | | | | | | | | | | | | | | | | | | | | 7 | | |
| <i>Liriodendron tulipifera var. tulipifera</i> | Tulip-tree, Yellow Poplar, Whitewood | Tree | | | | | | | | | | | 4 | 4 | 4 | | | | 2 | 2 | 2 | | | | | |
| <i>Nyssa sylvatica</i> | Blackgum | Tree | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | |
| <i>Platanus occidentalis var. occidentalis</i> | Sycamore, Plane-tree | Tree | 2 | 2 | 2 | 10 | 10 | 10 | 4 | 4 | 4 | 7 | 7 | 7 | 11 | 11 | 11 | | | | 5 | 5 | 5 | | | |
| <i>Quercus</i> | Oak | Tree | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | |
| <i>Quercus alba</i> | White oak | Tree | | | | | | | 2 | 2 | 2 | | | | | | | | | | | | 2 | 2 | | |
| <i>Quercus michauxii</i> | Swamp Chestnut Oak | Tree | 3 | 3 | 3 | | | | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 3 | 3 | | | | 3 | 3 | 3 | 1 | | |
| <i>Quercus nigra</i> | Water Oak | Tree | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | 1 | | |
| <i>Quercus phellos</i> | Willow Oak | Tree | 4 | 4 | 4 | 2 | 2 | 2 | | | | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | | |
| <i>Quercus rubra var. rubra</i> | Northern Red Oak | Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Salix nigra</i> | Black Willow | Tree | | | 4 | | | | | | | | | | | | | | | | | | | 1 | | |
| <i>Sambucus canadensis</i> | Common Elderberry | Shrub | | | | | | | | | | 1 | | | | | | | | | | | | | | |
| Unknown | | Shrub or Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| | Stem count | | 13 | 13 | 18 | 17 | 17 | 17 | 11 | 11 | 12 | 16 | 16 | 19 | 17 | 17 | 18 | 3 | 3 | 6 | 16 | 16 | 16 | 14 | | |
| | 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 | | 7 | 7 | 8 | 4 | 4 | 4 | 5 | 5 | 6 | 5 | 5 | 6 | 4 | 4 | 5 | 2 | 2 | 3 | 5 | 5 | 5 | 4 | | |
| | Stems per ACRE | | 526 | 526 | 728 | 688 | 688 | 688 | 445 | 445 | 486 | 647 | 647 | 769 | 688 | 688 | 728 | 121 | 121 | 243 | 647 | 647 | 647 | 567 | | |

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

| Table 9 Cont'd Total Planted Stem Counts (Annual Means) Cochran Stream and Wetland Restoration Project | | | | | | | | | | | |
|---|--------------------------------------|---------------|--------------|-------|-----|------------|-------|-----|------------|-------|-----|
| Scientific Name | Common Name | Species Type | Annual Means | | | | | | | | |
| | | | MY2 (2016) | | | MY1 (2015) | | | MY0 (2015) | | |
| | | | PnoLS | P-all | T | PnoLS | P-all | T | PnoLS | P-all | T |
| <i>Acer rubrum var. rubrum</i> | Red Maple | Tree | 1 | 1 | 5 | 1 | 1 | 1 | 4 | 4 | 4 |
| <i>Alnus serrulata</i> | Hazel Alder | Shrub | | | 3 | | | | | | |
| <i>Betula nigra</i> | River Birch | Tree | 12 | 12 | 12 | 14 | 14 | 14 | 16 | 16 | 16 |
| <i>Cephalanthus occidentalis</i> | Common Buttonbush | Shrub | 1 | 1 | 1 | | | | | | |
| <i>Diospyros virginiana</i> | Common Persimmon | Tree | 8 | 8 | 8 | | | | | | |
| <i>Fraxinus pennsylvanica</i> | Green Ash | Tree | | | | 1 | 1 | 1 | 2 | 2 | 2 |
| <i>Liriodendron tulipifera var. tulipifera</i> | Tulip-tree, Yellow Poplar, Whitewood | Tree | 6 | 6 | 6 | 10 | 10 | 10 | 27 | 27 | 27 |
| <i>Nyssa sylvatica</i> | Blackgum | Tree | 1 | 1 | 1 | | | | | | |
| <i>Platanus occidentalis var. occidentalis</i> | Sycamore, Plane-tree | Tree | 39 | 39 | 39 | 45 | 45 | 45 | 48 | 48 | 48 |
| <i>Quercus</i> | Oak | Tree | 2 | 2 | 2 | 23 | 23 | 23 | 38 | 38 | 38 |
| <i>Quercus alba</i> | White oak | Tree | 4 | 4 | 4 | | | | | | |
| <i>Quercus michauxii</i> | Swamp Chestnut Oak | Tree | 13 | 13 | 13 | 9 | 9 | 9 | 11 | 11 | 11 |
| <i>Quercus nigra</i> | Water Oak | Tree | 1 | 1 | 1 | 3 | 3 | 3 | | | |
| <i>Quercus phellos</i> | Willow Oak | Tree | 19 | 19 | 19 | 9 | 9 | 9 | 8 | 8 | 8 |
| <i>Quercus rubra var. rubra</i> | Northern Red Oak | Tree | | | | | | | 1 | 1 | 1 |
| <i>Salix nigra</i> | Black Willow | Tree | | | 5 | | | 3 | | | |
| <i>Sambucus canadensis</i> | Common Elderberry | Shrub | | | 1 | | | | | | |
| Unknown | | Shrub or Tree | | | | | | | 1 | 1 | 1 |
| | Stem count | | 107 | 107 | 120 | 115 | 115 | 118 | 156 | 156 | 156 |
| | size (ares) | | 8 | | | 8 | | | 8 | | |
| | size (ACRES) | | 0.20 | | | 0.20 | | | 0.20 | | |
| | Species count | | 12 | 12 | 15 | 9 | 9 | 10 | 10 | 10 | 10 |
| | Stems per ACRE | | 541 | 541 | 607 | 582 | 582 | 597 | 789 | 789 | 789 |

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

Color for Density

| |
|--|
| Exceeds requirements by 10% |
| Exceeds requirements, but by less than 10% |
| Fails to meet requirements, by less than 10% |
| Fails to meet requirements by more than 10% |
| Recruit Stems |

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Cochran - Vegetation Monitoring Plot 1
June 7th, 2016



Cochran - Vegetation Monitoring Plot 2
June 7th, 2016



Cochran - Vegetation Monitoring Plot 3
June 7th, 2016



Cochran - Vegetation Monitoring Plot 4
June 7th, 2016



Cochran - Vegetation Monitoring Plot 5
June 7th, 2016



Cochran - Vegetation Monitoring Plot 6
June 7th, 2016



Cochran - Vegetation Monitoring Plot 7
June 7th, 2016



Cochran - Vegetation Monitoring Plot 8
June 7th, 2016

Appendix D
Stream Geomorphology Data
(No Morphological Data Collected During MY2)

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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 | | | |
| Re: 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) | | | | | | | | | | | | | | | | | | | | | | | | | | 3 / 4 / 6 / 11 / 14 / - / - | |
| Reach Shear Stress (Competency) lb/ft ² | | | | | | | | | | | | | | | | | | | | | | | | | | 1.947 | |
| Max Part Size (mm) Mobilized at Bankfull | | | | | | | | | | | | | | | | | | | | | | | | | | 91 | |
| Stream Power (Transport Capacity) W/m ² | | | | | | | | | | | | | | | | | | | | | | | | | | 1.6 | |
| Additional Reach Parameters | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Drainage Area (mi ²) | | | | | | | | | | | | | | | | | | | | | | | | | | 1.11 | |
| Impervious Cover Estimate (%) | | | | | | | | | | | | | | | | | | | | | | | | | | - | |
| Rosgen Classification | | | | | | | | | | | | | | | | | | | | | | | | | | G | |
| Bankfull Velocity (fps) | | | | | | | | | | | | | | | | | | | | | | | | | | 4.5 | |
| Bankfull Discharge (cfs) | | | | | | | | | | | | | | | | | | | | | | | | | | 123.0 | |
| Valley Length (ft) | | | | | | | | | | | | | | | | | | | | | | | | | | 380 | |
| Channel Thalweg Length (ft) | | | | | | | | | | | | | | | | | | | | | | | | | | 400 | |
| Sinuosity | | | | | | | | | | | | | | | | | | | | | | | | | | 1.10 | |
| Water Surface Slope (ft/ft) | | | | | | | | | | | | | | | | | | | | | | | | | | 1.05 | |
| Bankfull Slope (ft/ft) | | | | | | | | | | | | | | | | | | | | | | | | | | 0.035 | |
| Bankfull Floodplain Area (acres) | | | | | | | | | | | | | | | | | | | | | | | | | | 0.033 | |
| Proportion Over Wide (%) | | | | | | | | | | | | | | | | | | | | | | | | | | - | |
| Entrenchment Class (ER Range) | | | | | | | | | | | | | | | | | | | | | | | | | | B | |
| Incision Class (BHR Range) | | | | | | | | | | | | | | | | | | | | | | | | | | - | |
| BEHI | | | | | | | | | | | | | | | | | | | | | | | | | | 20.6 | |
| 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 ^q (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 | | | | | | | | | |
| Impervious Cover Estimate (%) | | | | | | | | | | | | | | | | 0.72 | | | | | | | | | |
| Rosgen Classification | | | | | | | | | | | | | | | | E4 | | | | | | | | | |
| Bankfull Velocity (fps) | - | | | | | | | | | | | | | | | | | | | | | | | | |
| Bankfull Discharge (cfs) | - | | | | | | | | | | | | | | | | | | | | | | | | |
| Valley Length (ft) | | | | | | | | | | | | | | | | 989 | | | | | | | | | |
| Channel Thalweg Length (ft) | | | | | | | | | | | | | | | | 416.7 | | | | | | | | | |
| Sinuosity | | | | | | | | | | | | | | | | 1.1 | | | | | | | | | |
| Water Surface Slope (ft/ft) | | | | | | | | | | | | | | | | 0.0085 | | | | | | | | | |
| Bankfull Slope (ft/ft) | | | | | | | | | | | | | | | | 0.0076 | | | | | | | | | |
| Bankfull Floodplain Area (acres) | | | | | | | | | | | | | | | | 0.0068 | | | | | | | | | |
| 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% | | | | | | | | | | | | | | | | | | | | | | | | | |
| d16 / d35 / d50 / d84 / d95 / di ⁹⁰ / di ⁹⁵ (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) | | | | | | | 0.10 | | | | | | 2.77 | | | | | | | | | | | | |
| Impervious Cover Estimate (%) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rosgen Classification | | | | | | | G | | | | | | B4 | | | | | B4 | | | | | | B | |
| Bankfull Velocity (fps) | | | | | | | | | | | | | 4.5 | | | | | | | | | | | | |
| Bankfull Discharge (cfs) | | | | | | | | | | | | | 123.0 | | | | | | | | | | | | |
| Valley Length (ft) | | | | | | | | | | | | | 380.0 | | | | | | | | | | | | |
| Channel Thalweg Length (ft) | | | | | | | | | | | | | 400.0 | | | | | | | | | | | 402 | |
| Sinuosity | | | | | | | | | | | | | 1.1 | | | | | | | | | | | 1.07 | |
| Water Surface Slope (ft/ft) | | | | | | | | | | | | | | | | | | | | | | | | 0.025 | |
| Bankfull Slope (ft/ft) | | | | | | | | | | | | | | | | | | | | | | | | 0.029 | |
| Bankfull Floodplain Area (acres) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Proportion Over Wide (%) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Entrenchment Class (ER Range) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Incision Class (BHR Range) | | | | | | | | | | | | | | | | | | | | | | | | | |
| BEHI | | | | | | | | | | | | | | | | | | | | | | | | 26.6 | |
| Channel Stability or Habitat Metric | | | | | | | | | | | | | | | | | | | | | | | | | |
| Biological or Other | | | | | | | | | | | | | | | | | | | | | | | | | |

- Information unavailable.

Non-Applicable.

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

| | 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 | | | | | | | |
|--|--|---------|-----|-----|-----|-----|-----|-----|--|---------|-----|-----|-----|-----|-----|-----|--|---------|-----|-----|-----|-----|-----|-----|--|---------|-----|-----|-----|-----|-----|-----|--|---------|-----|-----|-----|-----|-----|-----|
| Dimension | Base | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 | Base | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 | Base | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 | Base | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 | Base | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
| Record Elevation (datum) Used | 2,156.1 | 2,156.1 | - | | | | | | 2,155.8 | 2,155.8 | - | | | | | | 2,152.1 | 2,152.1 | - | | | | | | 2,151.9 | 2,151.9 | - | | | | | | 2,149.9 | 2,149.9 | - | | | | | |
| Bankfull Width (ft) | 16.7 | 16.8 | - | | | | | | 17.3 | 17.1 | - | | | | | | 14.6 | 15.4 | - | | | | | | 16.2 | 17.4 | - | | | | | | 17.0 | 17.3 | - | | | | | |
| Floodprone Width (ft) | >217.0 | >217.0 | - | | | | | | >173.5 | >173.5 | - | | | | | | >135.0 | >135.0 | - | | | | | | >217.5 | >217.5 | - | | | | | | >236.5 | >236.5 | - | | | | | |
| Bankfull Mean Depth (ft) | 1.6 | 1.1 | - | | | | | | 1.0 | 0.9 | - | | | | | | 0.8 | 0.7 | - | | | | | | 1.9 | 1.8 | - | | | | | | 1.5 | 1.5 | - | | | | | |
| Bankfull Max Depth (ft) | 3.1 | 2.6 | - | | | | | | 1.5 | 1.4 | - | | | | | | 1.0 | 1.1 | - | | | | | | 3.5 | 4.3 | - | | | | | | 3.3 | 3.4 | - | | | | | |
| Bankfull Cross Sectional Area (ft ²) | 27.5 | 19.2 | - | | | | | | 16.6 | 15.2 | - | | | | | | 11.0 | 11.3 | - | | | | | | 31.0 | 31.3 | - | | | | | | 25.4 | 26.4 | - | | | | | |
| Bankfull Width/Depth Ratio | 10.2 | 14.7 | - | | | | | | 18.1 | 19.2 | - | | | | | | 19.2 | 20.8 | - | | | | | | 8.5 | 9.7 | - | | | | | | 11.4 | 11.4 | - | | | | | |
| Bankfull Entrenchment Ratio | >13.0 | >12.9 | - | | | | | | >10.0 | >10.2 | - | | | | | | >9.3 | >8.8 | - | | | | | | >13.4 | >12.5 | - | | | | | | >13.9 | >13.7 | - | | | | | |
| Bankfull Bank Height Ratio | 1.0 | 1.0 | - | | | | | | 1.0 | 1.0 | - | | | | | | 1.0 | 1.0 | - | | | | | | 1.0 | 1.0 | - | | | | | | 1.0 | 1.0 | - | | | | | |
| d50 (mm) | - | N/A | - | | | | | | - | 1.4 | - | | | | | | - | 28.0 | - | | | | | | - | N/A | - | | | | | | - | N/A | - | | | | | |
| | Cross-Section 6 (Riffle) Cochran Branch | | | | | | | | Cross-Section 7 (Riffle) Parrish Branch | | | | | | | | Cross-Section 8 (Pool) Parrish Branch | | | | | | | | Cross-Section 9 (Riffle) Parrish Branch | | | | | | | | | | | | | | | |
| Dimension | Base | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 | Base | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 | Base | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 | Base | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 | | | | | | | | |
| Record Elevation (datum) Used | 2,149.7 | 2,149.7 | - | | | | | | 2,160.2 | 2,160.2 | - | | | | | | 2,159.8 | 2,159.8 | - | | | | | | 2,154.6 | 2,154.6 | - | | | | | | | | | | | | | |
| Bankfull Width (ft) | 17.8 | 17.9 | - | | | | | | 4.4 | 4.5 | - | | | | | | 6.8 | 7.2 | - | | | | | | 5.9 | 6.6 | - | | | | | | | | | | | | | |
| Floodprone Width (ft) | >197.0 | >197.0 | - | | | | | | >14.2 | >14.2 | - | | | | | | >93.7 | >93.7 | - | | | | | | >24.0 | >24.0 | - | | | | | | | | | | | | | |
| Bankfull Mean Depth (ft) | 0.8 | 0.8 | - | | | | | | 0.4 | 0.4 | - | | | | | | 0.8 | 0.8 | - | | | | | | 0.4 | 0.3 | - | | | | | | | | | | | | | |
| Bankfull Max Depth (ft) | 1.1 | 1.2 | - | | | | | | 0.6 | 0.7 | - | | | | | | 1.8 | 2.0 | - | | | | | | 0.6 | 0.6 | - | | | | | | | | | | | | | |
| Bankfull Cross Sectional Area (ft ²) | 13.6 | 13.6 | - | | | | | | 1.8 | 2.0 | - | | | | | | 5.2 | 5.5 | - | | | | | | 2.1 | 2.0 | - | | | | | | | | | | | | | |
| Bankfull Width/Depth Ratio | 23.4 | 23.4 | - | | | | | | 10.9 | 10.4 | - | | | | | | 9.0 | 9.6 | - | | | | | | 16.6 | 21.7 | - | | | | | | | | | | | | | |
| Bankfull Entrenchment Ratio | >11.0 | >11.0 | - | | | | | | >3.2 | >3.1 | - | | | | | | >13.7 | >12.9 | - | | | | | | >4.0 | >3.7 | - | | | | | | | | | | | | | |
| Bankfull Bank Height Ratio | 1.0 | 1.0 | - | | | | | | 1.0 | 1.0 | - | | | | | | 1.0 | 1.0 | - | | | | | | 1.0 | 1.0 | - | | | | | | | | | | | | | |
| d50 (mm) | - | 11.0 | - | | | | | | - | 4.3 | - | | | | | | - | N/A | - | | | | | | - | 3.9 | - | | | | | | | | | | | | | |

N/A - Item does not apply.

- Information Unavailable

| Table 12. Cochran Stream and Wetland Restoration Project Bank Pin Arrays | | | | | |
|---|-----------------------------------|----------------|-----------------|-------------------------|-------------------------|
| Cross Section Number | Length of Exposed Pin (mm) | | | | |
| | Downstream | Middle | Upstream | Rate (mm/yr) | Rate (ft/yr) |
| 1 | 0 ^B | 0 ^B | 0 ^B | 0 | 0.00 |
| 4 | 0 ^B | 0 ^B | 0 ^B | 0 | 0.00 |
| 8 | 0 ^B | 0 ^B | 0 ^B | 0 | 0.00 |

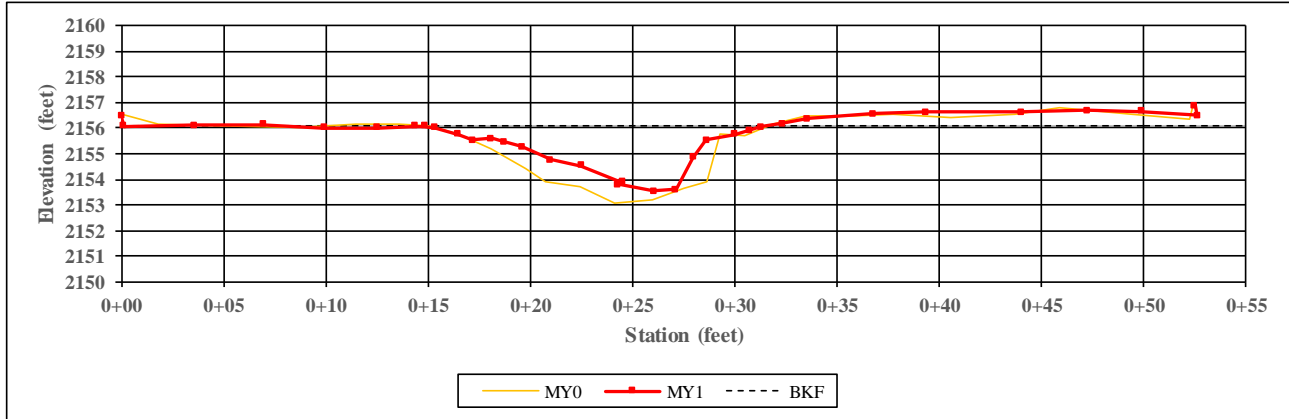
0^B = Buried Bank Pin

*Data Represented Collected During MY1

Project Name: Cochran
 Reach Name: Cochran 1b

XS Number: 1
 XS Type: Pool

Station: 104+73



| CHANNEL DIMENSIONS SUMMARY | MY0 | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
|--|-------|-------|-----|-----|-----|-----|-----|-----|
| Bankful Width (ft) | 16.7 | 16.8 | - | - | - | - | - | - |
| Floodprone Width (ft) | 217.0 | 217.0 | - | - | - | - | - | - |
| Bankfull Mean Depth (ft) | 1.6 | 1.1 | - | - | - | - | - | - |
| Bankfull Max Depth (ft) | 3.1 | 2.6 | - | - | - | - | - | - |
| Bankfull Cross-Sectional Area (ft ²) | 27.5 | 19.2 | - | - | - | - | - | - |
| Width/Depth Ratio | 10.2 | 14.7 | - | - | - | - | - | - |
| Entrenchment Ratio | 13.0 | 12.9 | - | - | - | - | - | - |
| Bank Height Ratio | 1.0 | 1.0 | - | - | - | - | - | - |



Left Descending Bank

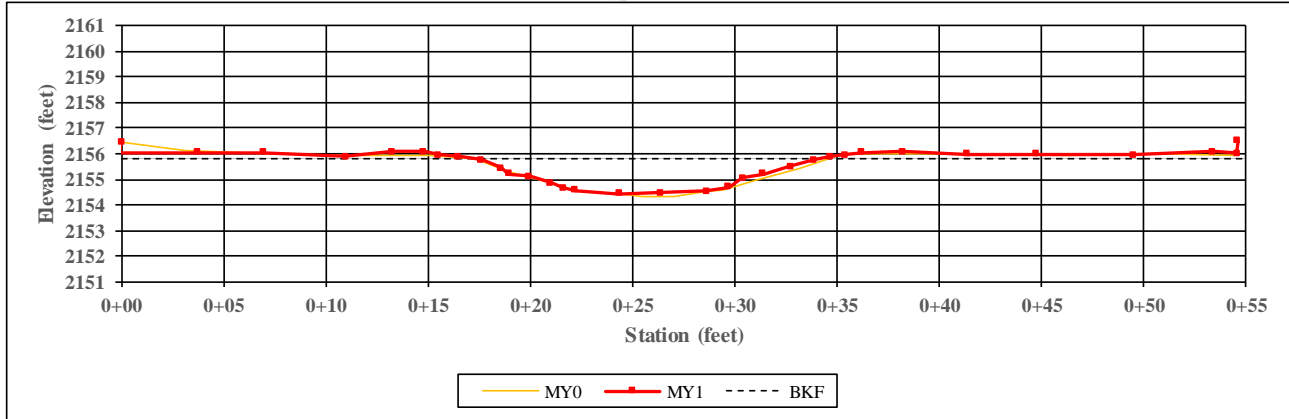


Right Descending Bank

Project Name: Cochran
Reach Name: Cochran 1b

XS Number: 2
XS Type: Riffle

Station: 105+08



| CHANNEL DIMENSIONS SUMMARY | MY0 | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
|--|-------|-------|-----|-----|-----|-----|-----|-----|
| Bankful Width (ft) | 17.3 | 17.1 | - | - | - | - | - | - |
| Floodprone Width (ft) | 173.5 | 173.5 | - | - | - | - | - | - |
| Bankfull Mean Depth (ft) | 1.0 | 0.9 | - | - | - | - | - | - |
| Bankfull Max Depth (ft) | 1.5 | 1.4 | - | - | - | - | - | - |
| Bankfull Cross-Sectional Area (ft ²) | 16.6 | 15.2 | - | - | - | - | - | - |
| Width/Depth Ratio | 18.1 | 19.2 | - | - | - | - | - | - |
| Entrenchment Ratio | 10.0 | 10.2 | - | - | - | - | - | - |
| Bank Height Ratio | 1.0 | 1.0 | - | - | - | - | - | - |



Left Descending Bank

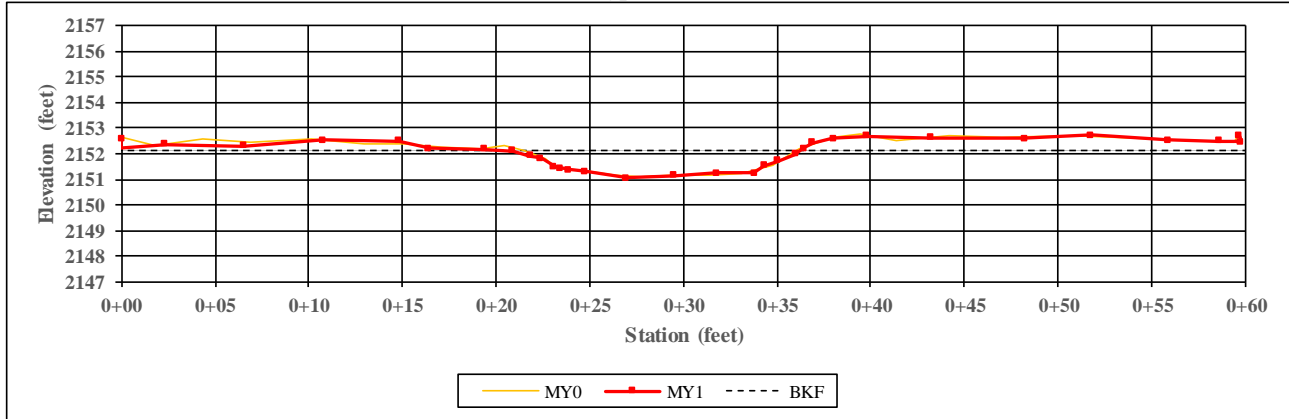


Right Descending Bank

Project Name: Cochran
Reach Name: Cochran 1b

XS Number: 3
XS Type: Riffle

Station: 110+60



| CHANNEL DIMENSIONS SUMMARY | MY0 | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
|--|-------|-------|-----|-----|-----|-----|-----|-----|
| Bankful Width (ft) | 14.6 | 15.4 | - | - | - | - | - | - |
| Floodprone Width (ft) | 135.0 | 135.0 | - | - | - | - | - | - |
| Bankfull Mean Depth (ft) | 0.8 | 0.7 | - | - | - | - | - | - |
| Bankfull Max Depth (ft) | 1.0 | 1.1 | - | - | - | - | - | - |
| Bankfull Cross-Sectional Area (ft ²) | 11.0 | 11.3 | - | - | - | - | - | - |
| Width/Depth Ratio | 19.2 | 20.8 | - | - | - | - | - | - |
| Entrenchment Ratio | 9.3 | 8.8 | - | - | - | - | - | - |
| Bank Height Ratio | 1.0 | 1.0 | - | - | - | - | - | - |



Left Descending Bank

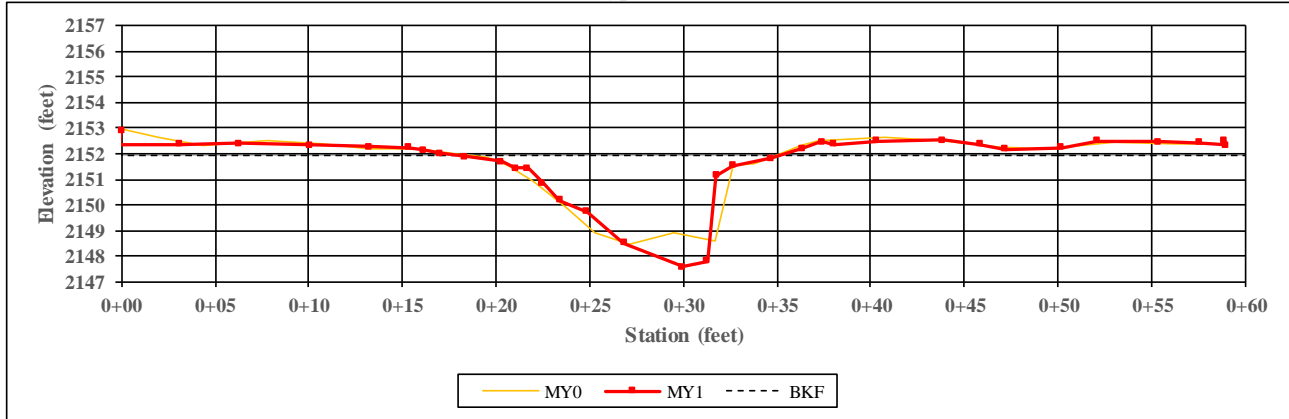


Right Descending Bank

Project Name: Cochran
 Reach Name: Cochran 1b

XS Number: 4
 XS Type: Pool

Station: 110+90



| CHANNEL DIMENSIONS SUMMARY | MY0 | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
|--|-------|-------|-----|-----|-----|-----|-----|-----|
| Bankful Width (ft) | 16.2 | 17.4 | - | - | - | - | - | - |
| Floodprone Width (ft) | 217.5 | 217.5 | - | - | - | - | - | - |
| Bankfull Mean Depth (ft) | 1.9 | 1.8 | - | - | - | - | - | - |
| Bankfull Max Depth (ft) | 3.5 | 4.3 | - | - | - | - | - | - |
| Bankfull Cross-Sectional Area (ft ²) | 31.0 | 31.3 | - | - | - | - | - | - |
| Width/Depth Ratio | 8.5 | 9.7 | - | - | - | - | - | - |
| Entrenchment Ratio | 13.4 | 12.5 | - | - | - | - | - | - |
| Bank Height Ratio | 1.0 | 1.0 | - | - | - | - | - | - |



Left Descending Bank

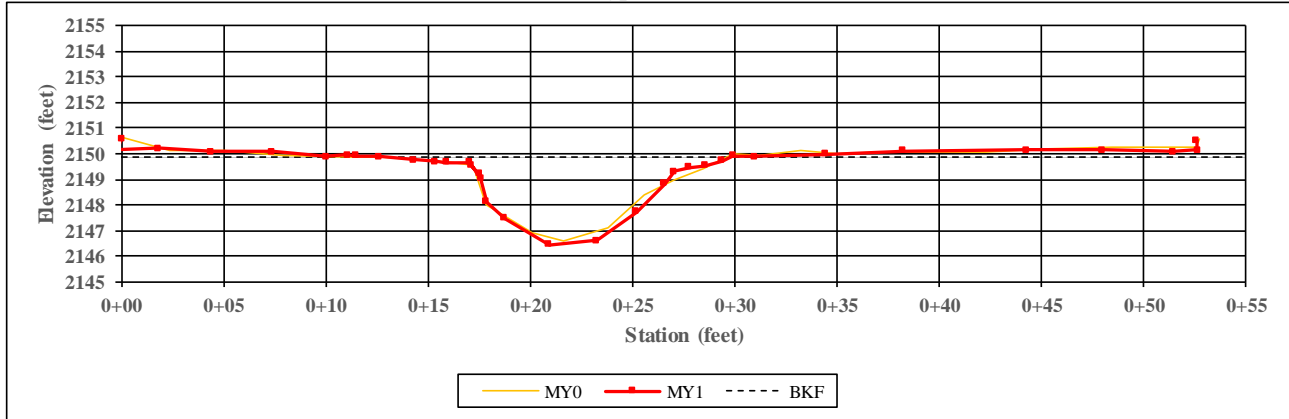


Right Descending Bank

Project Name: Cochran
Reach Name: Cochran 1b

XS Number: 5
XS Type: Pool

Station: 113+08



| CHANNEL DIMENSIONS SUMMARY | MY0 | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
|--|-------|-------|-----|-----|-----|-----|-----|-----|
| Bankful Width (ft) | 17.0 | 17.3 | - | - | - | - | - | - |
| Floodprone Width (ft) | 236.5 | 236.5 | - | - | - | - | - | - |
| Bankfull Mean Depth (ft) | 1.5 | 1.5 | - | - | - | - | - | - |
| Bankfull Max Depth (ft) | 3.3 | 3.4 | - | - | - | - | - | - |
| Bankfull Cross-Sectional Area (ft ²) | 25.4 | 26.4 | - | - | - | - | - | - |
| Width/Depth Ratio | 11.4 | 11.4 | - | - | - | - | - | - |
| Entrenchment Ratio | 13.9 | 13.7 | - | - | - | - | - | - |
| Bank Height Ratio | 1.0 | 1.0 | - | - | - | - | - | - |



Left Descending Bank

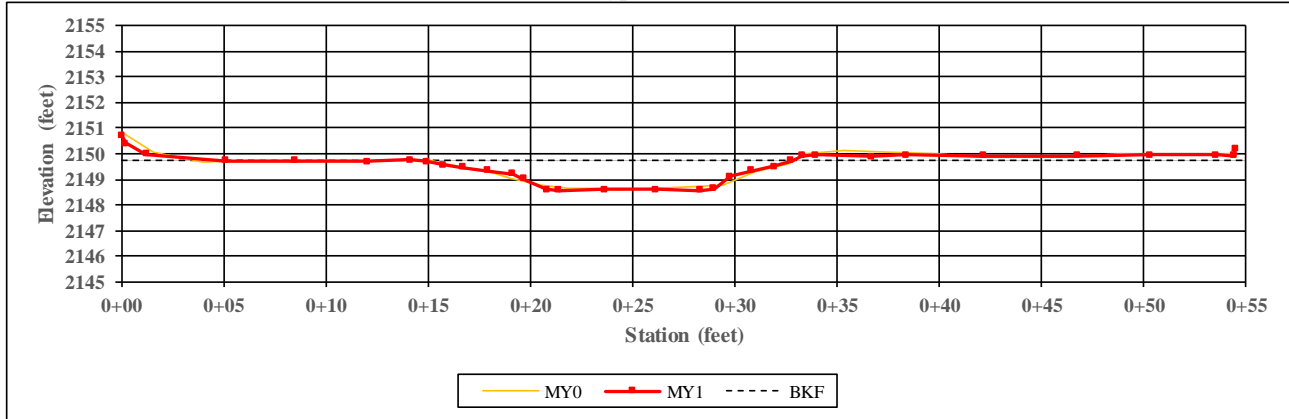


Right Descending Bank

Project Name: Cochran
Reach Name: Cochran 1b

XS Number: 6
XS Type: Riffle

Station: 113+44



| CHANNEL DIMENSIONS SUMMARY | MY0 | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
|--|-------|-------|-----|-----|-----|-----|-----|-----|
| Bankful Width (ft) | 17.8 | 17.9 | - | - | - | - | - | - |
| Floodprone Width (ft) | 197.0 | 197.0 | - | - | - | - | - | - |
| Bankfull Mean Depth (ft) | 0.8 | 0.8 | - | - | - | - | - | - |
| Bankfull Max Depth (ft) | 1.1 | 1.2 | - | - | - | - | - | - |
| Bankfull Cross-Sectional Area (ft ²) | 13.6 | 13.6 | - | - | - | - | - | - |
| Width/Depth Ratio | 23.4 | 23.4 | - | - | - | - | - | - |
| Entrenchment Ratio | 11.0 | 11.0 | - | - | - | - | - | - |
| Bank Height Ratio | 1.0 | 1.0 | - | - | - | - | - | - |



Left Descending Bank

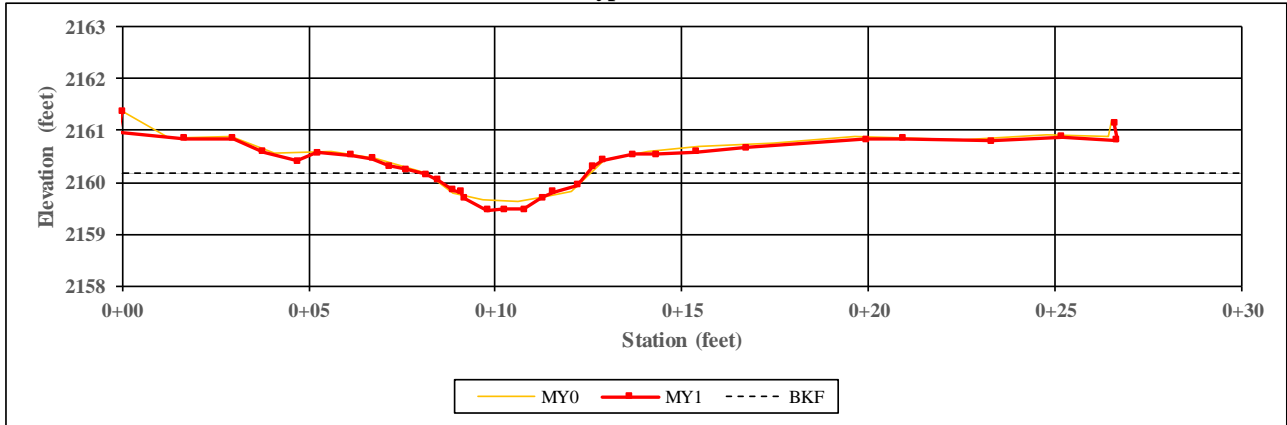


Right Descending Bank

Project Name: Cochran
Reach Name: Parrish

XS Number: 7
XS Type: Riffle

Station: 200+88



| CHANNEL DIMENSIONS SUMMARY | MY0 | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
|--|------|------|-----|-----|-----|-----|-----|-----|
| Bankful Width (ft) | 4.4 | 4.5 | - | - | - | - | - | - |
| Floodprone Width (ft) | 14.2 | 14.2 | - | - | - | - | - | - |
| Bankfull Mean Depth (ft) | 0.4 | 0.4 | - | - | - | - | - | - |
| Bankfull Max Depth (ft) | 0.6 | 0.7 | - | - | - | - | - | - |
| Bankfull Cross-Sectional Area (ft ²) | 1.8 | 2.0 | - | - | - | - | - | - |
| Width/Depth Ratio | 10.9 | 10.4 | - | - | - | - | - | - |
| Entrenchment Ratio | 3.2 | 3.1 | - | - | - | - | - | - |
| Bank Height Ratio | 1.0 | 1.0 | - | - | - | - | - | - |



Left Descending Bank

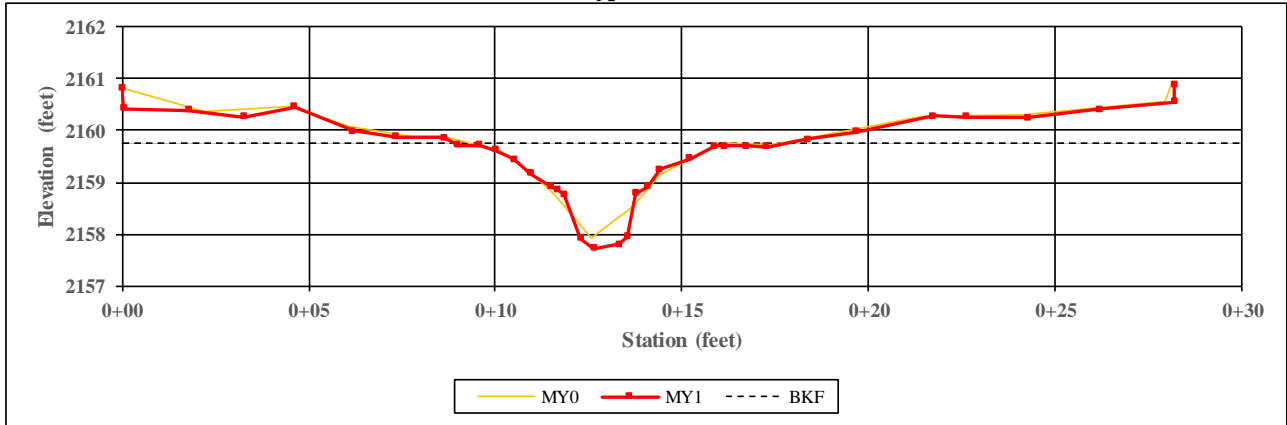


Right Descending Bank

Project Name: Cochran
Reach Name: Parrish

XS Number: 8
XS Type: Pool

Station: 201+07



| CHANNEL DIMENSIONS SUMMARY | MY0 | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
|--|------|------|-----|-----|-----|-----|-----|-----|
| Bankful Width (ft) | 6.8 | 7.2 | - | - | - | - | - | - |
| Floodprone Width (ft) | 93.7 | 93.7 | - | - | - | - | - | - |
| Bankfull Mean Depth (ft) | 0.8 | 0.8 | - | - | - | - | - | - |
| Bankfull Max Depth (ft) | 1.8 | 2.0 | - | - | - | - | - | - |
| Bankfull Cross-Sectional Area (ft ²) | 5.2 | 5.5 | - | - | - | - | - | - |
| Width/Depth Ratio | 9.0 | 9.6 | - | - | - | - | - | - |
| Entrenchment Ratio | 13.7 | 12.9 | - | - | - | - | - | - |
| Bank Height Ratio | 1.0 | 1.0 | - | - | - | - | - | - |



Left Descending Bank

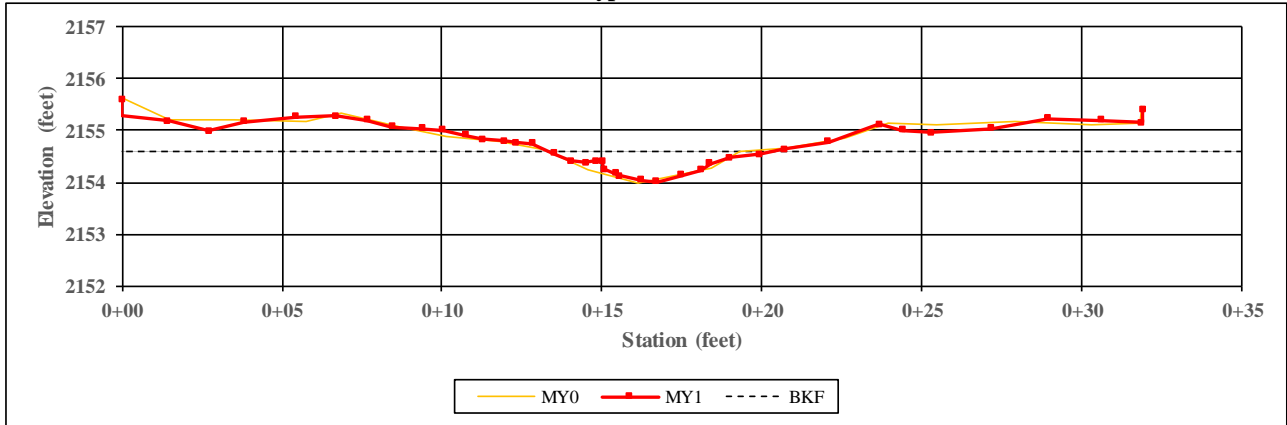


Right Descending Bank

Project Name: Cochran
Reach Name: Parrish

XS Number: 9
XS Type: Riffle

Station: 202+86



| CHANNEL DIMENSIONS SUMMARY | MY0 | MY1 | MY2 | MY3 | MY4 | MY5 | MY6 | MY7 |
|--|------|------|-----|-----|-----|-----|-----|-----|
| Bankful Width (ft) | 5.9 | 6.6 | - | - | - | - | - | - |
| Floodprone Width (ft) | 24.0 | 24.0 | - | - | - | - | - | - |
| Bankfull Mean Depth (ft) | 0.4 | 0.3 | - | - | - | - | - | - |
| Bankfull Max Depth (ft) | 0.6 | 0.6 | - | - | - | - | - | - |
| Bankfull Cross-Sectional Area (ft ²) | 2.1 | 2.0 | - | - | - | - | - | - |
| Width/Depth Ratio | 16.6 | 21.7 | - | - | - | - | - | - |
| Entrenchment Ratio | 4.0 | 3.7 | - | - | - | - | - | - |
| Bank Height Ratio | 1.0 | 1.0 | - | - | - | - | - | - |

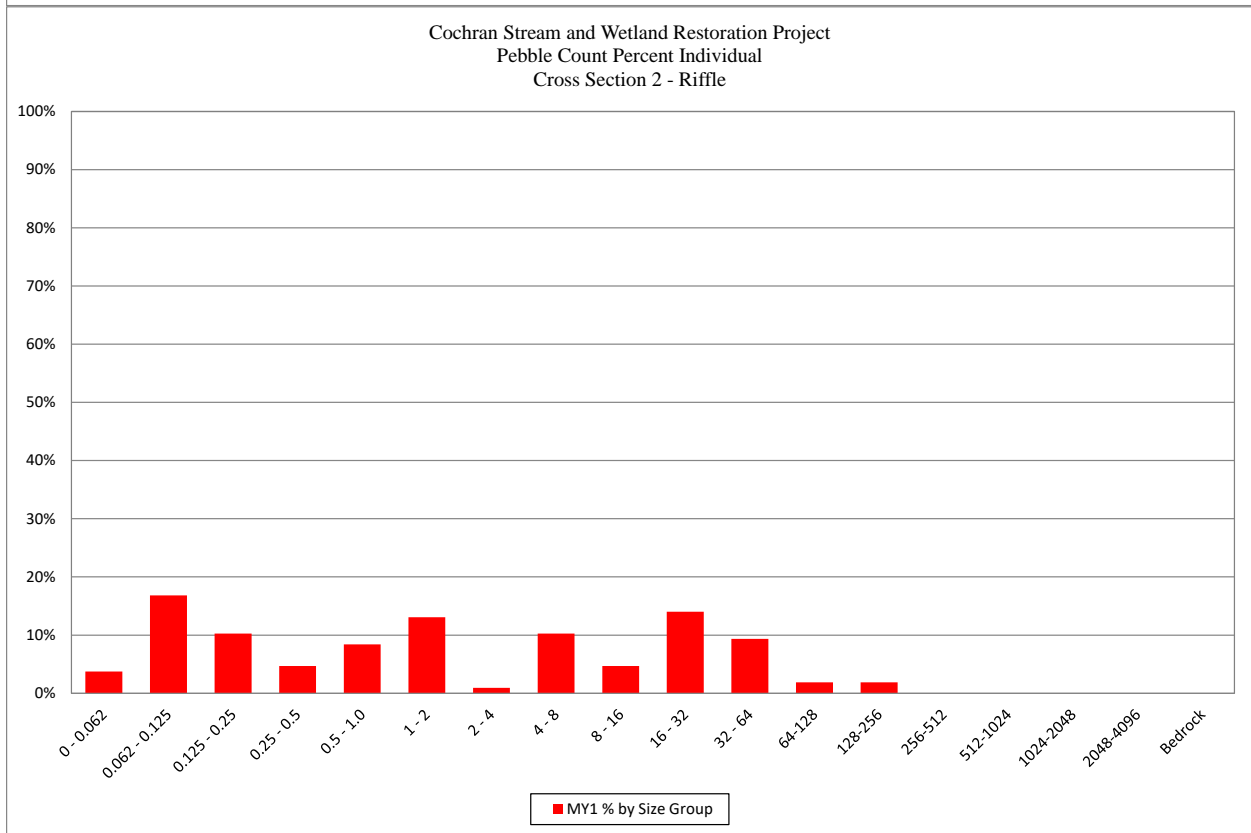
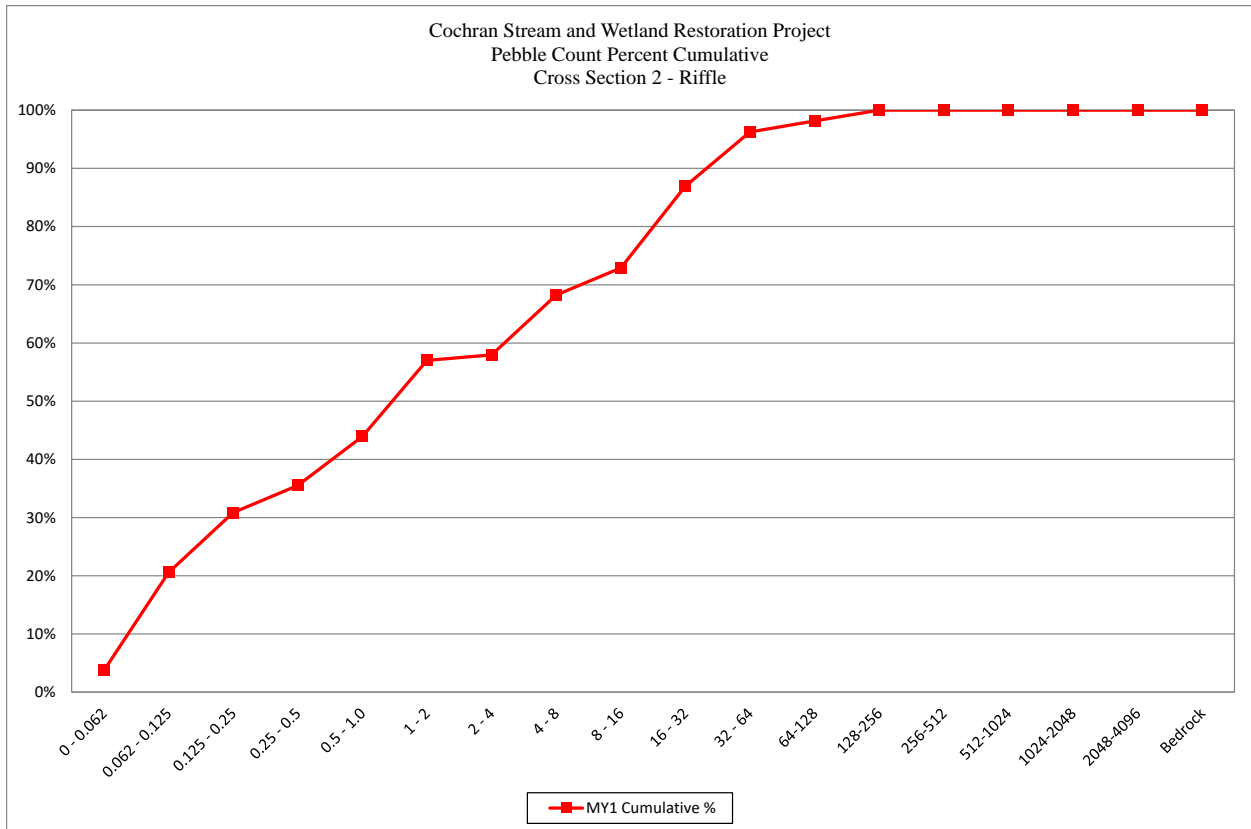


Left Descending Bank

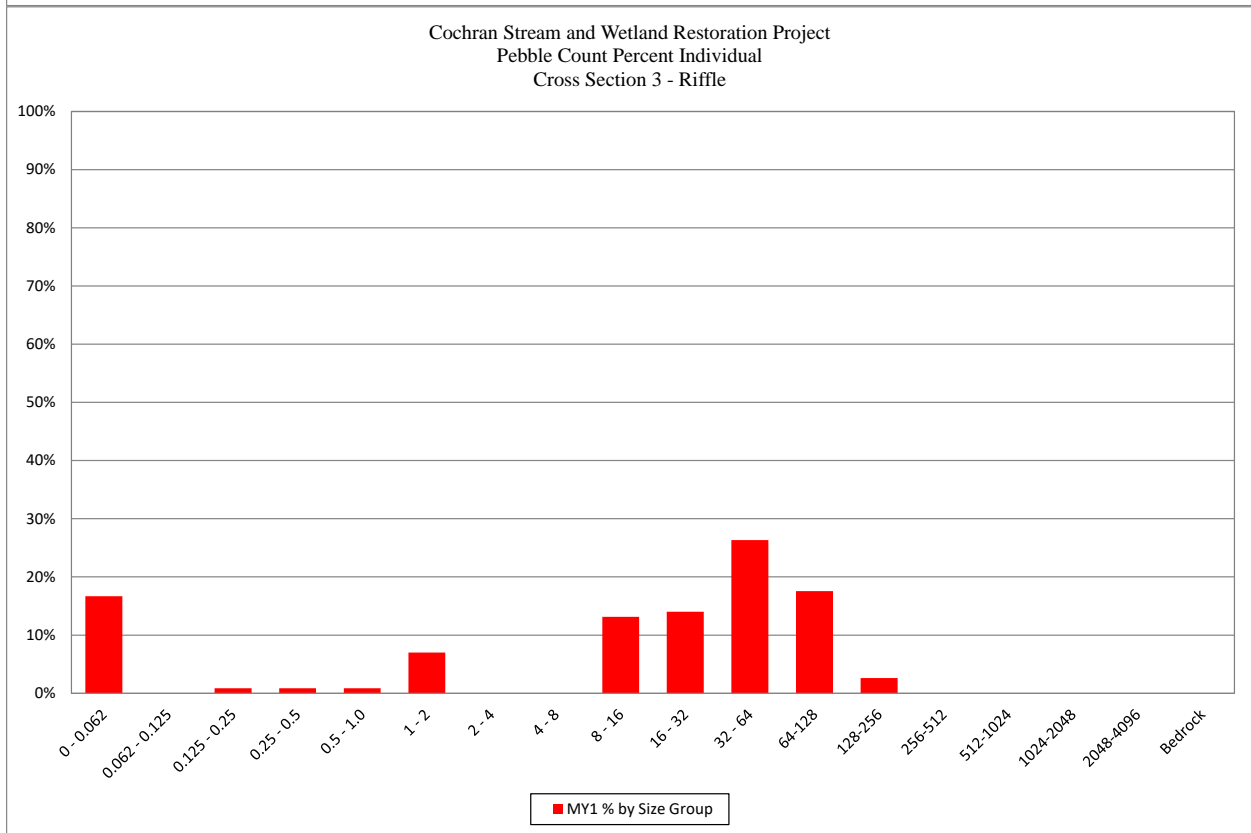
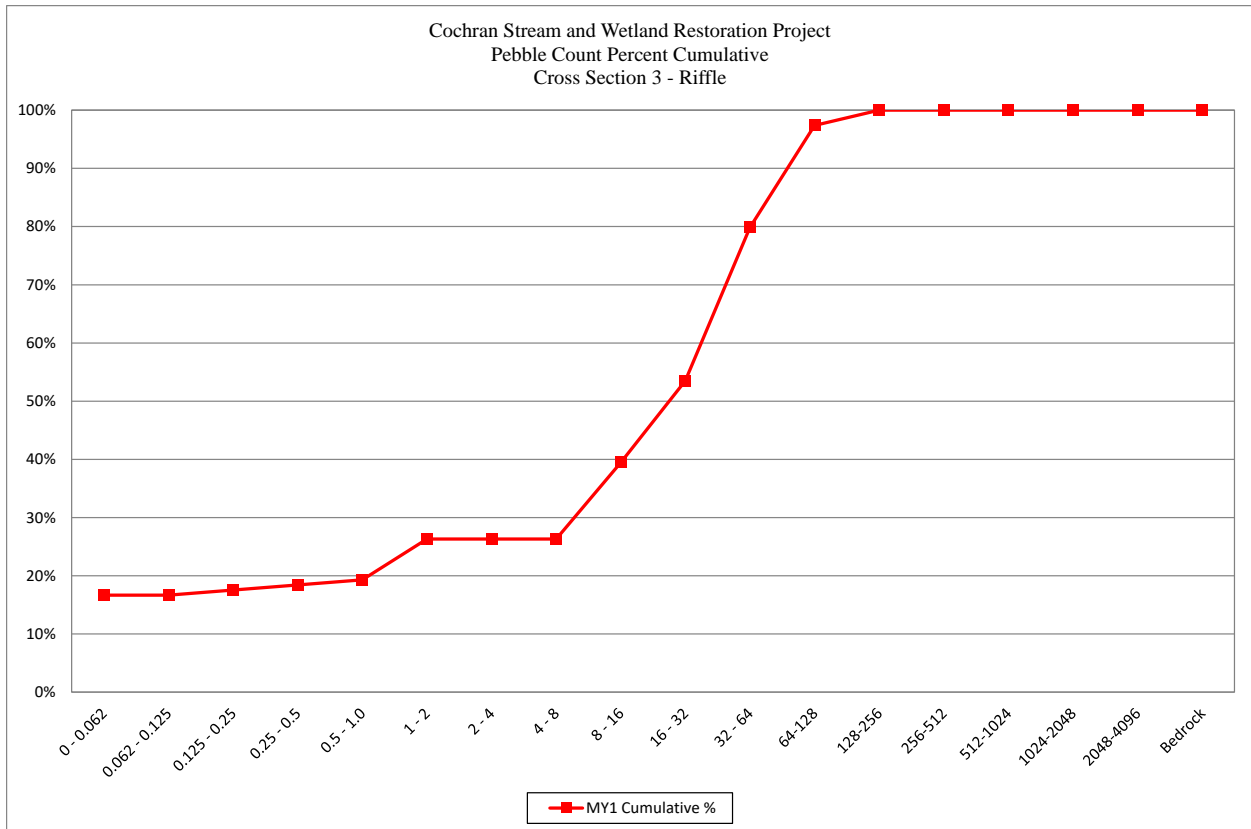


Right Descending Bank

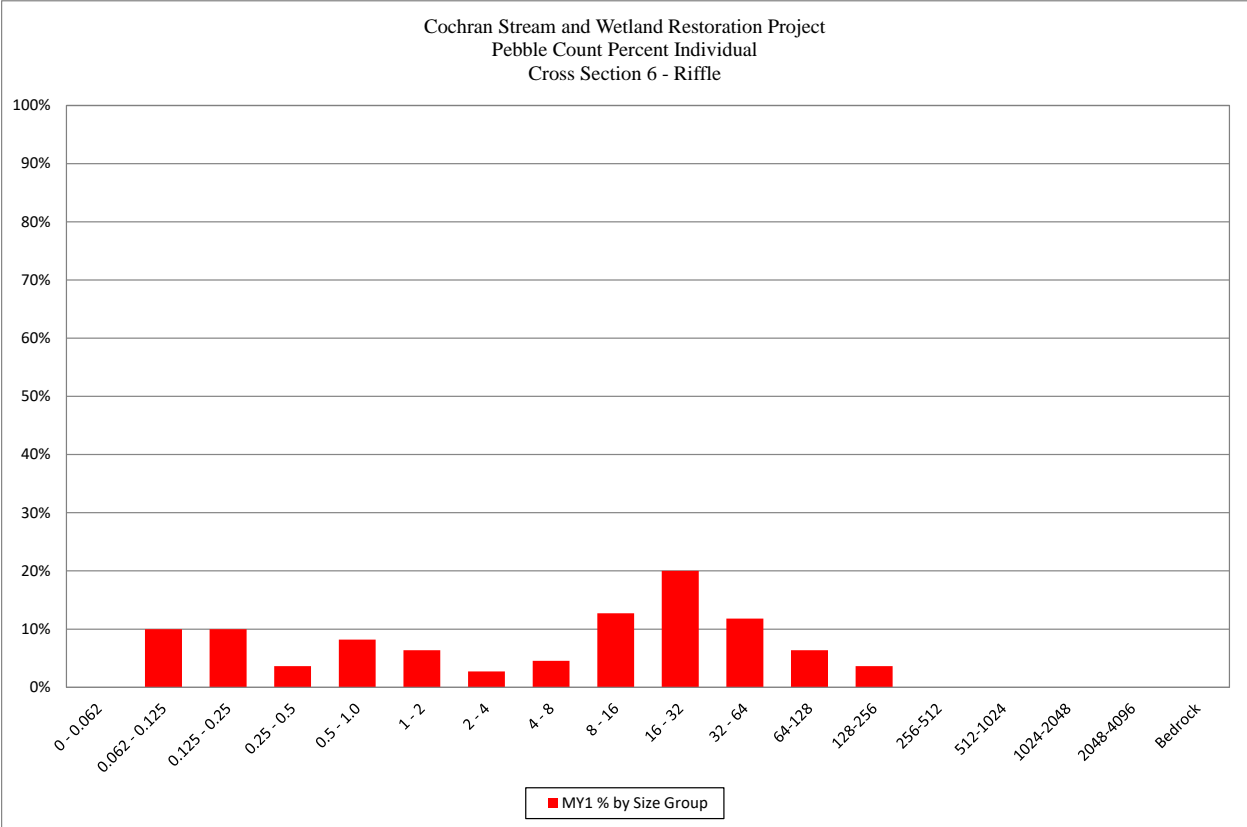
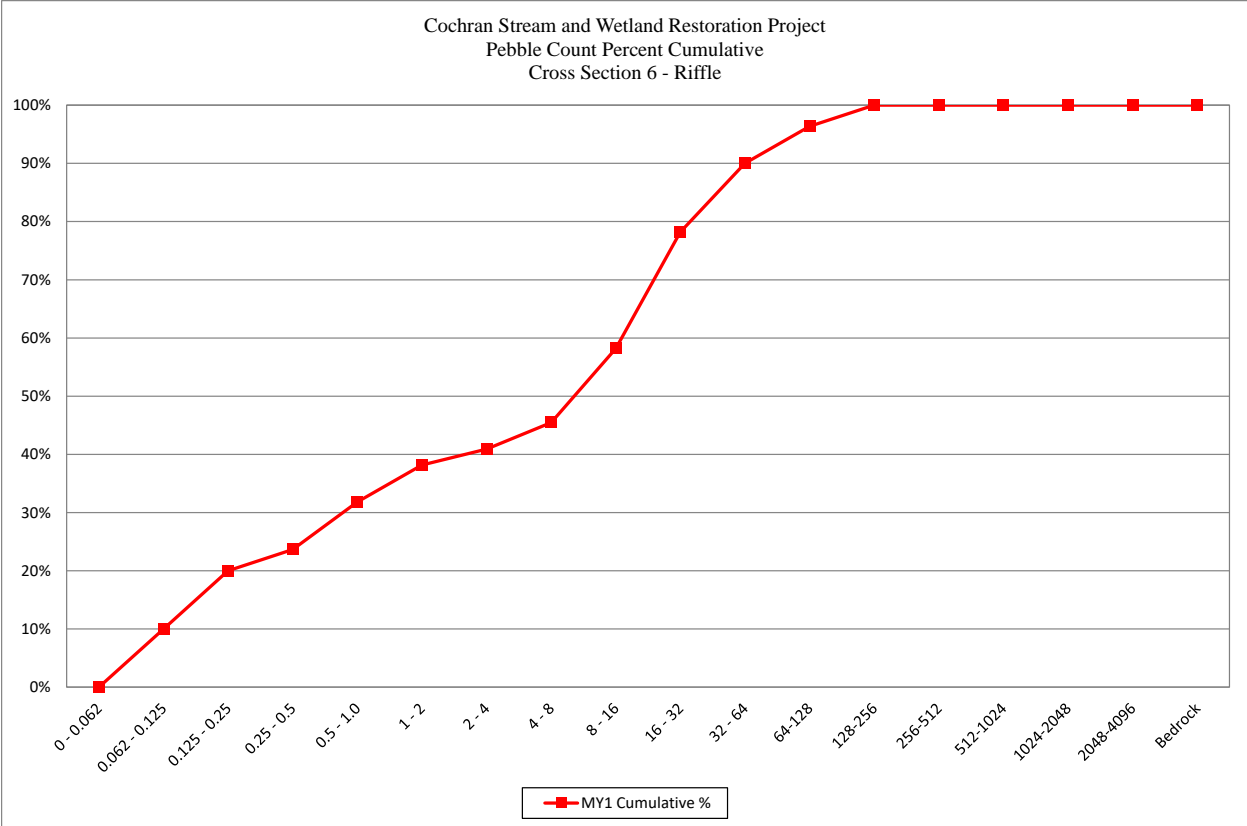
| Cochran | | | |
|--|---------------|-------------------------|-------------------------|
| Cross Section 2 - Riffle | | | |
| Monitoring Year - 2015; MY1 | | | |
| Bed Surface Material Particle Size Class (mm) | Number | % Individual | % Cumulative |
| 0 - 0.062 | 4 | 3.7% | 4% |
| 0.062 - 0.125 | 18 | 16.8% | 21% |
| 0.125 - 0.25 | 11 | 10.3% | 31% |
| 0.25 - 0.5 | 5 | 4.7% | 36% |
| 0.5 - 1.0 | 9 | 8.4% | 44% |
| 1 - 2 | 14 | 13.1% | 57% |
| 2 - 4 | 1 | 0.9% | 58% |
| 4 - 8 | 11 | 10.3% | 68% |
| 8 - 16 | 5 | 4.7% | 73% |
| 16 - 32 | 15 | 14.0% | 87% |
| 32 - 64 | 10 | 9.3% | 96% |
| 64-128 | 2 | 1.9% | 98% |
| 128-256 | 2 | 1.9% | 100% |
| 256-512 | 0 | 0.0% | 100% |
| 512-1024 | 0 | 0.0% | 100% |
| 1024-2048 | 0 | 0.0% | 100% |
| 2048-4096 | 0 | 0.0% | 100% |
| Bedrock | 0 | 0.0% | 100% |
| Total | 107 | 100% | 100% |
| | | Summary Data | |
| | | D50 | 1.4 |
| | | D84 | 26 |
| | | D95 | 57 |



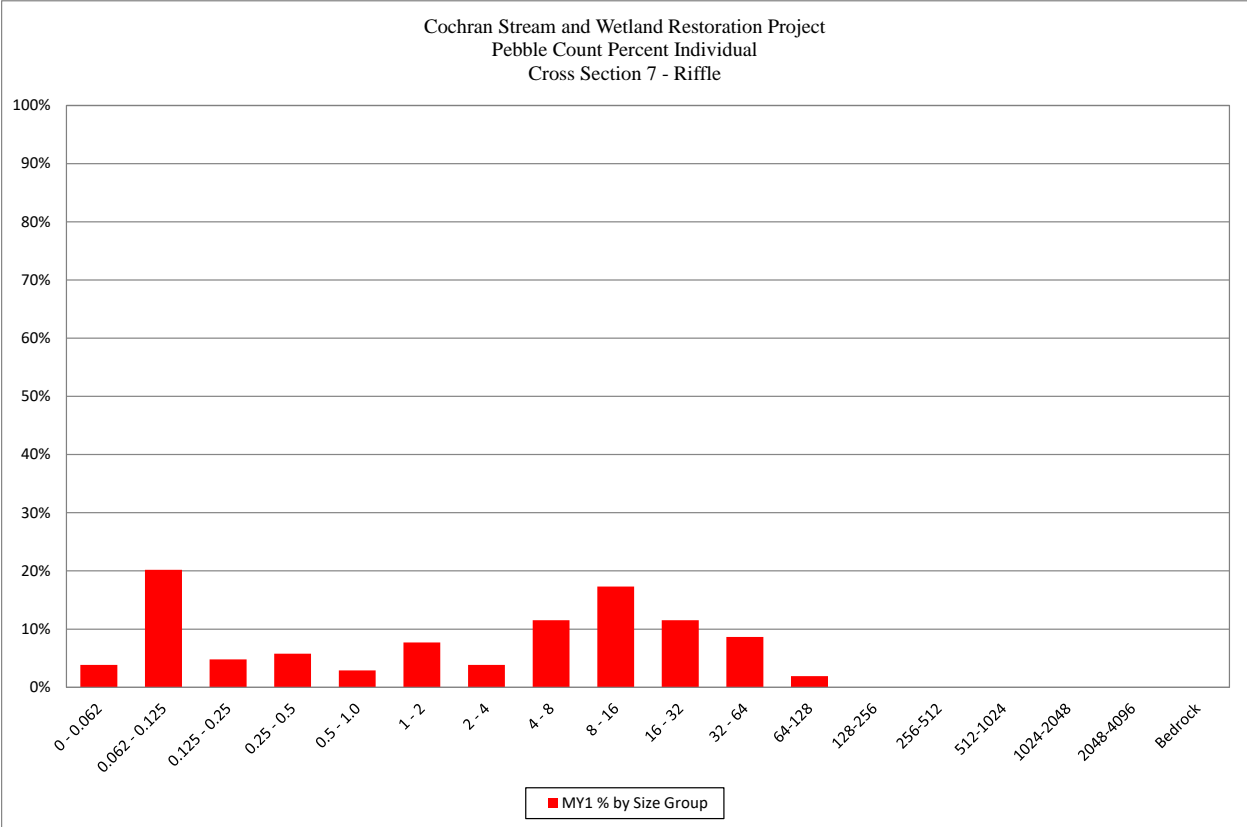
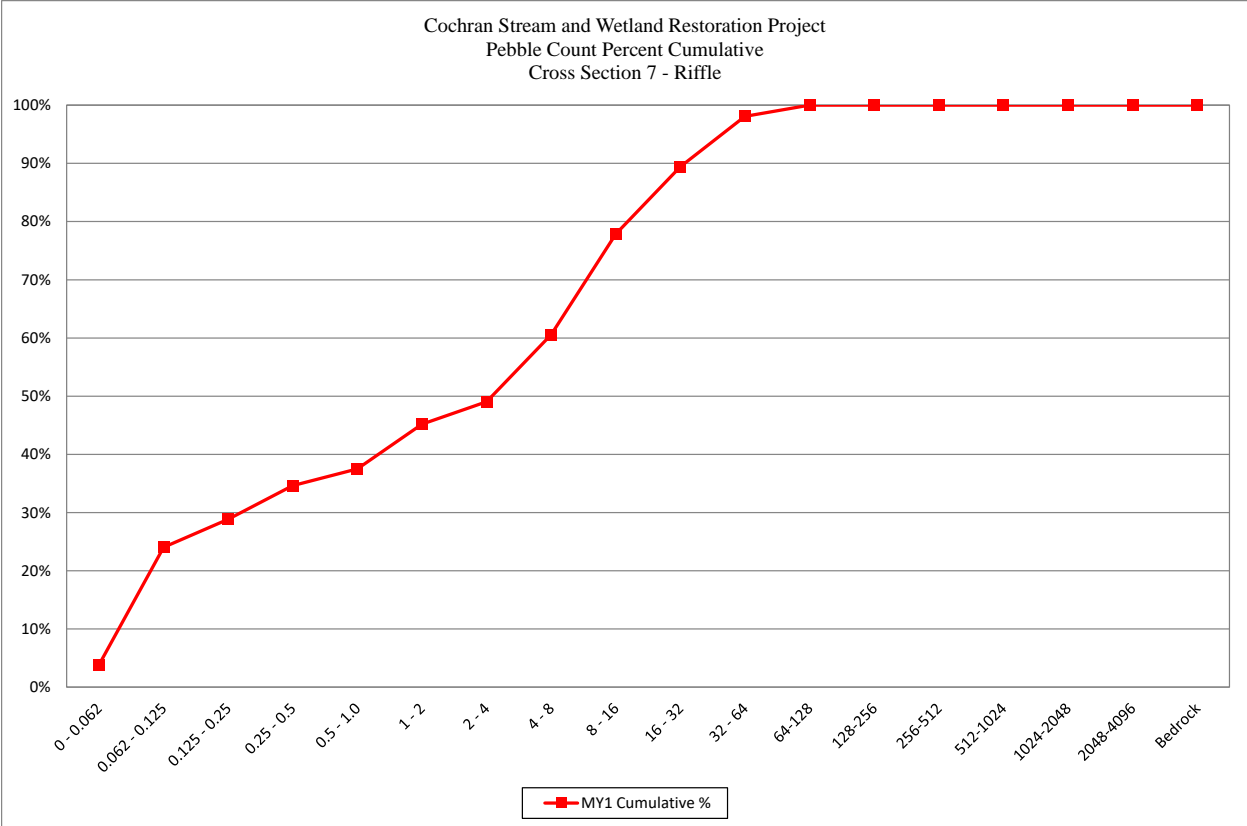
| Cochran | | | |
|--|---------------|-------------------------|-------------------------|
| Cross Section 3 - Riffle | | | |
| Monitoring Year - 2015; MY1 | | | |
| Bed Surface Material Particle Size Class (mm) | Number | % Individual | % Cumulative |
| 0 - 0.062 | 19 | 16.7% | 17% |
| 0.062 - 0.125 | 0 | 0.0% | 17% |
| 0.125 - 0.25 | 1 | 0.9% | 18% |
| 0.25 - 0.5 | 1 | 0.9% | 18% |
| 0.5 - 1.0 | 1 | 0.9% | 19% |
| 1 - 2 | 8 | 7.0% | 26% |
| 2 - 4 | 0 | 0.0% | 26% |
| 4 - 8 | 0 | 0.0% | 26% |
| 8 - 16 | 15 | 13.2% | 39% |
| 16 - 32 | 16 | 14.0% | 54% |
| 32 - 64 | 30 | 26.3% | 80% |
| 64-128 | 20 | 17.5% | 97% |
| 128-256 | 3 | 2.6% | 100% |
| 256-512 | 0 | 0.0% | 100% |
| 512-1024 | 0 | 0.0% | 100% |
| 1024-2048 | 0 | 0.0% | 100% |
| 2048-4096 | 0 | 0.0% | 100% |
| Bedrock | 0 | 0.0% | 100% |
| Total | 114 | 100% | 100% |
| Summary Data | | | |
| D50 | | 28 | |
| D84 | | 71 | |
| D95 | | 110 | |



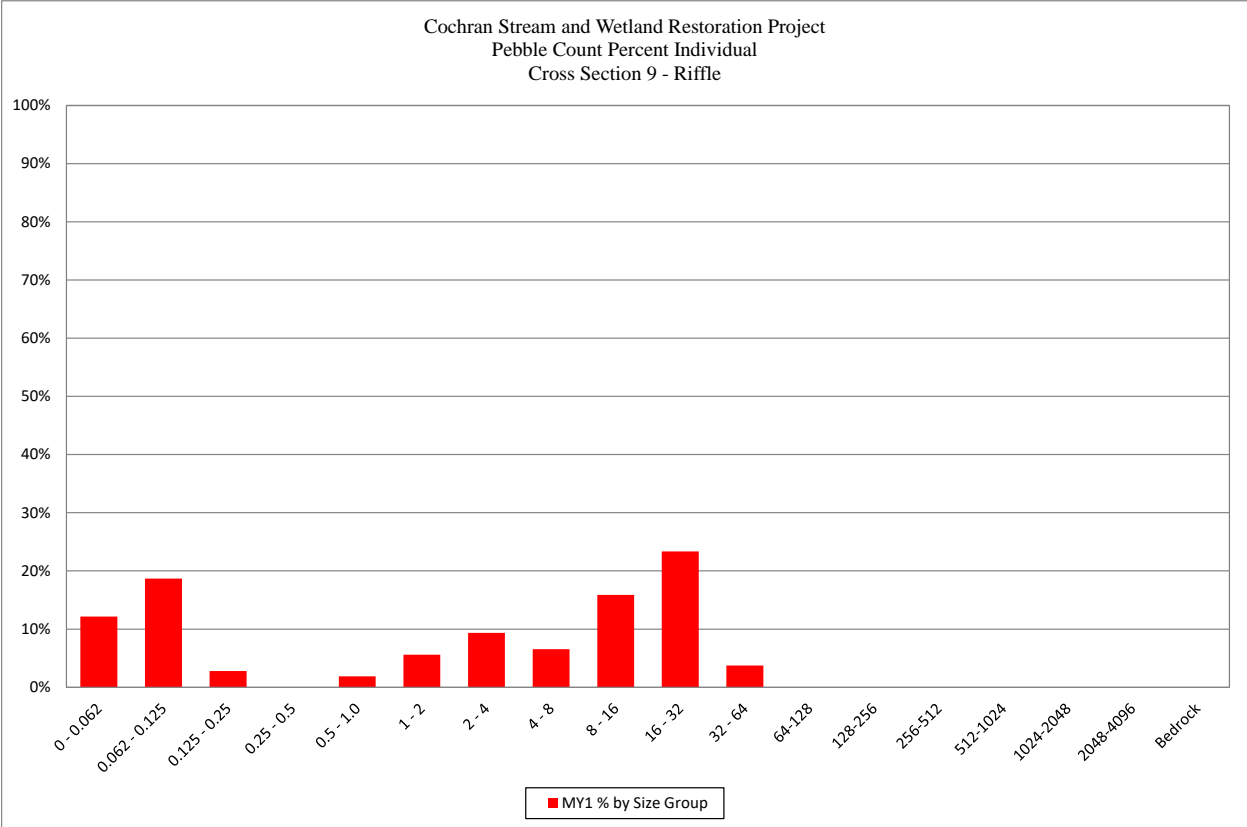
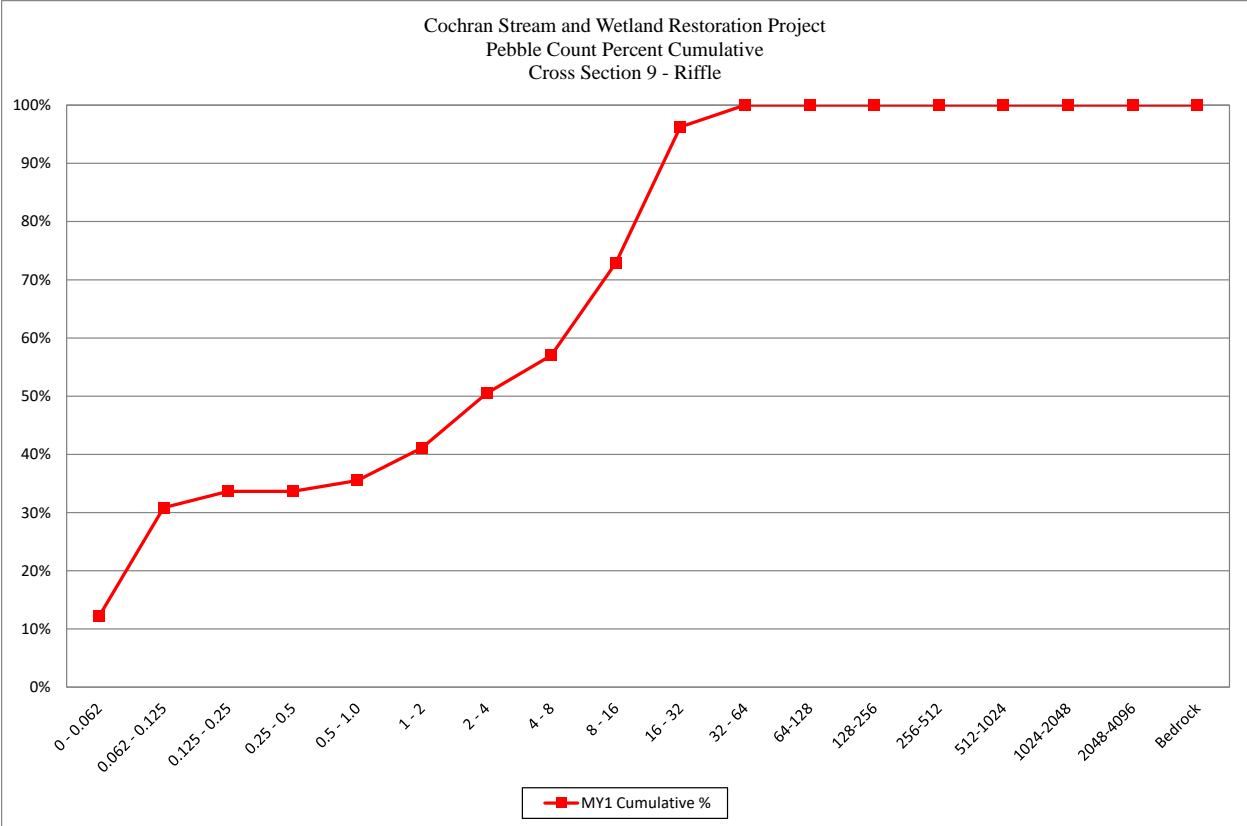
| Cochran | | | |
|--|---------------|-------------------------|-------------------------|
| Cross Section 6 - Riffle | | | |
| Monitoring Year - 2015; MY1 | | | |
| Bed Surface Material Particle Size Class (mm) | Number | % Individual | % Cumulative |
| 0 - 0.062 | 0 | 0.0% | 0% |
| 0.062 - 0.125 | 11 | 10.0% | 10% |
| 0.125 - 0.25 | 11 | 10.0% | 20% |
| 0.25 - 0.5 | 4 | 3.6% | 24% |
| 0.5 - 1.0 | 9 | 8.2% | 32% |
| 1 - 2 | 7 | 6.4% | 38% |
| 2 - 4 | 3 | 2.7% | 41% |
| 4 - 8 | 5 | 4.5% | 45% |
| 8 - 16 | 14 | 12.7% | 58% |
| 16 - 32 | 22 | 20.0% | 78% |
| 32 - 64 | 13 | 11.8% | 90% |
| 64-128 | 7 | 6.4% | 96% |
| 128-256 | 4 | 3.6% | 100% |
| 256-512 | 0 | 0.0% | 100% |
| 512-1024 | 0 | 0.0% | 100% |
| 1024-2048 | 0 | 0.0% | 100% |
| 2048-4096 | 0 | 0.0% | 100% |
| Bedrock | 0 | 0.0% | 100% |
| Total | 110 | 100% | 100% |
| Summary Data | | | |
| | D50 | 11 | |
| | D84 | 42 | |
| | D95 | 120 | |



| Cochran | | | |
|--|---------------|-------------------------|-------------------------|
| Cross Section 7 - Riffle | | | |
| Monitoring Year - 2015; MY1 | | | |
| Bed Surface Material Particle Size Class (mm) | Number | % Individual | % Cumulative |
| 0 - 0.062 | 4 | 3.8% | 4% |
| 0.062 - 0.125 | 21 | 20.2% | 24% |
| 0.125 - 0.25 | 5 | 4.8% | 29% |
| 0.25 - 0.5 | 6 | 5.8% | 35% |
| 0.5 - 1.0 | 3 | 2.9% | 38% |
| 1 - 2 | 8 | 7.7% | 45% |
| 2 - 4 | 4 | 3.8% | 49% |
| 4 - 8 | 12 | 11.5% | 61% |
| 8 - 16 | 18 | 17.3% | 78% |
| 16 - 32 | 12 | 11.5% | 89% |
| 32 - 64 | 9 | 8.7% | 98% |
| 64-128 | 2 | 1.9% | 100% |
| 128-256 | 0 | 0.0% | 100% |
| 256-512 | 0 | 0.0% | 100% |
| 512-1024 | 0 | 0.0% | 100% |
| 1024-2048 | 0 | 0.0% | 100% |
| 2048-4096 | 0 | 0.0% | 100% |
| Bedrock | 0 | 0.0% | 100% |
| Total | 104 | 100% | 100% |
| Summary Data | | | |
| D50 | | 4.3 | |
| D84 | | 24 | |
| D95 | | 41 | |



| Cochran | | | |
|--|---------------|-------------------------|-------------------------|
| Cross Section 9 - Riffle | | | |
| Monitoring Year - 2015; MY1 | | | |
| Bed Surface Material Particle Size Class (mm) | Number | % Individual | % Cumulative |
| 0 - 0.062 | 13 | 12.1% | 12% |
| 0.062 - 0.125 | 20 | 18.7% | 31% |
| 0.125 - 0.25 | 3 | 2.8% | 34% |
| 0.25 - 0.5 | 0 | 0.0% | 34% |
| 0.5 - 1.0 | 2 | 1.9% | 36% |
| 1 - 2 | 6 | 5.6% | 41% |
| 2 - 4 | 10 | 9.3% | 50% |
| 4 - 8 | 7 | 6.5% | 57% |
| 8 - 16 | 17 | 15.9% | 73% |
| 16 - 32 | 25 | 23.4% | 96% |
| 32 - 64 | 4 | 3.7% | 100% |
| 64-128 | 0 | 0.0% | 100% |
| 128-256 | 0 | 0.0% | 100% |
| 256-512 | 0 | 0.0% | 100% |
| 512-1024 | 0 | 0.0% | 100% |
| 1024-2048 | 0 | 0.0% | 100% |
| 2048-4096 | 0 | 0.0% | 100% |
| Bedrock | 0 | 0.0% | 100% |
| Total | 107 | 100% | 100% |
| Summary Data | | | |
| D50 | | 3.9 | |
| D84 | | 21 | |
| D95 | | 30 | |



Appendix E

Hydrologic Data

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| Table 13. Verification of Bankfull Events Cochran Stream and Wetland Restoration Project | | | | |
|---|----------------------|-------------|-------------------------------|------------------------|
| Date of Data Collection | Date of Occurrence | Method | Feet Above Bankfull Elevation | Photo # (if available) |
| Cochran Branch | | | | |
| 12/29/2015 | Unknown ¹ | Crest Gauge | 0.86 | |
| 3/24/2016 | Unknown ² | Crest Gauge | 0.68 | 1 |
| 8/17/2016 | Unknown ³ | Crest Gauge | 0.58 | 2 |
| | | | | |
| Parrish Branch | | | | |
| None Since Construction Completed | | | | |
| | | | | |
| | | | | |
| | | | | |

¹Potential Date is 12/24/2015
²Potential Date is 2/3/2016
³Potential Date is 7/15/2016

Photo Verification of Bankfull Events



Photo #1 - Cochran Branch Crest Gauge



Photo #2 – Cochran Branch Crest Gauge

Figure 3. Daily Precipitation Totals for the Cochran Stream and Wetland Restoration Site Project

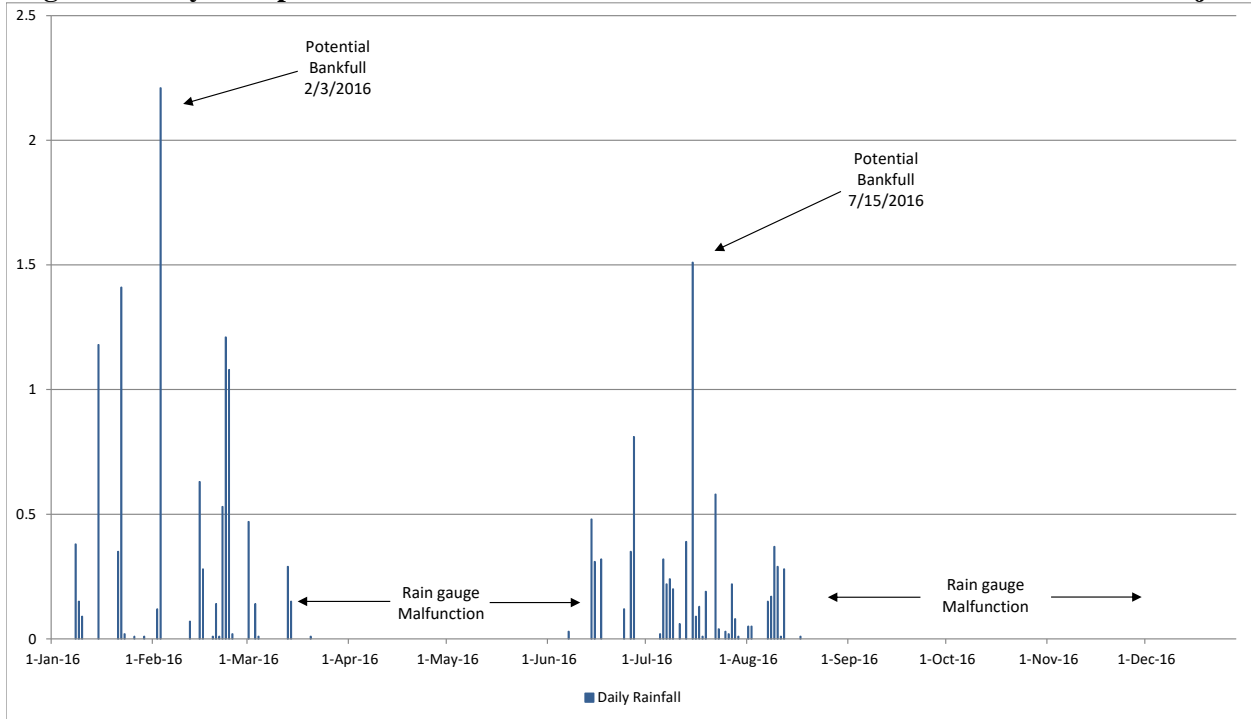
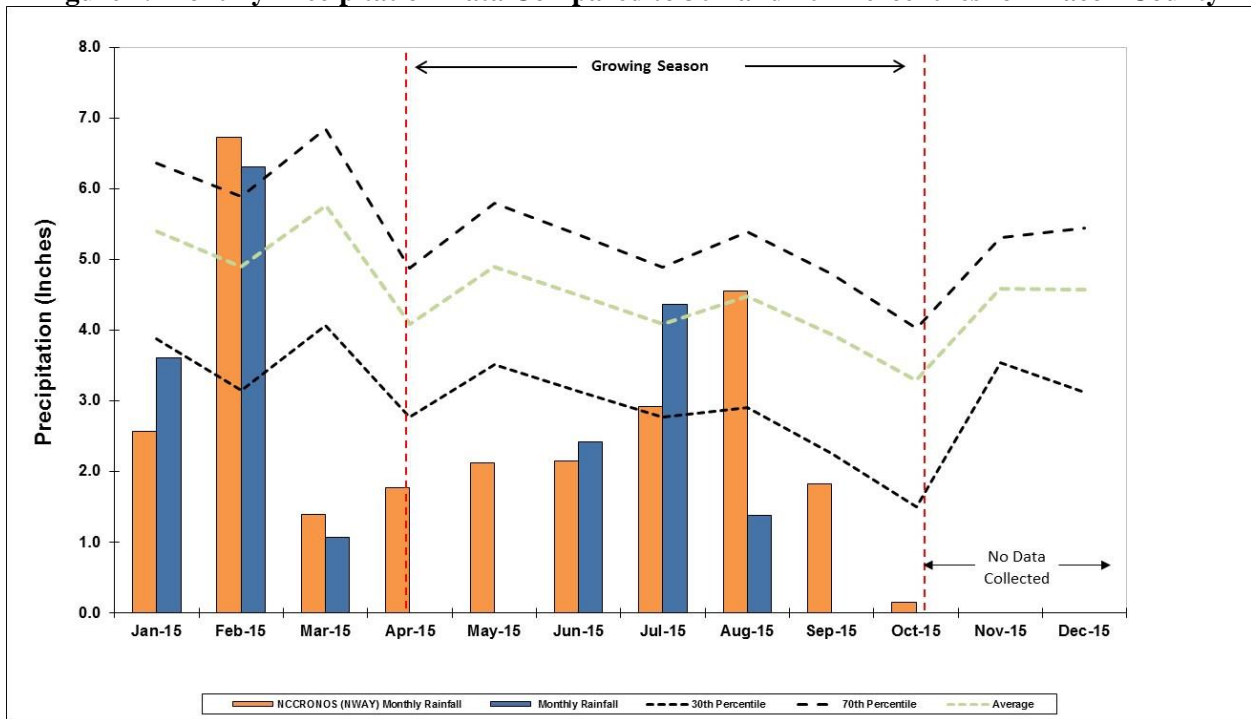


Figure 4. Monthly Precipitation Data Compared to 30th and 70th Percentiles for Macon County



**Table 14. Wetland Gauge 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 (2020) | Year 7 (2021) |
| GW-1 | Yes/ 18 13.6% | Yes/ 40 21.4% | | | | | |
| GW-2 | Yes/ 132 100% | Yes/ 187 100% | | | | | |
| GW-3 | Yes/ 132 100% | Yes/ 187 100% | | | | | |
| GW-4 | Yes/ 132 100% | Yes/ 187 100% | | | | | |
| GW-5 | Yes/ 132 100% | Yes/ 187 100% | | | | | |
| GW-6 | Yes/ 132 100% | Yes/ 187 100% | | | | | |
| GW-7 | Yes/ 132 100% | Yes/ 187 100% | | | | | |
| GW-8 | Yes/ 132 100% | Yes/ 187 100% | | | | | |

Hydrology Success Criteria = 8%; Growing season = 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

