

Annual Monitoring Report

Monitoring Year 1 of 7

FINAL

Cochran Stream and Wetland Restoration Site

NCDMS Contract No.: 004947

NCDMS Project No.: 95720

Macon County, NC

Data Collected: December 2015

Date Submitted: January 2016



Submitted to:

North Carolina Division of Mitigation Services

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

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Prepared for:



302 Jefferson Street, Suite 110
Raleigh, North Carolina 27605

Prepared by:



EQUINOX

balance through proper planning

37 Haywood Street, Suite 100
Asheville, North Carolina 28801

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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 distribution of bed materials in riffles and finer size class distribution in pools. The majority of riffle pebble counts should indicate maintenance or coarsening of substrate 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 the 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 15 consecutive days or more 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 NC Division of Water Quality (DWQ) 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 plant (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 1 (MY1) data was collected during December 2015. Monitoring activities included visual assessment of all reaches and the surrounding easement, collection of images at eight permanent photo stations, inventory of eight permanent vegetation monitoring plots, surveying of nine cross-sections, and conducting five pebble counts.

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. Several remaining populations of Chinese privet (*Ligustrum sinense*) were treated during June 2015. Follow-up treatments for Chinese privet will be performed during the winter of 2015-2016. Planted stems were difficult to assess across the site during leaf-off condition. Viability of planted stems will be monitored in subsequent site visits.

Monitoring of the permanent vegetation plots (n = 8; VP) was completed during December 2015. Summary tables and photographs associated with MY1 monitoring are located in Appendix C. MY1 monitoring data indicates that all but VP-6 are on track to meet the MY3 interim success criteria of 320

planted stems per acre. Vegetation Plot 6 had a density of 121 planted stems per acre, well below the Year 5 and Year 3 target densities of 260 and 320 planted stems per acre, respectively. Planted stem densities among plots ranged from 121 to 769 planted stems per acre with an annual mean of 582 planted stems per acre across all plots. A total of 10 species were documented within the plots. When volunteer stems are included, the mean annual total stems per acre rose to 597 and ranged between 121 and 769 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. This area will be replanted during spring 2016.

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 (Table 5 and Figure 2).

Geomorphic data for MY1 was collected during December 2015. Summary tables and cross-section plots related to stream morphology are located in Appendix D. Noticeable change in the cross-section data between MY0 and MY1 were limited to pool cross-sections 1 and 4, where deposition and scour, respectively, led to slight changes in the maximum pool depth (Appendix B, Table 11a). These changes are relatively minor and do not exceed expectations of adjustments within the channel, particularly for the first year of monitoring. As expected pebble counts indicate that riffles contain coarser substrate than pools. The riffle D_{50} fell into the very coarse sand to medium gravel size class for Cochran 1b and very fine gravel to fine gravel for Parrish Branch. Substrate will be monitored in future years for shifts in particle size composition.

The bank pin arrays indicate that no erosion is taking place in the pools. All bankpins were buried under soft accretions of sediment. Documented shifts in stream morphology do not exceed expectations between MY0 and MY1 as the constructed stream adjusts to conditions at the site. The project is meeting success criteria regarding stable cross-section dimensions as well as substrate size composition, and sediment transport.

1.4.3. Groundwater and Stream Hydrology

During MY1, all eight of the groundwater monitoring wells met the 8% hydroperiod success criteria (Table 13). Due to the fact that the baseline monitoring setup and MY1 data collection occurred during the same year, hydrologic data was collected for only 132 days of the 187 day growing season. Calculations of the maximum hydroperiod were based on the full growing season; however, as a result of the shortened data collection period, the maximum number of consecutive days within 12 inches of the ground surface is limited to 132 days. All monitoring wells still met the 8% hydroperiod success criteria. Hydroperiods among the monitoring wells ranged from 13.6% to 100%.

During a December 2015 site visit, one bankfull event was recorded on Cochran Branch (mainstem), at 0.86 feet above bankfull (Table 12). This is the first bankfull event since project completion.

2.0 METHODS

For MY1, visual assessment was performed during the geomorphic and vegetation data collection event. For future monitoring years, visual assessment of the project will be performed at the beginning and end of each monitoring year. Permanent photo station photos were collected during the geomorphic data collection event; however for future monitoring years, permanent photo station photos will be taken

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 were collected in the field and geo-referenced (NAD83 State Plane feet FIPS 3200). Morphological data were 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 are 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

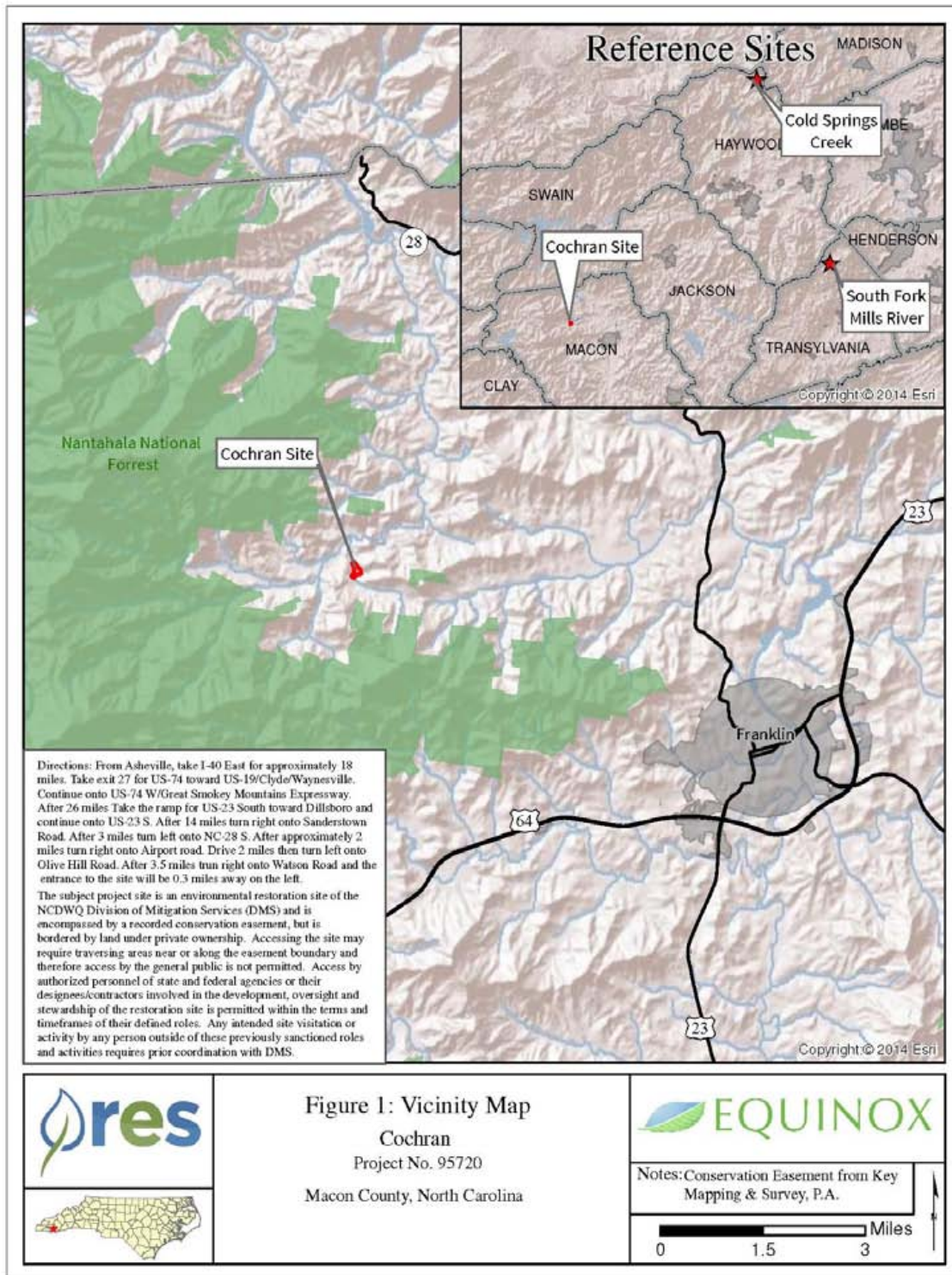
Environmental Banc & Exchange, LLC. 2014. Cochran Branch, Final Mitigation Plan, Macon County, North Carolina. NCEEP Project No. 95720

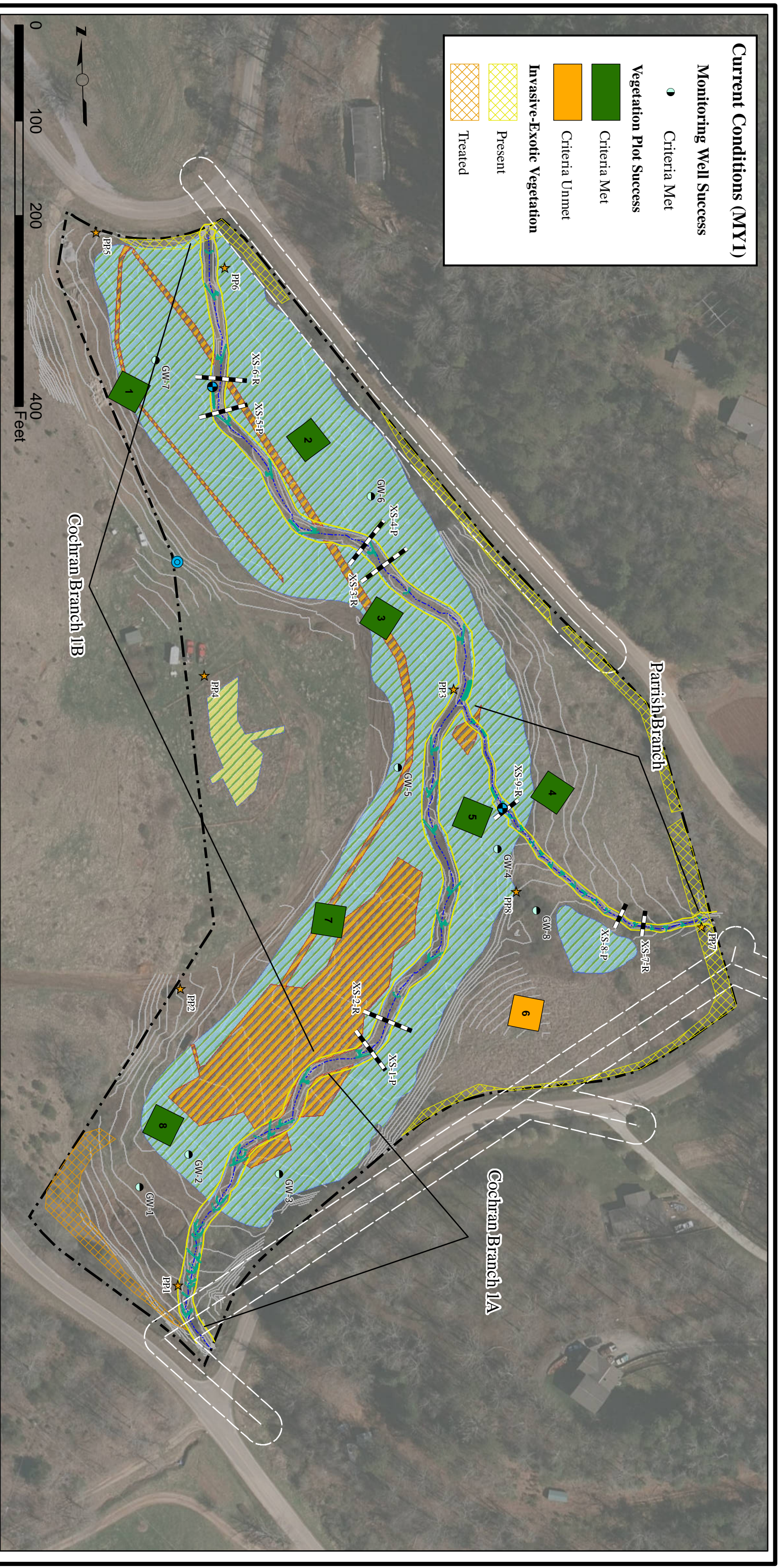
Harrelson, Cheryl, C. Rawlins and J. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. Gen. Tech. Rep. RM-245. Rocky Mountain Forest and Range Experiment Station. USDA Forest Service. Fort Collins, Colorado

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.

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Appendix A
General Tables and Figures





Current Conditions (MY1)

- Monitoring Well Success
 - Criteria Met
 - Criteria Unmet
- Vegetation Plot Success
 - Criteria Met
 - Criteria Unmet
- Invasive-Exotic Vegetation
 - Present
 - Treated

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

December 2015

| | | | |
|--|------------------|--|--------------------|
| | Crest Gauge | | Thalweg (As-Built) |
| | Rain Gauge | | Top of Bank |
| | Monitoring Well | | Duke ROW |
| | Photo Points | | Contour |
| | Cross-Section... | | Easement |

| | | | |
|--|------------------|--|--------------------|
| | Enhancement | | Hook-Log Run |
| | Re-establishment | | Hook Run |
| | Re-habilitation | | Log Vane with Hook |
| | | | Log Sill |
| | | | Boulder Shelf |
| | | | Brush Toe |
| | | | Armored Rifle |

Notes:
 1) This is not a survey and should not be construed as such.
 2) Baseline Data Provided by Kee Mapping
 3) Orthomagey 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 crossings and exclusions.

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 |
| Year 2 Monitoring | | |
| 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-MY1)- 2015 - 2016 | Equinox Environmental 37 Haywood St. Asheville, North Carolina 28802 Hunter Terrell (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 | 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). | Cross Hatch (Red - Dense/Yellow - Present) | 5 | 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

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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 Restoration Project | |
|---|---|
| Report Prepared By | Drew Alderman |
| Date Prepared | 12/7/2015 17:20 |
| | |
| database name | RES_95720_2015_A_Cochran_MY1.mdb |
| database location | Z:\ES\NRI&M\EBX Monitoring\Cochran\MY1-2014\Data\Veg |
| computer name | FIELD-PC |
| file size | 59998208 |
| | |
| | |
| 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 (MY1 2015) | | | | | | | | | | | | | | | | |
|---|---------------------------|----------------|------------------------------|-------|--------|--------|--------|-----|--------|-------|--------|--------|--------|------|--------|-------|--------|--------|-------|
| | | | Plot 1 | | Plot 2 | | Plot 3 | | Plot 4 | | Plot 5 | | Plot 6 | | Plot 7 | | Plot 8 | | |
| | | | Pnol,S | P-all | T | Pnol,S | P-all | T | Pnol,S | P-all | T | Pnol,S | P-all | T | Pnol,S | P-all | T | Pnol,S | P-all |
| Acer rubrum var. rubrum | Red maple | Tree | 1 | 1 | 1 | | | | | | | | | | | | | | |
| Betula nigra | River birch | Tree | 1 | 1 | 1 | 4 | 4 | 4 | 2 | 2 | 2 | | | | | | | | |
| Fraxinus pennsylvanica | Green ash | Tree | | | | | | | | | | | | | | | | | |
| Liriodendron tulipifera var. tulipifera | Tulip-tree, Yellow Poplar | Tree | 2 | 2 | 2 | | | | | | | | | | | | | | |
| Platanus occidentalis var. occidentalis | Sycamore, Plane-tree | Tree | 3 | 3 | 3 | 10 | 10 | 10 | 6 | 6 | 6 | 8 | 8 | 8 | 10 | 10 | 10 | 2 | 2 |
| Quercus | Oak | Tree | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | | | | |
| Quercus michauxii | Swamp chestnut oak | Tree | 2 | 2 | 2 | | | | 2 | 2 | 2 | | | | | | | | |
| Quercus nigra | Water oak | Tree | | | | | | | | | | 2 | 2 | 2 | | | | | |
| Quercus phellos | Willow oak | Tree | 3 | 3 | 3 | | | | | | | 1 | 1 | 1 | | | | | |
| Quercus rubra var. rubra | Northern red oak | Tree | | | | | | | | | | | | | | | | | |
| Salix nigra | Black willow | Tree | | | | 3 | | | | | | | | | | | | | |
| Unknown | Black willow | Shrub or Tree | | | | | | | | | | | | | | | | | |
| | | Stem count | 15 | 15 | 18 | 17 | 17 | 17 | 11 | 11 | 11 | 19 | 19 | 19 | 18 | 18 | 18 | 3 | 3 |
| | | size (ares) | 1 | 1 | 1 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | size (ACRES) | 0.02 | 0.02 | 0.02 | | | | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| | | Species count | 7 | 7 | 8 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 3 | 3 | 3 | 2 | 2 |
| | | Stems per ACRE | 607 | 607 | 728 | 688 | 688 | 688 | 445 | 445 | 445 | 769 | 769 | 769 | 728 | 728 | 728 | 121 | 121 |

¹Pnol,S: No livestock 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 | | | | | | | | | | | | | | | | |
|---|---------------------------|----------------|--------------|-------|------------|--------|------------|------|------------|-------|------|--|--|--|--|--|--|--|--|
| | | | MY1 (2015) | | MY0 (2015) | | MY1 (2015) | | MY0 (2015) | | | | | | | | | | |
| | | | Pnol,S | P-all | T | Pnol,S | P-all | T | Pnol,S | P-all | T | | | | | | | | |
| Acer rubrum var. rubrum | Red maple | Tree | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | | | | | | | | |
| Betula nigra | River birch | Tree | 14 | 14 | 14 | 16 | 16 | 16 | 16 | 16 | 16 | | | | | | | | |
| Fraxinus pennsylvanica | Green ash | Tree | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | | | | |
| Liriodendron tulipifera var. tulipifera | Tulip-tree, Yellow Poplar | Tree | 10 | 10 | 10 | 27 | 27 | 27 | 27 | 27 | 27 | | | | | | | | |
| Platanus occidentalis var. occidentalis | Sycamore, Plane-tree | Tree | 45 | 45 | 45 | 48 | 48 | 48 | 48 | 48 | 48 | | | | | | | | |
| Quercus | Oak | Tree | 23 | 23 | 23 | 38 | 38 | 38 | 38 | 38 | 38 | | | | | | | | |
| Quercus michauxii | Swamp chestnut oak | Tree | 9 | 9 | 9 | 11 | 11 | 11 | 11 | 11 | 11 | | | | | | | | |
| Quercus nigra | Water oak | Tree | 3 | 3 | 3 | | | | | | | | | | | | | | |
| Quercus phellos | Willow oak | Tree | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 8 | | | | | | | | |
| Quercus rubra var. rubra | Northern red oak | Tree | | | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | |
| Salix nigra | Black willow | Tree | | | | 3 | | | | | | | | | | | | | |
| Unknown | Black willow | Shrub or Tree | | | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | |
| | | Stem count | 115 | 115 | 118 | 156 | 156 | 156 | 156 | 156 | 156 | | | | | | | | |
| | | size (ares) | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | | | | | | | | |
| | | size (ACRES) | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | | | | | | | | |
| | | Species count | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | | | | | | | |
| | | Stems per ACRE | 582 | 582 | 597 | 789 | 789 | 789 | 789 | 789 | 789 | | | | | | | | |

¹Pnol,S: No livestock 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
December 7, 2015



Cochran - Vegetation Monitoring Plot 2
December 7, 2015



Cochran - Vegetation Monitoring Plot 3
December 7, 2015



Cochran - Vegetation Monitoring Plot 4
December 7, 2015



Cochran - Vegetation Monitoring Plot 5
December 7, 2015



Cochran - Vegetation Monitoring Plot 6
December 7, 2015



Cochran - Vegetation Monitoring Plot 7
December 7, 2015



Cochran - Vegetation Monitoring Plot 8
December 7, 2015

Appendix D
Stream Geomorphology Data

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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) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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% | | | | | | | | | | | | | | | | | | | | | | | | | |
| d16 / d35 / d50 / d84 / d95 / di ^p / di ⁹⁰ (mm) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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) | | | | | | | | | | | | | | | | | | | | | | | | C4 | |
| Bankfull Discharge (cfs) | | | | | | | | | | | | | | | | | | | | | | | | 66.0 | |
| Valley Length (ft) | | | | | | | | | | | | | | | | | | | | | | | | 989 | |
| Channel Thalweg Length (ft) | | | | | | | | | | | | | | | | | | | | | | | | 416.7 | |
| Sinuosity | | | | | | | | | | | | | | | | | | | | | | | | 1.088 | |
| Water Surface Slope (ft/ft) | | | | | | | | | | | | | | | | | | | | | | | | 1.1 | |
| Bankfull Slope (ft/ft) | | | | | | | | | | | | | | | | | | | | | | | | 1.12 | |
| Bankfull Floodplain Area (acres) | | | | | | | | | | | | | | | | | | | | | | | | 0.0076 | |
| Proportion Over Wide (%) | | | | | | | | | | | | | | | | | | | | | | | | 0.0068 | |
| 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 | | | | | | | | | | | | | | | | | | | | | | | | | 91 |
| Stream Power (Transport Capacity) W/m ² | | | | | | | | | | | | | | | | | | | | | | | | | 45 |
| Additional Reach Parameters | | | | | | | | | | | | | | | | | | | | | | | | | |
| Drainage Area (mi ²) | | | | | | | | | | | | | | | | | | | | | | | | | 0.10 |
| Impervious Cover Estimate (%) | | | | | | | | | | | | | | | | | | | | | | | | | 2.77 |
| Rosgen Classification | | | | | | | | | | | | | | | | | | | | | | | | | B |
| Bankfull Velocity (fps) | | | | | | | | | | | | | | | | | | | | | | | | | 4.5 |
| Bankfull Discharge (cfs) | | | | | | | | | | | | | | | | | | | | | | | | | 123.0 |
| Valley Length (ft) | | | | | | | | | | | | | | | | | | | | | | | | | 380.0 |
| Channel Thalweg Length (ft) | | | | | | | | | | | | | | | | | | | | | | | | | 375 |
| Sinuosity | | | | | | | | | | | | | | | | | | | | | | | | | 400.0 |
| Water Surface Slope (ft/ft) | | | | | | | | | | | | | | | | | | | | | | | | | 394 |
| Bankfull Slope (ft/ft) | | | | | | | | | | | | | | | | | | | | | | | | | 375 |
| Bankfull Floodplain Area (acres) | | | | | | | | | | | | | | | | | | | | | | | | | 402 |
| Proportion Over Wide (%) | | | | | | | | | | | | | | | | | | | | | | | | | 1.07 |
| Entrenchment Class (ER Range) | | | | | | | | | | | | | | | | | | | | | | | | | 1.05 |
| Incision Class (BHR Range) | | | | | | | | | | | | | | | | | | | | | | | | | 0.033 |
| BEHI | | | | | | | | | | | | | | | | | | | | | | | | | 0.029 |
| Channel Stability or Habitat Metric | | | | | | | | | | | | | | | | | | | | | | | | | - |
| Biological or Other | | | | | | | | | | | | | | | | | | | | | | | | | - |

- Information unavailable.

Non-Applicable.

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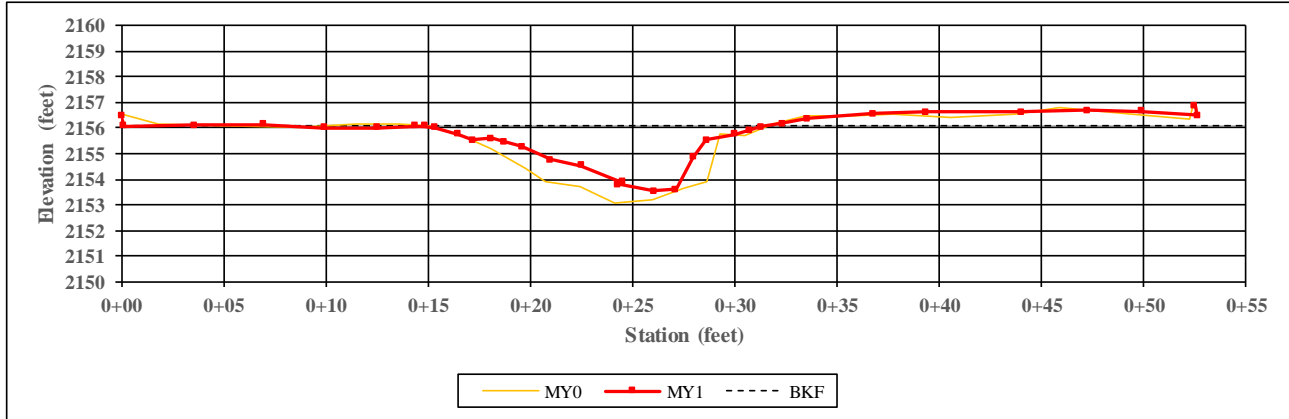
| Table 12. Cochran Stream and Wetland Restoration Project Bank Pin Arrays | | | | | |
|---|-----------------------------------|----------------|-----------------|-------------------------|-------------------------|
| Cross Section Number | Length of Exposed Pin (mm) | | | | |
| | Downstream | Middle | 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

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

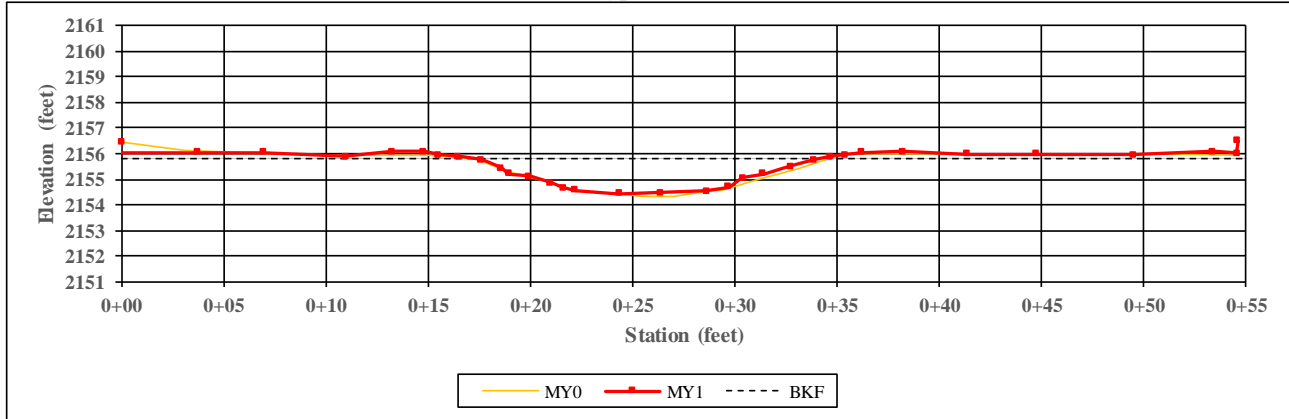


Right Descending Bank

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

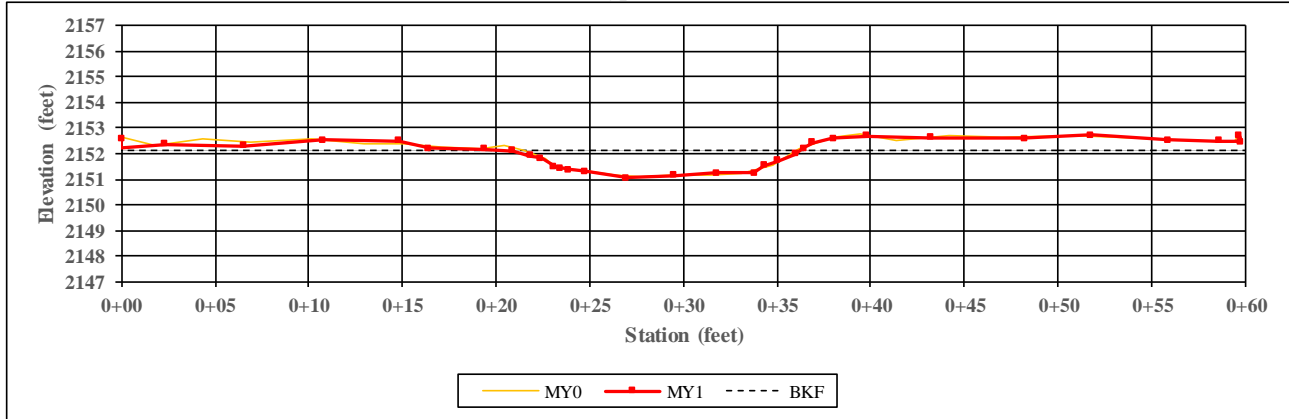


Right Descending Bank

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

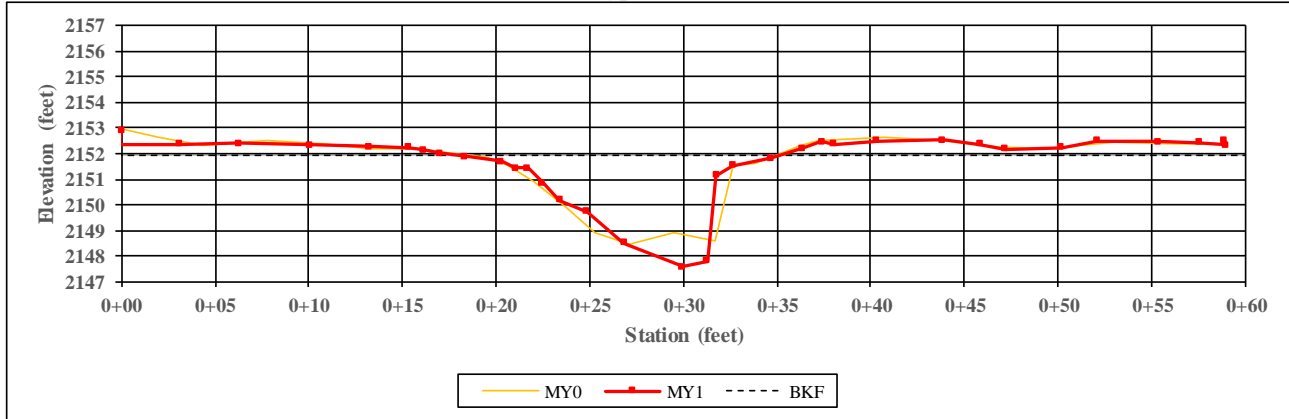


Right Descending Bank

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

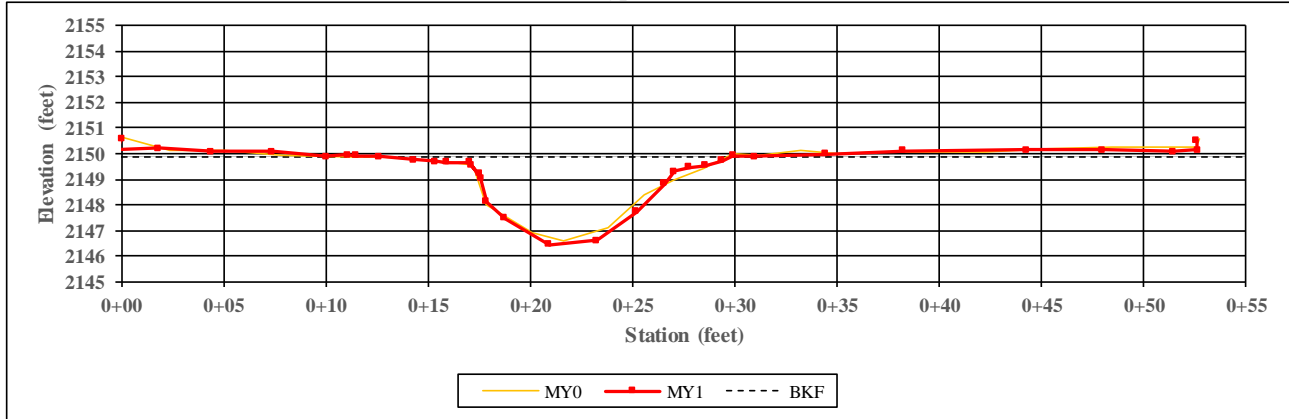


Right Descending Bank

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

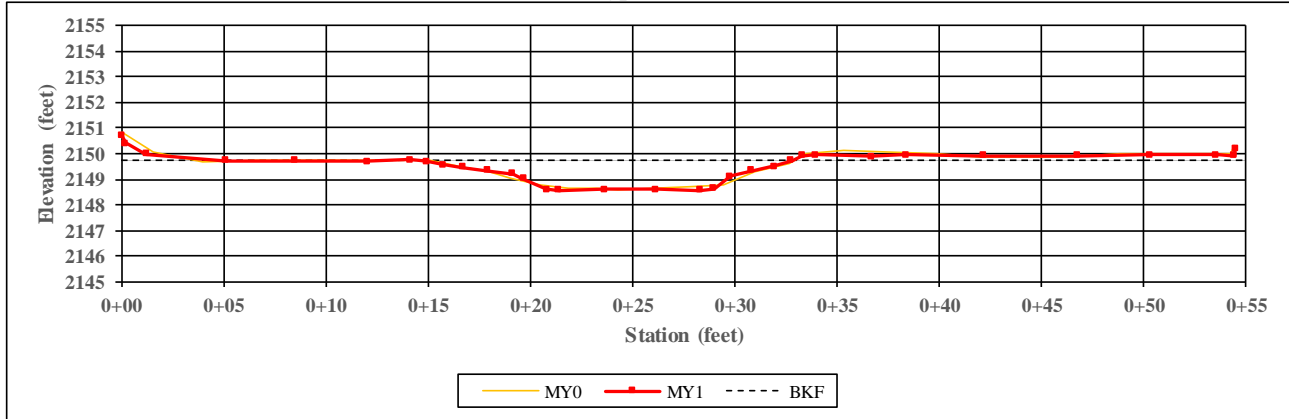


Right Descending Bank

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

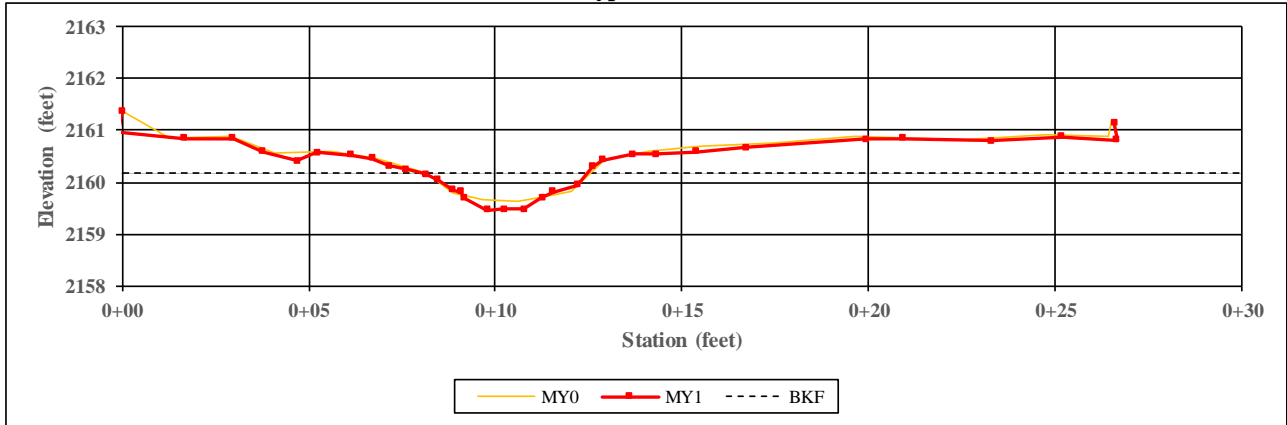


Right Descending Bank

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

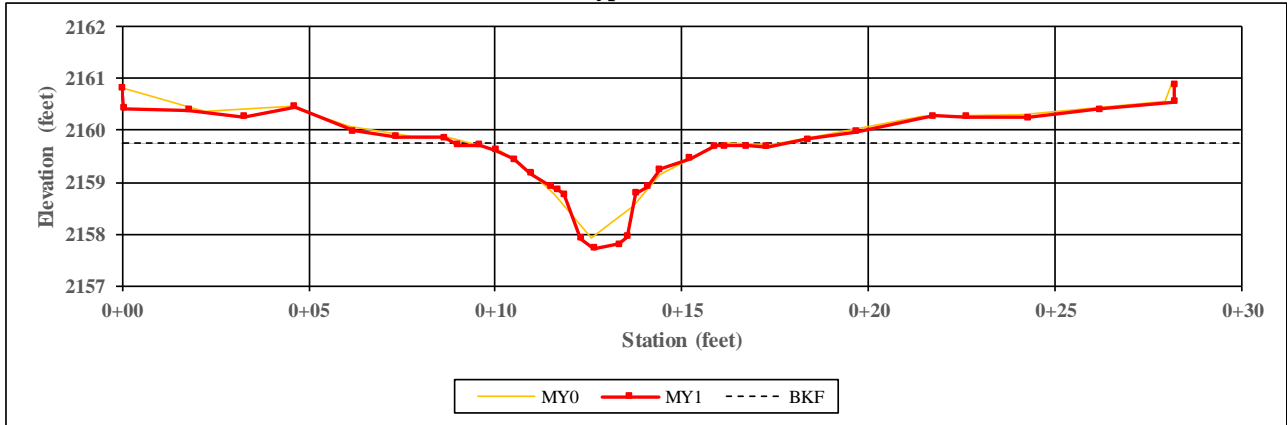


Right Descending Bank

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

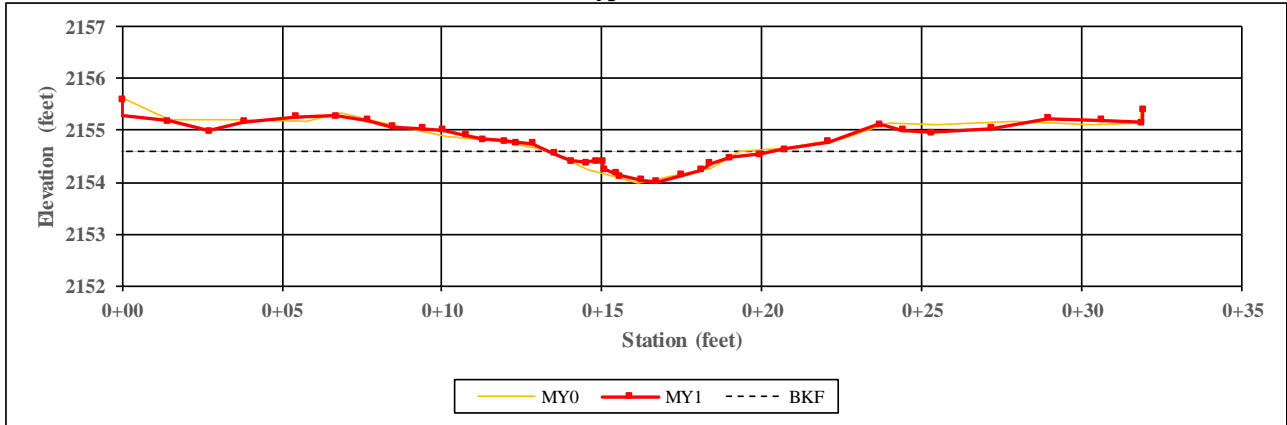


Right Descending Bank

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 | - | - | - | - | - | - |

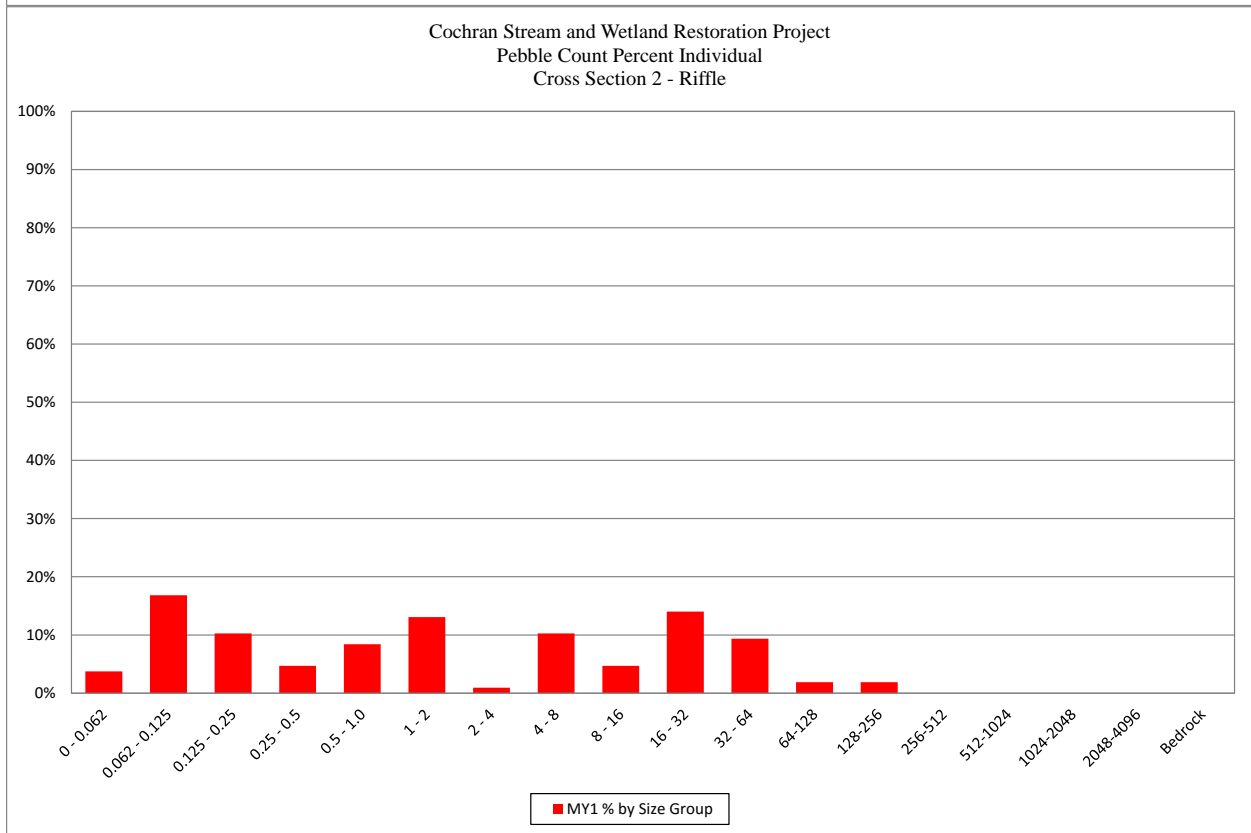
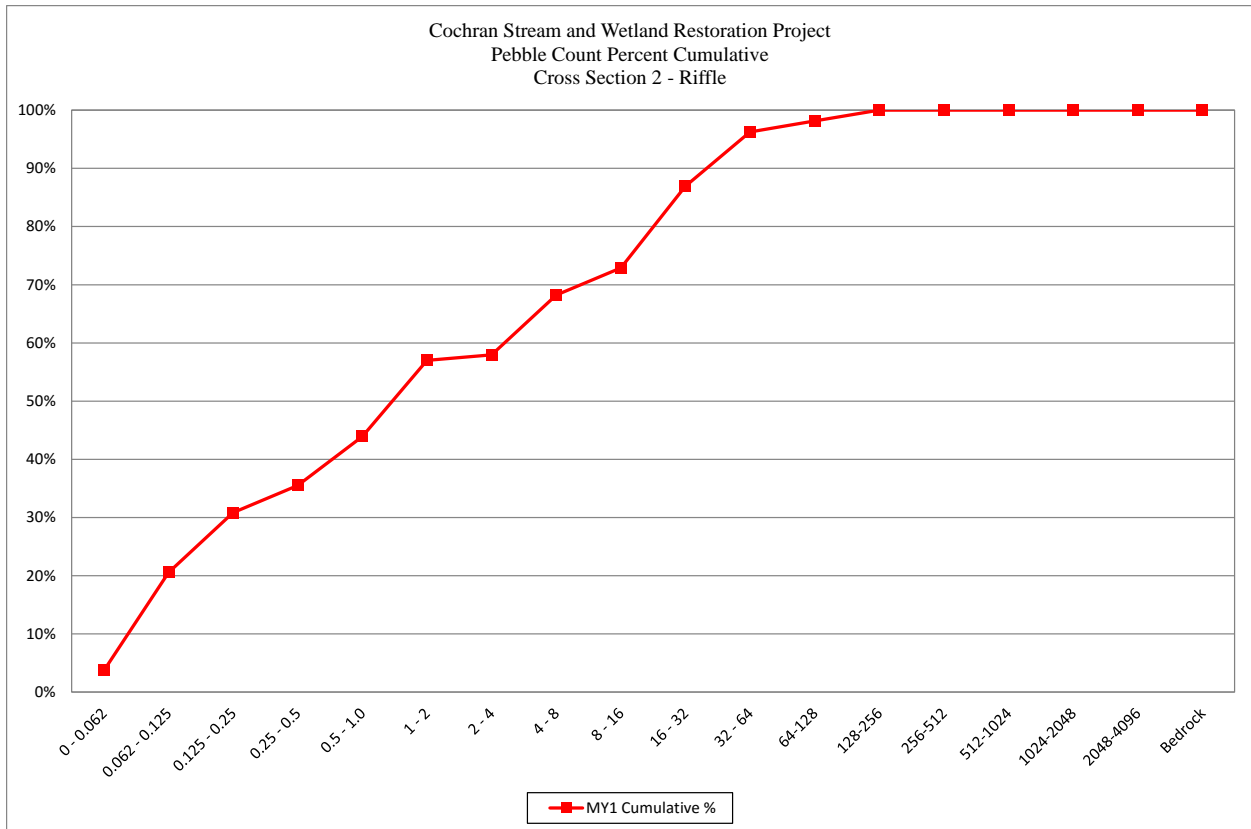


Left Descending Bank

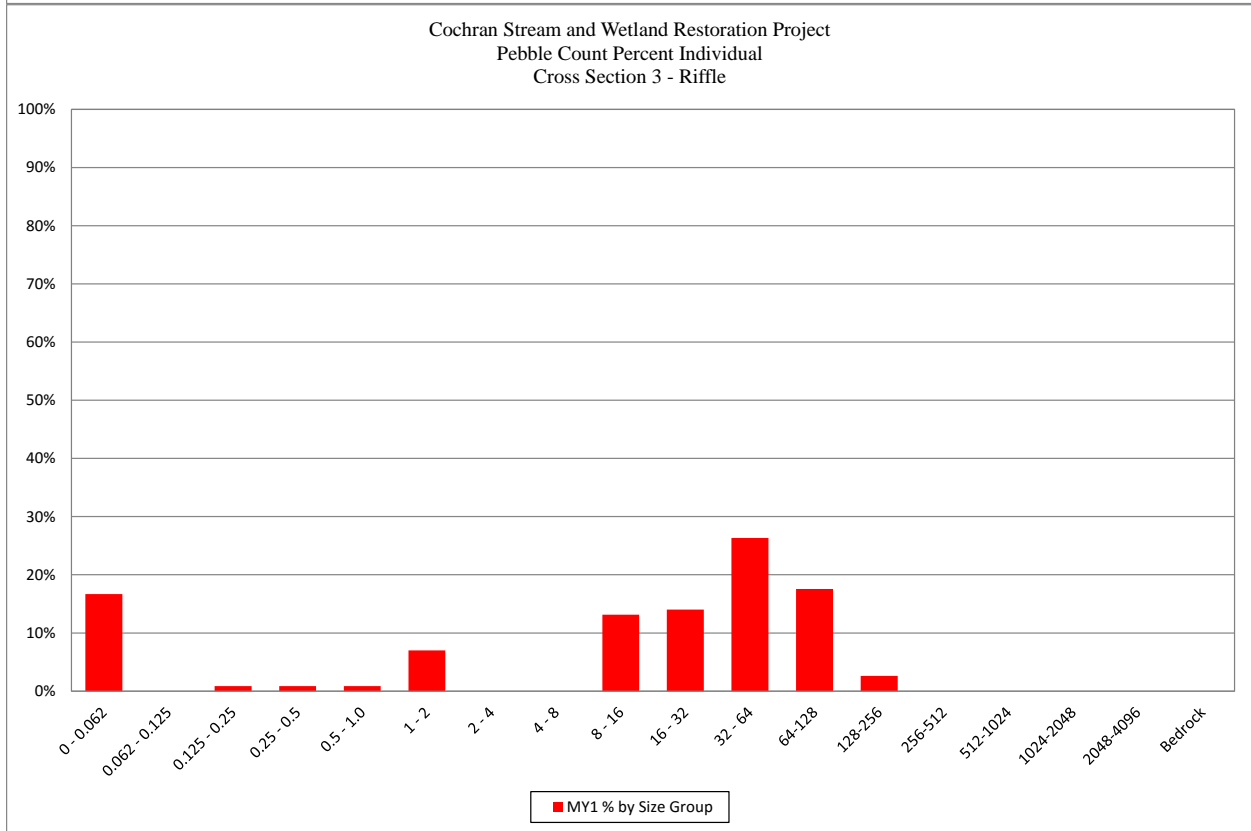
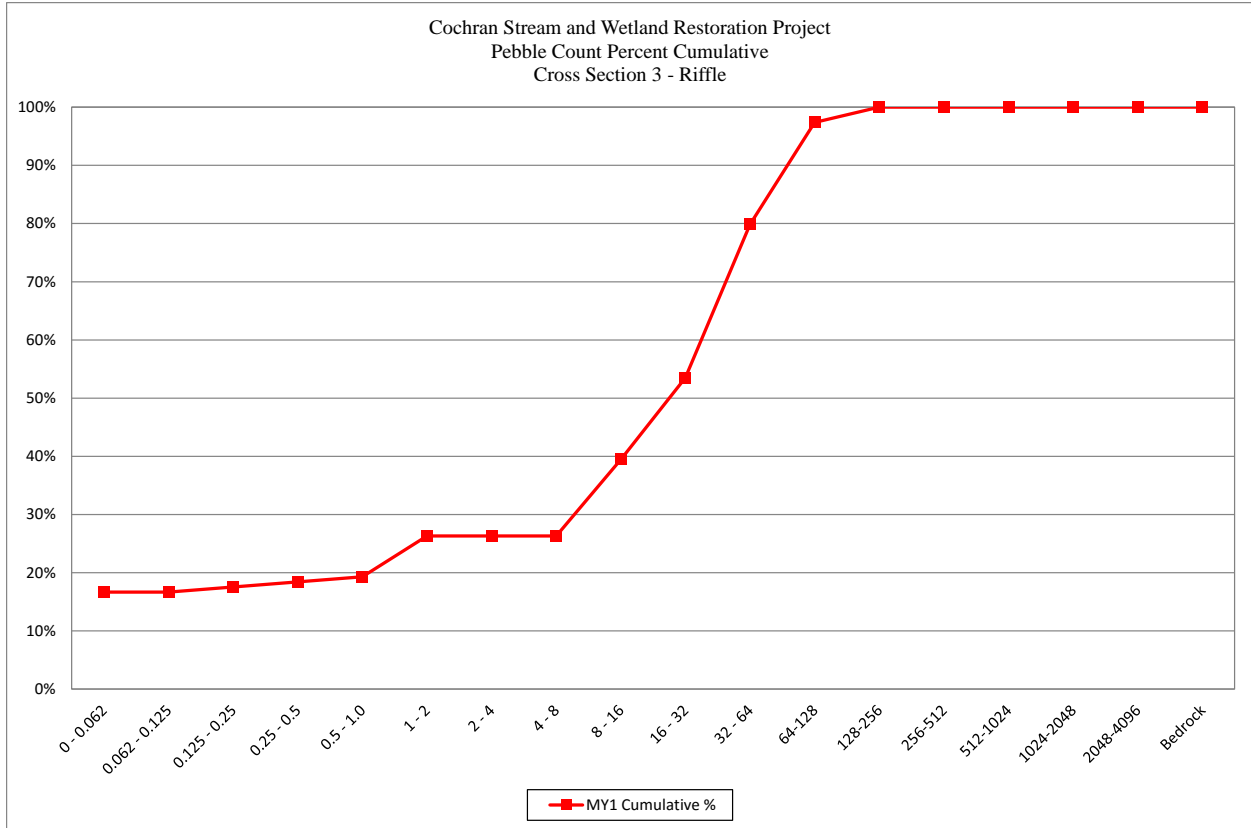


Right Descending Bank

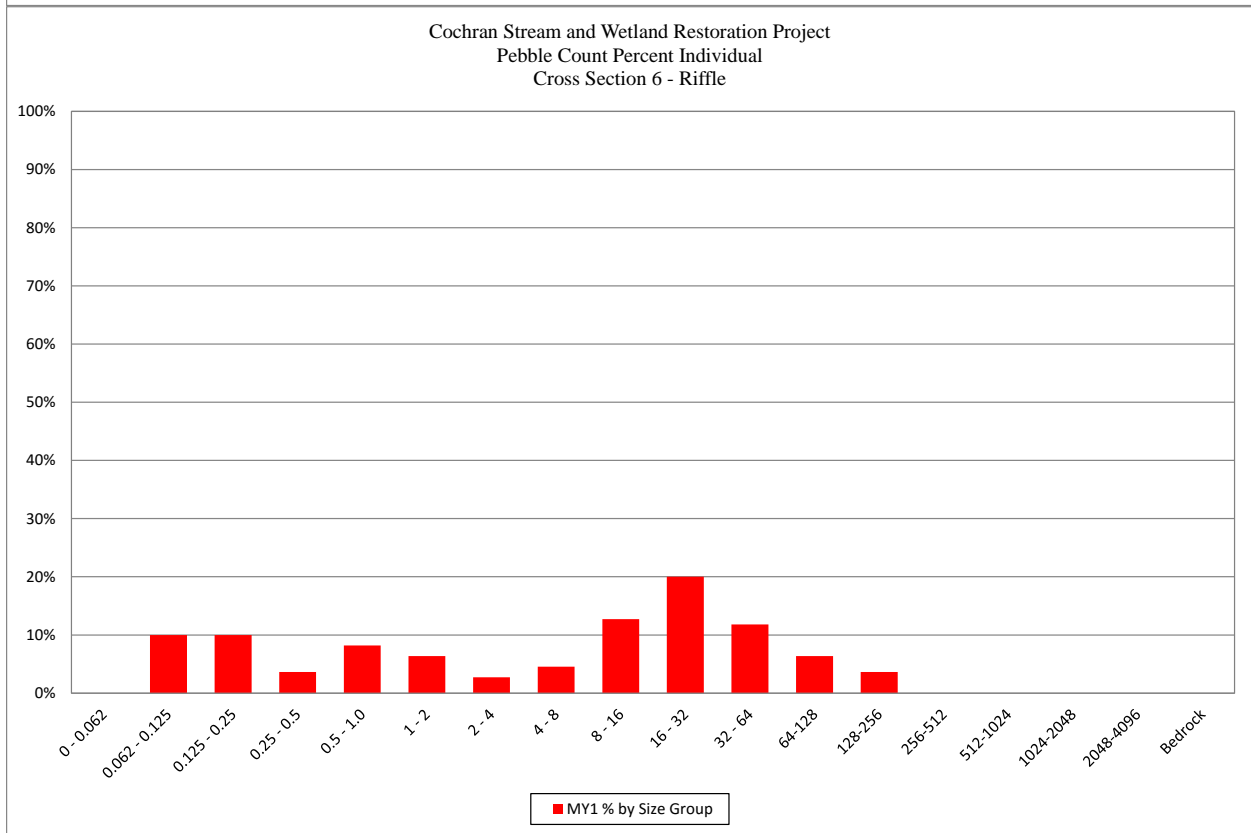
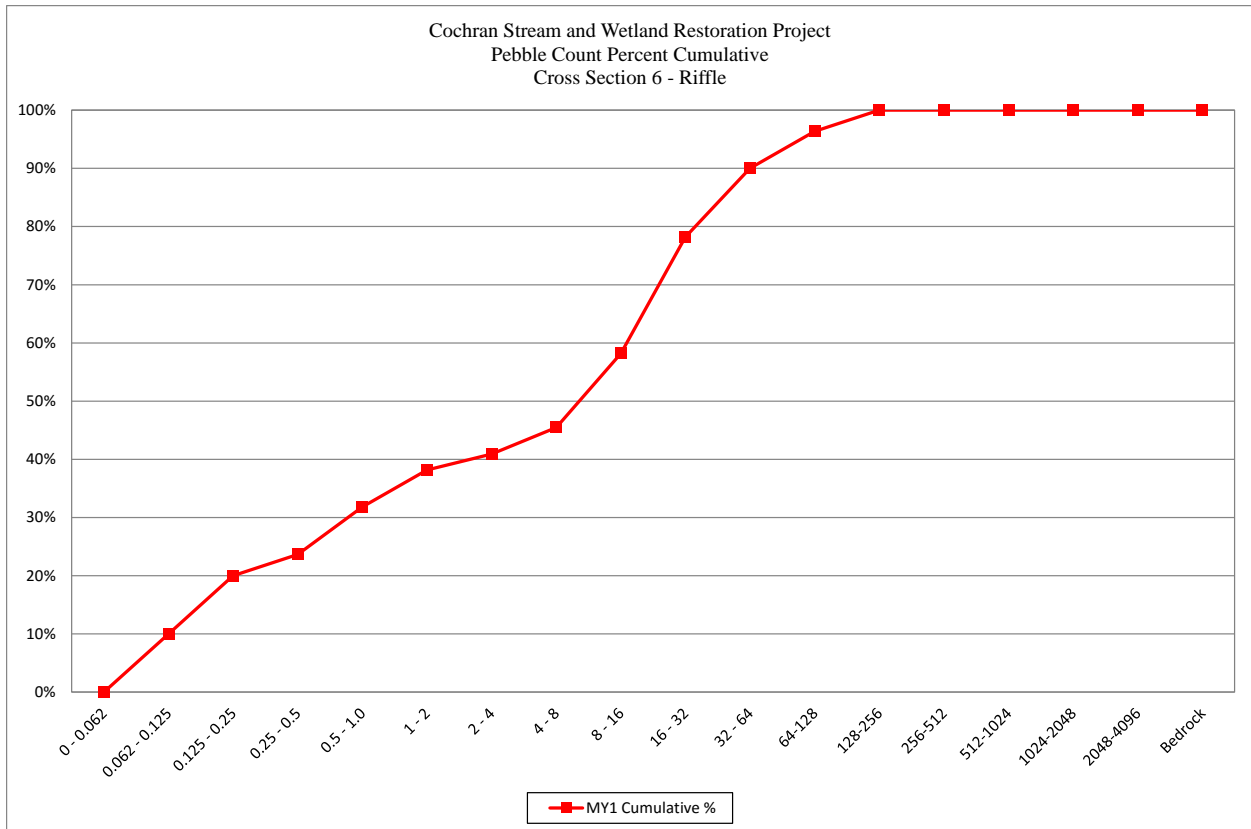
| Cochran | | | |
|--|---------------|-------------------------|-------------------------|
| Cross Section 2 - Riffle | | | |
| Monitoring Year - 2015; MY1 | | | |
| Bed Surface Material Particle Size Class (mm) | Number | % Individual | % Cumulative |
| 0 - 0.062 | 4 | 3.7% | 4% |
| 0.062 - 0.125 | 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 |



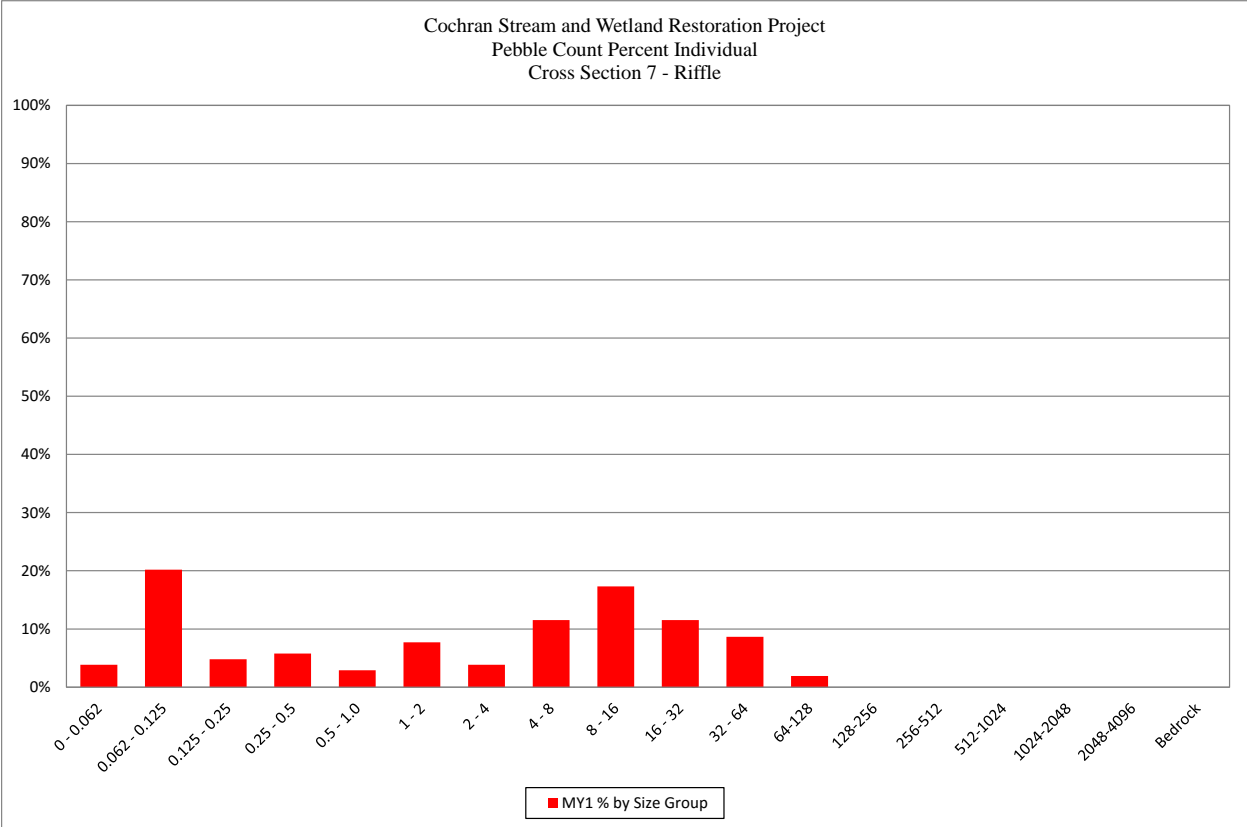
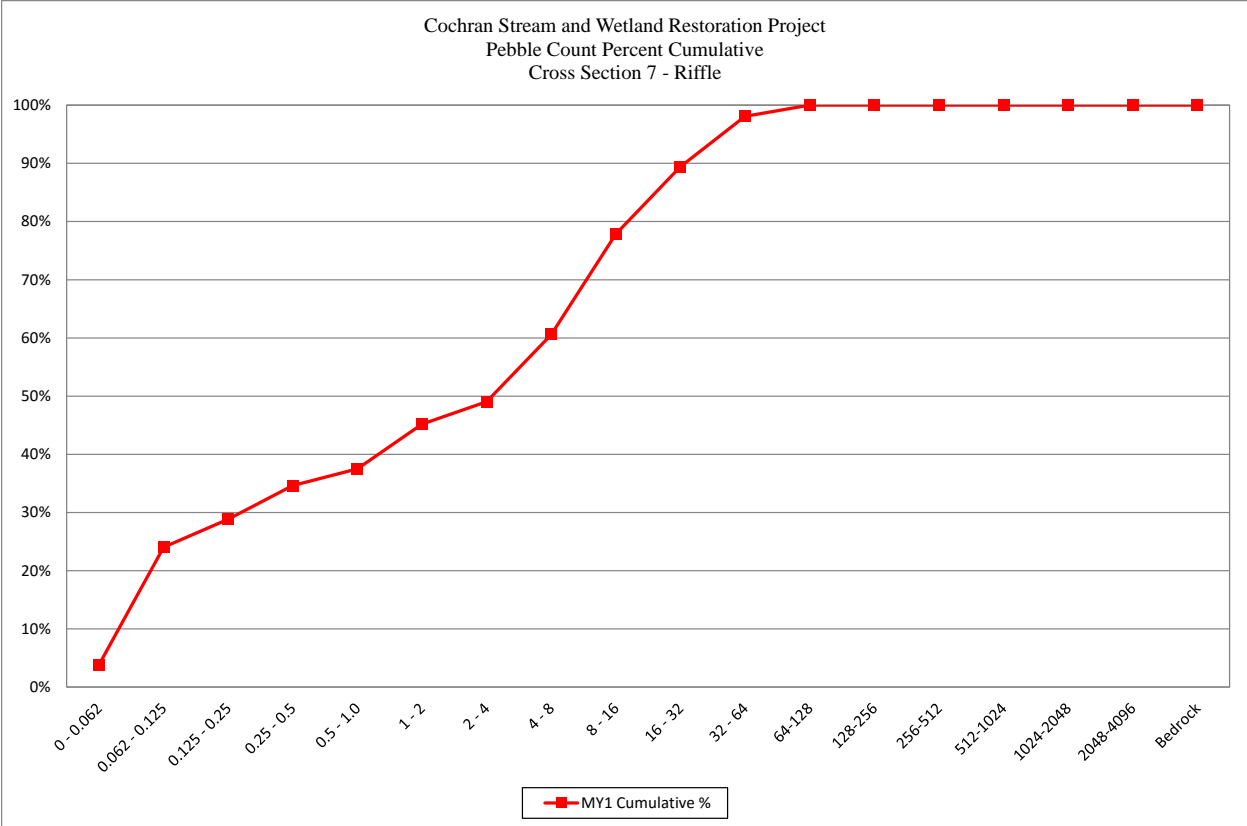
| Cochran | | | |
|--|---------------|-------------------------|-------------------------|
| Cross Section 3 - Riffle | | | |
| Monitoring Year - 2015; MY1 | | | |
| Bed Surface Material Particle Size Class (mm) | Number | % Individual | % Cumulative |
| 0 - 0.062 | 19 | 16.7% | 17% |
| 0.062 - 0.125 | 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 | |



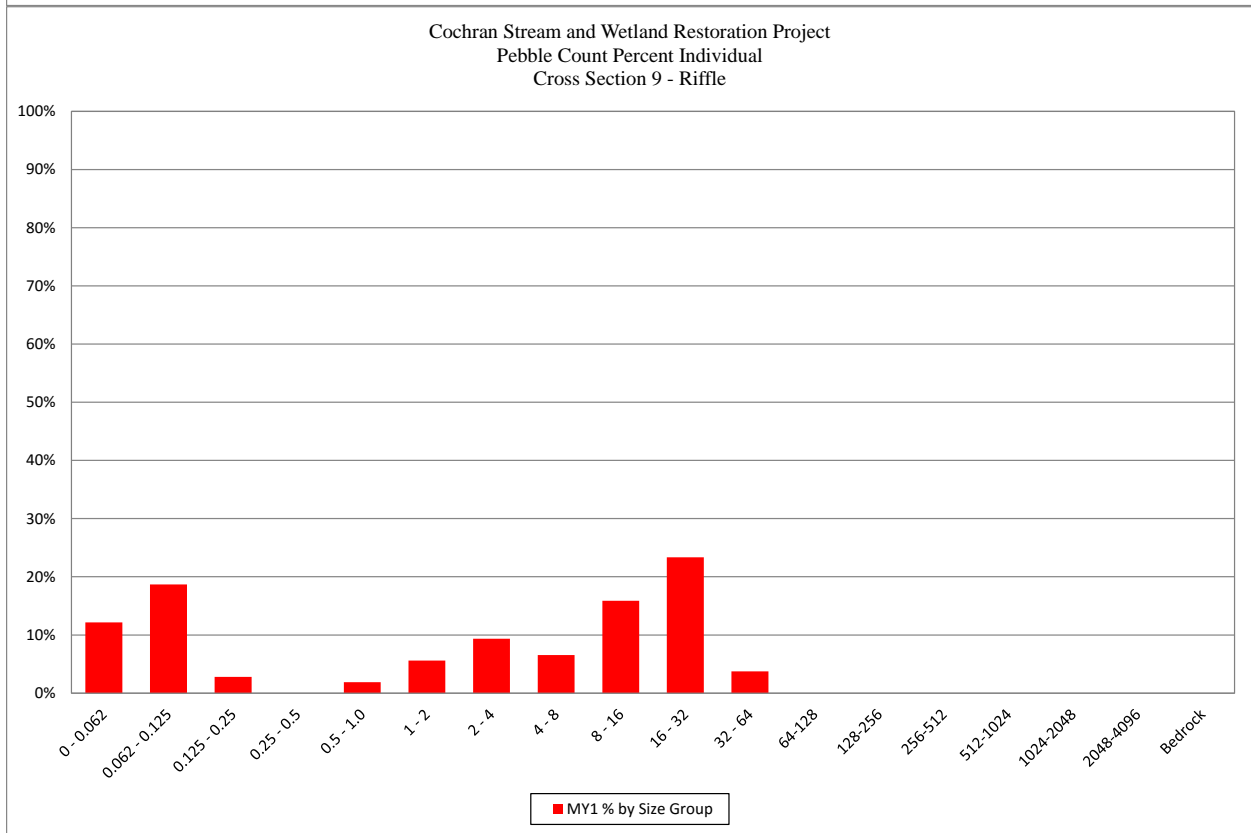
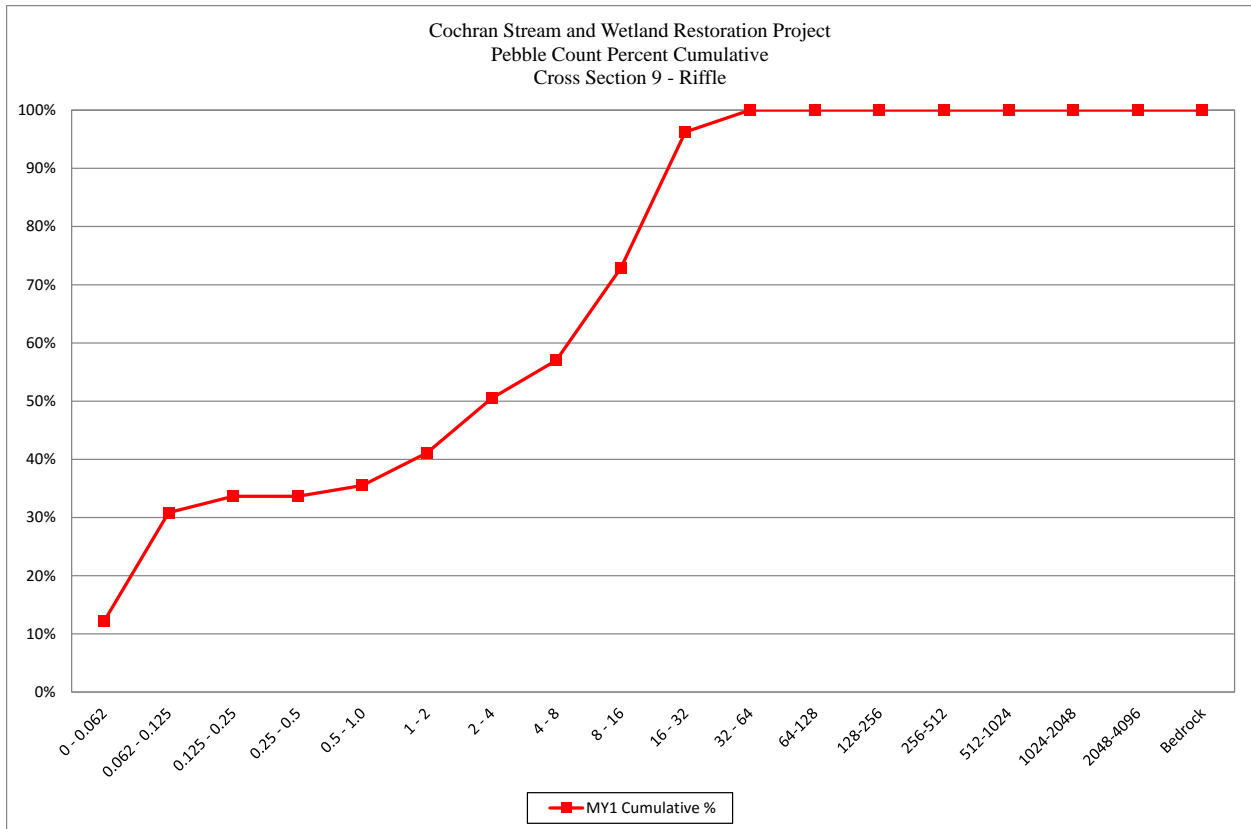
| Cochran | | | |
|--|---------------|-------------------------|-------------------------|
| Cross Section 6 - Riffle | | | |
| Monitoring Year - 2015; MY1 | | | |
| Bed Surface Material Particle Size Class (mm) | Number | % Individual | % Cumulative |
| 0 - 0.062 | 0 | 0.0% | 0% |
| 0.062 - 0.125 | 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 | |
| | | | | |
| | | | | |
| | | | | |
| Parrish Branch | | | | |
| None Since Construction Completed | | | | |
| | | | | |
| | | | | |
| | | | | |

¹Potential Date is 12/24/2015

Photo Verification of Bankfull Events



Photo #1- Cochran Branch Crest Gauge

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

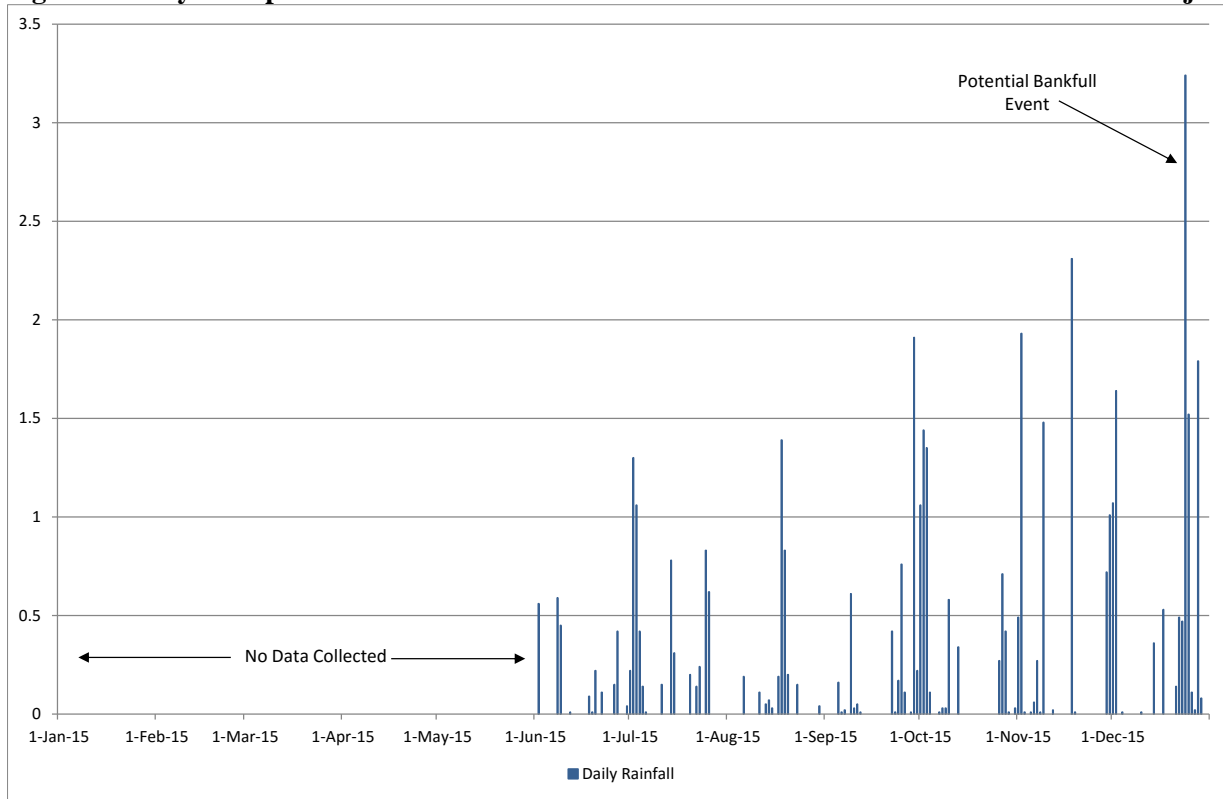
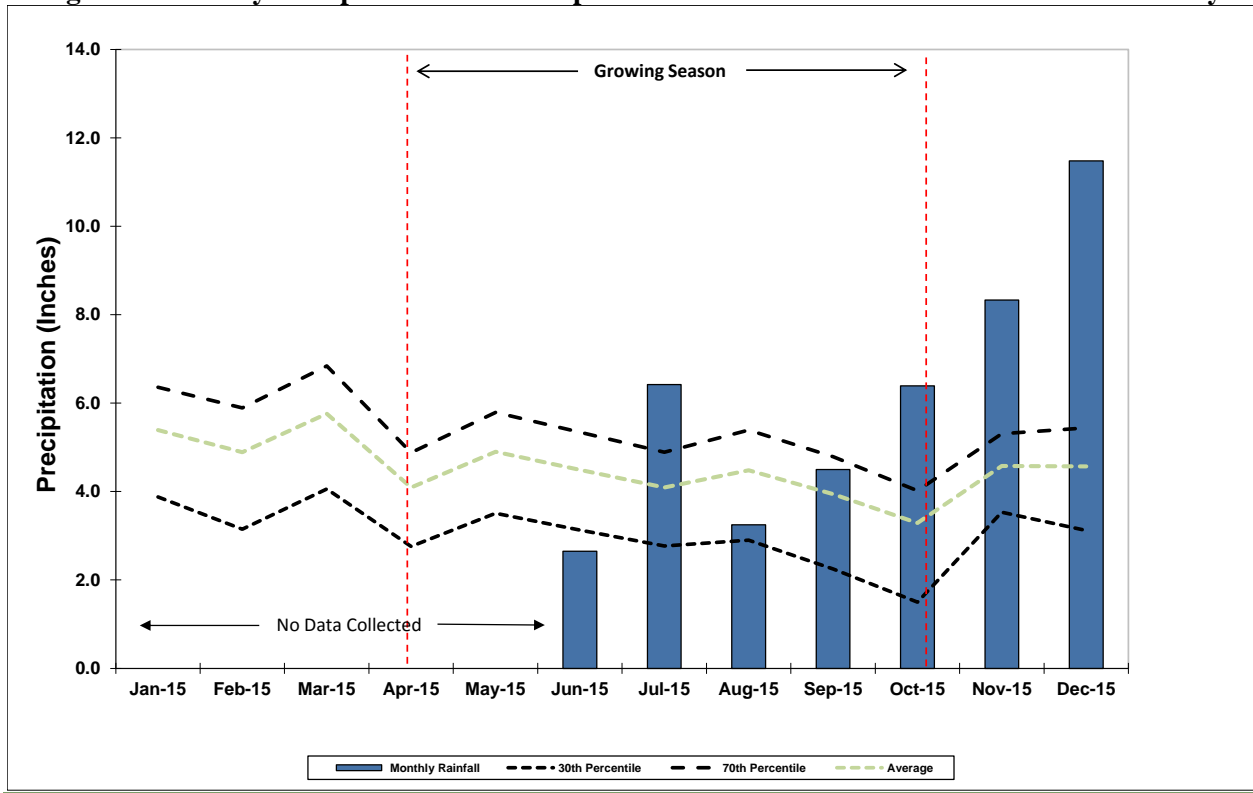


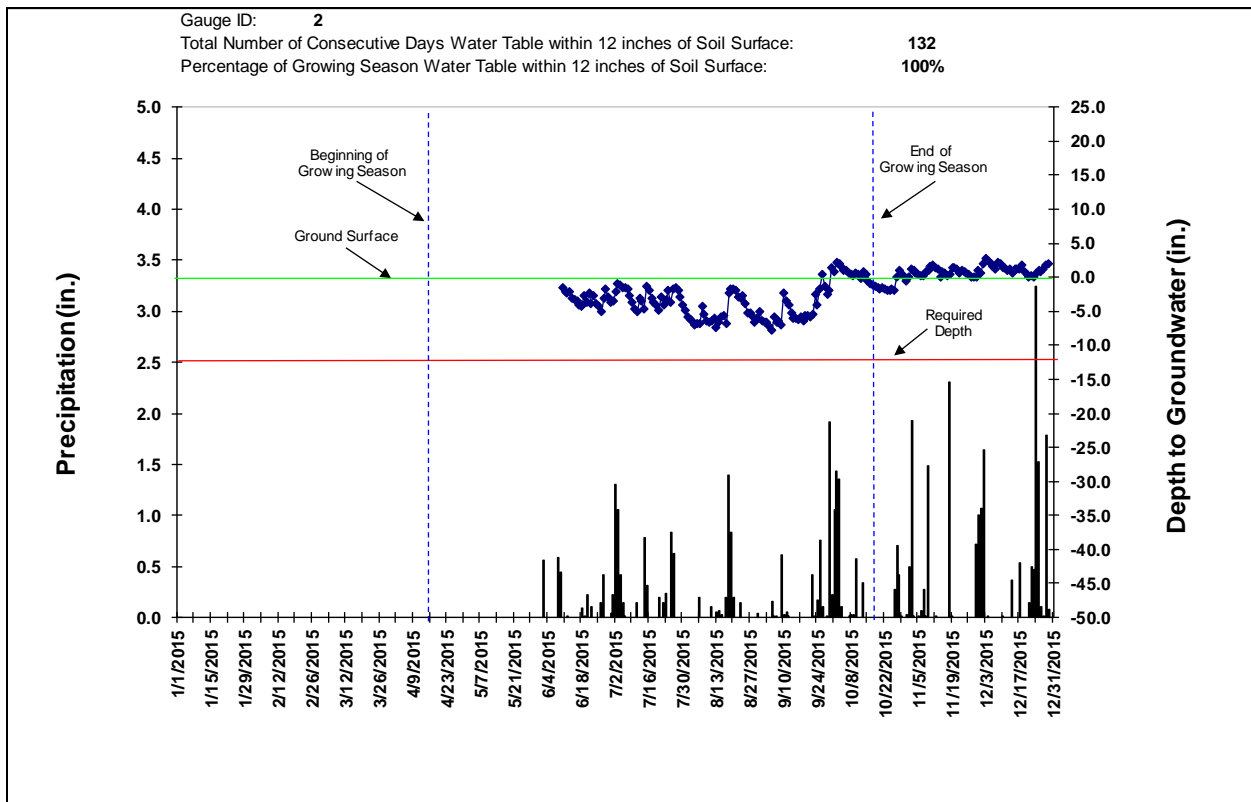
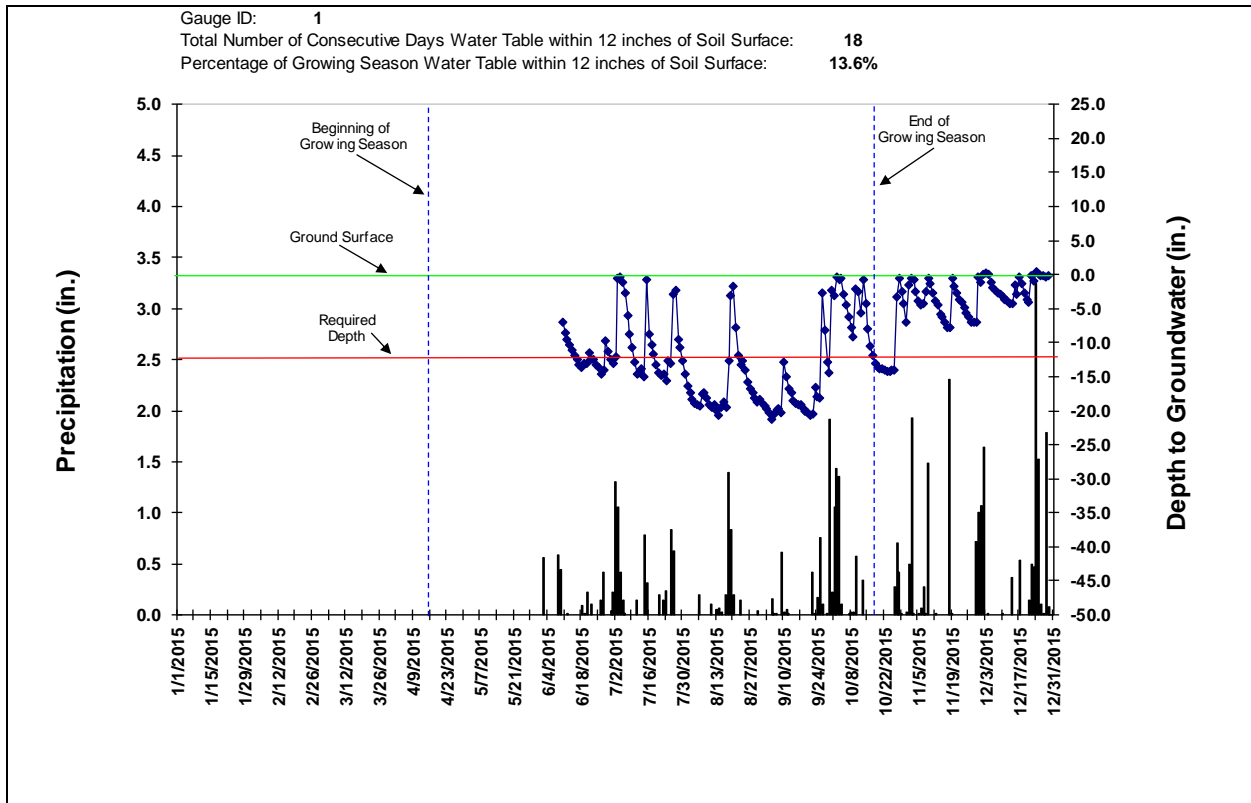
Figure 4. Monthly Precipitation Data Compared to 30th and 70th Percentiles for Macon County

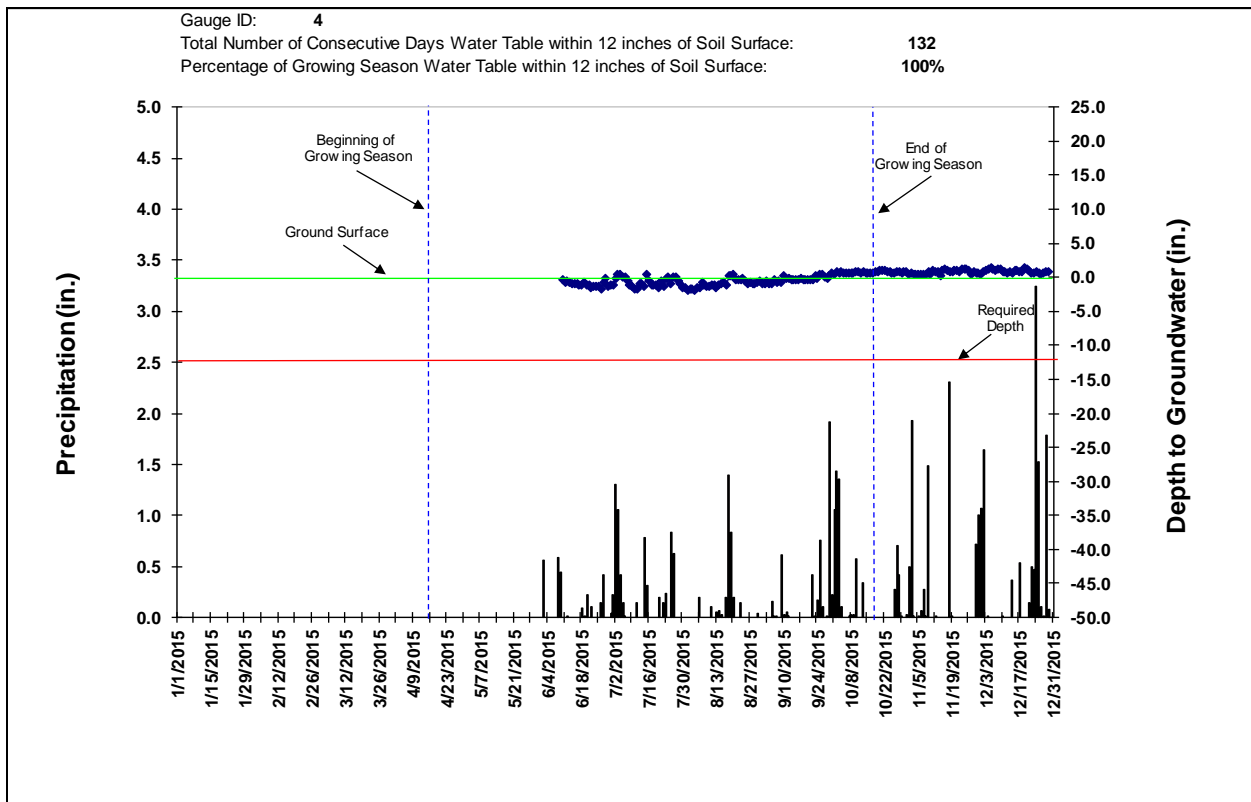
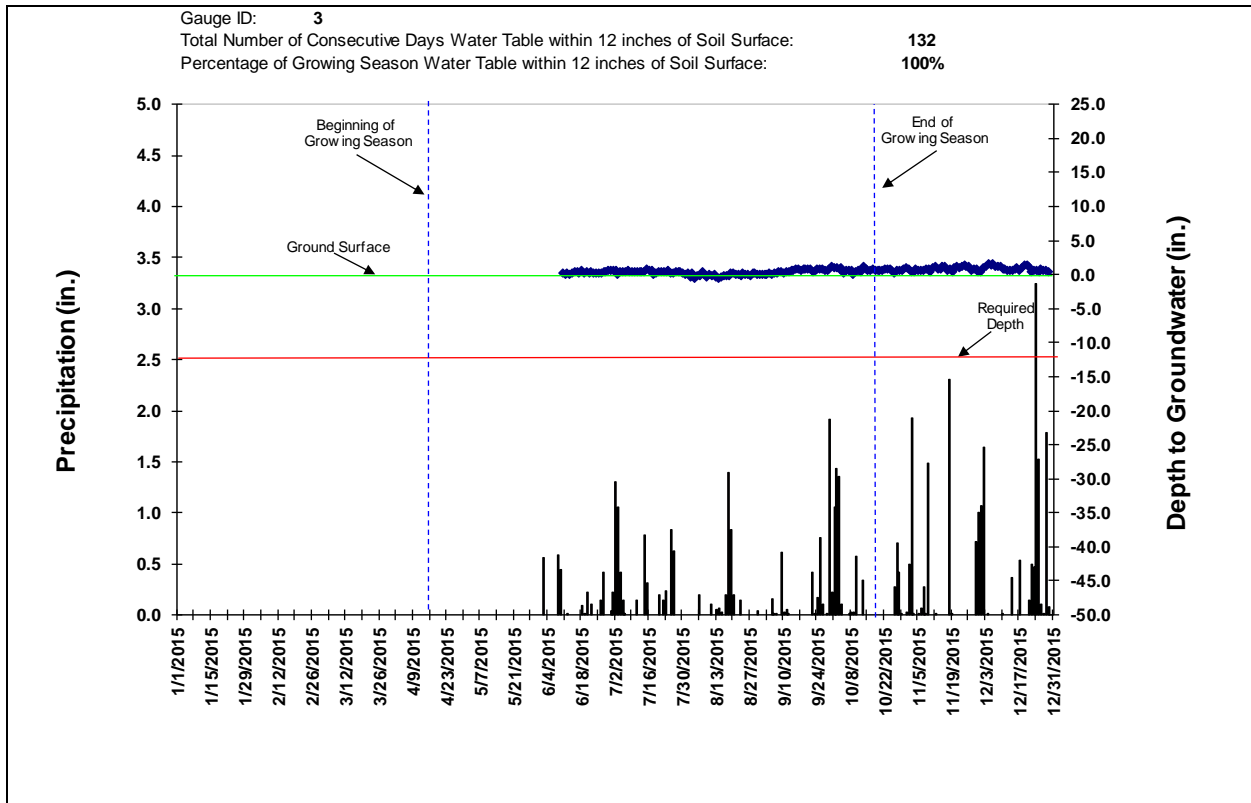


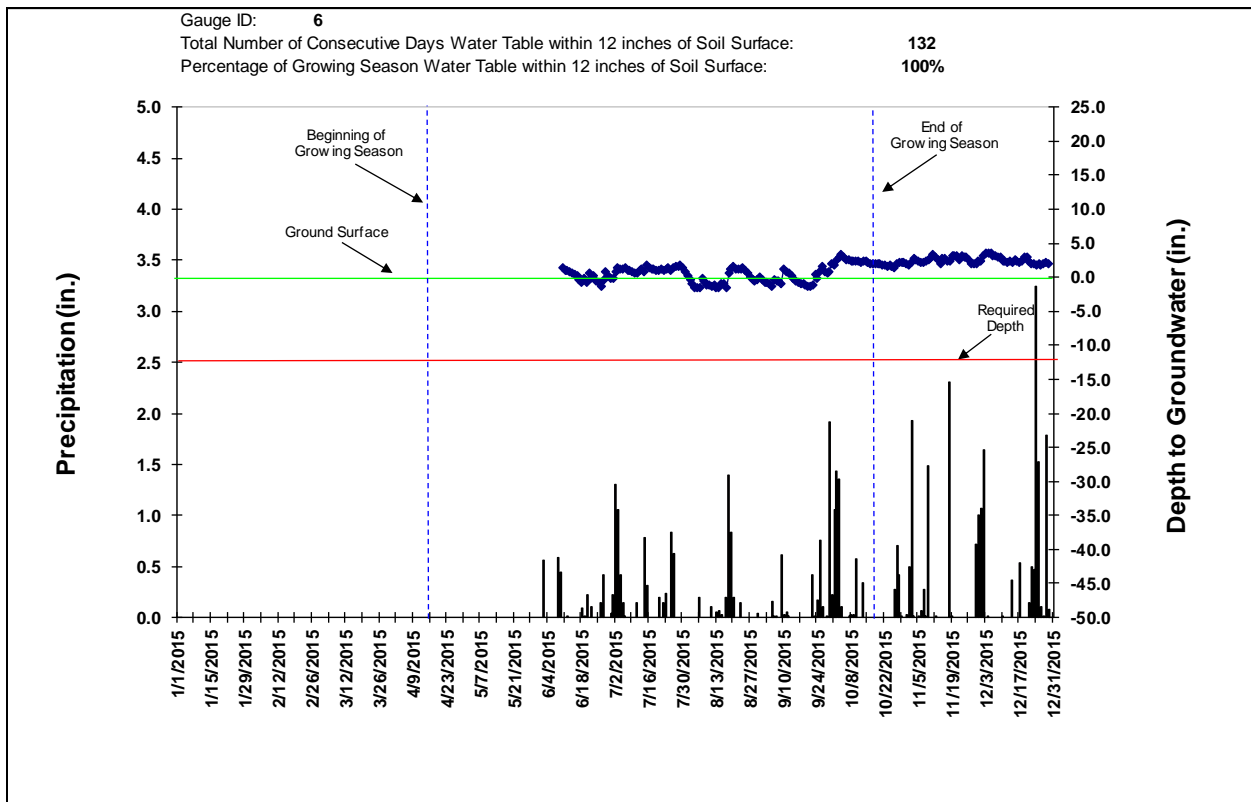
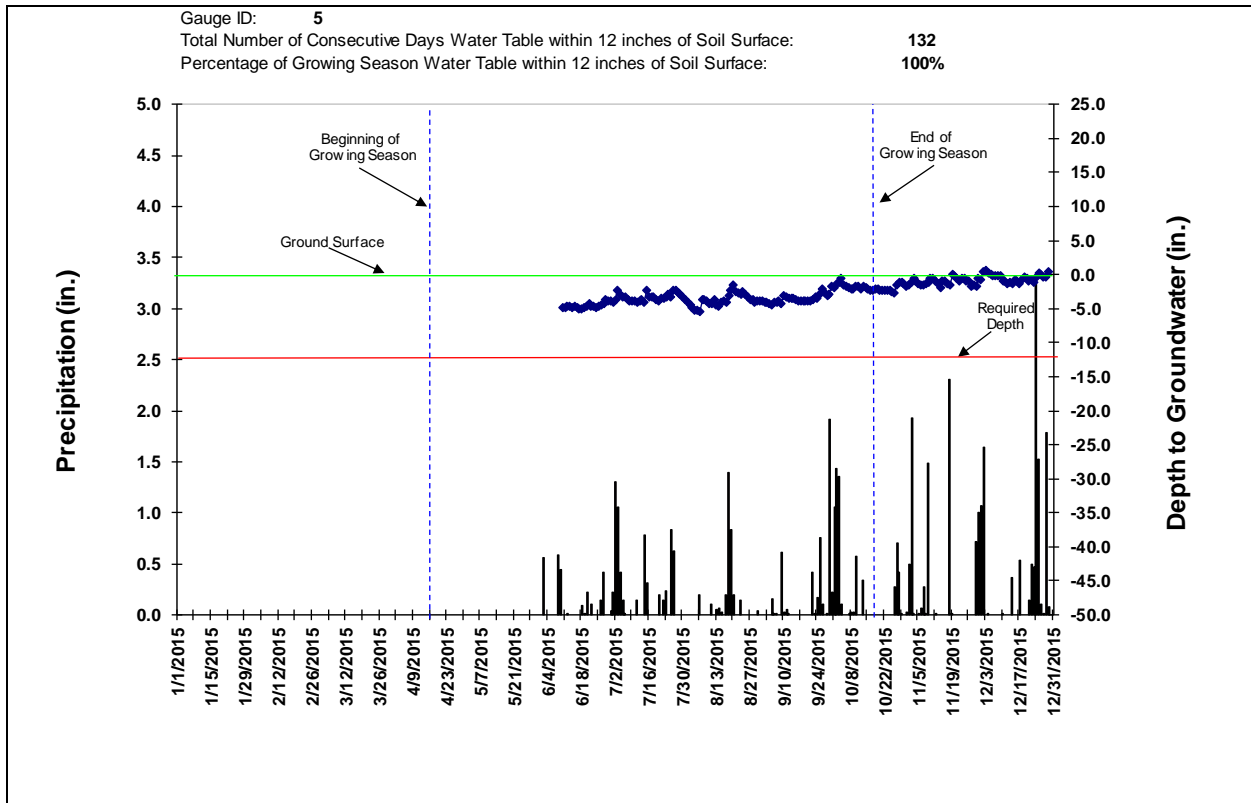
| Table 14. Wetland Gauge Attainment Data Summary of Groundwater Monitoring Results Cochran Stream & Wetland Restoration Site | | | | | | | |
|--|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Gauge ID | Success Criteria Achieved/ Max Consecutive Days During Growing Season Percent | | | | | | |
| | Year 1¹ (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% | | | | | | |
| GW-2 | Yes/ 132 100% | | | | | | |
| GW-3 | Yes/ 132 100% | | | | | | |
| GW-4 | Yes/ 132 100% | | | | | | |
| GW-5 | Yes/ 132 100% | | | | | | |
| GW-6 | Yes/ 132 100% | | | | | | |
| GW-7 | Yes/ 132 100% | | | | | | |
| GW-8 | Yes/ 132 100% | | | | | | |

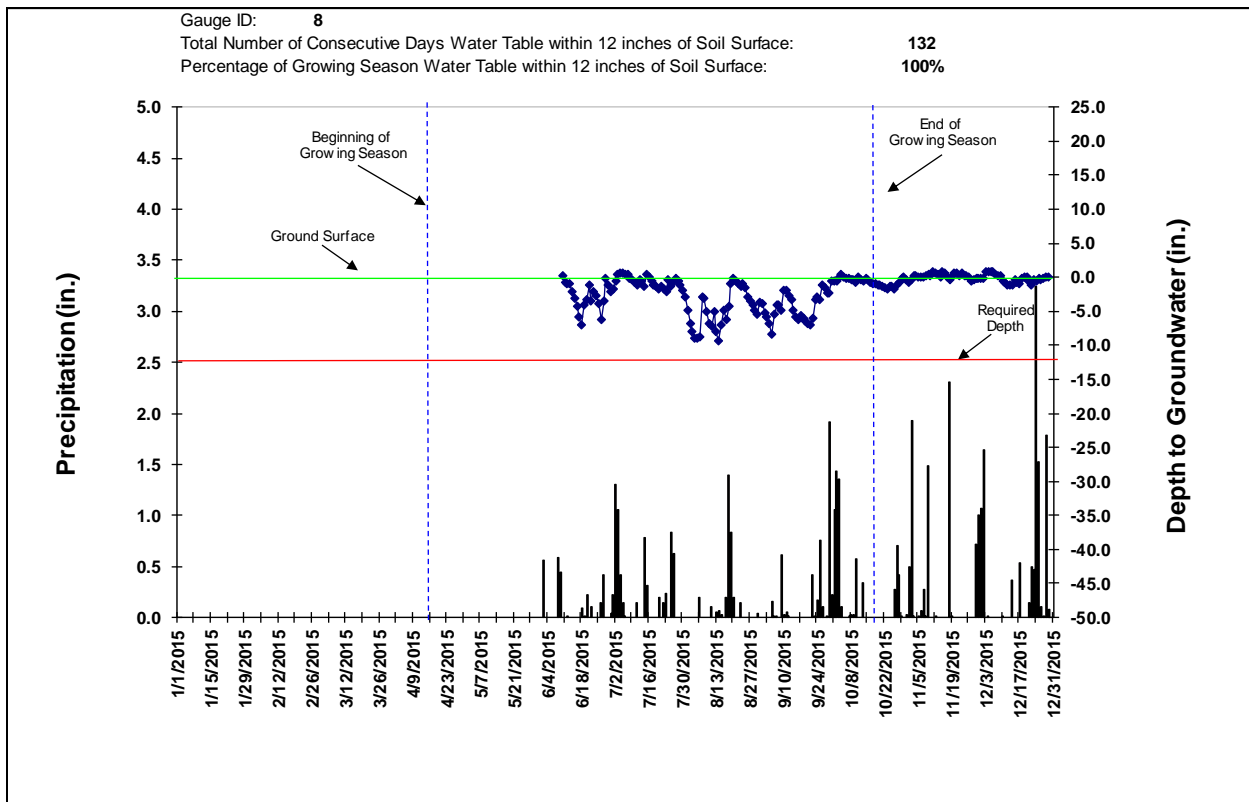
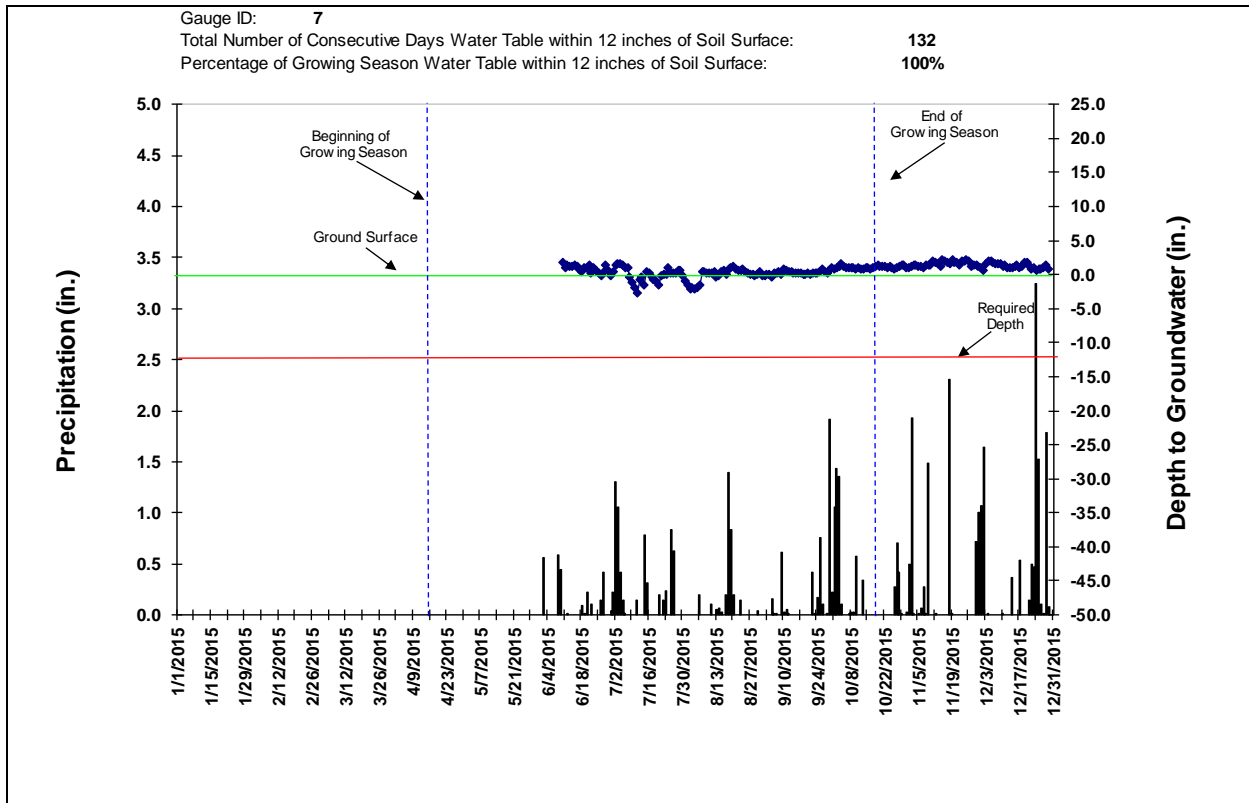
Hydrology Success Criteria = 8%; Growing season = 187 days

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









Gauge ID: Reference - Cat Creek (MW13)

Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: 130

Percentage of Growing Season Water Table within 12 inches of Soil Surface: 70%

