FINAL
MITIGATION PLAN

Cochran Branch
Macon County, North Carolina
Project No. 95720
Contract # 004370
RFP: 16-004370

Little Tennessee River Basin
Cataloging Unit 06010202040020

Prepared for:

NC Department of Environment and Natural Resources
Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

September 2014

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1652 Mail Service Center
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Prepared By:

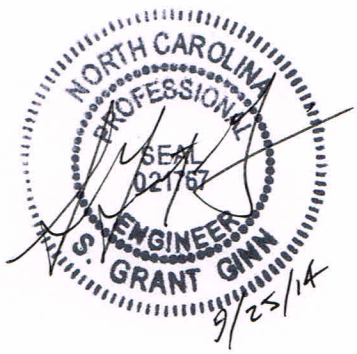
EBX

Environmental Banc & Exchange, LLC
909 Capability Drive, Suite 3100
Raleigh, NC 27606

And:

Wolf Creek ENGINEERING

Wolf Creek Engineering, PLLC
12½ Wall Street, Suite C
Asheville, NC 28801
(828) 449-1930



September 2014

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

September 2, 2104

Regulatory Division

Re: NCIRT Review and USACE Approval of the Cochran Branch Mitigation Plan; SAW-2013-00280; NCEEP Project # 95720

Mr. Tim Baumgartner
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Ecosystem Enhancement Program (NCEEP) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the Cochran Branch Mitigation Plan, which closed on August 15, 2014. These comments are attached for your review.

Based on our review of these comments, we have determined that no major concerns have been identified with the Draft Mitigation Plan, which is considered approved with this correspondence. However, several minor issues were identified, as described in the attached comment memo, which must be addressed in the Final Mitigation Plan.

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) Application for Nationwide permit approval of the project along with a copy of this letter. Issues identified above must be addressed in the Final Mitigation Plan. All changes made to the Final Mitigation Plan should be summarized in an errata sheet included at the beginning of the document. If it is determined that the project does not require a Department of the Army permit, you must still provide a copy of the Final Mitigation Plan, along with a copy of this letter, to the appropriate USACE field office at least 30 days in advance of beginning construction of the project. Please note that this approval does not preclude the inclusion of permit conditions in the permit authorization for the project, particularly if issues mentioned above are not satisfactorily addressed. Additionally, this letter provides initial approval for the Mitigation Plan, but this does not guarantee that the project will generate the requested amount of mitigation credit. As you are aware, unforeseen issues may arise during construction or monitoring of the project that may require maintenance or reconstruction that may lead to reduced credit.

Thank you for your prompt attention to this matter, and if you have any questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please call me at 919-846-2564.

Sincerely,

TUGWELL.TODD.JASON.1048429293
2014.09.02 15:34:20 -04'00'

Todd Tugwell
Special Projects Manager

Enclosures

Electronic Copies Furnished:
NCIRT Distribution List
CESAW-RG-A/Brown
Paul Wiesner, NCEEP
Lin Xu, NCEEP

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

CESAW-RG/Tugwell 15 August, 2014

MEMORANDUM FOR RECORD

SUBJECT: Cochran Branch - NCIRT Comments During 30-day Mitigation Plan Review

PURPOSE: The comments listed below were posted to the NCEEP Mitigation Plan Review Portal during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCEEP Project Name: Cochran Branch, Macon County, NC

USACE AID#: SAW-2013-00280
NCEEP #: 95720

30-Day Comment Deadline: 15 August, 2014

1. *Eric Kulz, NCDWR, 4 August, 2014*:

- No major comments regarding the stream portion of the project. DWR has concerns similar to past projects regarding the excavation of "relic" hydric soils for wetland restoration. The mit plan did not show proposed approximate locations of hydrology monitoring wells (or veg plots) as has been requested. The provider should ensure that a sufficient number of wells are placed to adequately assess the site.
- It is unclear from the mit plan and supporting documentation if Proposed WL area 3 is located in an area of hydric soils.

2. Todd Tugwell, USACE, 15 August, 2014:

- In Section 9.0, Performance Standards, please indicate that the stems-per-acre criteria is specifically for planted stems. Volunteers will be considered on a case-by-case basis toward meeting the overall success of the site.

/s/
Todd Tugwell
Special Projects Manager
Regulatory Division

IRT PROCESS SUMMARY

The NCIRT Review comments and the USACE Approval letter dated December 12, 2013 are included in the following pages to document the IRT Review process for this project. The following is a list of revisions that have been made to the Mitigation Plan in response to these comments:

1. Page 31- Proposed Monitoring Features (Figure 8) are included.
2. Page 26, Paragraph 4- Added statement specifying the presence of buried hydric soil indicators at wetland area 3.
3. Page 33, Paragraph 1- Revised performance standard to clarify that the density of stems/acre will be quantified by planted stems.

EXECUTIVE SUMMARY

Environmental Banc & Exchange (EBX) proposes to restore two stream reaches and the associated wetlands in central Macon County. The Cochran Branch Mitigation Site (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 unstable streams, Cochran Branch and Parrish Branch, along with degraded former wetlands on the Cochran Branch floodplain. This mitigation plan describes the details, methods and protocols proposed to generate approximately **1783 stream mitigation units** and **4.30 wetland mitigation units**, which include approximately **1783 linear feet of stream restoration through Priority I and II restoration and 4.35 acres of wetland rehabilitation, re-establishment, and enhancement.**

General Site Conditions

Historic land use at the Site has consisted primarily of agriculture and livestock grazing. Additional land use practices, including the excavation of drainage ditches, maintenance and removal of riparian vegetation and the relocating, dredging, and straightening of on-site streams have contributed to unstable channel characteristics, degraded water quality, and degradation of prior wetlands.

Current stream conditions at the Cochran Branch Mitigation Site consist of incised channels with unstable banks and a riparian buffer dominated by invasive exotic plants. Cochran Branch flows through an active pasture with livestock access to the stream. The stream is highly degraded with minimal riparian vegetation. Parrish branch, a tributary to Cochran Branch, has limited riparian vegetation with steep, unstable stream banks.

The floodplain adjacent to Cochran Branch contains approximately 4.4 acres of mapped hydric soils, the majority of which is buried by 6 to 12 inches of alluvial deposits. Ditching and grading activities have reduced the jurisdictional wetlands to less than 0.99 acres. The extant wetlands are degraded and heavily impacted by the present land use.

Restoration Concept

The goal of the project is to restore ecological function to the existing stream and riparian wetlands by returning the streams to a proper relationship with the floodplain, removing overburden soils, eliminating drainage ditches and spoil piles, removing invasive species, and replanting the riparian area with native plant species appropriate for the valley and watershed conditions. Benefits of grading activities will be to improve the groundwater hydrology of the proposed wetlands, increase hydrologic access of the floodplain for overbank flows, and provide attenuation of flood flows. Stream restoration activities will also yield improved water quality by re-establishment of a wooded riparian area and stabilized stream channel resulting in a reduced downstream sediment load. Improvement of terrestrial and aquatic habitats will result from removal exotic plant species, re-establishment of native vegetation in the riparian buffer, improved landform complexity associated with floodplain grading, and improved in-stream habitat complexity.

Proposed Cochran Branch is designed as a type C4 stream and Parrish Branch is designed as a Type B4 stream. These channel configurations provide a stable and natural form in the valleys in which the existing streams are found. The proposed channel dimensions, patterns, and profiles are based on the hydraulic relationships and morphologic dimensionless ratios of the reference reaches.

The installation of brush, rock, and wood structures will be utilized throughout the restored reaches of the Site. Brush toe structures will be installed on selected meander bends to provide bank stability and

aquatic habitat. Boulder structures will be used for grade control and to provide step-pool bedforms on steeper channel reaches. Log vanes with rootwads will be installed in meander bends to direct the flow away from the outside of the bend and provide toe and bank protection. On-site material including brush, boulders, logs, and bed material will be used to the maximum extent possible and in-stream structures will be designed to improve aquatic habitat.

The floodplain will be re-graded to expose the buried A-horizon and remove overburden from the hydric soils. The ditches that were excavated to facilitate drainage of the wetlands will be backfilled and the adjacent spoil piles will be graded out. Grading activities will restore micro-topography to impede overland drainage and maximize habitat diversity. Existing suitable topsoil will be harvested and stockpiled for reuse on the re-graded floodplain and elsewhere as needed throughout the Site.

This mitigation plan has been written in conformance with the requirements of the following:

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- NCDENR Ecosystem Enhancement Program In-Lieu Fee Instrument signed and dated July 28, 2010

These documents govern NCEEP operations and procedures for the delivery of compensatory mitigation.

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APPENDICES

1.0 RESTORATION PROJECT GOALS AND OBJECTIVES

The Cochran Branch Mitigation Site (the Site) is a stream and wetland restoration site located in central Macon County (Figure 1). The Site is located within the Little Tennessee River watershed and is being submitted for mitigation credit in the Little Tennessee River Basin Cataloging Unit 06010202.

EEP has developed River Basin Restoration Priorities (RBRP) to guide its restoration activities within each of the state's cataloging units. RBRPs delineate specific watersheds that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These watersheds, referred to as Targeted Local Watersheds (TLWs), receive priority for EEP planning and restoration project funds. The 2008 Little Tennessee River Basin RBRP identified fecal coliform and turbidity as major stressors within this TLW. The Cochran Branch Project was identified as a stream restoration opportunity to improve water quality and habitat within the TLW.

The overall goals, which define the purpose of the project, 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 use impacts

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

- Implement Priority I and II restoration of 1,783 feet of stream and rehabilitation/re-establishment of 4.35 acres of wetlands
- Implement appropriate changes in the 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 with 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

2.0 SITE SELECTION

2.1 Directions to Site

The Cochran Branch Mitigation Site is located in central Macon County approximately 6 miles northwest of Franklin, NC. From Asheville, take 1-40 W towards Knoxville. Take a slight right onto US-74 / Great Smoky Mountains Expressway. After approximately 26 miles, merge onto US-23 toward US-441 South / Dillsboro. After 14.6 miles, turn right onto Sanderstown Road. In 3.2 miles, turn left onto N. Carolina 28 South / Bryson City Road. In 1.7 miles turn right onto Airport Road. In 2.3 miles turn left onto Olive Hill Road. In 3.5 miles turn right onto Watson Road. The site is on the left at latitude 35°12'52" N and longitude 83°29'20" W.

2.2 Site Selection

2.2.1 Description

The Site encompasses approximately 10 acres of predominately agricultural land and includes a portion of **Cochran Branch** and **Parrish Branch** (See Figure 4). Historic land use at the Site has consisted primarily of agriculture and livestock grazing. Additional land use practices, including the maintenance and removal of riparian vegetation and the relocating, dredging, and straightening of on-site streams have contributed to unstable channel characteristics and degraded water quality. Ditches have been excavated and maintained to facilitate drainage of the floodplain and maximize agricultural production.

2.2.2 USGS Hydrologic Unit Code and NCDWQ River Basin Designations

The Cochran Branch Mitigation Site lies within the Little Tennessee River Watershed NC Division of Water Quality (DWQ) sub-basin 04-04-01 and local HUC 06010202040020 and is within an NCEEP targeted local watershed. Located near the headwaters of the Burningtown Creek sub-watershed, the Site consists of two unnamed stream reaches with highly degraded stream channels. For purposes of this project, these reaches are referred to as Cochran Branch and Parrish Branch. Cochran Branch drains to Burningtown Creek approximately 0.5 miles downstream of the project. Burningtown Creek is classified as B;Tr by DWQ (2012).

Class B waters are protected for primary recreation such as swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis. Class B waters are also designated for fishing, wildlife, fish consumption, aquatic life including propagation, survival and maintenance of biological integrity, and agriculture (NCDWQ). Trout waters (Tr) have conditions that sustain and allow for trout propagation and survival of stocked trout.

2.2.3 Watershed Characterization

The Site watershed is characteristic of the Blue Ridge region with moderate rainfall with annual precipitation averaging 50 to 60 inches. The Site encompasses 1,564 linear feet of perennial streams including Cochran Branch and Parrish Branch.

The drainage area of Cochran Branch at the downstream end of the Site is 1.25 mi^2 (811 acres) and the drainage area at the downstream end of Parrish Branch is 0.1 mi^2 (64 acres). Land use within the watershed consists of 82% forest, 11% low-density residential and 7% agricultural land. Impervious area covers less than 1% of the total watershed.

2.2.4 Physiography, Geology, and Soils

The Cochran Branch Mitigation Site lies within the Southern Crystalline Ridges and Mountains Level IV ecoregion of the Blue Ridge Level III ecoregion (USGS 2002). This ecoregion occurs primarily on Precambrian-age igneous and high-grade metamorphic rocks, which are mostly gneiss and schist, covered by well-drained, acidic, loamy soils. The local lithology is mapped as part of the Coweeta Group as biotite gneiss (ZYbn) with intrusive pegmatites. The biotite gneiss is migmatitic, interlayered and gradational with biotite-garnet gneiss and amphibolite with intrusive lenticular to tabular Devonian to Silurian dikes and sills of unfoliated, granitic to granodioritic.

The valleys associated with the project streams are Type II colluvial valleys (Rosgen). The valleys present a structurally influenced morphology with valley cross slopes averaging 25% and longitudinal slopes averaging 4%. The valley bottom adjacent to Cochran Branch transitions from a confined colluvial form at the upstream end to a locally broader alluvial form that is present throughout the majority of the site. Elevations on the Site range from 2,150 feet at the northern boundary along Cochran Branch to 2,172 feet at the southern boundary along Cochran Branch.

Dominant soils found on-site include clay loam and fine sandy loam soils as part of the Braddock, Evard-Cowee, Nikwasi, Saunook, and Tuckaseegee-Whiteside complexes (NRCS 1996)(Figure 3). All streams on site are gravel bed streams dominated by sandy substrate from eroded banks and upland areas.

2.2.5 Historical Land Use and Development Trends

Historic land use at the Site has consisted primarily of agriculture and livestock grazing. Additional land use practices, including the maintenance and removal of riparian vegetation and the relocating, dredging, and straightening of on-site streams have contributed to unstable channel characteristics and degraded water quality. Historic wetlands were likely drained in order to maximize agricultural production. A review of historical aerial photos from 1976, 1994, 1998, 2005, 2006, and 2008 verified that land use has remained relatively consistent and that straightening of the channels and ditching of the wetlands occurred definitively more than twenty (20) years ago and are likely to have occurred considerably earlier than aerial photographic records. Land use changes are not anticipated within the watershed and developmental pressure is relatively low.

2.2.6 Existing Site Conditions

In order to assess existing geomorphic conditions, cross section measurements were taken at eight (8) locations within the site. These measurements were used to evaluate existing width-depth ratios, bank-height ratios, entrenchment ratios and stream classification (See Appendix C). Additionally, a bed-width index and a maximum depth index were calculated to assess departure from reference conditions. Data collected from naturalized streams in the surrounding watersheds, the reference reach surveys and the regional curve sites were used to develop regional hydraulic geometry relationships for reference channel bed width and reference maximum bankfull.

The bed-width index (BWI) was calculated by dividing the channel bed width measurements taken from the site by the reference bed width, and the max depth index (MDI) was calculated by dividing the measured maximum bankfull depth by the reference maximum bankfull depth. BWI values less than 1.0 indicate that the bed is narrower than the natural bed width and there will be a tendency for the channel to widen resulting in scour at the toe of bank. MDI values greater than 1.0 indicate that the channel depth is greater than the natural channel depth and that the resulting increase in shear stress may cause scour in the bed.

Vertical and lateral stability were further evaluated by mapping existing erosional and depositional features throughout the site and calculating bank erosion hazard index (BEHI) and near-bank stress (NBS) rating (Appendix C3).

A soils investigation was conducted by a licensed soil scientist in order assess the presence of hydric soils and determine areas suitable for wetland restoration. Additionally, thirty test pits were excavated to determine locations of buried A-horizons and buried hydric soils.

Cochran Branch

The majority of Cochran Branch classifies as a Type G stream with low width-depth ratios typically ranging from 4.7 to 8.4 and entrenchment ratios typically ranging from 1.7 to 2.5. The bank-height ratios on Cochran Branch are typically within the range of 1.9 to 2.2. Additionally, the BWI values range from 0.6 to 0.9 while the MDI values range from 1.2 to 1.5 and the bankfull width of the existing channel is approximately 60% of the reference width. This suggests that future adjustments of the channel will occur in the form of widening of the bed width and pattern adjustments resulting in additional bank erosion.

Cochran Branch enters the site at the southern end through a 48-inch pipe under Watson Road and then makes a right angle turn to flow parallel to Watson Rd. Cochran Branch immediately passes over an exposed bedrock outcrop before dropping down into the entrenched channel that is characteristic of the remainder of the site. This bedrock outcrop serves as a grade control for the first 75 feet of the stream after which the channel bed drops approximately 3 feet. As the channel proceeds through next 150 feet the grade is somewhat steeper (3.5%) than remainder of the site which is generally has less than 1% slope. The entrenched Cochran Branch flows through an active pasture with no riparian buffer.

Inspection of the site topography suggests that the channel was realigned from its historic position along the center of the valley to the eastern edge of the valley bottom. The contour mapping indicates that the valley is slightly lower approximately 50 feet to the west of the existing channel and there is evidence of remnant spoil piles on the west bank of the channel. The channel appears to carrying a significant bedload of sand and gravel as evidenced by the presence of multiple point bars and mid-channel bars. Investigations into the sediment loads and channel conditions within the site and upstream verified that sediment loads are derived from on-site and upstream locations.

Since the initial channel relocation and straightening the stream has been actively eroding the channel banks in an effort to re-establish proper dimension and pattern. Bank erosion has been further aggravated by the presence of livestock and the occasional dam building activities of beavers.

Parrish Branch

Parrish Branch classifies as a Type G stream with low width-depth ratios typically ranging from 8.5 to 9.5 and entrenchment ratios of 1.6 to 2.3. The bank-height ratios on Parrish Branch are typically within the range of 2.3 to 10. Additionally, the BWI values through this reach range from 0.9 to 1.1 and the MDI values range from 0.9 to 1.2 indicating that the channel adjustments have neared the end of lateral bed widening.

Immediately upstream of the site, Parrish Branch collects the flow from two small roadway cross pipes and possibly two small seeps. The drainage from a third small cross pipe is added to Parrish Branch approximately half-way downstream. There are obvious signs that the channel was previously dredged which include the uniform ditch-like appearance, offset position from the low point in the valley, and spoil adjacent to the channel.

The presence of several nick points indicates the downward bed degradation and upstream head-cut migration are ongoing processes within the channel. Additionally, a well pronounced depositional feature and the downstream end of this tributary confirms that active degradation is contributing a significant sediment load to the existing channel.

Floodplain and Wetlands

The valley bottom adjacent to Cochran Branch which constitutes the historic alluvial floodplain is approximately 4.4 acres, of which approximately 0.88 acres remain as jurisdictional wetlands. The extreme upper portion of the floodplain has a down-valley slope of approximately 1.6% and the majority of the floodplain downstream from this upper portion has a down-valley slope of less than 1.0%. Although the floodplain has been severely impacted by past land use practices there is substantial evidence that this entire area was historically wetlands.

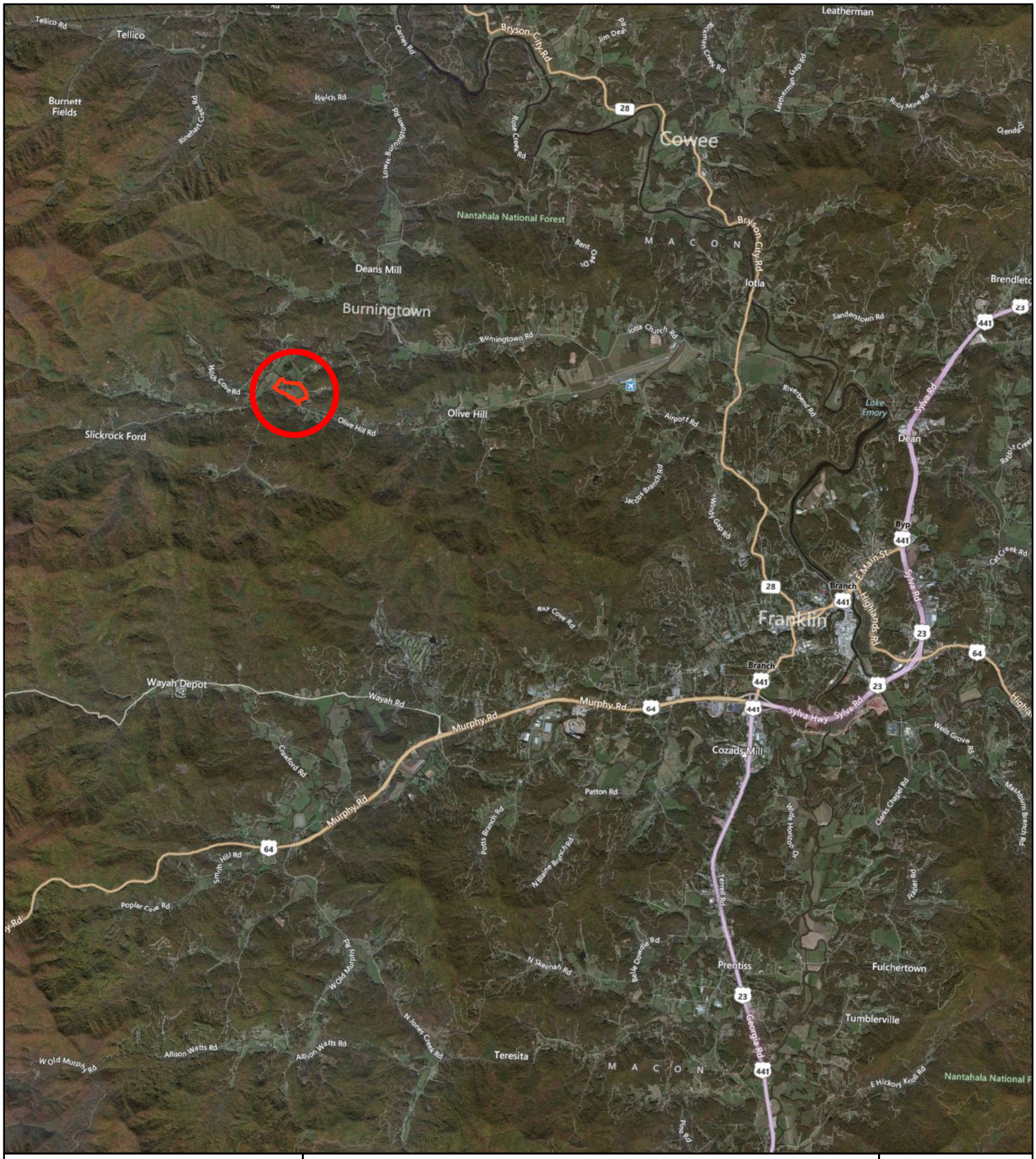
In addition to the Cochran Branch channel having been relocated to the east side of the floodplain, two drainage ditches have been excavated through the floodplain that parallel Cochran Branch. The main ditch begins in the extant wetlands at the base of the west toe of the valley slope and extends down-valley closely following the toe of slope. The second smaller ditch appears to have been excavated to drain the toe-of-slope area along the northwest portion of the floodplain. Both ditches are connected together at the downstream end of the site and flow through a 15-inch pipe under Middle Burningtown Rd. There are pronounced spoil piles along these ditches with sufficient evidence to suggest that the ditches have been maintained in the fairly recent past.

The effect of dredging and re-aligning of Cochran Branch and the floodplain ditches has been to severely impact the groundwater hydrology of the floodplains. The Cochran Branch channel invert is set approximately 3 to 4 feet below the floodplain surface and the drainage ditches are approximately 1 to 2 feet below the floodplain surface. These lower channel and ditch elevations not only facilitate the removal of surface water from the floodplain and reduce retention time they also affect hydrology by drawing down groundwater adjacent to these features.

In addition to lowering of the groundwater table and reduction in surface water retention, the former wetlands have been impacted by the deposition of soil, silt, and sediment on top of the former floodplain surface. The presence of this overburden is obvious in many locations across the floodplain by the occurrence of a distinct buried A-horizon. The overburden varies in depth from 6 to 12 inches and is likely the result of several past land use practices. During the late nineteenth century and early twentieth century logging practices clear-cut most of the mountain region and contributed to significant increases in erosion and sediment loads of streams. Following the clearing of the mountain slopes and prior to the availability of mechanized equipment, agricultural practices in the mountains often required that farmers cultivated the valley slope adjacent to the valley bottoms. Evidence of this practice at the Site can still be observed as faint parallel row scars on the valley slopes. Past heavy sediment loads in the streams and sediment production from logging and agriculture could easily account for the majority of the observed overburden. Added to that would be the wasting and grading out of material produced from the dredging of Cochran Branch and the drainage ditches.

NCWAM Assessment

The North Carolina Wetlands Assessment Method (NCWAM) was used to assess the function and provide a baseline condition of the existing wetlands (Appendix C). The NCWAM is meant to provide a consistent, rapid, scientifically based field method for determining the level of function relative to a reference condition for a given wetland type (NCWFAT 2010). NCWAM assigns a qualitative, overall function rating based on the condition of three sub-functions—hydrology, water quality, and habitat. Wetlands on the Cochran site consist of a network of non-tidal freshwater marshes located in the floodplain of Cochran Branch (Wetlands A, B, D, and E), and one isolated seep located on the terrace above the Cochran Branch floodplain along the western boundary of the easement. Existing wetlands rated low and medium for the non-tidal freshwater marsh and seep, respectively. The non-tidal freshwater marsh was limited by the physical structure, e.g. size and continuity. The seep rated medium and was mainly limited by low landscape connectivity.



VICINITY MAP

COCHRAN RESTORATION SITE

Macon County, North Carolina

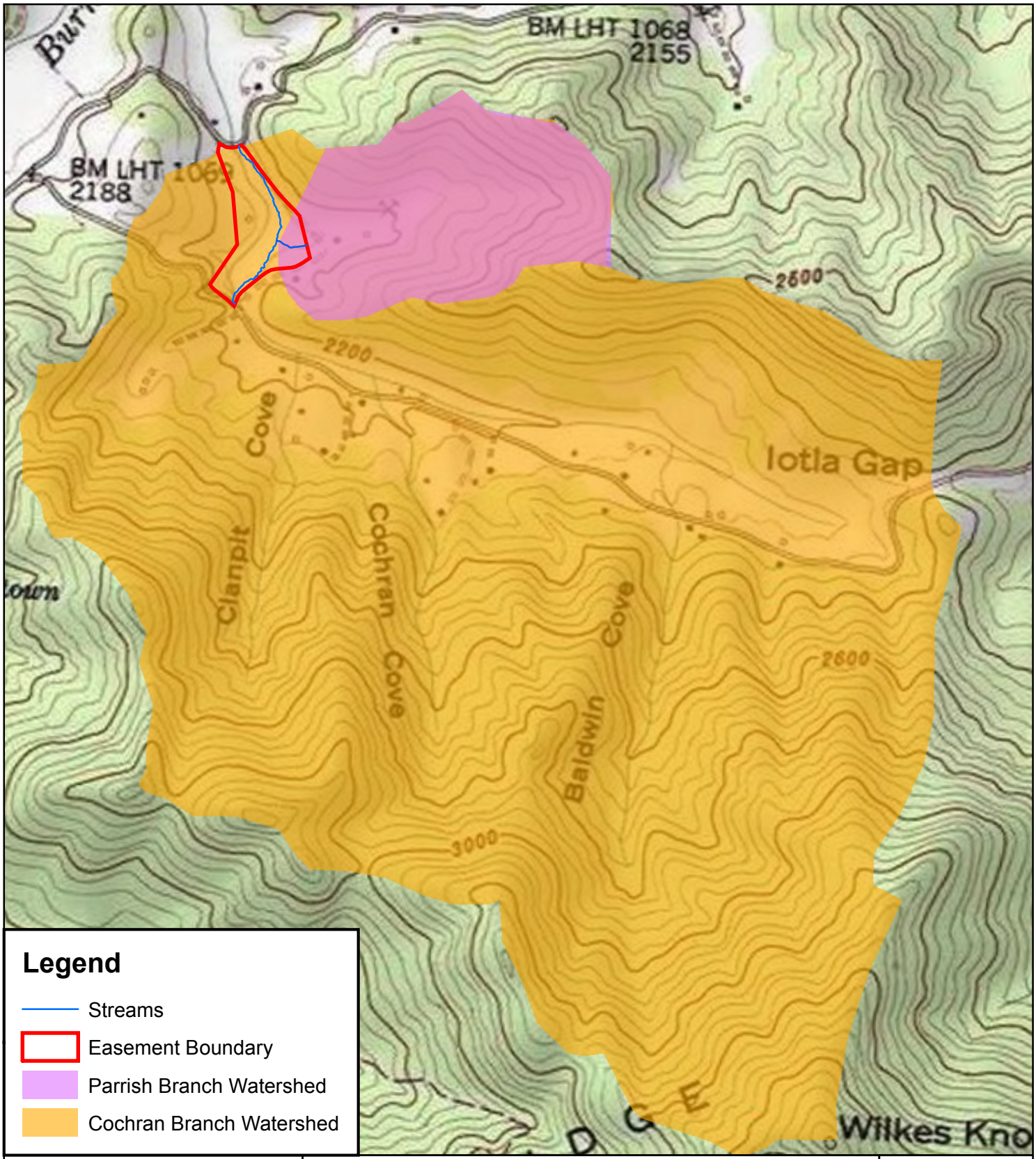
0 0.5 1 2 3 4 Miles

N

FIGURE

1

Date: 11/4/2013



Wolf Creek ENGINEERING

WATERSHED MAP

COCHRAN RESTORATION SITE

Macon County, North Carolina

0 200400 800 1,200 1,600

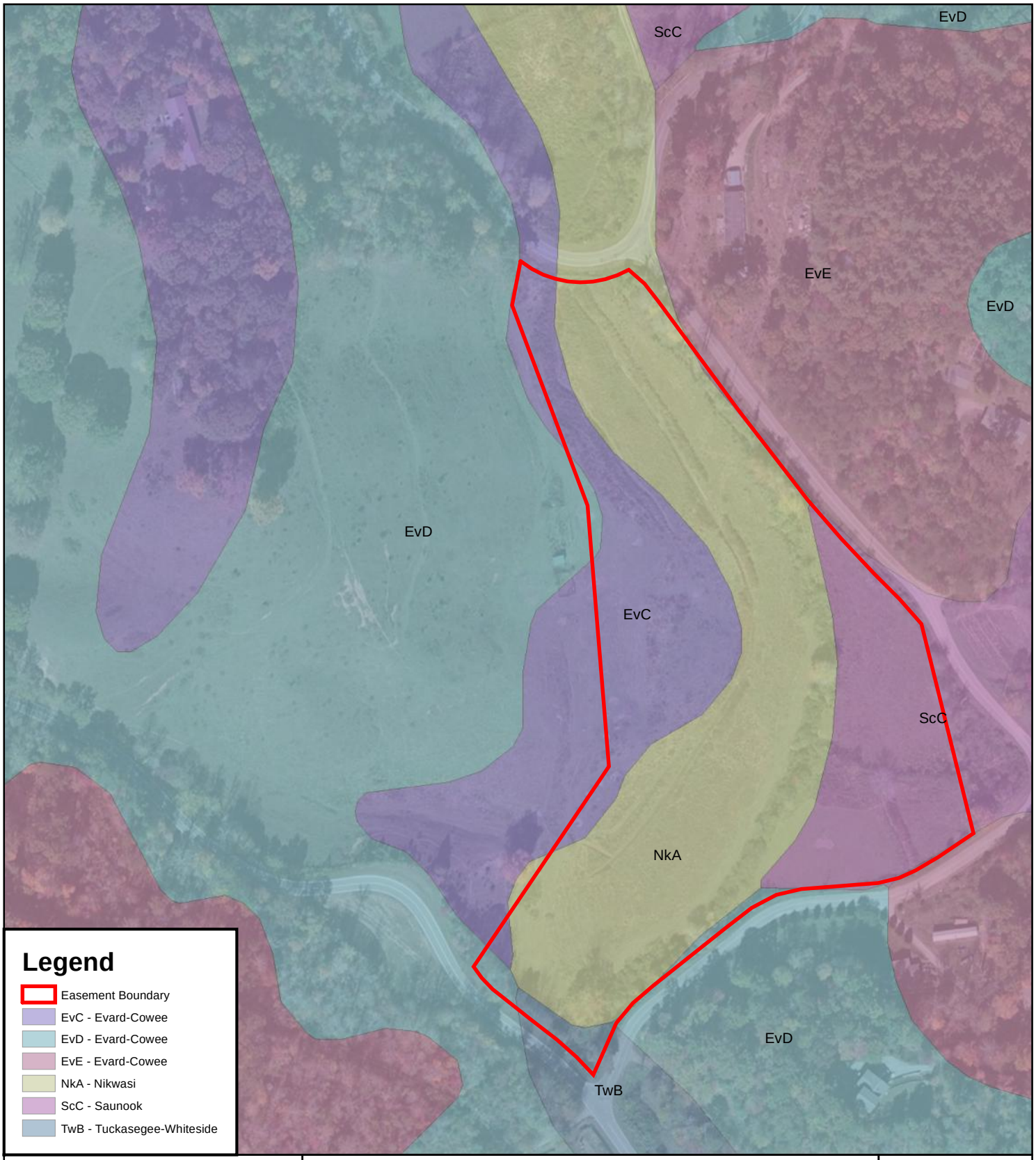
Feet

N

FIGURE

2

Date: 6/24/2014



Wolf Creek ENGINEERING

SOILS MAP

COCHRAN RESTORATION SITE

Macon County, North Carolina

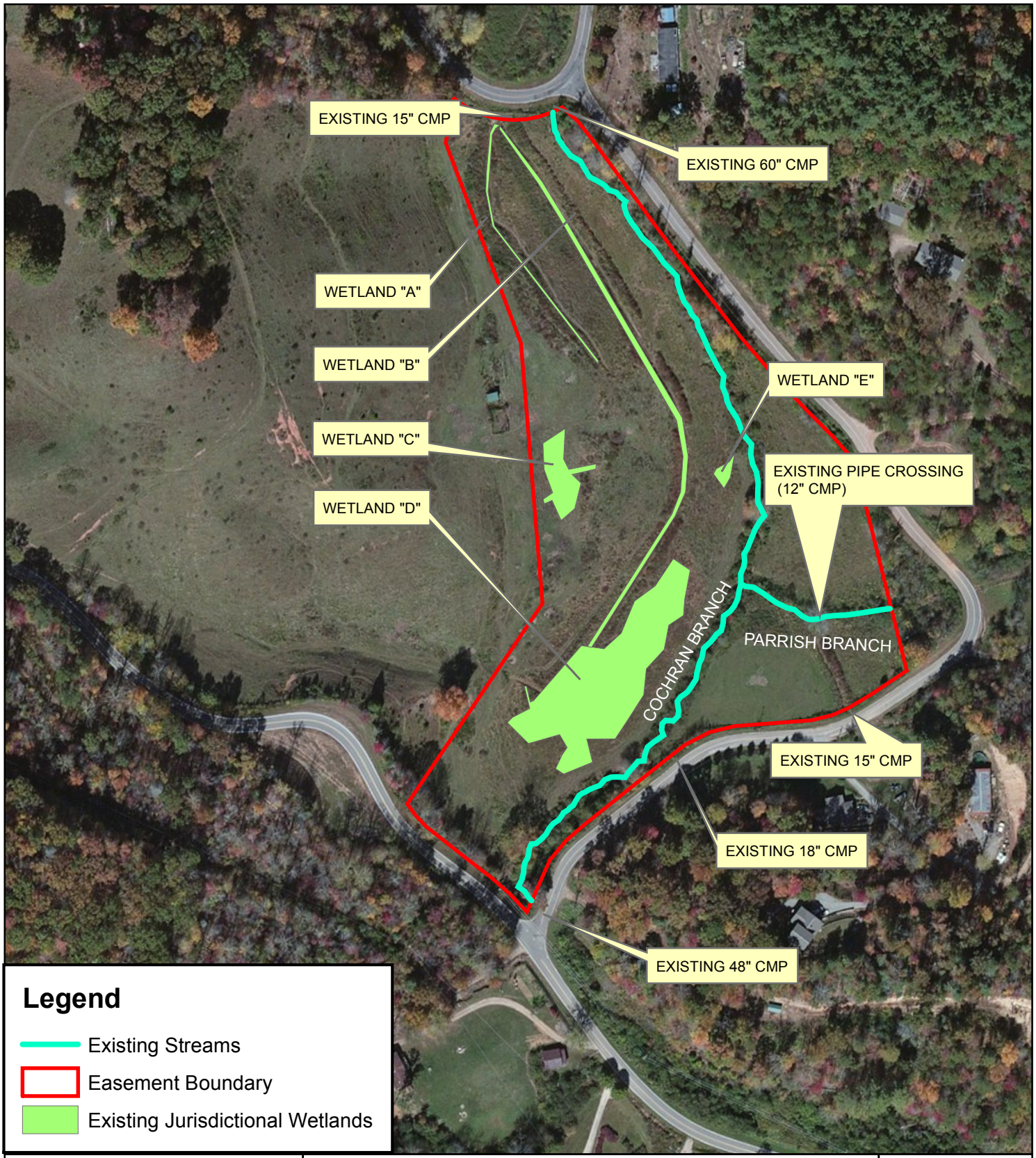
0 50 100 200 300 400 Feet

N

FIGURE

3

Date: 6/25/2014



Wolf Creek ENGINEERING

EXISTING CONDITIONS

COCHRAN RESTORATION SITE

Macon County, North Carolina

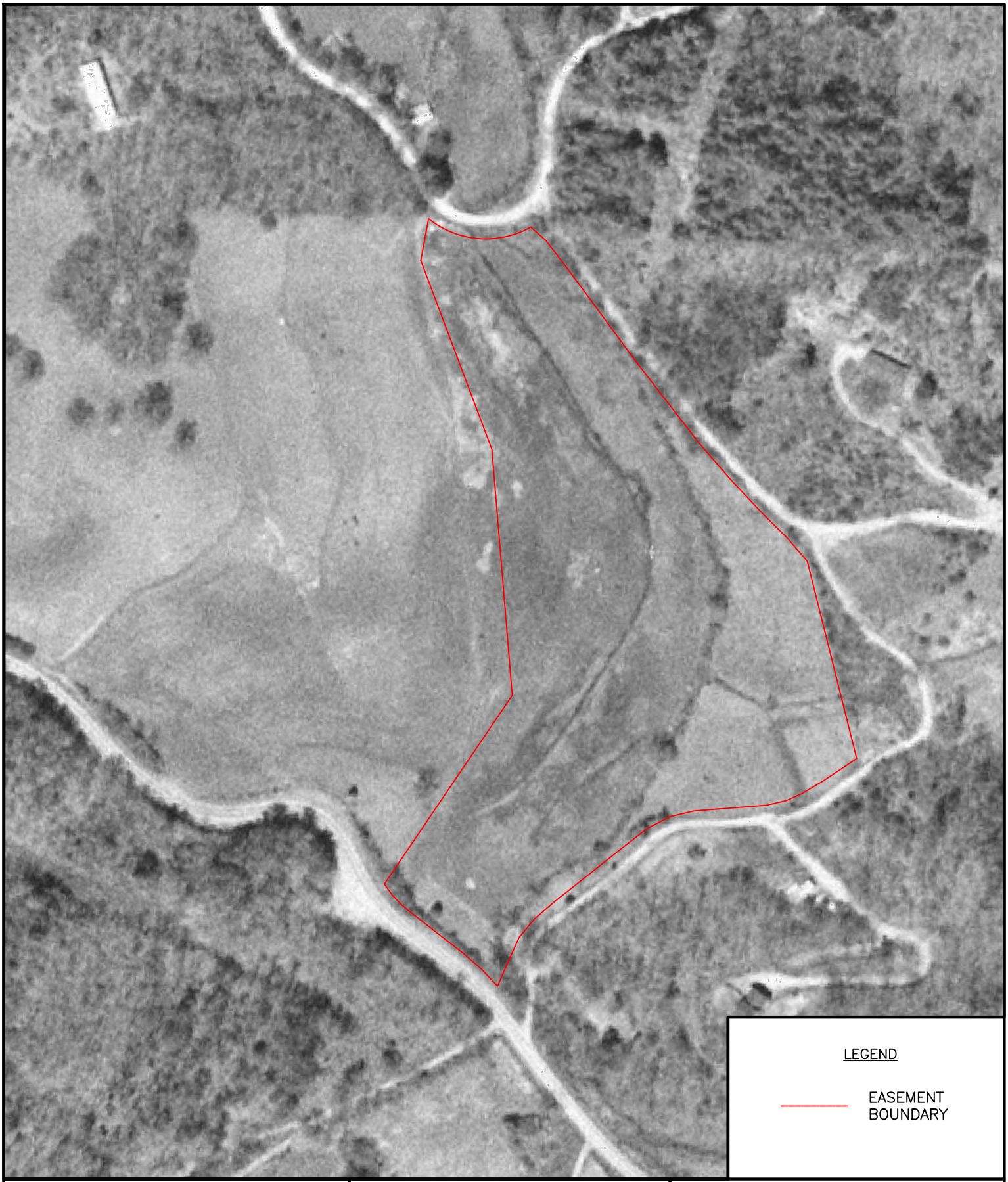
0 50 100 200 300 400 Feet

N

FIGURE

4

Date: 6/25/2014



PREPARED FOR: Ecosystem Enhancement Program

PREPARED BY: Wolf Creek Engineering

NOT TO SCALE

1994 AERIAL PHOTO
ENVIRONMENTAL DATA RESOURCES, INC.

HISTORICAL AERIAL PHOTO

COCHRAN RESTORATION SITE
MACON COUNTY, NORTH CAROLINA

FIGURE 5

Photo No. 1

Cochran Branch facing upstream @ Sta 101+00 5/1/2013

Photo No. 2

Cochran Branch facing downstream @ Sta 101+00 5/1/2013

Photo No. 3

Cochran Branch facing upstream @ Sta 104+25 5/1/2013

Photo No. 4

Cochran Branch @ Sta 106+00 5/1/2013

Photo No. 5

Cochran Branch facing downstream @ Sta 106+00 5/1/2013

Photo No. 6

Cochran Branch facing downstream @ Sta 108+00 5/1/2013

Photo No. 7

Cochran Branch facing upstream, @ Sta 109+00 5/1/2013

Photo No. 8

Cochran Branch facing upstream, @ Sta 111+25 5/1/2013

Photo No. 9

Cochran Branch facing upstream, @ Sta 112+25 5/1/2013

Photo No. 10

Cochran Branch facing downstream, @ Sta 114+00 5/1/2013

Photo No. 11

Parrish Branch facing downstream 5/1/2013

Photo No. 12

Parrish Branch facing upstream 5/1/2013

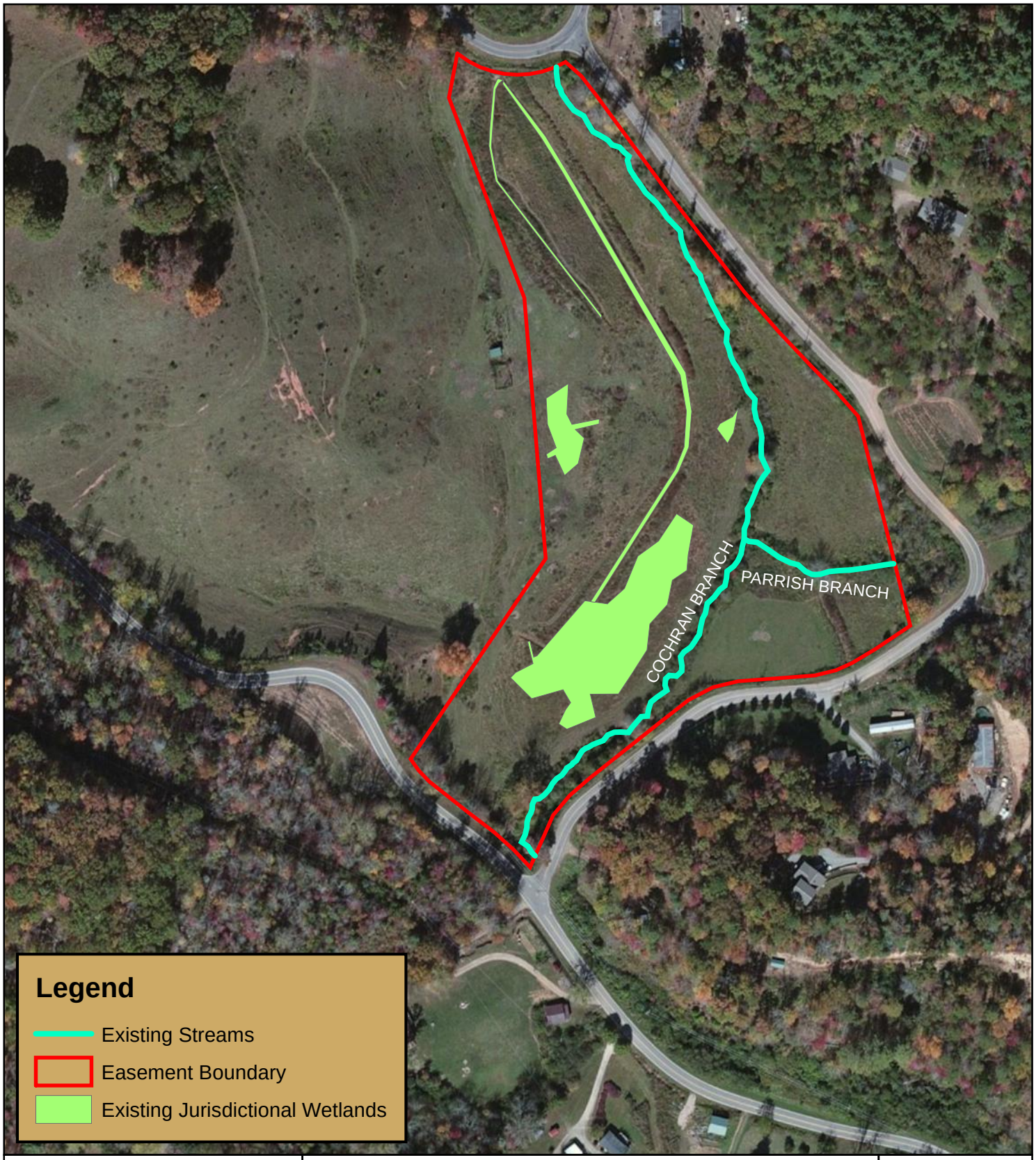
3.0 SITE PROTECTION INSTRUMENT

The land required for the construction, management, and stewardship of this mitigation project includes portions of the following parcels. A copy of the land protection instrument(s) is included in Appendix A.

	Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Number	Acreage protected
Parcel A	Jerry Lee Parrish	6556932975	Macon	Conservation Easement	E-17/287	10.06

When available, the recorded document(s) will be provided. If the recorded document(s) are not available, the template documents will be provided.

All site protection instruments require 60-day advance notification to the Corps and the State prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.



Wolf Creek ENGINEERING

SITE PROTECTION INSTRUMENT FIGURE

COCHRAN RESTORATION SITE

Macon County, North Carolina

0 50 100 200 300 400 Feet

N

FIGURE

6

Date: 6/25/2014

4.0 BASELINE INFORMATION

4.1 Project Information

Project Name	Cochran Branch
County	Macon County
Project Area (acres)	10.06 ac.
Project Coordinates (latitude and longitude)	35°12'52.03" N and longitude 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	06010202040020
DWQ Sub-basin		04-04-01	
Project Drainage Area (acres)		811 (1.25 sq. mi)	
Project Drainage Area Percentage of Impervious Area		<5%	
CGIA Land Use Classification		2.01.03 Hay and Pasture Land	

4.2 Reach Summary Information

Parameters	Cochran Branch	Parrish Branch			
Length of reach (linear feet)	1332	232			
Valley classification (Rosgen)	II	II			
Drainage area (square miles)	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	Very Poorly Drained	Very Poorly Drained, Mod. Well Drained			
Soil Hydric status	Hydric	Hydric, Non-Hydric			
Slope	0.66 %	4.2 %			
FEMA classification	N/A	N/A			
Native vegetation community	Agricultural	Agricultural			
Percent composition of exotic invasive vegetation					

4.3 Wetland Summary Information

Parameters	A	B	C	D	E
Size of Wetland (acres)	0.03	0.14	0.11	0.70	0.02
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian Non-Riverine	Riparian Non-Riverine	Riparian Non-Riverine	Riparian Non-Riverine	Riparian Non-Riverine
Mapped Soil Series	NkA	NkA	EvC	NkA	NkA
Drainage class	Very poorly drained	Very poorly drained	Very poorly drained	Very poorly drained	Very poorly drained
Soil Hydric Status	Hydric	Hydric	Hydric	Hydric	Hydric
Source of Hydrology	Groundwater	Groundwater	Seep	Groundwater	Groundwater
Hydrologic Impairment	Dredging/Ditching	Dredging/Ditching	Ag. Compaction	Dredging/Ditching	Dredging/Ditching
Native vegetation community	Pasture	Pasture	Pasture	Pasture	Pasture
Percent composition of exotic invasive vegetation					

4.4 Regulatory Considerations

Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States – Section 404	Yes	To Be Permitted	
Waters of the United States – Section 401	Yes	To Be Permitted	
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	

5.0 DETERMINATION OF CREDITS

Mitigation credits presented in the following tables are projections based upon site design. Upon completion of site construction the project components and credits data will be revised to be consistent with the as-built condition.

Cochran Branch, Macon County
EEP Project Number 95720

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	**1783**		**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*	Mitigation Ratio
Cochran Branch	**100+60 – 115+05**	**1332**	**PI**	**R**	**1387**	**1:1**
Parrish Branch	**200+15 – 204+11**	**232**	**PII**	**R**	**396**	**1:1**
Wetland Area 1		**-**	**Re-Est.**	**R**	**3.33**	**1:1**
Wetland Area 1		**0.88**	**Re-Hab.**	**R**	**0.82**	**1:1**
Wetland Area 2		**0.11**	**Enh.**	**RE**	**0.11**	**2:1**
Wetland Area 3		**-**	**Re-Est.**	**R**	**0.09**	**1:1**

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	1783		4.24			
Enhancement			0.11			
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes
FB	Entire Site	Protect Stream	

BMP Elements
BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer

Credit ratios for wetland restoration are proposed based on the NCDENR Memorandum titled "Consistency between Federal and State Wetland Mitigation Requirements" and dated July 30, 2013. As stated in this memorandum, the Federal Mitigation Rule define "**Restoration**" as the manipulation of the physical, chemical or biological characteristics of a site with the goal of returning/historic functions to a former or degraded aquatic resource. Within this definition restoration consists of "**Re-establishment**" of a former aquatic resource or "**Rehabilitation**" of a degraded aquatic resource. The memorandum provides that for consistency the federal definition of "Restoration" which includes both "Re-establishment" and "Rehabilitation" be used to satisfy the 1:1 restoration required in the State Rule [15A NCAC 02H .0506 (g)(6)].

Both re-establishment and rehabilitation are proposed for the Cochran Site due to the significant degradation and loss of wetland functions. The majority of the area containing hydric soils is no longer comprised of jurisdictional wetlands and those areas that retain jurisdictional status have suffered significant functional loss due to ditching, draining and agricultural land use. The restoration plan will provide for recovery of wetland functions related to hydrology, soils, and vegetation. Hydrology will be restored by eliminating ditches, raising the adjacent stream profile, and re-grading of the floodplain to provide appropriate micro- and macro-topography. Buried hydric soils will be uncovered and re-exposed by the floodplain grading. Invasive species will be removed and a riparian wetland vegetation community with be established. In addition to improvement and restoration of aquatic resources, the site will provide water quality improvement through the treatment and filtering of adjacent agricultural runoff.

6.0 CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary DA authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Forested Wetlands Credits			
Monitoring Year	**Credit Release Activity**	**Interim Release**	**Total Released**
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70%
5	Fifth year monitoring report demonstrates performance standards are being met; Provided that all performance standards are met, the IRT may allow the NCEEP to discontinue hydrologic monitoring after the fifth year, but vegetation monitoring must continue for an additional two years after the fifth year for a total of seven years.	10%	80%
6	Sixth year monitoring report demonstrates performance standards are being met	10%	90%
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval	10%	100%

Stream Credits			
Monitoring Year	**Credit Release Activity**	**Interim Release**	**Total Released**
0	Initial Allocation – see requirements above	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50% (60%*)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (70%*)
4	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%*)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%*)
6	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%*)
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval	10%	90% (100%*)

Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by the NCEEP without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; Per the NCEEP Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after two bank-full events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bank-full events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the NCEEP will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

7.0 MITIGATION WORK PLAN

7.1 Description of Target Stream, Wetland and Vegetation Communities

Reference reaches were sought to provide a target for design of the proposed streams. Searches were conducted first upstream and downstream of the Site and then into surrounding watersheds to find suitable references that contained comparable slope, bed material, and valley type. Two type E4 stream references were located Transylvania County; one on the South Fork Mills River and the other on Club Gap Branch. A type B4 stream reference was located on Cold Springs Creek, a tributary to the Pigeon River in Haywood County. The type E references will be used for proposed type C streams since reference quality type C streams are difficult to locate in the mountain provinces and are often associated with more disturbed conditions. Additionally, the type E reference represents the evolutionary endpoint for type C streams once sediment loads have diminished in response to channel stabilization and upstream watershed stabilization. The reference vegetation community data was also collected at the Cold Springs reference site.

7.1.1 Reference Reach

The reference reaches were selected to represent the probable configurations for the proposed streams. Detailed geomorphic survey and Level II Rosgen classifications were conducted on two reaches at South Fork Mills River and three reaches at Cold Springs for a total of over 1600 linear feet of reference profile (See Appendix C).

Club Gap Branch Reference

The Club Gap Branch reference reach is located in the Blue Ridge hydro-physiographic region of North Carolina. The Club Gap Branch watershed has many characteristics in common with the Cochran Branch watershed including elevation changes and valley type, however, the average annual rainfall is considerably higher (> 90 inches) since the watershed is in the high rainfall region of Transylvania County. The reference watershed is located in the Pink Beds area of the Pisgah National Forest and is predominantly forested. The drainage area for the Club Gap Branch reference is 0.25 mi^2.

The Club Gap Branch reach is representative of an E4 channel in a lower gradient alluvial floodplain nested within moderately sloped valley. Bed material, channel slope and valley form of this stream are consistent with the majority of Site and provide reasonable analogues for the potential channel forms that can be expected at the Site. The Club Gap Branch reference reach has a range of D_{50} of 13 mm to 17 mm, D_{84} of 22 mm to 33 mm, channel slope of 0.84%, width/depth ratio of 6 to 11 and sinuosity of 1.6.

South Fork Mills River Reference

The South Fork Mills River reference reach is located in the Blue Ridge hydro-physiographic region of North Carolina. The South Fork Mills River watershed has many characteristics in common with the Cochran Branch watershed including elevation changes and valley type, however, the average annual rainfall is considerably higher (> 90 inches) since the watershed is in the high rainfall region of Transylvania County. The reference watershed is located in the Pink Beds area of the Pisgah National Forest and is predominantly forested. The drainage area for the South Fork Mills River reference is 0.97 mi^2.

The South Fork Mills River reach is representative of an E4 channel in a lower gradient alluvial floodplain nested within moderately sloped valley. Bed material, channel slope and valley form of this stream are consistent with the majority of Site and provide reasonable analogues for the potential channel forms that can be expected at the Site. The South Fork Mills River reference reach has a range of D_{50} of 30 mm to 42 mm, D_{84} of 63 mm to 68 mm, channel slope of 0.54%, width/depth ratio of 7 to 10 and sinuosity of 1.2 to 1.5.

Cold Springs Reference
The Cold Springs Creek reference reach is located in the Blue Ridge hydro-physiographic region of North Carolina. The Cold Springs watershed has many characteristics in common with the upper reach of Cochran Branch and Parrish Branch watershed including average annual rainfall, elevation changes and valley type. The reference watershed is located in the Harmon Den Wildlife Management area of the Great Smokey Mountains National Park and is predominantly forested. The drainage area for the Cold Springs Creek reference is 2.63 mi^2.

The Cold Springs reach is representative of a B4 channel in a moderately sloped valley with a narrow, constrained floodplain. Bed material, channel slope and valley form of this stream are consistent with the Site and provide reasonable analogues for the potential channel forms that can be expected at the Site. The Cold Springs reference reaches have a range of D_{50} of 20 mm to 46 mm, D_{84} of 84 mm to 168 mm, channel slope of 2.3% to 3.2 %, width/depth ratio of 16 to 21 and sinuosity of 1.05 to 1.10.

Discharge and Bankfull Verification
Bankfull was readily identified on the reference reaches as it exhibited consistent indicators throughout the reaches. Verification of bankfull was accomplished by plotting the bankfull cross sectional area against the regional curve data. The data indicates that the bankfull identified in the surveyed reach is slightly lower than the line of the regional curve but consistent with the range of data collected in the regional curve study.

After verification of bankfull cross sectional area, bankfull discharge was calculated for the surveyed reach using a single-section analysis. Manning's 'n' was estimated from relative roughness calculations of the bed material and from observation of the channel form and vegetation conditions. Water surface slope was assumed to be consistent with the slope of the bed profile. Discharge was then compared to the regional curve data which indicated that the calculated bankfull discharges were consistent with the regional curve data.

Channel Stability Assessment
A detailed channel stability assessment was not performed for these reaches since the bank and bed stability was apparent from observation. Subsequent review of the surveyed dimensions confirmed that width-depth ratios and bank-height ratios were within the appropriate range for stable, self-maintaining streams. Additional observations included significant upstream and downstream reconnaissance to identify any past, present, or future signs or sources of degradation.

Limited Reach References
Through the course of conducting the reference reach searches, several streams were identified as possessing qualities of stability and natural form. However, these reaches were determined not to be suitable references for the project due to incompatible stream type, valley form, or insufficient reach length. In these locations morphological measurements were taken to supplement the data acquired from the reference reach sites. Measurements on ten individual reaches included bankfull width, bed width, depth of bankfull, toe depth, and width of thalweg.

7.1.2 Reference Wetlands and Vegetation Communities
Reference wetlands are difficult to identify in the mountain region due to the extensive impacts to the relatively scarce resource of bottomland floodplains. Additionally, the climatic and geologic variability in the mountain region can produce seemingly comparable wetland and/or bottomland features with divergent hydro-periods. In order to address the need to provide reference criteria for the proposed restoration the vegetation will be based on descriptions provided in literature for natural mountain vegetation communities and reference hydrology will be based on a past successful wetland restoration site in the mountains that has a five year monitoring record.

Vegetation Communities

The target vegetation communities for the site will be *Piedmont/Mountain Bottomland Forest* in the floodplain wetlands which will grade laterally upslope to *Montane Alluvial Forest* and then to *Montane Oak Hickory*. According to Schafle and Weakley the *Piedmont/Mountain Bottomland Forest* canopy is comprised primarily of mesic bottomland species such as tulip poplar (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), hackberry or sugarberry (*Celtic occidentalis/laevigata*), green ash (*Fraxinus pennsylvanica*), and bitternut hickory (*Carya cordiformis*). The understory can be diverse, and includes species such as ironwood (*Carpinus caroliniana*), American holly (*Ilex opaca*), and red maple (*Acer rubrum*). Vines are prominent, and include poison ivy (*Toxicodendron radicans*), various greenbriers (*Smilax spp.*), grapes (*Vitis spp.*), and Virginia creeper (*Parthenocissus virginianus*). Herbs are also diverse, and can include multiple types of sedges (*Carex spp*.), river oats (*Chasmanthium latifolium*), violets (*Viola spp*.), jumpseed (*Persicaria virginiana*), jack-in-the-pulpit (*Arisaema triphyllum*), and Virginia rye grass (*Elymus virginicus*).

The *Montane Alluvial Forest* canopy is a mixture of various bottomland trees such as sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), tulip poplar (*Liriodendron tulipifera*), river birch (*Betula nigra*), green ash (*Fraxinus americana*), and sometimes white oak (*Quercus alba*) and northern red oak (*Quercus rubra*). The subcanopy often contains witch hazel (*Hamamelis virginiana*), ironwood (*Carpinus caroliniana*), American holly (*Ilex opaca*), tag alder (*Alnus serrulata*), black willow (*Salix nigra*), and great laurel (*Rhododendron maximum*). Understory herbs include elderberry (*Sambucus canadensis*), dog-hobble (*Leucothoe fontanesiana*), golden ragwort (*Senecio aureus*), water leaf (*Hydrophyllum virginianum*), green-headed coneflower (*Rudbeckia laciniata*), jack-in-the-pulpit (*Arisaema triphyllum*), and water hemlock (*Cicuta maculata*).

The *Montane Oak-Hickory Forests* generally occur on dry-mesic slopes and partly sheltered ridges. The canopy is dominated by a mixture of oaks and hickories, the most prevalent being white oak (*Quercus alba*), northern red oak (*Quercus rubra*), chestnut oak (*Quercus montana*), mockernut hickory (*Carya tomentosa*), and pignut hickory (*Carya glabra*). Other trees include tulip poplar (*Liriodendron tulipifera*) and red maple (*Acer rubrum*), and juvenile sprouts of American chestnut (*Castanea dentate*) can frequently occur. The understory usually contains sourwood (*Oxydendrum arboreum*), blackgum (*Nyssa sylvatica*), flowering dogwood (*Cornus florida*), and serviceberry (*Amelanchier arborea*). Shrubs are generally ericaceous, and include mountain laurel (*Kalmia latifolia*), flame azalea (*Rhododendron calendulaceum*), huckleberry (*Gaylussacia* spp.), and blueberry (*Vaccinium* spp.). Herbs are sparse, with species such as Indian cucumber root (*Medeola virginiana*), solomon's seal (*Polygonatum biflorum*), false solomon's seal (*Maianthemum racemosum*), twisted stalk (*Uvularia puberla*), wild whorled yam (*Dioscorea villosa*), and squaw root (*Conopholis Americana*).

Reference Hydrology

The NCEEP completed construction on the Cat Creek Stream and Wetland Restoration Site in Macon County in 2010 and will conclude five years of groundwater monitoring in 2014. The site provides a similar geologic setting of a mountain stream that occupies a small floodplain with associated wetlands. Wetland hydrology on the Cat Creek Site is derived partly from toe-of-slope seeps and partly from floodplain connectivity with the stream. Continuation of monitoring of groundwater conditions at this site will provide a comparison for groundwater conditions at the Cochran Site. This will be especially helpful for comparisons of the hydro-periods in non-typical climatic years should they occur during the monitoring period. It is recognized that this is not the ideal scenario for hydrology comparisons given that the Cat Creek Site is a recently completed wetland restoration site. However, the mountain region offers a unique set of challenges with respect to variability in rainfall within the region. Rather than proposing to monitor hydrology in a wetland that may be similar in landscape position but relatively distant from the site, the proposed reference monitoring will occur on a site that is relatively close and similar. Additionally, since the site will have been monitored for five years in 2014, groundwater data will have been collected for twelve years by then end of monitoring for the Cochran Site.

7.2 Design Narrative

7.2.1 Restoration Approach

Cochran Branch

Cochran Branch is divided into two sub-reaches; Reach 1A is the steeper upstream reach and Reach 1B is downstream from the steeper reach and flows through the majority of the site. Reach 1A is proposed for Priority I restoration as a type B4 stream with moderate sinuosity and an average slope of 3.5%. Reach 1B is proposed for Priority I restoration as a type C4 stream with moderate sinuosity and an average slope of 0.85%. The existing degraded stream conditions sufficiently warrant complete reconstruction of the reach, however, equally as important is raising the stream profile to reconnect it to the floodplain, which is integral to the success and function of the proposed wetland restoration. Reconstruction of the channel will provide for configuration of proper cross sectional geometry that will reduce stress on the banks and eliminate bank scour. Additionally, reconstruction will provide the opportunity to harvest the gravel bed material in the existing channel and utilize it to construct proper, functional riffles. Riffles constructed from native gravel material along with in-stream structures will provide immediate habitat features and a dramatic functional lift.

Parrish Branch

Parrish Branch is proposed for restoration as a type B4 stream with moderate sinuosity and an average channel slope of 3.3%. Full restoration is required to address the degraded conditions of severe channel incision, unstable banks and improper channel dimensions which are negatively affecting the stream functions. A Priority II approach is required for the majority of the reach due to topographic constraints. The downstream end of Parrish Branch will be repositioned to connect the channel to the low point in the valley and the new floodplain of Cochran Branch which will constitute Priority I restoration.

Wetland Rehabilitation and Re-establishment

Wetland re-establishment is proposed for entire area of the Cochran floodplain that contains hydric soils and that is not presently considered jurisdictional wetlands. Wetland rehabilitation is proposed for the extant wetlands located within the Cochran floodplain. Using the NCWAM designations, the proposed rehabilitation would convert the existing *Non-tidal Freshwater Marsh* to a *Bottomland Hardwood Forrest*. The re-establishment and rehabilitation of the Cochran floodplain as a *Bottomland Hardwood Forrest* corresponds with the *Montane Alluvial Forrest* community (NCWFAT 2010).

Two additional wetland features will also be addressed that are not directly connected to the Cochran floodplain. Wetland enhancement is proposed for the existing pocket wetland located on the terrace adjacent to the floodplain. Additionally, the restoration of Parrish Branch and adjacent field indicators of buried hydric soils provide the opportunity to re-establish wetlands at the outfall of the middle ditch.

7.2.2 Restoration Methods

Stream Restoration

Restoration of Type C4 and B4 streams will consist of constructing a low to moderate sinuosity (1.05-1.14) stream with a moderate width-depth ratio (13-17) that accesses the floodplain at greater-than-bankfull flows. For stream reaches with average channel slopes from 1.5% to 4% the bed profile form is in a range that is transitioning from riffle-pool morphology at the lower slopes to step-pool morphology at the steeper slopes. The profile is therefore a combination of riffles, rapids, and step-pool features. For stream reaches with average slopes less than 1.5% the bed profile form is dominated by riffle-pool morphology.

Exploration for buried bed material will be conducted in proximity of the channel work to harvest available bed material for reuse in the constructed channel. Where the quantity of existing bed material is insufficient it will be supplemented with off-site material of appropriate size.

In some locations topographic constraints prevent Priority I restoration and it will be necessary to construct a bankfull bench. Along these reaches, topsoil will be removed prior to excavation and stockpiled. After completion of grading operations, topsoil will be redistributed across the floodplain bench to facilitate vegetation success.

Boulder and log structures will be used to provide vertical stability to the channel, assist in maintaining riffle, run and pool features and to provide habitat features. Run structures will generally be placed at the tail-of-riffle location to support the upstream riffle grade. Run structures will be composed of a series of small steps and pools which will transition into the main downstream pool. Log sills will be used in a similar fashion on smaller streams or on flatter grade reaches. Log J-hooks will be used to shift the flow away from the outside banks on selected meander bends. Brush-toe structures will be installed on the outside of certain meander bends to provide bank stability, increase bank roughness, and provide aquatic habitat. Trees with diameters in the range of 12" to 24" will be harvested from the site or nearby property for use as in-stream structures. Small diameter (less than 6") woody plants suitable for transplanting will be harvested on-site where available.

Earthwork activities will include excavation of the proposed channels, partial or complete backfilling of existing channels and removal of existing spoil berms. Grading work is designed to restore or mimic natural contours.

Wetland Rehabilitation and Re-establishment

Re-establishment of the wetlands on the Cochran Branch floodplain will involve the removal of overburden material to expose the underlying buried A-horizon and hydric soils. Wetland hydrology will be restored by raising the bed elevation of Cochran Branch and filling in the floodplain drainage ditches. Additional grading activities will include harvesting usable topsoil material for re-use on the re-graded floodplain, removal of spoil berms, and grading micro-topography to provide for additional retention of surface water and increased habitat diversity.

Rehabilitation of existing wetland on the Cochran Branch floodplain will primarily involve elimination of drainage features that are impacting wetland hydrology and improving micro-topography to improve surface water retention. Aggressive re-grading will be limited to areas where there is more than 4 inches of overburden on a well-defined buried A-horizon. Where re-grading is determined feasible, the topsoil and vegetation will be removed first and stockpiled for redistribution on the new floodplain surface.

Re-establishment of wetlands adjacent to Parrish Branch will involve re-grading the outfall of the middle ditch to form a subdued alluvial fan feature typical of wetland features found on small mountain streams. The graded fan feature will be saturated with flow from the persistent seep emanating from this ditch.

All Re-establishment and Rehabilitation areas will be ripped to remove effects of past compaction and planted with native wetland vegetation. This includes the enhancement area of pocket wetlands on the terrace adjacent to the Cochran floodplain.

General

All disturbed areas will be stabilized with temporary and permanent seed and covered with straw or mulch. Stream banks will be stabilized using a combination of erosion matting, bare-root plantings, and bio-engineering techniques in accordance with the plans in Appendix D. The entire conservation easement area will be planted with bare root seedlings in accordance with the planting plan.

The restored stream channel will be protected by a conservation easement that includes a riparian buffer of at least 30 feet and the re-established, rehabilitated, and enhanced wetland areas will be included in the conservation easement. The easement boundary for the stream and wetlands will be delineated by 10 foot

metal poles labeled with conservation easement signs. The restored buffer and easement boundaries are shown in Appendix A Figure 5.

7.2.3 Data Analysis

Hydraulic and Hydrologic Analysis

The proposed channel sections were evaluated for their ability to convey the bankfull flows and the flood flows of the watershed by performing a hydraulic analysis. Flood flow hydrology was based on USGS Regional Regression equations for the Blue Ridge-Piedmont hydrologic area. Bankfull discharge was based on the NRCS revised regional curves for the North Carolina Mountain and Piedmont hydrologic area. The analysis consisted of first modeling the existing conditions with the HEC-RAS water surface profile model. Cross sections were taken through the channel and the adjacent valley at representative locations throughout the project reach. Existing hydraulic conditions were evaluated and the model calibrated based on available site data.

The ability to accurately verify bankfull discharge within the site is limited by the degraded channel conditions and the lack of clear bankfull indicators. On a coarse scale, the existing HEC-RAS model does indicate bankfull water surface elevations within the channel banks where the channel is incised and above inner berm features where present. Additional bankfull verification is provided through the hydraulic geometry curves assembled from locations on site, immediately adjacent to the site, within the watershed and the neighboring watersheds (See Appendix C1).

Proposed conditions were analyzed by revising the existing sections based on the proposed channel geometry and by revising the model to reflect proposed pattern conditions and anticipated future roughness coefficients. Comparison of the existing and proposed HEC-RAS models provided assistance in the analysis of the sediment transport, bankfull flow capacity and confirmation that there will be no hydraulic trespass onto adjacent properties.

Sediment Competence Analysis

Data collection for sediment competence analyses included bar and bulk samples on Cochran Branch. The bed material consists of a mix of sand, gravel and cobble with a large constituent being composed of sand (30%-50%). Bed material collected in the sediment pits following a near bankfull event indicate that the total sand content may be as high as 50% to 80%. Pebble counts and bulk bed material samples indicate the D_{50} to be 7 to 16 mm and D_{84} to be 18 to 45 mm. However, this may overestimate the actual representative particle sizes given the findings from the sediment pit samples. In any case, shear stress calculations for particle sizes less than 10 to 20 mm should always be considered suspect as this represents the practical limit for competence calculations. For Cochran Branch Reach 1A a D_{50} of 35 mm was selected for the representative particle size which results in a design riffle slope range of 0.81% to 0.99%. For Cochran Branch Reach 1B D_{MAX} of 45 mm was selected for the largest particle to mobilize. This results in a riffle design slope range of 0.73% to 0.89%. For Parrish Branch a D_{50} of 35 mm was selected for the representative particle size which results in a design riffle slope range of 1.76% to 2.15%.

Sediment Capacity Analysis

In order to assist in evaluating the sediment capacity, a set of consecutive pit traps were installed in the stream bed upstream of the confluence with Parrish Branch on Cochran Branch. Four samples were collected from the pit traps following rainfall events. These samples were sieved and weighed. The second sample collected from the pit trap was following a rainfall event that registered 0.95 feet on the crest gauge. Although the traps completely filled during this event it can be estimated that the total bed load was at least 1.4 tons and probably as high as 2.8 tons for this less-than-bankfull event.

A flow duration hydrograph was constructed to simulate the second sampling event in order to model sediment transport using the quasi-unsteady flow routine in HEC-RAS. Seven sediment transport functions were evaluated for consistency with sediment data collected in the pit traps. The Wilcock

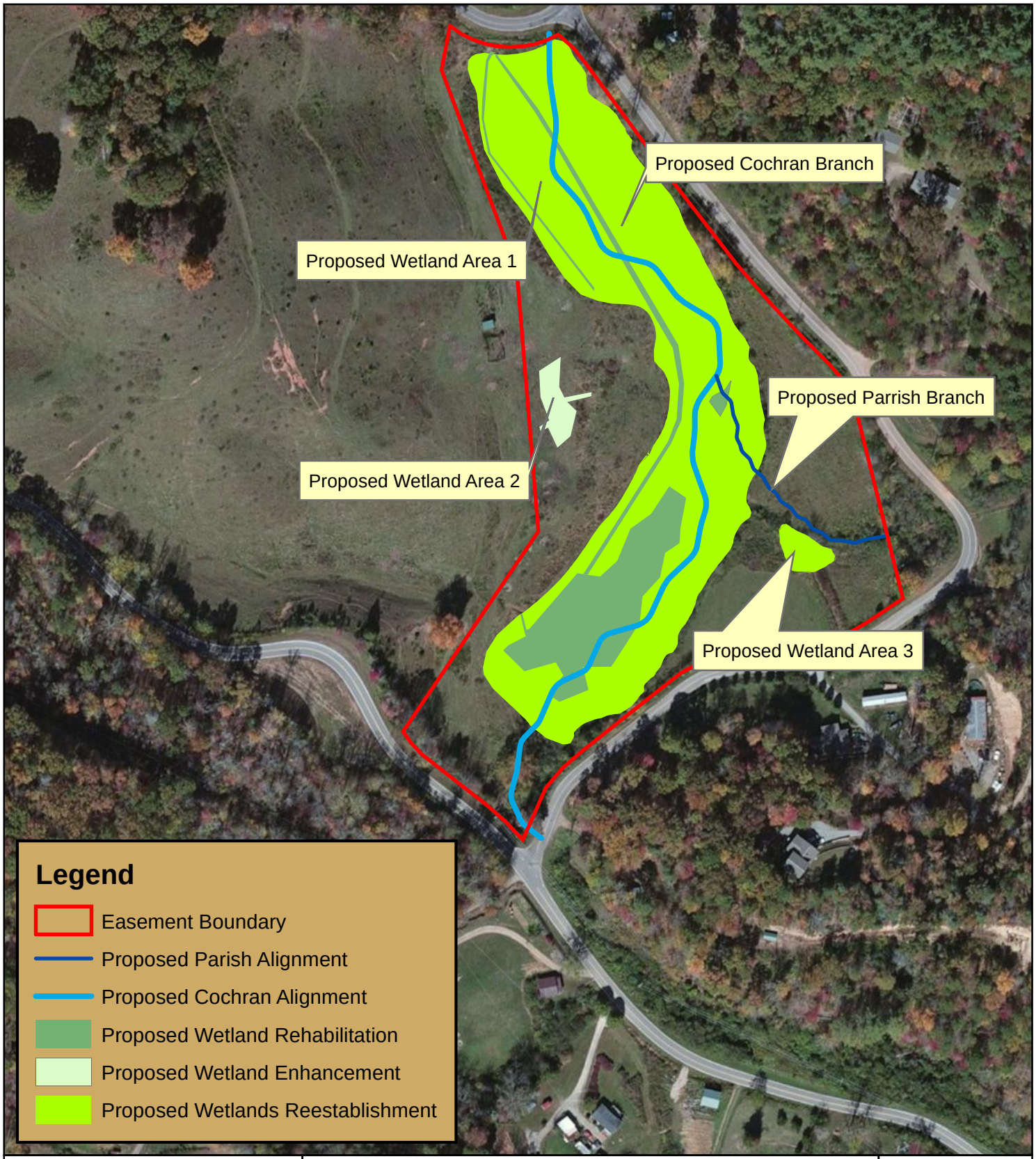
transport function provided results that fit best with the data. The Wilcock function predicted 1.3 to 3.9 tons of cumulative sediment output while the other sediment transport function predicted sediment output values more than one order of magnitude greater than the estimated load. Based on this correlation, the Wilcock function was used to evaluate sediment capacity under existing and proposed conditions.

Three quasi-unsteady simulations were run in HEC-RAS to qualitatively evaluate the sediment transport capacity. The modeling consisted of using HEC-HMS to produce a discharge hydrograph to simulate a 24-hour storm for the bankfull, 2-year, and 10-year discharge on a 0.25 hour computational increment cycle. Existing and proposed models were compared for differences in channel bed elevation and cumulative sediment output.

With respect to changes in channel invert elevation, Cochran performed similarly under existing and proposed conditions. Bed invert changes are generally between 0.0 ft. and 0.1 ft. for the bankfull flow and between 0.0 ft. and 0.2 ft. for the 2-year and 10-year flow.

With respect to cumulative mass output the model predicts an increase in volume for proposed the bankfull and the 2-year events compared to existing conditions and comparable results in the sediment output in the 10-year events for existing and proposed conditions. This is primarily in response to the proposed reconfiguration of the channel profile which will facilitate sediment transport. Given the limited predicted change in proposed channel invert elevation and the predicted increase in transport capacity for a stream with a moderately high sediment load this is interpreted as a positive result.

The design configuration was also evaluated for sediment transport capacity by assessing continuity and magnitude of stream power. Generally the proposed conditions model shows a decrease in stream power in all storm events. The decrease in stream power is to be expected due to the proposed increase in channel width/depth ratio and the elimination of the channel incision. However, this should not be a concern since the actual stream power values are sufficiently high to transport the sand particles which constitute the main wash load component.



Wolf Creek ENGINEERING

PROPOSED HYDROLOGIC FEATURES MAP

COCHRAN RESTORATION SITE

Macon County, North Carolina

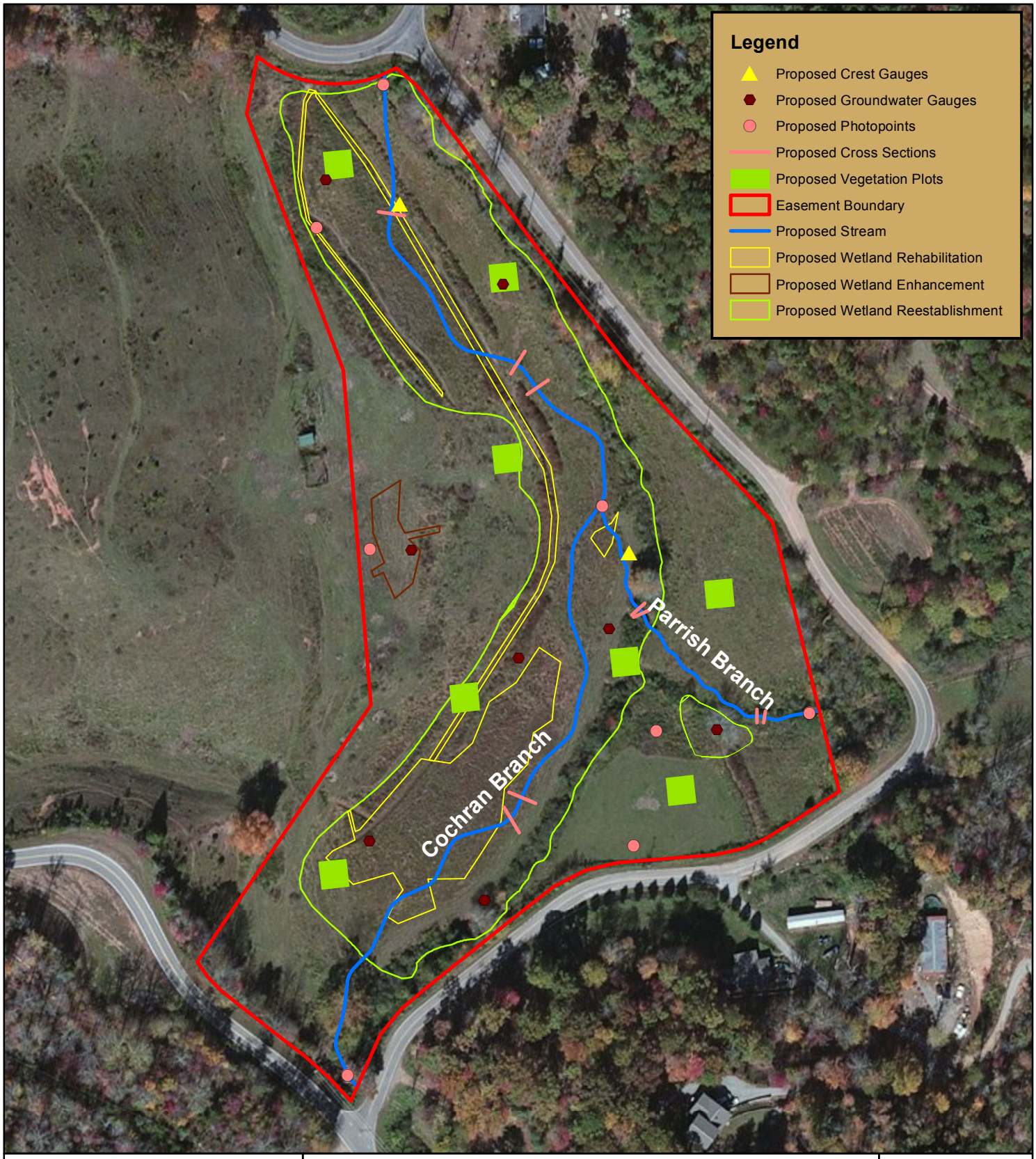
0 50 100 200 300 400 Feet

N

FIGURE

7

Date: 6/25/2014



Wolf Creek ENGINEERING

PROPOSED MONITORING FEATURES MAP

COCHRAN RESTORATION SITE

Macon County, North Carolina

0 40 80 160 240 320 Feet

N

FIGURE

8

Date: 9/24/2014

8.0 MAINTENANCE PLAN

EBX will monitor the site on a regular basis and shall conduct a physical inspection of the site a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

Component/Feature	**Maintenance through project close-out**
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Wetland	Routine wetland maintenance and repair activities may include securing of loose coir matting and supplemental installations of live stakes and other target vegetation within the wetland. Areas where storm water and floodplain flows intercept the wetland may also require maintenance to prevent scour.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.
Utility Right-of-Way	Utility rights-of-way within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Ford Crossing	Ford crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Road Crossing	Road crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Storm water Management Device	Storm water management devices will be monitored and maintained per the protocols and procedures defined by the NC Division of Water Quality Storm Water Best Management Practices Manual.

9.0 PERFORMANCE STANDARDS

Morphologic Parameters and Channel Stability

Restored and enhanced streams shall 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.

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.

Wetlands

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 the reference wetland groundwater data.

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 SMGs). 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).

10.0 MONITORING REQUIREMENTS

Monitoring data will be reported using the EEP monitoring template. The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, population of EEP databases for analysis, research purposes, and assist in decision making regarding project close-out.

Required	Parameter	Quantity	Frequency	Notes
NO	Pattern	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	N/a	
YES	Dimension	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Year 1, 3, 5 and 7	Bank pins will be installed on the outer bank at pool cross section locations
NO	Profile	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	N/a	Additional profile measurements may be required if problems are identified during the monitoring period
YES	Substrate	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Year 1, 3, 5 and 7	
YES	Surface Water Hydrology	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	annual	A Crest Gauge will be installed on site; the device will be inspected on a semi-annual basis to document the occurrence of bankfull events on the project
YES	Groundwater Hydrology	Quantity and location of gauges will be determined in consultation with EEP	annual	Groundwater monitoring gauges with data recording devices will be installed on site; the data will be downloaded on a monthly basis during the growing season
YES	Vegetation	Quantity and location of vegetation plots will be determined in consultation with EEP	annual	Vegetation will be monitored using the Carolina Vegetation Survey (CVS) protocols
YES	Exotic and nuisance vegetation and Beaver		annual	Locations of exotic and nuisance vegetation and the occurrence of beaver dams and approximate inundation limits will be mapped
YES	Project boundary		Semi-annual	Locations of fence damage, vegetation damage, boundary encroachments, etc. will be mapped

11.0 LONG-TERM MANAGEMENT PLAN

Upon approval for close-out by the Interagency Review Team (IRT) the site will be transferred to the State of North Carolina. This party shall be responsible for periodic inspection of the site to ensure that restrictions required in the conservation easement or the deed restriction document(s) are upheld. Endowment funds required to uphold easement and deed restrictions shall be negotiated prior to site transfer to the responsible party.

12.0 ADAPTIVE MANAGEMENT PLAN

Upon completion of site construction EBX will implement the post-construction monitoring protocols previously defined in this document. Project maintenance will be performed as described previously in this document. If, during the course of annual monitoring it is determined the site's ability to achieve site performance standards are jeopardized, EBX will notify the NCEEP of the need to develop a Plan of Corrective Action. The Plan of Corrective Action will be prepared by an engineering consultant. Once the Corrective Action Plan is prepared and finalized EBX will:

1. Notify the NCEEP.
2. Revise performance standards, maintenance requirements, and monitoring requirements as necessary and/or required by the NCEEP.
3. Obtain other permits as necessary.
4. Implement the Corrective Action Plan.
5. Provide the NCEEP a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

13.0 FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the Ecosystem Enhancement Program's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the U.S. Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by EEP. This commitment provides financial assurance for all mitigation projects implemented by the program.

14.0 OTHER INFORMATION

14.1 DEFINITIONS

Morphological description – the stream type; stream type is determined by quantifying channel entrenchment, dimension, pattern, profile, and boundary materials; as described in Rosgen, D. (1996), *Applied River Morphology, 2nd edition*

Native vegetation community – a distinct and reoccurring assemblage of populations of plants, animals, bacteria and fungi naturally associated with each other and their population; as described in Schafale, M.P. and Weakley, A. S. (1990), *Classification of the Natural Communities of North Carolina, Third Approximation*

Project Area - includes all protected lands associated with the mitigation project

14.2 REFERENCES

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North Carolina Floodplain Mapping Program. *Floodplain Mapping Information System*. http://floodmaps.nc.gov/FMIS/Default.aspx Raleigh, NC.

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Peet, R.K., Wentworth, T.S., and White, P.S. (1998), *A flexible, multipurpose method for recording vegetation composition and structure*. Castanea 63:262-274

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APPENDIX A
SITE PROTECTION INSTRUMENT(S)

APPENDIX B

BASELINE INFORMATION DATA

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Cochran Branch Stream & Wetland Restoration
County Name:	Macon County
EEP Number:	
Project Sponsor:	NCEEP
Project Contact Name:	Paul Wiesner
Project Contact Address:	5 Ravenscroft Drive, #102, Asheville, NC 28801
Project Contact E-mail:	Paul.Wiesner@ncdenr.gov
EEP Project Manager:	Paul Wiesner

Project Description

Stream restoration activities will restore 1,565 feet of stream along Cochran and Parrish Branches adding sinuosity to the channel, which will result in 1,756 feet of restored stream. In addition, 4.5 acres of riparian wetland will be restored. The site will be placed into a conservation easement that will remove approximately 10.6 acres of land from agricultural uses.

For Official Use Only

Reviewed By:

8/30/13
Date

Paul Wiesner
EEP Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

8-30-13
Date

For Division Administrator FHWA

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☑ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☑ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☑ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☑ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☑ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☑ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☑ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☑ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☑ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☑ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Does the project require the acquisition of real estate?	☑ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☑ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☑ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☑ Yes ☐ No
2. Is the site of religious importance to American Indians?	☐ Yes ☑ No ☐ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☑ No ☐ N/A
4. Have the effects of the project on this site been considered?	☑ Yes ☐ No ☐ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☑ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☑ No ☐ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☑ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☑ No ☐ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☑ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☐ Yes ☑ No ☐ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☑ No ☐ N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☑ No ☐ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☐ Yes ☐ No ☑ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☐ No ☑ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☑ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☑ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☑ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☑ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☑ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☑ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☑ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☑ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☑ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☑ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☑ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☑ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☑ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☑ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☑ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☑ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☑ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☑ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☑ N/A

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Cochran Branch City/County: Macon Sampling Date: 11/30/12

Applicant/Owner: Jerry Parrish State: NC Sampling Point: 16

Investigator(s): K. Mitchell Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Ditch Slope (%): 2-1

Subregion (LRR or MLRA): LRR N Lat: 35.216422 Long: -83.488808 Datum: NAD83

Soil Map Unit Name: Nikwasi NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** Yes ☒ No ☐
Hydric Soil Present?	Yes ☒ No ☐	
Wetland Hydrology Present?	Yes ☒ No ☐	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☒ Surface Water (A1)
- ☐ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☒ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☒ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☒	No ☐	Depth (inches):
Water Table Present?	Yes ☒	No ☐	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches):

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Wetland has been ditched. Ditch is a linear wetland

VEGETATION – Use scientific names of plants.

Sampling Point: 16

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30)			
1. –		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Sapling Stratum (Plot size: 15)			
1. –		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Shrub Stratum (Plot size: 15)			
1. –		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Herb Stratum (Plot size: 15)			
1. Juncus effusus	70%	☐	FACW+
2. Carex spp.	30%	☐	FAC-OBL
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	100% = Total Cover		
Woody Vine Stratum (Plot size: 5)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: 16

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/1						Loam	F3 Depleted matrix
6-12	10YR 3/1						Loam	F3 Depleted matrix

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Cochran Branch City/County: Macon Sampling Date: 11/30/12

Applicant/Owner: Jerry Poorish State: NC Sampling Point: 17

Investigator(s): K. Mitchell Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): – Slope (%): 1

Subregion (LRR or MLRA): LRR N Lat: 35.216446 Long: -83.48873 Datum: NAD83

Soil Map Unit Name: Nikwasi NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes ☐ No ☒
Hydric Soil Present?	Yes ☒ No ☐	
Wetland Hydrology Present?	Yes ☐ No ☒	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☒ Water Marks (B1)
- ☒ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☒ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches):
Water Table Present?	Yes ☐	No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☒	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: 17

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Sapling Stratum (Plot size: 15)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Shrub Stratum (Plot size: 15)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Herb Stratum (Plot size: 15)			
1. Juncus effusus	15%	☐	FACW+
2. Fescue, Festuca arundinacea	80%	☐	FAC-
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	95% = Total Cover		
Woody Vine Stratum (Plot size: 5)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

__ Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☐ No ☒

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: 17

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/3						Sil/Loam	
3-8	10YR 3/1						Loam	
8-12	10YR 4/1						Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Cochran Branch City/County: Macon Sampling Date: 11/30/12

Applicant/Owner: Jerry Parrish State: NC Sampling Point: WP 18

Investigator(s): K. Mitchell Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 2-1

Subregion (LRR or MLRA): LRR N Lat: 35.214945 Long: -83.489122 Datum: NAD 83

Soil Map Unit Name: Nikwasi NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** Yes ☒ No ☐
Hydric Soil Present?	Yes ☒ No ☐	
Wetland Hydrology Present?	Yes ☒ No ☐	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☒ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☒ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐ No ☒	Depth (inches):
Water Table Present?	Yes ☒ No ☐	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☒ No ☐	Depth (inches):

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: 18

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Sapling Stratum (Plot size: 15)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Shrub Stratum (Plot size: 15)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Herb Stratum (Plot size: 15)			
1. Juncus effusus	60%	☐	FACW+
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	60% = Total Cover		
Woody Vine Stratum (Plot size: 5)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

☑ Dominance Test is >50%

☐ Prevalence Index is ≤3.0[1]

☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: 18

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2						Loam	
6-12	10YR 3/1						Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☒ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Cochran Branch City/County: Macon Sampling Date: 11/30/12

Applicant/Owner: Jerry Parrish State: NC Sampling Point: 19

Investigator(s): K. Mitchell Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 2-1

Subregion (LRR or MLRA): LRR N Lat: 35.214913 Long: -83.489126 Datum: NAD83

Soil Map Unit Name: Nikwasi NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes ☐ No ☒
Hydric Soil Present?	Yes ☒ No ☐	
Wetland Hydrology Present?	Yes ☐ No ☒	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐ No ☒	Depth (inches):
Water Table Present?	Yes ☐ No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐ No ☒	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: 19

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Sapling Stratum (Plot size: 15)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Shrub Stratum (Plot size: 15)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Herb Stratum (Plot size: 15)			
1. Juncus effusus	15%	☐	FACW+
2. Fescue Festuca arundinacea	80%	☐	FAC-
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	95% = Total Cover		
Woody Vine Stratum (Plot size: 5)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

__ Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☐ No ☒

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: 19

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/3						Silt/loam	
6-12	10YR 3/2						loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☒ No ☐

Remarks:

NC DWQ Stream Identification Form Version 4.11 Form #1

Date: 3/28/2012	**Project/Site:** Parrish Farm Cochran Branch	**Latitude:** 35° 12946
Evaluator: W. Taylor	**County:** Macon	**Longitude:** -83° 29293
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 48	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:* Franklin

A. Geomorphology (Subtotal = 26.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	2	(3)
7. Recent alluvial deposits	0	1	2	(3)
8. Headcuts	0	1	(2)	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	0.5	1	(1.5)
16. Organic debris lines or piles	0	0.5	1	(1.5)
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 11.5)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	(3)
21. Aquatic Mollusks	0	(1)	2	3
22. Fish	0	0.5	1	(1.5)
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed NO	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Mayflies & caddis flies abundant in riffle areas.

Sketch: Photos 2→6

NC DWQ Stream Identification Form Version 4.11 Form#2

Date: 3/26/2012	**Project/Site:** Parrish Branch	**Latitude:** 35° 12946
Evaluator: W. Taylor	**County:** Macon	**Longitude:** -83° 29293
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 40	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:* Franklin

A. Geomorphology (Subtotal = 23.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	2	(3)
7. Recent alluvial deposits	0	1	2	(3)
8. Headcuts	0	(1)	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	0.5	1	(1.5)
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed NO	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Mayflies → present but not abundant

Sketch: Photo #5 → 10 → 15

APPENDIX C
MITIGATION WORK PLAN DATA and ANALYSES

C1 Hydraulic Geometry
- Design Curves
- Morphology Curves

C2 Design Calculations
- Conceptual Design Calculations
- Sediment Regime
- Design Section Calculations
- Morphologic Tables
- Competence Calculations
- Hydraulic Modeling
- Sediment Transport Analysis
- Capacity Calculations
- Bed Material Calculations

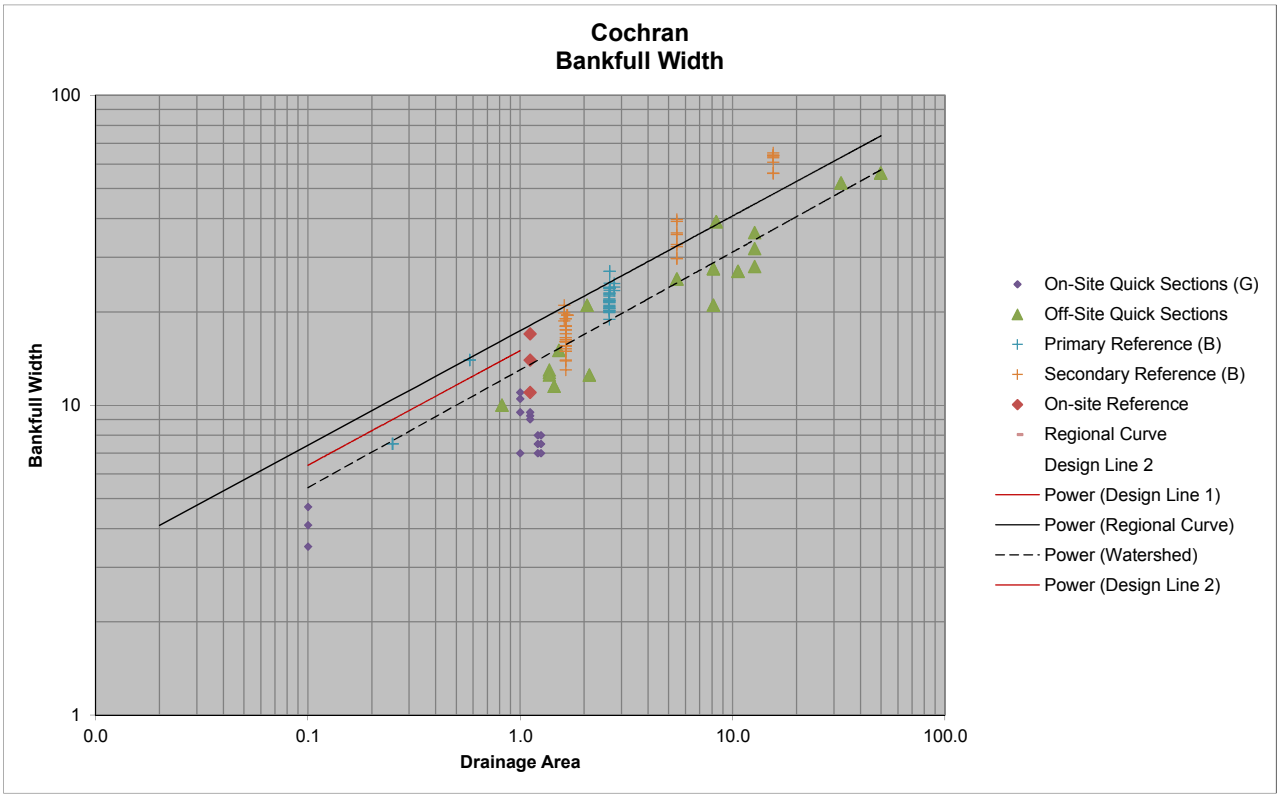
C3 Assessment Data
- BEHI/NBS Calculations
- Existing Morphology
- Sediment Data
- Morphologic Site Map
- NCWAM Assessment

C4 Reference Reach Data

C5 Soils Report

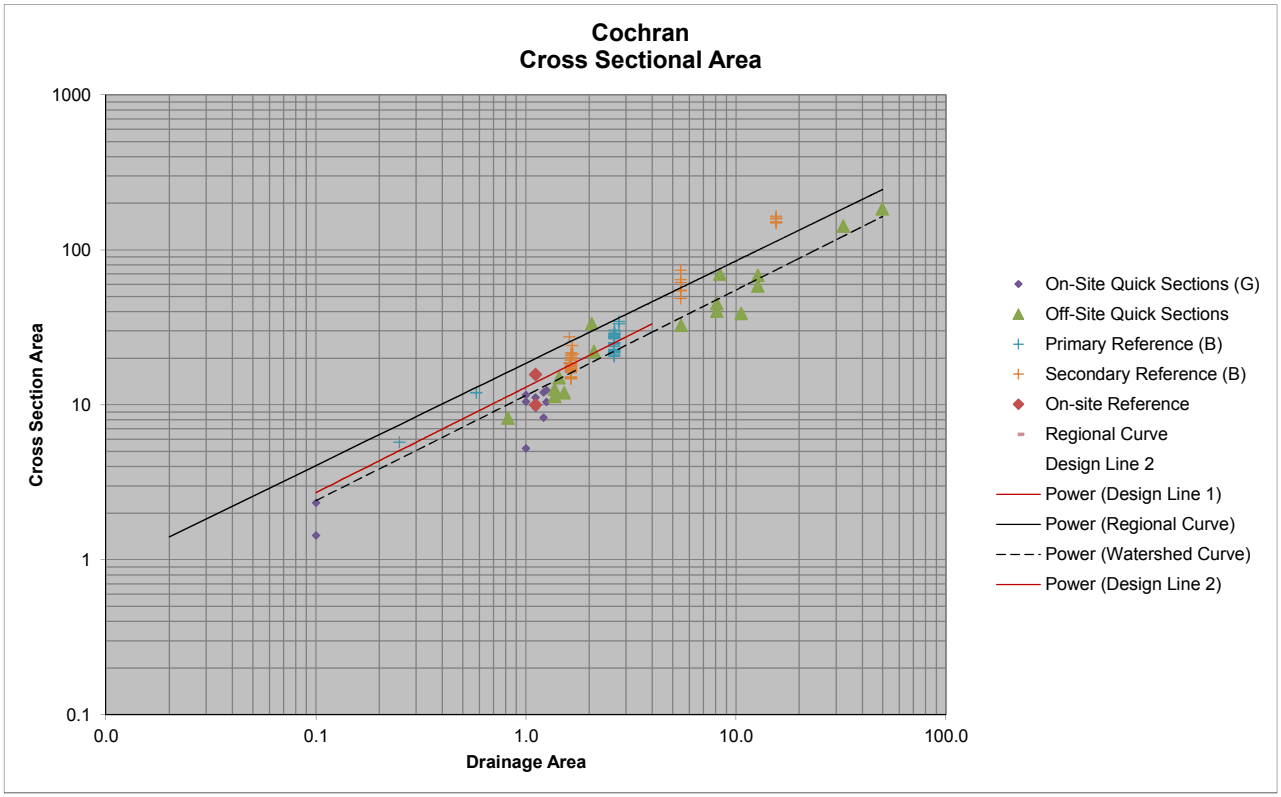
APPENDIX C1

Hydraulic Geometry



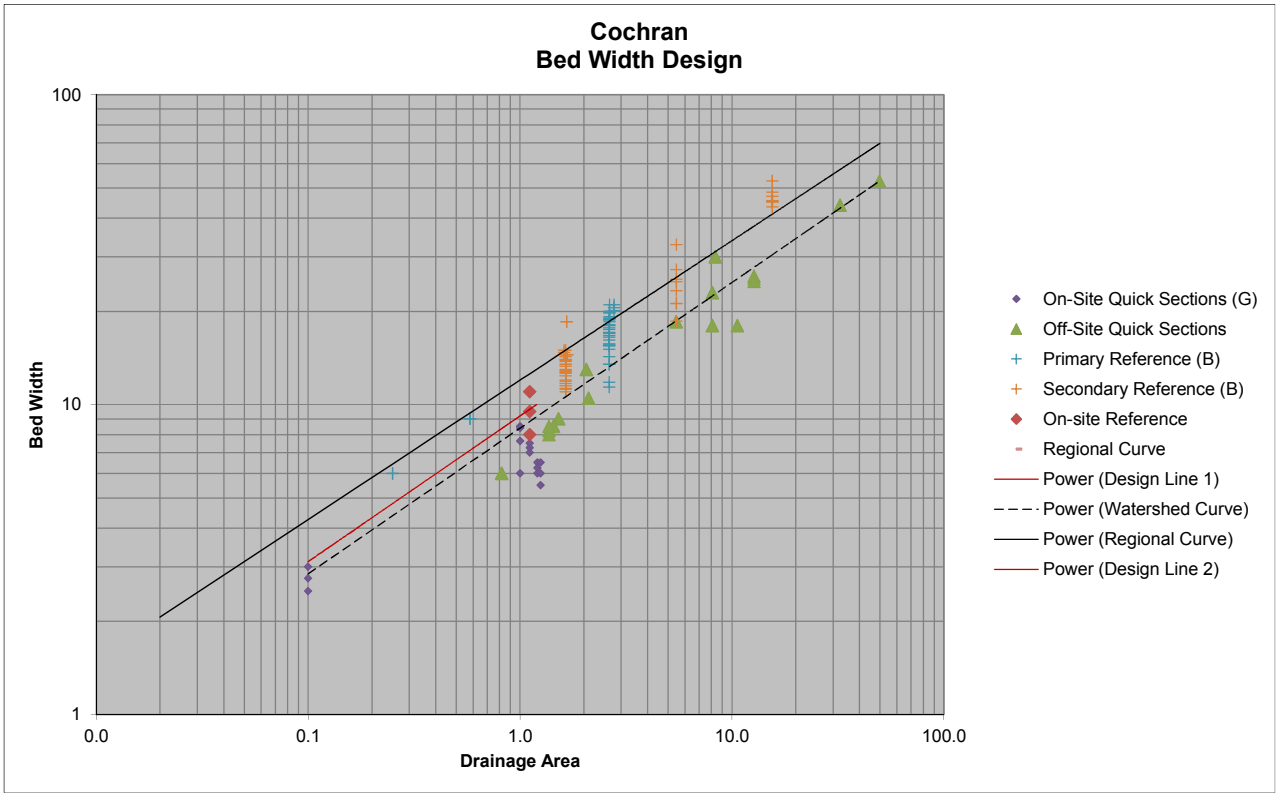
	Coefficient	Exponent
Design Line 1	15.0	0.37
Design Line 2		
Regional Curve	17.4	0.37
Watershed Curve	13.0	0.38

Design Line 1		Design Line 2		Regional Curve		Watershed Curve	
X	Y	X	Y	X	Y	X	Y
0.1	6.399	0.02	0.000	0.02	4.092	0.1	5.419
1	15.000	0.4	0.000	50	73.989	50	57.485



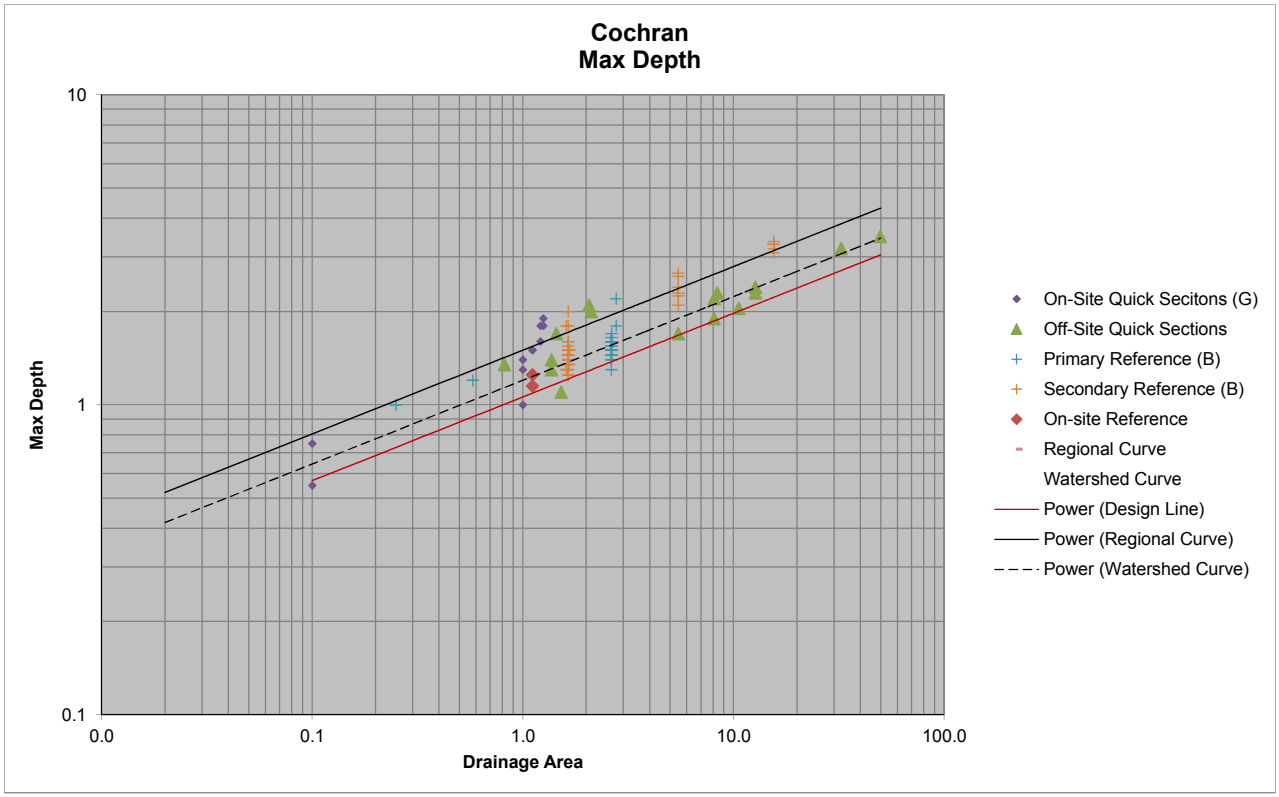
	Coefficient	Exponent
Design Line 1	13.0	0.68
Design Line 2		
Regional Curve	18.6	0.66
Watershed Curve	11.5	0.68

Design Line 1		Design Line 2		Regional Curve		Watershed Curve	
X	Y	X	Y	X	Y	X	Y
0.1	2.716	0.02	0.000	0.02	1.404	0.1	2.403
4	33.369	0.4	0.000	50	245.400	50	164.436



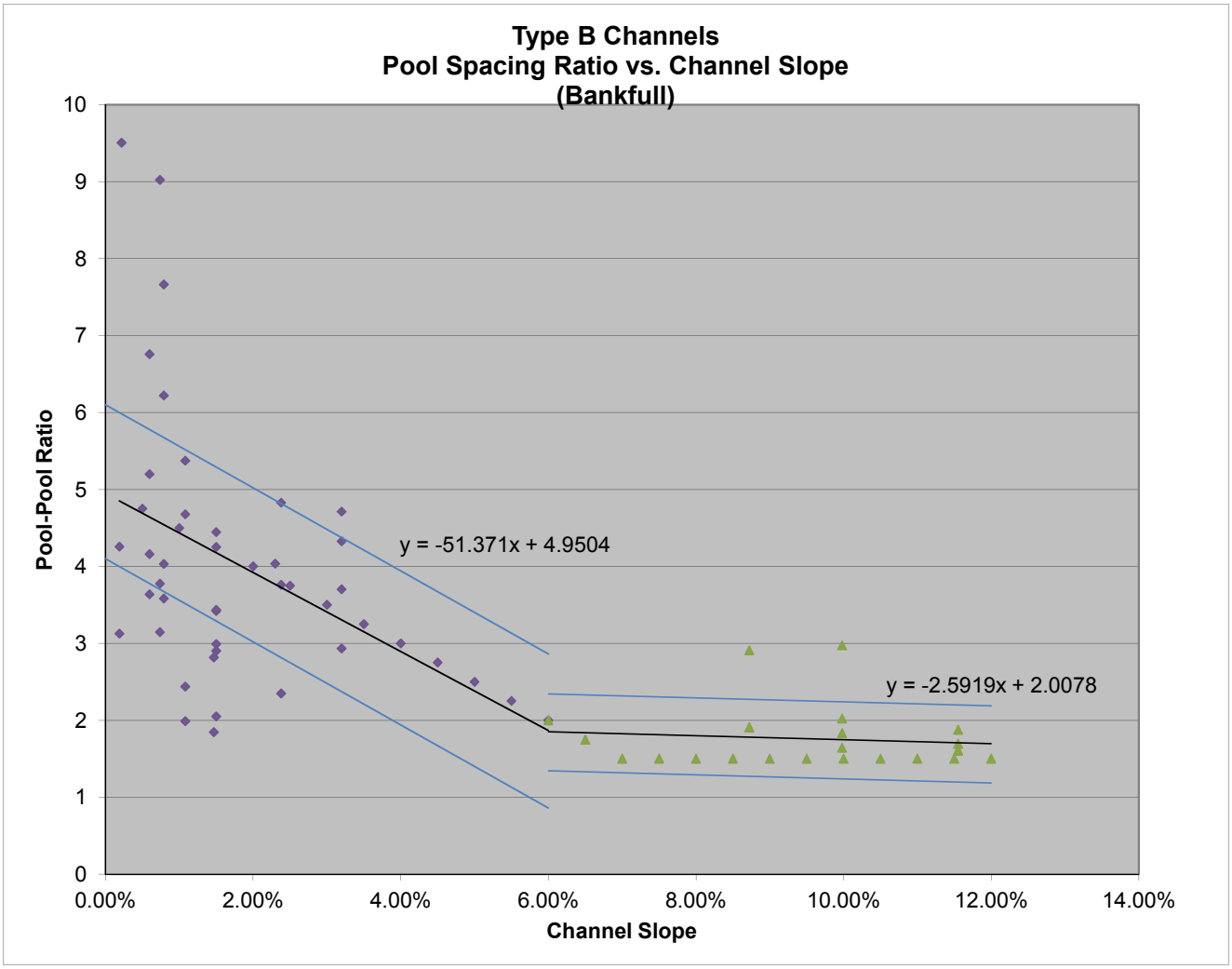
	Coefficient	Exponent
Design Line 1	9.2	0.47
Design Line 2		
Regional Curve	12.0	0.45
Watershed Curve	8.4	0.47

Design Line 1		Design Line 2		Regional Curve		Watershed Curve	
X	Y	X	Y	X	Y	X	Y
0.1	3.117	0.028	0.000	0.02	2.064	0.1	2.846
1.2	10.023	0.4	0.000	50	69.778	50	52.820



	Coefficient	Exponent
Design Line	1.06	0.27
Regional Curve	1.50	0.27
Watershed Curve	1.20	0.27

Design Line		Regional Curve		Watershed Curve	
X	Y	X	Y	X	Y
0.1	0.569	0.02	0.522	0.02	0.417
50	3.048	50	4.313	50	3.451



B Channels < 6%

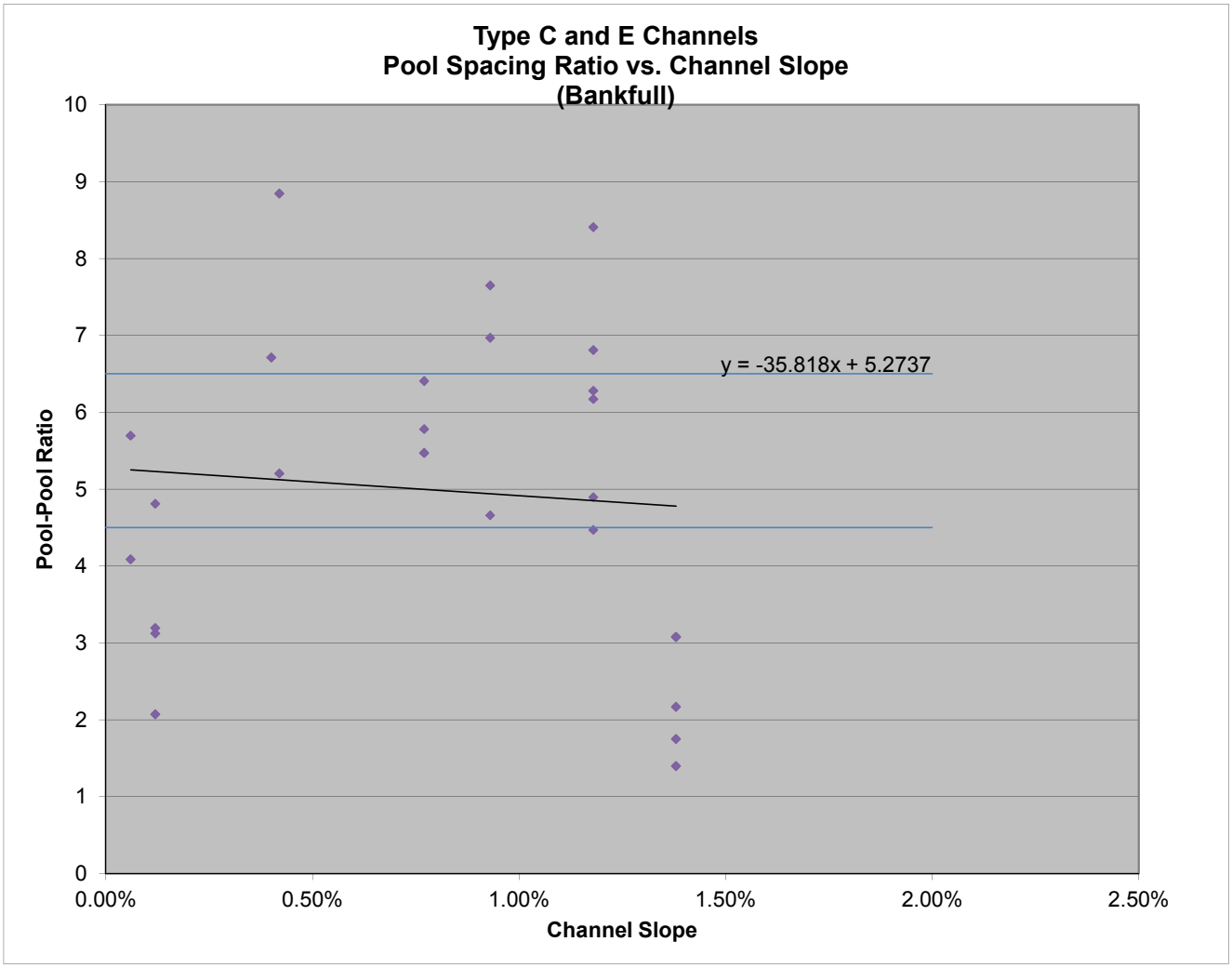
	Y-int	Slope
Trendline Coefficients	5.1	-54.0
Design Range (+/-)	1.0	
Upper Boundary Line	6.1	-54.0
Lower Boundary Line	4.1	-54.0

Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
0%	6.1	0%	4.1
6%	2.86	6%	0.86

B Channels > 6%

	Y-int	Slope
Trendline Coefficients	2.0	-2.6
Design Range (+/-)	0.5	
Upper Boundary Line	2.5	-2.6
Lower Boundary Line	1.5	-2.6

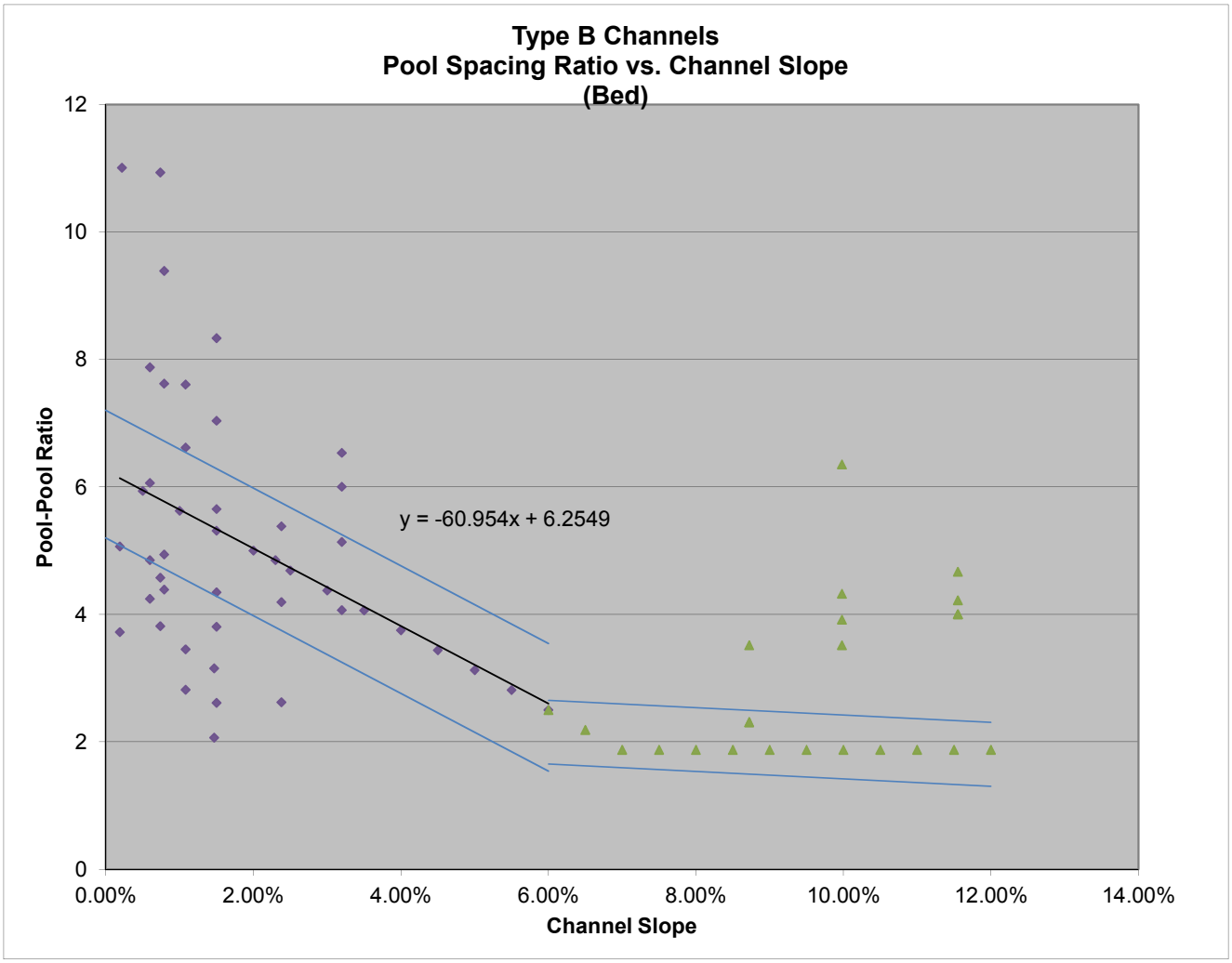
Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
6%	2.344	6%	1.344
12%	2.188	12%	1.188



C and E Channels

	Y-int	Slope
Trendline Coefficients	5.5	0.0
Design Range (+/-)	1.0	
Upper Boundary Line	6.5	0.0
Lower Boundary Line	4.5	0.0

Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
0%	6.5	0%	4.5
2%	6.5	2%	4.5



B Channels < 6%

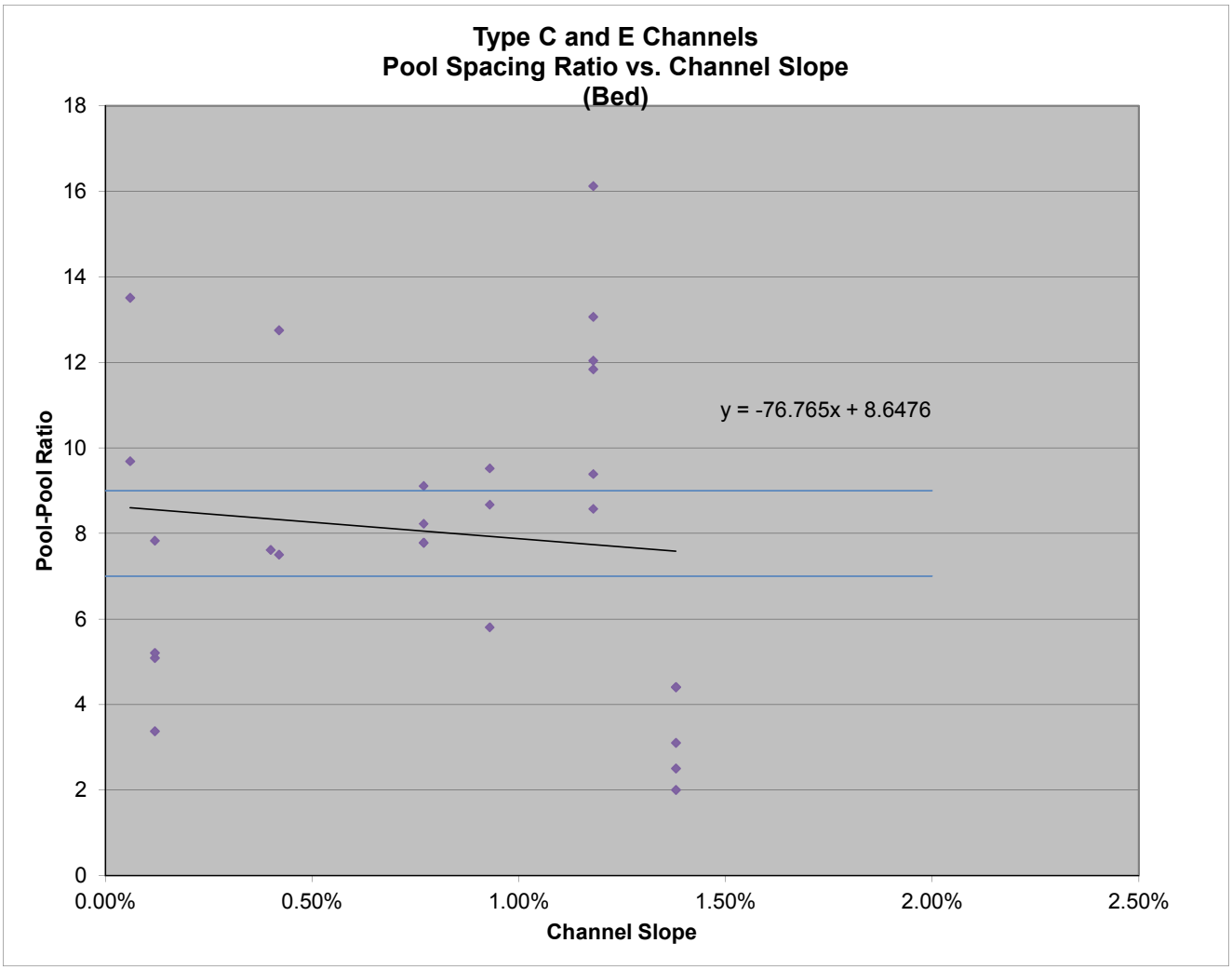
	Y-int	Slope
Trendline Coefficients	6.2	-61.0
Design Range (+/-)	1.0	
Upper Boundary Line	7.2	-61.0
Lower Boundary Line	5.2	-61.0

Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
0%	7.2	0%	5.2
6%	3.54	6%	1.54

B Channels > 6%

	Y-int	Slope
Trendline Coefficients	2.5	-5.8
Design Range (+/-)	0.5	
Upper Boundary Line	3.0	-5.8
Lower Boundary Line	2.0	-5.8

Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
6%	2.652	6%	1.652
12%	2.304	12%	1.304



C and E Channels

	Y-int	Slope
Trendline Coefficients	8.0	0.0
Design Range (+/-)	1.0	
Upper Boundary Line	9.0	0.0
Lower Boundary Line	7.0	0.0

Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
0%	9	0%	7
2%	9	2%	7

APPENDIX C2

Design Calculations

Stream Design Calculations

Status Summary

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Component	Status	Date of Final	Designer
Conceptual Design	FINAL	4/7/14	SGG
Discharge Calculations	FINAL	4/7/14	SGG
Sediment Regime	FINAL	4/7/14	SGG
Section Design	FINAL	4/7/14	SGG
Typical Section Dimensions	DRAFT		
Plan/Profile Measurements	DRAFT		
Morphologic Design Table	DRAFT		
Structure Dimensions	INCOMPLETE		
Competence Calculations	FINAL	4/7/14	SGG
Design Slopes	DRAFT		
HEC-RAS	DRAFT	4/7/14	RTS
Sediment Transport	DRAFT		
Transition Reach Design	INCOMPLETE		
Supplemental Bed Material	DRAFT		
Credit Calculations	INCOMPLETE		

1.0 Conceptual Design

Estimated Channel Values from Regional Curves

Design Status

FINAL
4/7/14
SGG

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Hydro-Physio Province: NC Mountains

Regional Curve Equations

	Coefficient	Exponent
W_{BKF}:	17.36	0.3693
A_{BKF}:	18.559	0.6616
d_{MEAN}:	1.1771	0.2697
Q_{BKF}:	55.425	0.7874
W_{BED}:	12	0.45
d_{MAX}:	1.5	0.27

Approximate Equations

	Coefficient	Exponent	
W_{BKF}:	14.53496	0.39	(Not Used in Calculations)
d_{MAX}:	1.64794	0.27	(Not Used in Calculations)

Reach	Estimated Dimensions from Regional Curves								
	Drain. Area (mi^2)	W_{BKF} (ft)	A_{BKF} (ft^2)	d_{MEAN} (ft)	W_{BED} (ft)	d_{MAX} (ft)	Pool Spacing (ft)	Rc (ft)	Tangent Length (ft)
COCHRAN REACH 1A	1.25	18.9	21.5	1.3	13.3	1.6	94	38	38
COCHRAN REACH 1B	1.25	18.9	21.5	1.3	13.3	1.6	94	38	38
PARRISH REACH 1	0.1	7.4	4.0	0.6	4.3	0.8	37	15	15

1.1 Reach Locations

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Reach	Existing Thalweg Stationing		Proposed Design Stationing		Description
	Begin	End	Begin	End	
COCHRAN REACH 1A	100+00	102+50	100+60	102+30	Upstream steeper reach
COCHRAN REACH 1B	102+50	114+74	102+30	114+50	Begin flatter grade to D/s tie-in
PARRISH REACH 1	200+00	202+56	200+15	203+74	U/s begin survey to CCRN confluence

2.0 Discharge Calculations

Design Status
FINAL
4/7/14
SGG

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Estimated Discharges

Reach	Drainage Area (mi^2)	Bankfull (cfs)	2-yr (cfs)	5-yr (cfs)	10-yr (cfs)	50-yr (cfs)	100-yr (cfs)			
COCHRAN REACH 1A	1.25	66	158	281	387	694	856			
COCHRAN REACH 1B	1.25	66	158	281	387	694	856			
PARRISH REACH 1	0.1	9	27	51	73	140	177			

2.1 Discharge Calculation Input

Discharge Method Used: USGS Regional Regression

Hydro-Physio Province: NC Mountains

NCDOT Rural Equations

Hydrologic Contour:	7.00
Watershed Length:	N/A
Watershed Width:	N/A
Percent Forest:	N/A

Regional Regression Equations

Event	Coef	Exp
2-yr	135	0.702
5-yr	242	0.677
10-yr	334	0.662
25-yr	476	0.645
50-yr	602	0.635
100-yr	745	0.625
200-yr	908	0.616
500-yr	1160	0.605

Bankfull Regional Equation

Event	Coef	Exp
Bankfull	55.425	0.7874

3.0 Sediment Regime

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status
FINAL
4/7/14
SGG

Reach	Cochran U/s End	Cochran U/s of Parrish Br	Cochran D/s of Parrish Br	Parrish Branch	Cochran Adjacent Forecast Reach	Cochran Extended Forecast Reach	Parish Adjacent Forecast Reach
Bed Material Nature							
Depth of Bed Probe (ft)	0.05 - 0.2	0.2	0.5 - 1.0	0.2	0.2 - 0.4	0.2 - 0.4	0.2
Matrix Bonding	Tight	Moderate	Loose	Moderate	Loose	Loose	Moderate
Parent Material Exposure	Yes	No	No	No	No	No	No
Well Graded	Yes	Yes	No	Yes	Yes	Yes	Yes
Depositional Patterns							
Point Bars	Minimal	Moderate	Extensive	None	Moderate	Moderate	Moderate
Mid-channel Bars	None	Moderate	Extensive	Moderate	Moderate	Moderate	Moderate
Side-channel Bars	Minimal	Moderate	Moderate	None	Moderate	Moderate	Moderate
Diagonal Bars	None	Minimal	Moderate	None	None	None	None
Bar Length/W_{BED}	<1	1 - 1.5	1 - 2	3	1 - 2	1 - 2	41641
Dune Presentation of Bars	None	Minimal	Moderate	Moderate	Moderate	Moderate	Moderate
Channel Branching	None	Minimal	Minimal	None	Minimal	Minimal	None
Tributary Deltas	N/a	N/a	Minimal	N/a	Minimal	Minimal	N/a
Dune Length/Height (ft)	N/a	N/a	15	N/a	15	15	N/a
Ripple Length/Height (ft)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Sediment Measurements							
Pebble Count (Riffle) % Sand		0%			7%		
D_{50}		39			33		
D_{84}		50			70		
D_{95}		50			70		
Pebble Count (Reach) % Sand							
D_{50}							
D_{84}							
D_{95}							
Bar Sample % Sand		56%	30%		39%		
D_{50}		6	11		8		
D_{84}		11	22		16		
D_{95}		14	29		25		
D_{MAX}		20	40		27		
Bed Sample % Sand		16%			34%		
D_{50}		21			10		
D_{84}		50			23		
D_{95}		50			31		
Sediment Regime							
Sediment Load	Mod. High	Mod. High	Mod. High	Moderate	Mod. High	Mod. High	Mod. High
Sediment Mobility	Moderate	Mod. High	Mod. High	Moderate	Mod. High	Mod. High	Mod. High

3.1 Sediment Regime

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

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Reach	Sediment Trap Sample 1	Sediment Trap Sample 2	Sediment Trap Sample 3	Sediment Trap Sample 4			
Bed Material Nature							
Depth of Bed Probe (ft)							
Matrix Bonding							
Parent Material Exposure							
Well Graded							
Depositional Patterns							
Point Bars							
Mid-channel Bars							
Side-channel Bars							
Diagonal Bars							
Bar Length/W_{BED}							
Dune Presentation of Bars							
Channel Branching							
Tributary Deltas							
Dune Length/Height (ft)							
Ripple Length/Height (ft)							
Sediment Measurements							
Pebble Count (Riffle) % Sand							
D_{50}							
D_{84}							
D_{95}							
Pebble Count (Reach) % Sand							
D_{50}							
D_{84}							
D_{95}							
Bar Sample % Sand	81%	95%	0%	47%			
D_{50}	33	11	11	17			
D_{84}	35	29	19	34			
D_{95}	35	29	33	45			
D_{MAX}	35	29	50	45			
Bed Sample % Sand							
D_{50}							
D_{84}							
D_{95}							
Sediment Regime							
Sediment Load							
Sediment Mobility							

4.0 Design Section 1

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status

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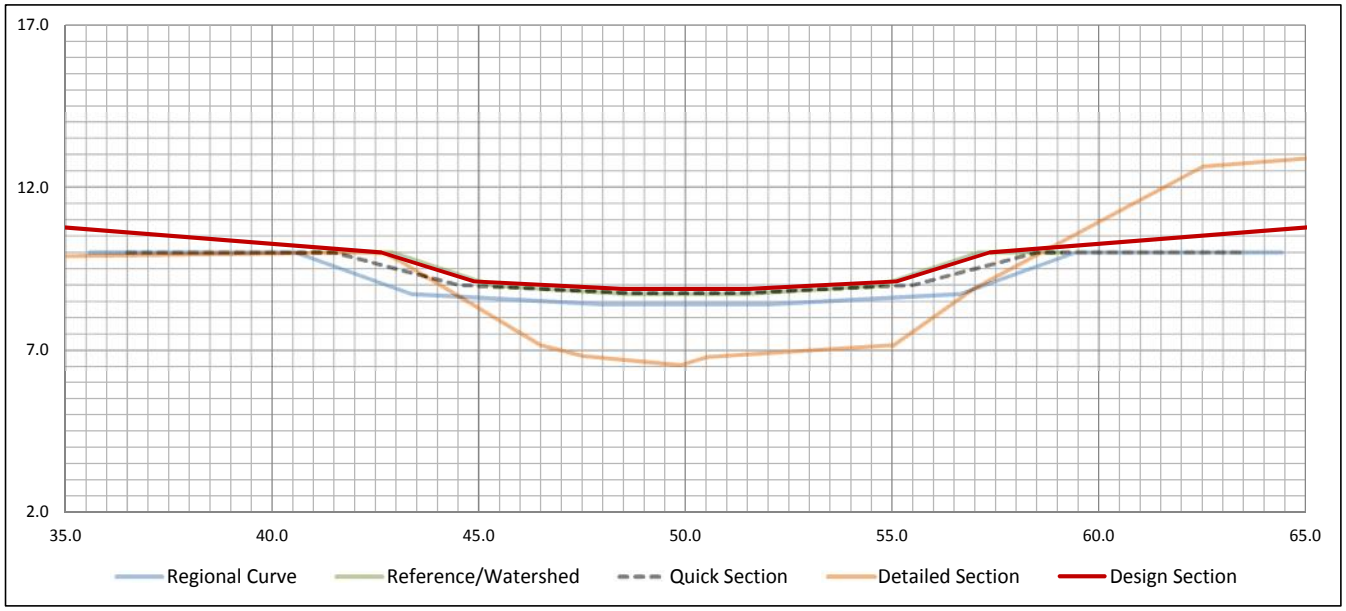

Design Section

	Coef	Exp
W_{BED}	9.20	0.47
d_{MAX}	1.06	0.27
Bank Slope	2.5	(H:1)
Thalweg Ratio	0.3	
Toe Depth Ratio	0.8	
Bench Width Ratio	0.7	
Bench Slope	10	(H:1)
Drainage Area	1.25	(sq. mi.)

Point of Comparison
Sta 103+00 under large tree

Section Comparisons

	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
W_{BKF}	18.9	14.2	17.0	12.5	14.7
	78%	104%	87%	118%	
W_{BED}	13.3	9.3	11.0		10.2
	77%	110%	93%		
W_{THL}	4.0	2.8	2.5		3.1
	77%	110%	123%		
d_{MAX}	1.6	1.3	1.3	2.4	1.1
	71%	88%	90%	48%	
d_{TOE}	1.3	1.0	1.0		0.9
	71%	88%	90%		
A_{BKF}	21.5	13.4	15.7	19.0	12.7
	59%	95%	81%	67%	
d_{MEAN}	1.14	0.95	0.92	1.52	0.86
	76%	91%	94%	57%	
P	19.4	14.6	17.3	20.6	15.1
	78%	103%	87%	73%	
Hydr. R	1.11	0.92	0.90	0.92	0.84
	76%	92%	93%	92%	
W/d Ratio	16.5	15.0	18.4	8.2	17.0
	103%	114%	92%	207%	

4.1 Design Section 2

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status

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4/7/14
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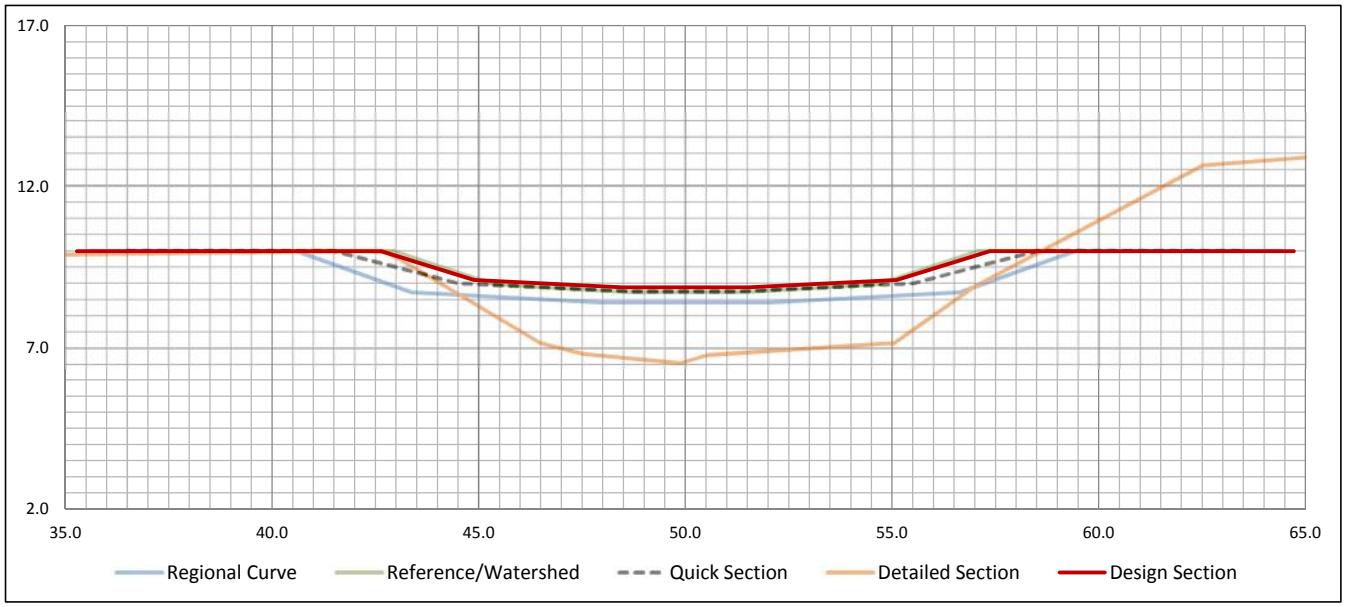


Design Section

	Coef	Exp	
W_{BED}	9.20	0.47	
d_{MAX}	1.06	0.27	
Bank Slope	2.5		(H:1)
Thalweg Ratio	0.3		
Toe Depth Ratio	0.8		
Bench Width Ratio	0.5		
Bench Slope	0		(H:1)
Drainage Area	1.25		(sq. mi.)

Point of Comparison
Sta 103+00 under large tree

Section Comparisons

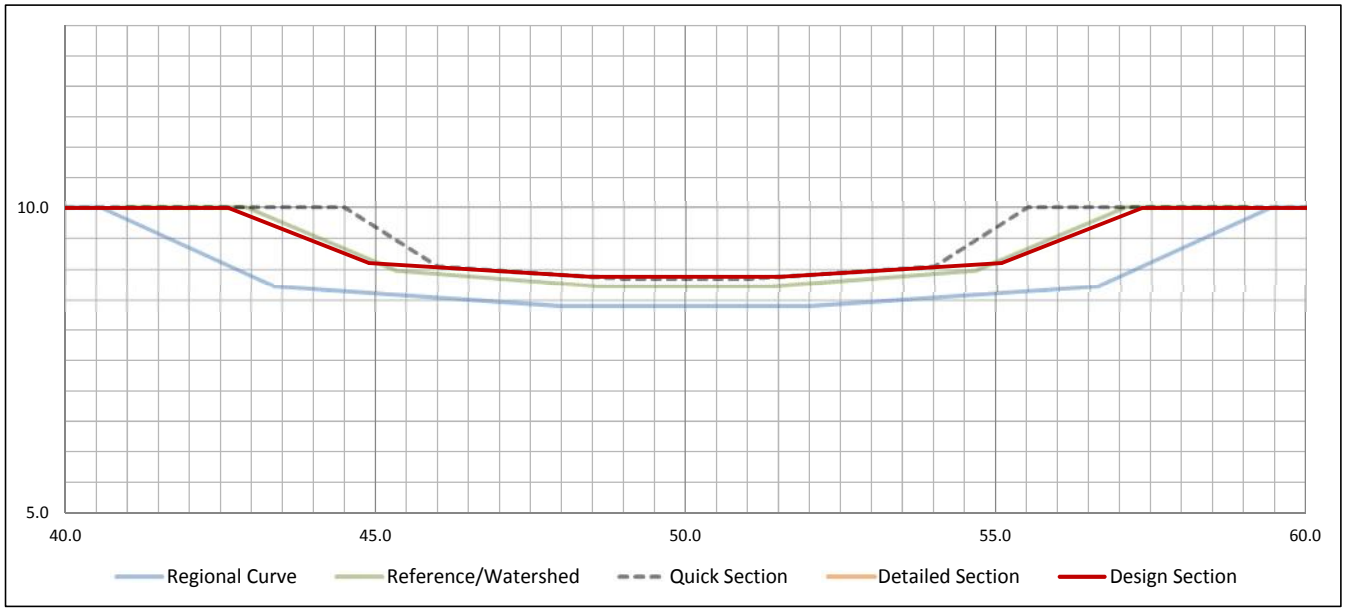
	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
W_{BKF}	18.9	14.2	17.0	12.5	14.7
	78%	104%	87%	118%	
W_{BED}	13.3	9.3	11.0		10.2
	77%	110%	93%		
W_{THL}	4.0	2.8	2.5		3.1
	77%	110%	123%		
d_{MAX}	1.6	1.3	1.3	2.4	1.1
	71%	88%	90%	48%	
d_{TOE}	1.3	1.0	1.0		0.9
	71%	88%	90%		
A_{BKF}	21.5	13.4	15.7	19.0	12.7
	59%	95%	81%	67%	
d_{MEAN}	1.14	0.95	0.92	1.52	0.86
	76%	91%	94%	57%	
P	19.4	14.6	17.3	20.6	15.1
	78%	103%	87%	73%	
Hydr. R	1.11	0.92	0.90	0.92	0.84
	76%	92%	93%	92%	
W/d Ratio	16.5	15.0	18.4	8.2	17.0
	103%	114%	92%	207%	

4.2 Design Section 3

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status

FINAL
4/7/14
SGG



Design Section

	Coef	Exp	
W_{BED}	9.20	0.47	
d_{MAX}	1.06	0.27	
Bank Slope	2.5		(H:1)
Thalweg Ratio	0.3		
Toe Depth Ratio	0.8		
Bench Width Ratio	0.5		
Bench Slope	0		(H:1)
Drainage Area	1.25		(sq. mi.)

Point of Comparison
U/s end, D/s of culvert

Section Comparisons

	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
W_{BKF}	18.9	14.2	11.0	0.0	14.7
	78%	104%	134%	#DIV/0!	
W_{BED}	13.3	9.3	8.0		10.2
	77%	110%	128%		
W_{THL}	4.0	2.8	2.0		3.1
	77%	110%	153%		
d_{MAX}	1.6	1.3	1.2	#VALUE!	1.1
	71%	88%	98%	#VALUE!	
d_{TOE}	1.3	1.0	1.0		0.9
	71%	88%	95%		
A_{BKF}	21.5	13.4	10.0		12.7
	59%	95%	127%	#VALUE!	
d_{MEAN}	1.14	0.95	0.91		0.86
	76%	91%	95%	#VALUE!	
P	19.4	14.6	11.6		15.1
	78%	103%	130%	#VALUE!	
Hydr. R	1.11	0.92	0.87		0.84
	76%	92%	97%	#VALUE!	
W/d Ratio	16.5	15.0	12.1		17.0
	103%	114%	141%	#VALUE!	

4.3 Design Section 4

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status

FINAL
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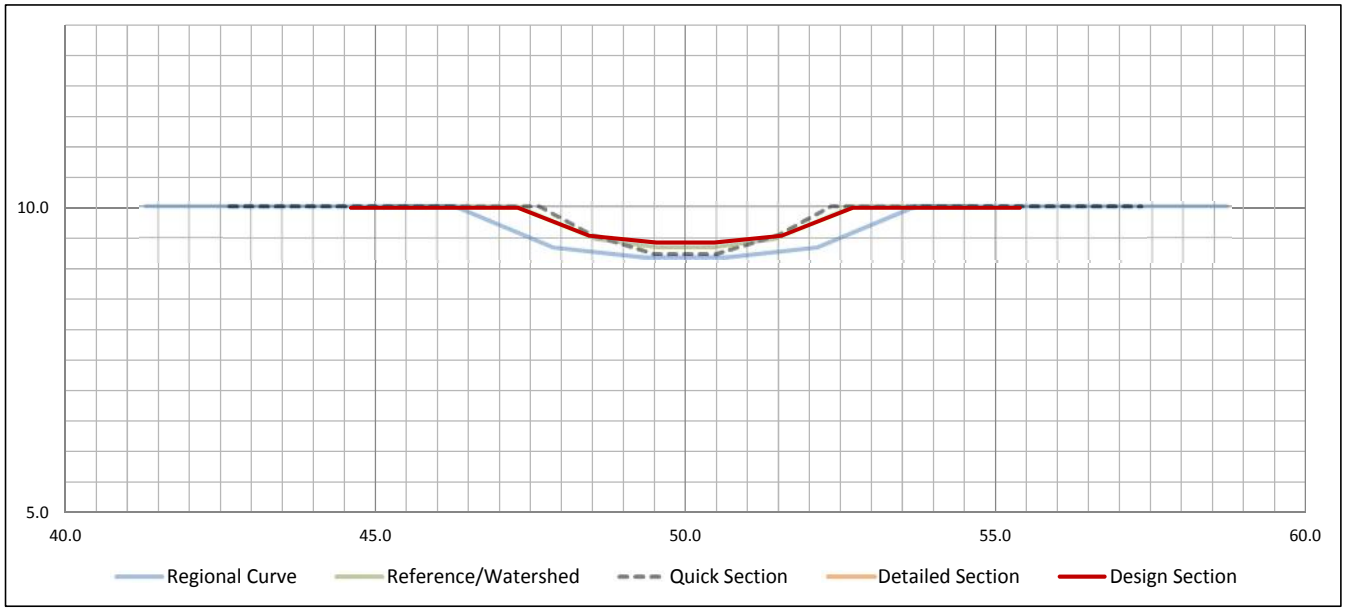

Design Section

	Coef	Exp	
W_{BED}	9.20	0.47	
d_{MAX}	1.06	0.27	
Bank Slope	2.5		(H:1)
Thalweg Ratio	0.3		
Toe Depth Ratio	0.8		
Bench Width Ratio	0.5		
Bench Slope	0		(H:1)
Drainage Area	0.10		(sq. mi.)

Point of Comparison
Parrsih Br. Upstream end

Section Comparisons

	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
W_{BKF}	7.4	5.4	4.7	0.0	5.4
	73%	100%	115%	#DIV/0!	
W_{BED}	4.3	2.8	3.0		3.1
	73%	110%	104%		
W_{THL}	1.3	0.9	1.0		0.9
	73%	110%	94%		
d_{MAX}	0.8	0.6	0.8	0.0	0.6
	71%	88%	76%	#DIV/0!	
d_{TOE}	0.6	0.5	0.5		0.5
	71%	88%	101%		
A_{BKF}	4.0	2.4	2.3		2.2
	54%	90%	93%	#VALUE!	
d_{MEAN}	0.55	0.44	0.50		0.40
	74%	91%	81%	#VALUE!	
P	7.7	5.6	5.0		5.6
	73%	99%	111%	#VALUE!	
Hydr. R	0.53	0.43	0.47		0.39
	74%	91%	83%	#VALUE!	
W/d Ratio	13.6	12.2	9.5		13.4
	99%	110%	142%	#VALUE!	

5.0 Typical Section Dimensions

Design Status: **DRAFT**

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Reach	Drainage Area (mi²)	Design Section	W_{BKF}	W_{BED}	W_{THAL}	W_{BENCH}	d_{MAX}	d_{TOE}	Bank Slope (H:1)
COCHRAN REACH 1A	1.25	1	14.7	10.2	3.1	10	1.13	0.90	2.5
COCHRAN REACH 1B	1.25	2	14.7	10.2	3.1	7	1.13	0.90	2.5
PARRISH REACH 1	0.1	1	5.4	3.1	0.9	4	0.57	0.46	2.5

Reach	Pool Dimensions				
	Width Ratio	W_{IN}	W_{OUT}	d_{POOL}/d_{MAX} Ratio	d_{POOL}
COCHRAN REACH 1A	1.1	8.8	7.4	1.5	1.69
COCHRAN REACH 1B	1.1	8.8	7.4	1.5	1.69
PARRISH REACH 1	1.1	3.2	2.7	1.5	0.85

5.1 Hydraulic Dimensions

Design Status

DRAFT

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Reach	Stream Type	A_{BKF}	P_{WET}	R_{HYD}	d_{MEAN}	W/D Ratio	Entrench Ratio
COCHRAN REACH 1A	B4	12.7	15.1	0.84	0.86	17.0	5.4
COCHRAN REACH 1B	C4	12.7	15.1	0.84	0.86	17.0	11.5
PARRISH REACH 1	B4	2.2	5.6	0.39	0.40	13.4	5.6

5.2 Morphologic Dimensions

Reach	Pool Spacing/W_{AVG}			Pool Spacing				Belt Width	
	min	target	max	min	target	max	min	target	max
COCHRAN REACH 1A	2.7	3.6	4.6	34.1	**45.4**	56.8	18.7	**24.9**	31.2
COCHRAN REACH 1B	5.0	6.0	7.0	62.3	**74.8**	87.3	24.9	**49.9**	62.3
PARRISH REACH 1	2.9	3.9	4.9	12.4	**16.5**	20.7	6.4	**8.5**	10.6

5.3 Morphologic Dimensions

Design Status: **DRAFT**

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Reach	R_C/W_{AVG}		Radius of Curvature		S_{AVG}	S_{VALLEY}	Sinuosity	Meander Width Ratio
	min	max	min	max				
COCHRAN REACH 1A	2.0	3.0	25	37	0.035	0.029	1.05	1.5
COCHRAN REACH 1B	1.5	2.5	19	31	0.085	0.007	1.14	3.2
PARRISH REACH 1	2.0	3.0	9	13	0.033	0.024	1.05	2.8

Reach	Percent Tangent	Percent Curve	Feature Length					
			Minimum		Target		Maximum	
			Tangent	Curve	Tangent	Curve	Tangent	Curve
COCHRAN REACH 1A	65%	35%	22.2	11.9	30	16	37	20
COCHRAN REACH 1B	55%	45%	34.3	28.1	41	34	48	39
PARRISH REACH 1	65%	35%	8.1	4.3	11	6	13	7

5.4 Structure Dimensions

Design Status
INCOMPLETE

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Reach	Arm Length (L)	Throat Width (W)	Buried Length (X)	Total Log Length	Boulder Size		
					Length	Width	Depth
COCHRAN REACH 1A	16.0	5.0	5	26			
COCHRAN REACH 1B	16.0	5.0	5	26			
PARRISH REACH 1	5.0	2.0	3	11			

6.0 Competence Calculations

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status
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Reach	Hydraulic Radius (ft)	Largest Particle Calculations				Representative Particle Calculations			
		τ*	γ_s	D_{MAX} (mm)	S (ft/ft)	τ*	γ_s	D_{50} (mm)	S (ft/ft)
COCHRAN REACH 1A	0.84	0.028	1.65	45	0.0081	0.040	1.65	35	0.0090
COCHRAN REACH 1B	0.84	0.028	1.65	45	0.0081	0.047	1.65	21	0.0063
PARRISH REACH 1	0.39	0.028	1.65	45	0.0176	0.040	1.65	35	0.0195

Reach	Calculation Method	Sediment Load	Percent Calculated Slope		Design Slope Range (ft/ft)		
			Min	Max			
COCHRAN REACH 1A	Representative Particle	Moderate	90%	110%	0.0081	to	0.0099
COCHRAN REACH 1B	Largest Particle	Moderate	90%	110%	0.0073	to	0.0089
PARRISH REACH 1	Representative Particle	Moderate	90%	110%	0.0176	to	0.0215

7.0 HEC-RAS Output Existing Conditions											
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	E.G. Elev	Froude # Chl	Vel Chnl	Shear Chan	Power Chan	Power Total
			(cfs)	(ft)	(ft)	(ft)		(ft/s)	(lb/sq ft)	(lb/ft s)	(lb/ft s)
Co1	7.1	Bankfull	66	2165.18	2169.37	2169.47	0.28	2.49	0.23	0.57	0.57
Co1	7.1	2-yr	158	2165.18	2175.96	2175.97	0.05	0.75	0.01	0.01	0.00
Co1	7.1	5-yr	281	2165.18	2176.51	2176.53	0.07	1.18	0.03	0.04	0.01
Co1	7.1	10-yr	387	2165.18	2176.75	2176.77	0.09	1.55	0.06	0.09	0.02
Co1	7.1	50-yr	694	2165.18	2177.27	2177.31	0.14	2.51	0.14	0.36	0.09
Co1	7.1	100-yr	856	2165.18	2177.58	2177.65	0.16	2.95	0.2	0.58	0.13
Co1	7.01		Culvert								
Co1	7	Bankfull	66	2163.69	2165.86	2166.15	0.71	4.33	0.82	3.56	3.56
Co1	7	2-yr	158	2163.69	2166.84	2167.28	0.68	5.35	1.07	5.71	4.26
Co1	7	5-yr	281	2163.69	2167.15	2168.15	0.95	8.1	2.33	18.87	13.17
Co1	7	10-yr	387	2163.69	2167.67	2168.85	0.94	8.89	2.62	23.31	14.78
Co1	7	50-yr	694	2163.69	2168.86	2170.46	0.94	10.58	3.29	34.83	18.81
Co1	7	100-yr	856	2163.69	2169.37	2171.17	0.94	11.32	3.62	40.91	20.83
Co1	6	Bankfull	66	2162.28	2164.28	2164.89	1	6.3	1.75	11.01	11.01
Co1	6	2-yr	158	2162.28	2165.3	2166.21	0.99	7.66	2.27	17.41	17.41
Co1	6	5-yr	281	2162.28	2165.8	2166.4	0.86	7.38	1.97	14.52	4.67
Co1	6	10-yr	387	2162.28	2166.13	2166.82	0.89	8.18	2.31	18.92	6.14
Co1	6	50-yr	694	2162.28	2166.84	2167.76	0.96	9.97	3.16	31.53	10.34
Co1	6	100-yr	856	2162.28	2167.17	2168.16	0.97	10.57	3.45	36.52	12.22
Co1	5	Bankfull	66	2154.72	2156.8	2157.02	0.55	3.74	0.58	2.16	2.16
Co1	5	2-yr	158	2154.72	2157.7	2158.14	0.66	5.33	1.06	5.63	5.63
Co1	5	5-yr	281	2154.72	2158.44	2158.78	0.59	5.28	0.96	5.09	0.86
Co1	5	10-yr	387	2154.72	2158.98	2159.19	0.48	4.69	0.73	3.4	0.61
Co1	5	50-yr	694	2154.72	2159.2	2159.57	0.66	6.61	1.42	9.37	1.6
Co1	5	100-yr	856	2154.72	2159.46	2159.8	0.65	6.65	1.4	9.33	1.81
Co1	4	Bankfull	66	2152.98	2154.88	2155.04	0.53	3.16	0.45	1.41	1.41
Co1	4	2-yr	158	2152.98	2155.81	2156.05	0.52	3.9	0.58	2.28	2.28
Co1	4	5-yr	281	2152.98	2156.54	2156.9	0.57	4.8	0.82	3.92	3.92
Co1	4	10-yr	387	2152.98	2156.57	2157.23	0.77	6.51	1.5	9.77	9.77
Co1	4	50-yr	694	2152.98	2157.09	2157.43	0.63	5.78	1.12	6.45	2.18
Co1	4	100-yr	856	2152.98	2157.34	2157.71	0.65	6.18	1.25	7.7	2.71
Co1	3	Bankfull	66	2151.09	2153.46	2153.6	0.51	3.05	0.41	1.25	1.25
Co1	3	2-yr	158	2151.09	2154.01	2154.35	0.7	4.68	0.9	4.21	4.21
Co1	3	5-yr	281	2151.09	2154.36	2154.85	0.83	5.9	1.36	8.04	2.85
Co1	3	10-yr	387	2151.09	2154.6	2155.04	0.8	5.98	1.36	8.14	2.38
Co1	3	50-yr	694	2151.09	2155.38	2155.71	0.68	5.76	1.16	6.68	2.69
Co1	3	100-yr	856	2151.09	2155.69	2156.03	0.66	5.83	1.16	6.73	2.98
Co1	2	Bankfull	66	2148.9	2151.2	2151.43	0.53	3.91	0.61	2.38	1.59
Co1	2	2-yr	158	2148.9	2153.72	2153.76	0.18	1.92	0.11	0.21	0.06
Co1	2	5-yr	281	2148.9	2154.39	2154.4	0.11	1.32	0.05	0.07	0.02
Co1	2	10-yr	387	2148.9	2154.56	2154.57	0.14	1.7	0.08	0.14	0.04
Co1	2	50-yr	694	2148.9	2155.01	2155.05	0.21	2.65	0.19	0.51	0.13
Co1	2	100-yr	856	2148.9	2155.24	2155.29	0.23	3.02	0.25	0.75	0.19
Co1	1.2	Bankfull	66	2147.6	2150.83	2150.87	0.2	1.77	0.11	0.19	0.05
Co1	1.2	2-yr	158	2147.6	2153.73	2153.73	0.04	0.52	0.01	0.00	0.00
Co1	1.2	5-yr	281	2147.6	2154.37	2154.37	0.06	0.77	0.02	0.01	0.00
Co1	1.2	10-yr	387	2147.6	2154.52	2154.53	0.07	1.03	0.03	0.03	0.01
Co1	1.2	50-yr	694	2147.6	2154.93	2154.95	0.12	1.69	0.07	0.12	0.03
Co1	1.2	100-yr	856	2147.6	2155.14	2155.16	0.14	1.99	0.1	0.19	0.05

Co1	1.1	Bankfull	66	2147.07	2150.76	2150.82	0.24	2.03	0.15	0.3	0.3
Co1	1.1	2-yr	158	2147.07	2153.72	2153.72	0.08	1.02	0.03	0.03	0.01
Co1	1.1	5-yr	281	2147.07	2154.35	2154.37	0.1	1.34	0.05	0.07	0.01
Co1	1.1	10-yr	387	2147.07	2154.5	2154.52	0.13	1.74	0.08	0.14	0.03
Co1	1.1	50-yr	694	2147.07	2154.87	2154.92	0.2	2.69	0.19	0.52	0.12
Co1	1.1	100-yr	856	2147.07	2155.06	2155.13	0.22	3.1	0.25	0.78	0.19
Co1	1.01		Culvert								
Co1	1	Bankfull	66	2146	2148.07	2148.37	0.65	4.39	0.8	3.53	3.14
Co1	1	2-yr	158	2146	2148.95	2149.48	0.71	6.07	1.3	7.92	2.98
Co1	1	5-yr	281	2146	2149.69	2150.37	0.73	7.25	1.69	12.29	2.78
Co1	1	10-yr	387	2146	2150.12	2150.87	0.75	7.94	1.94	15.42	2.99
Co1	1	50-yr	694	2146	2151.01	2151.84	0.78	9.22	2.43	22.41	3.7
Co1	1	100-yr	856	2146	2151.35	2152.21	0.79	9.72	2.63	25.59	4.09
Co1	0.1	Bankfull	66	2145.5	2147.57	2147.87	0.65	4.4	0.8	3.53	3.14
Co1	0.1	2-yr	158	2145.5	2148.45	2148.98	0.71	6.07	1.31	7.93	2.99
Co1	0.1	5-yr	281	2145.5	2149.18	2149.87	0.74	7.3	1.72	12.57	2.86
Co1	0.1	10-yr	387	2145.5	2149.61	2150.37	0.76	7.99	1.97	15.76	3.07
Co1	0.1	50-yr	694	2145.5	2150.49	2151.34	0.79	9.29	2.47	22.94	3.8
Co1	0.1	100-yr	856	2145.5	2150.84	2151.71	0.8	9.78	2.67	26.1	4.17

7.1 HEC-RAS Output Proposed Conditions											
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	E.G. Elev	Froude # Chl	Vel Chnl	Shear Chan	Power Chan	Power Total
			(cfs)	(ft)	(ft)	(ft)		(ft/s)	(lb/sq ft)	(lb/ft s)	(lb/ft s)
Co1	7.1	Bankfull	66	2165.18	2169.37	2169.47	0.28	2.49	0.23	0.57	0.57
Co1	7.1	2-yr	158	2165.18	2175.96	2175.97	0.05	0.75	0.01	0.01	0.00
Co1	7.1	5-yr	281	2165.18	2176.51	2176.53	0.07	1.18	0.03	0.04	0.01
Co1	7.1	10-yr	387	2165.18	2176.75	2176.77	0.09	1.55	0.06	0.09	0.02
Co1	7.1	50-yr	694	2165.18	2177.26	2177.31	0.14	2.51	0.14	0.36	0.09
Co1	7.1	100-yr	856	2165.18	2177.52	2177.59	0.16	2.98	0.2	0.6	0.14
Co1	7.01		Culvert								
Co1	7	Bankfull	66	2164.63	2165.95	2166.22	0.72	4.18	0.78	3.26	1.62
Co1	7	2-yr	158	2164.63	2166.42	2166.99	0.91	6.38	1.61	10.27	5.07
Co1	7	5-yr	281	2164.63	2166.98	2167.76	0.94	7.71	2.12	16.37	7.88
Co1	7	10-yr	387	2164.63	2167.36	2168.31	0.97	8.62	2.51	21.6	10.15
Co1	7	50-yr	694	2164.63	2168.29	2169.6	1	10.44	3.3	34.49	15.16
Co1	7	100-yr	856	2164.63	2168.71	2170.18	1.01	11.16	3.64	40.59	17.31
Co1	6	Bankfull	66	2163.52	2164.63	2165.06	1.01	5.31	1.35	7.19	7.19
Co1	6	2-yr	158	2163.52	2165.33	2165.83	0.86	6.06	1.45	8.78	3.07
Co1	6	5-yr	281	2163.52	2165.84	2166.47	0.88	7.19	1.85	13.33	4.45
Co1	6	10-yr	387	2163.52	2166.16	2166.9	0.91	8.01	2.19	17.57	5.78
Co1	6	50-yr	694	2163.52	2166.94	2167.88	0.94	9.52	2.82	26.83	8.65
Co1	6	100-yr	856	2163.52	2167.23	2168.3	0.98	10.31	3.21	33.07	10.74
Co1	5	Bankfull	66	2156.23	2157.58	2157.82	0.68	4	0.71	2.84	0.75
Co1	5	2-yr	158	2156.23	2158.06	2158.36	0.72	5.08	1.02	5.16	0.68
Co1	5	5-yr	281	2156.23	2158.39	2158.7	0.74	5.75	1.22	7.01	0.94
Co1	5	10-yr	387	2156.23	2158.56	2158.9	0.79	6.44	1.49	9.57	1.41
Co1	5	50-yr	694	2156.23	2158.9	2159.35	0.92	8.07	2.21	17.86	3.05
Co1	5	100-yr	856	2156.23	2159.06	2159.55	0.95	8.62	2.48	21.35	3.86
Co1	4	Bankfull	66	2153.46	2154.84	2155.06	0.65	3.88	0.66	2.57	0.62
Co1	4	2-yr	158	2153.46	2155.5	2155.64	0.5	3.77	0.54	2.03	0.29
Co1	4	5-yr	281	2153.46	2155.91	2156.04	0.49	4.14	0.6	2.49	0.44
Co1	4	10-yr	387	2153.46	2156.19	2156.32	0.49	4.41	0.66	2.89	0.57
Co1	4	50-yr	694	2153.46	2156.75	2156.92	0.54	5.31	0.89	4.73	1.06
Co1	4	100-yr	856	2153.46	2156.99	2157.18	0.56	5.7	1	5.69	1.32
Co1	3	Bankfull	66	2152.25	2153.87	2153.98	0.43	2.81	0.33	0.92	0.15
Co1	3	2-yr	158	2152.25	2154.08	2154.37	0.71	5.06	1.01	5.09	0.81
Co1	3	5-yr	281	2152.25	2154.36	2154.74	0.81	6.24	1.45	9.05	1.67
Co1	3	10-yr	387	2152.25	2154.55	2154.99	0.87	7.05	1.79	12.64	2.51
Co1	3	50-yr	694	2152.25	2155.15	2155.6	0.84	7.73	1.97	15.22	3.46
Co1	3	100-yr	856	2152.25	2155.47	2155.9	0.8	7.81	1.94	15.11	3.55
Co1	2	Bankfull	66	2149.85	2150.96	2151.4	1.01	5.28	1.34	7.08	7.08
Co1	2	2-yr	158	2149.85	2153.73	2153.74	0.08	0.85	0.02	0.02	0
Co1	2	5-yr	281	2149.85	2154.35	2154.35	0.1	1.2	0.04	0.05	0.01
Co1	2	10-yr	387	2149.85	2154.55	2154.56	0.13	1.54	0.07	0.1	0.03
Co1	2	50-yr	694	2149.85	2155	2155.03	0.19	2.38	0.15	0.36	0.1
Co1	2	100-yr	856	2149.85	2155.23	2155.27	0.21	2.74	0.2	0.54	0.15
Co1	1.2	Bankfull	66	2148.14	2150.82	2150.83	0.09	0.81	0.02	0.02	0.00
Co1	1.2	2-yr	158	2148.14	2153.73	2153.73	0.04	0.48	0.01	0.00	0.00
Co1	1.2	5-yr	281	2148.14	2154.33	2154.33	0.05	0.73	0.01	0.01	0.00
Co1	1.2	10-yr	387	2148.14	2154.52	2154.53	0.07	0.97	0.02	0.02	0.01
Co1	1.2	50-yr	694	2148.14	2154.94	2154.95	0.11	1.6	0.06	0.1	0.03
Co1	1.2	100-yr	856	2148.14	2155.14	2155.15	0.13	1.9	0.09	0.17	0.05

Co1	1.1	Bankfull	66	2146.98	2150.81	2150.82	0.08	0.84	0.02	0.02	0.01
Co1	1.1	2-yr	158	2146.98	2153.72	2153.72	0.05	0.76	0.01	0.01	0
Co1	1.1	5-yr	281	2146.98	2154.32	2154.33	0.07	1.12	0.03	0.03	0.01
Co1	1.1	10-yr	387	2146.98	2154.51	2154.52	0.09	1.45	0.05	0.07	0.01
Co1	1.1	50-yr	694	2146.98	2154.9	2154.93	0.15	2.32	0.12	0.29	0.05
Co1	1.1	100-yr	856	2146.98	2155.09	2155.13	0.17	2.72	0.17	0.46	0.08
Co1	1.01		Culvert								
Co1	1	Bankfull	66	2146	2148.07	2148.37	0.65	4.39	0.8	3.53	3.14
Co1	1	2-yr	158	2146	2148.95	2149.49	0.7	6.06	1.3	7.86	2.95
Co1	1	5-yr	281	2146	2149.68	2150.37	0.74	7.28	1.71	12.47	2.83
Co1	1	10-yr	387	2146	2150.12	2150.87	0.75	7.95	1.95	15.49	3.01
Co1	1	50-yr	694	2146	2151	2151.84	0.78	9.23	2.43	22.46	3.71
Co1	1	100-yr	856	2146	2151.35	2152.21	0.79	9.73	2.64	25.68	4.1
Co1	0.1	Bankfull	66	2145.5	2147.57	2147.87	0.65	4.4	0.8	3.53	3.14
Co1	0.1	2-yr	158	2145.5	2148.45	2148.98	0.71	6.07	1.31	7.93	2.99
Co1	0.1	5-yr	281	2145.5	2149.18	2149.87	0.74	7.3	1.72	12.57	2.86
Co1	0.1	10-yr	387	2145.5	2149.61	2150.37	0.76	7.99	1.97	15.76	3.07
Co1	0.1	50-yr	694	2145.5	2150.49	2151.34	0.79	9.29	2.47	22.94	3.8
Co1	0.1	100-yr	856	2145.5	2150.84	2151.71	0.8	9.78	2.67	26.1	4.17

7.2 HEC-RAS Output Comparison							
River	River Sta	Profile	WSEL Diff	Power ch Diff	Power ch % Diff	Power Tot Diff	Power Tot % Diff
Co1	7.1	Bankfull	0	0	0%	0	0%
Co1	7.1	2-yr	0	0	0%	0	0%
Co1	7.1	5-yr	0	0	0%	0	0%
Co1	7.1	10-yr	0	0	0%	0	0%
Co1	7.1	50-yr	-0.01	0	0%	0	0%
Co1	7.1	100-yr	-0.06	0.02	3%	0.01	8%
Co1	7.01	0	0	0	#DIV/0!	0	#DIV/0!
Co1	7	Bankfull	0.09	-0.3	-8%	-1.94	-54%
Co1	7	2-yr	-0.42	4.56	80%	0.81	19%
Co1	7	5-yr	-0.17	-2.5	-13%	-5.29	-40%
Co1	7	10-yr	-0.31	-1.71	-7%	-4.63	-31%
Co1	7	50-yr	-0.57	-0.34	-1%	-3.65	-19%
Co1	7	100-yr	-0.66	-0.32	-1%	-3.52	-17%
Co1	6	Bankfull	0.35	-3.82	-35%	-3.82	-35%
Co1	6	2-yr	0.03	-8.63	-50%	-14.34	-82%
Co1	6	5-yr	0.04	-1.19	-8%	-0.22	-5%
Co1	6	10-yr	0.03	-1.35	-7%	-0.36	-6%
Co1	6	50-yr	0.1	-4.7	-15%	-1.69	-16%
Co1	6	100-yr	0.06	-3.45	-9%	-1.48	-12%
Co1	5	Bankfull	0.78	0.68	31%	-1.41	-65%
Co1	5	2-yr	0.36	-0.47	-8%	-4.95	-88%
Co1	5	5-yr	-0.05	1.92	38%	0.08	9%
Co1	5	10-yr	-0.42	6.17	181%	0.8	131%
Co1	5	50-yr	-0.3	8.49	91%	1.45	91%
Co1	5	100-yr	-0.4	12.02	129%	2.05	113%
Co1	4	Bankfull	-0.04	1.16	82%	-0.79	-56%
Co1	4	2-yr	-0.31	-0.25	-11%	-1.99	-87%
Co1	4	5-yr	-0.63	-1.43	-36%	-3.48	-89%
Co1	4	10-yr	-0.38	-6.88	-70%	-9.2	-94%
Co1	4	50-yr	-0.34	-1.72	-27%	-1.12	-51%
Co1	4	100-yr	-0.35	-2.01	-26%	-1.39	-51%
Co1	3	Bankfull	0.41	-0.33	-26%	-1.1	-88%
Co1	3	2-yr	0.07	0.88	21%	-3.4	-81%
Co1	3	5-yr	0	1.01	13%	-1.18	-41%
Co1	3	10-yr	-0.05	4.5	55%	0.13	5%
Co1	3	50-yr	-0.23	8.54	128%	0.77	29%
Co1	3	100-yr	-0.22	8.38	125%	0.57	19%
Co1	2	Bankfull	-0.24	4.7	197%	5.49	345%
Co1	2	2-yr	0.01	-0.19	-90%	-0.06	-100%
Co1	2	5-yr	-0.04	-0.02	-29%	-0.01	-50%
Co1	2	10-yr	-0.01	-0.04	-29%	-0.01	-25%
Co1	2	50-yr	-0.01	-0.15	-29%	-0.03	-23%
Co1	2	100-yr	-0.01	-0.21	-28%	-0.04	-21%
Co1	1.2	Bankfull	-0.01	-0.17	-89%	-0.05	-98%
Co1	1.2	2-yr	0	0	0%	0	0%
Co1	1.2	5-yr	-0.04	0	0%	0	0%
Co1	1.2	10-yr	0	-0.01	-33%	0	0%
Co1	1.2	50-yr	0.01	-0.02	-17%	0	0%
Co1	1.2	100-yr	0	-0.02	-11%	0	0%

Co1	1.1	Bankfull	0.05	-0.28	-93%	-0.29	-97%
Co1	1.1	2-yr	0	-0.02	-67%	-0.01	-100%
Co1	1.1	5-yr	-0.03	-0.04	-57%	0	0%
Co1	1.1	10-yr	0.01	-0.07	-50%	-0.02	-67%
Co1	1.1	50-yr	0.03	-0.23	-44%	-0.07	-58%
Co1	1.1	100-yr	0.03	-0.32	-41%	-0.11	-58%
Co1	1.01	0	0	0	#DIV/0!	0	#DIV/0!
Co1	1	Bankfull	0	0	0%	0	0%
Co1	1	2-yr	0	-0.06	-1%	-0.03	-1%
Co1	1	5-yr	-0.01	0.18	1%	0.05	2%
Co1	1	10-yr	0	0.07	0%	0.02	1%
Co1	1	50-yr	-0.01	0.05	0%	0.01	0%
Co1	1	100-yr	0	0.09	0%	0.01	0%
Co1	0.1	Bankfull	0	0	0%	0	0%
Co1	0.1	2-yr	0	0	0%	0	0%
Co1	0.1	5-yr	0	0	0%	0	0%
Co1	0.1	10-yr	0	0	0%	0	0%
Co1	0.1	50-yr	0	0	0%	0	0%
Co1	0.1	100-yr	0	0	0%	0	0%

8.0 HEC-RAS Sediment Data Calibration

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Cochran	Co1	7.1	65.74	0.00	3.90	3.90
Cochran	Co1	7	72.12	0.00	10.47	3.90
Cochran	Co1	6	260.41	0.00	3.87	10.47
Cochran	Co1	5	285.62	0.00	1.25	3.87
Cochran	Co1	4	223.02	0.00	1.35	1.25
Cochran	Co1	3	341.9	0.00	1.25	1.35
Cochran	Co1	2	283.07	0.00	0.86	1.25
Cochran	Co1	1.2	54.79	0.00	0.72	0.86
Cochran	Co1	1.1	89.98	0.03	0.00	0.72
Cochran	Co1	1	50	-0.07	1.73	0.00
Cochran	Co1	0.1	0	-0.03	2.01	1.73

8.1 HEC-RAS Sediment Data - Existing (Bankfull)

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Cochran	Co1	7.1	65.74	0.00	3.78	3.78
Cochran	Co1	7	72.12	-0.14	14.39	3.78
Cochran	Co1	6	260.41	0.00	5.83	14.39
Cochran	Co1	5	285.62	0.01	2.11	5.83
Cochran	Co1	4	223.02	0.00	2.21	2.11
Cochran	Co1	3	341.9	0.00	2.06	2.21
Cochran	Co1	2	283.07	0.01	1.15	2.06
Cochran	Co1	1.2	54.79	0.01	0.71	1.15
Cochran	Co1	1.1	89.98	0.03	0.00	0.71
Cochran	Co1	1	50	-0.10	2.88	0.00
Cochran	Co1	0.1	0	-0.04	3.33	2.88

HEC-RAS Sediment Data - Proposed (Bankfull)

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Cochran	Co1	7.1	65.74	0.00	3.80	3.80
Cochran	Co1	7	66.29	0.00	11.23	3.80
Cochran	Co1	6	245.69	0.00	9.32	11.23
Cochran	Co1	5	270.65	0.00	5.87	9.32
Cochran	Co1	4	178.42	-0.01	5.97	5.87
Cochran	Co1	3	311.87	0.00	7.28	5.97
Cochran	Co1	2	308.99	0.00	7.63	7.28
Cochran	Co1	1.2	64.2	0.01	7.87	7.63
Cochran	Co1	1.1	89.98	0.22	0.00	7.87
Cochran	Co1	1	50	-0.10	2.88	0.00
Cochran	Co1	0.1	0	-0.04	3.33	2.88

8.2 HEC-RAS Sediment Data - Existing (2 Year)

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Cochran	Co1	7.1	65.74	0.00	3.64	3.64
Cochran	Co1	7	72.12	-0.40	20.55	3.64
Cochran	Co1	6	260.41	0.00	9.37	20.55
Cochran	Co1	5	285.62	0.02	3.95	9.37
Cochran	Co1	4	223.02	0.00	4.04	3.95
Cochran	Co1	3	341.9	0.01	3.13	4.04
Cochran	Co1	2	283.07	0.02	1.29	3.13
Cochran	Co1	1.2	54.79	0.01	0.65	1.29
Cochran	Co1	1.1	89.98	0.03	0.00	0.65
Cochran	Co1	1	50	-0.16	4.96	0.00
Cochran	Co1	0.1	0	-0.05	5.56	4.96

HEC-RAS Sediment Data - Proposed (2 Year)

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Cochran	Co1	7.1	65.74	0.00	3.67	3.67
Cochran	Co1	7	66.29	-0.10	15.00	3.67
Cochran	Co1	6	245.69	0.00	10.42	15.00
Cochran	Co1	5	270.65	0.00	6.04	10.42
Cochran	Co1	4	178.42	-0.01	6.24	6.04
Cochran	Co1	3	311.87	0.00	7.32	6.24
Cochran	Co1	2	308.99	0.01	6.34	7.32
Cochran	Co1	1.2	64.2	0.01	5.52	6.34
Cochran	Co1	1.1	89.98	0.15	0.00	5.52
Cochran	Co1	1	50	-0.16	4.96	0.00
Cochran	Co1	0.1	0	-0.05	5.56	4.96

8.3 HEC-RAS Sediment Data - Existing (10 Year)

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Cochran	Co1	7.1	65.74	0.00	3.46	3.46
Cochran	Co1	7	72.12	-0.56	26.24	3.46
Cochran	Co1	6	260.41	0.00	14.48	26.24
Cochran	Co1	5	285.62	0.03	8.48	14.48
Cochran	Co1	4	223.02	-0.01	9.20	8.48
Cochran	Co1	3	341.9	0.03	5.34	9.20
Cochran	Co1	2	283.07	0.04	1.35	5.34
Cochran	Co1	1.2	54.79	0.01	0.58	1.35
Cochran	Co1	1.1	89.98	0.03	0.00	0.58
Cochran	Co1	1	50	-0.28	9.06	0.00
Cochran	Co1	0.1	0	-0.11	10.33	9.06

HEC-RAS Sediment Data - Proposed (10 Year)

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Cochran	Co1	7.1	65.74	0.00	3.51	3.51
Cochran	Co1	7	66.29	-0.28	21.81	3.51
Cochran	Co1	6	245.69	0.00	13.65	21.81
Cochran	Co1	5	270.65	0.00	8.35	13.65
Cochran	Co1	4	178.42	-0.02	10.28	8.35
Cochran	Co1	3	311.87	0.01	12.11	10.28
Cochran	Co1	2	308.99	0.02	8.47	12.11
Cochran	Co1	1.2	64.2	0.02	5.48	8.47
Cochran	Co1	1.1	89.98	0.15	0.00	5.48
Cochran	Co1	1	50	-0.28	9.07	0.00
Cochran	Co1	0.1	0	-0.10	10.34	9.07

10.0 Supplemental Bed Material Design
(Off-site Material)

Design Status
DRAFT

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Material Gradation Percentage of Total by Weight						
Material Size	ON-SITE SAND / CLAY	1/2" STONE (NO. 57)	3/4" STONE (NO. 5)	2" STONE (SURGE)	6" STONE NCDOT (CLASS A)	12" STONE NCDOT (CLASS B)
Sand	100					
#16						
#10		2				
#8		3				
#4		12	2			
3/8"		25	3			
1/2"		48	32			
3/4"		7	58			
1"		3	5			
1.5"					19	
2"				50	19	
3"				50	19	
4"					19	19
5"					19	19
6"					5	19
8"						19
9"						19
10"						5
12"						
14"						
16"						
18"						
24"						
Total %	100	100	100	100	100	100

10.1 Supplemental Bed Material Design

(Off-site Material)

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status: **DRAFT**

Material Composition							
Reach	ON-SITE SAND / CLAY	1/2" STONE (NO. 57)	3/4" STONE (NO. 5)	2" STONE (SURGE)	6" STONE NCDOT (CLASS A)	12" STONE NCDOT (CLASS B)	Depth of Material (ft)
COCHRAN REACH 1A	30%			70%			0.4
COCHRAN REACH 1B	50%			50%			0.4
PARRISH REACH 1	30%			70%			0.4

Design Size Distribution (mm)						
Reach	D_{16}	D_{35}	D_{50}	D_{65}	D_{84}	D_{95}
COCHRAN REACH 1A	<1	40	45	51	65	72
COCHRAN REACH 1B	<1	<1	38	46	60	71
PARRISH REACH 1	<1	40	45	51	65	72

10.2 Supplemental Bed Material Design

(With Harvested Bed Material)

Design Status

DRAFT

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Material Gradation Percentage of Total by Weight						
Material Size	ON-SITE HARVEST MATERIAL	1/2" STONE (NO. 57)	3/4" STONE (NO. 5)	2" STONE (SURGE)	6" STONE NCDOT (CLASS A)	12" STONE NCDOT (CLASS B)
Sand	5					
#16						
#10	5	2				
#8		3				
#4	5	12	2			
3/8"	10	25	3			
1/2"	10	48	32			
3/4"	15	7	58			
1"	20	3	5			
1.5"	20				19	
2"	10			50	19	
3"				50	19	
4"					19	19
5"					19	19
6"					5	19
8"						19
9"						19
10"						5
12"						
14"						
16"						
18"						
24"						
Total %	100	100	100	100	100	100

10.3 Supplemental Bed Material Design

(With Harvested Bed Material)

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status: **DRAFT**

Material Composition							
Reach	ON-SITE HARVEST MATERIAL	1/2" STONE (NO. 57)	3/4" STONE (NO. 5)	2" STONE (SURGE)	6" STONE NCDOT (CLASS A)	12" STONE NCDOT (CLASS B)	Depth of Material (ft)
COCHRAN REACH 1A	70%			30%			0.4
COCHRAN REACH 1B	70%			30%			0.4
PARRISH REACH 1	70%			30%			0.4

Design Size Distribution (mm)						
Reach	D_{16}	D_{35}	D_{50}	D_{65}	D_{84}	D_{95}
COCHRAN REACH 1A	9	19	26	39	50	68
COCHRAN REACH 1B	9	19	26	39	50	68
PARRISH REACH 1	9	19	26	39	50	68

11.0 Stream Credit Calculations

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status
DRAFT

Credit Ratio Definition

Description	Approach	Ratio
Restoration	R	1:1
Enhancement I	EI	1.5:1
Enhancement II	EII	2.5:1
Preservation	P	5:1
High Quality Pres.	HQP	5:1

Reach	Location/Comments	Existing (ft)	Proposed (ft)	Approach	Credit Ratio	SMU
COCHRAN REACH 1A			295	R	1:1	295
COCHRAN REACH 1B			1092	R	1:1	1092
PARRISH REACH 1			396	R	1:1	396

Component Totals

Restoration / Enhancement

Approach	Ft	SMU
Restoration	1783	1783
Enhancement I		
Enhancement II		
Subtotal:	1783	1783

Preservation

Approach	Ft	SMU
Preservation		
High Quality Pres.		
Subtotal:		

Total Credits: 1783

11.1 Wetland Credit Calculations

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon Co., NC

Design Status
DRAFT

Credit Ratio Definition

Description	Approach	Ratio
Re-establishment	R (Re-Est)	1:1
Rehabilitation	R (Rehab)	1:1
Creation	R (Creation)	3:1
Enhancement	RE (Enh)	2:1
Preservation	RE (Pres)	5:1
High Quality Pres.	RE (HQP)	5:1

Reach	Location/Comments	Existing (Ac)	Proposed (Ac)	Approach	Credit Ratio	WMU
Area 1	Cochran Floodplain		3.33	R (Re-Est)	1:1	3.33
Area 1	Cochran Floodplain	0.77	0.82	R (Rehab)	1:1	0.82
Area 2	Cochran Terrace	0.11	0.11	RE (Enh)	2:1	0.06
Area 3	Parrish Seep		0.09	R (Re-Est)	1:1	0.09

Component Totals

Restoration

Approach	AC	WMU
Re-establishment	3.42	3.42
Rehabilitation	0.82	0.82
Creation		
Subtotal:	4.24	4.24

Restoration Equivalent

Approach	AC	WMU
Enhancement	0.11	0.06
Preservation		
High Quality Pres.		
Subtotal:	0.11	0.06

Total Credits: 4.30

APPENDIX C3

Assessment Data

Erosion Rate Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Cochran Branch
Reach: 1

Date: 11/11/13
Observer: mf,ce
Page: 1

Observed Values

Reach Name	1	2	3	4	5	6	7
Station/Location							
Photo No.							
Reach Length	40	40	50	30	100	30	100
Bank	Right	Left	Lt & Rt	Right	Lt & Rt	Left	Lt & Rt
Bank Height	1.2	1.2	1	3	2	1.5	3
Bankfull Height	1	1	1	1	1.2	1	1
Root Depth	0.8	0.9	0.5	0.5	0.5	0.7	0.8
Root Density	0.75	0.8	0.6	0.55	0.75	0.75	0.65
Bank Angle	30	65	70	75	55	40	75
Surface Protection	0.8	0.8	0.6	0.6	0.65	0.75	0.65
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay
Stratification	None	None	Moderate	None	None	None	None
Thalweg Position	Off-center	Off-center	Center	Center	Center	Center	Center
DTOE/DMEAN	< 1	< 1	> 1	< 1	< 1	< 1	< 1
Local Slope > Avg	No	No	Yes	No	No	No	No

BEHI Calculation

Bnk Ht / Bkf Ht	1.2	1.2	1	3	1.66666667	1.5	3
BEHI Score	3.4	3.4	1.0	9.6	6.1	5.3	9.6
Root Depth / Bnk Ht	0.7	0.8	0.5	0.2	0.3	0.5	0.3
BEHI Score	3.2	2.8	4.0	8.0	7.0	4.4	6.8
Weighted Root Density	0.5	0.6	0.3	0.1	0.2	0.4	0.2
BEHI Score	4.3	3.4	6.0	8.8	7.5	5.6	7.7
Bank Angle	30.0	65.0	70.0	75.0	55.0	40.0	75.0
BEHI Score	2.5	4.5	5.0	5.5	3.8	3.0	5.5
Surface Protection	0.8	0.8	0.6	0.6	0.7	0.8	0.7
BEHI Score	1.7	1.7	3.4	3.4	3.0	2.1	3.0
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stratification Adjustment	0	0	5.0	0	0	0	0
Total BEHI Score	15.1	15.8	24.4	35.3	27.4	20.4	32.6
Rating	Low	Low	Moderate	High	Moderate	Moderate	High

NBS Calculation

Thalweg Position Score	2	2	1	1	1	1	1
Toe Depth Ratio Score	0	0	1	0	0	0	0
Local Slope Score	0	0	1	0	0	0	0
Total NBS Rating	2	2	3	1	1	1	1
WARSS NBS Rating	2	2	5	1	1	1	1
Rating	Low	Low	Very High	Very Low	Very Low	Very Low	Very Low

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.0	0.0	0.2	0.1	0.0	0.0	0.1
Erosion Total (ft^3/yr)	0	0	21	8	7	1	57

Total Erosion (Sheet Total)	94

Erosion Rate Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Cochran Branch
Reach: 0

Date: 11/11/13
Observer: mf,ce
Page: 2

Observed Values

Reach Name	8	9	10	11	12	13	14
Station/Location							
Photo No.							
Reach Length	25	25	50	50	50	50	100
Bank	Right	Left	Lt & Rt	Right	Left	Lt & Rt	Lt & Rt
Bank Height	1.2	2.5	3	4	2.8	3	3
Bankfull Height	1	1	1	1	1	1.2	1.2
Root Depth	0.7	1.5	0.8	0.5	0.7	0.6	0.3
Root Density	0.5	0.65	0.65	0.5	0.6	0.6	0.4
Bank Angle	45	75	70	75	60	55	75
Surface Protection	0.5	0.65	0.65	0.5	0.5	0.6	0.4
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay
Stratification	None	None	Moderate	None	None	None	None
Thalweg Position	Off-center	Off-center	Center	Center	Center	Off-center	Off-center
DTOE/DMEAN	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Local Slope > Avg	No	No	No	No	No	No	No

BEHI Calculation

Bnk Ht / Bkf Ht	1.2	2.5	3	4	2.8	2.5	2.5
BEHI Score	3.4	8.8	9.6	10.0	9.3	8.8	8.8
Root Depth / Bnk Ht	0.6	0.6	0.3	0.1	0.3	0.2	0.1
BEHI Score	3.6	3.5	6.8	8.5	7.0	7.6	8.8
Weighted Root Density	0.3	0.4	0.2	0.1	0.2	0.1	0.0
BEHI Score	6.1	5.2	7.7	9.2	8.0	8.4	9.5
Bank Angle	45.0	75.0	70.0	75.0	60.0	55.0	75.0
BEHI Score	3.3	5.5	5.0	5.5	4.0	3.8	5.5
Surface Protection	0.5	0.7	0.7	0.5	0.5	0.6	0.4
BEHI Score	4.3	3.0	3.0	4.3	4.3	3.4	5.1
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stratification Adjustment	0	0	5.0	0	0	0	0
Total BEHI Score	20.6	26.0	37.1	37.5	32.6	32.0	37.7
Rating	Moderate	Moderate	High	High	High	High	High

NBS Calculation

Thalweg Position Score	2	2	1	1	1	2	2
Toe Depth Ratio Score	0	0	0	0	0	0	0
Local Slope Score	0	0	0	0	0	0	0
Total NBS Rating	2	2	1	1	1	2	2
WARSS NBS Rating	2	2	1	1	1	2	2
Rating	Low	Low	Very Low	Very Low	Very Low	Low	Low

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Erosion Total (ft^3/yr)	1	2	28	19	13	31	61

Total Erosion (Sheet Total)	155

Erosion Rate Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Cochran Branch
Reach: 0

Date: 11/11/13
Observer: mf,ce
Page: 3

Observed Values

Reach Name	15	16	17	18	19	20	
Station/Location							
Photo No.							
Reach Length	50	50	50	100	100	150	
Bank	Right	Left	Lt & Rt	Lt & Rt	Lt & Rt	Lt & Rt	
Bank Height	1.2	3	2.5	4	3	1.9	
Bankfull Height	0.5	1.2	1	1.4	1.2	1.5	
Root Depth	0.5	0.5	0.7	0.9	0.6	0.8	
Root Density	0.5	0.45	0.65	0.65	0.6	0.7	
Bank Angle	70	80	65	80	55	70	
Surface Protection	0.5	0.5	0.55	0.65	0.6	0.6	
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	
Stratification	None	None	Moderate	None	None	None	
Thalweg Position	Center	Center	Center	Center	Off-center	Off-center	
DTOE/DMEAN	< 1	< 1	< 1	< 1	< 1	< 1	
Local Slope > Avg	No	No	No	No	No	No	

BEHI Calculation

Bnk Ht / Bkf Ht	2.4	2.5	2.5	2.85714286	2.5	1.26666667	
BEHI Score	8.6	8.8	8.8	9.4	8.8	4.0	
Root Depth / Bnk Ht	0.4	0.2	0.3	0.2	0.2	0.4	
BEHI Score	5.0	8.0	6.6	7.3	7.6	4.9	
Weighted Root Density	0.2	0.1	0.2	0.1	0.1	0.3	
BEHI Score	7.2	9.0	7.6	8.1	8.4	6.1	
Bank Angle	70.0	80.0	65.0	80.0	55.0	70.0	
BEHI Score	5.0	6.0	4.5	6.0	3.8	5.0	
Surface Protection	0.5	0.5	0.6	0.7	0.6	0.6	
BEHI Score	4.3	4.3	3.9	3.0	3.4	3.4	
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	
Stratification Adjustment	0	0	5.0	0	0	0	
Total BEHI Score	30.1	36.1	36.4	33.7	32.0	23.5	
Rating	High	High	High	High	High	Moderate	

NBS Calculation

Thalweg Position Score	1	1	1	1	2	2	
Toe Depth Ratio Score	0	0	0	0	0	0	
Local Slope Score	0	0	0	0	0	0	
Total NBS Rating	1	1	1	1	2	2	
WARSS NBS Rating	1	1	1	1	2	2	
Rating	Very Low	Very Low	Very Low	Very Low	Low	Low	

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.1	0.1	0.1	0.0	
Erosion Total (ft^3/yr)	6	14	24	75	61	18	

Total Erosion (Sheet Total)	198

Erosion Rate Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Parrish Branch
Reach: 0

Date: 11/11/13
Observer: mf,ce
Page: 4

Observed Values

Reach Name	21	22	23				
Station/Location							
Photo No.							
Reach Length	100	100	50				
Bank	Lt & Rt	Lt & Rt	Lt & Rt				
Bank Height	1.7	3	4.5				
Bankfull Height	0.45	0.5	0.5				
Root Depth	0.5	0.5	0.5				
Root Density	0.6	0.5	0.5				
Bank Angle	55	70	70				
Surface Protection	0.65	0.5	0.5				
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay				
Stratification	None	None	Moderate				
Thalweg Position	Center	Center	Center				
DTOE/DMEAN	< 1	< 1	< 1				
Local Slope > Avg	No	No	No				

BEHI Calculation

Bnk Ht / Bkf Ht	3.77777778	6	9				
BEHI Score	10.0	10.0	10.0				
Root Depth / Bnk Ht	0.3	0.2	0.1				
BEHI Score	6.5	8.0	8.7				
Weighted Root Density	0.2	0.1	0.1				
BEHI Score	7.6	8.9	9.3				
Bank Angle	55.0	70.0	70.0				
BEHI Score	3.8	5.0	5.0				
Surface Protection	0.7	0.5	0.5				
BEHI Score	3.0	4.3	4.3				
Bank Material Adjustment	0.0	0.0	0.0				
Stratification Adjustment	0	0	5.0				
Total BEHI Score	30.9	36.2	42.2				
Rating	High	High	Very High				

NBS Calculation

Thalweg Position Score	1	1	1				
Toe Depth Ratio Score	0	0	0				
Local Slope Score	0	0	0				
Total NBS Rating	1	1	1				
WARSS NBS Rating	1	1	1				
Rating	Very Low	Very Low	Very Low				

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.5				
Erosion Total (ft^3/yr)	32	57	228				

Total Erosion (Sheet Total)	316

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Cochran Branch
Reach: 1

Date: 11/11/13
Observers: mf,ce
Page: 1

Observed Values

Section Number	1	2	3	4	5	6	
Reach Name	Cochran	Cochran	Cochran	Cochran	Cochran	Cochran	
Location		pit trap					
D_A (mi^2)	1.11	1.11	1.21	1.21	1.25	1.25	
W_{BKF} (ft)	9.0	9.5	7.0	8.0	7.0	8.0	
W_{BED} (ft)	7.0	7.5	6.0	6.5	5.5	6.5	
D_{BKF} (ft)	1.00	1.10	0.90	1.00	1.40	1.20	
$D_{TOE\ LT}$ (ft)	-0.20	-0.10	-0.10	0.40	0.10	0.10	
$D_{TOE\ RT}$ (ft)	-0.40	0.00	-0.20	0.20	0.00	0.40	
Field D_{THAL} (ft)	0.50	0.40	0.70	0.80	0.40	0.70	
W_{THAL} (ft)	3.0	2.5	2.0	4.0	2.5	2.0	
Bank/Terrace Height (ft)	3.0	3.0	3.0	2.5	4.0	2.5	
Flood Prone Width (ft)	12	16	15	20	16	30	

Section Calculations

D_{MAX}	1.50	1.50	1.60	1.80	1.80	1.90	
Average D_{TOE}	0.70	1.05	0.75	1.30	1.45	1.45	
D_{THAL}	0.80	0.45	0.85	0.50	0.35	0.45	
A_{BKF}	9.6	11.2	8.3	12.1	10.5	12.4	
D_{MEAN}	1.07	1.18	1.18	1.51	1.49	1.55	
W/D ratio	8.4	8.1	5.9	5.3	4.7	5.2	
Bank Height Ratio	2.0	2.0	1.9	1.4	2.2	1.3	
Entrenchment Ratio	1.3	1.7	2.1	2.5	2.3	3.8	

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.4	0.47

Reference Max Depth Equation

Coef	Exp
1.2	0.27

Reference Bed Width	8.8	8.8	9.2	9.2	9.3	9.3	
Bed Width Index (BWI)	0.8	0.9	0.7	0.7	0.6	0.7	
Reference D_{MAX}	1.2	1.2	1.3	1.3	1.3	1.3	
Max Depth Index (MDI)	1.2	1.2	1.3	1.4	1.4	1.5	

Stream Classification

Stream Type	G	G	G	G	G	G	

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Cochran Branch
Reach: good xs

Date: 11/11/13
Observers: mf,gg
Page: 2

Observed Values

Section Number	9	10					
Reach Name	Cochran	Cochran					
Location	ds culvert	103+00					
D_A (mi^2)	1.11	1.11					
W_{BKF} (ft)	11.0	17.0					
W_{BED} (ft)	8.0	11.0					
D_{BKF} (ft)	0.75	0.85					
$D_{TOE\ LT}$ (ft)	0.40	0.20					
$D_{TOE\ RT}$ (ft)	0.00	0.10					
Field D_{THAL} (ft)	0.40	0.40					
W_{THAL} (ft)	2.0	2.5					
Bank/Terrace Height (ft)	1.0	3.0					
Flood Prone Width (ft)	25	20					

Section Calculations

D_{MAX}	1.15	1.25					
Average D_{TOE}	0.95	1.00					
D_{THAL}	0.20	0.25					
A_{BKF}	10.0	15.7					
D_{MEAN}	0.91	0.92					
W/D ratio	12.1	18.4					
Bank Height Ratio	0.9	2.4					
Entrenchment Ratio	2.3	1.2					

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.4	0.47

Reference Max Depth Equation

Coef	Exp
1.2	0.27

Reference Bed Width	8.8	8.8					
Bed Width Index (BWI)	0.9	1.2					
Reference D_{MAX}	1.2	1.2					
Max Depth Index (MDI)	0.9	1.0					

Stream Classification

Stream Type	C	F					

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Parrish Branch
Reach: 1

Date: 11/11/13
Observers: mf,ce
Page: 3

Observed Values

Section Number	7	8					
Reach Name	Parrish	Parrish					
Location							
D_A (mi^2)	0.10	0.10					
W_{BKF} (ft)	4.7	3.5					
W_{BED} (ft)	3.0	2.5					
D_{BKF} (ft)	0.45	0.45					
$D_{TOE\ LT}$ (ft)	0.00	0.00					
$D_{TOE\ RT}$ (ft)	0.00	-0.10					
Field D_{THAL} (ft)	0.30	0.10					
W_{THAL} (ft)	1.0	0.7					
Bank/Terrace Height (ft)	1.7	5.5					
Flood Prone Width (ft)	8	8					

Section Calculations

D_{MAX}	0.75	0.55					
Average D_{TOE}	0.45	0.40					
D_{THAL}	0.30	0.15					
A_{BKF}	2.3	1.4					
D_{MEAN}	0.50	0.41					
W/D ratio	9.5	8.5					
Bank Height Ratio	2.3	10.0					
Entrenchment Ratio	1.6	2.3					

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.4	0.47

Reference Max Depth Equation

Coef	Exp
1.2	0.27

Reference Bed Width	2.8	2.8					
Bed Width Index (BWI)	1.1	0.9					
Reference D_{MAX}	0.6	0.6					
Max Depth Index (MDI)	1.2	0.9					

Stream Classification

Stream Type	G	G					

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Cochran Branch
Reach: 1

Date: 11/11/13
Observers: mf,ce,gg
Page: 4

Observed Values

Section Number	11	12	13				
Reach Name							
Location	Adj U/s	Adj U/s	Adj U/s				
D_A (mi^2)	1.00	1.00	1.00				
W_{BKF} (ft)	10.5	7.0	11.0				
W_{BED} (ft)	8.5	6.0	8.4				
D_{BKF} (ft)	1.00	0.50	0.95				
$D_{TOE\ LT}$ (ft)	0.00	0.00	0.00				
$D_{TOE\ RT}$ (ft)	-0.10	0.00	-0.20				
Field D_{THAL} (ft)	0.40	0.50	0.35				
W_{THAL} (ft)	3.0	2.0	1.5				
Bank/Terrace Height (ft)	4.0	2.0	3.0				
Flood Prone Width (ft)	20	10	16				

Section Calculations

D_{MAX}	1.40	1.00	1.30				
Average D_{TOE}	0.95	0.50	0.85				
D_{THAL}	0.45	0.50	0.45				
A_{BKF}	11.6	5.3	10.5				
D_{MEAN}	1.11	0.75	0.95				
W/D ratio	9.5	9.3	11.6				
Bank Height Ratio	2.9	2.0	2.3				
Entrenchment Ratio	1.9	1.4	1.5				

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.4	0.47

Reference Max Depth Equation

Coef	Exp
1.2	0.27

Reference Bed Width	8.4	8.4	8.4				
Bed Width Index (BWI)	1.0	0.7	1.0				
Reference D_{MAX}	1.2	1.2	1.2				
Max Depth Index (MDI)	1.2	0.8	1.1				

Stream Classification

Stream Type	G	G	G				

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Watershed Sections
Reach: 1

Date: 11/11/13
Observers: mf,gg
Page: 5

Observed Values

Section Number	14	15	16	17	18	19	20
Reach Name	Burningtwn	Burningtwn	Lt P. Brngt	Lt P. Brngt	Wayah Cr.	Arrowwood	Arrowwood
Location	C1 WildsCv	C1 WildsCv	C2 Ray Cr	C3 Ray Cr	C4 Wayah	C5	C5
D_A (mi^2)	12.71	12.71	5.47	10.60	8.36	1.37	1.37
W_{BKF} (ft)	36.0	28.0	25.5	27.0	39.0	13.0	12.5
W_{BED} (ft)	26.0	25.0	18.5	18.0	30.0	8.0	8.5
D_{BKF} (ft)	1.80	1.80	1.10	1.40	1.70	0.90	1.00
$D_{TOE\ LT}$ (ft)	0.40	0.30	0.30	0.00	0.00	0.00	0.00
$D_{TOE\ RT}$ (ft)	0.00	0.30	0.00	0.00	0.00	0.00	0.00
Field D_{THAL} (ft)	0.60	0.50	0.60	0.65	0.60	0.40	0.40
W_{THAL} (ft)	7.0	6.0	4.5	5.0	8.0	1.5	2.0
Bank/Terrace Height (ft)	3.5	4.0	1.5	3.0	3.5	1.5	2.0
Flood Prone Width (ft)	50	50	40	37	55	24	21

Section Calculations

D_{MAX}	2.40	2.30	1.70	2.05	2.30	1.30	1.40
Average D_{TOE}	2.00	2.10	1.25	1.40	1.70	0.90	1.00
D_{THAL}	0.40	0.20	0.45	0.65	0.60	0.40	0.40
A_{BKF}	68.6	58.8	32.7	39.0	70.1	11.4	12.6
D_{MEAN}	1.91	2.10	1.28	1.44	1.80	0.87	1.01
W/D ratio	18.9	13.3	19.9	18.7	21.7	14.9	12.4
Bank Height Ratio	1.5	1.7	0.9	1.5	1.5	1.2	1.4
Entrenchment Ratio	1.4	1.8	1.6	1.4	1.4	1.8	1.7

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.4	0.47

Reference Max Depth Equation

Coef	Exp
1.2	0.27

Reference Bed Width	27.7	27.7	18.7	25.5	22.8	9.7	9.7
Bed Width Index (BWI)	0.9	0.9	1.0	0.7	1.3	0.8	0.9
Reference D_{MAX}	2.4	2.4	1.9	2.3	2.1	1.3	1.3
Max Depth Index (MDI)	1.0	1.0	0.9	0.9	1.1	1.0	1.1

Stream Classification

Stream Type	B	B	B	B	B	B	B

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Watershed Sections
Reach: 1

Date: 11/22/13
Observers: mf,gg
Page: 6

Observed Values

Section Number	21	22					
Reach Name	Pink Beds	Pink Beds					
Location	Pb1	Pb2					
D_A (mi^2)	0.58	0.25					
W_{BKF} (ft)	14.0	7.5					
W_{BED} (ft)	9.0	6.0					
D_{BKF} (ft)	0.90	0.60					
$D_{TOE\ LT}$ (ft)	0.00	-0.10					
$D_{TOE\ RT}$ (ft)	0.00	0.30					
Field D_{THAL} (ft)	0.30	0.40					
W_{THAL} (ft)	2.0	0.7					
Bank/Terrace Height (ft)	1.5	1.4					
Flood Prone Width (ft)	30	25					

Section Calculations

D_{MAX}	1.20	1.00					
Average D_{TOE}	0.90	0.70					
D_{THAL}	0.30	0.30					
A_{BKF}	12.0	5.7					
D_{MEAN}	0.86	0.76					
W/D ratio	16.3	9.8					
Bank Height Ratio	1.3	1.4					
Entrenchment Ratio	2.1	3.3					

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

Coef	Exp
1.5	0.27

Reference Bed Width	9.4	6.4					
Bed Width Index (BWI)	1.0	0.9					
Reference D_{MAX}	1.3	1.0					
Max Depth Index (MDI)	0.9	1.0					

Stream Classification

Stream Type	B	E					

Bulk Material Samples

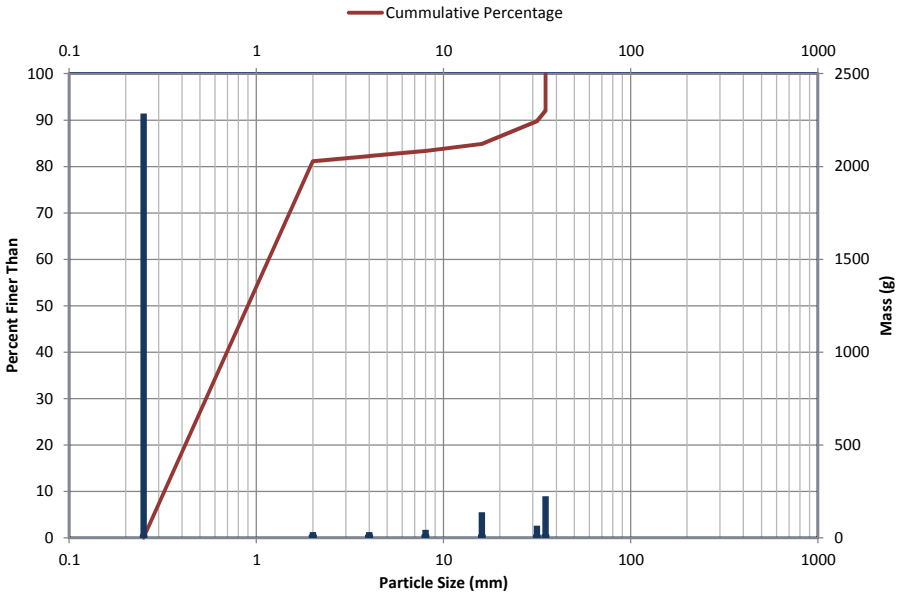
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon, NC

Reach: Cochran
Location: U/S end of site
Sample Type: Sediment Trap

Largest Particle
Dim: 80 X 35 X 30 mm
Mass: 224 g

Second Largest Particle
Dim: 35 X 32 X 22 mm
Mass: 46 g

Size (mm)	Mass (g)
0.25	2286
2	31
4	31
8	43
16	137
31.5	65
35	224
35	
35	
35	
35	
35	



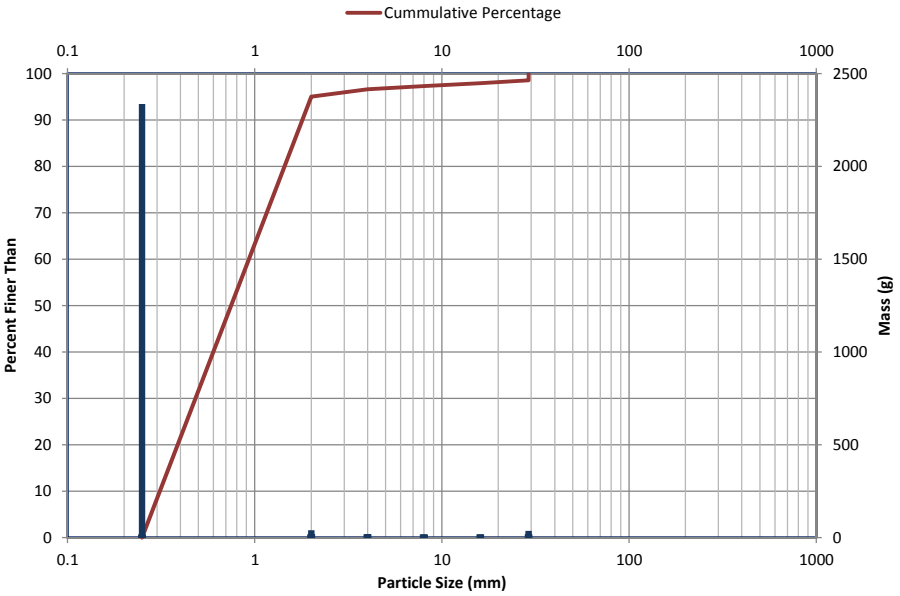
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	1	**1**	2	11	35	81%
D > 2mm	12	25	33	35	35	35	0%

Reach: Cochran
Location: U/S end of site
Sample Type: Sediment Trap

Largest Particle
Dim: 40 X 29 X 28 mm
Mass: 36 g

Second Largest Particle
Dim: 32 X 20 X 7 mm
Mass: 15 g

Size (mm)	Mass (g)
0.25	2336
2	39
4	17
8	15
16	15
29	36
29	
29	
29	
29	
29	
29	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	1	**1**	1	2	2	95%
D > 2mm	3	5	11	23	29	29	0%

Bulk Material Samples

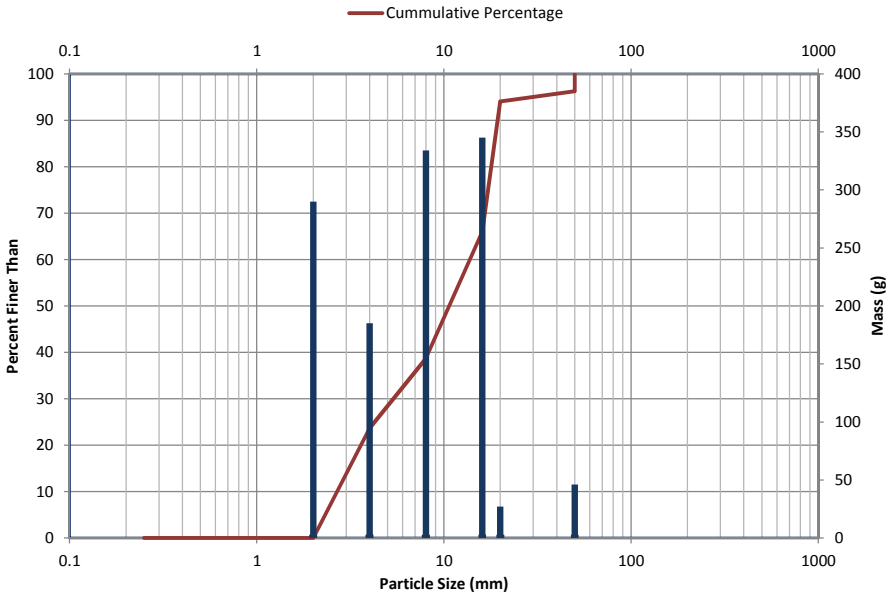
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon, NC

Reach: Cochran
Location: U/S (no Field Sheet)
Sample Type: Sediment Trap

Largest Particle
Dim: 62 X 50 X 5 mm
Mass: 46 g

Second Largest Particle
Dim: 35 X 20 X 15 mm
Mass: 27 g

Size (mm)	Mass (g)
0.25	
2	290
4	185
8	334
16	345
20	27
50	46
50	
50	
50	
50	
50	



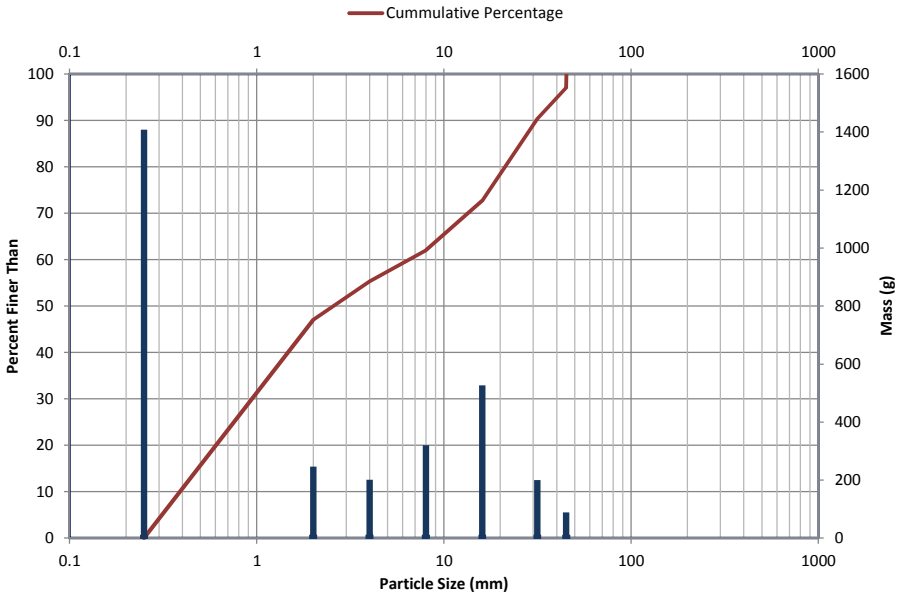
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	3	7	**11**	16	19	33	0%
All Material	3	7	11	16	19	33	0%

Reach: Cochran
Location: U/S (no Field Sheet)
Sample Type: Sediment Trap

Largest Particle
Dim: 70 X 45 X 10 mm
Mass: 89 g

Second Largest Particle
Dim: 60 X 40 X 20 mm
Mass: 85 g

Size (mm)	Mass (g)
0.25	1408
2	247
4	201
8	320
16	527
31.5	200
45	89
45	
45	
45	
45	
45	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	2	**3**	10	26	41	47%
D > 2mm	4	11	17	24	34	45	0%

Bulk Material Samples

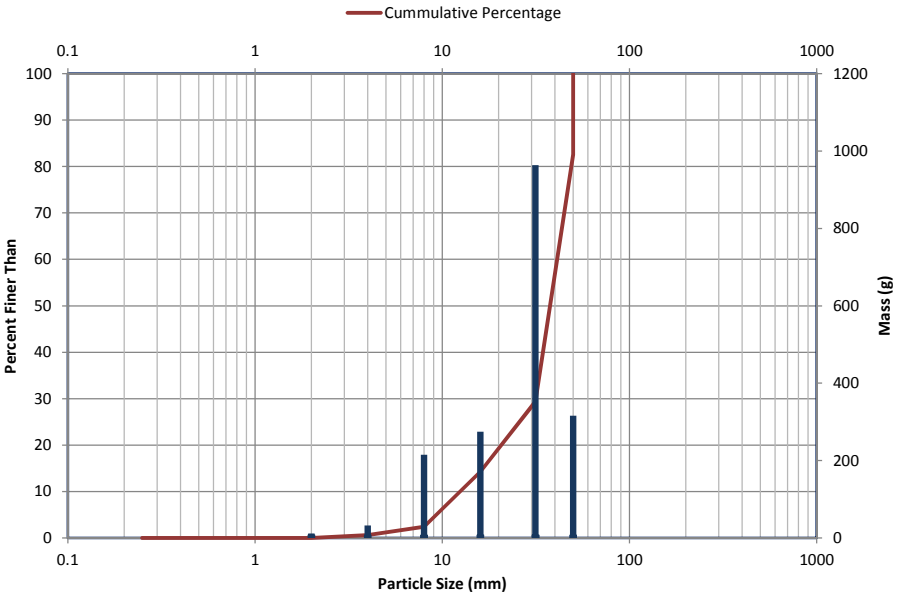
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon, NC

Reach: Cochran
Location: ON-SITE Sample 1 (Near Tree)
Sample Type: Pavement

Largest Particle
Dim: 80 X 50 X 34 mm
Mass: 316 g

Second Largest Particle
Dim: 90 X 45 X 30 mm
Mass: 192 g

Size (mm)	Mass (g)
0.25	
2	11
4	32
8	215
16	274
31.5	964
50	316
50	
50	
50	
50	
50	



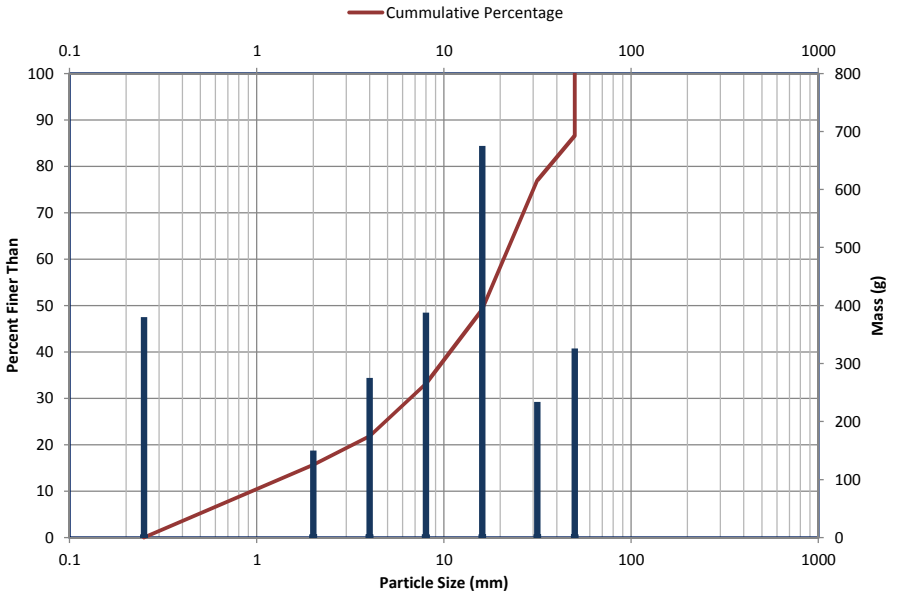
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	18	33	**39**	44	50	50	0%
All Material	18	33	39	44	50	50	0%

Reach: Cochran
Location: ON-SITE Sample 1 (Near Tree)
Sample Type: Sub-pavement

Largest Particle
Dim: 105 X 50 X 30 mm
Mass: 326 g

Second Largest Particle
Dim: 72 X 40 X 28 mm
Mass: 131 g

Size (mm)	Mass (g)
0.25	380
2	150
4	275
8	388
16	675
31.5	234
50	326
50	
50	
50	
50	
50	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	2	9	**16**	25	45	50	16%
D > 2mm	7	14	21	28	50	50	0%

Bulk Material Samples

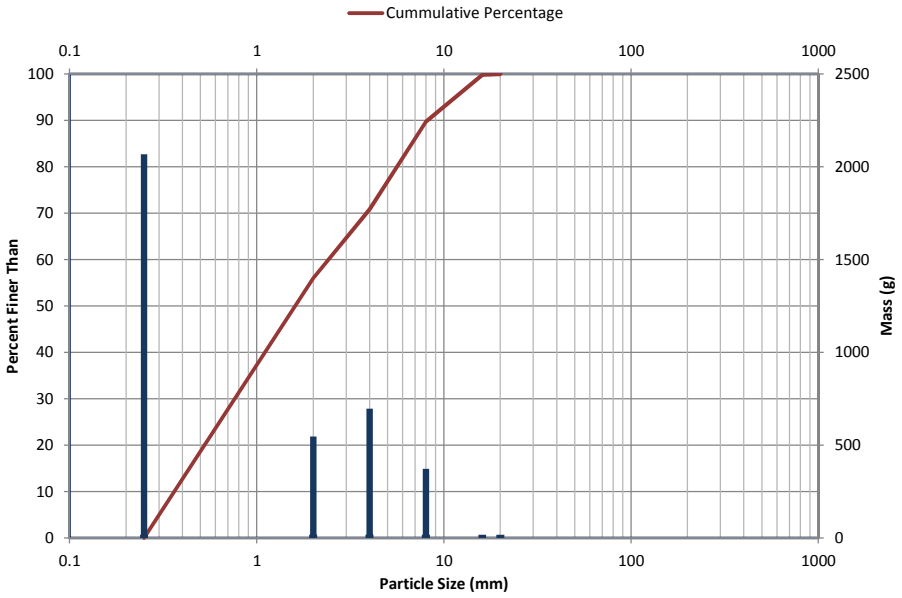
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon, NC

Reach: Cochran
Location: ON-SITE Sample 2 (D/S of Gauge)
Sample Type: Bar

Largest Particle
Dim: 24 X 18 X 4 mm
Mass: 4 g

Second Largest Particle
Dim: 30 X 20 X 3 mm
Mass: 3 g

Size (mm)	Mass (g)
0.25	2067
2	546
4	697
8	373
16	3
20	4
20	
20	
20	
20	
20	
20	



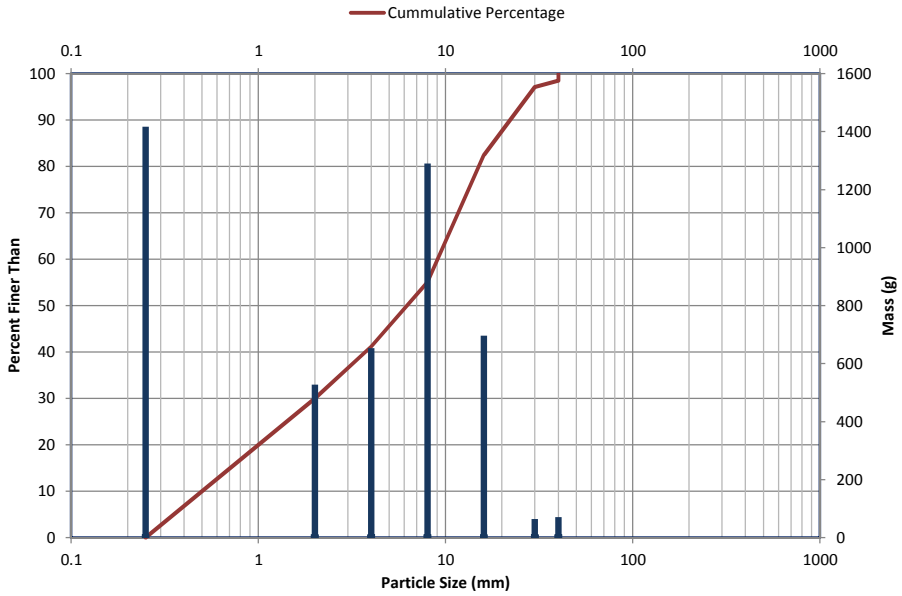
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	1	**2**	3	7	12	56%
D > 2mm	3	4	6	7	11	14	0%

Reach: Cochran
Location: ON-SITE Sample 3 (D/S End)
Sample Type: Bar

Largest Particle
Dim: 55 X 40 X 25 mm
Mass: 71 g

Second Largest Particle
Dim: 50 X 30 X 15 mm
Mass: 54 g

Size (mm)	Mass (g)
0.25	1417
2	528
4	653
8	1290
16	696
30	64
40	71
40	
40	
40	
40	
40	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	3	**7**	11	18	28	30%
D > 2mm	4	8	11	14	22	29	0%

Bulk Material Samples

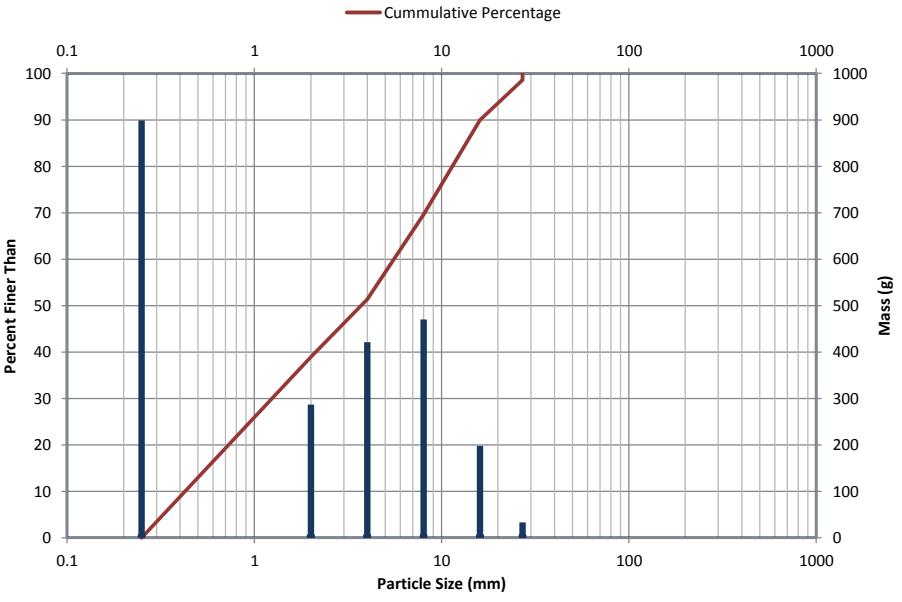
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon, NC

Reach: Cochran
Location: U/S of site
Sample Type: Bar

Largest Particle
Dim: 40 X 27 X 25 mm
Mass: 33 g

Second Largest Particle
Dim: 34 X 26 X 22 mm
Mass: 19 g

Size (mm)	Mass (g)
0.25	899
2	287
4	421
8	470
16	198
27	33
27	
27	
27	
27	
27	
27	



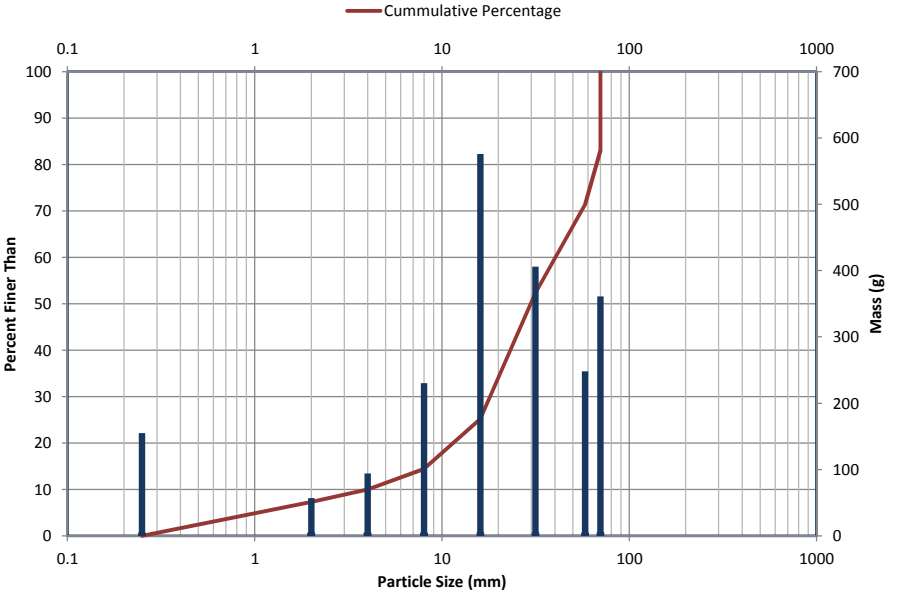
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	2	**4**	7	14	22	39%
D > 2mm	4	6	8	12	16	25	0%

Reach: Cochran
Location: U/S of site
Sample Type: Pavement

Largest Particle
Dim: 104 X 70 X 49 mm
Mass: 361 g

Second Largest Particle
Dim: 69 X 58 X 54 mm
Mass: 248 g

Size (mm)	Mass (g)
0.25	155
2	57
4	94
8	230
16	576
31.5	406
58	248
70	361
70	
70	
70	
70	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	9	22	**30**	49	70	70	7%
D > 2mm	14	24	33	53	70	70	0%

Bulk Material Samples

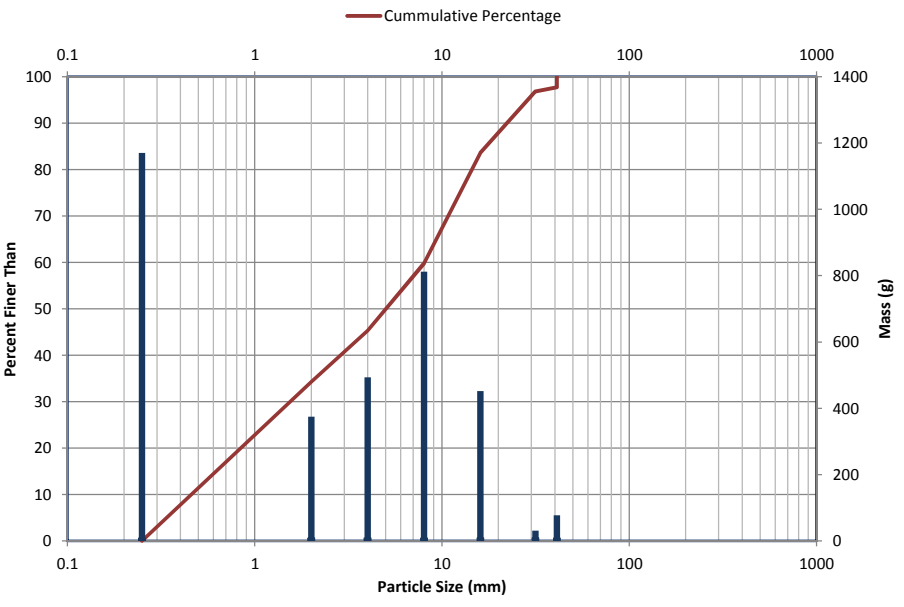
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Macon, NC

Reach: Cochran
Location: U/S of site
Sample Type: Sub-pavement

Largest Particle
Dim: 49 X 41 X 36 mm
Mass: 77 g

Second Largest Particle
Dim: 47 X 31 X 23 mm
Mass: 31 g

Size (mm)	Mass (g)
0.25	1170
2	375
4	493
8	812
16	452
31.5	31
41	77
41	
41	
41	
41	
41	



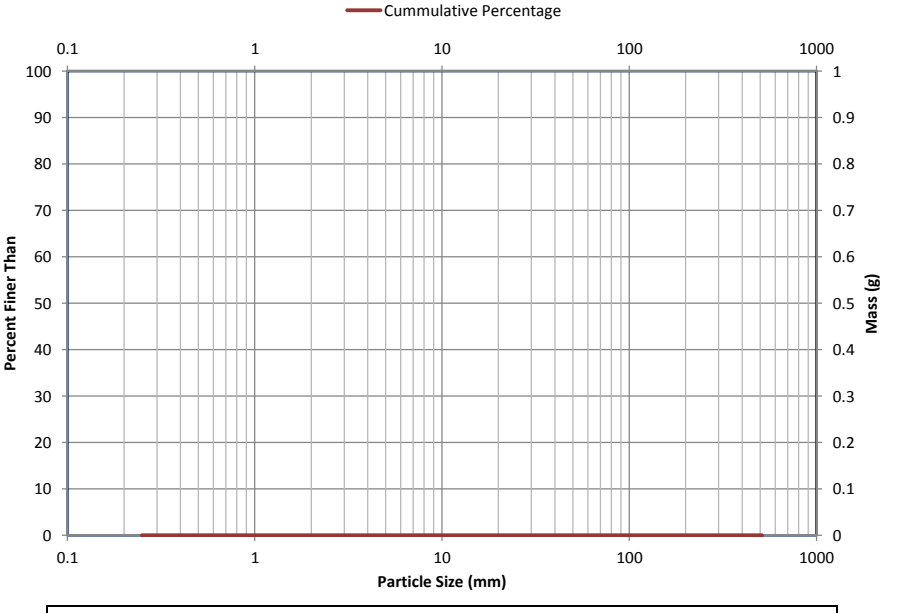
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	2	**5**	10	16	29	34%
D > 2mm	4	7	10	14	23	31	0%

Reach: 0
Location:
Sample Type: Other

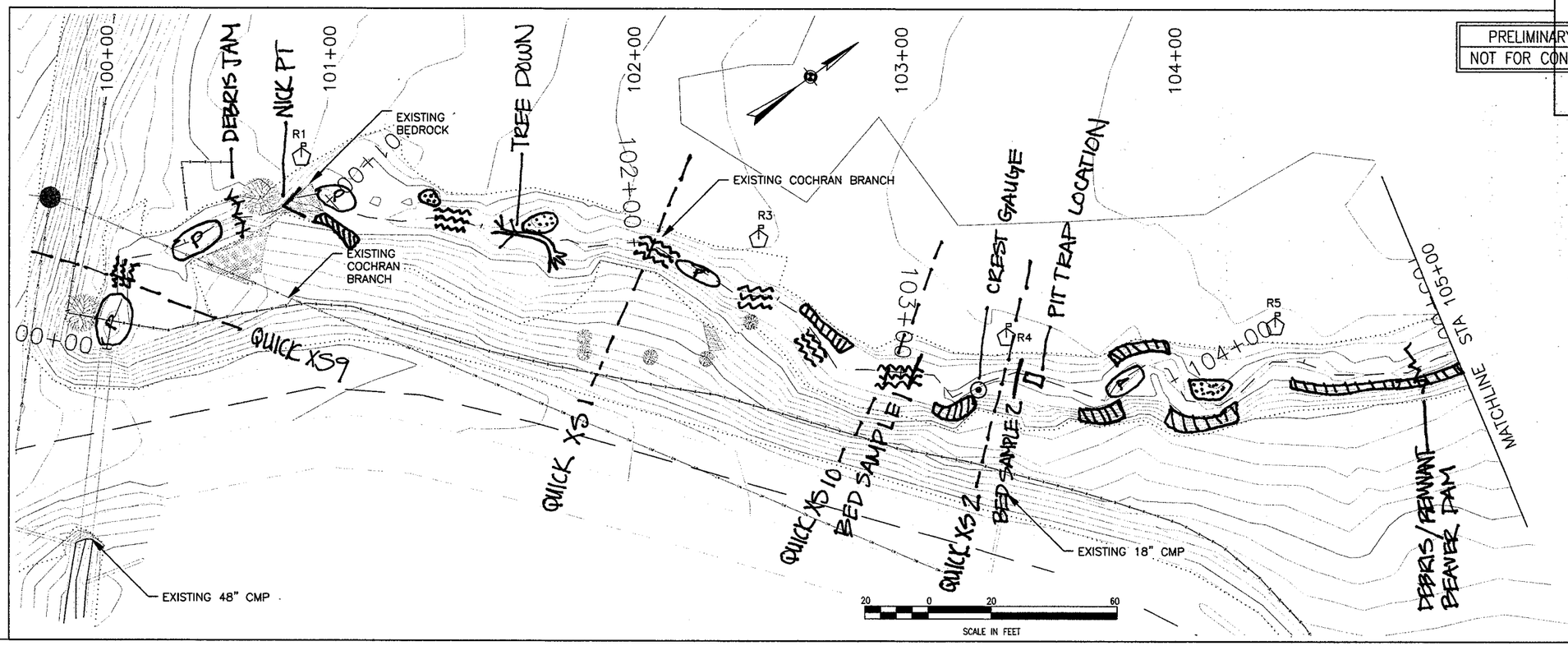
Largest Particle
Dim: N/A
Mass: N/A

Second Largest Particle
Dim: 0 X 0 X 0 mm
Mass: N/A

Size (mm)	Mass (g)
0.25	
2	
4	
8	
16	
31.5	
63	
90	
128	
180	
255	
512	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample							
All Material							



PRELIMINARY PLANS
NOT FOR CONSTRUCTION

Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
7 Florida Ave Weaverville, NC 28787
PHONE: (828) 658-3649 WWW.WOLFCREEKENG.COM

PROJECT COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC & EXCHANGE
TITLE **PLAN & PROFILE**

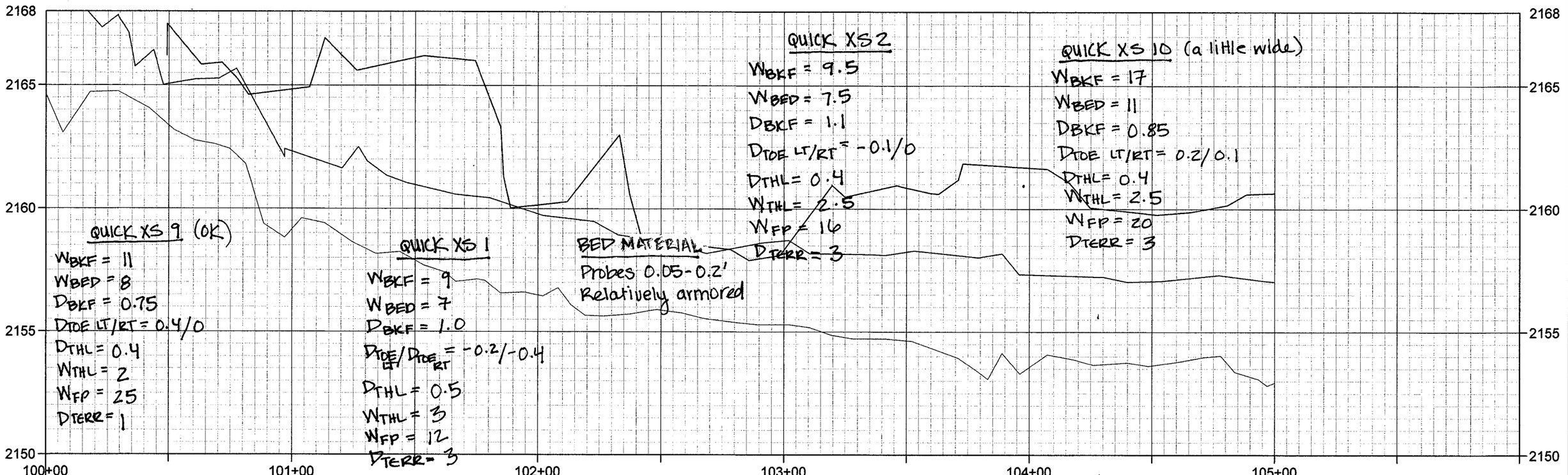
SCALE	DRWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	CME	1059	4
DATE 9/23/2013	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION

LOCATION KEY

LEGEND

- EXIST THALWEG
- EXIST TOP OF BANK
- EXIST FENCE
- PHOTO REF POINT
- EXISTING TREE
- EXIST WETLANDS
- ERODING BANK
- BAR
- RIFFLE
- POOL



FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'
HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL: 1" = 4'

COCHRAN BRANCH

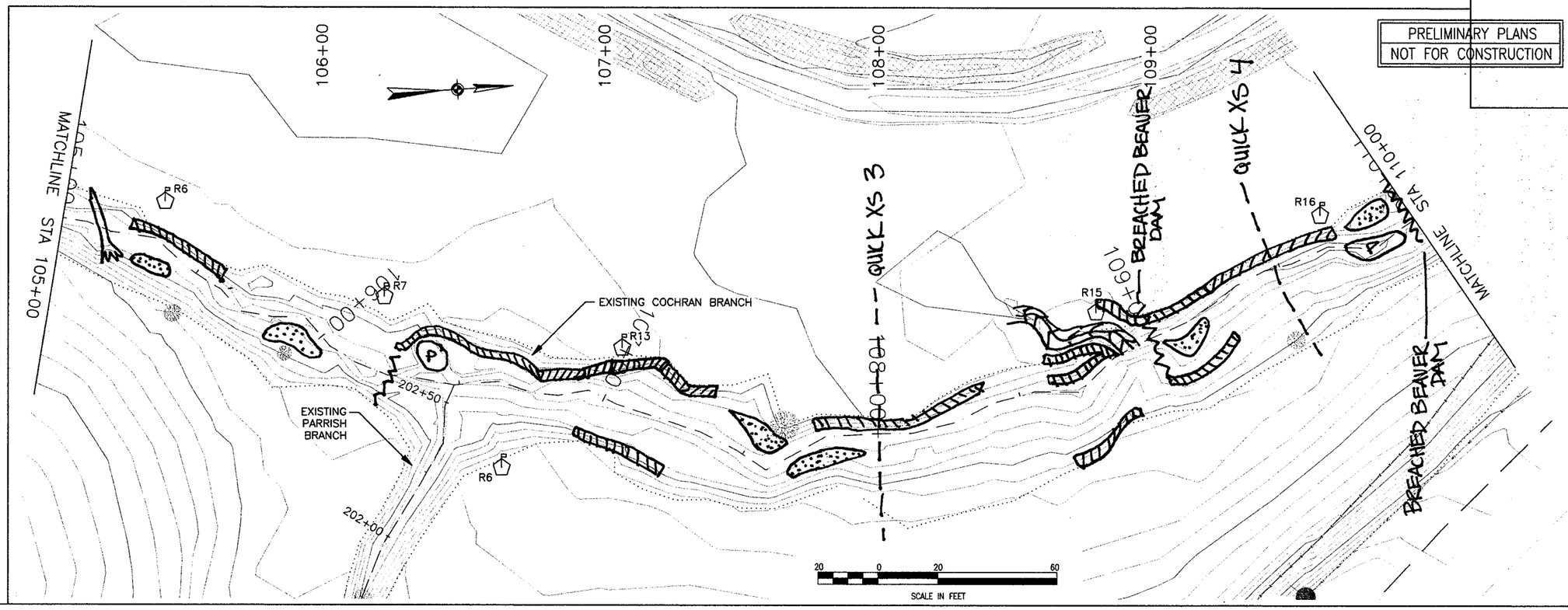
Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
7 Florida Ave Weaverville, NC 28787
PHONE: (828) 658-3649 WWW.WOLFCREEKENG.COM

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANGE
TITLE: **PLAN & PROFILE**

SCALE	DRWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	CME	1059	5
DATE 9/23/2013	CHKD. BY SGG		

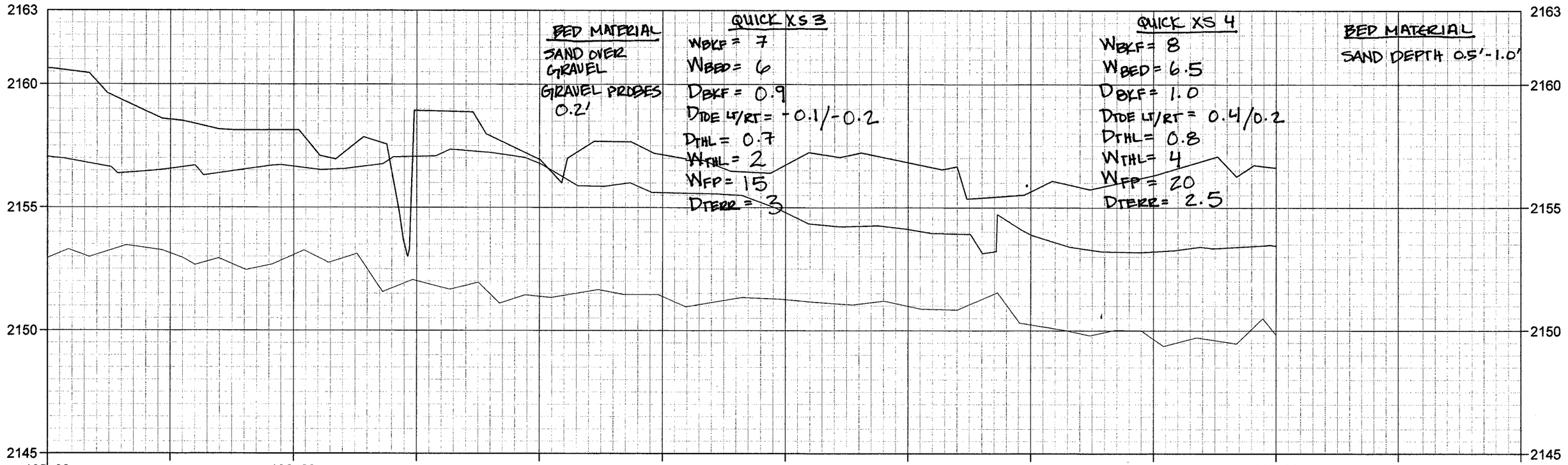
DATE	BY	REV.	DESCRIPTION



LOCATION KEY

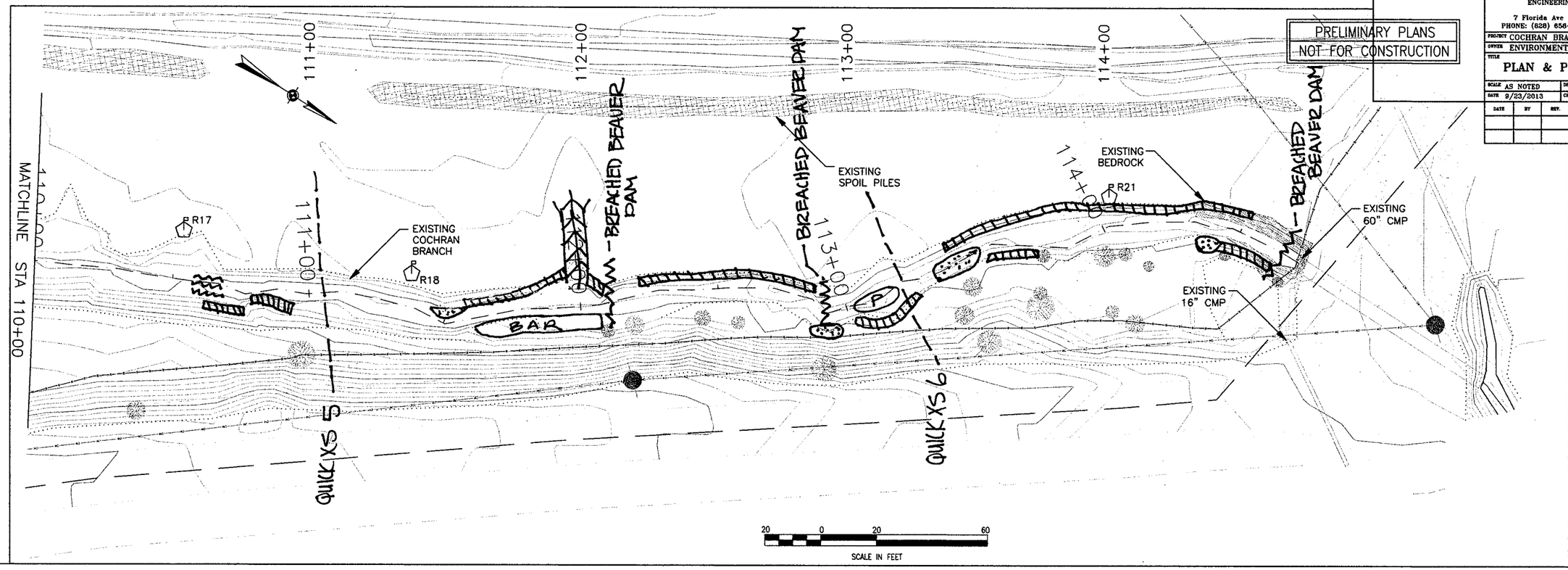
LEGEND

- EXIST THALWEG
- EXIST TOP OF BANK
- EXIST FENCE
- PHOTO REF POINT
- EXISTING TREE
- EXIST WETLANDS
- ERODING BANKS
- BAR
- RIFFLE
- POOL



FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'
HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

COCHRAN BRANCH



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PROJECT COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC & EXCHANGE
TITLE **PLAN & PROFILE**

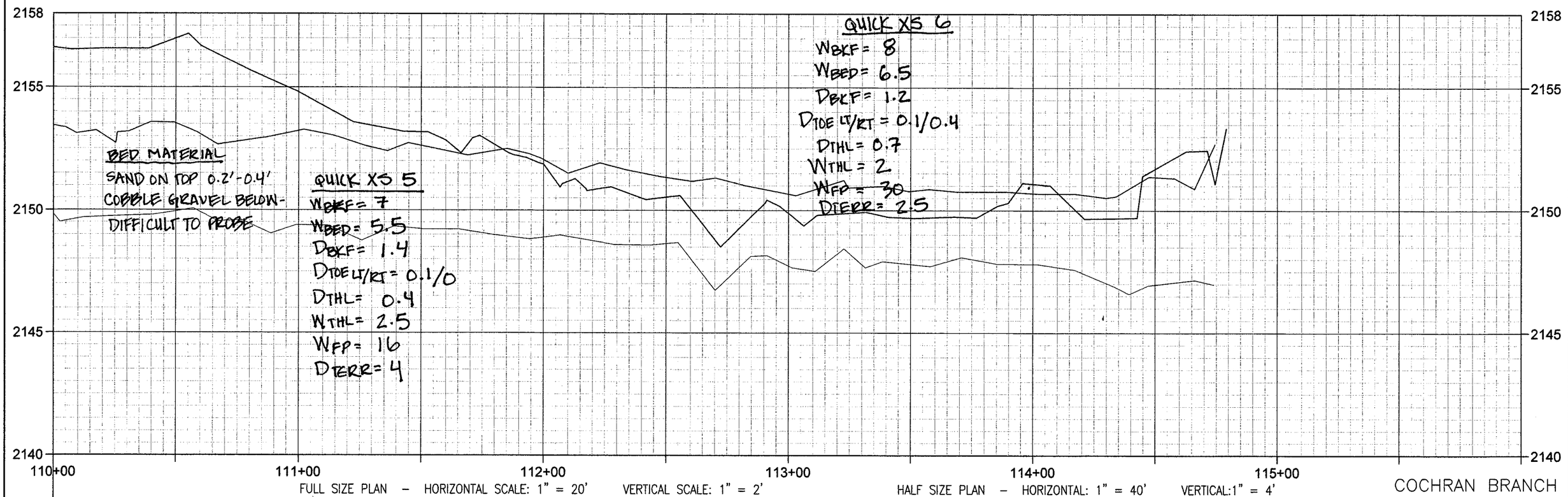
SCALE	DRWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	CME	1059	6
DATE 9/23/2013	CKED. BY SGG		

DATE	BY	REV.	DESCRIPTION

LOCATION KEY

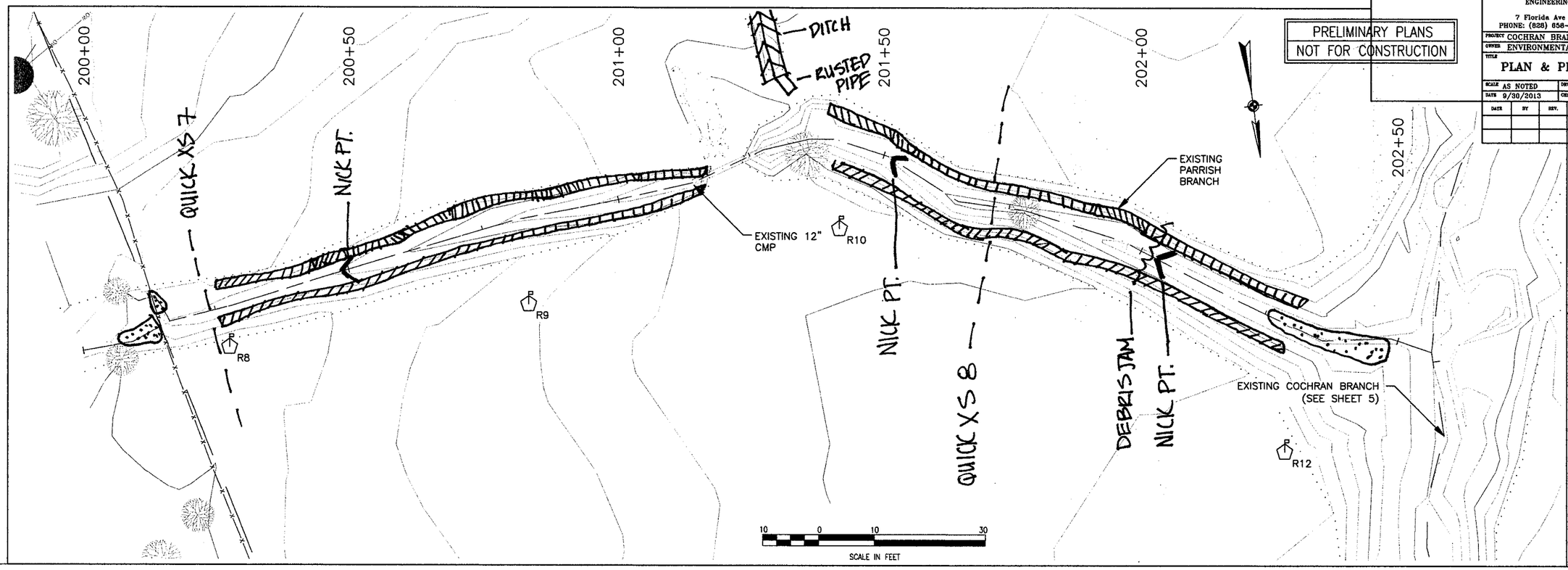
LEGEND

- EXIST THALWEG
- EXIST TOP OF BANK
- EXIST FENCE
- PHOTO REF POINT
- EXISTING TREE
- EXIST WETLANDS
- ERODING BANKS
- BAR
- RIFFLE
- (P) POOL



FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'
HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

COCHRAN BRANCH



PRELIMINARY PLANS
NOT FOR CONSTRUCTION

Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
7 Florida Ave Weaverville, NC 28787
PHONE: (828) 658-3649 WWW.WOLFCREEKENG.COM

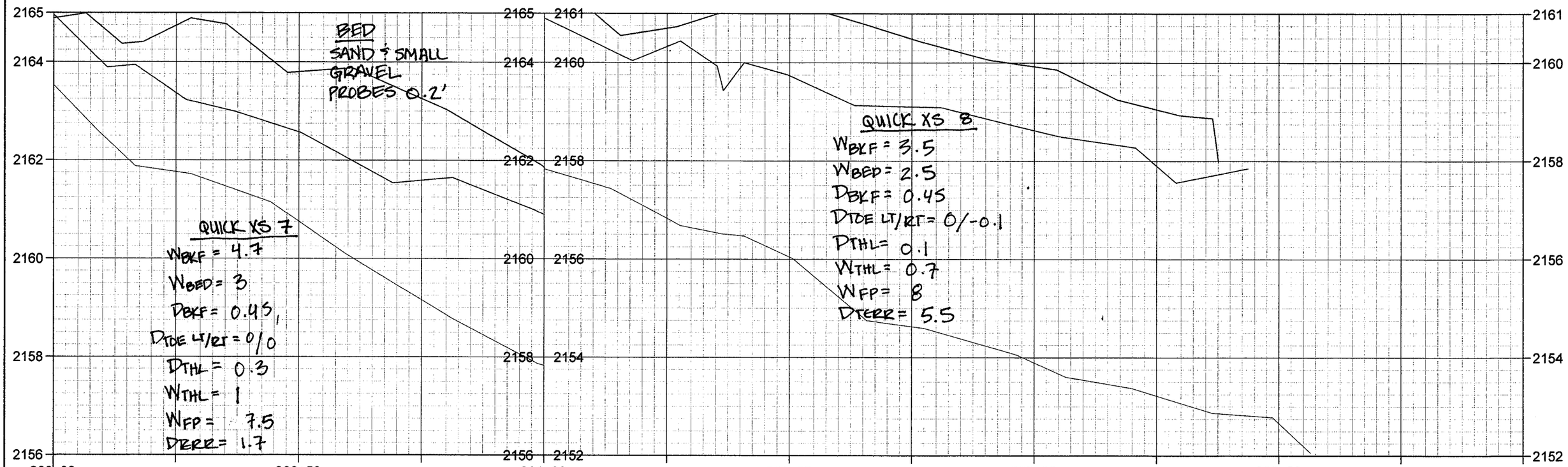
PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANGE
TITLE: PLAN & PROFILE

SCALE	AS NOTED	DRWN. BY	CME	PROJECT NO.	SHEET NUMBER
DATE	9/30/2013	CHKD. BY	SGG	1059	7

DATE	BY	REV.	DESCRIPTION

LOCATION KEY

LEGEND
- EXIST THALWEG
- EXIST TOP OF BANK
- EXIST FENCE
- PHOTO REF POINT
- EXISTING TREE
- EXIST WETLANDS
- ERODING BANKS
- BAR
- RIFFLE
- (P) POOL



FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 10' VERTICAL SCALE: 1" = 1'
HALF SIZE PLAN – HORIZONTAL: 1" = 20' VERTICAL:1" = 2'

COCHRAN BRANCH

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name: Cochran Freshwater Marsh Complex (W01-04) | Date: 4/10/2014
Wetland Type: Non-Tidal Freshwater Marsh | Assessor Name/Organization: Terrell; Equinox Environ

Notes on Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	NA
	Sub-Surface Storage and Retention	Condition	NA
Water Quality	Pathogen Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Particulate Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Physical Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**MEDIUM**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**LOW**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**NO**
Habitat	Conditon	**LOW**

Overall Wetland Rating **LOW**

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	Cochran Seep Wetlands (W03)	Date	4/10/2014
Wetland Type	Seep	Assessor Name/Organization	nter Terrell; Equinox Envi

Notes on Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	NO
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	NA
	Sub-Surface Storage and Retention	Condition	NA
Water Quality	Pathogen Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Particulate Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Physical Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**MEDIUM**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**MEDIUM**
	Condition/Opportunity	NA
	Opportunity Presence? (Y/N)	NA
Habitat	Conditon	**LOW**

Overall Wetland Rating **MEDIUM**

APPENDIX C4

Reference Reach Data

Summary

Stream:	Club Gap
Watershed:	Forested
Location:	Pink Beds
Latitude:	35.35151
Longitude:	82.77590
State:	North Carolina
County:	Transylvania
Date:	April 1, 2014
Observers:	Grant Ginn, Chris Engle, Ryan Stokes
Channel type:	E4
Drainage area (sq.mi.):	0.25
notes:	---

Dimension		bankfull channel typical	min	max
floodplain:	width flood prone area (ft)	32.2	25.0	40.0
	low bank height (ft)	1.4	1.1	1.8
riffle-run:	x-area bankfull (sq.ft.)	8.8	7.7	10.0
	width bankfull (ft)	8.5	6.3	10.7
	width bed (ft)	5.70	4.7	7.0
	width thalweg (ft)	1.4	1.1	1.7
	depth bankfull (ft)	1.1	1.0	1.2
	depth thalweg (ft)	0.3	0.2	0.5
	max depth (ft)	1.4	1.2	1.6
pool:	x-area pool (sq.ft.)	9.7	8.3	11.8
	width bankfull (ft)	8.3	6.4	9.3
	width bed (ft)	5.0	2.5	6.5
	width thalweg (ft)	1.5	1.0	2.0
	depth bankfull (ft)	1.0	1.0	1.2
	depth thalweg (ft)	0.6	0.6	0.8
	max depth pool (ft)	1.6	1.5	1.8
dimensionless ratios:		typical	min	max
riffle-run:	width depth ratio	8.4	5.2	10.5
	bank height ratio	1.0	0.8	1.1
	entrenchment ratio	3.5	2.3	4.8
	riffle max depth ratio	1.3	1.3	1.5
pool:	width depth ratio	7.3	4.4	9.7
	bank height ratio	0.9	0.7	0.9
	entrenchment ratio	4.4	3.8	4.8
	pool max depth ratio	1.7	1.3	2.1

Pattern	typical	min	max
meander length (ft)	41.0	25.0	56.0
belt width (ft)	33.0	20.0	53.0
amplitude (ft)			
radius (ft)	11.2	7.5	15.0
arc angle (degrees)			
stream length (ft)	200.0		
valley length (ft)	123.0		
Sinuosity	1.63		
Meander Length Ratio	2.0	1.2	2.7
Meander Width Ratio	1.6	1.0	2.6
Radius Ratio	0.5	0.4	0.7

Summary

Stream:	Club Gap
Watershed:	Forested
Location:	Pink Beds
Latitude:	35.35151
Longitude:	82.77590
State:	North Carolina
County:	Transylvania
Date:	April 1, 2014
Observers:	Grant Ginn, Chris Engle, Ryan Stokes
Channel type:	E4
Drainage area (sq.mi.):	0.25
notes:	---

Profile

	typical	min	max
pool-pool spacing (ft)	32.4	17.0	51.0
riffle length (ft)	6.6	10.0	4.0
pool length (ft)	15.2	3.0	23.0
run length (ft)	5.8	4.0	11.0
glide length (ft)	6.4	3.0	10.0
channel slope (%)	0.84		
riffle slope (%)	2.2	0.9	4.0
pool slope (%)	2.0	0.3	3.2
run slope (%)	0.7	0.1	1.6
glide slope (%)	0.9	0.4	2.0
measured valley slope (%)	3		
valley slope from sinuosity (%)	1.4		
Riffle Length Ratio	0.3	0.5	0.2
Pool Length Ratio	0.7	0.1	1.1
Run Length Ratio	0.3	0.2	0.5
Glide Length Ratio	0.3	0.1	0.5
Riffle Slope Ratio	1.9	1.5	4.6
Pool Slope Ratio	0.5	0	0.6
Run Slope Ratio	1.2	5.3	7.5
Glide Slope Ratio	1.2	0.3	0.4
Pool Spacing Ratio	1.6	0.8	2.5

Channel Materials	Riffle Surface	Sub Pavement	BkF Channel
D16 (mm)	0.25	7.2	0.92
D35 (mm)	8	32	13
D50 (mm)	13	50	17
D65 (mm)	17	70	20
D84 (mm)	22	92	33
D95 (mm)	37	110	58
mean (mm)	2.3		5.5
dispersion	26.8		10.2
skewness	-0.5		-0.4
Shape Factor			
% Silt/Clay	1%	0%	0%
% Sand	29%	100%	17%
% Gravel	69%	0%	79%
% Cobble	0%	0%	3%
% Boulder	0%	0%	0%
% Bedrock	1%		
% Clay Hardpan			
% Detritus/Wood			
% Artificial			
Largest Mobile (mm)			

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Club Gap
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	1	2	3	4	5	6	7
Reach Name	Trib	Trib	Trib	Trib	Trib	Trib	Trib
Location	Riff 1	Pool 1	Riff 2	Pool 2	Pool 2.1	Riff 3	Pool 3
D_A (mi^2)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
W_{BKF} (ft)	9.8	8.7	10.7	6.4	8.4	9.0	9.0
W_{BED} (ft)	7.0	5.7	5.3	4.4	5.5	4.7	2.5
D_{BKF} (ft)	1.0	1.0	1.1	1.2	1.0	1.0	1.0
$D_{TOE\ LT}$ (ft)	-0.1	0.5	0.1	0.5	0.0	0.0	0.5
$D_{TOE\ RT}$ (ft)	-0.2	0.1	0.0	0.4	0.3	0.1	0.5
Field D_{THAL} (ft)	0.3	0.6	0.2	0.6	0.6	0.3	0.6
W_{THAL} (ft)	1.2	1.5	1.3	1.5	1.6	1.2	1.0
Bank/Terrace Height (ft)	1.1	1.4	1.8	1.5	1.1	1.4	1.3
Flood Prone Width (ft)	30	30	25	40	40	30	40

Section Calculations

D_{MAX}	1.25	1.53	1.20	1.82	1.56	1.25	1.55
Average D_{TOE}	0.88	1.23	1.09	1.65	1.13	1.03	1.40
D_{THAL}	0.38	0.30	0.11	0.17	0.43	0.23	0.15
A_{BKF}	8.9	9.9	9.1	9.4	9.4	7.7	8.3
D_{MEAN}	0.91	1.14	0.85	1.47	1.12	0.85	0.92
W/D ratio	10.8	7.6	12.6	4.4	7.5	10.5	9.7
Bank Height Ratio	0.9	0.9	1.5	0.8	0.7	1.1	0.8
Entrenchment Ratio	3.1	3.4	2.3	6.3	4.8	3.3	4.4

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

Coef	Exp
1.5	0.27

Reference Bed Width	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Bed Width Index (BWI)	1.1	0.9	0.8	0.7	0.9	0.7	0.4
Reference D_{MAX}	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Max Depth Index (MDI)	1.2	1.5	1.2	1.8	1.5	1.2	1.5

Stream Classification

Stream Type	E	E	E	E	E	E	E

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Club Gap
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	8	9	10	11	12	13	14
Reach Name	Trib	Trib	Trib	Trib	Trib	Trib	Trib
Location	Riff 4	Riff 4	Riff 4	Pool 4	Riff 5	Riff 5	Pool 5
D_A (mi^2)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
W_{BKF} (ft)	7.3	6.3	7.7	9.1	8.6	8.5	7.5
W_{BED} (ft)	5.5	4.9	5.2	5.0	6.3	6.4	5.5
D_{BKF} (ft)	1.1	1.1	1.2	1.0	1.0	1.0	1.1
$D_{TOE\ LT}$ (ft)	0.5	0.3	0.4	0.0	0.1	0.0	-0.1
$D_{TOE\ RT}$ (ft)	-0.4	-0.2	0.0	0.5	-0.3	-0.2	0.0
Field D_{THAL} (ft)	0.5	0.5	0.4	0.7	0.4	0.4	0.6
W_{THAL} (ft)	1.5	1.7	1.5	1.0	1.2	1.1	1.6
Bank/Terrace Height (ft)	1.6	1.3	1.6	1.5	1.4	1.5	1.5
Flood Prone Width (ft)	25	25	25	35	30	30	30

Section Calculations

D_{MAX}	1.60	1.55	1.60	1.70	1.35	1.35	1.65
Average D_{TOE}	1.18	1.13	1.40	1.23	0.89	0.90	1.08
D_{THAL}	0.43	0.43	0.20	0.48	0.47	0.45	0.58
A_{BKF}	9.0	7.7	9.7	10.1	8.3	8.4	9.0
D_{MEAN}	1.23	1.22	1.26	1.11	0.97	0.99	1.20
W/D ratio	5.9	5.2	6.1	8.2	8.9	8.6	6.2
Bank Height Ratio	1.0	0.8	1.0	0.9	1.0	1.1	0.9
Entrenchment Ratio	3.4	4.0	3.2	3.8	3.5	3.5	4.0

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

Coef	Exp
1.5	0.27

Reference Bed Width	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Bed Width Index (BWI)	0.9	0.8	0.8	0.8	1.0	1.0	0.9
Reference D_{MAX}	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Max Depth Index (MDI)	1.6	1.5	1.6	1.6	1.3	1.3	1.6

Stream Classification

Stream Type	E	E	E	E	E	E	E

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Club Gap
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	15	16					
Reach Name	Trib	Trib					
Location	Riff 6	Pool 6					
D_A (mi^2)	0.25	0.25					
W_{BKF} (ft)	8.4	9.3					
W_{BED} (ft)	6.0	6.5					
D_{BKF} (ft)	1.1	1.0					
$D_{TOE\ LT}$ (ft)	0.0	0.4					
$D_{TOE\ RT}$ (ft)	0.4	0.3					
Field D_{THAL} (ft)	0.4	0.8					
W_{THAL} (ft)	1.5	2.0					
Bank/Terrace Height (ft)	1.3	1.6					
Flood Prone Width (ft)	40	40					

Section Calculations

D_{MAX}	1.50	1.70					
Average D_{TOE}	1.27	1.25					
D_{THAL}	0.24	0.45					
A_{BKF}	10.0	11.8					
D_{MEAN}	1.19	1.27					
W/D ratio	7.1	7.3					
Bank Height Ratio	0.9	0.9					
Entrenchment Ratio	4.8	4.3					

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

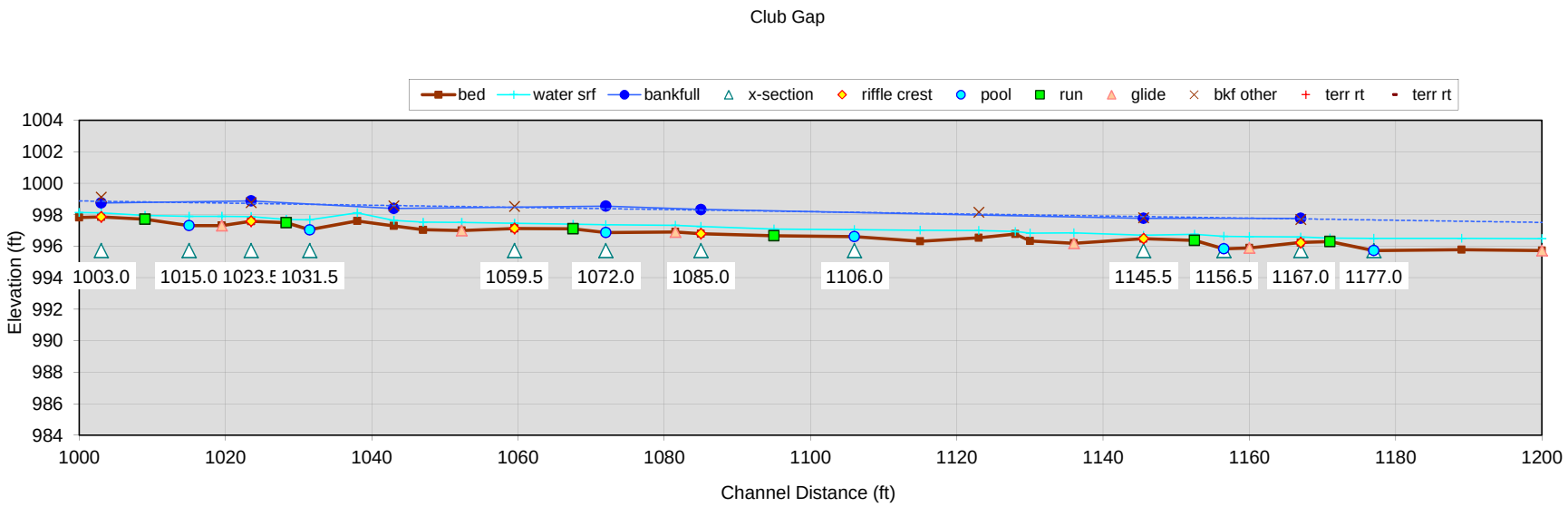
Coef	Exp
1.5	0.27

Reference Bed Width	6.4	6.4					
Bed Width Index (BWI)	0.9	1.0					
Reference D_{MAX}	1.0	1.0					
Max Depth Index (MDI)	1.5	1.6					

Stream Classification

Stream Type	E	E					

Longitudinal Slope Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	0.84	---	1200.0 (58.8 channel widths)	---	---	---
riffle	2.2 (0.9 - 4)	2.6 (1.1 - 4.8)	6.6 (4 - 10)	0.3 (0.2 - 0.5)	---	---
pool	2 (0.3 - 3.2)	2.4 (0.4 - 3.8)	15.2 (3 - 23)	0.7 (0.1 - 1.1)	32.4 (17 - 51)	1.6 (0.8 - 2.5)
run	0.7 (0.1 - 1.6)	0.8 (0.1 - 1.9)	5.8 (4 - 11)	0.3 (0.2 - 0.5)	---	---
glide	0.9 (0.4 - 2)	1.1 (0.5 - 2.4)	6.4 (3 - 10)	0.3 (0.1 - 0.5)	---	---

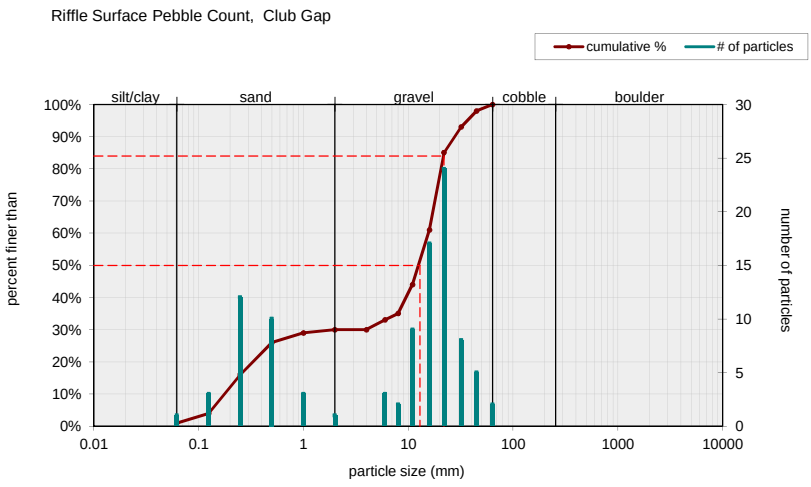
1) Individual Pebble Count

Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	3
fine sand	0.125 - 0.25	12
medium sand	0.25 - 0.5	10
coarse sand	0.5 - 1	3
very coarse sand	1 - 2	1
very fine gravel	2 - 4	
fine gravel	4 - 6	3
fine gravel	6 - 8	2
medium gravel	8 - 11	9
medium gravel	11 - 16	17
coarse gravel	16 - 22	24
coarse gravel	22 - 32	8
very coarse gravel	32 - 45	5
very coarse gravel	45 - 64	2
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		100
bedrock	----------	1
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		101

Note:



Size (mm)	
D16	0.25
D35	8
D50	13
D65	17
D84	22
D95	37

Size Distribution	
mean	2.3
dispersion	26.8
skewness	-0.53

Type			
silt/clay	1%	bedrock	1%
sand	29%		
gravel	69%		
cobble	0%		
boulder	0%		

2) Weighted Pebble Count

Feature Percent of Reach

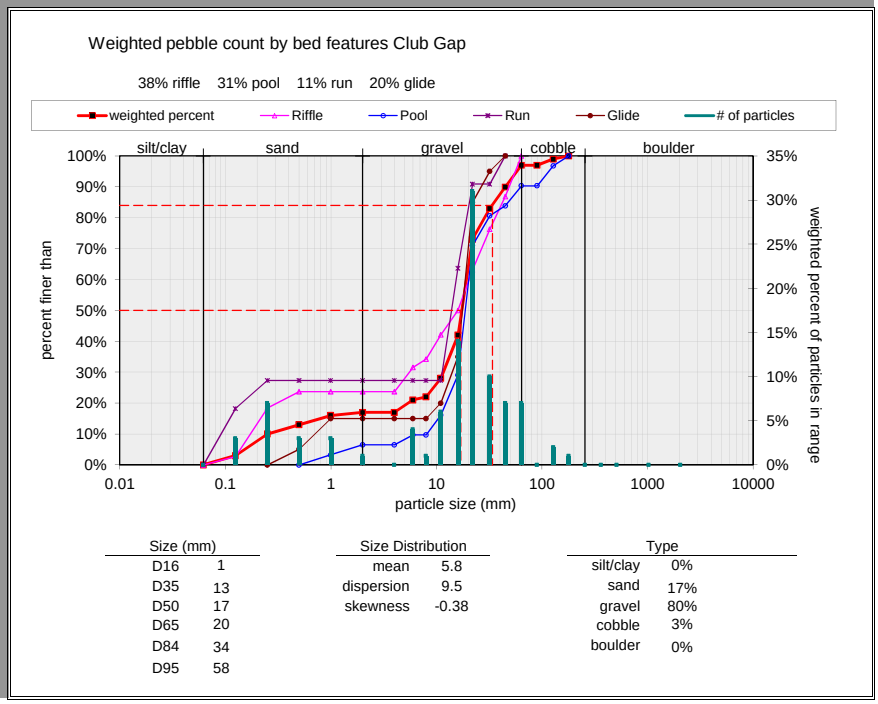
Riffle, Pool, Run, Glide

Riffle	38	%	Run	11 %
Pool	31	%	Glide	20 %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	0.0
very fine sand	0.062 - 0.125	3.0
fine sand	0.125 - 0.25	7.0
medium sand	0.25 - 0.5	3.0
coarse sand	0.5 - 1	3.0
very coarse sand	1 - 2	1.0
very fine gravel	2 - 4	0.0
fine gravel	4 - 6	4.0
fine gravel	6 - 8	1.0
medium gravel	8 - 11	6.0
medium gravel	11 - 16	14.0
coarse gravel	16 - 22	31.0
coarse gravel	22 - 32	10.0
very coarse gravel	32 - 45	7.0
very coarse gravel	45 - 64	7.0
small cobble	64 - 90	0.0
medium cobble	90 - 128	2.0
large cobble	128 - 180	1.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock	----------	0.0
clay hardpan	----------	0.0
detritus/wood	----------	0.0
artificial	----------	0.0
total weighted count:		100.0

Note:



Size (mm)	
D16	1
D35	13
D50	17
D65	20
D84	34
D95	58

Size Distribution	
mean	5.8
dispersion	9.5
skewness	-0.38

Type	
silt/clay	0%
sand	17%
gravel	80%
cobble	3%
boulder	0%

Bulk Material Samples

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Bervard, NC

Reach: Club Gap
Location: Sample 1
Sample Type: Bar

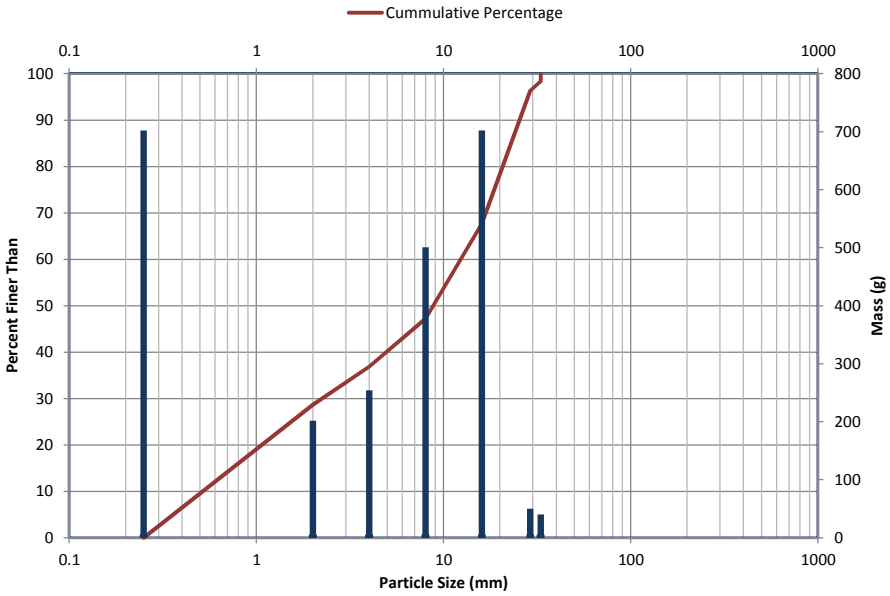
Largest Particle

Dim:	36 X 33 X 15 mm
Mass:	40 g

Second Largest Particle

Dim:	38 X 29 X 21 mm
Mass:	50 g

Size (mm)	Mass (g)
0.25	702
2	202
4	254
8	501
16	702
29	50
33	40
33	
33	
33	
33	
33	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	4	**9**	15	23	28	29%
All Material	1	4	9	15	23	28	29%

Reach: Club Gap
Location: Sample 2 Riff
Sample Type: Pavement

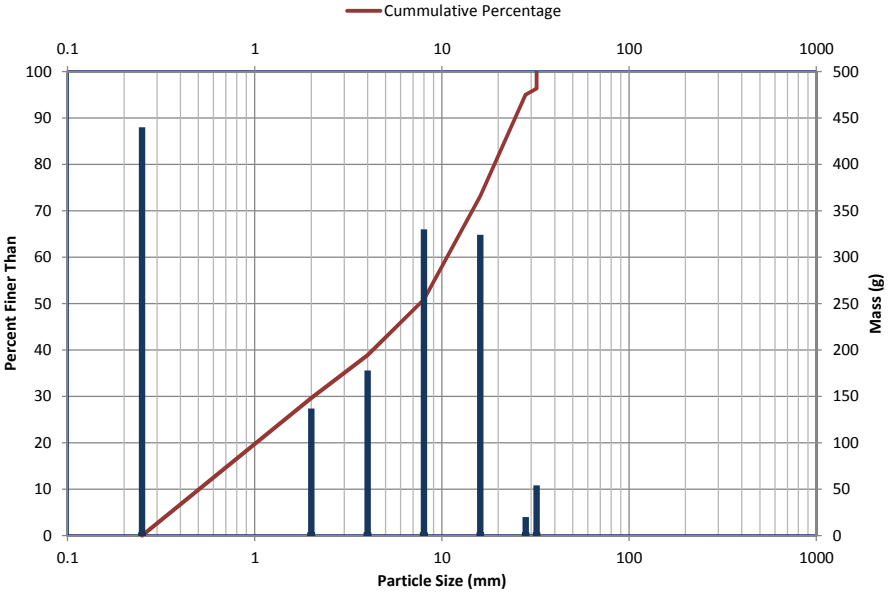
Largest Particle

Dim:	41 X 32 X 22 mm
Mass:	54 g

Second Largest Particle

Dim:	32 X 28 X 12 mm
Mass:	20 g

Size (mm)	Mass (g)
0.25	440
2	137
4	178
8	330
16	324
28	20
32	54
32	
32	
32	
32	
32	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	3	**8**	13	22	28	30%
All Material	1	3	8	13	22	28	30%

Bulk Material Samples

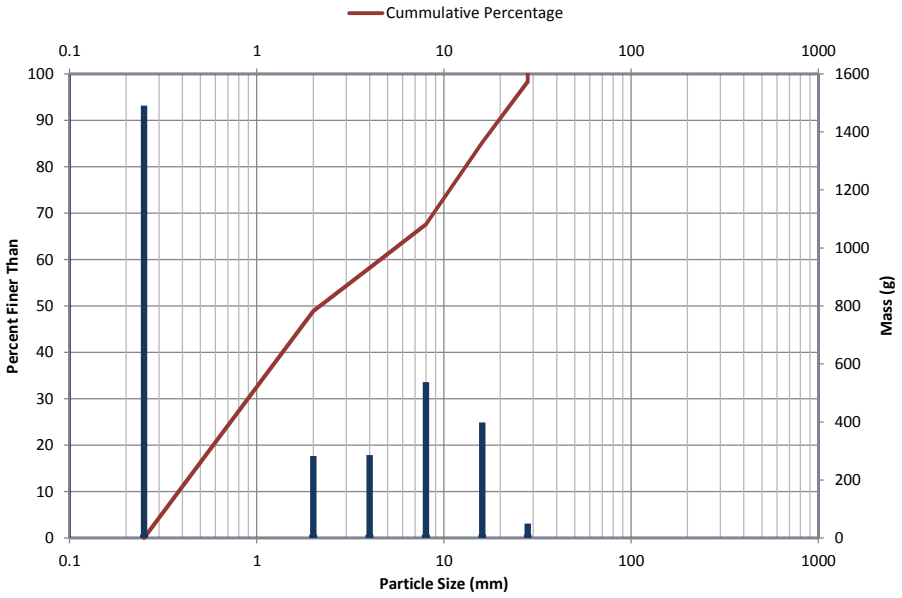
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Bervard, NC

Reach: Club Gap
Location: Sample 2 Riff
Sample Type: Sediment Trap

Largest Particle
Dim: 42 X 25 X 18 mm
Mass: 50 g

Second Largest Particle
Dim: 40 X 28 X 16 mm
Mass: 39 g

Size (mm)	Mass (g)
0.25	1491
2	283
4	286
8	538
16	399
28	50
28	
28	
28	
28	
28	
28	



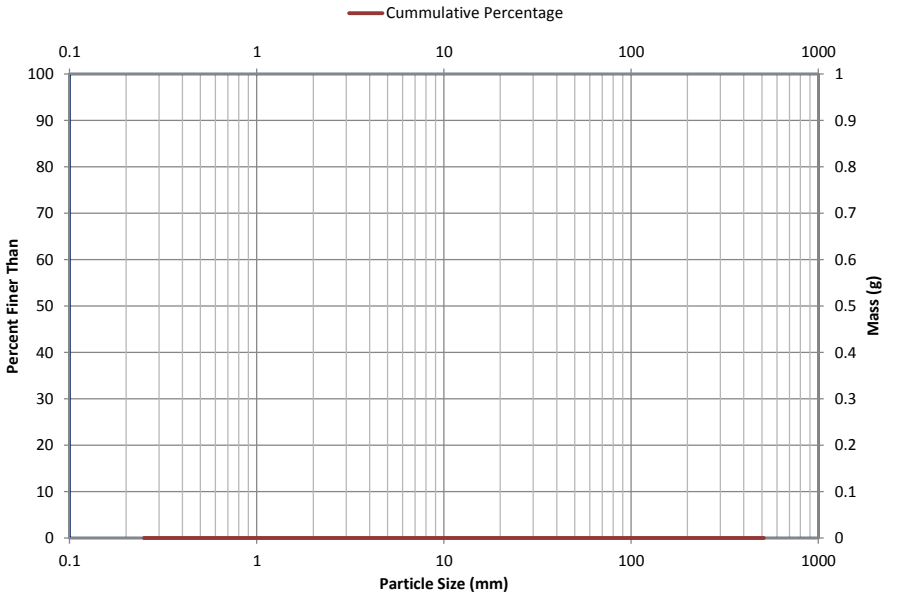
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	2	**2**	7	15	25	49%
All Material	1	2	2	7	15	25	49%

Reach: 0
Location:
Sample Type: Sediment Trap

Largest Particle
Dim: N/A
Mass: N/A

Second Largest Particle
Dim: 0 X 0 X 0 mm
Mass: N/A

Size (mm)	Mass (g)
0.25	
2	
4	
8	
16	
31.5	
63	
90	
128	
180	
255	
512	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample							
All Material							

Club Gap Branch Riffle

Club Gap Branch Pool

Club Gap Branch Pool

Club Gap Branch Bed Material

Summary

Stream:	South Fork Mills River
Watershed:	Forested
Location:	Pink Beds
Latitude:	35.35161
Longitude:	82.77448
State:	North Carolina
County:	Transylvania
Date:	April 1, 2014
Observers:	Grant Ginn, Chris Engle, Ryan Stokes
Channel type:	E4
Drainage area (sq.mi.):	0.72
notes:	---

Dimension		bankfull channel typical	min	max
floodplain:	width flood prone area (ft)	72.5	60.0	72.5
	low bank height (ft)	2.6	2.0	2.6
riffle-run:	x-area bankfull (sq.ft.)	25.9	18.2	35.9
	width bankfull (ft)	14.4	12.0	16.5
	width bed (ft)	10.8	8.5	13.0
	width thalweg (ft)	2.5	2.0	3.5
	depth bankfull (ft)	1.5	1.4	1.8
	depth thalweg (ft)	0.7	0.4	1.7
	max depth (ft)	2.3	1.9	3.3
pool:	x-area pool (sq.ft.)	39.2	32.4	45.9
	width bankfull (ft)	16.0	14.5	17.5
	width bed (ft)	12.8	11.0	14.5
	width thalweg (ft)	3.5	3.0	4.0
	depth bankfull (ft)	1.6	1.6	1.6
	depth thalweg (ft)	1.6	1.5	1.6
	max depth pool (ft)	0.5	0.4	0.6
dimensionless ratios:		typical	min	max
riffle-run:	width depth ratio	8.2	7.1	10.0
	bank height ratio	1.1	0.7	1.6
	entrenchment ratio	4.9	4.3	5.5
	riffle max depth ratio	1.3	1.1	1.5
pool:	width depth ratio	6.6	6.5	6.7
	bank height ratio	0.9	0.8	1.1
	entrenchment ratio	5.0	4.6	5.5
	pool max depth ratio	1.7	1.4	1.9

Pattern	typical	min	max
meander length (ft)			
belt width (ft)			
amplitude (ft)			
radius (ft)			
arc angle (degrees)			
stream length (ft)	416.7		
valley length (ft)			
Sinuosity			
Meander Length Ratio			
Meander Width Ratio			
Radius Ratio			

Summary

Stream:	South Fork Mills River
Watershed:	Forested
Location:	Pink Beds
Latitude:	35.35161
Longitude:	82.77448
State:	North Carolina
County:	Transylvania
Date:	April 1, 2014
Observers:	Grant Ginn, Chris Engle, Ryan Stokes
Channel type:	E4
Drainage area (sq.mi.):	0.72
notes:	---

Profile

	typical	min	max
pool-pool spacing (ft)	84.9	67.9	101.9
riffle length (ft)	82.0	62.6	101.4
pool length (ft)	45.1	13.4	80.3
run length (ft)	20.4	14.3	26.4
glide length (ft)	23.5	12.8	35.5
channel slope (%)	0.5		
riffle slope (%)	0.6	0.6	0.7
pool slope (%)	0.3	0.1	0.6
run slope (%)	0.9		
glide slope (%)	0.4	0.1	1.0
measured valley slope (%)			
valley slope from sinuosity (%)			
Riffle Length Ratio	5.5	4.2	6.8
Pool Length Ratio	3.0	0.9	5.4
Run Length Ratio	1.4	1.0	1.8
Glide Length Ratio	1.6	0.9	2.4
Riffle Slope Ratio	1.2	1.1	1.3
Pool Slope Ratio	0.6	0.1	1.1
Run Slope Ratio	1.7		
Glide Slope Ratio	0.8	0.2	1.8
Pool Spacing Ratio	5.7	4.6	6.9

Channel Materials	Riffle Surface	Sub Pavement	Bar
D16 (mm)	7	2	2
D35 (mm)	26	10	9
D50 (mm)	42	22	20
D65 (mm)	54	36	30
D84 (mm)	68	63	47
D95 (mm)	70	76	56
mean (mm)			
dispersion			
skewness			
Shape Factor			
% Silt/Clay			
% Sand	9%	19%	20%
% Gravel			
% Cobble			
% Boulder			
% Bedrock			
% Clay Hardpan			
% Detritus/Wood			
% Artificial			
Largest Mobile (mm)			

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: South Fork Mills
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	1	2	3	4	5	6	7
Reach Name	SF	SF	SF	SF	SF	SF	SF
Location	Riff	Riff	H Riff	Pool	Pool	Riff (U/S Tirb)	Riff (U/S Tirb)
D_A (mi^2)	0.72	0.72	0.72	0.72	0.72	0.72	0.72
W_{BKF} (ft)	16.5	14.5	16.5	14.5	17.5	12.0	13.0
W_{BED} (ft)	11.5	11.0	13.0	11.0	14.5	8.5	9.5
D_{BKF} (ft)	1.6	1.8	1.5	1.6	1.6	1.5	1.4
$D_{TOE\ LT}$ (ft)	0.3	0.7	0.3	0.6	0.4	0.0	0.3
$D_{TOE\ RT}$ (ft)	0.0	-0.4	0.5	-0.3	1.4	0.4	0.0
Field D_{THAL} (ft)	1.7	0.8	0.5	1.5	1.6	0.4	0.5
W_{THAL} (ft)	3.0	3.5	2.0	4.0	3.0	2.0	2.5
Bank/Terrace Height (ft)	2.5	2.7	2.6	3.3	2.5	3.0	2.0
Flood Prone Width (ft)	80	80	80	80	80	60	60

Section Calculations

D_{MAX}	3.34	2.60	1.90	3.10	3.20	1.85	1.85
Average D_{TOE}	1.73	1.95	1.80	1.75	2.48	1.70	1.55
D_{THAL}	1.62	0.65	0.10	1.35	0.73	0.15	0.30
A_{BKF}	35.9	29.6	27.3	32.4	45.9	18.2	19.2
D_{MEAN}	2.17	2.04	1.65	2.24	2.63	1.52	1.48
W/D ratio	7.6	7.1	10.0	6.5	6.7	7.9	8.8
Bank Height Ratio	0.7	1.0	1.4	1.1	0.8	1.6	1.1
Entrenchment Ratio	4.8	5.5	4.8	5.5	4.6	5.0	4.6

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

Coef	Exp
1.5	0.27

Reference Bed Width	10.4	10.4	10.4	10.4	10.4	10.4	10.4
Bed Width Index (BWI)	1.1	1.1	1.3	1.1	1.4	0.8	0.9
Reference D_{MAX}	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Max Depth Index (MDI)	2.4	1.9	1.4	2.3	2.3	1.3	1.3

Stream Classification

Stream Type	E	E	E	E	E	E	E

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: South Fork Mills
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	8						
Reach Name	S						
Location	Riff (U/S Tirb)						
D_A (mi^2)	0.72						
W_{BKF} (ft)	14.0						
W_{BED} (ft)	11.5						
D_{BKF} (ft)	1.4						
$D_{TOE\ LT}$ (ft)	0.6						
$D_{TOE\ RT}$ (ft)	0.3						
Field D_{THAL} (ft)	0.7						
W_{THAL} (ft)	2.0						
Bank/Terrace Height (ft)	2.0						
Flood Prone Width (ft)	60						

Section Calculations

D_{MAX}	2.05						
Average D_{TOE}	1.85						
D_{THAL}	0.20						
A_{BKF}	24.9						
D_{MEAN}	1.78						
W/D ratio	7.9						
Bank Height Ratio	1.0						
Entrenchment Ratio	4.3						

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

Coef	Exp
1.5	0.27

Reference Bed Width	10.4						
Bed Width Index (BWI)	1.1						
Reference D_{MAX}	1.4						
Max Depth Index (MDI)	1.5						

Stream Classification

Stream Type	E						

Bulk Material Samples

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Bervard, NC

Reach: South Fork Mills River
Location: Side Bar
Sample Type: Bar

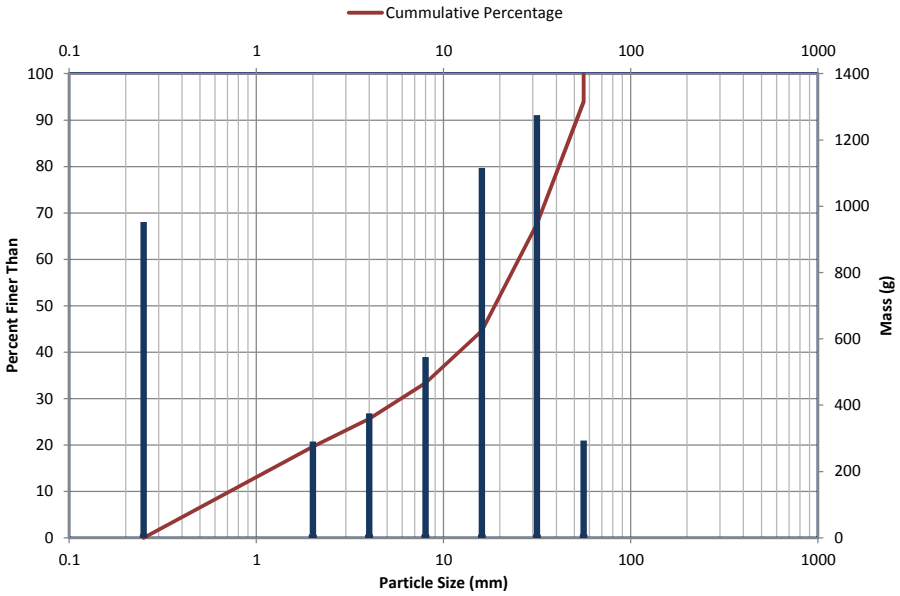
Largest Particle

Dim: 95 X 52 X 30 mm
Mass: 293 g

Second Largest Particle

Dim: 75 X 56 X 21 mm
Mass: 21 g

Size (mm)	Mass (g)
0.25	953
2	290
4	375
8	545
16	1116
31.5	1275
56	293
56	
56	
56	
56	
56	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	2	9	**20**	30	47	56	20%
All Material	2	9	20	30	47	56	20%

Reach: South Fork Mills River
Location: Riffle
Sample Type: Pavement

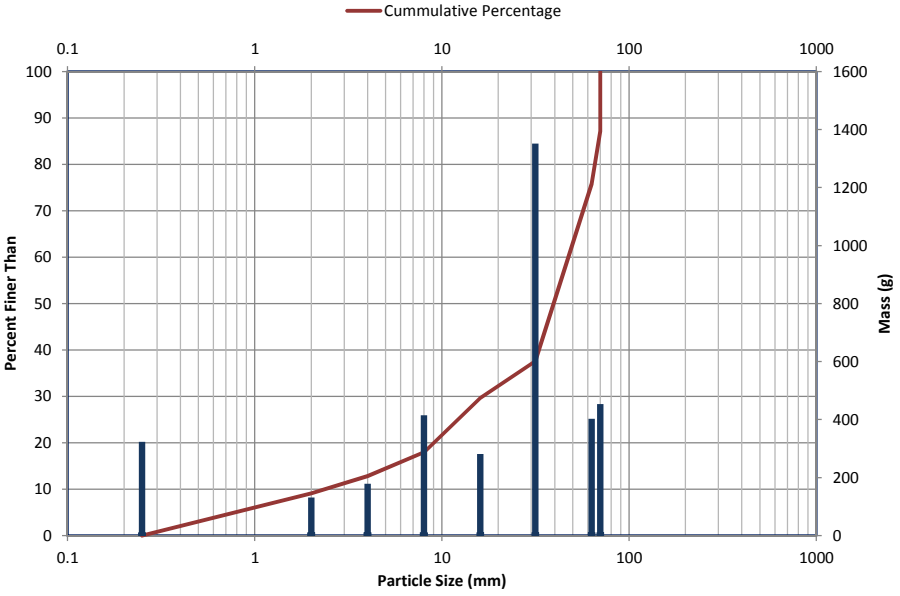
Largest Particle

Dim: 99 X 70 X 32 mm
Mass: 454 g

Second Largest Particle

Dim: 80 X 65 X 50 mm
Mass: 403 g

Size (mm)	Mass (g)
0.25	323
2	131
4	179
8	415
16	281
31.5	1351
63	403
70	454
70	
70	
70	
70	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	7	26	**42**	54	68	70	9%
All Material	7	26	42	54	68	70	9%

Bulk Material Samples

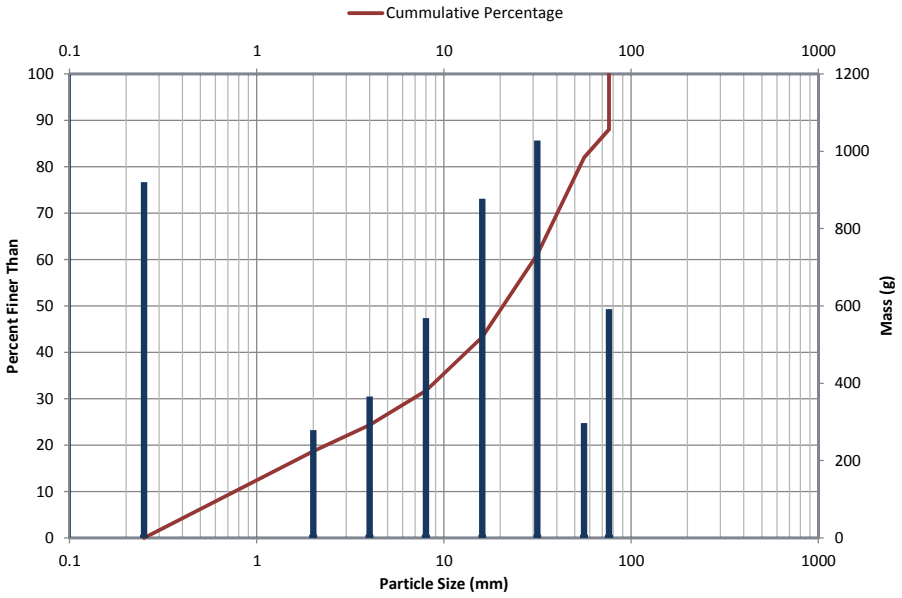
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Bervard, NC

Reach: South Fork Mills River
Location: Riffle
Sample Type: Sub-pavement

Largest Particle
Dim: 100 X 76 X 45 mm
Mass: 592 g

Second Largest Particle
Dim: 72 X 56 X 54 mm
Mass: 297 g

Size (mm)	Mass (g)
0.25	920
2	279
4	366
8	569
16	877
31.5	1028
56	297
76	592
76	
76	
76	
76	



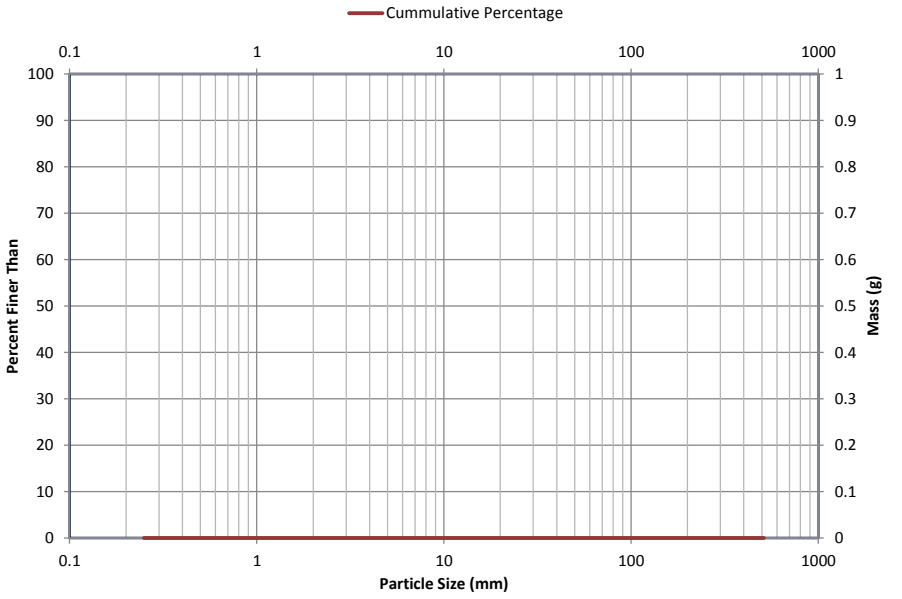
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	2	10	**22**	36	63	76	19%
All Material	2	10	22	36	63	76	19%

Reach: 0
Location:
Sample Type: Other

Largest Particle
Dim: N/A
Mass: N/A

Second Largest Particle
Dim: 0 X 0 X 0 mm
Mass: N/A

Size (mm)	Mass (g)
0.25	
2	
4	
8	
16	
31.5	
63	
90	
128	
180	
255	
512	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample							
All Material							

South Fork Mills River Riffle

South Fork Mills River Pool

Summary

Stream:	Cold Springs Reach 1
Watershed:	Forested
Location:	Harmon Den
Latitude:	35.76472
Longitude:	82.97333
State:	North Carolina
County:	Haywood
Date:	November 2, 2011
Observers:	Grant Ginn, Chris Engle, Megan Mailloux
Channel type:	B4
Drainage area (sq.mi.):	2.63
notes:	---

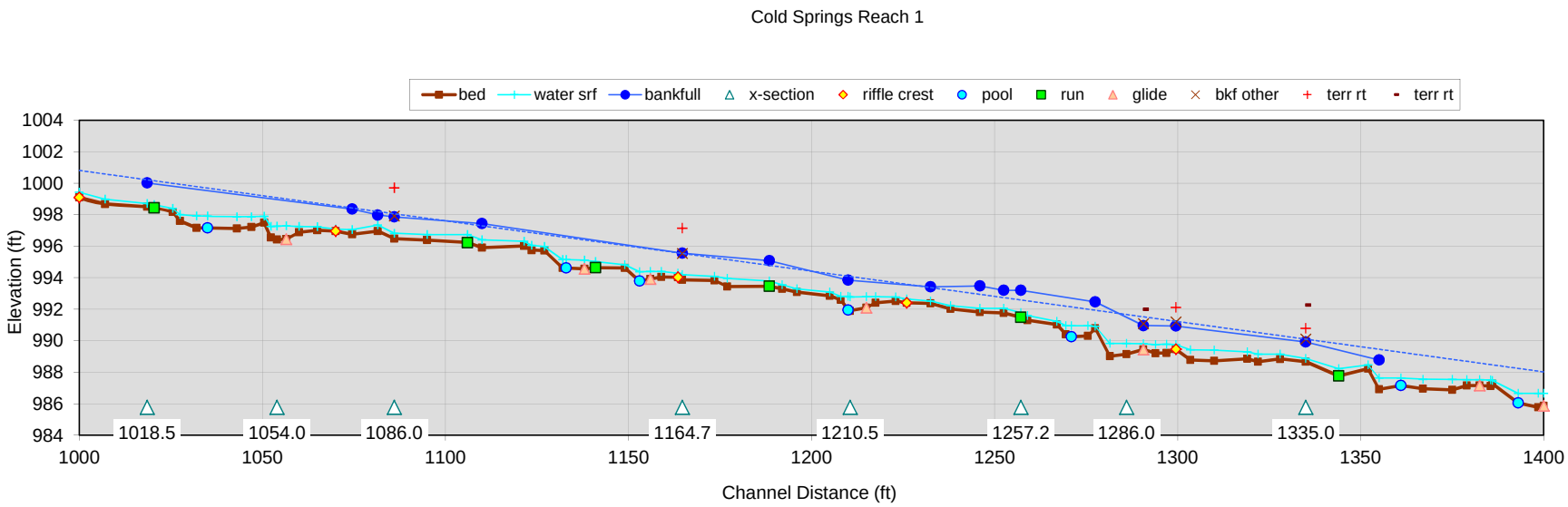
Dimension		bankfull channel typical	min	max	
floodplain:	width flood prone area (ft)	30.0	27.0	55.0	
	low bank height (ft)	1.8	1.4	2.1	
riffle-run:	x-area bankfull (sq.ft.)	22.0	20.7	23.9	
	width bankfull (ft)	20.4	19.9	21.8	
	mean depth (ft)	1.08	1.0	1.2	
	max depth (ft)	1.5	1.4	1.6	
	hydraulic radius (ft)	1.0			
pool:	x-area pool (sq.ft.)	22.0	20.0	28.1	
	width pool (ft)	18.0	15.4	18.0	
	max depth pool (ft)	2.1	1.8	2.6	
	hydraulic radius (ft)	1.2			
dimensionless ratios:		typical	min	max	
	width depth ratio	18.9	16.8	21.0	
	entrenchment ratio	1.5	1.3	2.7	
	riffle max depth ratio	1.4	1.3	1.5	
	bank height ratio	1.2	1.0	1.4	
	pool area ratio	1.0	0.9	1.3	
	pool width ratio	0.9	0.8	0.9	
	pool max depth ratio	1.9	1.7	2.4	
hydraulics:		typical	min	max	
	discharge rate (cfs)	119.0	118.6	130.4	
	channel slope (%)	3.2			
		riffle-run	min	max	pool
	velocity (ft/s)	5.4	5.5	5.8	5.4
	Froude number	0.95	0.91	1.04	0.76
	shear stress (lbs/sq.ft.)	1.997	1.764	1.937	2.396
	shear velocity (ft/s)	1.015	0.954	1.000	1.112
	stream power (lb/s)	237.6	236.9	260.4	
	unit stream power (lb/ft/s)	11.648	10.621	11.502	
	relative roughness	11.3	---	---	
	friction factor u/u*	5.3	6.0	6.2	
	threshold grain size (t*=0.06) (mm)	95.2	86.7	95.2	
	Shield's parameter	0.203			

Pattern	typical	min	max
meander length (ft)	---	---	---
belt width (ft)	40.0	---	---
amplitude (ft)	---	---	---
radius (ft)	83.0	83.0	156.0
arc angle (degrees)	---	---	---
stream length (ft)	---		
valley length (ft)	---		
Sinuosity	---		
Meander Length Ratio	---	---	---
Meander Width Ratio	2.0	---	---
Radius Ratio	4.1	4.1	7.6

Profile	typical	min	max
pool-pool spacing (ft)	82.0	61.0	98.0
riffle length (ft)	31.0	20.0	45.0
pool length (ft)	21.0	5.0	23.0
run length (ft)	18.0	12.0	27.0
glide length (ft)	10.0	7.0	14.0
channel slope (%)	3.2		
riffle slope (%)	2.5	1.22	3.89
pool slope (%)	0.3	0	0.5
run slope (%)	6.05	4.47	6.29
glide slope (%)	0.3	0.24	0.3
measured valley slope (%)	3		
valley slope from sinuosity (%)	---		
Riffle Length Ratio	1.5	1	2.2
Pool Length Ratio	1	0.2	1.1
Run Length Ratio	0.9	0.6	1.3
Glide Length Ratio	0.5	0.3	0.7
Riffle Slope Ratio	0.8	0.4	1.2
Pool Slope Ratio	0.1	0	0.2
Run Slope Ratio	1.9	1.4	2
Glide Slope Ratio	0.1	0.1	0.1
Pool Spacing Ratio	4	3	4.8

Channel Materials	Riffle Surface		Sub Pavement	BkF Channel
D16 (mm)	1.5	---	7.2	1
D35 (mm)	17	---	32	10
D50 (mm)	29	---	50	20
D65 (mm)	51	---	70	40
D84 (mm)	97	---	92	84
D95 (mm)	210	---	110	180
mean (mm)	12.1			9.2
dispersion	11.3			12.1
skewness	-0.3			-0.2
Shape Factor	---			
% Silt/Clay	0%	---	0%	1%
% Sand	18%	---	100%	20%
% Gravel	54%	---	0%	56%
% Cobble	25%	---	0%	19%
% Boulder	2%	---	0%	3%
% Bedrock	1%	---		
% Clay Hardpan		---		
% Detritus/Wood		---		
% Artificial		---		
Largest Mobile (mm)	115			

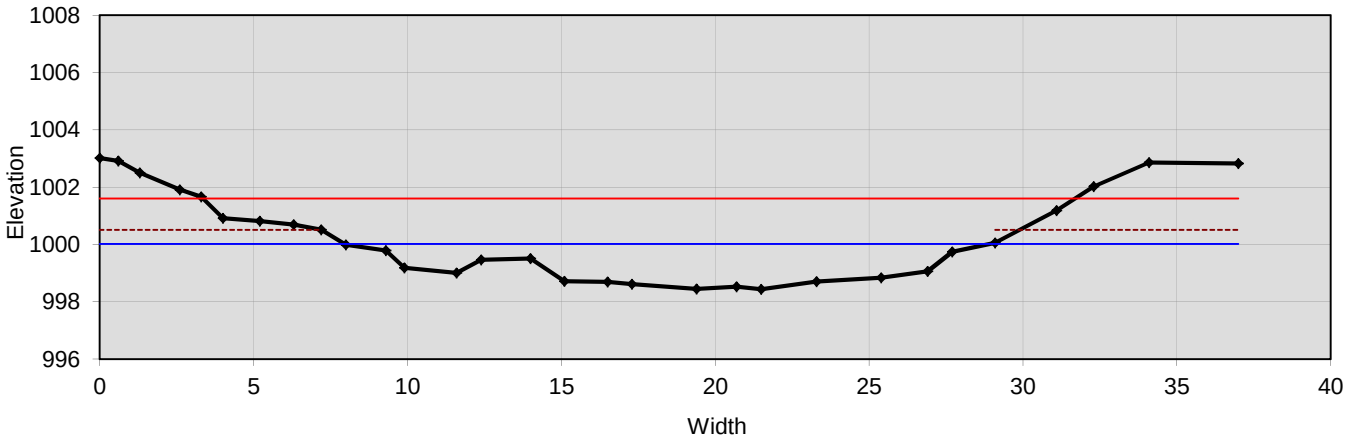
Longitudinal Slope Profile



	slope (%)		slope ratio		length (ft)		length ratio		pool-pool spacing (ft)		p-p ratio	
reach	3.2		---		1400.0	(68.6 channel widths)	---		---		---	
riffle	2.5	(1.22 - 3.89)	0.8	(0.4 - 1.2)	31.4	(20 - 45)	1.5	(1 - 2.2)	---		---	
pool	0.3	(0 - 0.5)	0.1	(0 - 0.2)	21.0	(5 - 23)	1	(0.2 - 1.1)	82.0	(61 - 98)	4	(3 - 4.8)
run	6.05	(4.47 - 6.29)	1.9	(1.4 - 2)	18.0	(12 - 27)	0.9	(0.6 - 1.3)	---		---	
glide	0.3	(0.24 - 0.3)	0.1	(0.1 - 0.1)	10.0	(7 - 14)	0.5	(0.3 - 0.7)	---		---	

Cross Section RF1

10 + 17.8 Cold Springs Reach 1, Riffle



Bankfull Dimensions	
21.3	x-section area (ft.sq.)
21.0	width (ft)
1.0	mean depth (ft)
1.6	max depth (ft)
22.0	wetted parimeter (ft)
1.0	hyd radi (ft)
20.7	width-depth ratio

Flood Dimensions	
28.0	W flood prone area (ft)
1.3	entrenchment ratio
2.1	low bank height (ft)
1.3	low bank height ratio

Materials	
29	D50 Riffle (mm)
97	D84 Riffle (mm)
95	threshold grain size (mm):

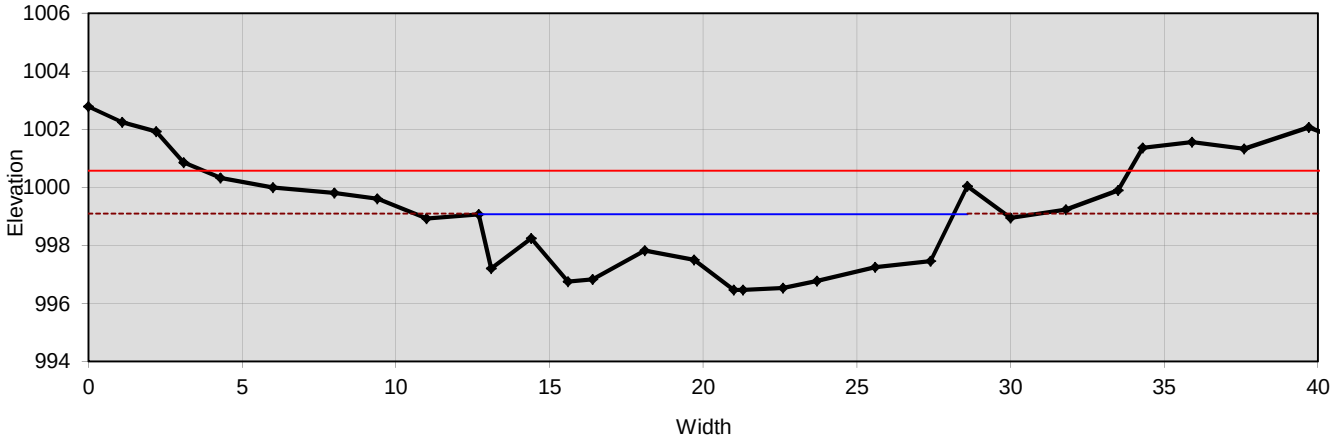
Bankfull Flow	
5.6	velocity (ft/s)
118.6	discharge rate (cfs)
0.99	Froude number

Flow Resistance	
0.047	Manning's roughness
0.26	D'Arcy-Weisbach fric.
6.0	resistance factor u/u*
3.2	relative roughness

Forces & Power	
3.2	channel slope (%)
1.94	shear stress (lb/sq.ft.)
1.00	shear velocity (ft/s)
11.3	unit strm power (lb/ft/s)

Cross Section PL1

10 + 54.1 Cold Springs Reach 1, Pool



Bankfull Dimensions	
28.1	x-section area (ft.sq.)
15.4	width (ft)
1.8	mean depth (ft)
2.6	max depth (ft)
19.8	wetted parimeter (ft)
1.4	hyd radi (ft)
8.5	width-depth ratio

Flood Dimensions	
45.0	W flood prone area (ft)
2.9	entrenchment ratio
2.6	low bank height (ft)
1.0	low bank height ratio

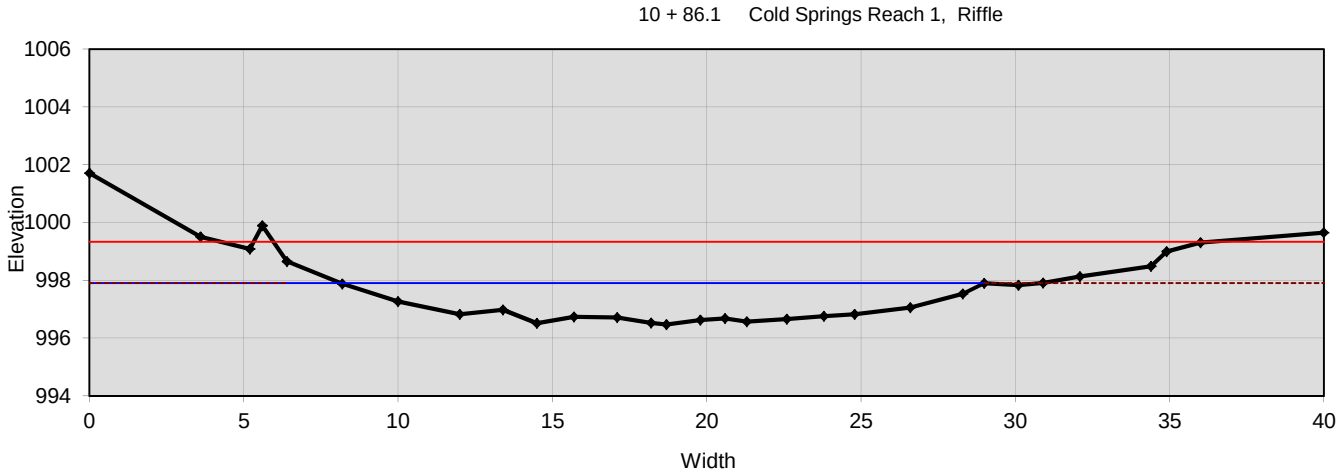
Materials	
29	D50 Riffle (mm)
97	D84 Riffle (mm)
139	threshold grain size (mm):

Bankfull Flow	
7.2	velocity (ft/s)
201.6	discharge rate (cfs)
1.06	Froude number

Flow Resistance	
0.047	Manning's roughness
0.23	D'Arcy-Weisbach fric.
7.1	resistance factor u/u*
5.7	relative roughness

Forces & Power	
3.2	channel slope (%)
2.84	shear stress (lb/sq.ft.)
1.21	shear velocity (ft/s)
26	unit strm power (lb/ft/s)

Cross Section RF2



Bankfull Dimensions	
20.7	x-section area (ft.sq.)
20.8	width (ft)
1.0	mean depth (ft)
1.4	max depth (ft)
21.3	wetted parimeter (ft)
1.0	hyd radi (ft)
21.0	width-depth ratio

Flood Dimensions	
32.0	W flood prone area (ft)
1.5	entrenchment ratio
1.4	low bank height (ft)
1.0	low bank height ratio

Materials	
29	D50 Riffle (mm)
97	D84 Riffle (mm)
95	threshold grain size (mm):

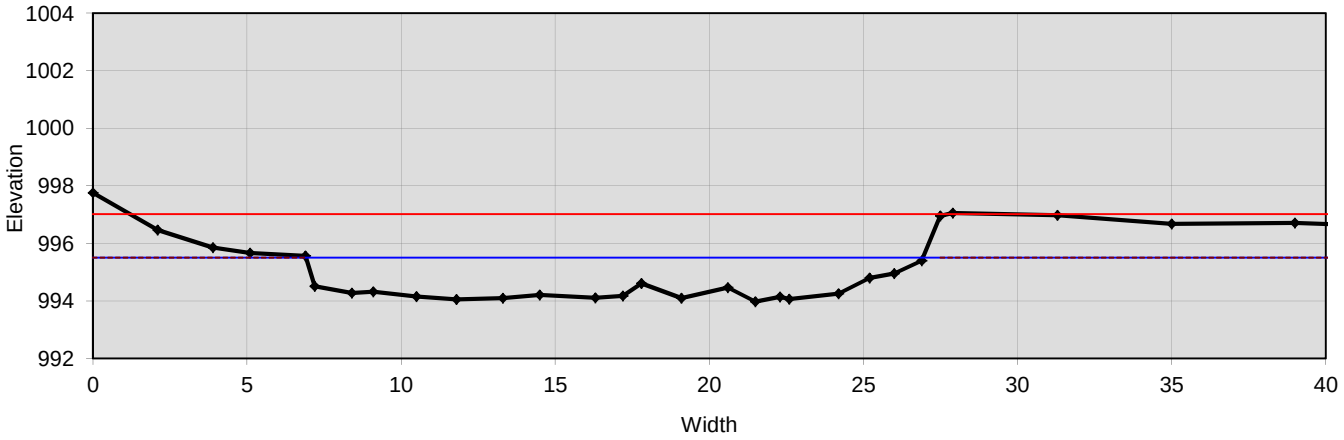
Bankfull Flow	
5.8	velocity (ft/s)
120.1	discharge rate (cfs)
1.04	Froude number

Flow Resistance	
0.045	Manning's roughness
0.24	D'Arcy-Weisbach fric.
6.0	resistance factor u/u*
3.1	relative roughness

Forces & Power	
3.2	channel slope (%)
1.94	shear stress (lb/sq.ft.)
1.00	shear velocity (ft/s)
11.5	unit strm power (lb/ft/s)

Cross Section RF3

11 + 64.6 Cold Springs Reach 1, Riffle



Bankfull Dimensions	
23.9	x-section area (ft.sq.)
20.0	width (ft)
1.2	mean depth (ft)
1.5	max depth (ft)
21.6	wetted parimeter (ft)
1.1	hyd radi (ft)
16.8	width-depth ratio

Flood Dimensions	
27.0	W flood prone area (ft)
1.3	entrenchment ratio
1.5	low bank height (ft)
1.0	low bank height ratio

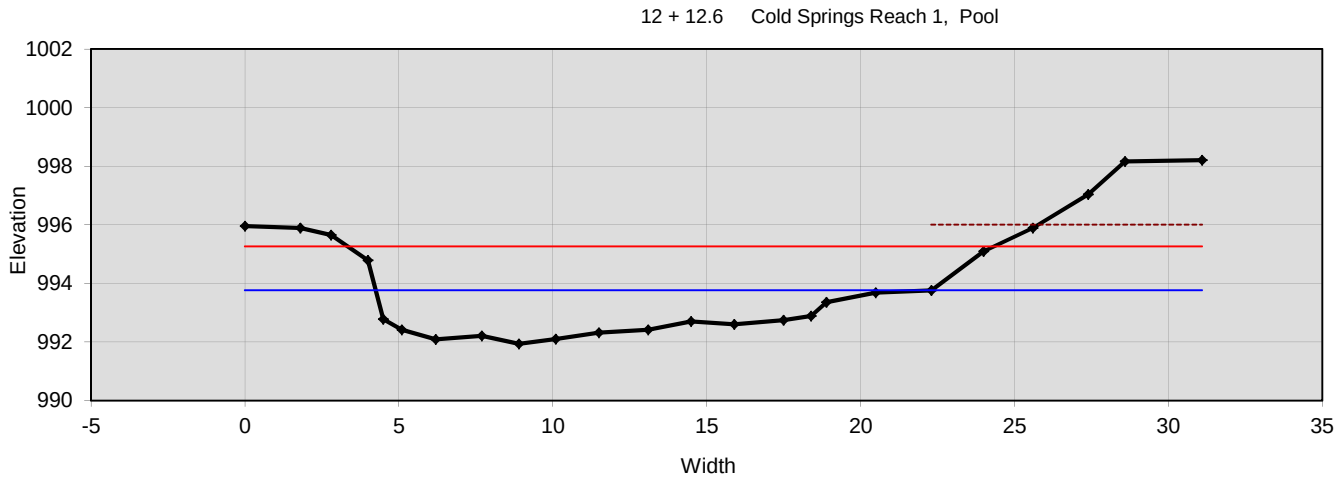
Materials	
29	D50 Riffle (mm)
97	D84 Riffle (mm)
92	threshold grain size (mm):

Bankfull Flow	
5.5	velocity (ft/s)
130.4	discharge rate (cfs)
0.91	Froude number

Flow Resistance	
0.048	Manning's roughness
0.26	D'Arcy-Weisbach fric.
6.2	resistance factor u/u*
3.8	relative roughness

Forces & Power	
2.7	channel slope (%)
1.86	shear stress (lb/sq.ft.)
0.98	shear velocity (ft/s)
11	unit strm power (lb/ft/s)

Cross Section PL3



Bankfull Dimensions	
20.0	x-section area (ft.sq.)
18.0	width (ft)
1.1	mean depth (ft)
1.8	max depth (ft)
19.3	wetted parimeter (ft)
1.0	hyd radi (ft)
16.3	width-depth ratio

Flood Dimensions	
24.0	W flood prone area (ft)
1.3	entrenchment ratio
4.1	low bank height (ft)
2.2	low bank height ratio

Materials	
29	D50 Riffle (mm)
97	D84 Riffle (mm)
86	threshold grain size (mm):

Bankfull Flow	
5.6	velocity (ft/s)
111.7	discharge rate (cfs)
0.96	Froude number

Flow Resistance	
0.045	Manning's roughness
0.23	D'Arcy-Weisbach fric.
6.3	resistance factor u/u*
3.5	relative roughness

Forces & Power	
2.7	channel slope (%)
1.75	shear stress (lb/sq.ft.)
0.95	shear velocity (ft/s)
10.4	unit strm power (lb/ft/s)

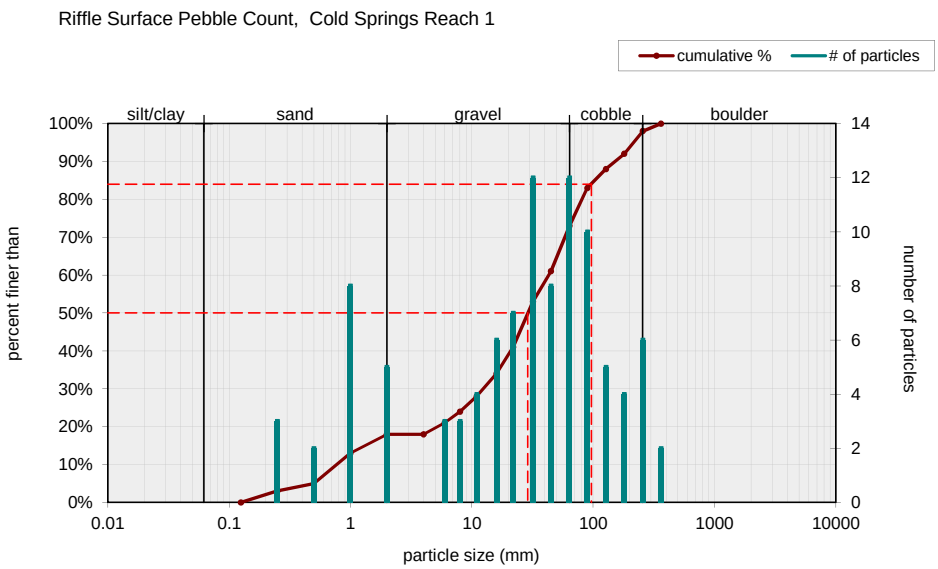
1) Individual Pebble Count

Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	3
medium sand	0.25 - 0.5	2
coarse sand	0.5 - 1	8
very coarse sand	1 - 2	5
very fine gravel	2 - 4	
fine gravel	4 - 6	3
fine gravel	6 - 8	3
medium gravel	8 - 11	4
medium gravel	11 - 16	6
coarse gravel	16 - 22	7
coarse gravel	22 - 32	12
very coarse gravel	32 - 45	8
very coarse gravel	45 - 64	12
small cobble	64 - 90	10
medium cobble	90 - 128	5
large cobble	128 - 180	4
very large cobble	180 - 256	6
small boulder	256 - 362	2
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		100
bedrock	----------	1
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		101

Note:



Size (mm)	
D16	1.5
D35	17
D50	29
D65	51
D84	97
D95	210

Size Distribution	
mean	12.1
dispersion	11.3
skewness	-0.28

Type			
silt/clay	0%	bedrock	1%
sand	18%		
gravel	54%		
cobble	25%		
boulder	2%		

2) Weighted Pebble Count

Feature Percent of Reach

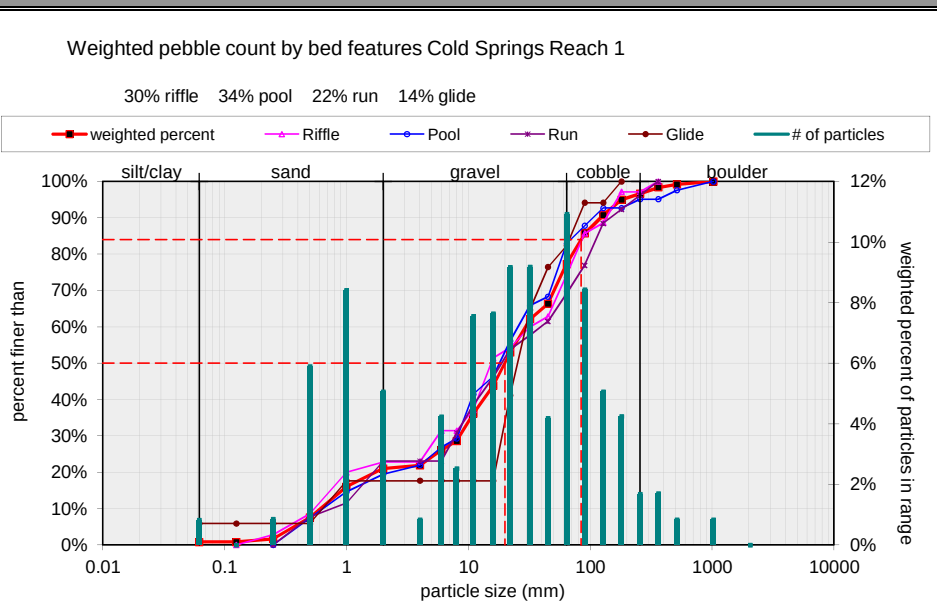
Riffle, Pool, Run, Glide

Riffle	30	%	Run	22	%
Pool	34	%	Glide	14	%

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	0.8
very fine sand	0.062 - 0.125	0.0
fine sand	0.125 - 0.25	0.9
medium sand	0.25 - 0.5	5.9
coarse sand	0.5 - 1	8.4
very coarse sand	1 - 2	5.1
very fine gravel	2 - 4	0.8
fine gravel	4 - 6	4.2
fine gravel	6 - 8	2.5
medium gravel	8 - 11	7.6
medium gravel	11 - 16	7.6
coarse gravel	16 - 22	9.2
coarse gravel	22 - 32	9.2
very coarse gravel	32 - 45	4.2
very coarse gravel	45 - 64	10.9
small cobble	64 - 90	8.4
medium cobble	90 - 128	5.1
large cobble	128 - 180	4.2
very large cobble	180 - 256	1.7
small boulder	256 - 362	1.7
small boulder	362 - 512	0.8
medium boulder	512 - 1024	0.8
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
total weighted count:		100.0

Note:



Size (mm)	
D16	1
D35	10
D50	20
D65	40
D84	84
D95	180

Size Distribution	
mean	9.2
dispersion	12.1
skewness	-0.24

Type	
silt/clay	1%
sand	20%
gravel	56%
cobble	19%
boulder	3%

Summary

Stream:	Cold Springs Reach 2
Watershed:	Forested
Location:	Harmon Den
Latitude:	35.76528
Longitude:	82.97472
State:	North Carolina
County:	Haywood
Date:	January 17, 2012
Observers:	Grant Ginn, Chris Engle, Megan Mailloux
Channel type:	B4
Drainage area (sq.mi.):	2.64
notes:	---

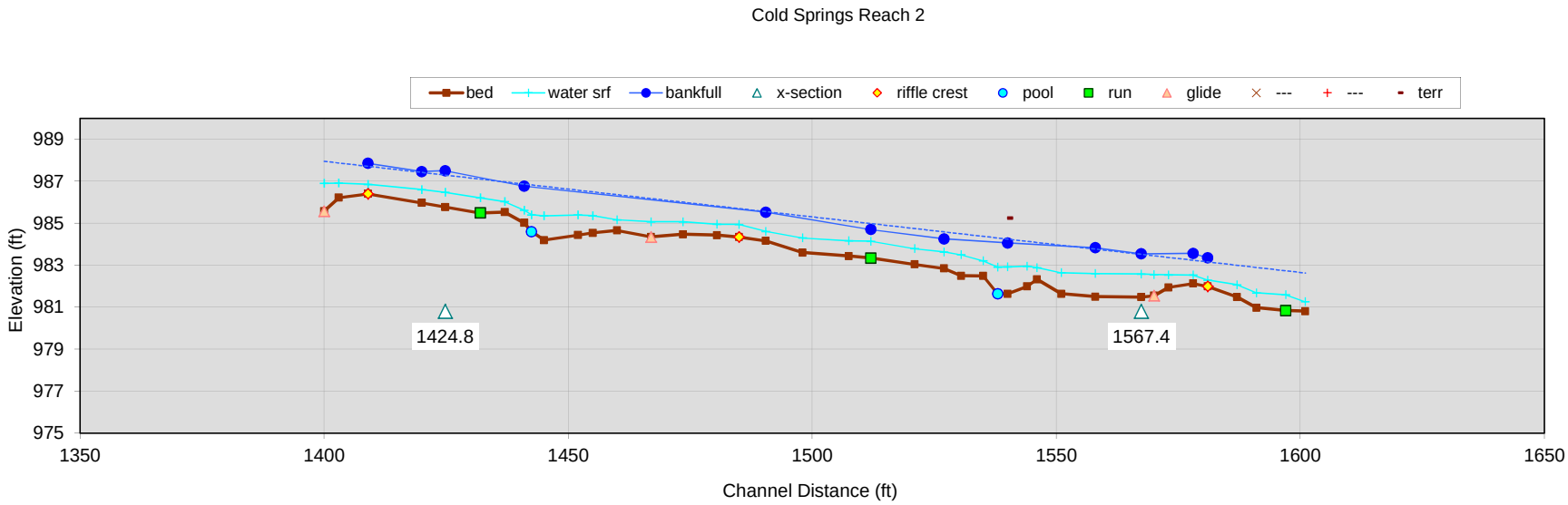
Dimension		bankfull channel typical	min	max	
floodplain:	width flood prone area (ft)	43.0	---	---	
	low bank height (ft)	1.9	---	---	
riffle-run:	x-area bankfull (sq.ft.)	26.7	---	---	
	width bankfull (ft)	23.8	---	---	
	mean depth (ft)	1.12	---	---	
	max depth (ft)	1.6	---	---	
	hydraulic radius (ft)	1.1			
pool:	x-area pool (sq.ft.)	26.6	26.6	26.6	
	width pool (ft)	20.2	20.2	20.2	
	max depth pool (ft)	2.1	2.1	2.1	
	hydraulic radius (ft)	1.2			
dimensionless ratios:		typical	min	max	
	width depth ratio	21.2	---	---	
	entrenchment ratio	1.8	---	---	
	riffle max depth ratio	1.4	---	---	
	bank height ratio	1.2	---	---	
	pool area ratio	1.0	1.0	1.0	
	pool width ratio	0.8	0.8	0.8	
	pool max depth ratio	1.9	1.8	1.8	
hydraulics:		typical	min	max	
	discharge rate (cfs)	119.0	---	---	
	channel slope (%)	2.3			
		riffle-run	min	max	pool
	velocity (ft/s)	4.5	---	---	4.5
	Froude number	0.75	---	---	0.52
	shear stress (lbs/sq.ft.)	1.579	---	---	1.722
	shear velocity (ft/s)	0.903	---	---	0.943
	stream power (lb/s)	170.8	---	---	
	unit stream power (lb/ft/s)	7.176	---	---	
	relative roughness	8.8	---	---	
	friction factor u/u*	4.9	---	---	
	threshold grain size (t*=0.06) (mm)	76.7	---	---	
	Shield's parameter	0.119			

Pattern	typical	min	max
meander length (ft)	---	---	---
belt width (ft)	41.0	---	---
amplitude (ft)	---	---	---
radius (ft)	34.0	34.0	48.0
arc angle (degrees)	---	---	---
stream length (ft)	---		
valley length (ft)	---		
Sinuosity	---		
Meander Length Ratio	---	---	---
Meander Width Ratio	1.7	---	---
Radius Ratio	1.4	1.4	2.0

Profile	typical	min	max
pool-pool spacing (ft)	95.5	---	---
riffle length (ft)	25.0	16.0	27.0
pool length (ft)	28.0	24.0	32.0
run length (ft)	18.0	11.0	26.0
glide length (ft)	10.0	9.0	18.0
channel slope (%)	2.3		
riffle slope (%)	2.87	2.78	4.95
pool slope (%)	0.47	0.47	1.27
run slope (%)	4.38	4.04	6.55
glide slope (%)	0.51	0.25	0.72
measured valley slope (%)	---		
valley slope from sinuosity (%)	---		
Riffle Length Ratio	1.1	0.7	1.1
Pool Length Ratio	1.2	1	1.3
Run Length Ratio	0.8	0.5	1.1
Glide Length Ratio	0.4	0.4	0.8
Riffle Slope Ratio	1.2	1.2	2.2
Pool Slope Ratio	0.2	0.2	0.6
Run Slope Ratio	1.9	1.8	2.8
Glide Slope Ratio	0.2	0.1	0.3
Pool Spacing Ratio	4	---	---

Channel Materials	Riffle Surface		Sub Pavement	BkF Channel
D16 (mm)	5.2	---	9.5	7.3
D35 (mm)	23	---	37	22
D50 (mm)	39	---	67	46
D65 (mm)	58	---	86	77
D84 (mm)	120	---	120	160
D95 (mm)	210	---	140	270
mean (mm)	25.0			34.2
dispersion	5.3			4.9
skewness	-0.2			-0.1
Shape Factor	---			
% Silt/Clay	0%	---	0%	0%
% Sand	14%	---	100%	11%
% Gravel	55%	---	0%	49%
% Cobble	28%	---	0%	34%
% Boulder	3%	---	0%	6%
% Bedrock		---		
% Clay Hardpan		---		
% Detritus/Wood		---		
% Artificial		---		
Largest Mobile (mm)	152			

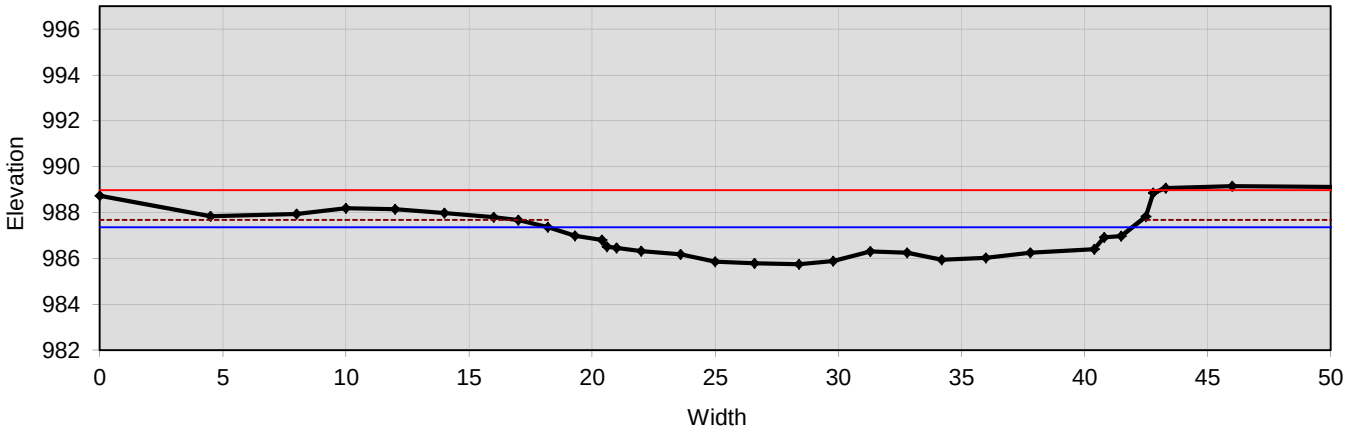
Longitudinal Slope Profile



	slope (%)		slope ratio		length (ft)		length ratio		pool-pool spacing (ft)	p-p ratio
reach	2.3		---		1601.0	(67.3 channel widths)	---		---	---
riffle	2.87	(2.78 - 4.95)	1.2	(1.2 - 2.2)	22.0	(16 - 27)	1.1	(0.7 - 1.1)	---	---
pool	0.47	(0.47 - 1.27)	0.2	(0.2 - 0.6)	28.0	(24 - 32)	1.2	(1 - 1.3)	95.5	4
run	4.38	(4.04 - 6.55)	1.9	(1.8 - 2.8)	18.0	(11 - 26)	0.8	(0.5 - 1.1)	---	---
glide	0.51	(0.25 - 0.72)	0.2	(0.1 - 0.3)	10.0	(9 - 18)	0.4	(0.4 - 0.8)	---	---

Cross Section RF1

14 + 24.8 Cold Springs Reach 2, Riffle



Bankfull Dimensions	
26.7	x-section area (ft.sq.)
23.8	width (ft)
1.1	mean depth (ft)
1.6	max depth (ft)
24.6	wetted parimeter (ft)
1.1	hyd radi (ft)
21.1	width-depth ratio

Flood Dimensions	
43.0	W flood prone area (ft)
1.8	entrenchment ratio
1.9	low bank height (ft)
1.2	low bank height ratio

Materials	
39	D50 Riffle (mm)
120	D84 Riffle (mm)
77	threshold grain size (mm):

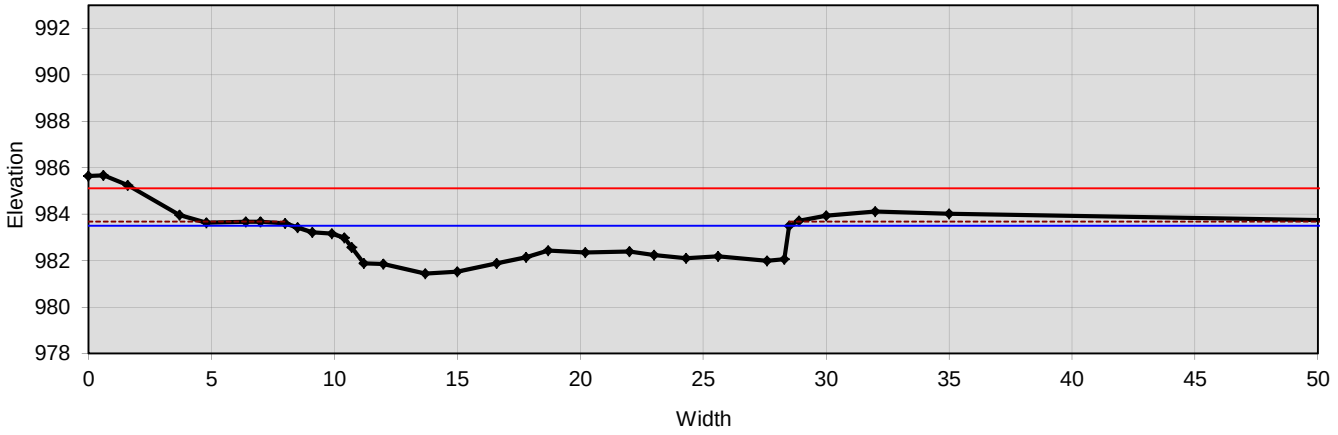
Bankfull Flow	
5.2	velocity (ft/s)
138.6	discharge rate (cfs)
0.88	Froude number

Flow Resistance	
0.046	Manning's roughness
0.24	D'Arcy-Weisbach fric.
5.7	resistance factor u/u*
2.9	relative roughness

Forces & Power	
2.3	channel slope (%)
1.56	shear stress (lb/sq.ft.)
0.90	shear velocity (ft/s)
8.4	unit strm power (lb/ft/s)

Cross Section PL1

15 + 67.5 Cold Springs Reach 2, Pool



Bankfull Dimensions	
26.6	x-section area (ft.sq.)
20.2	width (ft)
1.3	mean depth (ft)
2.1	max depth (ft)
22.3	wetted parimeter (ft)
1.2	hyd radi (ft)
15.4	width-depth ratio

Flood Dimensions	
55.0	W flood prone area (ft)
2.7	entrenchment ratio
2.2	low bank height (ft)
1.1	low bank height ratio

Materials	
39	D50 Riffle (mm)
120	D84 Riffle (mm)
84	threshold grain size (mm):

Bankfull Flow	
5.4	velocity (ft/s)
143.5	discharge rate (cfs)
0.87	Froude number

Flow Resistance	
0.047	Manning's roughness
0.24	D'Arcy-Weisbach fric.
6.1	resistance factor u/u*
3.3	relative roughness

Forces & Power	
2.3	channel slope (%)
1.71	shear stress (lb/sq.ft.)
0.94	shear velocity (ft/s)
10.2	unit strm power (lb/ft/s)

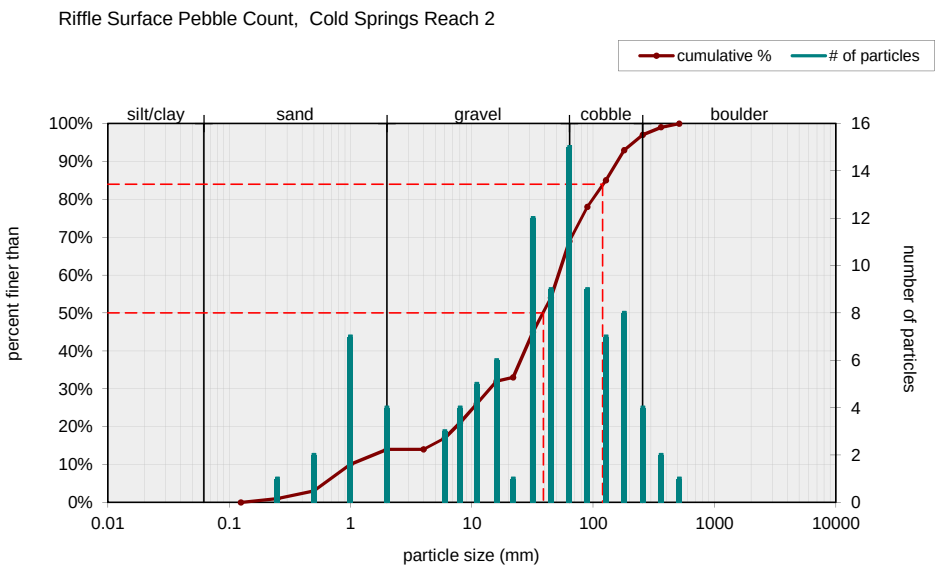
1) Individual Pebble Count

Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	1
medium sand	0.25 - 0.5	2
coarse sand	0.5 - 1	7
very coarse sand	1 - 2	4
very fine gravel	2 - 4	
fine gravel	4 - 6	3
fine gravel	6 - 8	4
medium gravel	8 - 11	5
medium gravel	11 - 16	6
coarse gravel	16 - 22	1
coarse gravel	22 - 32	12
very coarse gravel	32 - 45	9
very coarse gravel	45 - 64	15
small cobble	64 - 90	9
medium cobble	90 - 128	7
large cobble	128 - 180	8
very large cobble	180 - 256	4
small boulder	256 - 362	2
small boulder	362 - 512	1
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		100
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		100

Note:



Size (mm)	
D16	5.2
D35	23
D50	39
D65	58
D84	120
D95	210

Size Distribution	
mean	25.0
dispersion	5.3
skewness	-0.17

Type	
silt/clay	0%
sand	14%
gravel	55%
cobble	28%
boulder	3%

2) Weighted Pebble Count

Feature Percent of Reach

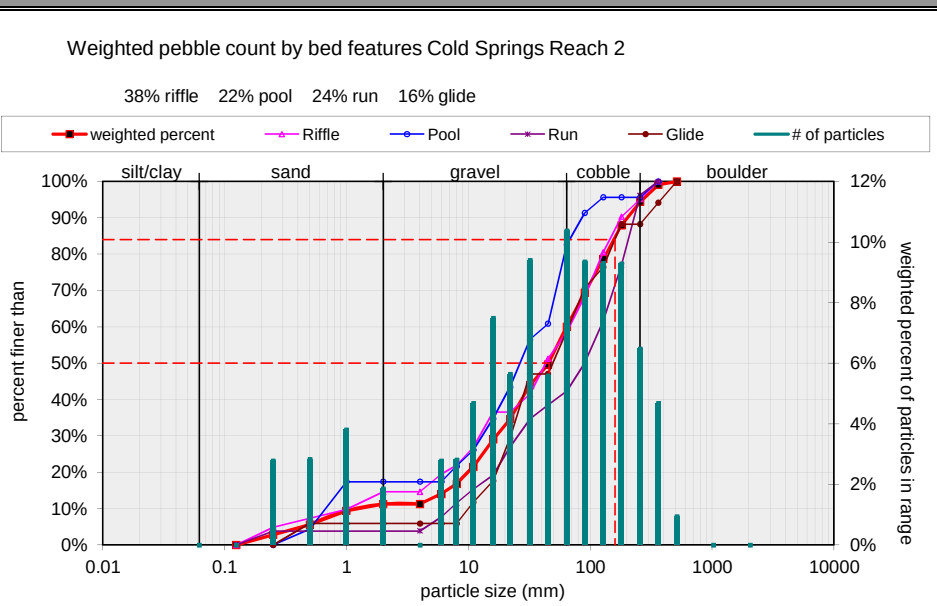
Riffle, Pool, Run, Glide

Riffle	38	%	Run	24	%
Pool	22	%	Glide	16	%

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	0.0
very fine sand	0.062 - 0.125	0.0
fine sand	0.125 - 0.25	2.8
medium sand	0.25 - 0.5	2.8
coarse sand	0.5 - 1	3.8
very coarse sand	1 - 2	1.9
very fine gravel	2 - 4	0.0
fine gravel	4 - 6	2.8
fine gravel	6 - 8	2.8
medium gravel	8 - 11	4.7
medium gravel	11 - 16	7.5
coarse gravel	16 - 22	5.6
coarse gravel	22 - 32	9.4
very coarse gravel	32 - 45	5.6
very coarse gravel	45 - 64	10.4
small cobble	64 - 90	9.3
medium cobble	90 - 128	9.3
large cobble	128 - 180	9.3
very large cobble	180 - 256	6.5
small boulder	256 - 362	4.7
small boulder	362 - 512	0.9
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
total weighted count:		100.0

Note:



Size (mm)	
D16	7.3
D35	22
D50	46
D65	77
D84	160
D95	270

Size Distribution	
mean	34.2
dispersion	4.9
skewness	-0.11

Type	
silt/clay	0%
sand	11%
gravel	49%
cobble	34%
boulder	6%

Summary

Stream:	Cold Springs Creek (Original)
Watershed:	Pigeon River
Location:	Pisgah National Forest, Harmon Den, I-40 Exit 7
Latitude:	35.76352
Longitude:	82.97678
State:	North Carolina
County:	Haywood
Date:	October 25, 2007
Observers:	SGG & CME
Channel type:	B4
Drainage area (sq.mi.):	2.77
notes:	---

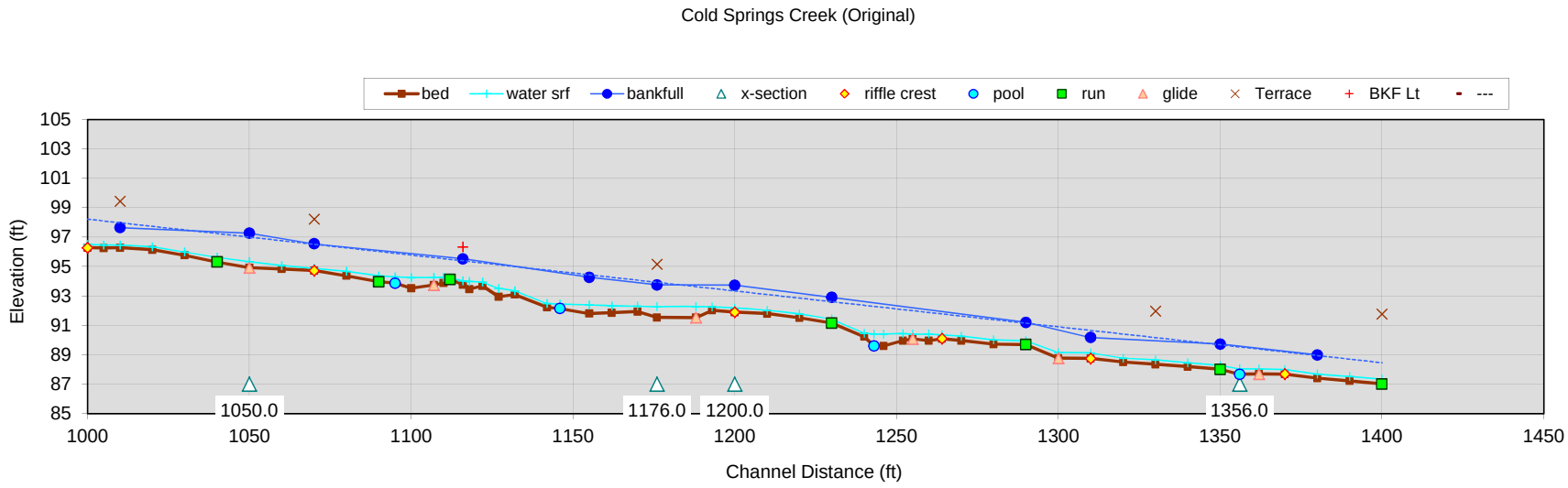
Dimension		bankfull channel typical	min	max	
floodplain:	width flood prone area (ft)	48.0	43.0	52.0	
	low bank height (ft)	2.1	1.8	2.4	
riffle-run:	x-area bankfull (sq.ft.)	33.4	33.4	34.6	
	width bankfull (ft)	24.7	23.4	24.7	
	mean depth (ft)	1.35	1.3	1.5	
	max depth (ft)	1.8	1.8	2.2	
	hydraulic radius (ft)	1.3			
pool:	x-area pool (sq.ft.)	33.4	30.0	33.4	
	width pool (ft)	29.6	25.2	29.6	
	max depth pool (ft)	2.3	2.3	2.3	
	hydraulic radius (ft)	1.1			
dimensionless ratios:		typical	min	max	
	width depth ratio	18.3	15.8	18.4	
	entrenchment ratio	1.9	1.7	2.1	
	riffle max depth ratio	1.3	1.3	1.6	
	bank height ratio	1.2	1.0	1.3	
	pool area ratio	1.0	0.9	1.0	
	pool width ratio	1.2	1.0	1.2	
	pool max depth ratio	1.7	1.7	1.7	
hydraulics:		typical	min	max	
	discharge rate (cfs)	123.0	202.1	218.6	
	channel slope (%)	2.4			
		riffle-run	min	max	pool
	velocity (ft/s)	3.7	6.1	6.3	3.7
	Froude number	0.57	0.94	0.95	0.38
	shear stress (lbs/sq.ft.)	1.947	1.920	2.043	1.647
	shear velocity (ft/s)	1.002	0.995	1.027	0.922
	stream power (lb/s)	184.2	302.7	327.4	
	unit stream power (lb/ft/s)	7.458	12.131	13.866	
	relative roughness	9.2	---	---	
	friction factor u/u*	3.7	5.9	6.2	
	threshold grain size (t*=0.06) (mm)	100.4	94.3	100.4	
	Shield's parameter	0.128			

Pattern	typical	min	max
meander length (ft)	100.0	---	---
belt width (ft)	43.0	---	---
amplitude (ft)	---	---	---
radius (ft)	75.0	44.0	103.0
arc angle (degrees)	---	---	---
stream length (ft)	400.0		
valley length (ft)	380.0		
Sinuosity	1.1		
Meander Length Ratio	4.0	---	---
Meander Width Ratio	1.7	---	---
Radius Ratio	3.0	1.8	4.2

Profile	typical	min	max
pool-pool spacing (ft)	87.0	51.0	113.0
riffle length (ft)	29.0	20.0	40.0
pool length (ft)	18.0	6.0	42.0
run length (ft)	13.0	5.0	34.0
glide length (ft)	11.0	5.0	20.0
channel slope (%)	2.38		
riffle slope (%)	2.23	1.54	2.77
pool slope (%)	0.28	0.11	0.4
run slope (%)	5.32	4	7.84
glide slope (%)	0.63	0.44	0.83
measured valley slope (%)	---		
valley slope from sinuosity (%)	2.5		
Riffle Length Ratio	1.2	0.8	1.6
Pool Length Ratio	0.7	0.2	1.7
Run Length Ratio	0.5	0.2	1.4
Glide Length Ratio	0.4	0.2	0.8
Riffle Slope Ratio	0.9	0.6	1.2
Pool Slope Ratio	0.1	0	0.2
Run Slope Ratio	2.2	1.7	3.3
Glide Slope Ratio	0.3	0.2	0.3
Pool Spacing Ratio	3.5	2.1	4.6

Channel Materials	Riffle Surface		Point Bar	BkF Channel
D16 (mm)	5.2	---	30	3.3
D35 (mm)	22	---	71	15
D50 (mm)	45	---	79	31
D65 (mm)	75	---	87	62
D84 (mm)	130	---	99	120
D95 (mm)	190	---	110	170
mean (mm)	26.0			19.9
dispersion	5.8			6.6
skewness	-0.2			-0.2
Shape Factor	---			
% Silt/Clay	1%	---	0%	2%
% Sand	10%	---	100%	9%
% Gravel	48%	---	0%	53%
% Cobble	41%	---	0%	33%
% Boulder	0%	---	0%	0%
% Bedrock	1%	---		4%
% Clay Hardpan		---		
% Detritus/Wood		---		
% Artificial		---		
Largest Mobile (mm)	91			

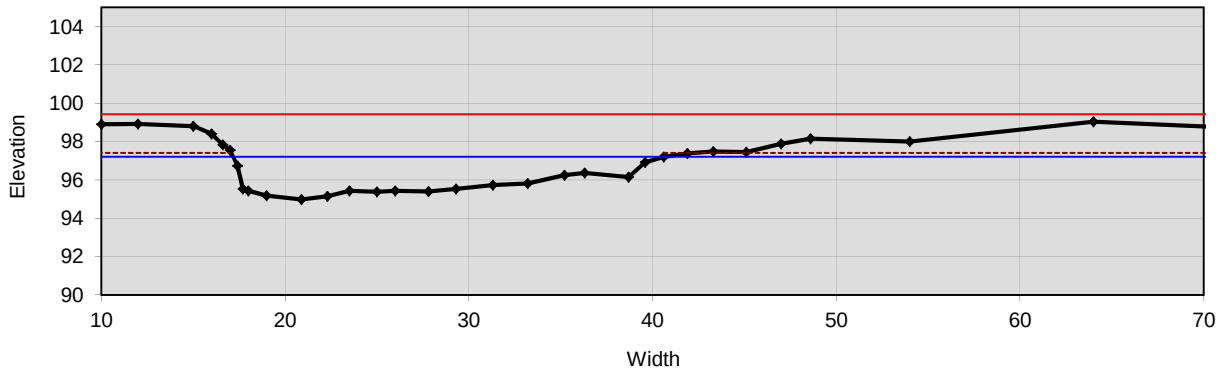
Longitudinal Slope Profile



	slope (%)		slope ratio		length (ft)		length ratio		pool-pool spacing (ft)		p-p ratio	
reach	2.38		---		1400.0	(56.7 channel widths)	---		---		---	
riffle	2.23	(1.54 - 2.77)	0.9	(0.6 - 1.2)	29.3	(20 - 40)	1.2	(0.8 - 1.6)	---		---	
pool	0.28	(0.11 - 0.4)	0.1	(0 - 0.2)	18.0	(6 - 42)	0.7	(0.2 - 1.7)	87.0	(51 - 113)	3.5	(2.1 - 4.6)
run	5.32	(4 - 7.84)	2.2	(1.7 - 3.3)	13.0	(5 - 34)	0.5	(0.2 - 1.4)	---		---	
glide	0.63	(0.44 - 0.83)	0.3	(0.2 - 0.3)	11.0	(5 - 20)	0.4	(0.2 - 0.8)	---		---	

Cross Section XS 1

10 + 51 Cold Springs Creek (Original), Riffle



Bankfull Dimensions	
34.6	x-section area (ft.sq.)
23.4	width (ft)
1.5	mean depth (ft)
2.2	max depth (ft)
25.2	wetted parimeter (ft)
1.4	hyd radi (ft)
15.8	width-depth ratio

Flood Dimensions	
52.0	W flood prone area (ft)
2.2	entrenchment ratio
2.4	low bank height (ft)
1.1	low bank height ratio

Materials	
45	D50 Riffle (mm)
130	D84 Riffle (mm)
100	threshold grain size (mm):

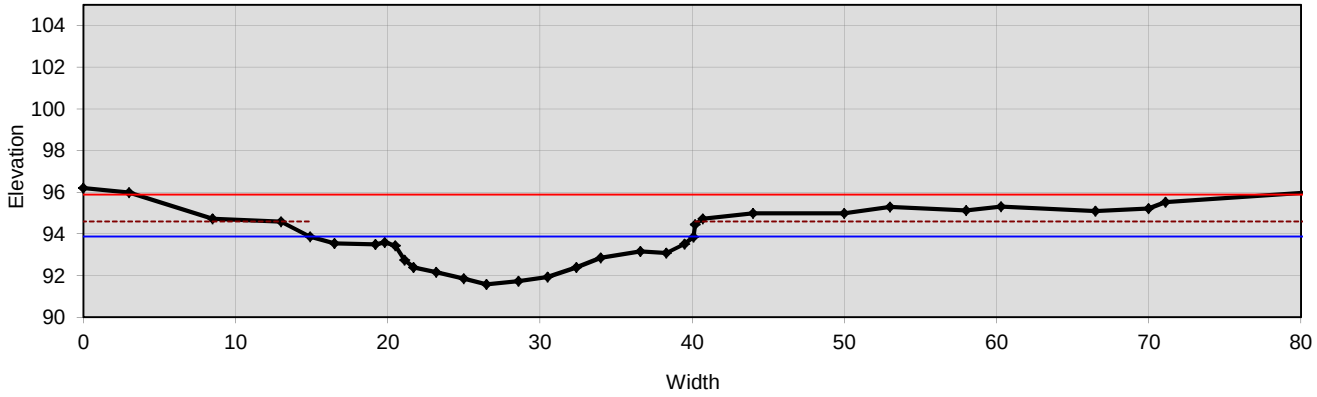
Bankfull Flow	
6.3	velocity (ft/s)
218.6	discharge rate (cfs)
0.95	Froude number

Flow Resistance	
0.045	Manning's roughness
0.21	D'Arcy-Weisbach fric.
6.2	resistance factor u/u*
3.5	relative roughness

Forces & Power	
2.38	channel slope (%)
2.04	shear stress (lb/sq.ft.)
1.03	shear velocity (ft/s)
13.9	unit strm power (lb/ft/s)

Cross Section XS 2

11 + 78 Cold Springs Creek (Original), Pool



Bankfull Dimensions	
30.0	x-section area (ft.sq.)
25.2	width (ft)
1.2	mean depth (ft)
2.3	max depth (ft)
26.1	wetted parimeter (ft)
1.1	hyd radi (ft)
21.2	width-depth ratio

Flood Dimensions	
80.0	W flood prone area (ft)
3.2	entrenchment ratio
3.0	low bank height (ft)
1.3	low bank height ratio

Materials	
45	D50 Riffle (mm)
130	D84 Riffle (mm)
84	threshold grain size (mm):

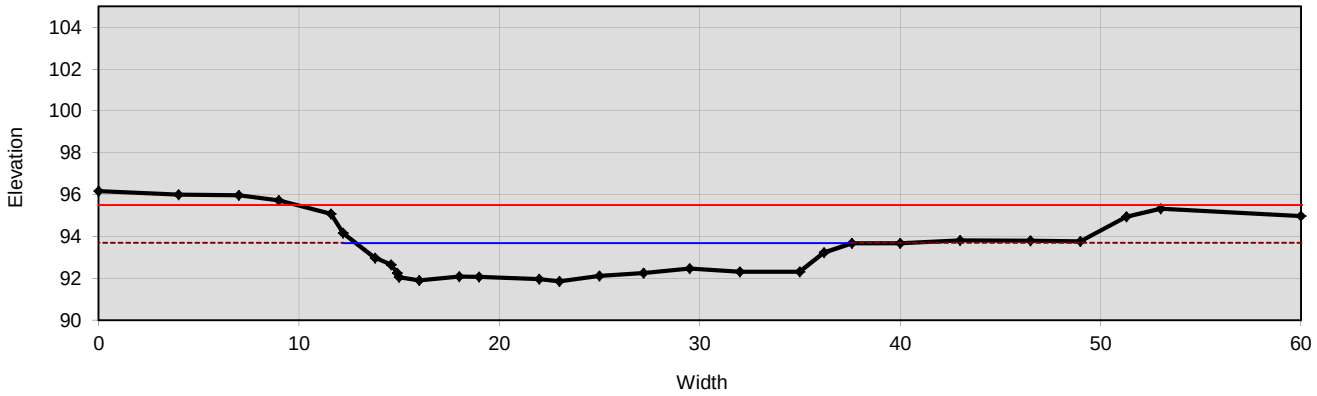
Bankfull Flow	
5.6	velocity (ft/s)
168.0	discharge rate (cfs)
0.92	Froude number

Flow Resistance	
0.045	Manning's roughness
0.22	D'Arcy-Weisbach fric.
5.9	resistance factor u/u*
2.8	relative roughness

Forces & Power	
2.38	channel slope (%)
1.71	shear stress (lb/sq.ft.)
0.94	shear velocity (ft/s)
9.9	unit strm power (lb/ft/s)

Cross Section XS 3

12 + 1 Cold Springs Creek (Original), Riffle



Bankfull Dimensions	
33.4	x-section area (ft.sq.)
24.7	width (ft)
1.3	mean depth (ft)
1.8	max depth (ft)
25.8	wetted parimeter (ft)
1.3	hyd radi (ft)
18.4	width-depth ratio

Flood Dimensions	
43.0	W flood prone area (ft)
1.7	entrenchment ratio
1.8	low bank height (ft)
1.0	low bank height ratio

Materials	
45	D50 Riffle (mm)
130	D84 Riffle (mm)
94	threshold grain size (mm):

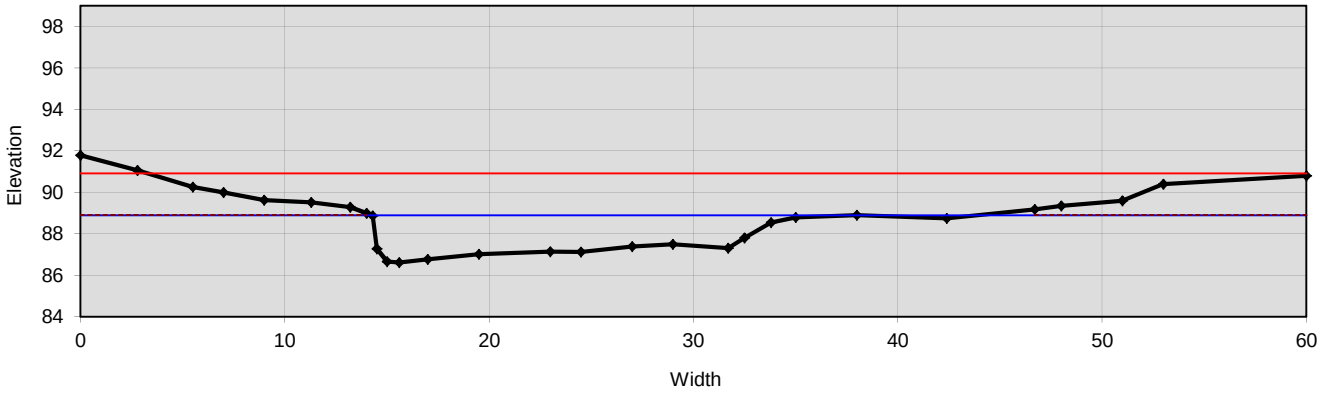
Bankfull Flow	
6.1	velocity (ft/s)
202.1	discharge rate (cfs)
0.94	Froude number

Flow Resistance	
0.045	Manning's roughness
0.22	D'Arcy-Weisbach fric.
5.9	resistance factor u/u*
3.2	relative roughness

Forces & Power	
2.38	channel slope (%)
1.92	shear stress (lb/sq.ft.)
1.00	shear velocity (ft/s)
12.1	unit strm power (lb/ft/s)

Cross Section XS 4

13 + 58 Cold Springs Creek (Original), Pool



Bankfull Dimensions

33.4	x-section area (ft.sq.)
29.6	width (ft)
1.1	mean depth (ft)
2.3	max depth (ft)
31.7	wetted parimeter (ft)
1.1	hyd radi (ft)
26.1	width-depth ratio

Flood Dimensions

49.0	W flood prone area (ft)
1.7	entrenchment ratio
2.3	low bank height (ft)
1.0	low bank height ratio

Materials

45	D50 Riffle (mm)
130	D84 Riffle (mm)
77	threshold grain size (mm):

Bankfull Flow

5.3	velocity (ft/s)
177.0	discharge rate (cfs)
0.91	Froude number

Flow Resistance

0.045	Manning's roughness
0.23	D'Arcy-Weisbach fric.
5.7	resistance factor u/u*
2.7	relative roughness

Forces & Power

2.38	channel slope (%)
1.57	shear stress (lb/sq.ft.)
0.90	shear velocity (ft/s)
8.9	unit strm power (lb/ft/s)

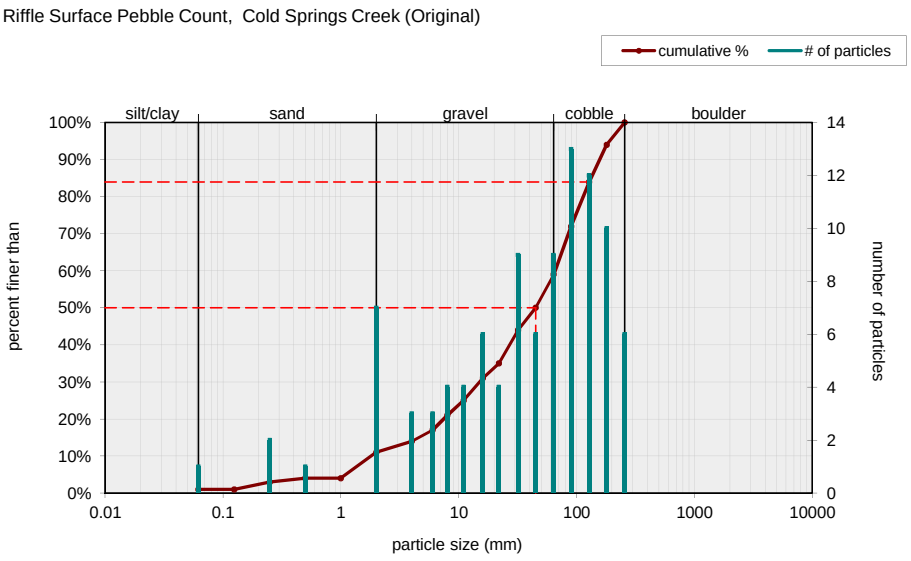
1) Individual Pebble Count

Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	2
medium sand	0.25 - 0.5	1
coarse sand	0.5 - 1	
very coarse sand	1 - 2	7
very fine gravel	2 - 4	3
fine gravel	4 - 6	3
fine gravel	6 - 8	4
medium gravel	8 - 11	4
medium gravel	11 - 16	6
coarse gravel	16 - 22	4
coarse gravel	22 - 32	9
very coarse gravel	32 - 45	6
very coarse gravel	45 - 64	9
small cobble	64 - 90	13
medium cobble	90 - 128	12
large cobble	128 - 180	10
very large cobble	180 - 256	6
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		100
bedrock	----------	1
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		101

Note: Upstream End of Profile



Size (mm)	
D16	5.2
D35	22
D50	45
D65	75
D84	130
D95	190

Size Distribution	
mean	26.0
dispersion	5.8
skewness	-0.20

Type			
silt/clay	1%	bedrock	1%
sand	10%		
gravel	48%		
cobble	41%		
boulder	0%		

2) Weighted Pebble Count

Feature Percent of Reach

Riffle, Pool, Run, Glide

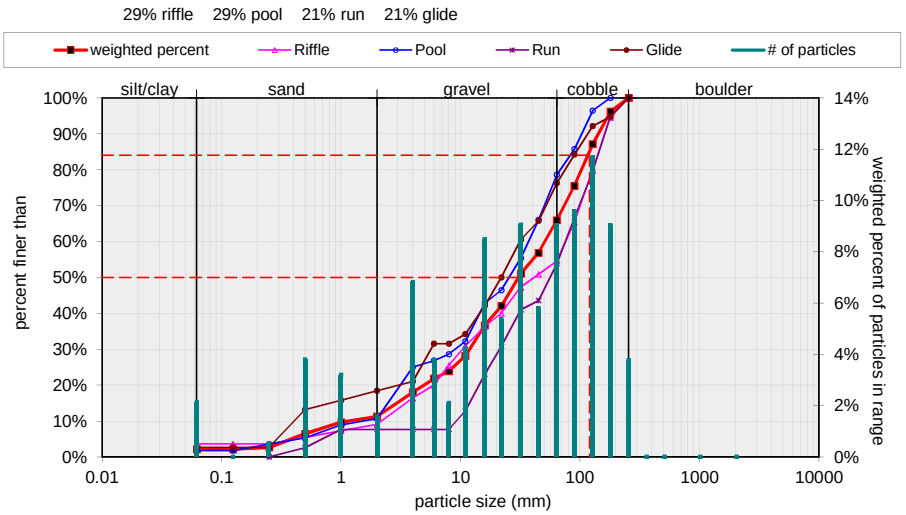
Riffle	29	%	Run	21 %
Pool	29	%	Glide	21 %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	2.1
very fine sand	0.062 - 0.125	0.0
fine sand	0.125 - 0.25	0.5
medium sand	0.25 - 0.5	3.8
coarse sand	0.5 - 1	3.2
very coarse sand	1 - 2	1.6
very fine gravel	2 - 4	6.8
fine gravel	4 - 6	3.8
fine gravel	6 - 8	2.1
medium gravel	8 - 11	4.2
medium gravel	11 - 16	8.5
coarse gravel	16 - 22	5.4
coarse gravel	22 - 32	9.1
very coarse gravel	32 - 45	5.8
very coarse gravel	45 - 64	9.0
small cobble	64 - 90	9.6
medium cobble	90 - 128	11.7
large cobble	128 - 180	9.0
very large cobble	180 - 256	3.8
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		3.8
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
total weighted count:		103.8

Note:

Weighted pebble count by bed features Cold Springs Creek (Original)



Size (mm)	
D16	3.3
D35	15
D50	31
D65	62
D84	120
D95	170

Size Distribution	
mean	19.9
dispersion	6.6
skewness	-0.15

Type			
silt/clay	2%	bedrock	4%
sand	9%		
gravel	53%		
cobble	33%		
boulder	0%		

Photo No. 1

Cold Springs Reach 1 facing upstream 11/2/2011

Photo No. 2

Cold Springs Reach 1 facing upstream 11/2/2011

Photo No. 3

Cold Springs Reach 1 facing downstream 11/2/2011

Photo No. 4

Cold Springs Reach 1 facing downstream 11/2/2011

Photo No.5

Cold Springs Reach 2 facing downstream @ Sta 14+00 1/17/2012

Photo No. 6

Cold Springs Reach 2 facing upstream @ Sta 14+25 1/17/2012

Photo No. 7

Cold Springs Reach 2 facing upstream @ Sta 14+50 1/17/2012

Photo No. 8

Cold Springs Reach 2 facing upstream @ Sta 14+75 1/17/2012

Photo No. 9

Cold Springs Reach 3 facing upstream 10/25/2007

Photo No. 10

Cold Springs Reach 3 facing downstream 10/25/2007

APPENDIX C5

Soils Report

Burningtown Creek Mitigation Project

Macon County, North Carolina

2012 Hydric Soil Assessment

Prepared for
Environmental Banc and Exchange, LLC
909 Capability Drive, Suite 3100
Raleigh, NC 27606

Prepared by
WK Dickson and Co., Inc.
720 Corporate Center Drive
Raleigh, NC 27607
(919) 782-0495

George Lankford, NC LSS # 1223

March 2012

Soil Scientist Seal

This report describes the results of this soil evaluation. Any subsequent transfer of the report by the user shall be made by transferring the complete report, including cover page, figures, maps, appendices, all attachments and disclaimers.

1.0 Introduction

1.1 Project Description

The Burningtown Creek Stream and Wetland Mitigation Project is in Macon County, North Carolina. The site is approximately 6.25 miles northwest of Franklin. The site is approximately 8 acres located immediately south of Upper Burningtown Road (SR 1392) along Watson Road (SR 1480). The project area was assessed for the presence of hydric soil and hydric soil indicators. The project site is located along the floodplain of an Unnamed Tributary to Burningtown Creek (UT). The dominant land use is grazing and abandoned farmland. Evidence of drainage is present as ditches and a subsurface drainage network. The subsurface drainage network of natural soil fissures/crack, drain tile, and channels was observed along the incised stream banks and was primarily visible within the downstream portion.

This report describes the results of this soil evaluation. Any subsequent transfer of the report by the user shall be made by transferring the complete report, including figures, maps, appendices, all attachments and disclaimers. The standard of this report follows Standard of Practice based on the standard Draft CSSC A-0002-01. During the site evaluation soil borings were taken throughout the identified areas.

1.2 General Watershed Information

The Unnamed Tributary is divided by Upper Burningtown Road and flows north. The upstream portion has numerous agricultural ditches and swales on the project property that were constructed to route water off the site and increase drainage. The downstream portion is abandoned farmland containing primarily herbaceous vegetation. Beaver activities have impacted the site to varying degrees with old beaver runs visible in places. Shallow natural cavities have formed beneath the upper soil layer that transmits flows directly into the channel.

2.0 Site Soils

2.1 NRCS Soil Survey

The property is located within the Evard-Cowee-Saunook soil association. This association is found on sloping to steep well drained uplands soil. Within the low mountains, numerous drainage ways join to form creeks where streams flow, winding through bowl and finger shaped coves with narrow to moderately wide floodplains. Soils on the floodplains are mapped by the NRCS as Nikwasi, and Reddies soils and are frequently flooded. Nikwasi soil is listed on the NRCS hydric soil list and Reddies is listed as having hydric inclusions. The surrounding upland soils are mapped as Evard-Cowee complex, 8 to 15 percent slopes and Saunook loam, 8 to 15 percent slopes.

2.2 On-Site Soil Investigation

A series of soil borings were performed that verify the presence and extent of hydric soil along the floodplain. The NRCS guide for identifying and delineating hydric soils Field Indicators of Hydric Soils in the United States (Version 7.0) was used. Indicators valid for the, Land Resource Region N (East and Central Farming and Forest Region) were used. Using criteria based on observed field indicators, topography, landscape position, and professional judgment, soils across the project area were classified as hydric soils or non- hydric soil.

Hydric soil indicators develop over time in saturated conditions. The characteristics are formed in an anaerobic environment predominantly by the accumulation or loss of iron, manganese, sulfur, or carbon compounds (organic matter). These indicators remain long after saturated

conditions have been removed. A boundary depicting areas containing hydric soil was determined (Exhibit 1).

The hydric soils at this site typically have a surface layer 4 to 10 inches thick of dark or very dark brown clay loam or silt loam, often with distinct or prominent and common dark yellowish brown mottles. This is underlain by a distinct black horizon, often with distinct and common brown or reddish brown mottles. The black horizon typically has high organic matter content and near mucky texture. This black horizon is most likely a buried A horizon. Surface texture varies from sandy loam to loam. Subsurface textures rang from mucky loams and silt loams to clay loam and sandy clay loam. The soil borings document the presence of hydric soil indicators within 12 inches of the soil surface across much of the floodplain within the project area. Soil boring logs are attached. Most of the soils located within the floodplain have similar characteristics to Nikwasi soils, but appear to have a layer of over wash. The boring descriptions do not contain adequate detail to classify these soils as Nikwasi or Reddies soils.

Soil profiles were evaluated for morphologic characteristics and divided into three mapping units for the site. These map units are;

- Soils having hydric indicators within 12 inches;
- Soils having hydric indicator between 12 inches and 18 inches;
- Soils lacking hydric indicators.

An area of 7.02 acres was identified as having hydric characteristics within 12 inches and 2.54 acres was identified with hydric characteristics between 12 and 16 inches. These hydric indicators are likely relict due to the observed drainage efforts across the site. The boundary along the toe of slope follows a distinct topographic break in the upstream portion and in much of the downstream portion. The boundary along the channel is more defined by the change in depth to a buried A horizon. .

The origin of the surface horizon lacking sufficient hydric indicators varies across the site. It can be assumed a combination of man made and natural events created this accumulation. Along the existing channel, dredging to enhance drainage, breached beaver impoundments, and removal of accumulated sediment would have resulted in accumulation near the channel. Sediments and side casting of channel sediment would likely be a material that similar to the surface material observed over much of the site. Excavation of field ditches has created areas of fill. Other sources may have originated from road construction and upland erosion from the surrounding steep slopes. The presence of rip-rap near the roadway at the head of a field ditch indicate efforts to create access to this field. Heavy upland erosion was likely after clearing to create pasture. Areas of active erosion are still evident upslope. Unknown mining activities are shown on the USGS map upslope to the east of the project area. The exact source and age of these alluvial soils is unknown and variable.

3.0 Conclusion

Hydric soil is present across much of the floodplain of the Burning Town Creek Site. In some areas, the hydric soil is buried below 12 inches due to a combination of natural and manmade deposition. A combination of flood deposition, upslope erosion, road impacts, and initial land clearing/agricultural practices have resulted in overlying non hydric layer.

Hydric Soil	Area (acres)	
A	0.31	
B	3.12	
C	0.40	
D	2.62	
E	0.45	
F	0.12	
Total Hydric Soil Acreage:	7.02	
Buried Hydric Soil Acreage:	Section I	1.23
	Section II	1.31
Total Hydric and Buried:	9.56	

A
SB 5
F
E
SB 6
BP 3
SB 7
C
D
BP 2
BP 1
I
II
SB 4
II
SB 3
II
SB 1
B
SB 2

LICENSED SOIL SCIENTIST
George E. Lankford
1223
STATE OF NORTH CAROLINA

Soil Scientist's Seal

- Soil Profile Points
- Soil Borings
- Buried Hydric Soil (12-16")
- Hydric Soil Boundaries

0 300 600 Feet

1 inch = 200 feet

N W E S

Exhibit 1. Hydric Soil Boundary Burningtown Creek Site

WK DICKSON
community infrastructure consultants

Burningtown Creek Site Photo Log
Macon County, NC

Profile BP-1

Profile BP-3

Profile BP-2

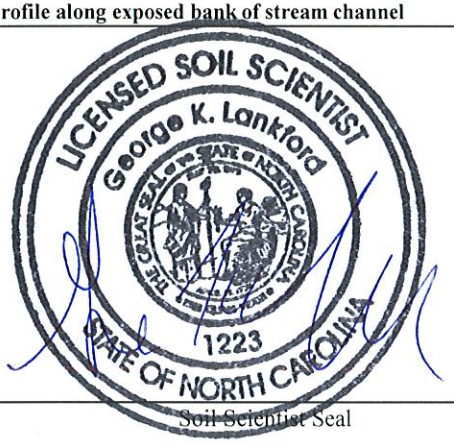
Burningtown Creek Site
Soil Profiles

Boring No.	From Depth	To Depth	Matrix	Mottle	Mottle Description	Texture	Hydric Indicator
SB 1	0	4	10YR 3/3			Silt Loam	
	4	8	7.5YR 3/3			Silt Loam	
	8	16	7.5YR 3/4	7.5YR 4/6	4 %, pore lining	Silt Loam	TF2?
	16	24	7.5YR 2.5/1	7.5YR 4/6	4 %, pore lining	mucky Silt Loam	A7 mucky mineral (buried)
SB 2	0	3	2.5Y 3/2			Loam	
	3	8	10YR 3/2	10YR 3/6	10 %, pore lining/matrix/nodules	Silt Loam	F 12 Iron-Manganese Masses
	8	18	10YR 2/1			mucky Silt Loam	A7 mucky mineral
SB 3	0	2	2.5YR 4/3	7.5YR 3/4	10 %, pore lining	Loam	
	2	10	2.5YR 4/2	7.5YR 3/4	25 %, pore lining/matrix/nodules	Loam	A11 Depleted Below Dark Surface
	10	19	7.5YR 2.5/1	7.5YR 4/6	10 %, pore lining	Silt Loam (high OM content)	
SB 4	0	7	2.5Y 3/2	10YR 3/4	3 %, pore lining	Loam	
	7	14	2.5Y 4/1	7.5YR 4/6	5 %, pore lining	Silt Loam	F 12 Iron-Manganese Masses F3 Depleted Matrix
	14	19	2.5Y 4/2	7.5YR 4/6	5 %, pore lining	Silt Loam	F3 Depleted Matrix
SB 5	0	3	10YR 2/2			Silt Loam	
	3	9	10YR 3/2	10YR 3/6	5 %, pore lining	Loam	
	9	19	10YR 2/1	10YR 3/6	2 %, pore lining	mucky Clay Loam	A7 mucky mineral
SB 6	0	2	7.5YR 2.5/2	7.5YR 4/6	5 %, pore lining	Loam	
	2	8	5YR 4/6			Loam	
	8	25	N 2.5/-	5YR 3/4	2 %, pore lining	mucky Silt Loam	A7 mucky mineral
SB 7	0	6	7.5YR 3/3			Loam	
	6	11	7.5YR 3/1	10YR 3/3 7.5YR 4/4	5 %, pore lining/matrix 4 %, pore lining	Silt Loam	A5 Stratified Layers
	11	18	10YR 4/3	7.5YR 4/4	5 %, pore lining	Sandy Clay Loam	
	18	22	10YR 5/2	10YR 5/6	20 %, pore lining/matrix	Clay Loam	F3 Depleted Matrix
BP 1	0	12	10YR 3/3			Loam	
	12	24	N 2.5/-			mucky Silt Loam	A7 mucky mineral F2 Loamy Geyed matrix
	24	27	10YR 2/1			Silt Loam	
BP 2	0	10	7.5YR 3/3			Loam	
	10	20	N 2.5/-			mucky Silt Loam	A7 mucky mineral F2 Loamy Geyed matrix
	20	23	7.5YR 2.5/2	7.5YR 4/3	20 %, pore lining/matrix	Silt Loam	

Burningtown Creek Site
Soil Profiles

Boring No.	From Depth	To Depth	Matrix	Mottle	Mottle Description	Texture	Hydric Indicator
BP 3	0	8	7.5YR 3/4			Loam	
	8	24	7.5YR 2.5/1	7.5YR 3/1	25 %, pore lining/matrix	Silt Loam	
	24	29	7.5YR 4/1	7.5YR 4/6	15 %, pore lining/matrix	Silty Clay Loam	

Borings Collected on March 26-28, 2012
SB = auger boring profiles
BP = profile along exposed bank of stream channel



Soil Scientist Seal

This is an attachment to a report that describes the results of this soil evaluation. Any subsequent transfer of the report by the user shall be made by transferring the complete report, including cover page, figures, maps, appendices, all attachments and disclaimers.

APPENDIX D
PROJECT PLAN SHEETS (11”x17”)

NC EEP PROJECT #95720

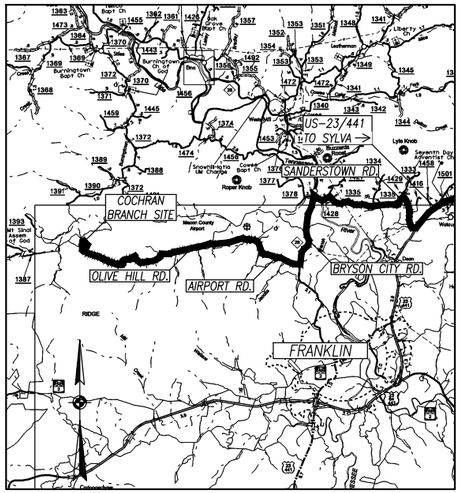
ENVIRONMENTAL BANC AND EXCHANGE

STATE	EEP PROJECT NO.	SHEET NO.	TOTAL SHEETS
NC	95720	1	15

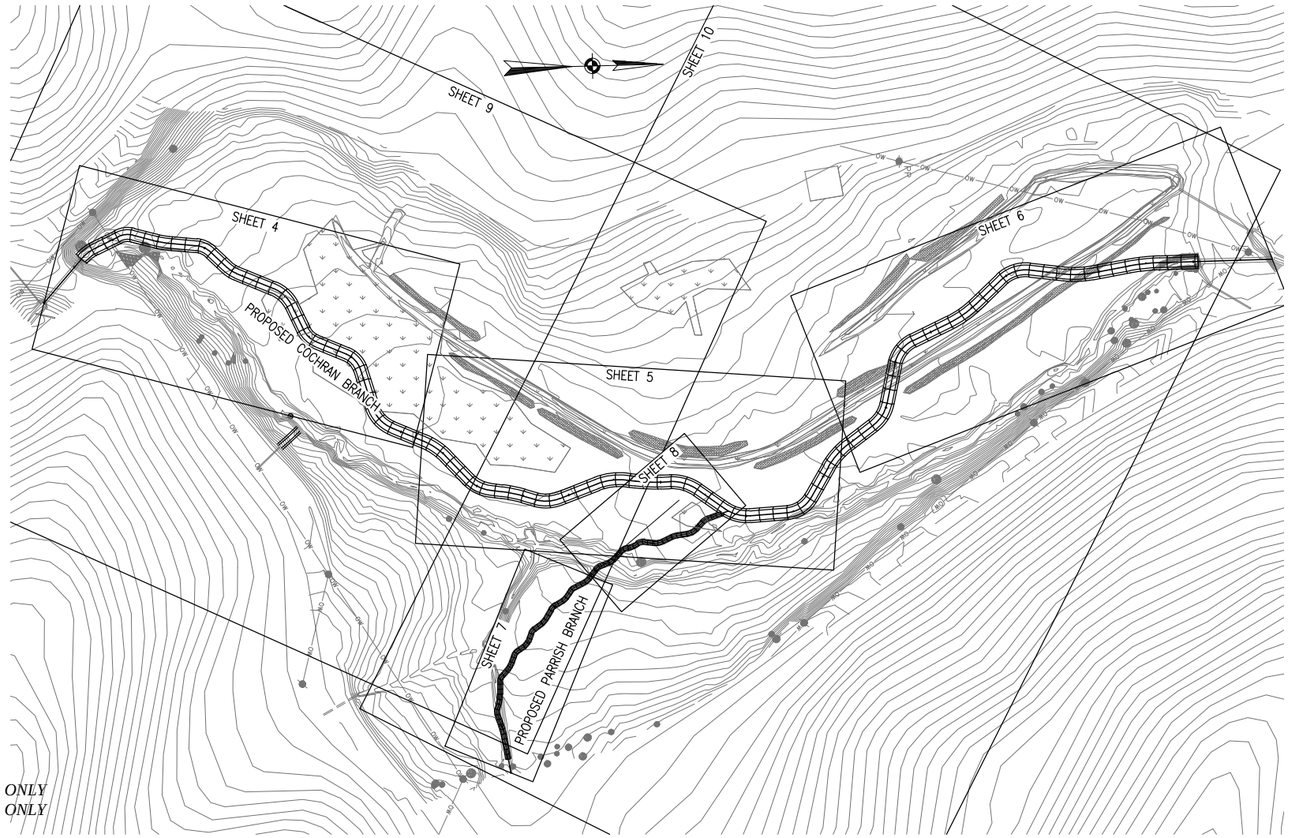
A	PRELIMINARY PLANS	25 JUNE 2014
STR.	DESCRIPTION	DATE
REVISIONS		

COCHRAN BRANCH
STREAM RESTORATION PROJECT

COCHRAN BRANCH
MACON COUNTY, NORTH CAROLINA



VICINITY MAP
NOT TO SCALE



SHEET INDEX

PRELIMINARY PLANS

GRAPHIC SCALES (SCALE IN FEET)

20 0 20 60
PLAN & HORIZONTAL PROFILE – SHEETS 4–6

10 0 10 30
PLAN & HORIZONTAL PROFILE – SHEETS 7–8

30 0 30 90
WETLAND GRADING PLAN – SHEETS 9–10

2 0 2 6
VERTICAL PROFILE – SHEETS 4–6

1 0 1 3
VERTICAL PROFILE – SHEETS 7–8

PROJECT LENGTHS

PROPOSED RESTORATION:

COCHRAN BRANCH	= 1,387 FT
PARRISH BRANCH	= 396 FT
TOTAL LENGTH	= 1,783 FT
WETLAND RE-ESTABLISHMENT	= 3.42 AC
WETLAND REHABILITATION	= 0.82 AC
WETLAND ENHANCEMENT	= 0.11 AC

Prepared by:

Wolf Creek Engineering, Pllc
License No. P-0417
12½ Wall St., Suite C
Asheville, North Carolina 28801
Phone: 828-449-1930
www.wolfcreekeng.com

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

PROJECT ENGINEER

Prepared for:

Aaron Speaks
PROJECT MANAGER

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
12 1/2 Wall St., Suite C Asheville, NC 28801
PHONE: (828) 449-1930 WWW.WOLFCREEKENG.COM

PROJECT	COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER	ENVIRONMENTAL BANC & EXCHANGE
TITLE	SITE PLAN

SCALE AS NOTED	DRWN. BY CME	PROJECT NO. 1059	SHEET NUMBER 1A
DATE 25 JUNE 2014	CHKD. BY SGG		

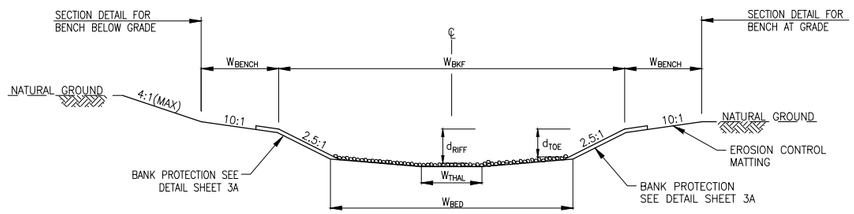
DATE	BY	REV.	DESCRIPTION

LOCATION KEY

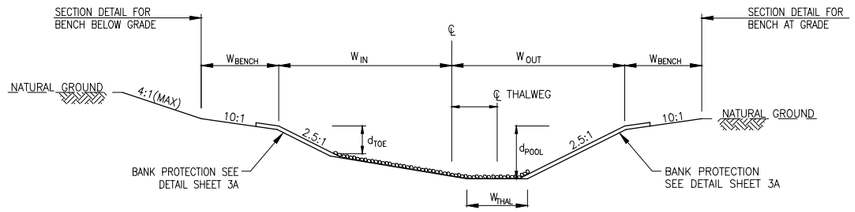
OLIVE HILL ROAD
PROPOSED CONSERVATION EASEMENT BOUNDARY
EXISTING 48" CMP TO REMAIN
PROPOSED COCHRAN BRANCH REACH 1A
PROPOSED COCHRAN BRANCH REACH 1B
PROPOSED CONSERVATION EASEMENT BOUNDARY
EXISTING OVERHEAD UTILITY (TO BE RELOCATED)
EXISTING WETLAND A
MIDDLE BURNINGTOWN ROAD
EXISTING 15" CMP TO REMAIN
EXISTING 60" CMP TO REMAIN
EXISTING 16" CMP TO REMAIN
EXISTING WETLAND D
PROPOSED WETLAND AREA 2
EXISTING WETLAND C
PROPOSED RIPRAP BASIN
PROPOSED 4-FT BASE DITCH WITH CLASS B STONE
EXISTING WETLAND B
WATSON ROAD
EXISTING 18" CMP TO REMAIN
PROPOSED WETLAND AREA 1
EXISTING WETLAND E
PROPOSED PARRISH BRANCH REACH 1
PROPOSED WETLAND AREA 3
EXISTING 15" CMP TO REMAIN
WATSON ROAD

LEGEND
- PROPOSED STREAM RESTORATION
- PROPOSED WETLAND RE-ESTABLISHMENT
- PROPOSED WETLAND REHABILITATION
- PROPOSED WETLAND ENHANCEMENT

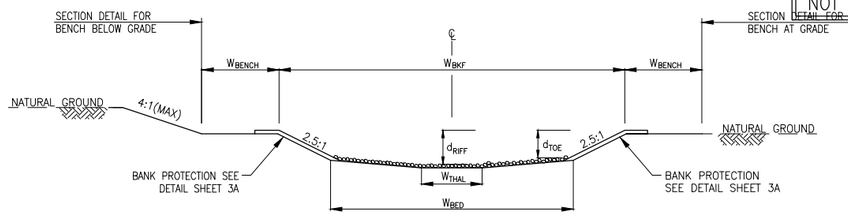
50 0 50 150
SCALE IN FEET



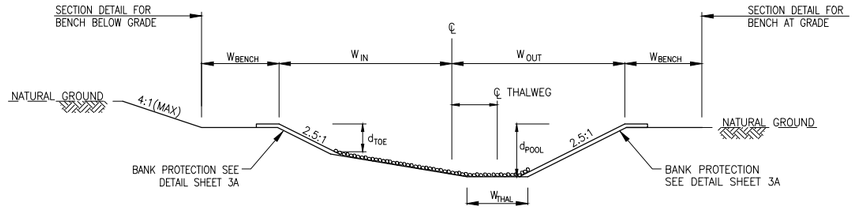
SECTION 1
TYPICAL RIFFLE
NOT TO SCALE



SECTION 1
TYPICAL POOL
NOT TO SCALE



SECTION 2
TYPICAL RIFFLE
NOT TO SCALE



SECTION 2
TYPICAL POOL
NOT TO SCALE

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

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ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
12 1/2 Wall St., Suite C Asheville, NC 28801
PHONE: (828) 449-1930 WWW.WOLFCREEKENG.COM

PROJECT COCHRAN BRANCH STREAM RESTORATION
OWNER ENVIRONMENTAL BANC & EXCHANGE
TITLE TYPICAL SECTIONS

SCALE	DWN. BY	PROJECT NO.	DRAWING NUMBER
AS NOTED	CME	1059	2
DATE 25 JUNE 2014	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION

GENERAL NOTES:
1. CONTRACTOR SHALL PERFORM ALL NECESSARY SUBSURFACE UTILITY INVESTIGATIONS PRIOR TO COMMENCING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFICATION OF EXISTING CONDITIONS, OBSTRUCTIONS, AND UTILITIES WHICH MAY AFFECT PROPOSED WORK. CONSTRUCTION SHALL BEGIN AT THE UPSTREAM END OF EACH CHANNEL REACH AND PROCEED DOWNSTREAM UNLESS APPROVED OTHERWISE BY THE ENGINEER.
2. ALL MECHANIZED EQUIPMENT OPERATED IN OR NEAR THE STREAM OR ITS TRIBUTARIES SHALL BE INSPECTED REGULARLY AND MAINTAINED TO PREVENT CONTAMINATION OF STREAM WATERS FROM FUELS, LUBRICANTS, HYDRAULIC FLUIDS, OR OTHER TOXIC MATERIALS.
3. CLEARING AND GRUBBING SHALL BE LIMITED TO THAT WHICH IS NECESSARY FOR CONSTRUCTION OF THE PROPOSED CHANNEL AND SHALL BE APPROVED BY THE ENGINEER.
4. CONTRACTOR IS RESPONSIBLE FOR PROVIDING SAFE INGRESS AND EGRESS FROM SITE FOR ALL VEHICLES INCLUDING, BUT NOT LIMITED TO, TRAFFIC ON ADJACENT PUBLIC ROADS AFFECTED BY CONSTRUCTION TRAFFIC.
5. CONTRACTOR SHALL DISPOSE OF ALL WASTE MATERIALS GENERATED BY CONSTRUCTION ACTIVITIES IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRS TO EXISTING FACILITIES FROM DAMAGES OCCURRING AS A RESULT OF CONSTRUCTION ACTIVITIES.
7. THE INSTALLATION OF EROSION CONTROL MEASURES AND PRACTICES SHALL OCCUR PRIOR TO LAND DISTURBING ACTIVITIES.

TABLE 1: SECTION DIMENSIONS

REACH	TYPICAL SECTION	STATION	RIFFLE DIMENSIONS						POOL DIMENSIONS			
			W_{BKF} (ft)	W_{BED} (ft)	W_{THAL} (ft)	W_{BENCH} (ft)	d_{RIFF} (ft)	d_{TOE} (ft)	W_{IN} (ft)	W_{OUT} (ft)	d_{POOL} (ft)	APPROX. POOL DEPTH (ft)
COCHRAN REACH 1A	1	100+60 TO 102+30	14.7	10.2	3.1	10	1.13	0.90	8.83	7.36	1.69	0.5
COCHRAN REACH 1B	2	102+30 TO 114+50	14.7	10.2	3.1	7	1.13	0.90	8.83	7.36	1.69	0.5
PARRISH REACH 1	1	200+15 TO 203+74	5.4	3.1	0.9	4	0.57	0.46	3.24	2.70	0.85	0.5

NOTE: APPROXIMATE POOL DEPTH IS DEPTH OF POOL RELATIVE TO DOWNSTREAM HEAD OF RIFFLE

TABLE 2A: SUPPLEMENTAL BED MATERIAL (OFF-SITE MATERIAL)

REACH	PERCENT OF TOTAL MIX						DEPTH OF BED MATERIAL (FT)
	ON-SITE SAND / CLAY	1/2" STONE (NO. 57)	3/4" STONE (NO. 5)	2" STONE (SURGE)	6" STONE NCDOT (CLASS A)	12" STONE NCDOT (CLASS B)	
COCHRAN REACH 1A	30%	-	-	70%	-	-	0.4
COCHRAN REACH 1B	50%	-	-	50%	-	-	0.4
PARRISH REACH 1	30%	-	-	70%	-	-	0.4

TABLE 2B: SUPPLEMENTAL BED MATERIAL (WITH HARVESTED GRAVEL)

REACH	PERCENT OF TOTAL MIX						DEPTH OF BED MATERIAL (FT)
	ON-SITE HARVEST MATERIAL	1/2" STONE (NO. 57)	3/4" STONE (NO. 5)	2" STONE (SURGE)	6" STONE NCDOT (CLASS A)	12" STONE NCDOT (CLASS B)	
COCHRAN REACH 1A	70%	-	-	30%	-	-	0.4
COCHRAN REACH 1B	70%	-	-	30%	-	-	0.4
PARRISH REACH 1	70%	-	-	30%	-	-	0.4

TABLE 3: MORPHOLOGIC TABLE

REACH	COCHRAN REACH 1A	COCHRAN REACH 1B	PARRISH REACH 1
STREAM TYPE	B4	C4	B4
DRAINAGE AREA (mi^2)	1.25	1.25	0.10
W_{BKF} (ft)	14.7	14.7	5.4
XS_{BKF} (ft)	12.7	12.7	2.2
d_{MEAN} (ft)	0.9	0.9	0.4
d_{MAX} (ft)	1.1	1.1	0.6
S_{AVG} (ft/ft)	0.035	0.085	0.033
S_{VALLEY} (ft/ft)	0.029	0.007	0.024
W/D RATIO	17.0	17.0	13.4
ENTRENCHMENT RATIO	5.4	11.5	5.6
SINUOSITY	1.05	1.14	1.05
POOL-POOL RATIO	2.7 - 4.6	5 - 7	2.9 - 4.9
MEANDER WIDTH RATIO	1.5	3.2	2.8

SURVEY:
THE COORDINATE SYSTEM IS THE NAD83 NORTH CAROLINA STATE PLANE GRID.

THE VERTICAL DATUM IS NAVD88.

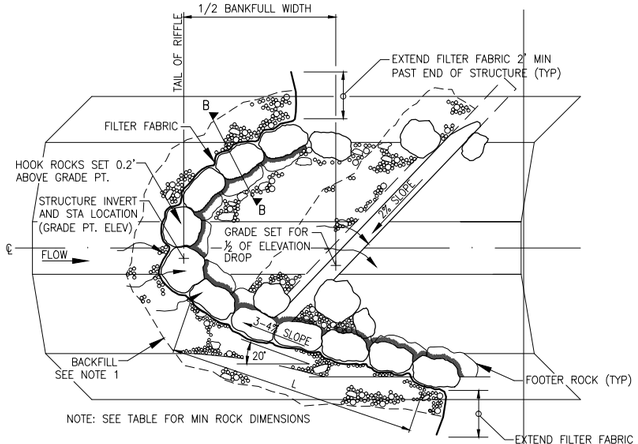
CHANNEL CONSTRUCTION NOTES:
1. BED MATERIAL ON RIFFLE SECTIONS SHALL CONSIST OF BED MATERIAL EXCAVATED FROM EXISTING CHANNEL. WHERE INSUFFICIENT BED MATERIAL IS PRESENT IT SHALL BE SUPPLEMENTED WITH MATERIAL ACCORDING TO TABLE 2 AND AS DIRECTED BY THE ENGINEER.
2. THE CHANNEL BANKS SHALL BE STABILIZED ACCORDING TO THE BANK PROTECTION DETAILS ON SHEET 3A.
3. DIMENSION TOLERANCES SHALL BE AS FOLLOWS:
   WIDTH: +/- 0.5 FT
   DEPTH: +/- 0.2 FT
   RIFFLE ELEVATIONS: +/- 0.1 FT
   POOL ELEVATIONS: + 0.1 FT, - 0.5 FT
   STRUCTURE ELEVATIONS: +/- 0.1 FT
4. EXISTING CHANNEL INDICATED TO BE FILLED ON PLANS SHALL BE BACKFILLED WITH 1-FOOT LIFTS AND COMPACTED TO IN-SITU SOIL DENSITY. CHANNEL SHALL BE FREE FROM BRUSH AND ORGANIC DEBRIS PRIOR TO BACKFILLING.
5. PUMP AROUND OPERATION SHALL BE USED TO DIVERT FLOW DURING CONSTRUCTION WHEN PRACTICAL.

TREE SURVEY/HARVEST/PROTECTION NOTES:
1. WOODY MATERIAL WILL BE HARVESTED ON-SITE FOR USE AS IN-STREAM STRUCTURES FOR STREAMBANK STABILITY, GRADE CONTROL, AND AQUATIC HABITAT ENHANCEMENT/RESTORATION. WOODY MATERIAL INCLUDES BOTH LARGE AND SMALL SIZE DIAMETER TREES INCLUDING STEM AND ROOT MASS. TREES WILL BE HARVESTED FROM UPLAND AREAS AS WELL AS ALONG RECONSTRUCTED STREAM BANKS DURING THE RESTORATION CONSTRUCTION PROCESS.
2. PREFERRED HARVEST TREES TO BE SELECTED FOR RESTORATION PURPOSES SHALL FIRST INCLUDE ALL DISEASED, DAMAGED, HAZARD, AND UNDESIRABLE TREE SPECIES UNTIL THE QUANTITIES NEEDED FOR STREAM RESTORATION ARE MET. AREAS SELECTED FOR HARVEST SHALL OCCUR WITHIN THE LIMITS OF DISTURBANCE AND DELINEATED BY A CERTIFIED ARBORIST OR OTHER PROFESSIONAL ECOLOGIST/BIOLOGIST.
3. ALL WOODY MATERIALS WILL BE STOCKPILED IN THE APPROVED STAGING AND STOCKPILE AREAS.
4. IN ALL AREAS WHERE TREES ARE HARVESTED PROPER BMP AND EROSION AND SEDIMENT CONTROL WILL BE IMPLEMENTED AND THE AREA IMMEDIATELY STABILIZED WITH TEMPORARY AND PERMANENT SEEDING/MULCH AS HARVESTING OCCURS.

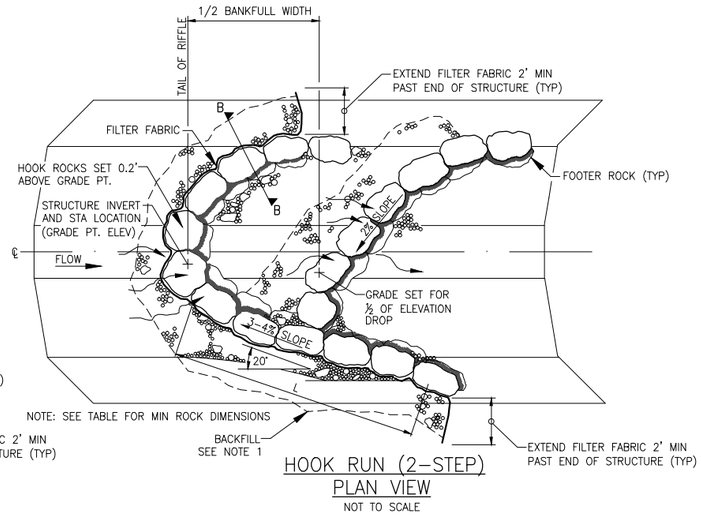
TABLE 4: STRUCTURE DIMENSIONS						
REACH	STRUCTURES		BOULDERS			TOTAL LOG LENGTH (FT)
	L (FT)	X (FT)	LENGTH (FT)	WIDTH (FT)	DEPTH (FT)	
COCHRAN BR REACH 1A	16	5	–	–	–	26
COCHRAN BR REACH 1B	16	5	–	–	–	26
PARRISH BRANCH	5	3	–	–	–	11

NOTE: TOTAL LOG LENGTH INCLUDES THE ROOTBALL

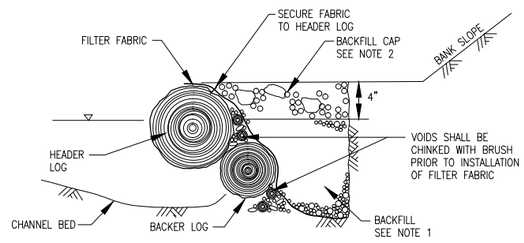
TABLE 5: LOG DIAMETERS		
TOTAL LOG LENGTH (FT)	MIN DIAMETER (IN)	MAX DIAMETER (IN)
< 20	12	18
20–40	18	24
40–60	24	30



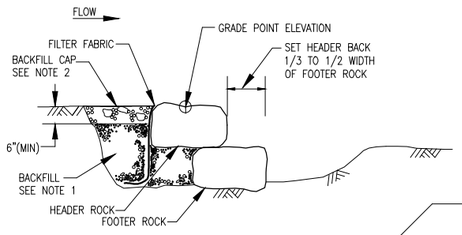
HOOK–LOG RUN (2–STEP)
PLAN VIEW
NOT TO SCALE



HOOK RUN (2–STEP)
PLAN VIEW
NOT TO SCALE



SECTION A–A
NOT TO SCALE



SECTION B–B
NOT TO SCALE

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

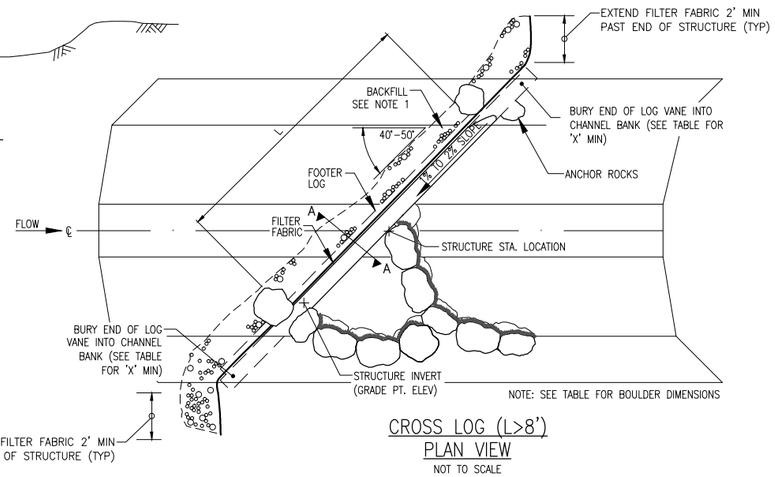
Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
12 1/2 Wall St., Suite C Asheville, NC 28801
PHONE: (828) 449-1930 WWW.WOLFCREEKENG.COM

PROJECT: COCHRAN BRANCH STERAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXHANGE
TITLE: DETAILS

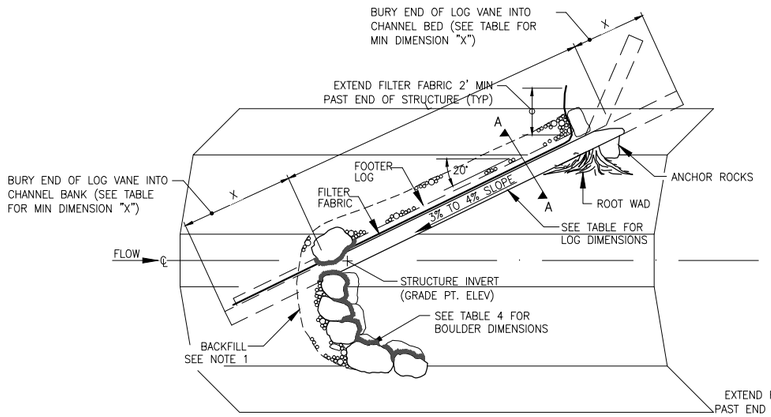
SCALE	AS NOTED	DRWN. BY	CME	PROJECT NO.	DRAWING NUMBER
DATE	25 JUNE 2014	CHKD. BY	SGC	1059	3

DATE	BY	REV.	DESCRIPTION

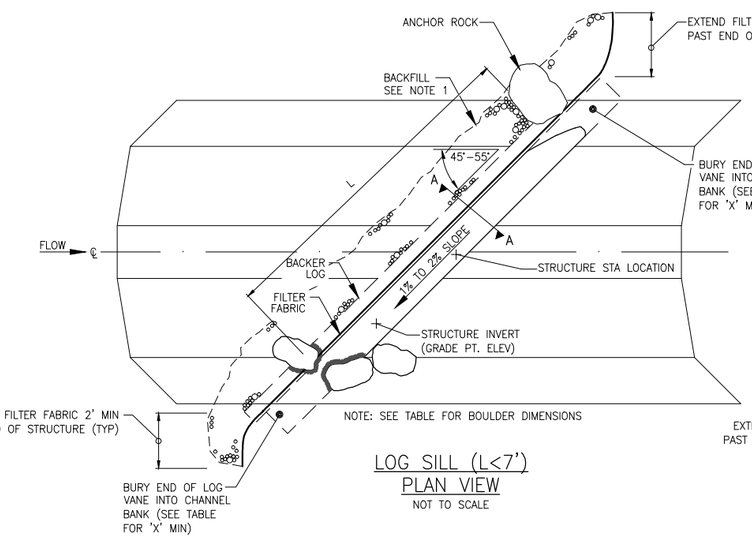
NOTES:
1. STRUCTURE BACKFILL MATERIAL SHALL CONSIST OF ON–SITE SOIL COMPACTED TO IN–SITU DENSITY.
2. STRUCTURE BACKFILL CAP SHALL CONSIST OF 2–4" STONE AND ON–SITE SOIL MIXED IN EQUAL PARTS. MIXTURE CAN BE ACHIEVED BY COMPACTING STONE INTO PLACED SOIL. WHERE ON–SITE STONE/GRAVEL IS AVAILABLE AND OF SUFFICIENT SIZE, IT MAY BE USED IN PLACE OF QUARRY STONE, AS APPROVED BY THE ENGINEER.
3. ALL VOIDS AND GAPS BETWEEN BOULDERS AND LOGS SHALL BE CHINKED WITH STONE PRIOR TO INSTALLATION OF FILTER FABRIC.



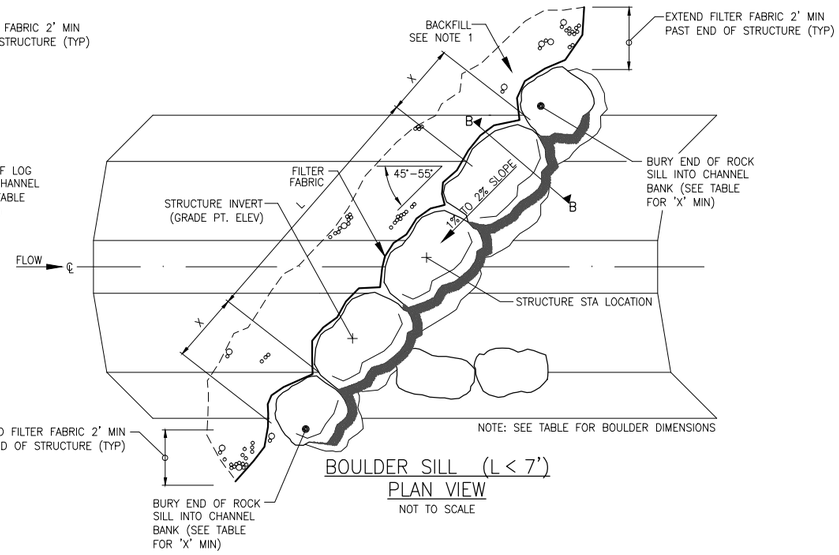
CROSS LOG (L>8')
PLAN VIEW
NOT TO SCALE



LOG VANE W/ HOOK
PLAN VIEW
NOT TO SCALE



LOG SILL (L<7')
PLAN VIEW
NOT TO SCALE



BOULDER SILL (L < 7')
PLAN VIEW
NOT TO SCALE

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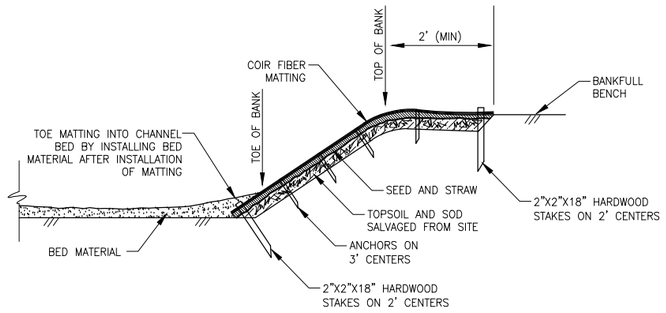
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
12 1/2 Wall St., Suite C Asheville, NC 28801
PHONE: (828) 449-1930 WWW.WOLFCREEKENG.COM

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

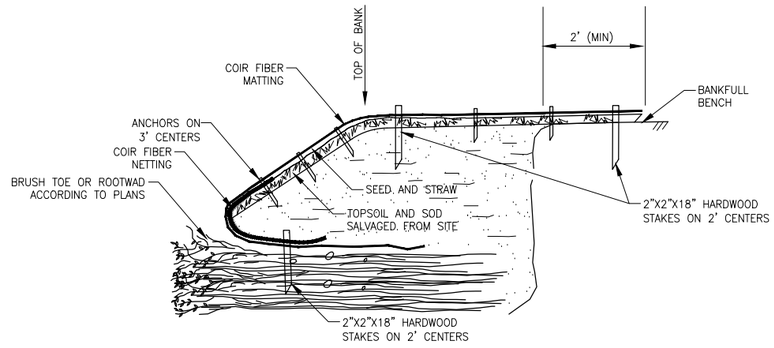
PROJECT: COCHRAN BRANCH STERAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXHANGE
TITLE: **DETAILS**

SCALE	AS NOTED	DWN. BY	CME	PROJECT NO.	DRAWING NUMBER
DATE	25 JUNE 2014	CHKD. BY	SGG	1059	3A

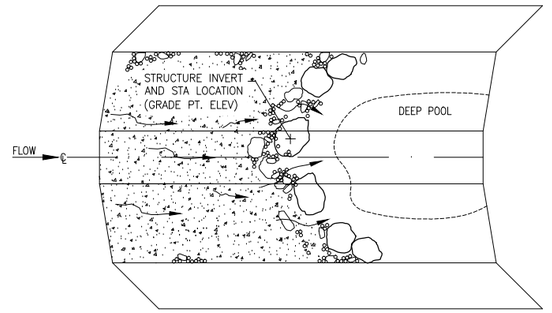
DATE	BY	REV.	DESCRIPTION



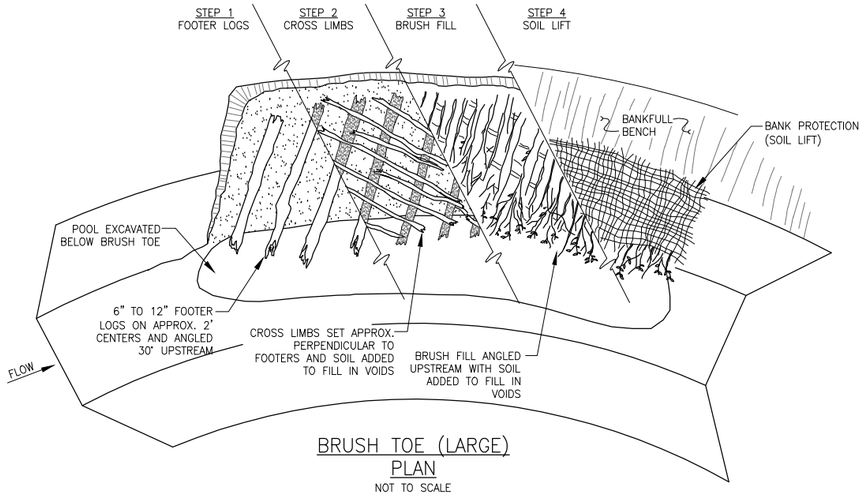
BANK PROTECTION – METHOD 1
SOD AND MAT
NOT TO SCALE



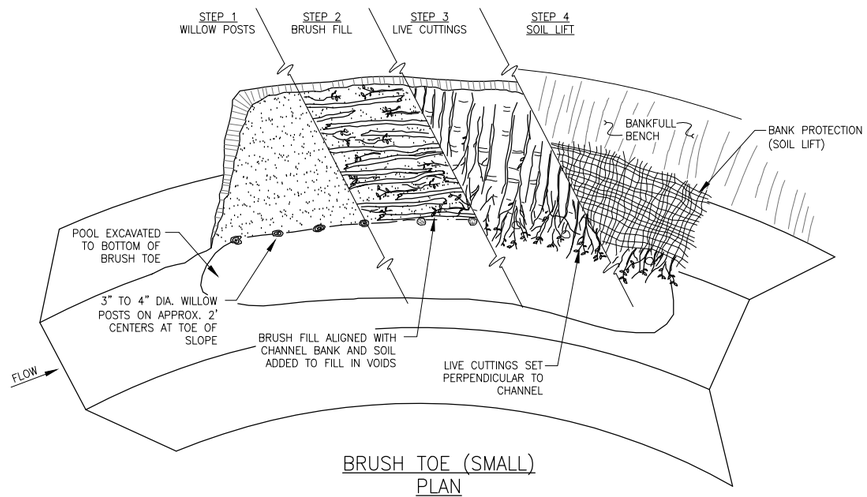
BANK PROTECTION – METHOD 2
SOIL LIFT
NOT TO SCALE



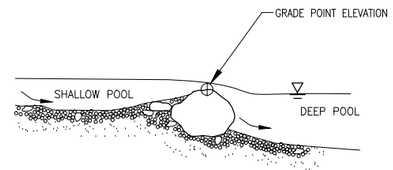
BOULDER SHELF
PLAN VIEW
NOT TO SCALE



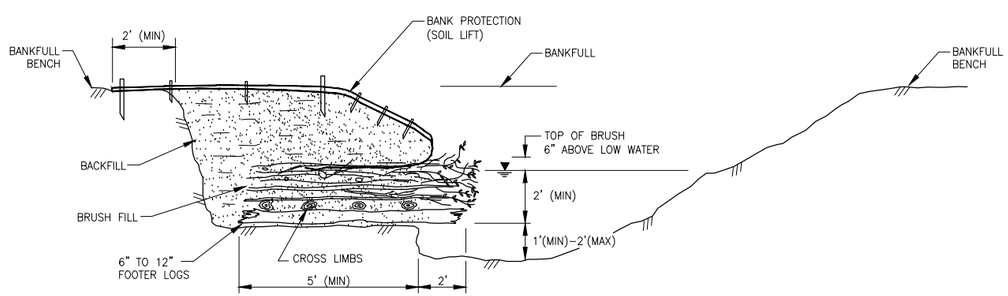
BRUSH TOE (LARGE)
PLAN
NOT TO SCALE



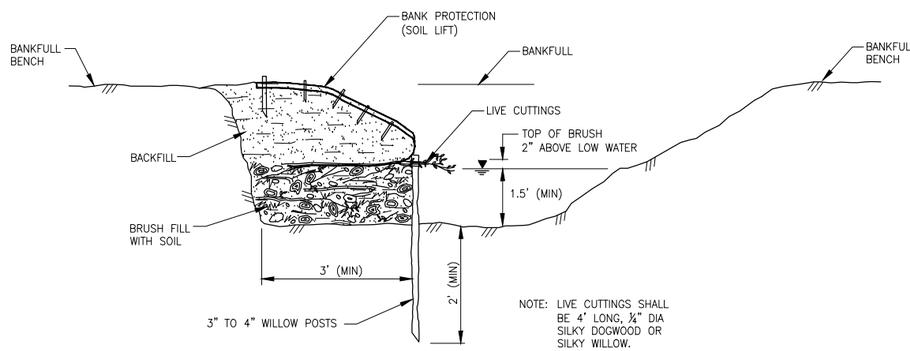
BRUSH TOE (SMALL)
PLAN
NOT TO SCALE



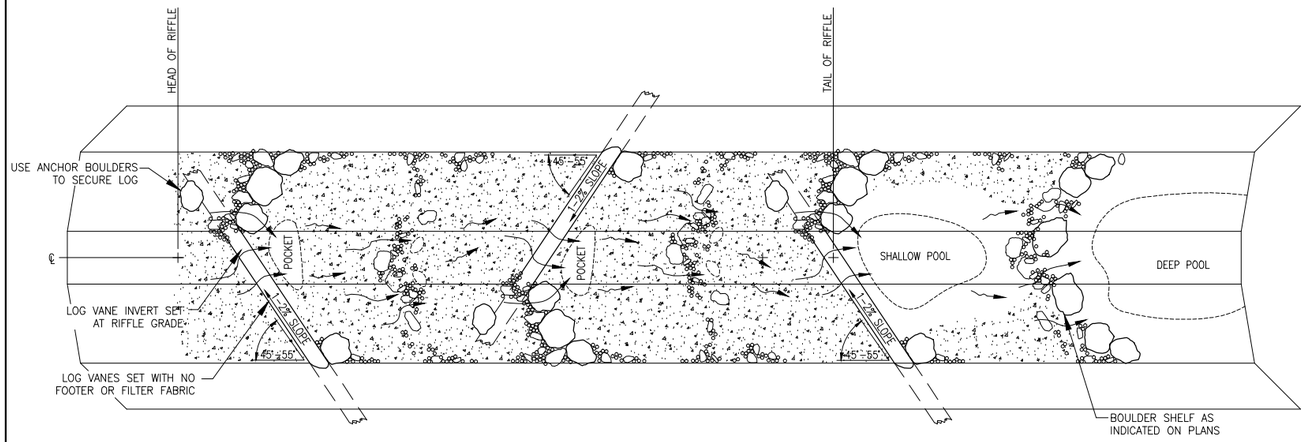
BOULDER SHELF
PROFILE VIEW
NOT TO SCALE



BRUSH TOE (LARGE)
SECTION
NOT TO SCALE

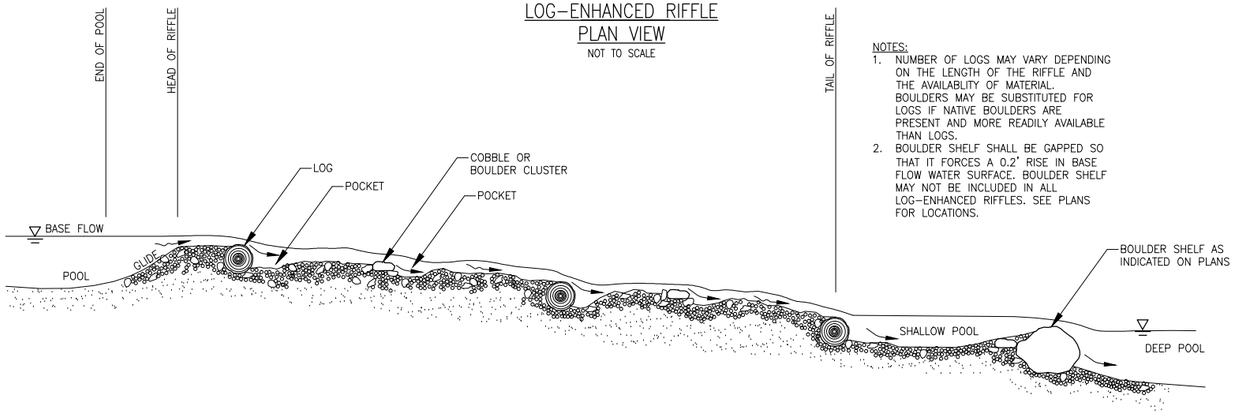


BRUSH TOE (SMALL)
SECTION
NOT TO SCALE



LOG-ENHANCED RIFFLE PLAN VIEW

NOT TO SCALE

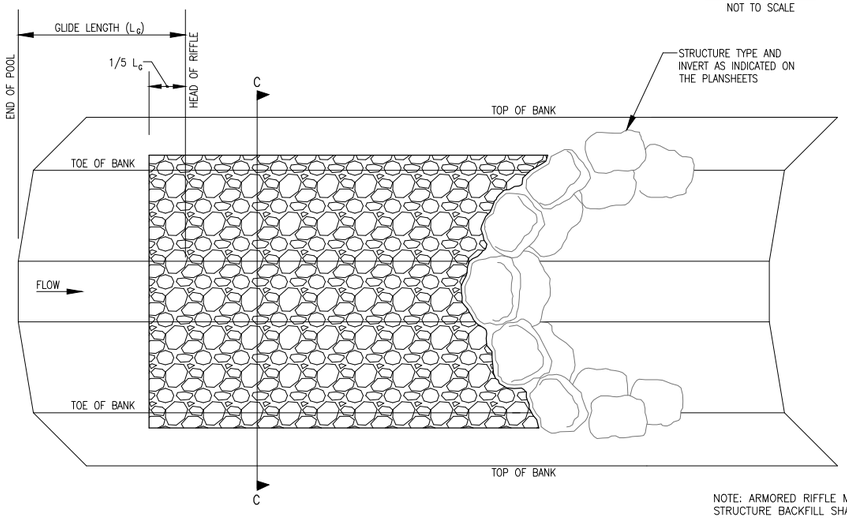


NOTES:

1. NUMBER OF LOGS MAY VARY DEPENDING ON THE LENGTH OF THE RIFFLE AND THE AVAILABLITY OF MATERIAL. BOULDERS MAY BE SUBSTITUTED FOR LOGS IF NATIVE BOULDERS ARE PRESENT AND MORE READILY AVAILABLE THAN LOGS.
2. BOULDER SHELF SHALL BE GAPPED SO THAT IT FORCES A 0.2' RISE IN BASE FLOW WATER SURFACE. BOULDER SHELF MAY NOT BE INCLUDED IN ALL LOG-ENHANCED RIFFLES. SEE PLANS FOR LOCATIONS.

LOG-ENHANCED RIFFLE PROFILE VIEW

NOT TO SCALE

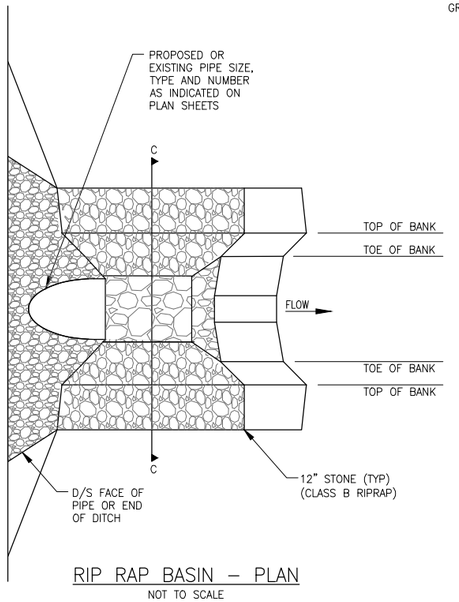


ARMORED RIFFLE DETAIL

NOT TO SCALE

NOTE: ARMORED RIFFLE MATERIAL AND STRUCTURE BACKFILL SHALL BE COMPOSED OF MATERIAL IN THE FOLLOWING PROPORTIONS AS DIRECTED BY THE ENGINEER:

MATERIAL	% BY VOLUME
12" STONE (CLASS B)	60%
6" STONE (CLASS A)	30%
ONSITE SOIL	10%



RIP RAP BASIN – PLAN

NOT TO SCALE

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

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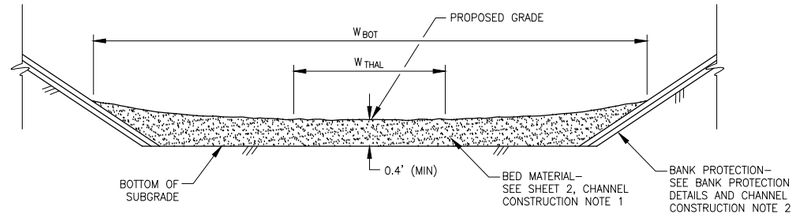
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
12 1/2 Wall St., Suite C Asheville, NC 28801
PHONE: (828) 449-1930 WWW.WOLFCREEKENG.COM

PROJECT	COCHRAN BRANCH STERAM RESTORATION PROJECT
OWNER	ENVIRONMENTAL BANC & EXHANGE
TITLE	DETAILS

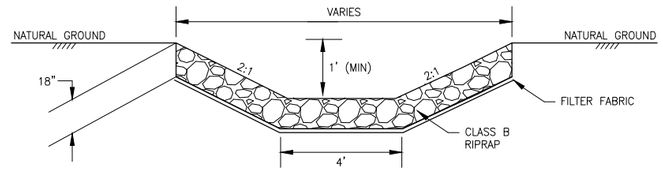
SCALE	AS NOTED	DRWN. BY CME	PROJECT NO. 1059
DATE	25 JUNE 2014	CHKD. BY SGG	DRAWING NUMBER 3B

DATE	BY	REV.	DESCRIPTION



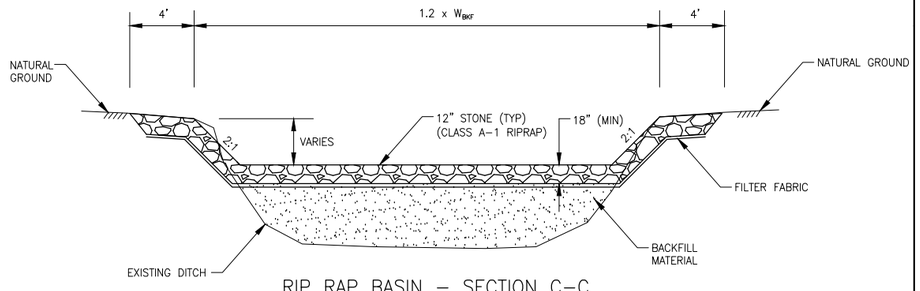
BED MATERIAL DETAIL

NOT TO SCALE



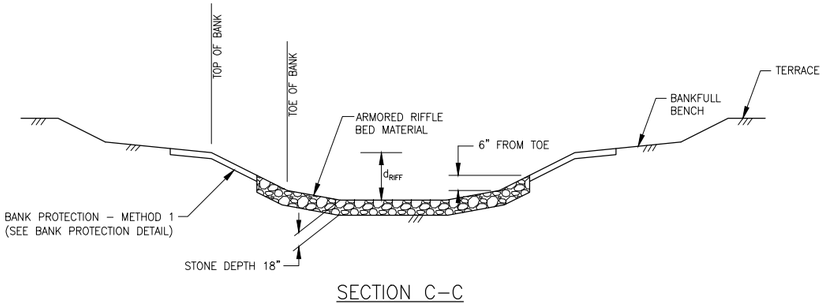
4' BASE DITCH W/ CLASS B RIPRAP

NOT TO SCALE



RIP RAP BASIN – SECTION C-C

NOT TO SCALE



SECTION C-C

NOT TO SCALE

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

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LICENSE NO. P-0417
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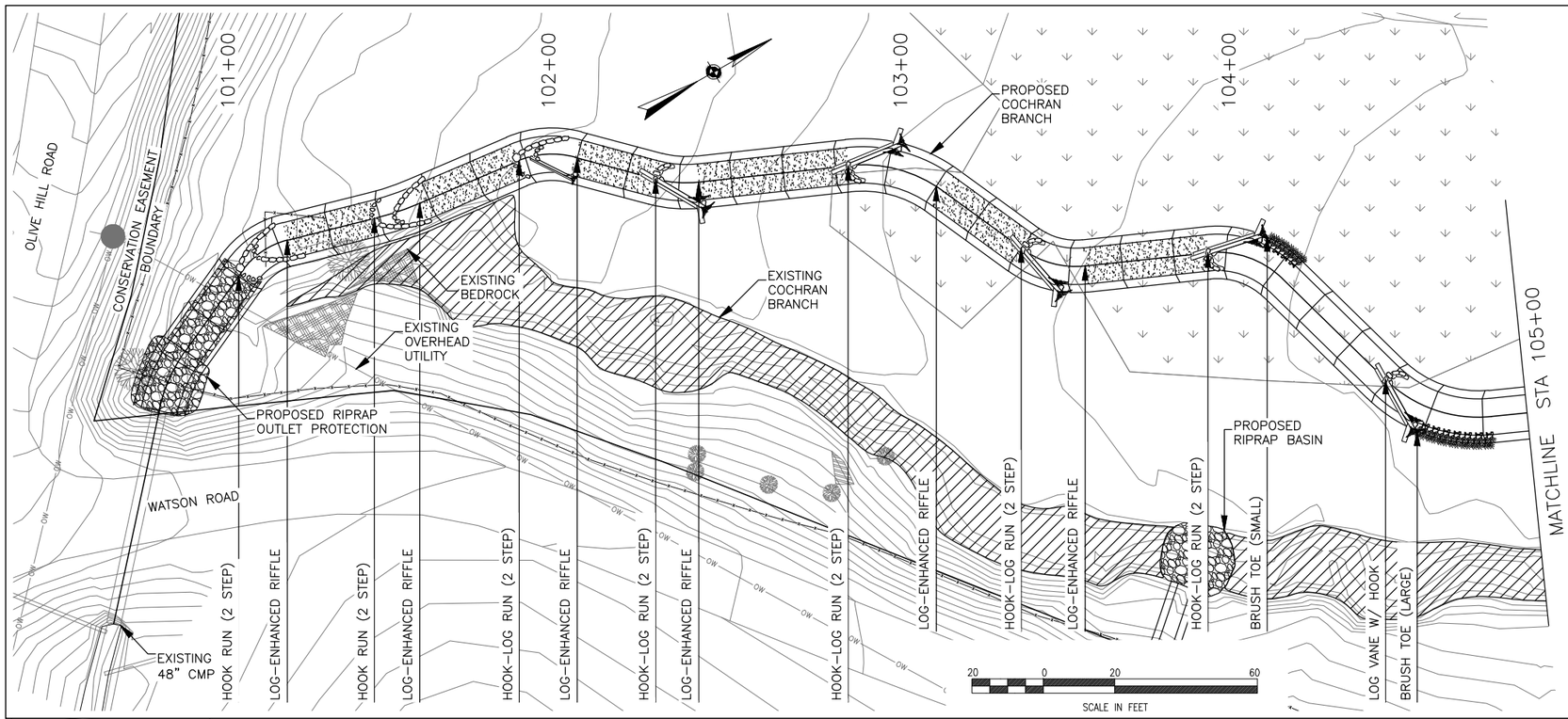
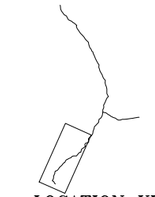
PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANCE
TITLE: PLAN & PROFILE

SCALE	DRWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	CME	1059	4
DATE: 15 APR 2014	CHKD. BY: SGG		

DATE	BY	REV.	DESCRIPTION

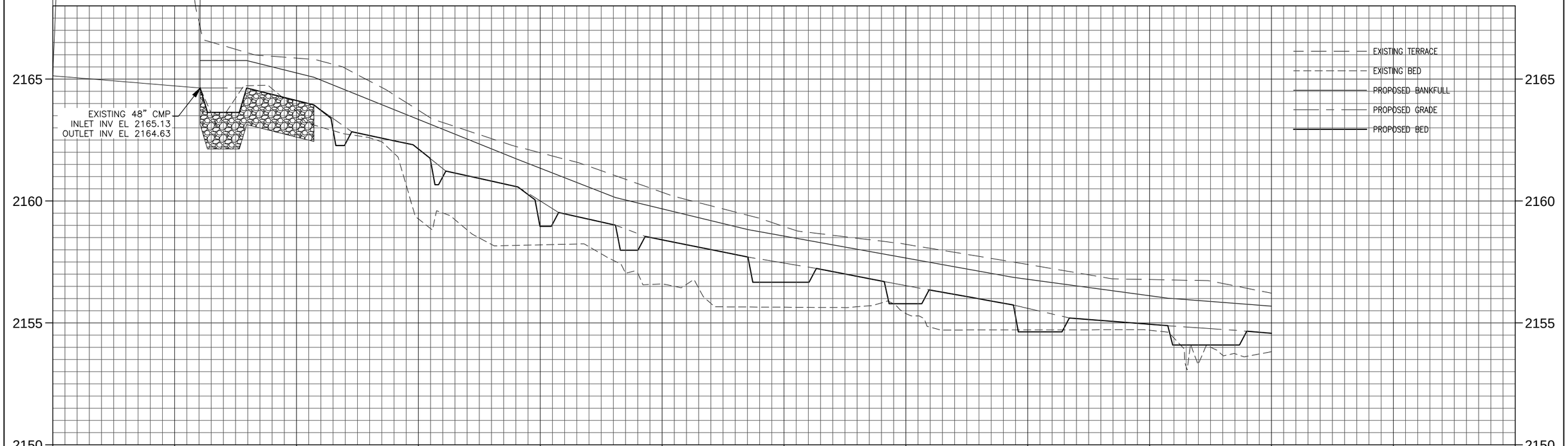


LOCATION KEY



LEGEND

- PROPOSED STREAM RESTORATION
- ARMORED RIFFLE
- EXISTING FENCE
- EXISTING TREE
- EXISTING WETLANDS
- FILL



FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'
HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

COCHRAN BRANCH

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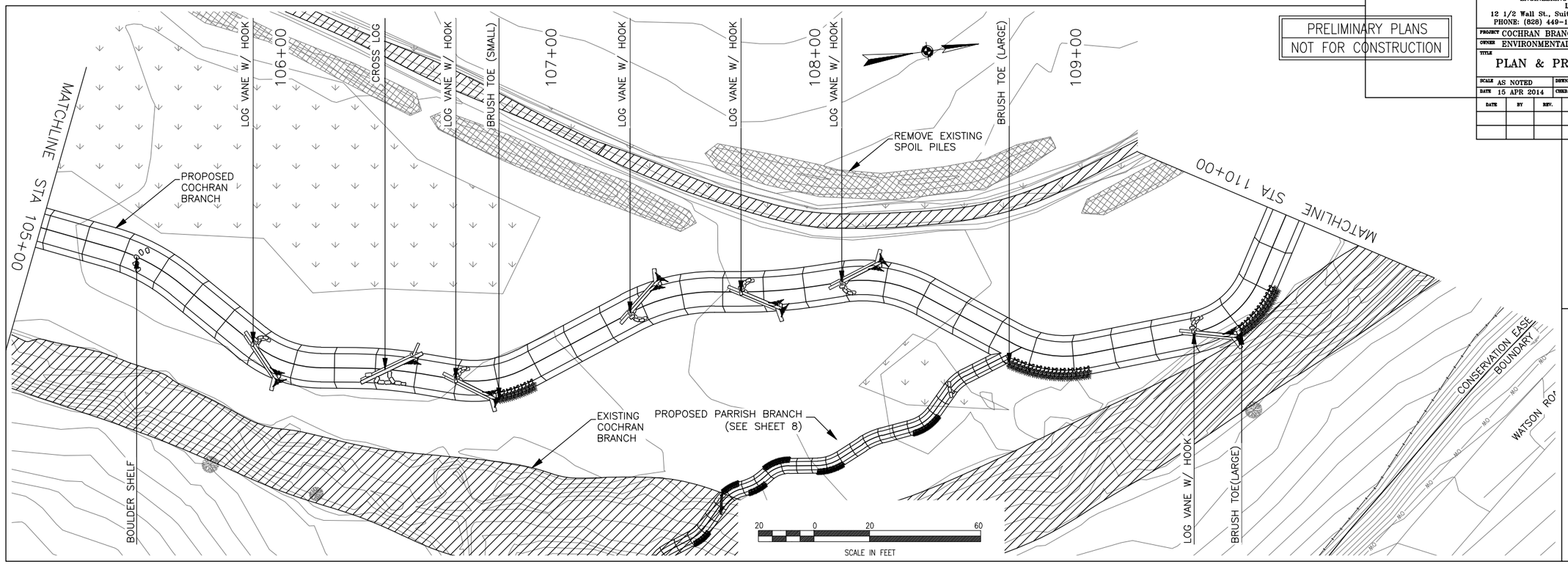
PRELIMINARY PLANS
NOT FOR CONSTRUCTION

PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANGE
TITLE: PLAN & PROFILE

SCALE	AS NOTED	DWN. BY	CME	PROJECT NO.	SHEET NUMBER
DATE	15 APR 2014	CHKD. BY	SGG	1059	5

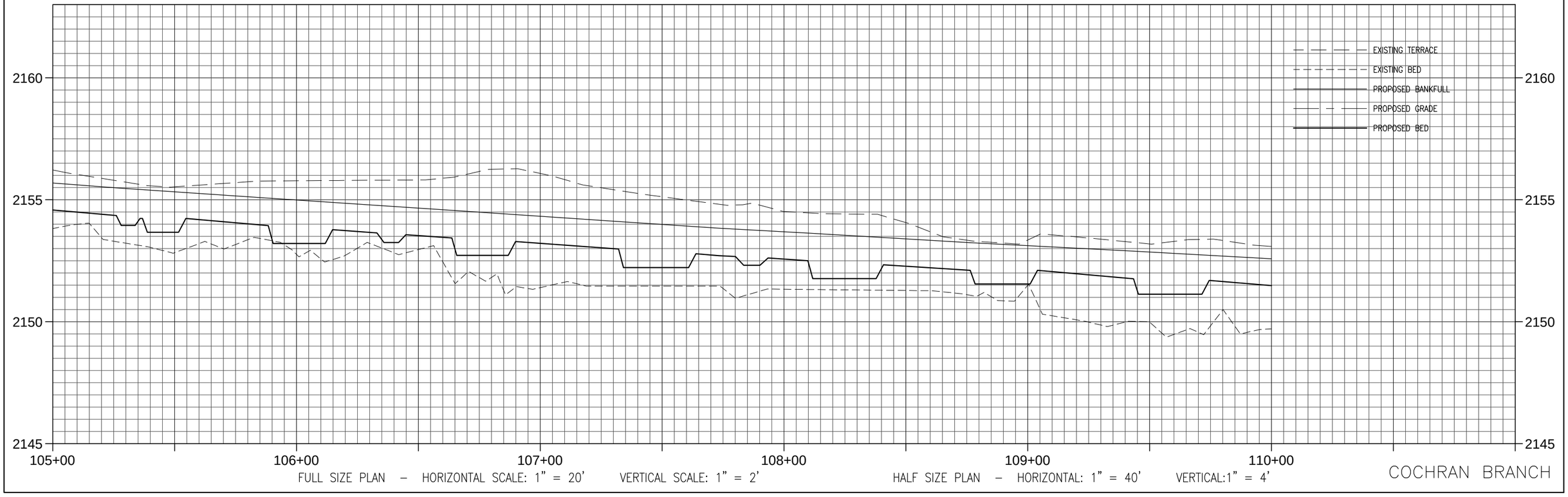
DATE	BY	REV.	DESCRIPTION



LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- ARMORED RIFFLE
- EXISTING FENCE
- EXISTING TREE
- EXISTING WETLANDS
- FILL



FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'
HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

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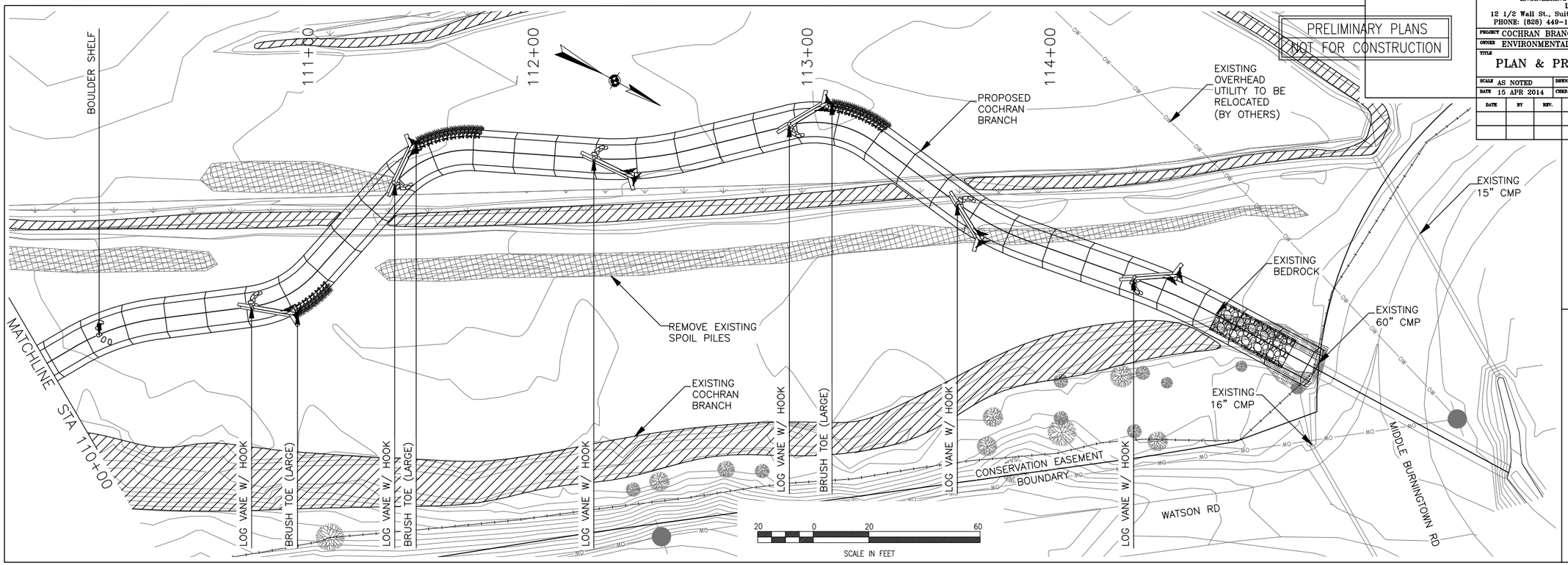
PRELIMINARY PLANS
NOT FOR CONSTRUCTION

PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANGE
TITLE: PLAN & PROFILE

SCALE	DRWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	CME	1059	6
DATE: 15 APR 2014	CHKD. BY: SGG		

DATE	BY	REV.	DESCRIPTION



LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- ARMORED RIFFLE
- EXISTING FENCE
- EXISTING TREE
- EXISTING WETLANDS
- FILL

FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'
HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

COCHRAN BRANCH

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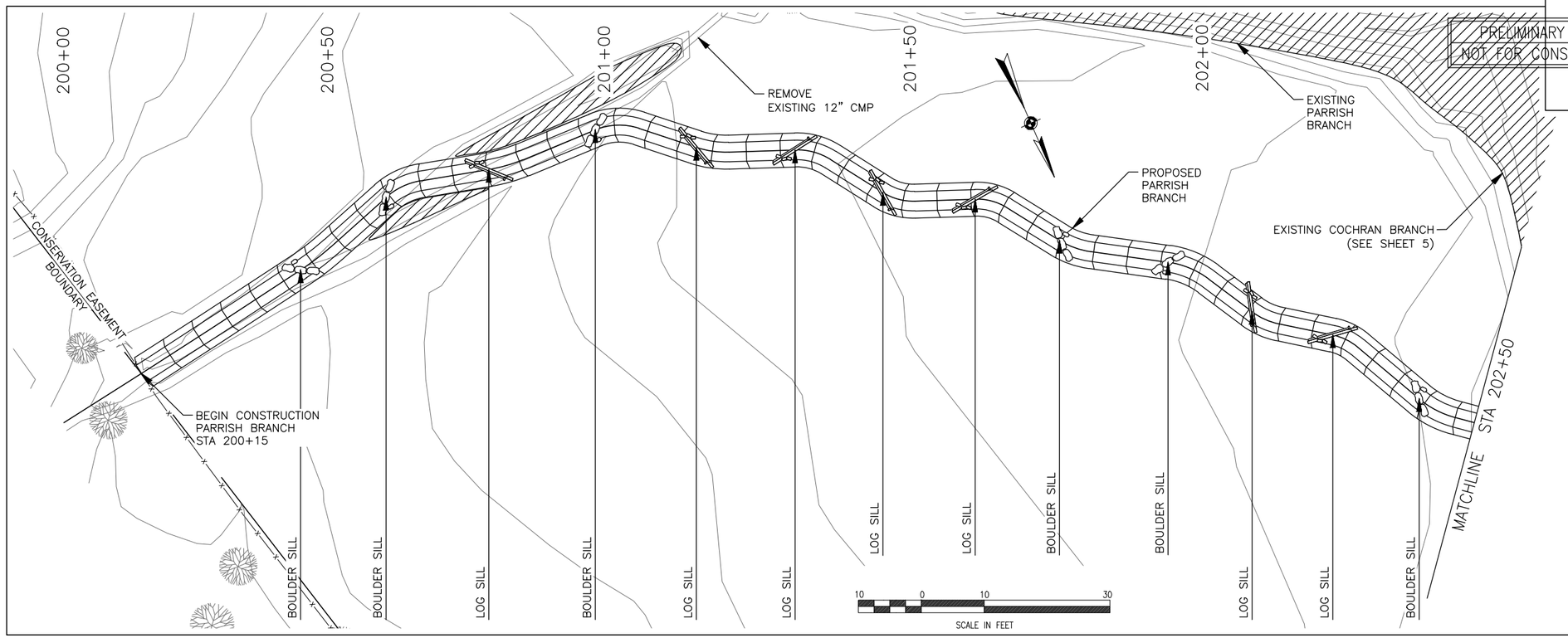
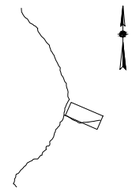
PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANGE
TITLE: PLAN & PROFILE

SCALE	AS NOTED	DRWN. BY	CME	PROJECT NO.	SHEET NUMBER
DATE	15 APR 2014	CHKD. BY	SGG	1059	7

DATE	BY	REV.	DESCRIPTION

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

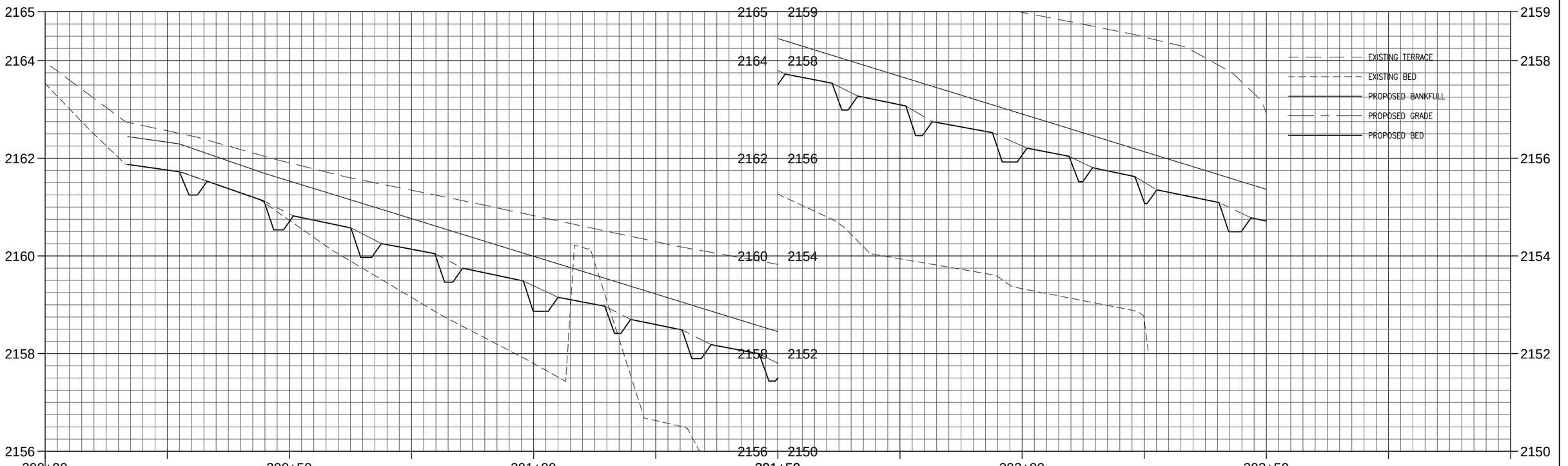




LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- ARMORED RIFFLE
- EXISTING FENCE
- EXISTING TREE
- EXISTING WETLANDS
- FILL



FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 10' VERTICAL SCALE: 1" = 1'
HALF SIZE PLAN – HORIZONTAL: 1" = 20' VERTICAL:1" = 2'

PARRISH BRANCH

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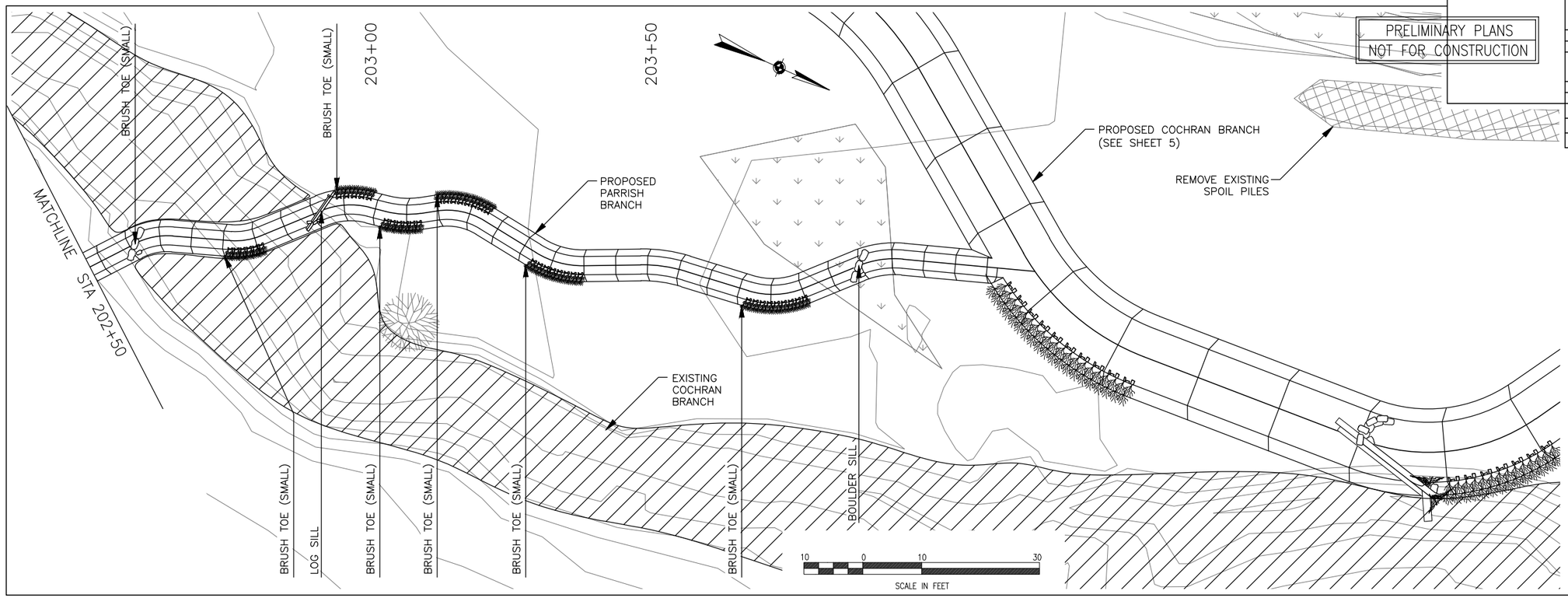
PRELIMINARY PLANS
NOT FOR CONSTRUCTION

PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANGE
TITLE: PLAN & PROFILE

SCALE	DWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	CME	1059	8
DATE: 15 APR 2014	CHKD. BY: SGG		

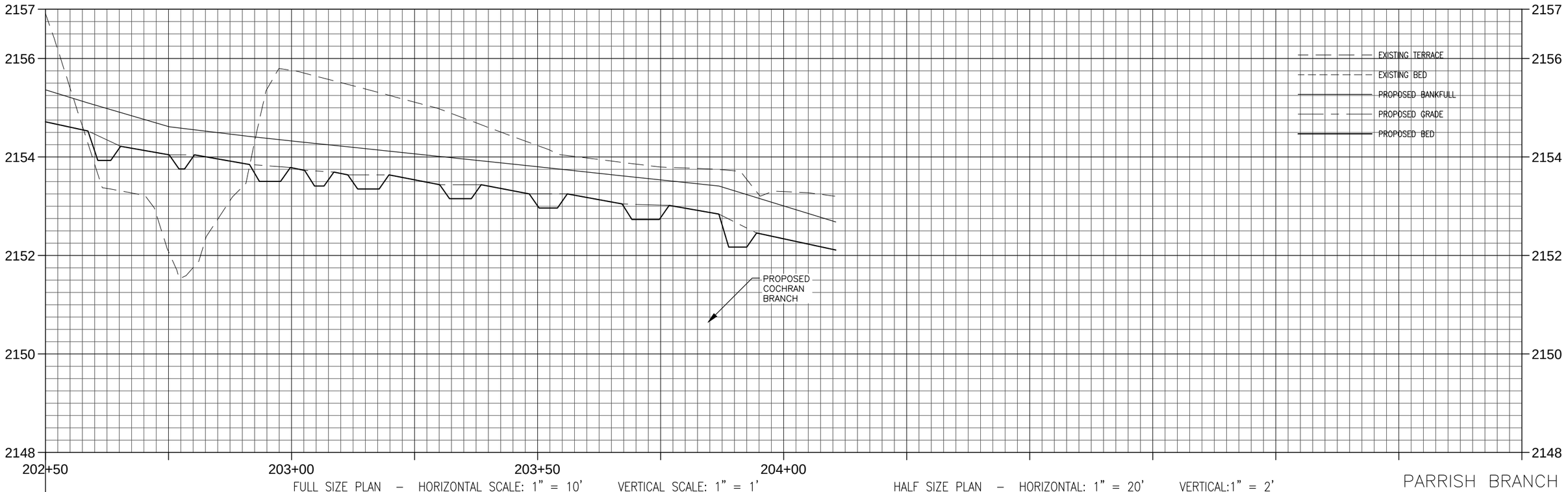
DATE	BY	REV.	DESCRIPTION



LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- ARMORED RIFFLE
- EXISTING FENCE
- EXISTING TREE
- EXISTING WETLANDS
- FILL



FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 10' VERTICAL SCALE: 1" = 1'

HALF SIZE PLAN – HORIZONTAL: 1" = 20' VERTICAL:1" = 2'

PARRISH BRANCH

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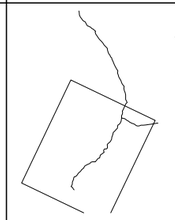
PRELIMINARY PLANS
NOT FOR CONSTRUCTION

PROJECT	COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER	ENVIRONMENTAL BANC & EXCHANGE
TITLE	WETLAND GRADING PLAN

SCALE	DWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	CME	1059	9
DATE 15 APR 2014	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION



PROPOSED STREAM RESTORATION
EXISTING FENCE
EXISTING TREE
FILL
EXISTING WETLAND

101+00
102+00
103+00
104+00
105+00
106+00
CONSERVATION EASEMENT BOUNDARY
10:1 (MAX)
10:1 (MAX)
REMOVE SPOIL (TYP)
FILL EXISTING DITCH
EXISTING WETLAND B
EXISTING WETLAND C
OLIVE HILL RD.
PROPOSED COCHRAN BRANCH
EXISTING WETLAND D
WATSON RD.
FILL EXISTING CHANNEL
MATCHLINE STA 106+50
EXISTING 48" CMP
EXISTING OVERHEAD UTILITY
PROPOSED 4-FT BASE DITCH WITH CLASS B RIPRAP
PROPOSED RIPRAP BASIN
FILL EXISTING CHANNEL

30 0 30 90
SCALE IN FEET

WETLAND GRADING

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

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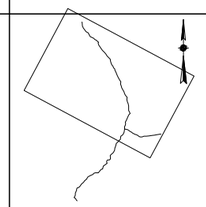
PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANGE
TITLE: **WETLAND GRADING PLAN**

SCALE	DWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	CME	1059	10
DATE: 15 APR 2014	CHKD. BY: SGG		

DATE	BY	REV.	DESCRIPTION



PROPOSED STREAM RESTORATION
EXISTING FENCE
EXISTING TREE
FILL
EXISTING WETLAND

MATCHLINE STA 106+50
107+00
108+00
109+00
110+00
111+00
112+00
113+00
114+00
EXISTING PARRISH BRANCH
PROPOSED PARRISH BRANCH
4:1
4:1
10:1 (MAX)
EXISTING WETLAND B
CONSERVATION EASEMENT BOUNDARY
EXISTING WETLAND E
PROPOSED COCHRAN BRANCH
REMOVE SPOIL (TYP)
10:1 (MAX)
CONSERVATION EASEMENT BOUNDARY
EXISTING OVERHEAD UTILITY TO BE RELOCATED (BY OTHERS)
FILL EXISTING DITCH
EXISTING WETLAND A
FILL EXISTING CHANNEL
EXISTING COCHRAN BRANCH
FILL EXISTING DITCH
10:1 (MAX)
WATSON RD.
MIDDLE BURNINGTOWN RD.

30 0 30 90
SCALE IN FEET

WETLAND GRADING

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

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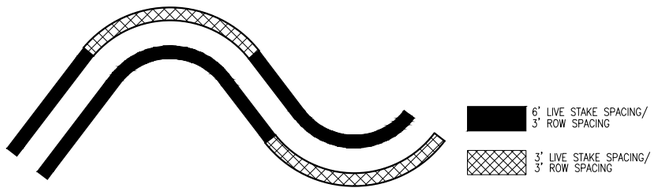
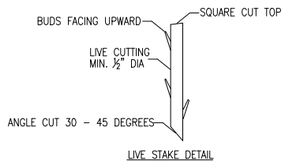
PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANGE
TITLE: **PLANTING DETAILS**

SCALE	DRWN. BY	PROJECT NO.	DRAWING NUMBER
AS NOTED	CME	1059	P-1
DATE: 15 APR 2014	CHKD. BY: SGG		

DATE	BY	REV.	DESCRIPTION

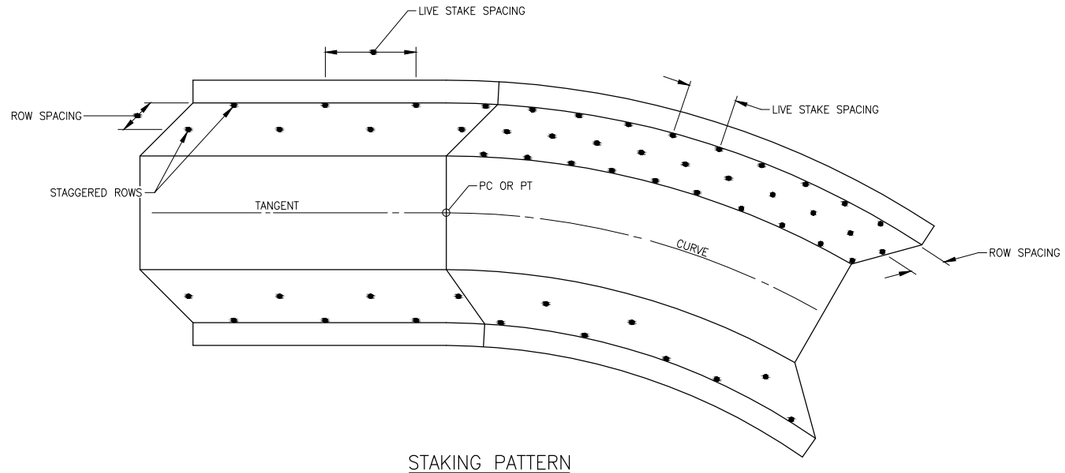


PLAN VIEW



LIVE STAKE DETAIL

NUMBER OF LIVE STAKE ROWS			
CHANNEL DEPTH (FT)	INSIDE OF BEND	TANGENT	OUTSIDE OF BEND
0 – 1.5	1	1	2
1.5 – 2.5	2	2	3
2.5 – 3.5	3	3	4



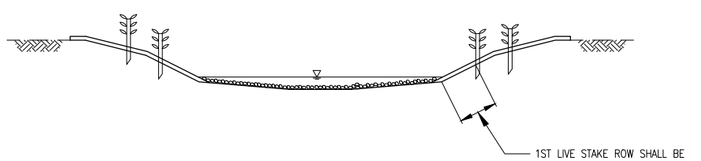
STAKING PATTERN
NOT TO SCALE

PLANTING NOTES:

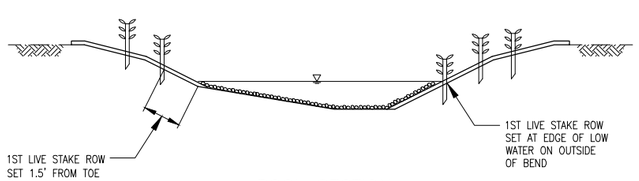
TEMPORARY AND PERMANENT SEED
1. ALL DISTURBED AREAS WILL BE STABILIZED USING MULCH AND TEMPORARY SEED TO PROVIDE ADEQUATE GROUND COVER AND CONDITION THE SOIL.
2. MULCH MUST BE ADDED TO ACHIEVE 80% COVERAGE (ROUGHLY 2 TONS/ACRE FOR WHEAT STRAW)
3. A FERTILITY SOIL TEST SHALL BE USED TO DETERMINE FERTILIZER AMOUNTS OR, IF NO SOIL TEST IS AVAILABLE, A STANDARD MIXTURE SHALL BE APPLIED OF 2 TONS OF LIME PER ACRE AND 700–1000 LBS OF 10–10–10 FERTILIZER PER ACRE.

BARE ROOT PLANTINGS
1. PLANT BARE ROOT SHRUBS AND TREES IN AREAS AS INDICATED ON THE PLANS.
2. PROVIDE 8' OF SPACING BETWEEN PLANTS.
3. LOOSEN COMPACTED SOIL AND PLANT IN HOLES FORMED WITH A MATTOCK, DIBBLE BAR OR EQUAL.
4. PROVIDE PLANTING HOLE SUFFICIENT IN SIZE AND DEPTH TO PREVENT CROWDING OF ROOTS.
5. ROOTS SHALL BE KEPT MOIST DURING TRANSPORTATION, DISTRIBUTION, AND INSTALLATION.
6. PLANTS SHALL BE HEELED–IN INTO MOIST SOIL IF NOT PROMPTLY PLANTED AFTER DELIVERY TO THE PROJECT SITE.

LIVE STAKES:
1. STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
2. STAKES THAT ARE SPLIT SHALL NOT BE INSTALLED.
3. STAKES SHALL BE INSTALLED ORTHOGONALLY TO THE BANK AND WITH BUDS POINTING UPWARDS.
4. STAKES SHALL BE ½ TO 2 INCHES IN DIAMETER AND 2 TO 3 FEET IN LENGTH.
5. AFTER INSTALLATION, THE TOP PORTION OF STAKES SHALL BE PRUNED WITH A SQUARE CUT LEAVING NO LESS THAN 3 INCHES AND NO MORE THAN 6 INCHES ABOVE THE GROUND.



RIFFLE SECTION
NOT TO SCALE



POOL SECTION
NOT TO SCALE

COMMON NAME	SCIENTIFIC NAME	STRATUM	PLANT MATERIAL SIZE	STEMS/ACRE	AREA (Acres)	TOTAL STEMS
STREAMSIDE						
Black Willow	*Salix nigra*	midstory	Live Stake	-	-	-
Buttonbush	*Cephalanthus occidentalis*	understory	Live Stake	-	-	-
Silky Dogwood	*Cornus amomum*	understory	Live Stake	-	-	-
Ninebark	*Physocarpus opulifolius*	understory	Live Stake	-	-	-
UPLAND						
Black Cherry	*Prunus serotina*	overstory	Bare Root	-	-	-
Red Oak	*Quercus rubra*	overstory	Bare Root	-	-	-
Chestnut Oak	*Quercus montana*	overstory	Bare Root	-	-	-
Scarlet Oak	*Quercus falcata*	overstory	Bare Root	-	-	-
Mockernut Hickory	*Carya tomentosa*	overstory	Bare Root	-	-	-
Pignut Hickory	*Carya glabra*	overstory	Bare Root	-	-	-
Dogwood	*Cornus florida*	overstory	Bare Root	-	-	-
Ironwood	*Carpinus caroliniana*	overstory	Bare Root	-	-	-
Tulip Poplar	*Liriodendron tulipifera*	overstory	Bare Root	-	-	-
White Oak	*Quercus alba*	overstory	Bare Root	-	-	-
Serviceberry	*Amelanchier arborea*	midstory	Bare Root	-	-	-
Sourwood	*Oxydendrum arboreum*	midstory	Bare Root	-	-	-
Witch Hazel	*Hamamelis virginiana*	midstory	Bare Root	-	-	-
Mountain Laurel	Kalmia latifolia	midstory	Bare Root	-	-	-
WETLAND						
Green Ash	*Fraxinus pennsylvanica*	overstory	Bare Root	-	-	-
River Birch	*Betula nigra*	overstory	Bare Root	-	-	-
Sycamore	*Plantanus occidentalis*	overstory	Bare Root	-	-	-
Tag Alder	*Alnus serrulata*	understory	Bare Root	-	-	-
Buttonbush	*Cephalanthus occidentalis*	understory	Bare Root	-	-	-
Winterberry	*Ilex verticillata*	understory	Bare Root	-	-	-
Black Chokeberry	*Aronia melanocarpa*	understory	Bare Root	-	-	-
Elderberry	*Sambucus canadensis*	understory	Bare Root	-	-	-

COMMON NAME	SCIENTIFIC NAME	SEEDING DENSITY (lbs/acre)	% MIX
PERMANENT MIX			
Switchgrass	*Panicum virgatum*	-	-
Broom Sedge	*Andropogon viginicus*	-	-
Indian Grass	*Sorhgastrum nutans*	-	-
Eastern Gamma Grass	*Tripsacum dactyoides*	-	-
Joe-Pye Weed	*Eupatorium fistulosum*	-	-
Deer tongue	*Panicum clandestinum*	-	-
	Totals	-	-

COMMON NAME	SCIENTIFIC NAME	LBS/ ACRE
Temporary Seeding		
August to March (cool season)		
Oats		-
Wheat Grass	*Triticum aestivum*	-
Rye Grain	*Secale cereal*	-
Barley		-
April to August (warm season)		
Millet	*Utochola ramose*	-
Buckwheat	*Fagopyrum esculentun*	-

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
12 1/2 Wall St., Suite C Asheville, NC 28801
PHONE: (828) 449-1930 WWW.WOLFCREEKENG.COM

PROJECT: COCHRAN BRANCH STREAM RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC & EXCHANGE
TITLE: PLANTING PLAN

SCALE	DRWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	CME	1059	P-2
DATE: 15 APR 2014	CHKD. BY: SGG		

DATE	BY	REV.	DESCRIPTION

LOCATION KEY

OLIVE HILL ROAD

NO PLANTING WITHIN 20' OF UTILITY LINE

PROPOSED 4-FT BASE DITCH WITH CLASS B STONE

PROPOSED COCHRAN BRANCH

PROPOSED CONSERVATION EASEMENT BOUNDARY

EXISTING OVERHEAD UTILITY (TO BE RELOCATED)

MIDDLE BURNINGTOWN ROAD

NO PLANTING WITHIN 20' OF UTILITY LINE

WATSON ROAD

WATSON ROAD

EXISTING OVERHEAD UTILITY

PROPOSED PARRISH BRANCH

NO PLANTING WITHIN 20' OF UTILITY LINE

LEGEND

WETLAND PLANTING

UPLAND PLANTING

50 0 50 150

SCALE IN FEET

Office Use Only:
Corps action ID no. _____
DWQ project no. _____
Form Version 1.3 Dec 10 2008

Pre-Construction Notification (PCN) Form

A. Applicant Information

1. Processing		
1a. Type(s) of approval sought from the Corps:	☒ Section 404 Permit ☐ Section 10 Permit	
1b. Specify Nationwide Permit (NWP) number: 27 or General Permit (GP) number:		
1c. Has the NWP or GP number been verified by the Corps?	☒ Yes ☐ No	
1d. Type(s) of approval sought from the DWQ (check all that apply): ☒ 401 Water Quality Certification – Regular ☐ Non-404 Jurisdictional General Permit ☐ 401 Water Quality Certification – Express ☐ Riparian Buffer Authorization		
1e. Is this notification solely for the record because written approval is not required?	For the record only for DWQ 401 Certification: ☐ Yes ☒ No	For the record only for Corps Permit: ☐ Yes ☒ No
1f. Is payment into a mitigation bank or in-lieu fee program proposed for mitigation of impacts? If so, attach the acceptance letter from mitigation bank or in-lieu fee program.	☐ Yes ☒ No	
1g. Is the project located in any of NC's twenty coastal counties. If yes, answer 1h below.	☐ Yes ☒ No	
1h. Is the project located within a NC DCM Area of Environmental Concern (AEC)?	☐ Yes ☒ No	

2. Project Information	
2a. Name of project:	Cochran Branch Stream Restoration Project
2b. County:	Macon
2c. Nearest municipality / town:	Franklin
2d. Subdivision name:	N/A
2e. NCDOT only, T.I.P. or state project no:	N/A
3. Owner Information	
3a. Name(s) on Recorded Deed:	Jerry Lee Parrish
3b. Deed Book and Page No.	E-17/287
3c. Responsible Party (for LLC if applicable):	
3d. Street address:	4956 Upper Burningtown Rd.
3e. City, state, zip:	Franklin, NC, 28734
3f. Telephone no.:	
3g. Fax no.:	
3h. Email address:	

4. Applicant Information (if different from owner)	
4a. Applicant is:	☐ Agent ☒ Other, specify: Project Sponsor
4b. Name:	Lin Xu, Project Review Coordinator
4c. Business name (if applicable):	North Carolina Ecosystem Enhancement Program
4d. Street address:	1652 Mail Service Center
4e. City, state, zip:	Raleigh, NC 27699
4f. Telephone no.:	(919) 707-8319
4g. Fax no.:	(919) 715-2219
4h. Email address:	
5. Agent/Consultant Information (if applicable)	
5a. Name:	
5b. Business name (if applicable):	Environmental Banc & Exchange
5c. Street address:	909 Capability Drive, Suite 3100
5d. City, state, zip:	Raleigh, NC 27606
5e. Telephone no.:	(919) 829-9909
5f. Fax no.:	(919) 829-9913
5g. Email address:	

B. Project Information and Prior Project History	
1. Property Identification	
1a. Property identification no. (tax PIN or parcel ID):	6556-93-2975
1b. Site coordinates (in decimal degrees):	Latitude: 35.21575 (DD.DDDDDD) Longitude: - 83.48805 (-DD.DDDDDD)
1c. Property size:	38.38 acres
2. Surface Waters	
2a. Name of nearest body of water (stream, river, etc.) to proposed project:	Burningtown Creek
2b. Water Quality Classification of nearest receiving water:	B; Tr
2c. River basin:	Little Tennessee
3. Project Description	
3a. Describe the existing conditions on the site and the general land use in the vicinity of the project at the time of this application: The proposed project is located on privately owned property which is used primarily for agriculture and livestock grazing. Additional land use practices, including the excavation of drainage ditches, maintenance and removal of riparian vegetation and the relocating, dredging, and straightening of on-site streams have contributed to unstable channel characteristics, degraded water quality, and degradation of prior wetlands.	
3b. List the total estimated acreage of all existing wetlands on the property: 0.99 acres	
3c. List the total estimated linear feet of all existing streams (intermittent and perennial) on the property: 1,564 linear feet of existing streams	
3d. Explain the purpose of the proposed project: The purpose of this project is to restore ecological function, natural stability, wetland hydrology, and aquatic and terrestrial habitat to a tract of land which has been negatively impacted by agricultural land use.	
3e. Describe the overall project in detail, including the type of equipment to be used: The proposed activities are intended to restore degraded portions of two streams located within the project limits. Erosion control measures will be installed prior to any land disturbing activity to prevent erosion and retain sedimentation onsite. Where the stream channels depart from morphologically stable conditions, they will be reconstructed with proper dimension, pattern and profile. Restoration will include raising the stream profile to restore hydrologic connection to historic floodplains, removal of overburden immediately adjacent to stream channels to reduce bank height and erosion potential and the installation of in-stream structures to provide grade control and improved habitat for aquatic species. Native vegetation will be planted to provide restoration of a natural forested buffer adjacent to the stream channels and habitat for insect, terrestrial and avian species. Impacts to existing wetlands by way of the proposed channel alignment will be carefully monitored to ensure no unintentional or excessive impacts occur. Upon completion of the work, all access roads, staging areas, construction entrances and silt fence will be removed and all disturbed soils will be stabilized with mulch and native seed to establish permanent ground cover. Equipment anticipated for construction efforts include track-hoes, skid-steers, track-trucks and off-road trucks.	

4. Jurisdictional Determinations	
4a. Have jurisdictional wetland or stream determinations by the Corps or State been requested or obtained for this property / project (including all prior phases) in the past? Comments:	☒ Yes ☐ No ☐ Unknown
4b. If the Corps made the jurisdictional determination, what type of determination was made?	☒ Preliminary ☐ Final
4c. If yes, who delineated the jurisdictional areas? Name (if known): Kevin Mitchell	Agency/Consultant Company: Equinox Environmental Other:
4d. If yes, list the dates of the Corps jurisdictional determinations or State determinations and attach documentation. Wetland determination report is attached. Jurisdictional determination to be finalized with PCN submittal.	
5. Project History	
5a. Have permits or certifications been requested or obtained for this project (including all prior phases) in the past?	☒ Yes ☐ No ☐ Unknown
5b. If yes, explain in detail according to "help file" instructions. Land Quality permit application was been submitted and is currently being reviewed.	
6. Future Project Plans	
6a. Is this a phased project?	☐ Yes ☒ No
6b. If yes, explain.	

C. Proposed Impacts Inventory

1. Impacts Summary

1a. Which sections were completed below for your project (check all that apply):

☒ Wetlands ☒ Streams - tributaries ☐ Buffers

☐ Open Waters ☐ Pond Construction

2. Wetland Impacts

If there are wetland impacts proposed on the site, then complete this question for each wetland area impacted.

2a. Wetland impact number – Permanent (P) or Temporary (T)	2b. Type of impact	2c. Type of wetland (if known)	2d. Forested	2e. Type of jurisdiction (Corps - 404, 10 DWQ – non-404, other)	2f. Area of impact (acres)
W1 ☒ P ☐ T	Restoration	Riparian Non-Riverine	☐ Yes ☒ No	☒ Corps ☐ DWQ	0.061
W2 ☐ P ☐ T			☐ Yes ☐ No	☐ Corps ☐ DWQ	
W3 ☐ P ☐ T			☐ Yes ☐ No	☐ Corps ☐ DWQ	
W4 ☐ P ☐ T			☐ Yes ☐ No	☐ Corps ☐ DWQ	
W5 ☐ P ☐ T			☐ Yes ☐ No	☐ Corps ☐ DWQ	
W6 ☐ P ☐ T			☐ Yes ☐ No	☐ Corps ☐ DWQ	
2g. **Total wetland impacts**					0.061

2h. Comments: The re-alignment of Cochran and Parrish Branch will result in instances where the proposed alignments intersect existing wetlands, converting small areas of degraded wetlands to stream channel. Adjacent to the proposed channels, impacted surface soils will be removed to expose the buried hydric soils and A horizon. Hydrologic connection will be improved and through wetland restoration, re-establishment and enhancement efforts, total wetland areas within the site are projected to increase from 0.99 acres to 4.35 acres.

3. Stream Impacts

If there are perennial or intermittent stream impacts (including temporary impacts) proposed on the site, then complete this question for all stream sites impacted.

3a. Stream impact number - Permanent (P) or Temporary (T)	3b. Type of impact	3c. Stream name	3d. Perennial (PER) or intermittent (INT)?	3e. Type of jurisdiction (Corps - 404, 10 DWQ – non-404, other)	3f. Average stream width (feet)	3g. Impact length (linear feet)
S1 ☐ P ☒ T	Restoration	Cochran Branch	☒ PER ☐ INT	☒ Corps ☐ DWQ	13.3	1,332
S2 ☐ P ☒ T	Restoration	Parrish Branch	☒ PER ☐ INT	☒ Corps ☐ DWQ	4.3	232
S3 ☐ P ☐ T			☐ PER ☐ INT	☐ Corps ☐ DWQ		
S4 ☐ P ☐ T			☐ PER ☐ INT	☐ Corps ☐ DWQ		
S5 ☐ P ☐ T			☐ PER ☐ INT	☐ Corps ☐ DWQ		
S6 ☐ P ☐ T			☐ PER ☐ INT	☐ Corps ☐ DWQ		
3h. **Total stream and tributary impacts**						1,564

3i. Comments: Site streams exhibit instabilities in the form of actively migrating headcuts and eroding vertical banks, both of

which will be improved upon following the implementation of restoration activities.

4. Open Water Impacts

If there are proposed impacts to lakes, ponds, estuaries, tributaries, sounds, the Atlantic Ocean, or any other open water of the U.S. then individually list all open water impacts below.

4a. Open water impact number – Permanent (P) or Temporary (T)	4b. Name of waterbody (if applicable)	4c. Type of impact	4d. Waterbody type	4e. Area of impact (acres)
O1 ☐ P ☐ T				
O2 ☐ P ☐ T				
O3 ☐ P ☐ T				
O4 ☐ P ☐ T				
4f. Total open water impacts				

4g. Comments: There are no anticipated impacts to open waters as a result of this project.

5. Pond or Lake Construction

If pond or lake construction proposed, then complete the chart below.

5a. Pond ID number	5b. Proposed use or purpose of pond	5c. Wetland Impacts (acres)			5d. Stream Impacts (feet)			5e. Upland (acres)
		Flooded	Filled	Excavated	Flooded	Filled	Excavated	Flooded
P1								
P2								
5f. Total								

5g. Comments: No construction of lakes or ponds is proposed.

5h. Is a dam high hazard permit required?	☐ Yes ☒ No If yes, permit ID no:
5i. Expected pond surface area (acres):	
5j. Size of pond watershed (acres):	
5k. Method of construction:	

6. Buffer Impacts (for DWQ)

If project will impact a protected riparian buffer, then complete the chart below. If yes, then individually list all buffer impacts below. If any impacts require mitigation, then you **MUST** fill out Section D of this form.

6a. Project is in which protected basin?	☐ Neuse ☐ Tar-Pamlico ☐ Other: ☐ Catawba ☐ Randleman				
6b. Buffer impact number – Permanent (P) or Temporary (T)	6c. Reason for impact	6d. Stream name	6e. Buffer mitigation required?	6f. Zone 1 impact (square feet)	6g. Zone 2 impact (square feet)
B1 ☐ P ☐ T			☐ Yes ☐ No		
B2 ☐ P ☐ T			☐ Yes ☐ No		
B3 ☐ P ☐ T			☐ Yes ☐ No		
		6h. **Total buffer impacts**			

6i. Comments: No protected buffers exist within the project limits.

D. Impact Justification and Mitigation

1. Avoidance and Minimization

1a. Specifically describe measures taken to avoid or minimize the proposed impacts in designing project.
Where mature vegetation exists on the stream banks, it will be harvested and incorporated into the newly constructed stream bank.

1b. Specifically describe measures taken to avoid or minimize the proposed impacts through construction techniques.
Existing herbaceous material and top soil will be harvested for reuse to encourage quick re-vegetation of disturbed wetlands and stream banks.

2. Compensatory Mitigation for Impacts to Waters of the U.S. or Waters of the State

2a. Does the project require Compensatory Mitigation for impacts to Waters of the U.S. or Waters of the State?	☐ Yes ☒ No
2b. If yes, mitigation is required by (check all that apply):	☐ DWQ ☐ Corps
2c. If yes, which mitigation option will be used for this project?	☐ Mitigation bank ☐ Payment to in-lieu fee program ☐ Permittee Responsible Mitigation

3. Complete if Using a Mitigation Bank

3a. Name of Mitigation Bank: N/A

3b. Credits Purchased (attach receipt and letter)	Type	Quantity

3c. Comments:	
4. Complete if Making a Payment to In-lieu Fee Program	
4a. Approval letter from in-lieu fee program is attached.	☐ Yes
4b. Stream mitigation requested:	linear feet
4c. If using stream mitigation, stream temperature:	☐ warm ☐ cool ☐ cold
4d. Buffer mitigation requested (DWQ only):	square feet
4e. Riparian wetland mitigation requested:	acres
4f. Non-riparian wetland mitigation requested:	acres
4g. Coastal (tidal) wetland mitigation requested:	acres
4h. Comments:	
5. Complete if Using a Permittee Responsible Mitigation Plan	
5a. If using a permittee responsible mitigation plan, provide a description of the proposed mitigation plan.	
6. Buffer Mitigation (State Regulated Riparian Buffer Rules) – required by DWQ	
6a. Will the project result in an impact within a protected riparian buffer that requires buffer mitigation?	☐ Yes ☒ No

6b. If yes, then identify the square feet of impact to each zone of the riparian buffer that requires mitigation. Calculate the amount of mitigation required.

Zone	6c. Reason for impact	6d. Total impact (square feet)	Multiplier	6e. Required mitigation (square feet)
Zone 1			3 (2 for Catawba)	
Zone 2			1.5	
	6f. **Total buffer mitigation required:**			

6g. If buffer mitigation is required, discuss what type of mitigation is proposed (e.g., payment to private mitigation bank, permittee responsible riparian buffer restoration, payment into an approved in-lieu fee fund).

N/A

6h. Comments: No appreciable buffer exists within the project limits. Proposed buffer restoration includes seeding of native grasses and planting of native bare root stems within the proposed conservation easement boundary.

E. Stormwater Management and Diffuse Flow Plan (required by DWQ)	
1. Diffuse Flow Plan	
1a. Does the project include or is it adjacent to protected riparian buffers identified within one of the NC Riparian Buffer Protection Rules?	☐ Yes ☒ No
1b. If yes, then is a diffuse flow plan included? If no, explain why. Comments:	☐ Yes ☒ No
2. Stormwater Management Plan	
2a. What is the overall percent imperviousness of this project?	<1 %
2b. Does this project require a Stormwater Management Plan?	☐ Yes ☒ No
2c. If this project DOES NOT require a Stormwater Management Plan, explain why: The project will not increase runoff and the drainage area has less than 24% impervious area.	
2d. If this project DOES require a Stormwater Management Plan, then provide a brief, narrative description of the plan:	
2e. Who will be responsible for the review of the Stormwater Management Plan?	☐ Certified Local Government ☐ DWQ Stormwater Program ☐ DWQ 401 Unit
3. Certified Local Government Stormwater Review	
3a. In which local government's jurisdiction is this project?	N/A
3b. Which of the following locally-implemented stormwater management programs apply (check all that apply):	☐ Phase II ☐ NSW ☐ USMP ☐ Water Supply Watershed ☐ Other:
3c. Has the approved Stormwater Management Plan with proof of approval been attached?	☐ Yes ☒ No
4. DWQ Stormwater Program Review	
4a. Which of the following state-implemented stormwater management programs apply (check all that apply):	☐ Coastal counties ☐ HQW ☐ ORW ☐ Session Law 2006-246 ☐ Other:
4b. Has the approved Stormwater Management Plan with proof of approval been attached?	☐ Yes ☒ No
5. DWQ 401 Unit Stormwater Review	
5a. Does the Stormwater Management Plan meet the appropriate requirements?	☐ Yes ☐ No
5b. Have all of the 401 Unit submittal requirements been met?	☐ Yes ☐ No

F. Supplementary Information		
1. Environmental Documentation (DWQ Requirement)		
1a. Does the project involve an expenditure of public (federal/state/local) funds or the use of public (federal/state) land?	☒ Yes	☐ No
1b. If you answered "yes" to the above, does the project require preparation of an environmental document pursuant to the requirements of the National or State (North Carolina) Environmental Policy Act (NEPA/SEPA)?	☒ Yes	☐ No
1c. If you answered "yes" to the above, has the document review been finalized by the State Clearing House? (If so, attach a copy of the NEPA or SEPA final approval letter.) Comments: The catagorical exclusions have been completed to provide EEP compliance with NEPA/SEPA and a copy of this form is included with this submittal.	☐ Yes	☒ No
2. Violations (DWQ Requirement)		
2a. Is the site in violation of DWQ Wetland Rules (15A NCAC 2H .0500), Isolated Wetland Rules (15A NCAC 2H .1300), DWQ Surface Water or Wetland Standards, or Riparian Buffer Rules (15A NCAC 2B .0200)?	☐ Yes	☒ No
2b. Is this an after-the-fact permit application?	☐ Yes	☒ No
2c. If you answered "yes" to one or both of the above questions, provide an explanation of the violation(s):		
3. Cumulative Impacts (DWQ Requirement)		
3a. Will this project (based on past and reasonably anticipated future impacts) result in additional development, which could impact nearby downstream water quality?	☐ Yes	☒ No
3b. If you answered "yes" to the above, submit a qualitative or quantitative cumulative impact analysis in accordance with the most recent DWQ policy. If you answered "no," provide a short narrative description. This project is a stream restoration project. The site will be protected in perpetuity and will not result in future or cumulative impacts.		
4. Sewage Disposal (DWQ Requirement)		
4a. Clearly detail the ultimate treatment methods and disposition (non-discharge or discharge) of wastewater generated from the proposed project, or available capacity of the subject facility. No wastewater will be generated by the proposed project.		

5. Endangered Species and Designated Critical Habitat (Corps Requirement)		
5a. Will this project occur in or near an area with federally protected species or habitat?	☐ Yes	☒ No
5b. Have you checked with the USFWS concerning Endangered Species Act impacts?	☐ Yes	☒ No
5c. If yes, indicate the USFWS Field Office you have contacted.	☐ Raleigh ☐ Asheville	
5d. What data sources did you use to determine whether your site would impact Endangered Species or Designated Critical Habitat? USFWS database of Endangered Species, Threatened Species, Federal Species of Concern and Candidate Species for Macon County, along with field investagations.		
6. Essential Fish Habitat (Corps Requirement)		
6a. Will this project occur in or near an area designated as essential fish habitat?	☐ Yes	☒ No
6b. What data sources did you use to determine whether your site would impact Essential Fish Habitat? NOAA Essential Fish Habitat Mapper v3.0		
7. Historic or Prehistoric Cultural Resources (Corps Requirement)		
7a. Will this project occur in or near an area that the state, federal or tribal governments have designated as having historic or cultural preservation status (e.g., National Historic Trust designation or properties significant in North Carolina history and archaeology)?	☒ Yes	☐ No
7b. What data sources did you use to determine whether your site would impact historic or archeological resources? In compliance with Section 106 of the National Historic Preservation Act, Legacy Research Associates performed an archaeological survey within the Cochran Branch Site. Two areas of potential effect (APE) were tested, resulting in ceramic and lithic artifacts being found. Based on these findings, both tested sites have the potential to contain significant archaeological information and are recommended as being potentially eligible for the National Register for Historic Places (NRHP). Both APE sites are outside of the proposed construction zones of the wetland and riparian buffer restoration areas; however, they are within areas that will be planted with bare root hardwood trees. The two sites will be marked prior to planting and planting procedures to minimize soil disturbances. All other activities associated with the Cochran Branch stream and wetland restoration project will have no adverse effect on the two surveyed sites or any other property, as indicated in the ERTR for this project, used to complete the Categorical Exclusions form included with this submittal.		
8. Flood Zone Designation (Corps Requirement)		
8a. Will this project occur in a FEMA-designated 100-year floodplain?	☐ Yes	☒ No
8b. If yes, explain how project meets FEMA requirements: The project streams are not FEMA detail-studied streams and all fill activies occur outside the FEMA Floodway.		
8c. What source(s) did you use to make the floodplain determination? NC Floodmaps		

Lin Xu Applicant/Agent's Printed Name	_____ Applicant/Agent's Signature (Agent's signature is valid only if an authorization letter from the applicant is provided.)	Date