FINAL
MITIGATION PLAN

Junes Branch
Jackson County, North Carolina
Project No. 95027

Little Tennessee River Basin
Cataloging Unit 06010203

Prepared for:

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

April 2013

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Prepared By:

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

And:

Wolf Creek Engineering, PLLC
7 Florida Avenue
Weaverville, NC 28787
(828) 658-3649

NORTH CAROLINA PROFESSIONAL SEAL 021767 ENGINEER S. GRANT GINN 4/22/13

April 2013

IRT PROCESS SUMMARY

The NCIRT Review comments and the USACE Approval letter dated August 24, 2012 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. Revised permanent seed mix: Appendix D, Sheet P-1, Permanent Seeding Table
2. Revised Performance Standards:
    - Page 31, Paragraph 1, revised first sentence to reference USACE Stream Mitigation Guidelines (2003).
    - Page 31, Paragraph 2, Deleted reference to Entrenchment Ratio requirements.
    - Page 31, Paragraph 6, Added statement that bankfull events must happen during separate monitoring years.
3. Revised Doris Branch alignment to provide more than 30' buffer: Appendix D, Sheet 10.
4. Added statement that wetland areas will be protected by fence during construction: Page 26, Paragraph 6.
5. Revised background aerial image to remove barn that no longer exists:
    - Appendix D, Sheet 1A
    - Page 29, Figure 7

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

REPLY TO
ATTENTION OF:

August 24, 2012

Regulatory Division

Re: NCIRT Review and USACE Approval of the Junes Branch Mitigation Plan (SAW 2012-01101)

Ms. Suzanne Klimek
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Ms. Klimek:

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 Junes Branch Mitigation Plan, which closed on August 8, 2012. 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. However, the minor issues with the Draft and discussed in the attached comments, must be addressed in the Final Mitigation Plan.

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) 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. Please be sure that all updates to the Mitigation Plan are specifically identified in a table at the front of the Mitigation Plan. This helps expedite our review of the Final Mitigation Plan and issuance of the Nationwide Permit. 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,

Tyler Crumbley
Regulatory Specialist

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
CESAW-RG-A/Brown
Jeff Jurek, NCEEP
Paul Wiesner, NCEEP

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

REPLY TO
ATTENTION OF:

CESAW-RG/Crumbley August 8, 2012

MEMORANDUM FOR RECORD

SUBJECT: NCIRT Comments During 30-day Mitigation Plan Review

Purpose: The comments and responses 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: Junes Branch Mitigation Project, Jackson County, NC

USACE AID#: SAW-2011-01101

30-Day Comment Deadline: August 8, 2012

1. Eric Kulz, NCDWQ, July 24, 2012:

- I have questions regarding the rationale and explanation for P1 restoration of Bumgarner Branch Reach 1a. The designer states that due to livestock and herbaceous vegetation on the banks the stream bed is narrow. It is not excessively incised and has connection to its floodplain. I have not been able to find the bank height ratio in the report. It says that the channel will widen and become unstable and overwiden once cattle are excluded and woody vegetation replaces herbaceous vegetation. This appears contrary to generally-accepted stream assessment and restoration principles.
- The permanent seed mix consists of white clover, orchard grass, creeping red fescue, Korean lespedeza, and birdsfoot trefoil. All but red fescue are exotic and are not listed as noxious, but the USDA plants database says they all have the potential to become weedy or invasive. DWQ recommends using a native riparian seed mix, a number of which are available through native plant nurseries.

NCEEP Response, August 1, 2012:

The following is a response from the project designer (Wolf Creek Eng.) to DWQ's 7/24/12 comments:

- The reviewer states that he is unable to find the bank-height-ratios, however, the bank-height-ratios are stated in Section 2.2.6 of the narrative. Specifically for the reach in question in paragraph 4 under the "Bumgarner Branch" subsection of 2.2.6, the report states that the bank-height-ratios range from 1.1 to 1.5. Additionally, the field data

collected for this project can be found in Appendix C4. Specifically, the table titled "Site Assessment Calculations" has data collected on the upstream end of Bumgarner Branch (Section Numbers 6, 7 and 16 and designated in the "Reach" and "Location" rows as "Bumgarner-U/s of road", "Bumgarner-mid horse pasture" and "Bumgarner-u/s end") indicates bank-height-ratios of 1.5, 1.1 and 1.5. The reviewer states that the report claims the channel will "over-widen once the cattle are excluded" and that this is "contrary to generally accepted stream assessment and restoration principles." First, there is no claim in the report that the channel will "over-widen," simply that the width of the bed of the channel will increase from its present excessively narrow width of approximately 3 ft. to a more geomorphically stable width of at least 8 ft. As stated in the report, this projected dimension is based on data collected on reference and naturalized streams in the surrounding watersheds and in the mountain region. Data on more than 30 locations were collected for this project and is depicted in the graphs in Appendix C1. The concept that a stream will widen from an unsustainably narrow condition to a more appropriate width is neither novel or contrary to generally accepted stream principles. Perhaps what is an encumbrance is the idea that exclusion of livestock will facilitate this process or that the presence of livestock perpetuates the existing condition. However, experience and observation suggest that the presence of livestock can prevent the natural succession from herbaceous vegetation to woody vegetation and without the presence of woody vegetation the herbaceous vegetation will provide a denser ground cover. In some cases, as in the present situation, this denser ground cover can temporarily retard soil erosion. As stated paragraph 3 of Section 7.2.1 of the report, this is demonstrated immediately upstream of the site where livestock access is restricted, woody vegetation in the form of privet and alder have become established, and the channel bed has widened to 6 ft. with every indication that it will widen further.

- The reviewer states that the permanent seed mix contains exotic species. The seed mix included in this project is not the standard native mix that we have used in the past. This seed mix was directed by EEP on our last EEP project (Middle South Muddy Creek). There were no unusual soil conditions on that project so my understanding was that this was the preferred seed mix by EEP and was therefore carried over to this project. If this is not the case we would recommend a permanent seed mix containing Broom Sedge, Deer Tongue, Switch Grass, Indian Grass, Eastern Gama Grass and Joe-Pye-Weed.

Eric Kulz, NCDWQ, August 7, 2012:

- I had a productive and interesting discussion with Grant Ginn regarding Bumgarner Branch. The design dimension for this reach is supported by the regional curves, and the proposed design is supported by DWQ. DWQ maintains the recommendation that the permanent seeding mix consist of native riparian species, and not the list proposed in the draft plan.

2. Todd Tugwell, USACE, June 25, 2012:

- The performance standards included in Section 9.0 of the Draft Mitigation Plan are generally more specific than required by the 2003 Stream Mitigation Guidelines (SMGs).

Additional standards have been included that may result in situations determined to be unacceptable during review of the monitoring reports or at project closeout, such as the standard that the Entrenchment Ration remain below 1.3. Another example is included under "Surface Water Hydrology" where it states that the surface water gauge must achieve bankfull or greater elevations at least twice, but it does not indicate that these events must occur in separate years, as required by the SMGs. Please note that the project will be held to the currently accepted performance standards as stated in the 2003 SMGs, and the project should state so in Section 9.0.

- Forested buffer widths along the channel appear to be less than 30 feet in some areas (see Sta 111+50 on Doris Branch), and just over 30 feet for much of the rest of the project. Be verify that buffer widths are wide enough to meet the minimum standard for mountain counties (30 feet minimum) after project construction and anticipated channel adjustments have occurred.
- Based on a review of Figure 7 and Preliminary Construction Plans (Site Plan aerial image), there appears to be a structure that extends into the proposed Conservation Easement area. Please verify whether this structure is located in the proposed easement and revise the plan if necessary.
- Wetland areas located within the project boundary should be protected from impact by construction traffic by fencing. If impacts to wetland are anticipated, be sure that all impacts are avoided where possible and minimized where unavoidable. The Preconstruction Notification (PCN) application must account for all temporary and permanent impacts to wetlands.
- Please note that due to the location of this project, additional information regarding potential impacts to resources protected under Section 106 of the National Historic Preservation Act, beyond what is listed in the Categorical Exclusion Checklist included in Appendix A, will be required during the permit review. This information should be included in the PCN application, but does not have to be included in the Final Mitigation Plan.

<u>NCEEP Response, August 1, 2012</u>:

The following is a response from the project designer (Wolf Creek Eng.) to USACE's 7/25/12 comments:

- We will revise the performance standards to be consistent with the 2003 SMG and include a statement in the narrative to indicate the intended compliance. All buffer widths have been checked to be 30 ft. or greater. We can revise the alignment at the lower end of Doris Branch to provide slightly more than 30 ft. if required, however, given the small size of this stream it is unlikely that channel pattern adjustments will occur following construction. The structure that appears in Figure 7 to be inside of the easement no longer exists. This is simply an outdated aerial image. If necessary we can photoshop this structure out of the image. There is no need for the construction activities to impact the wetlands. We will add a statement to the report narrative, Section 7.2.2, indicating that the wetlands will be protected from construction activities and final construction plans will indicate locations for protective fencing around these sensitive areas.

EXECUTIVE SUMMARY

Environmental Banc & Exchange (EBX) proposes to restore and enhance four unstable stream reaches in central Jackson County. The Junes Branch Stream Restoration Site is located approximately 2 miles east of Sylva, North Carolina at the latitude 35.357378° N and longitude 83.191391° W. The Site encompasses approximately 5.8 acres of agricultural land and consists of four unstable streams: Bumgarner Branch, Junes Branch, Higdon Branch, and Doris Branch. This mitigation plan describes the details, methods and protocols proposed to generate approximately **3,093 stream mitigation credits**, which includes **approximately 3,061 linear feet of stream restoration through Priority I restoration**.

General Site Conditions

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. Spoil piles have been observed on-site indicating that historic wetlands were likely drained in order to maximize agricultural production.

Current stream conditions at the Junes Branch Stream Restoration Site contain incised channels with unstable banks and a riparian buffer dominated by invasive exotic plants. Bumgarner Branch east of Fairview Road flows through an active pasture with livestock access to the stream. The riparian buffer is dominated by invasive exotic plants and the channel exhibits eroding stream banks contributing fine sediment to the channel substrate. The downstream portion of Bumgarner Branch west of Fairview Road is incised with actively eroding stream banks. Junes Branch, Higdon Branch, and Doris Branch contain abundant invasive exotic plants within the riparian buffer and are also comprised of incised channels with eroding stream banks. The adjacent land use along Junes Branch and the downstream portion of Bumgarner is no longer active pasture and currently consists of fallow fields and hay production fields.

Restoration Concept

Restoration and enhancement practices proposed for this project have been designed with the intent to minimize unnecessary disturbance to adjacent land. Professional judgment has been used to determine which channel reaches could potentially benefit most from preservation or enhancement over full restoration. Where restoration was determined to be warranted, consideration was given to which reaches could best be served by maintaining as much of the existing channel pattern as possible.

Proposed Bumgarner Branch, Junes Branch, Higdon Branch and Doris branch are designed as Type B4 streams. These channel configurations provide a stable and natural form in the Type II colluvial valleys in which the existing streams are found. The proposed channel dimensions, patterns, and profiles are based on 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 to prevent headcut formation and to provide step-pool bed form 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.

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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FIGURES

APPENDICES

1.0 RESTORATION PROJECT GOALS AND OBJECTIVES

EEP develops River Basin Restoration Priorities (RBRP) to guide its restoration activities within each of the state's 54 cataloging units. RBRPs delineate specific watersheds that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These watersheds are called Targeted Local Watersheds (TLWs) and receive priority for EEP planning and restoration project funds.

The 2008 Little Tennessee River Basin RBRP identified HUC 06010203020010 as a Targeted Local Watershed http://www.nceep.net/services/lwps/Little_Tennessee/RBRP_LTN_2008.pdf. Only 44% of the stream length within this watershed has adequate buffers.

The 2008 Little Tennessee River Basin RBRP identified fecal coliform and turbidity as major stressors within this TLW. The Junes Branch Project was identified as a stream restoration opportunity to improve water quality and habitat within the TLW.

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

- Improve water quality within the restored channel reaches and downstream watercourses through:
  - reducing turbidity by stabilizing existing stream banks and altering stream channel dimension, pattern and profile
  - reducing nutrient loads and fecal coliform bacteria from adjacent agricultural fields by fencing the riparian area to keep livestock out of the stream and restoring a wooded riparian buffer
- Improve local aquatic and terrestrial habitat and diversity within the restored channels and their vicinity through:
  - reducing water temperatures by planting native vegetation in the riparian zone and creating shade
  - improving habitat complexity by restoring the stream profile to stable riffle/pool complex and step/pool complexes
  - improving terrestrial habitat by excluding livestock and creating a native riparian buffer
  - improving aquatic habitat by establishing tree canopy to provide organic material such as woody debris and leaf packs to stream
  - removing invasive exotic species and planting native vegetation in the riparian buffer
- Improve flood flow attenuation on-site and downstream through:
  - raising the bed or creating bankfull benches to allow for overbank flows every 1-2 years and will improve the connection to the active floodplain

The project goals will be addressed through the following project objectives:

- Restore stable channel morphology and proper sediment transport capacity.
- Create and improve stream bed form and improve aquatic and benthic macroinvertebrate habitat.
- Reconnect the stream to the historic floodplain or construct a floodplain bench that is accessible at the proposed bankfull channel elevation.
- Improve channel and stream bank stabilization by integrating in-stream structures and native bank vegetation.
- Provide riparian buffer restoration by establishing a native forested and herbaceous riparian buffer plant community with a minimum width of 30 feet from the edge of the restored channels. This new community will be established in conjunction with the eradication of any existing exotic or undesirable plant species.

2.0 SITE SELECTION

2.1 Directions to Site

The Junes Branch Stream Restoration Site (the Site) is located in central Jackson County approximately 2 miles east of Sylva, NC. From Asheville, take I-40 West for approximately 18 miles. Take exit 27 onto US-74 toward US-19/Clyde/US-23/Waynesville. Take exit 107 toward Jones Cove Road and merge onto US-23 South/US-74 West. After approximately 20 miles, take exit 85 toward NC-107/Cullowhee. Keep right at the fork in the ramp and continue onto US-23/Asheville Highway. Make a slight left onto NC-107/East Main Street for approximately 2 miles before turning left onto Fairview Road (SR 1724). The Site begins at latitude 35.355166° N and longitude 83.192067° W.

2.2 Site Selection

2.2.1 Description

The Site encompasses approximately 5.8 acres of predominately agricultural land and includes a portion of **Bumgarner Branch**, and three unnamed tributaries that for the purposes of this project are called **Junes Branch**, **Higdon Branch** and **Doris 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. Spoil piles have also been observed on-site which indicates that historic wetlands were likely drained in order to maximize agricultural production.

2.2.2 USGS Hydrologic Unit Code and NCDWQ River Basin Designations

The Junes Branch Site is located within the Little Tennessee River Basin, United States Geological Survey (USGS) 14-digit Hydrologic Unit 06010203020010, and the North Carolina Division of Water Quality (NCDWQ) sub basin 04-04-02. Bumgarner Branch has been assigned the Stream Index Number 2-79-35-1 by NCDWQ and is designated as Class C surface water. Tributaries to Bumgarner Branch have not been indexed, but are also designated as Class C surface waters.

Class C waters are protected for uses such as secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival and maintenance of biological integrity, and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner (NCDWQ).

Bumgarner Branch flows into Mill Creek approximately 0.5 miles downstream of the Site which is also assigned Class C use support designation. Mill Creek drains into the Tuckasegee River another 1.5 miles downstream. This section of the Tuckasegee River has been assigned Class B; Tr. Class B waters are protected for primary recreation activities 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 (NCDWQ). These waters are also protected for Class C uses. The designation Tr (Trout Waters) includes areas protected for natural 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 52.9 inches. Elevations within the Site range from 2,200 ft. at the northwestern

extent to 2,150 ft. along Junes Branch. The Site encompasses approximately 3,061 linear feet of streams including Bumgarner Branch, Junes Branch, Higdon Branch and Doris Branch.

The drainage area of Bumgarner Branch at the downstream end of the Site is 1.03 mi^2 (668 acres). Land use within the watershed consists of 68% forest, 21% low-density residential and 11% agricultural land. Impervious area covers less than 1% of the total watershed. Land use changes are not anticipated within the watershed and developmental pressure is relatively low although evidence of new home construction was identified on two lots in the watershed.

2.2.4 Physiography, Geology, and Soils

The Site lies within the Southern Crystalline Ridges and Mountains sub-region of the Blue Ridge ecoregion. This sub-region occurs primarily on Precambrian 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 biotite gneiss.

The valleys associated with Bumgarner Branch and its tributaries within the project extents are Type II colluvial valleys (Rosgen). The valleys present a wash-slope morphology with cross-slopes ranging from 3% to 22% and a longitudinal slope approximately 3%.

Soils found on site include the Cullowhee fine sandy loam and Whiteside-Tuckasegee complex, which consists of a fine sandy loam in the upper horizon and a cobbly sandy clay loam in the lower horizon. None of the soils found on the site are considered hydric (See Table 4.2).

2.2.5 Historical Land Use and Development Trends

The Junes Branch Site encompasses approximately 5.8 acres of pastureland for horses, hay production, and some forest stands. Grazing livestock have historically had access to most stream reaches and adjacent terraces. The lack of deep-rooted vegetation and unstable channel characteristics appear to have contributed to the degradation of stream banks.

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.

2.2.6 Existing Site Conditions

In order to assess existing geomorphic conditions, cross section measurements were taken at seventeen (17) 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 C4).

Bumgarner Branch
The majority of Bumgarner Branch classifies as a Type G stream with low width-depth ratios typically ranging from 5 to 9 and entrenchment ratios typically ranging from 1.5 to 2.2. The bank-height ratios on Bumgarner are typically within the range of 1.5 to 4.6. Additionally, the BWI values range for 0.5 to 0.7 while the MDI values range from 0.3 to 1.3 and the bankfull width of the existing channel is approximately 65% of the reference width. This suggests that future adjustments of the channel will occur in the form of widening of the bed width resulting in additional bank erosion.

Visual inspection of the soil horizons exposed along the banks of Bumgarner Branch reveal no evidence of a gravel layer or stream bed layer occurring above the present stream bed elevation. Three (3) test pits were excavated with a track-hoe on lower Bumgarner. One test pit exposed thin gravel layers (0.1ft - 0.2 ft thick) at depths of 2 ft and 4 ft below existing grade. The other two pits revealed no gravel layers above the existing stream bed. However, both contained a buried 'A' horizon at a depth of 2 ft and a substantial gravel layer at a depth of 3 ft. It is possible that rapid aggradation of the valley and subsequent incision of the channel have returned the stream to a former vertical position. It should be noted that where riffles appear stable the bed is difficult to probe and larger bed material is present. Since the bed material does not generally present as a cobble bed it is possible that the channel incision has exposed a historic cobble bed, supporting the theory of rapid aggradation and subsequent incision of the channel.

The pipe culvert under Fairview Road on Bumgarner Branch is perched above the channel invert on the downstream side, indicating that the channel bed has incised since the installation of the pipe. On the upstream side the pipe has acted as a grade control and prevented the channel from down cutting. The presence of the pipe may be contributing to deposition of the suspended material on the floodplain.

The reach of Bumgarner Branch upstream of Fairview Road is distinctive from the rest of Bumgarner Branch in that it classifies as a Type E stream due to the higher entrenchment ratios of 5 to 6. Through this reach bank-height ratios range from 1.1 to 1.5 and the MDI values range from 0.9 to 1.3 suggesting that there may be some level of departure from reference conditions but that vertical stress on the bed is probably not excessive. However, the BWI values through this reach range from 0.3 to 0.6 indicating a high potential for the channel bed to widen to two or three times its present width. It is likely that the continued impacts by livestock are perpetuating a state whereby a thalweg-sized channel is formed inside of a larger channel that is partially stabilized with herbaceous cover.

Junes Branch
The majority of Junes Branch classifies as a Type G stream with low width-depth ratios typically ranging from 5 to 9 and entrenchment ratios typically ranging from 1.8 to 2.2. The bank-height ratio on Junes Branch ranges from 1.9 to 3.3. Additionally, the BWI values range from 0.4 to 0.7 while the MDI values typically range from 1.2 to 1.7. These values suggest that there is considerable stress on the bed of the channel that will likely result in future widening and down cutting.

The Junes Branch channel has the appearance of a narrow thalweg cut into a former ditch bed. There is evidence, particularly along the reach upstream of the driveway crossing, that the channel has been dredged and relocated. This evidence consists of re-graded topography and a lower central valley position that is offset from the present channel location. There were no instances of a exposed gravel layer or sand layer in the banks that would indicate the stream previously occupied a higher elevation.

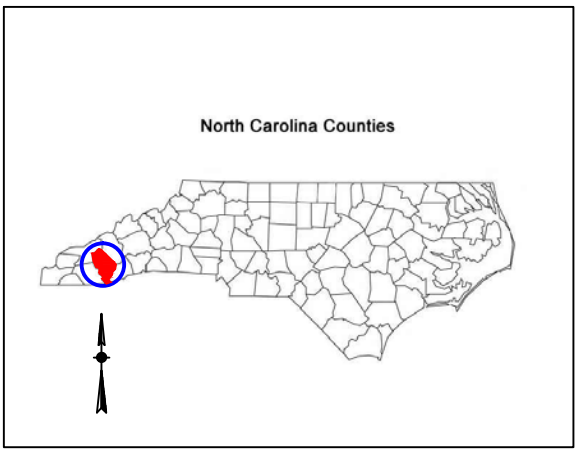
Five test pits were excavated on Junes Branch. Two of the pits contained a buried 'A' horizon underlain by a gravel layer 6 inches thick. One test pit revealed no gravel layer and the remaining two contained a 1

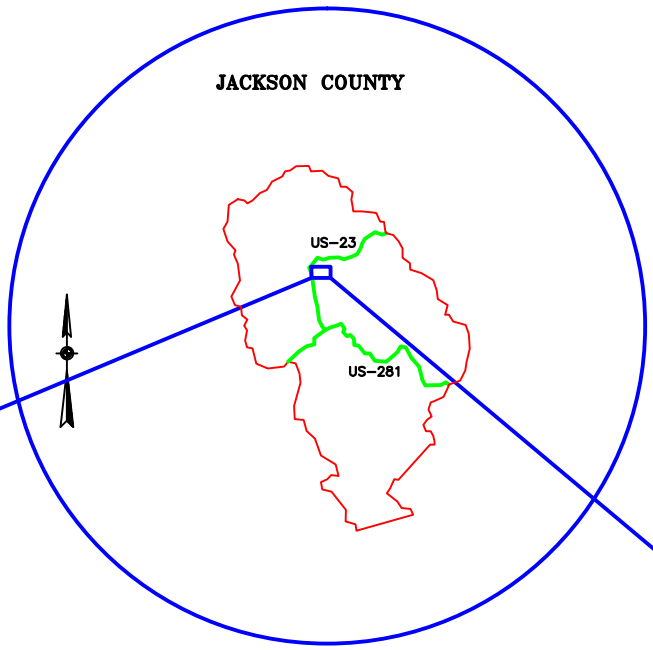
ft thick gravel layer 2 to 3 ft below the terrace. It is unclear whether the gravel layer represents an early or late Holocene deposit.

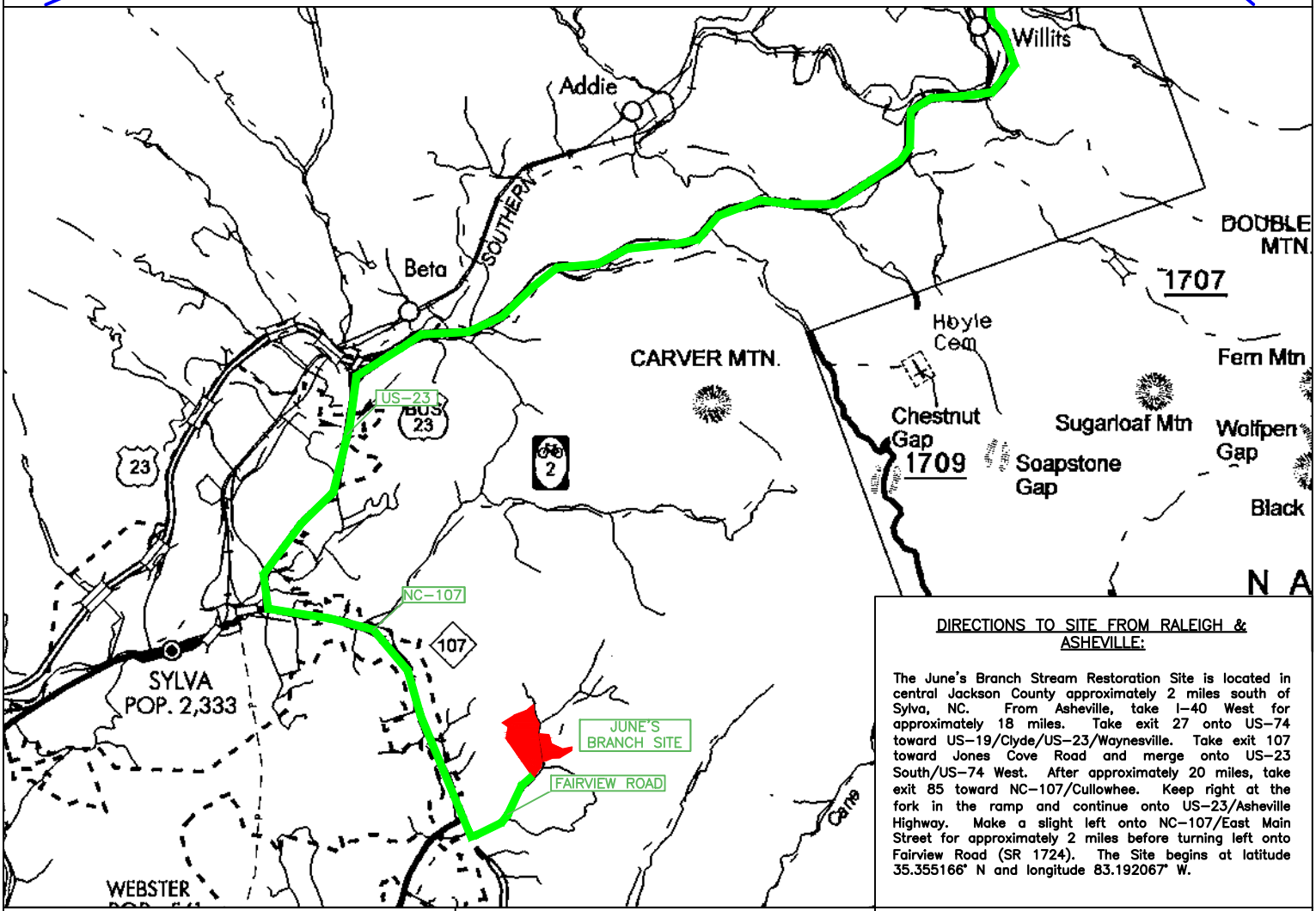
The bed of Junes Branch is composed primarily of sand that probes easily to a depth of 0.3 ft to 1.0 ft. In many instances a dense gravel layer is encountered below the sand bed. There are a few short reaches where the bed is composed of a significant fraction of large gravel and cobble. It appears that depositional reaches are locally positioned downstream of headcutting reaches which are identified with the exposed gravel and cobble bed sections. The present sediment loads are being routed by the incised channel without significant accumulation of depositional material and the overall profile trend is degradational.

Higdon Branch
Higdon Branch is a small stream that has formed in the bottom of a larger dredged channel. The larger dredged channel has a base width of approximately 12 feet with a spoil pile on the left bank that is 2 to 4 feet high and approximately 10 feet wide. The bed of the dredged channel and the bed of Higdon Branch consists primarily of unconsolidated silt and sand indicating that the channel was probably originally dredged deeper and has subsequently aggraded. Although erosion and stability are not major concerns on this stream, the dredging has resulted in a stream that is completely isolated from the historic floodplain and valley.

Doris Branch
Doris Branch is a headwater seep that forms into an intermittent channel. The existing intermittent channel was apparently frequently excavated to drain the adjacent floodplain and wetlands. A distinctive spoil berm approximately 2 feet above the natural ground extends along the entire length of this channel on the right bank. This spoil berm separates the wetlands and Doris Branch from the Bumgarner Branch floodplain.







DIRECTIONS TO SITE FROM RALEIGH & ASHEVILLE:

The June's Branch Stream Restoration Site is located in central Jackson County approximately 2 miles south of Sylva, NC. From Asheville, take I-40 West for approximately 18 miles. Take exit 27 onto US-74 toward US-19/Clyde/US-23/Waynesville. Take exit 107 toward Jones Cove Road and merge onto US-23 South/US-74 West. After approximately 20 miles, take exit 85 toward NC-107/Cullowhee. Keep right at the fork in the ramp and continue onto US-23/Asheville Highway. Make a slight left onto NC-107/East Main Street for approximately 2 miles before turning left onto Fairview Road (SR 1724). The Site begins at latitude 35.355166° N and longitude 83.192067° W.

PREPARED FOR:

Ecosystem Enhancement Program

PREPARED BY:

Wolf Creek Engineering

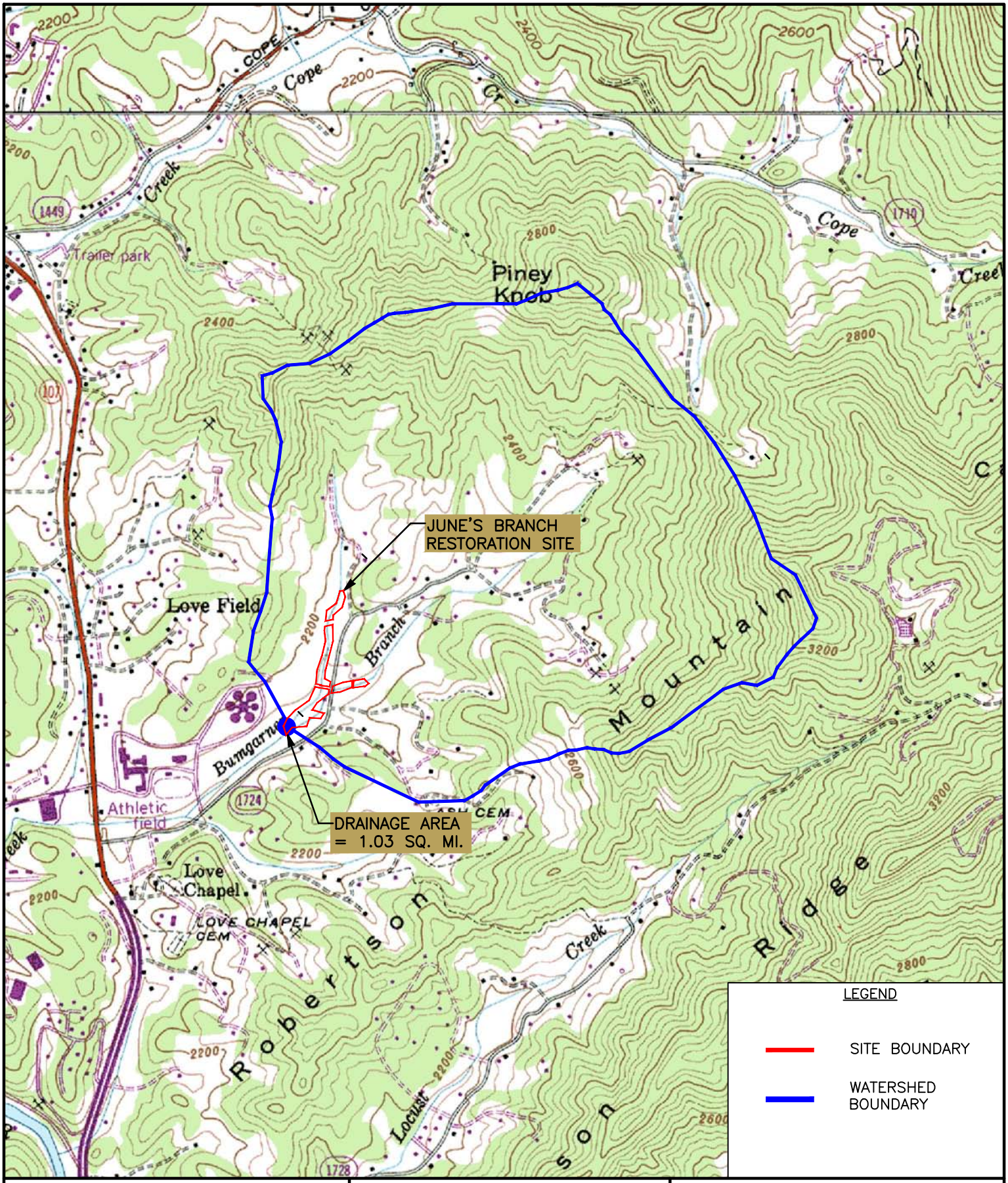
1 0 1 2

SCALE IN MILES

VICINITY MAP

JUNE'S BRANCH RESTORATION SITE
JACKSON COUNTY, NORTH CAROLINA

FIGURE 1



PREPARED FOR:

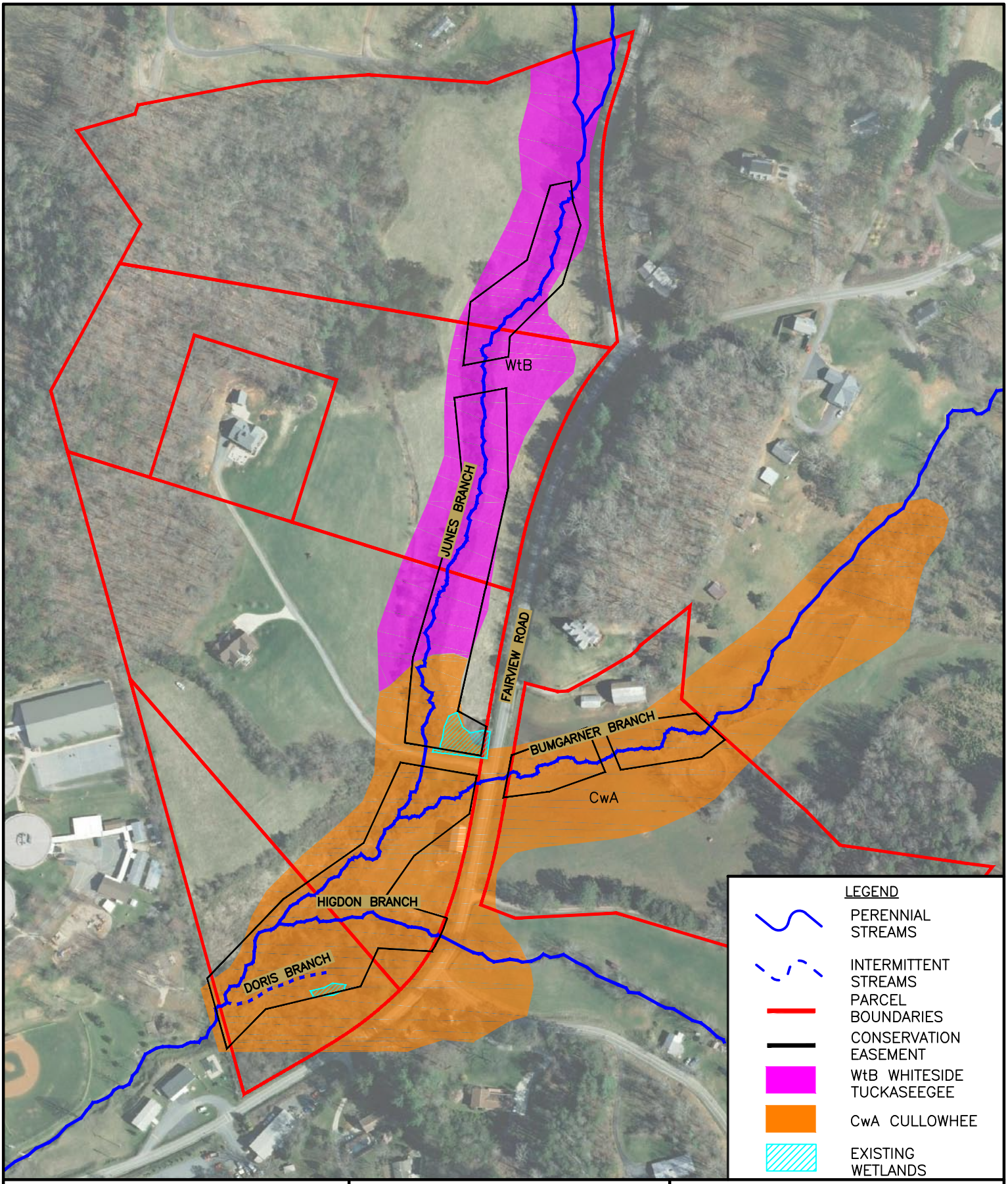
PREPARED BY:

1500 0 1500 4500

SCALE IN FEET

WATERSHED MAP

JUNE'S BRANCH RESTORATION SITE
JACKSON COUNTY, NORTH CAROLINA
FIGURE 2



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PREPARED BY:

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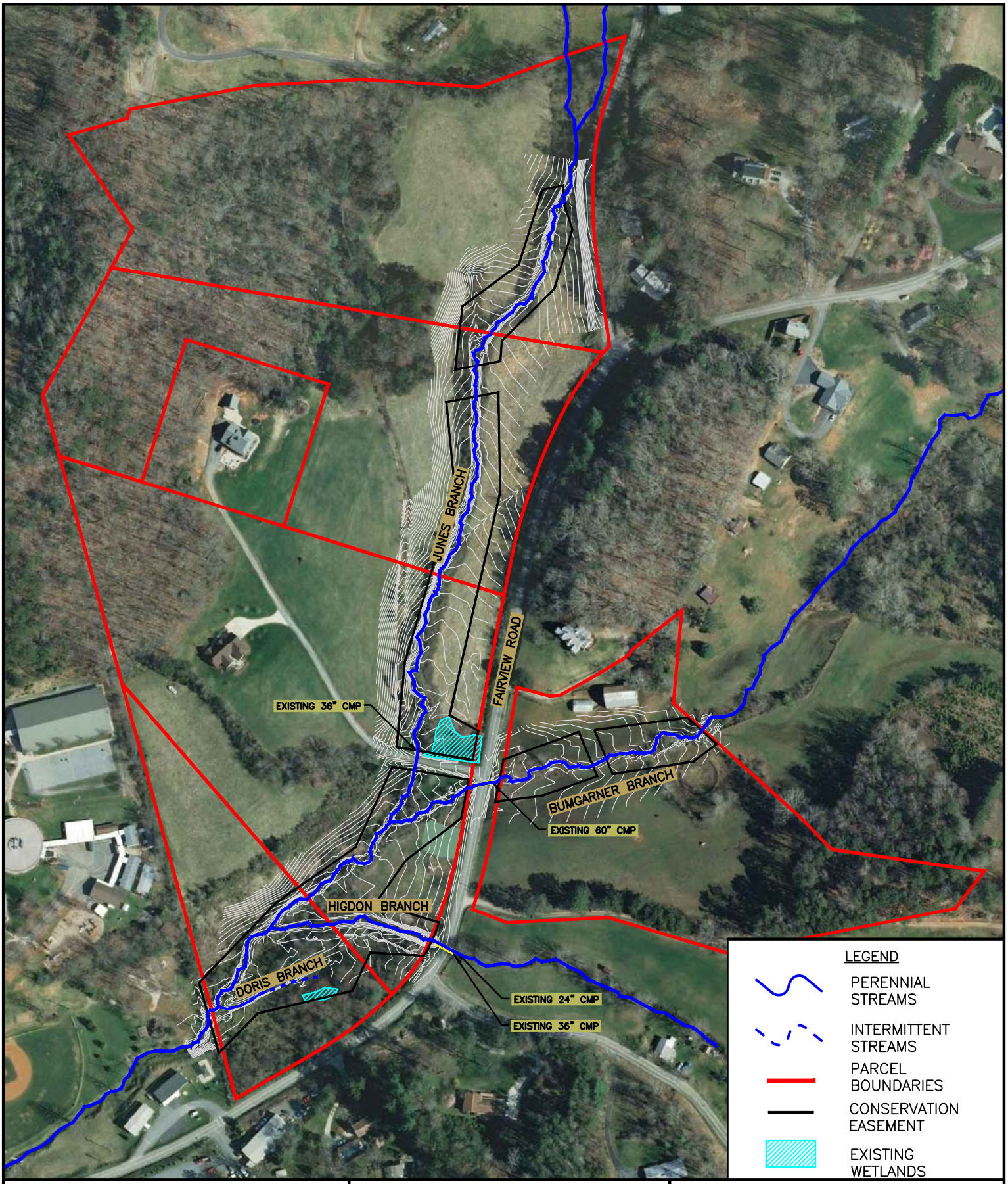
SOIL MAP

JUNE'S BRANCH RESTORATION SITE
JACKSON COUNTY, NORTH CAROLINA

FIGURE 3



PREPARED FOR: Ecosystem Enhancement Program

PREPARED BY: Wolf Creek Engineering

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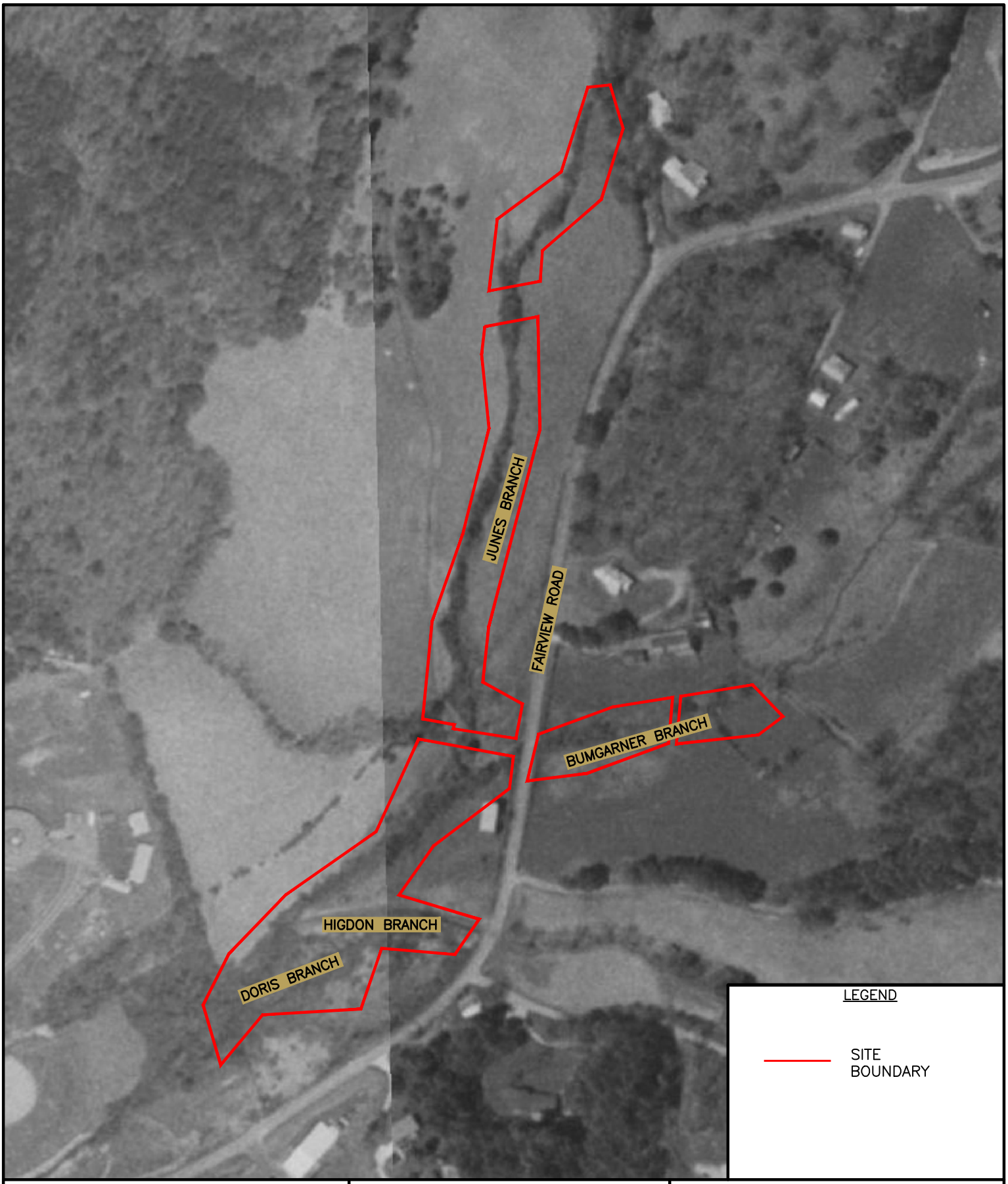
SCALE IN FEET

EXISTING HYDROLOGIC FEATURES MAP

JUNE'S BRANCH RESTORATION SITE
JACKSON COUNTY, NORTH CAROLINA

FIGURE 4



PREPARED FOR: Ecosystem Enhancement Program

PREPARED BY: Wolf Creek Engineering

NOT TO SCALE

1975 AERIAL PHOTO
ENVIRONMENTAL DATA RESOURCES, INC.

HISTORICAL AERIAL PHOTO

JUNE'S BRANCH RESTORATION SITE
JACKSON COUNTY, NORTH CAROLINA

FIGURE 5

Photo No. 1

June's Branch facing upstream @ Sta 207+00 1/2/2012

Photo No. 2

Upstream of Culvert on June's Branch @ Sta 213+00 1/2/2012

Photo No. 3

Culvert on June's Branch facing upstream @ Sta 213+00 1/2/2012

Photo No. 4

Bumgarner Branch in horse pasture facing upstream 1/2/2012

Photo No. 5

Bumgarner Branch facing dowmstream 1/2/2012

Photo No. 6

Bumgarner Branch facing downstream 2/14/2012

Photo No. 7

Bumgarner Branch facing upstream 2/14/2012

Photo No. 8

Bank erosion on lower Bumgarner Branch 2/14/2012

Photo No. 9

Higdon Branch facing upstream 1/2/201

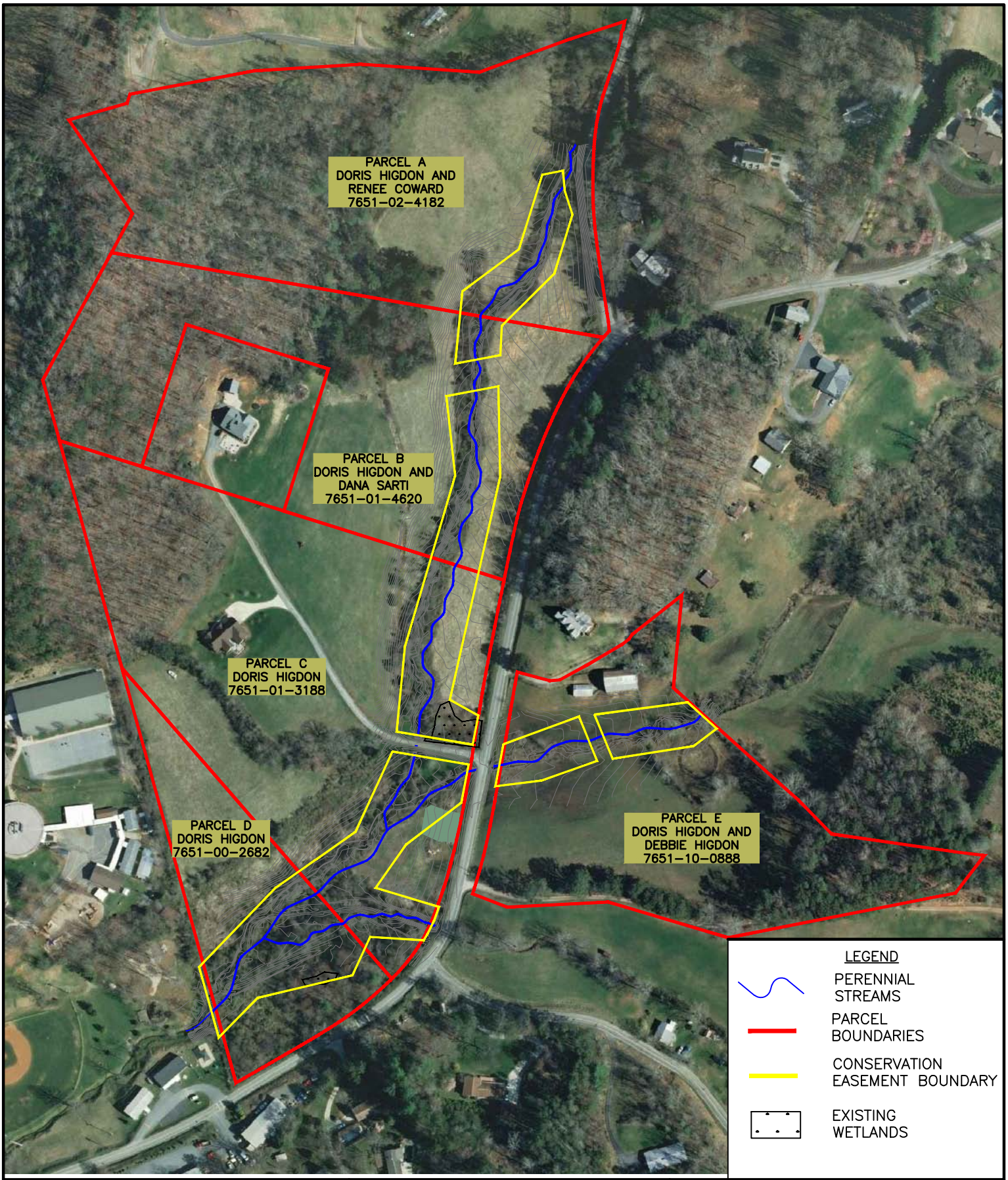
3.0 SITE PROTECTION INSTRUMENT

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	Doris Higdon and Renee Coward	7651-02-4182	Jackson	Conservation Easement	491/622	0.65
Parcel B	Doris Higdon and Dana Sarti	7651-01-4620	Jackson	Conservation Easement	491/622	0.93
Parcel C	Doris Higdon	7651-01-3188	Jackson	Conservation Easement	491/622	2.3
Parcel D	Doris Higdon	7651-00-2682	Jackson	Conservation Easement	491/622	1.15
Parcel E	Doris and Debbie Higdon	7651-10-0888	Jackson	Conservation Easement	514/533	0.79

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.



PREPARED FOR: Ecosystem Enhancement Program

PREPARED BY: Wolf Creek Engineering

250 0 250 750

SCALE IN FEET

2010 AERIAL PHOTO

SITE PROTECTION INSTRUMENT FIGURE

JUNE'S BRANCH RESTORATION SITE
JACKSON COUNTY, NORTH CAROLINA

FIGURE 6

4.0 BASELINE INFORMATION

4.1 Project Information

Project Name	Junes Branch		
County	Jackson County		
Project Area (acres)	5.8 ac.		
Project Coordinates (latitude and longitude)	35.357378° N and longitude 83.191391° W		
Project Watershed Summary Information			
Physiographic Province	Blue Ridge		
River Basin	Little Tennessee		
USGS Hydrologic Unit 8-digit	06010203	USGS Hydrologic Unit 14-digit	06010203020010
DWQ Sub-basin	04-04-02		
Project Drainage Area (acres)	668		
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	Bumgarner Br. 1	Bumgarner Br. 2	Junes Br.	Higdon Br.	Doris Br.
Length of reach (linear feet)	610	550	1311	530	260
Valley classification (Rosgen)	II	II	II	II	II
Drainage area	0.93	1.03	0.23	0.08	0.01
NCDWQ stream identification score	40	40	38	38	29.5
NCDWQ Water Quality Classification	C	C	-	-	-
Morphological Description (stream type) (Rosgen)	E	G	G	E	G
Evolutionary trend (Rosgen)	C	F	F	E	G
Underlying mapped soils	CwA, WtB	CwA, WtB	WtB	CwA	CwA
Drainage class	Somewhat Poorly Drained- Mod. Well Drained	Somewhat Poorly Drained- Mod. Well Drained	Mod. Well Drained	Somewhat Poorly Drained	Somewhat Poorly Drained
Soil Hydric status	Non-Hydric	Non-Hydric	Non-Hydric	Non-Hydric	Non-Hydric
Slope	2.2 %	2.2 %	2.3%		
FEMA classification	N/A	N/A	N/A	N/A	N/A
Native vegetation community	Agricultural	Agricultural	Agricultural	Agricultural	Agricultural
Percent composition of exotic invasive vegetation	30%	30%	30%	40%	40%

4.3 Wetland Summary Information

Parameters	Wetland 1	Wetland 2	
Size of Wetland (acres)	0.03	0.13	
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian Non-Riverine	Riparian Non-Riverine	
Mapped Soil Series	CwA	CwA	
Drainage class	Somewhat Poorly Drained	Somewhat Poorly Drained	
Soil Hydric Status	Hydric	Hydric	
Source of Hydrology	Seep	Seep	
Hydrologic Impairment	None	Dredging/Ditching	
Native vegetation community	Scrub-Shrub	Forested	
Percent composition of exotic invasive vegetation	2%	42%	

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 these 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.

Junes Branch, Jackson County
EEP Project Number 003979

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	**3093**								

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
Bumgarner Branch 1	**100+37- 107+27**	**610**	**PI**	**R**	**594**	**1:1**
Bumgarner Branch 2	**107+27-112+50**	**550**	**PI**	**R**	**476**	**1:1**
June's Branch	**200+97- 215+15**	**1311**	**PI**	**R**	**1319**	**1:1**
Higdon Branch	**300+46-304+08**	**530**	**PI**	**R**	**422**	**1:1**
Doris Branch	**400+00-402+37**	**260**	**PI**	**R**	**282**	**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	3093					
Enhancement						
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

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 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%
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%

Non-forested Wetlands 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	15%	55%
3	Third year monitoring report demonstrates performance standards are being met	20%	75%
4	Fourth year monitoring report demonstrates performance standards are being met	10%	85%
5	Fifth year monitoring report demonstrates performance standards are being met and project has received closeout approval	15%	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% (65%*)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (75%*)
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70% (85%*)
5	Fifth year monitoring report demonstrates performance standards are being met and project has received closeout approval	15%	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 15% 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 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. A Type B4 reference was located on Cold Springs Creek, a tributary to the Pigeon River in Haywood County. The reference vegetation community data was also collected at the Cold Springs reference site.

7.1.1 Reference Reach

The reference reach was selected to represent the probable configurations for the proposed stream restoration. Detailed geomorphic survey and Level II Rosgen classifications were conducted on three reaches of Cold Springs for a total of 1000 LF or 44 times bankfull width (See Appendix C).

Cold Springs Reference

The Cold Springs Creek reference reach is located in the Blue Ridge hydrophysiographic region of North Carolina. The Cold Springs watershed has many characteristics in common with the Junes 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 Cold Springs as it exhibited consistent indicators throughout the reach. Verification of bankfull was accomplished by plotting the bankfull cross sectional area against the regional curve data (Appendix C). The graph 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 nine individual reaches included bankfull width, bed width, depth of bankfull, toe depth, and width of thalweg.

7.1.2 Reference Vegetation Community

A plant community survey was performed at Cold Spring Creek on November 9, 2007. This small stream plant community, common to the Appalachian Mountains, is located within a mesic hardwood forest cove. The riparian plant community most closely resembles a *Montane Alluvial Forest* as described by Schafale and Weakley (1990). Canopy species observed included American beech (*Fagus grandifolia*), black birch (*Betula lenta*), Eastern hemlock (*Tsuga canadensis*), red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), and tulip poplar (*Liriodendron tulipifera*). Subcanopy species included American holly (*Ilex opaca*), iron wood (*Carpinus caroliniana*), and rosebay rhododendron (*Rhododendron maximum*). Herbaceous species included American alumroot (*Heuchera americana*), *Aster* sp., Christmas fern (*Polystichum acrostichoides*), dog hobble (*Leucothoe fontanesiana*), golden ragwort (*Senecio aureus*), lady fern (*Athyrium asplenioides*), sphagnum moss (*Sphagnum* spp.), woodland stonecrop (*Sedum ternatum*), and *Viola* spp.

7.2 Design Narrative

7.2.1 Restoration Approach

Bumgarner Branch

Bumgarner Branch is divided into two main reaches; Reach 1 is located upstream of the confluence with Junes Branch and Reach 2 is located downstream of the confluence with Junes Branch. Reach 1 is further subdivided into Reach 1a, which is located upstream of Fairview Road and Reach 1b, which is downstream of Fairview Road.

Reach 1a is proposed for Priority I restoration as a Type B4 stream with moderate sinuosity and an average channel slope of 2.4%. Consideration was given to improving Reach 1a using a minimally invasive approach such as enhancement and stabilization or simply excluding livestock and allowing natural recovery of the stream. These considerations stem from the observations that this section of stream is not excessively incised and maintains a functional connection with its floodplain. Additionally the presence of herbaceous cover provides some degree of stability for the soils outside of the channel banks.

The overriding concern with an enhancement or "livestock exclusion only" approach is the nature of the anticipated channel adjustments. Since the existing channel bed width is only 3 feet, it is expected that stable channel forms will not develop until the channel bed has widened to at least 8 feet. Channel widening will accelerate as successional woody vegetation replaces the existing herbaceous vegetation. This is demonstrated immediately upstream of the Site where the channel has widened to approximately 6 feet in response to the absence of livestock impacts and shading from alders and privet. Even with a bed width of 6 feet, the channel had not reached a stable cross section and exhibits evidence of bank scour. If this progression in channel form is permitted to occur through Reach 1a, it is estimated that approximately 2,500 ft^3 of soil (150 tons) will be eroded from the banks and transported to the downstream reaches. Additionally, a temporal loss in ecological recovery will be associated with this scenario since it can be expected that this process with likely take years if not decades.

The recommended approach is for complete reconstruction of a Type B4 stream. This will provide for construction of the proper cross sectional geometry that will reduce stress on the banks and eliminate bank scour. Additionally, reconstruction will provide the opportunity to harvest the cobble bed material that is buried under the finer sediments and utilize it to construct proper, functional riffles. Riffles constructed from native gravel and cobble material along with step-pool structures will provide immediate habitat features and a dramatic functional lift.

The case for restoration on Reach 1b is more obvious since the channel is more incised and the extent of bank erosion is more apparent. Additionally, the incision of the channel bed has resulted in a "hanging invert" at the downstream end of the pipe culvert under Fairview Road. Restoration efforts will raise the channel bed to reconnect the channel to the floodplain and restore connectivity for passage of aquatic life through the culvert.

Reach 2 is proposed for Priority I restoration as a Type B4c stream with an average channel slope of 1.5%. Priority I and Priority II approaches were both considered on this reach. The primary factor for considering the use of a Priority II approach was the presence of suitable bed material and bed form in several locations. Appropriate bank features and vegetation were generally absent along this reach and therefore did not provide an additional incentive for this approach. Disincentives for pursuing a Priority II approach included extensive excavation required to construct the proper channel and floodplain bench dimensions, concerns associated with establishing vegetation on excavated soil horizons, and loss of connectivity with the historic floodplain. Although generation of wetland credits is not a stated goal of this project, a Priority I approach does provide the opportunity to enhance existing wetland and floodplain groundwater hydrology.

Junes Branch
Junes Branch is proposed for restoration as a Type B4 stream with moderate sinuosity and an average channel slope of 2.5%. Full reconstruction is required to address the degraded conditions of severe channel incision, unstable banks and improper channel dimensions which are negatively affecting stream functions. A Priority I approach is the goal for the entire reach of Junes Branch, however, a Priority II approach is required in a few locations due to topographic constraints.

Higdon Branch
Higdon Branch is proposed for restoration as a Type B4 and B4c stream. The case for restoration on Higdon Branch is not made on the basis of channel stability, although there are several instances of channel bed nick points and bank erosion. Most of these occurrences are relatively minor and could be stabilized with local treatments. The overriding issue affecting ecological function on this reach is extreme topographic separation of Higdon Branch from the adjacent floodplains caused by the agricultural ditching of the stream. This separation is further exaggerated by the adjacent spoil berm. In order to reconnect Higdon to the adjacent natural terrain, improve floodplain groundwater hydrology and assist in wetland recovery, a Priority I approach is recommended for Higdon Branch. A Priority II approach will be required of the upstream end of this reach in order to tie the profile into the existing pipe at Fairview Road.

Doris Branch
Doris Branch is proposed for restoration as a Type B4 stream. The case for restoration of Doris Branch is based solely on the potential to improve ecological conditions. Raising the bed of Doris Branch will improve groundwater hydrology in the adjacent wetlands and removal of the adjacent spoil berm will reconnect Doris Branch and the wetlands to the Bumgarner Branch floodplain.

7.2.2 Restoration Methods

Restoration of Type B4 and B4c streams will consist of constructing a low to moderate sinuosity (1.05-1.10) stream with a moderate width-depth ratio (13-17) that accesses the floodplain at greater-than-

bankfull flows. For streams 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.

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. During construction, all wetland areas will be protected from construction activities by fence.

Cross pipes will be oversized so that the pipe diameter will be comparable to the channel bed width where practical. The invert of the pipe will be buried below the bed of the channel to allow bed material to pass through the pipe. A boulder grade control structure will be placed downstream of the pipe to hold the low water surface just above the outlet and allow for aquatic life passage. Smaller diameter pipes will be placed on either side of the primary pipe to provide additional floodplain flow conveyance.

All disturbed areas will be stabilized with temporary and permanent seed and covered with straw or mulch. Live stakes will be installed on the stream banks in accordance with the planting plan in Appendix D. The entire conservation easement area will be planted with bare root seedlings in accordance with the planting plan in Appendix D.

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 analysis included riffle and reach pebble counts and bulk samples on Junes Branch and Bumgarner Branch. The bed material consists of a mix of sand, gravel and cobble with a large constituent being composed of sand (40%-60%). Using the raw data from the Site for competence calculations provides essentially meaningless results since the high sand content skews the size of the D_{50} to sand sized particles. Even using the raw data collected from the upstream off-site reaches which both have a D_{50} of 18 mm provides dubious results. In this case the predicted stable channel slopes would be 1.2% and 0.8% on Bumgarner and Junes respectively, while the valley slopes are 2.3% and 2.8%. This would suggest that the stable channel slopes and the existing valley slopes are incompatible.

There are several possible explanations for the incongruence of Site data and the Site topography. The first attempt to reconcile the data was to recognize the large sand content as wash load and remove it from the bed load calculations. The adjusted data provides a D_{50} in the range of 37 mm to 46 mm on Bumgarner and 16 mm on Junes Branch. Using the adjusted D_{50} as the representative particle in the competence calculations improves the results but does not completely resolve the incongruence with the valley slopes.

In order to better understand the relationship between the bed material, the channel slope and the valley slope a detailed assessment was conducted of the reference reach competence. Critical dimensionless shear (τ_c*) was calculated using the Andrew's equation (1984), the slope based Lamb equation (2008), and the range of standard values available in the scientific literature. Shear stress was used to predict stable channel slopes for the rifle pebble count, reach pebble count and bulk sample D_{50}, D_{84}, D_{95} and D_{max} particle sizes. The combination that provided the best agreement with the existing channel slopes was the standard critical shear value of 0.047 with the D_{84} representing the threshold particle size. This result is consistent with field observations of the channel as a relatively low sediment supply stream that is at least partially self-armored.

Although the present condition of Bumgarner and Junes Branch is not a low sediment supply system it is reasonable to consider the gravel and cobble fraction of the bed material to be in low supply. Given that condition, the stable configuration of these streams would be a partially armored bed of gravel and cobble that permits the transport of the sand wash load through the system. Shear stress calculations were performed using a critical dimensionless shear value of 0.04 and a threshold particle size of 73 mm on Bumgarner and 56 mm on Junes Branch. The critical dimensionless shear value was selected to be slightly less than the reference reach value to account for potentially higher mobility associated with the disturbed nature of the post construction bed conditions. The threshold particle sizes were taken from the average of the two largest particles in the bulk samples from upstream of the Site. These particle sizes were consistent with the D_{84} sizes from the adjusted data sets and are representative of what may actually

be supplied by the watershed. The shear stress calculations were used to predict stable channel slopes of approximately 2.0% which is more consistent with the overall valley slopes.

Sediment Capacity Analysis
In order to assist in evaluating the sediment capacity, a set of consecutive pit traps were installed in the stream bed at the downstream end of Bumgarner Branch. Three samples were collected from the pit traps following rainfall events. These samples were sieved and weighed. The last sample collected from the pit trap was following a rainfall event that registered 0.85 ft. on the crest gauge. From this sample it was estimated that the total bed load was between 0.3 to 0.6 tons for this less-than-bankfull event.

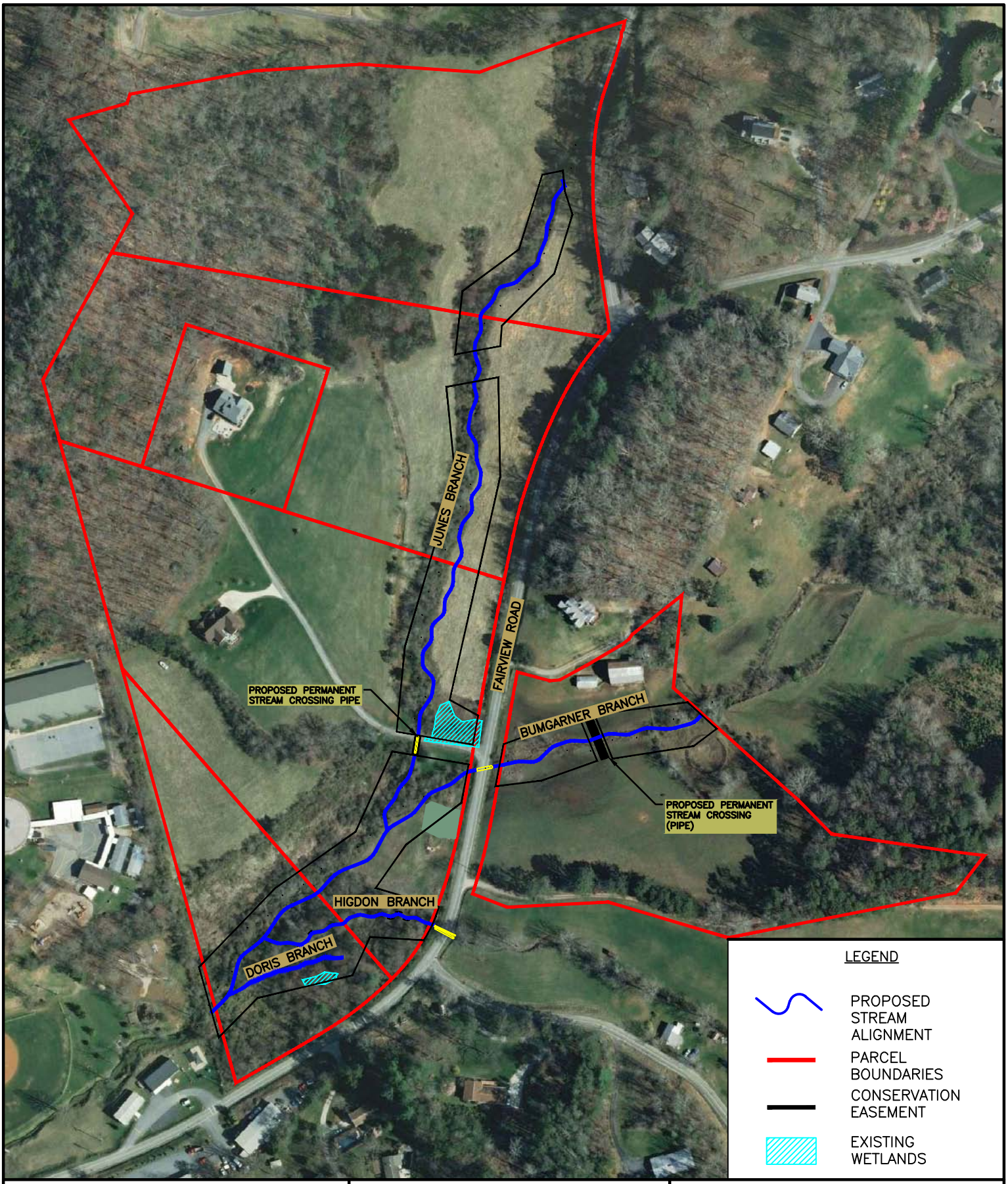
A flow duration hydrograph was constructed to simulate the third sampling event in order to model sediment transport using the quasi-unsteady flow routine in HEC-RAS. Seven sediment transport functions were evaluated for consistency with sediment data collected in the pit traps. The Wilcock transport function provided results that fit best with the data. The Wilcock function predicted 0.8 to 2.7 tons of cumulative sediment output at the downstream end of Bumgarner while the other sediment transport function predicted sediment output values more than two orders 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.

Two quasi-unsteady simulations were run in HEC-RAS to qualitatively to evaluate the sediment transport capacity. The modeling consisted of running the bankfull discharge and the 10-year discharge for a constant 24 hour simulation on a one 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 the channel invert elevation, Bumgarner and Junes Branch perform similarly under existing and proposed conditions. Bed invert changes are generally between 0.1 ft. and 0.2 ft. for the bankfull flow and between 0.2 ft. and 0.3 ft. for the 10-year flow. One exception is that the existing model predicts approximately 1 ft. of aggradation at the downstream end of Junes Branch in the bankfull flow and 1 ft. of scour in the 10-year flow while the proposed model predicts less than 0.2 ft. of bed change.

With respect to cumulative mass output the model predicts an approximate average reduction of 40% in the sediment output. This is primarily in response to the proposed reconfiguration of the bed material composition which will reduce the percentage of sand from 50% to 20% of the total. Given the limited predicted change in proposed channel invert elevation this can be interpreted as not resulting in aggradation.

The design configuration was also evaluated for sediment transport capacity by assessing continuity and magnitude of stream power. Generally the proposed conditions model show a significant decrease in stream power in the higher frequency events with comparable or somewhat higher stream power in the lower frequency events. The decrease in stream power in the higher frequency events is to be expected due to the proposed increase in channel width/depth ratio. However, this is not troubling since the actual stream power values are sufficiently high to transport the sand particles which constitute the main wash load component.



PREPARED FOR:

PREPARED BY:

250 0 250 750

SCALE IN FEET

PROPOSED HYDROLOGIC FEATURES MAP

JUNE'S BRANCH RESTORATION SITE
JACKSON COUNTY, NORTH CAROLINA

FIGURE 7

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

Dimension

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

Pattern and Profile

Measurements and calculated values should indicate stability with little deviation from as-built conditions and established morphological ranges for the restored stream type. Pool depths may vary from year to year, but the majority should maintain depths sufficient to be observed as distinct features in the profile. The pools should maintain their depth with flatter water surface slopes, while the riffles should remain shallower and steeper. Pattern measurements will not be collected unless conditions seem to indicate that a detectable change appears to have occurred based on profile and/or dimension measurements.

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.

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 320 stems per acre by the end of the Year 3 monitoring period and a minimum of 260 stems per acre at the end of Year 5. 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.

10.0 MONITORING REQUIREMENTS

Annual 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	annual	
YES	Dimension	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	annual	
YES	Profile	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	annual	
YES	Substrate	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	annual	
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
NO	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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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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Schafale, M.P. and Weakley, A. S. (1990), *Classification of the Natural Communities of North Carolina, Third Approximation,* NC Natural Heritage Program, Raleigh, NC

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APPENDIX A
SITE PROTECTION INSTRUMENT(S)

PLAT CABINET: 19 SLIDE: 761

LINE	BEARING	DISTANCE	LINE	BEARING	DISTANCE
L1	N 15°32'56" W	145.02	L17	N 72°45'55" W	99.32'
L2	N 44°02'11" E	23.20'	L18	N 72°45'55" W	85.92'
L3	S 80°12'10" E	152.57'	L19	S 79°32'55" W	91.93'
L4	S 11°13'32" W	78.43'	L20	S 04°59'27" E	39.08'
L5	S 73°11'04" E	136.15'	L21	S 17°36'22" E	50.82'
L6	S 30°52'10" W	44.84'	L22	S 45°18'51" W	145.66'
L7	S 37°48'21" W	32.54'	L23	S 04°17'54" W	59.37'
L8	N 86°15'38" W	98.33'	L24	N 80°23'16" W	224.58'
L9	S 24°53'40" W	37.57'	L25	N 80°23'16" W	85.61'
L10	S 24°53'40" W	46.60'	L26	N 22°09'21" W	94.26'
L11	S 44°36'55" W	23.05'	L27	S 53°24'19" W	57.73'
L12	N 41°07'39" W	104.76'	L28	S 22°09'21" E	94.97'
L13	N 80°12'10" W	152.39'	L29	N 11°13'32" E	85.17'
L14	N 79°32'55" E	103.32'	L30	N 11°28'29" E	40.02'
L15	S 60°53'54" E	64.55'	L31	N 11°54'25" E	64.88'
L16	S 11°13'32" W	58.75'	L32	N 82°31'51" E	31.01'

PLAT REVISED 11/16/12 TO ADD PROPOSED WELL AND WATERING STATIONS

ELDRIDGE PAINTER & BETTY JO PAINTER
PIN: 7651-03-2003
DB: 1492 PG: 439

EXISTING GRAVEL DRIVE R/W PER DB: 474 PG: 630

SPO FILE: 50-AM
DORIS HIGDON, RENEE H. COWARD & J.K. COWARD, JR.
PIN: 7651-02-4182
DB: 491 PG: 622
(LOT A) PC:12 PG:455

(SEE NOTE #12)

HASKETT ROAD (45' FOOT R/W PER DB: 1124 PG: 615) SR: 1725

END SPECIAL R/W CONDITION PER DB: 1124 PG: 615

This property is not located within a public water supply watershed and can be recorded in the Register of Deeds Office.
12/10/12 Date — Watershed Administrator

AREA (A-1) 0.65 ACRES

AREA (B-1) 0.15 ACRES

AREA (B-2) 0.78 ACRES

AREA (C-1) 0.88 ACRES

AREA (C-2) 1.42 ACRES

AREA (D-1) 1.15 ACRES

AREA (E-1) 0.38 ACRES

AREA (E-2) 0.41 ACRES

1" IR
1" IP/CAP SET
N 28°12'05" E 373.85' (386.90')
N 80°23'16" W 710.22'
AXLE
JOEL A. SARTI & DANA SARTI
PIN: 7651-01-2647
DB: 1202 PG: 165
PC: 12 PG: 455
3/4" RBR
N 72°45'55" W 311.95'
N 15°32'56" W TOTAL: 1461.70' (602.86')
(591.81')
S 41°07'39" E 521.75'

SPO FILE: 50-AR
DORIS HIGDON, JOEL A. SARTI & DANA H. SARTI
PIN: 7651-02-4620
DB: 491 PG: 622
(LOT B) PC:12 PG:455

SPO FILE: 50-AZ
DORIS HIGDON, DENNY HIGDON
PIN: 7651-01-3188
DB:491 PG:622
(LOT C) PC:12 PG:455

SPO FILE: 50-AS
DORIS HIGDON
PIN: 7651-00-2682
DB: 491 PG: 622
(LOT D) PC:12 PG:455

JACKSON COUNTY BOARD OF EDUCATION
PIN: 7641-90-4562
DB: 360 PG: 579

SPO FILE: 50-AT
DORIS HIGDON & DEBBIE HIGDON
PIN: 7651-10-0888
DB: 514 PG: 533

DEBRA HIGDON
PIN:7651-01-9384
DB: 1122 PG: 77

T RAY FRANKLIN & CLARA FRANKLIN
PIN: 7651-11-3176
DB: 604 PG: 297

CLAUDE C. RIDLEY JR & SHARON RIDLEY
PIN: 7651-10-3397
DB: 460 PG: 418

N 78°52'15" E 41.49'
N 17°30'48" E 155.57'
N 53°34'57" E 138.75'
S 17°09'44" W 122.83'
N 06°36'20" E 54.50'
N 06°36'20" E 90.78'
60' CROSSING
50' R/W PER DB:1479 PG: 449
N 05°32'41" W 159.62'
S 00°57'01" E 180.21'
N 16°25'34" E 179.95'
S 12°45'58" W 204.53'
N 16°25'34" E 170.44'
S 12°45'58" W 247.28'
N 05°37'57" E 171.03'
20' WIDE ACCESS EASEMENT PER DB:1202 PG:165
40' CROSSING
N 24°46'01" E 176.07'
S 52°57'02" W 134.82'
N 58°09'38" E 150.70'
S 41°07'39" E 215.54'
N 44°02'11" E 238.01'
20' CROSSING
S 76°39'30" W 192.69'
S 44°36'55" W 87.10'
S 35°12'23" W 105.68'
1/4" IR @ 14.64'
S 66°57'14" E 114.48'
N 88°03'26" E 197.83'
1 1/2" IP
1 1/2" IP
S 82°56'20" W 92.12'
30' CROSSING
S 70°39'23" W 117.62'
S 81°14'26" W 162.12'
N 69°57'51" E 159.66'
N 82°31'51" E 186.45'
S 00°23'56" E 148.89' (TIE)
BARN
BARN
GRAVEL DRIVE
N 07°02'02" E 161.77' (TIE ONLY)
ANGLE IRON
S 47°31'28" E 53.32'
S 47°31'28" E 77.64'
1 1/2" IP FOUND 2.5' WEST OF LINE @ 101.92'
S 47°31'28" E 223.05'
1/2" IP
N 22°17'49" E 94.39'
24" POST OAK
1" IP (DISTURBED)
S 60°38'43" E 340.50'
1" IP @ 21.00'
1/4" IR @ 10'
1" RBR
N 65°42'13" E 226.78' (TIE)
NLF
END 60' R/W PER NCDOT DIVISION 14
GRID TIE: N 80°29'05" E 4584.69' (GRID) 4585.72' (GROUND) COMBINED FACTOR: 0.99977539
NGS STATION "PETER" NAD 83(2007) SPC'S: EPOCH DATE: 2002 N: 609480.59 FEET E: 745518.51FEET Z: 2156.33 FEET
OFFICE OF REGISTER OF DEEDS JOE HAMILTON JACKSON COUNTY, N.C.
KEE GPS CONTROL MONUMENT N: 610238.49' E: 750040.12'
NAIL SET
CMP
OLD BLOCK FOUNDATION
FLOW
GATE
PROPOSED CE ACCESS PATH (SEE NOTE #11)
CE ACCESS ROAD (SEE NOTE #11)
(SEE NOTE #12)
FAIRVIEW ROAD (R/W WIDTH IS BY MAINTENANCE PER NCDOT) SR: 1724
GRAVEL DRIVE

CURVE	RADIUS	ARC LENGTH	CHORD LENGTH	CHORD BEARING
C1	459.76'	106.64'	106.40'	N 53°30'48" E
C2	408.38'	119.46'	119.03'	N 40°56'10" E
C3	296.47'	100.62'	100.14'	N 22°51'08" E
C4	1270.99'	116.83'	116.79'	N 14°58'29" E
C5	890.17'	192.16'	191.78'	N 23°47'32" E
C6	690.89'	100.04'	99.96'	N 34°07'28" E
C7	611.62'	119.25'	119.07'	N 10°28'34" W
C8	366.67'	115.43'	114.96'	N 10°14'57" E

CORNER #	NORTHING	EASTING
1	610449.334	750214.110
2	610589.047	750175.242
3	610605.720	750191.364
4	610776.826	750356.809
5	610856.324	750484.829
6	611016.199	750558.590
7	610990.237	750708.933
8	610913.310	750693.665
9	610832.078	750586.060
10	610745.726	750525.131
11	610706.338	750655.463
12	610642.138	750612.508
13	610648.551	750514.389
14	610572.201	750478.957
15	610527.736	750291.467
16	610465.744	750230.301
17	611055.416	750566.551
18	611225.619	750583.337
19	611561.708	750682.420
20	611720.584	750666.997
21	611739.326	750768.601
22	611559.140	750771.590
23	611118.506	750671.754
24	611087.109	750728.159
25	611029.484	750716.722
26	611784.065	750680.383
27	611928.377	750697.094
28	612010.746	750808.745
29	612159.104	750855.560
30	612167.112	750896.266
31	612079.735	750915.039
32	611962.375	750878.794
33	611859.943	750775.233
34	611800.741	750770.784
35	611030.431	750778.080
36	611085.133	750928.079
37	610997.173	750963.896
38	610958.215	750852.920
39	610946.891	750761.500
40	611089.164	750958.829
41	611113.401	751143.694
42	611060.971	751200.961
43	611026.554	751154.609
44	611001.865	750994.377

ROAD CALLS

LINE	BEARING	DISTANCE
R1	N 58°40'53" E	124.99'
R2	N 59°31'18" E	148.92'
R3	N 12°44'31" E	40.11'
R4	N 11°13'32" E	430.66'
R5	N 11°27'55" E	158.05'
R6	N 11°50'40" E	119.73'
R7	N 04°53'25" W	56.41'
R8	N 06°48'33" W	131.41'
R9	N 02°37'39" W	50.02'
R10	N 19°16'05" E	41.24'
R11	N 21°08'14" E	109.94'
R12	N 18°26'57" E	35.76'

TOTAL CONSERVATION EASEMENT AREA = 5.82 ACRES

THIS PLAT DOES NOT CREATE A SUBDIVISION OF PROPERTY IN JACKSON COUNTY. THE PURPOSE OF THIS SURVEY IS TO IDENTIFY THE CONSERVATION EASEMENT AREAS ONLY. NO TRANSFER OF PROPERTY IS TAKING PLACE.

CERTIFICATE OF SURVEY AND ACCURACY:

I, PHILLIP B. KEE, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTION RECORDED IN DB: 491, PG: 622, DB: 514, PG: 533, PB: 12, PG: 455); THAT DASHED LINES INDICATE LINES NOT SURVEYED; THAT THE RATIO OF PRECISION AS CALCULATED DOES NOT EXCEED 1:10,000; AND THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED.

I ALSO HEREBY CERTIFY THAT THIS PLAT IS OF ONE OF THE FOLLOWING: GS 47-30 F(11) D; THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXCEPTION TO THE DEFINITION OF SUBDIVISION.

WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 16TH DAY OF NOVEMBER, A.D., 2012.

NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

THIS DOCUMENT IS NOT VALID UNLESS SIGNED AND SEALED

Phillip B. Kee
PHILLIP B. KEE, PLS NC-4647

SURVEYOR'S NOTES:

1. ALL DISTANCES ARE GROUND MEASUREMENTS IN US SURVEY FEET UNLESS OTHERWISE NOTED.
2. AREAS CALCULATED BY THE COORDINATE METHOD.
3. PROPERTY SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS AND RESTRICTIONS THAT ARE RECORDED, UNRECORDED, WRITTEN AND UNWRITTEN.
4. JACKSON COUNTY GIS WEBSITE USED TO IDENTIFY PROPERTY OWNERS.
5. THE PROFESSIONAL SURVEYOR HAS MADE NO INVESTIGATION OR INDEPENDENT SEARCH FOR EASEMENTS, RIGHT OF WAYS, ENCUMBRANCES, RESTRICTIVE COVENANTS, CORRECT OWNERSHIP OR ANY OTHER FACTS THAT AN ACCURATE AND CURRENT TITLE SEARCH MAY DISCLOSE. A NC LICENSED ATTORNEY SHOULD BE CONSULTED.
6. BY GRAPHIC DETERMINATION, THE SUBJECT PROPERTY APPEARS TO BE OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN (ZONE X) AS DETERMINED BY THE F.E.M.A. MAP#3700765100J DATED APRIL 19, 2010.
7. GRID COORDINATES AND BEARINGS WERE DERIVED FROM GLOBAL POSITIONING SYSTEM OBSERVATIONS THAT WERE OBSERVED ON (12/19/11) AND WERE PERFORMED TO THE GEOSPATIAL POSITIONING ACCURACY STANDARDS (CLASS A HORIZONTAL AND CLASS C VERTICAL); AT THE 95% CONFIDENCE LEVEL USING GPS L1 STATIC OBSERVATIONS WITH MAGELLAN PROMARK3 RECEIVERS.
8. UTILITIES WERE LOCATED BASED ON VISIBLE ABOVE GROUND STRUCTURES, THEREFORE THE LOCATION OF UNDERGROUND UTILITIES ARE APPROXIMATE OR MAY BE PRESENT AND NOT SHOWN HEREON. CALL 1-800-632-4949 BEFORE DIGGING.
9. ALL EXISTING FENCES WITHIN THE CONSERVATION EASEMENT AREAS ARE TO BE REMOVED.
10. BOUNDARY LINES NOT SURVEYED ARE INDICATED AS DASHED LINES AND WERE DERIVED FROM A SURVEY FOR "DORIS HIGDON", PREPARED BY DAVENPORT & ASSOC., INC., DATED 09/09/03, BEING RECORDED IN PB:12 PG:455 IN THE JACKSON COUNTY REGISTRY.
11. THE STATE OF NORTH CAROLINA RESERVES THE RIGHT TO USE A 12' WIDE NON-EXCLUSIVE EASEMENT FOR THE PURPOSE OF INGRESS, EGRESS AND REGRESS FROM PATHS AND ROADS, WHICH ARE SHOWN HEREON IN APPROXIMATE LOCATIONS, FOR ACCESS TO CONSERVATION EASEMENT AREAS. ACCESS IS ALSO PERMITTED BETWEEN ALL STREAM CROSSINGS. SEE SECTION IIIA IN THE CONSERVATION EASEMENT AGREEMENT.
12. THE RIGHT OF WAY WIDTH REQUIRED FOR OVERHEAD DISTRIBUTION POWER LINES OF ANY VOLTAGE IS NORMALLY A 30-FOOT CORRIDOR (15 FEET ON EACH SIDE) PER DUKE ENERGY. SEE DB:1041 PG:641.

CERTIFICATE OF OWNERSHIP AND DEDICATION:

I HEREBY CERTIFY THAT I AM THE OWNER OF THE PROPERTY AS SHOWN AND DESCRIBED HEREON. I ALSO HEREBY ACCEPT AND ADOPT THIS RECORD PLAT AND CONSERVATION EASEMENT WITH MY FREE CONSENT AND DEDICATED ALL EASEMENTS, RIGHT OF WAYS AND ACCESS ROADS TO PUBLIC AND/OR PRIVATE USE AS NOTED ON SAID PLAT.

DORIS HIGDON — DATE 12-5-12
RENEE H. COWARD — DATE 12/6/12
J.K. COWARD, JR. — DATE 12/6/12
JOEL A. SARTI — DATE 12/2/12
DANA H. SARTI — DATE 12/2/12
DENNY HIGDON — DATE 12-03-12
DEBBIE HIGDON — DATE 12/1/12

APPROVED FOR RECORDING
JACKSON COUNTY PLANNING OFFICE
Signature — 12/10/12 Date

REGISTERED THIS THE 10 DAY OF December 2012 AT 10:50 AM AND RECORDED IN PLAT CABINET 19 SLIDE 761 BY:
DEPUTY
Joe Hamilton
REGISTER OF DEEDS

I, Kimi McClure, REVIEW OFFICER FOR JACKSON COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED, MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.
Kimi McClure 12/10/12
REVIEW OFFICER — DATE

0' 120' 240' 360'
1 INCH = 120 FEET

VICINITY MAP
(NOT TO SCALE)
SITE
HWY 107
SR: 1724 FAIRVIEW ROAD
SR: 1727 ASHE LOOP
SR: 1725 HASKETT ROAD

CONSERVATION EASEMENT CORNER (TYPICAL)
STATE OF NORTH CAROLINA CONSERVATION EASEMENT

LEGEND:

●	CALCULATED POINT (NOT SET)
◉	EXISTING IRON PIN (AS NOTED)
○	CONSERVATION EASEMENT CORNER (#5 REBAR WITH EEP CAP SET)
▣	NGS MONUMENT
▲	EXISTING NAIL
ø	UTILITY POLE
~	NOT TO SCALE (NTS)
□	FIBER OPTIC CABLE RISER
IP	IRON PIPE
IR	IRON ROD
NLF	NAIL FOUND
RBR	REBAR
CNR	CORNER
DB:	DEED BOOK
PG:	PAGE
PC:	PLAT CABINET
CMP	CORRUGATED METAL PIPE
SR	STATE ROAD
PL	PROPERTY LINE

———	BOUNDARY LINE
— — —	BOUNDARY LINE NOT SURVEYED
----------	TIE LINE ONLY
— — — —	ADJOINING DEED LINES
—·—·—	RIGHT OF WAY (R/W)
——X——	FENCE LINE
——OW——	OVERHEAD WIRE
	EXISTING STREAM
	CONSERVATION EASEMENT (CE) AREA
	GRAVEL
	SOIL ROADBED/ACCESS PATH
Ⓦ	PROPOSED WATERING STATION
⊘	PROPOSED WELL
NGS	NATIONAL GEODETIC SURVEY
N.A.D.	NORTH AMERICAN DATUM 1983
SPC	STATE PLANE COORDINATES
POB	POINT OF BEGINNING
O/S	OFFSET
CC	CONTROL CORNER

GRID NORTH NAD 83

FINAL PLAT OF A CONSERVATION EASEMENT SURVEY FOR:

THE STATE OF NORTH CAROLINA, NC DEPARTMENT OF ADMINISTRATION, ECOSYSTEM ENHANCEMENT PROGRAM, JUNES BRANCH STREAM RESTORATION PROJECT

SPO FILE NUMBER: 050-AM, 050-AR, 050-AZ, 050-AS, & 050-AT
EEP PROJECT ID#: 95027 CONTRACT # 003979

CURRENT OWNERS LISTED AS:
DORIS HIGDON, RENEE H. COWARD, J.K. COWARD, JR., JOEL A. SARTI, DANA H. SARTI, DENNY HIGDON, & DEBBIE HIGDON

PARCEL IDENTIFICATION NUMBER'S:
7651-02-4182 (LOT A), 7651-01-4620 (LOT B), 7651-01-3188 (LOT C), 7651-00-2682 (LOT D) & 7651-10-0888
REFERENCES: DB:491 PG:622, DB:514 PG:533 & PC:12 PG:455
SYLVA TOWNSHIP, JACKSON COUNTY, NORTH CAROLINA

SURVEY BY: NH,MM,PBK	DRAWN BY: PBK	SCALE: 1"=120'
SURVEY DATES: 12/19/11-09/27/12 (REV. 11/16/12)		JOB #111192-CE

Kee MAPPING & SURVEYING
P.O. Box 2566
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(828) 645-8275
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PC 19 SL 761

APPENDIX B
BASELINE INFORMATION DATA

Appendix A

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:	June's Branch Stream Restoration
County Name:	Jackson County
EEP Number:	003979
Project Sponsor:	NCEEP
Project Contact Name:	Paul Wiesner
Project Contact Address:	5 Ravenscroft Drive, Suite 102, Asheville, NC 28801
Project Contact E-mail:	Paul.Wiesnerl@ncdener.gov
EEP Project Manager:	Paul Wiesner

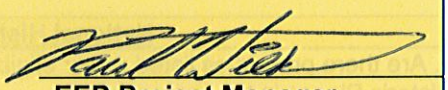
Project Description

Stream restoration activities will restore approximately 2,662 feet of stream and enhance 206 feet of stream along Bumgarner Branch, June's Branch, Higdon Branch, and Doris Branch by restoring natural channel morphology and proper sediment transport capacity, improving bed form diversity, constructing a floodplain bench, improving channel and stream bank stabilization, establishing a forested and herbaceous riparian buffer plant community.

For Official Use Only

Reviewed By:

11/31/2011
Date


EEP Project Manager

Conditional Approved By:

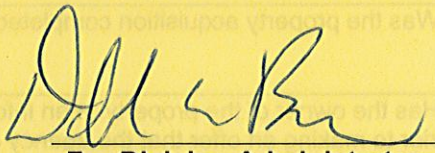
Date

For Division Administrator
FHWA

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

Final Approval By:

11-21-11
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

BUMGARNER BRANCH

NC DWQ Stream Identification Form Version 4.11

Date: 1/25/2011	**Project/Site:** ~~Jones Br~~ Bumgarner Br.	**Latitude:** 35.35653
Evaluator: S. Melton, K. Mitchell	**County:** Jackson	**Longitude:** -83.19013
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:* Sylva Sum

A. Geomorphology (Subtotal = 19)	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 = 11)				
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 = 10)				
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	FACW = 0.75; OBL = 1.5 Other = (0)			

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

Notes: Caddisfly, Mayflies present in stream

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 1/25/2011	**Project/Site:** June's Branch (UT1)	**Latitude:** 35.35934
Evaluator: S. Melton, K. Mitchell	**County:** Jackson	**Longitude:** -83.19082
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 38	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:* Sym South

A. Geomorphology (Subtotal = 19.5)	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 = 9)				
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	FACW = 0.75; OBL = 1.5 Other = (0)			

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

Notes: Caddisflies present

Sketch:

HIGDON BRANCH

NC DWQ Stream Identification Form Version 4.11

Date: 1/25/2011	**Project/Site:** Jones Branch (UT 2)	**Latitude:** 35.35557
Evaluator: S. Melton, K. Mitchell	**County:** Jackson	**Longitude:** -83.19203
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 38	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** Syva South *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17)	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 = 11.5)				
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 = 9.5)				
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	FACW = 0.75; OBL = 1.5 Other = (0)			

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

Notes: Caddisflies present

Sketch:

DORIS BRANCH

NC DWQ Stream Identification Form Version 4.11 (UT3)

Date: 1/25/2011	**Project/Site:** Jones Branch	**Latitude:** 35.35516
Evaluator: Mitchell (Melton)	**County:** Jackson	**Longitude:** -83.19238
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 29.5	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:* Sylva South

A. Geomorphology (Subtotal = 10.5)	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 = 10.5)				
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 = 8.5)				
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	FACW = 0.75; OBL = 1.5 Other = (0)			

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

Notes:

Sketch:

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Jones Branch City/County: Jackson Sampling Date: 10/4/11

Applicant/Owner: EBX State: NC Sampling Point: WP 1

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

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0 %

Subregion (LRR or MLRA): LRR N Lat: 35.35656 Long: -83.19124 Datum: NAD83

Soil Map Unit Name: Cullowhee series NWI classification: Scrub Shrub

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: Boundary marked by WP 3-11

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): 10-12in.

Wetland Hydrology Present? Yes ☒ No ☐

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

Remarks:

pic 1 = Carex

pic 2 = unknown weed

pic 3 = soils

VEGETATION – Use scientific names of plants.

Sampling Point: WP 1

Tree Stratum (Plot size: 30 sq. feet) 50=17.5 20=7	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	30%	☒	OBL
2. Acer rubrum	5%	☐	FAC
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	35	= Total Cover	
Sapling Stratum (Plot size: 15 sq. feet)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
50=6.5 20=2.6	–	= Total Cover	
Shrub Stratum (Plot size: 15 sq. feet)			
1. Alnus serrulata	10%	☒	FACW+
2. Cornus amomum	3%	☒	FACW+
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
50=15 20=6	13	= Total Cover	
Herb Stratum (Plot size: 5 sq. feet)			
1.		☐	
2. Scirpus atrovirens (Green Bulrush)	15%	☒	OBL
3. Juncus effusus	10%	☒	FACW+
4. Polygonum setaceum	2%	☐	FACW
5. NY Ironweed Vernonia noveboracensis	1%	☐	FAC+
6. Jo-Pye Weed Eupatoriadelphus fistulosus	1%	☐	FAC+
7. Cardinal Flower Lobelia cardinalis	1%	☐	FACW+
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	30	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

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

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	45	x 1 =	45
FACW species	26	x 2 =	52
FAC species	7	x 3 =	21
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	71 (A)		118 (B)

Prevalence Index = B/A = 1.66

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X 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: WP1

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
0-5	10YR 5/4	100					Sandy loam	
5-12	10YR 5/2	100					Sandy 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:

Photo #3

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Jones Branch City/County: Jackson Sampling Date: 10/4/11

Applicant/Owner: EBX State: NC Sampling Point: WP 2

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

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): ~1%

Subregion (LRR or MLRA): LRR N Lat: 35.35666 Long: -83.19122 Datum: NAD 83

Soil Map Unit Name: Cullowhee NWI classification: Managed Pasture

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

Are Vegetation [X], Soil [ ], or Hydrology [ ] significantly disturbed? Are "Normal Circumstances" present? Yes [X] 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 [X]	**Is the Sampled Area within a Wetland?** Yes [ ] No [X]
Hydric Soil Present?	Yes [ ]	No [X]	
Wetland Hydrology Present?	Yes [ ]	No [X]	

Remarks: Field has been utilized as managed pasture for 30+ years.

HYDROLOGY

Wetland Hydrology Indicators:

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

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [X] Water Marks (B1)
- [X] 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 [X]	Depth (inches):
Water Table Present?	Yes [ ]	No [X]	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes [ ]	No [X]	Depth (inches):

Wetland Hydrology Present? Yes [ ] No [X]

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

Remarks:

pic 4,5 - managed pasture

~~Juncus~~ - Carex stricta

- Sacrpus Actofinanus - Green Bulrush

VEGETATION – Use scientific names of plants.

Sampling Point: WP 2

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Sapling Stratum (Plot size:)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Shrub Stratum (Plot size:)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Herb Stratum (Plot size: 5 sq. feet)			
1. Fescue Festuca arundinacea	100%	☒	FAC-
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	100% = Total Cover		
Woody Vine Stratum (Plot size:)			
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: WP2

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-12	10YR 5/6	100%					Clay 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: Jones Branch City/County: Jackson Sampling Date: 10/4/11

Applicant/Owner: EBX State: NC Sampling Point: WP14

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

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0%

Subregion (LRR or MLRA): LRR N Lat: 35.35521 Long: -83.19220 Datum: NAD 83

Soil Map Unit Name: Cullowhee NWI classification: Forested

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: Wetland boundary WP 16-23

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): 12+

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: WP 14

Tree Stratum (Plot size: 30 sq. ft)	50 = 42.5, 20 = 17	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum		80%	☒	FAC
2. Salix nigra		5%	☐	OBL
3.			☐	
4.			☐	
5.			☐	
6.			☐	
7.			☐	
		85%	= Total Cover	

Sapling Stratum (Plot size:)				
1.			☐	
2.			☐	
3.			☐	
4.			☐	
5.			☐	
6.			☐	
7.			☐	
	50 = 25, 20 = 10		= Total Cover	

Shrub Stratum (Plot size: 15 sq. feet)				
1. Privet (chinese) Ligustrum sinense		40%	☒	FAC
2. Cornus ammomum		10%	☒	FACW+
3.			☐	
4.			☐	
5.			☐	
6.			☐	
7.			☐	
	50 = 21, 20 = 8.4	50%	= Total Cover	

Herb Stratum (Plot size: 5 sq. feet)				
1. Jewelweed Impatiens capensis		40%	☒	FACW
2. Multiflora Rosa multiflora		2%	☐	UPL
3.			☐	
4.			☐	
5.			☐	
6.			☐	
7.			☐	
8.			☐	
9.			☐	
10.			☐	
11.			☐	
12.			☐	
		42	= Total Cover	

Woody Vine Stratum (Plot size:)				
1.			☐	
2.			☐	
3.			☐	
4.			☐	
5.			☐	
			= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

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

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	50	x 2 =	100
FAC species	120	x 3 =	360
FACU species	0	x 4 =	0
UPL species	2	x 5 =	10
Column Totals:	177 (A)		475 (B)

Prevalence Index = B/A = 2.68

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X 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: WP 14

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
0-8	10YR 5/3	100%					Silty loam	
8-12	10YR 3/3	100					Silty 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: Jones Branch City/County: Jackson Sampling Date: 10/4/11

Applicant/Owner: EBX State: NC Sampling Point: WP 15

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

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 21 90

Subregion (LRR or MLRA): LRR N Lat: 35.35504 Long: -83.19226 Datum: NAD 83

Soil Map Unit Name: Cullowhee NWI classification: Forested

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: WP 15

Tree Stratum (Plot size: 30 sq. feet) 50=50 20=20	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	95%	☒	FAC
2. White pine Pinus strobus	5%	☐	FACU
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	100	= Total Cover	
Sapling Stratum (Plot size: 15 sq. feet) 50=5 20=2			
1. Acer rubrum	10%	☒	FAC
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	10	= Total Cover	
Shrub Stratum (Plot size: 30 sq. feet) 50=10 20=4			
1. Privet (Chinese) Ligustrum sinense	20%	☒	FAC
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	20%	= Total Cover	
Herb Stratum (Plot size: 5 sq. feet) 50=4 20=1.6			
1. Privet Ligustrum sinense	5%	☒	FAC
2. American holly Ilex opaca	1%	☐	FAC-
3. Prunus serotina	2%	☒	FACU
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	8%	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	131	x 3 =	393
FACU species	7	x 4 =	28
UPL species		x 5 =	
Column Totals:	138 (A)		421 (B)

Prevalence Index = B/A = 3.05

Hydrophytic Vegetation Indicators:

X 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: WP 15

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-12	10YR 5/6	100%					Clay 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:

EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. State NFIP Engineer), NC Floodplain Mapping Unit (attn. State NFIP Coordinator) and NC Ecosystem Enhancement Program.

Project Location

Name of project:	Junes Branch Restoration
Name if stream or feature:	Bumgarner Branch
County:	Jackson County, NC
Name of river basin:	Little Tennessee
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Jackson County
DFIRM panel number for entire site:	3700765100J
Consultant name:	Wolf Creek Engineering, pllc
Phone number:	(828) 658-3649
Address:	7 Florida Avenue Weaverville, NC 28787

Design Information

Environmental Banc & Exchange (EBX) proposes to restore and enhance four unstable stream reaches in central Jackson County. The Junes Branch Stream Restoration Site is located approximately 2 miles east of Sylva, North Carolina at the latitude 35.357378° N and longitude 83.191391° W. The Site encompasses approximately 5.7 acres of agricultural land and consists of four unstable streams: Bumgarner Branch, Junes Branch, Higdon Branch, and Doris Branch.

Reach	Length	Priority
Bumgarner Branch	*1170*	*One (Restoration)*
Junes Branch	*1269*	*One (Restoration)*
Higdon Branch	*331*	*One (Restoration)*
Doris Branch	*237*	*One (Restoration)*

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

○ Yes ◉ No

If project is located in a SFHA, check how it was determined:

☐ Redelineation

☐ Detailed Study

☐ Limited Detail Study

☐ Approximate Study

☐ Don't know

List flood zone designation:

Check if applies:

☐ AE Zone

- ○ Floodway
- ○ Non-Encroachment
- ◉ None

☐ A Zone

- ○ Local Setbacks Required
- ○ No Local Setbacks Required

If local setbacks are required, list how many feet: N/A

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

○ Yes ◉ No

Land Acquisition (Check)

☐ State owned (fee simple)

☐ Conservation easment (Design Bid Build)

☑ Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)

Is community/county participating in the NFIP program?

◉ Yes ○ No

Note: if community is not participating, then all requirements should be addressed to NFIP (attn: State NFIP Engineer, (919) 715-8000)

Name of Local Floodplain Administrator: Tony Elders, CFM
Phone Number: ***828-631-2261***

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☑ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision

☐ Other Requirements

List other requirements:

Comments:

Name: Grant Ginn Signature: [signature]

Title: President/Wolf Creek Engineering, pllc Date: 5-3-12

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
- Capacity Calculations
- Bed Material Calculations

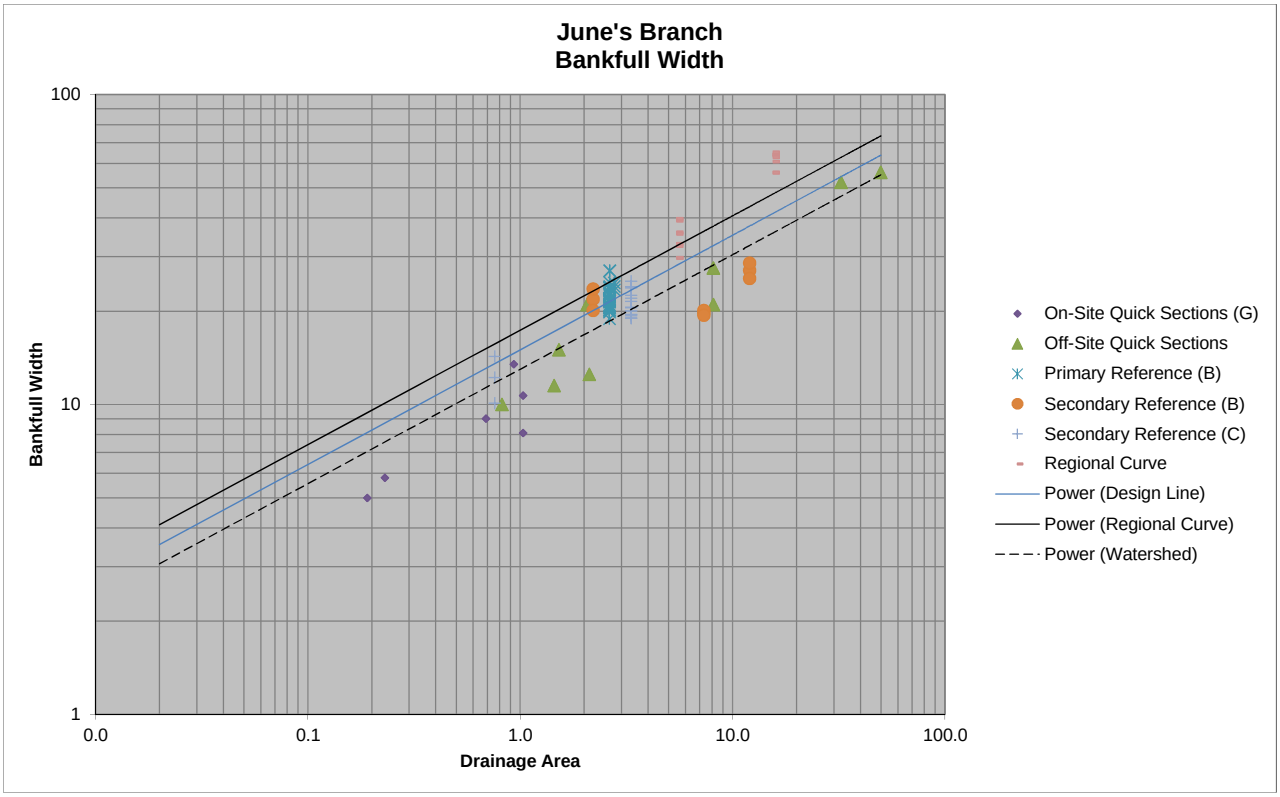
C3 Hydraulic Modeling
- Existing HEC-RAS Output
- Proposed HEC-RAS Output
- HEC-RAS Sediment Transport

C4 Assessment Data
- BEHI/NBS Calculations
- Existing Morphology
- Sediment Data
- Morphologic Site Map

C5 Reference Reach Data
- Cold Springs Reach 1
- Cold Springs Reach 2
- Cold Springs Reach 3

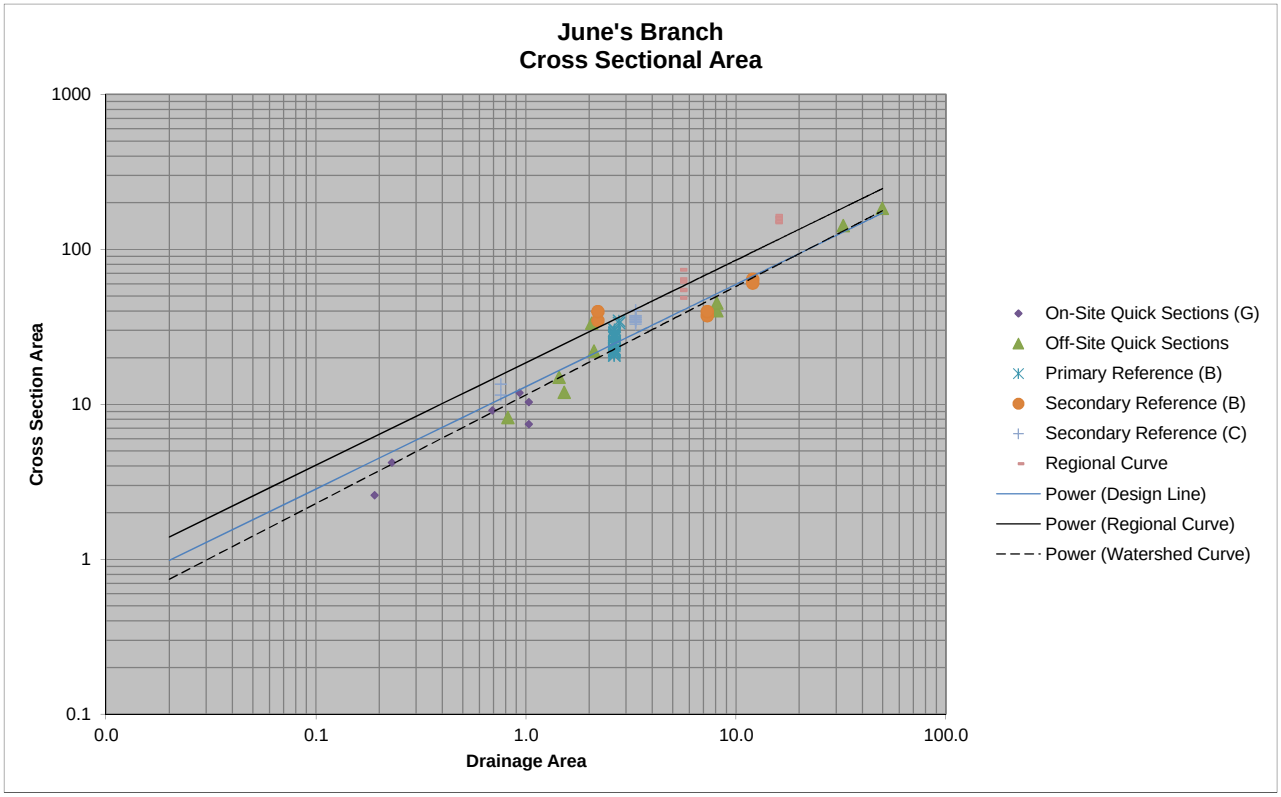
APPENDIX C1

Hydraulic Geometry



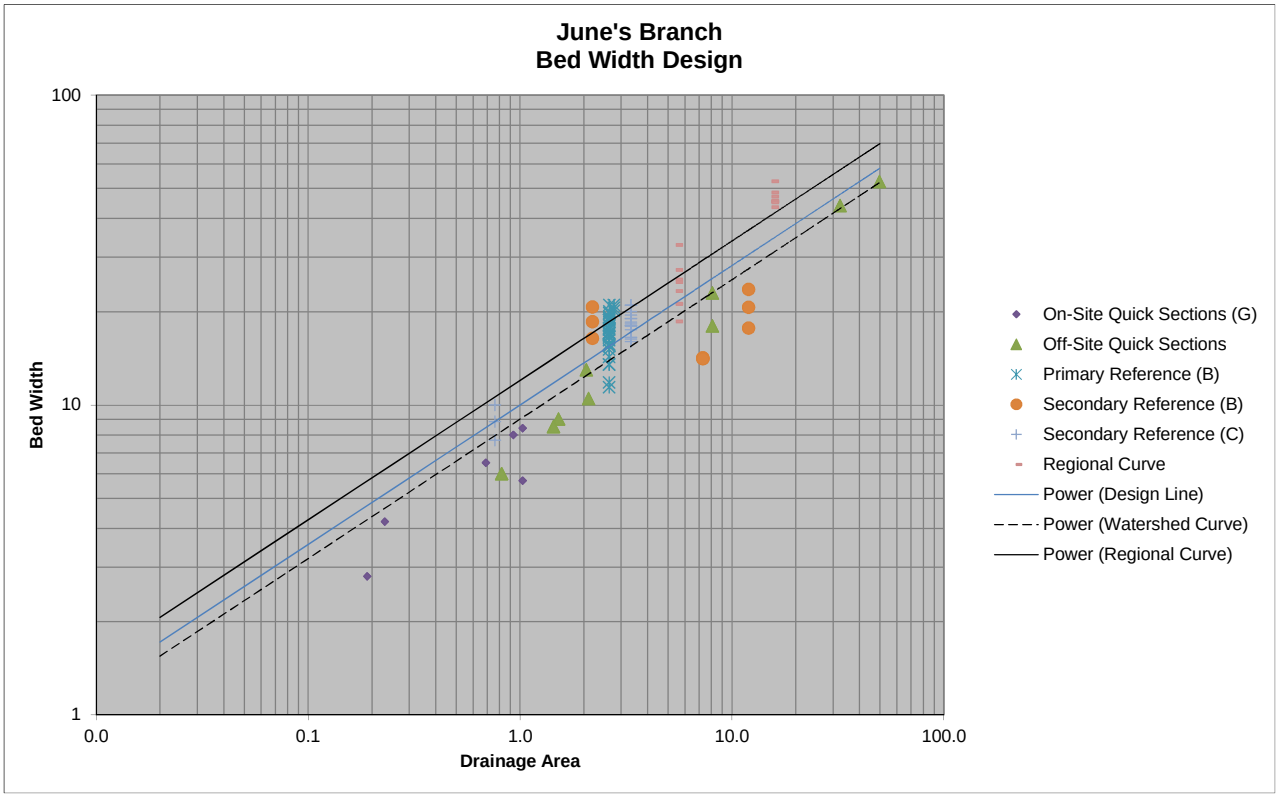
	Coefficient	Exponent
Design Line	15.0	0.37
Regional Curve	17.4	0.37
Watershed Curve	13.0	0.37

Design Line		Regional Curve		Watershed Curve	
X	Y	X	Y	X	Y
0.02	3.528	0.02	4.094	0.02	3.066
50	63.784	50	73.617	50	55.128



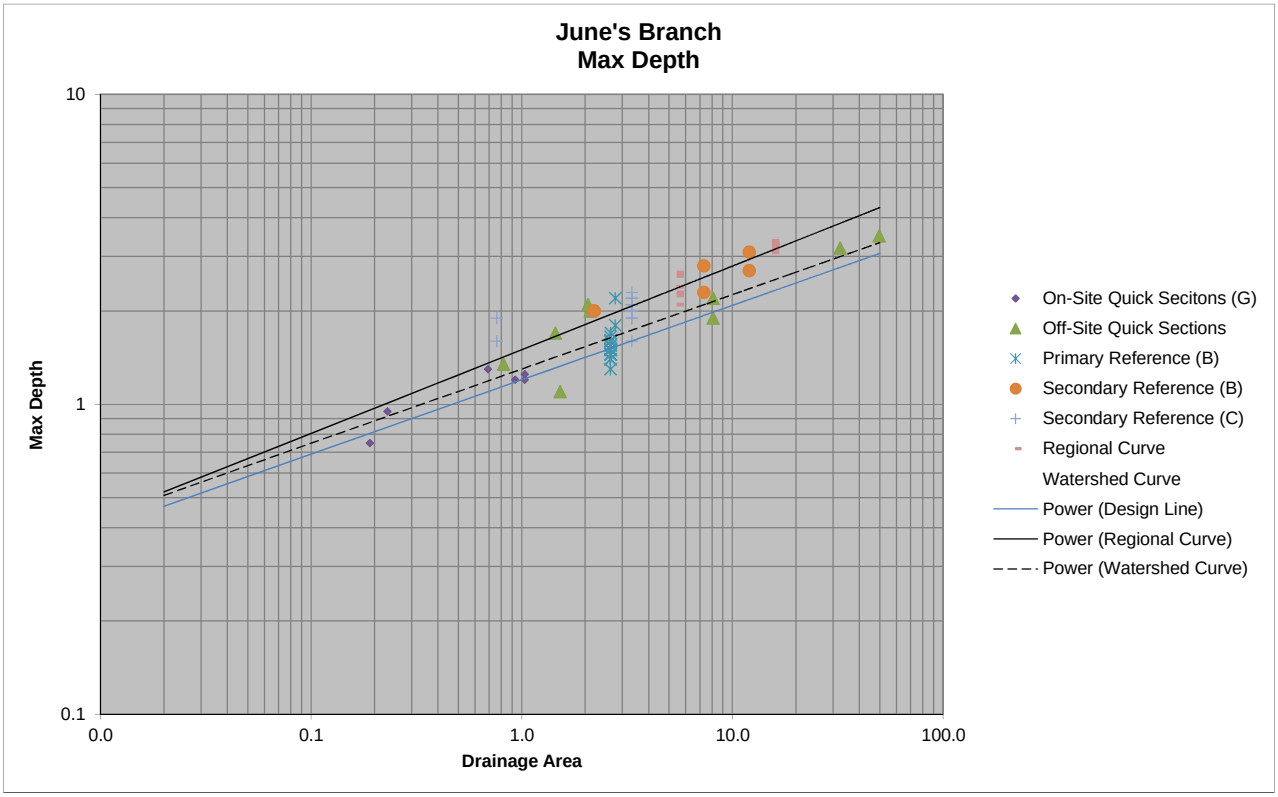
	Coefficient	Exponent
Design Line	13.0	0.66
Regional Curve	18.6	0.66
Watershed Curve	11.5	0.70

Design Line		Regional Curve		Watershed Curve	
X	Y	X	Y	X	Y
0.02	0.983	0.02	1.395	0.02	0.744
50	171.895	50	246.941	50	177.818



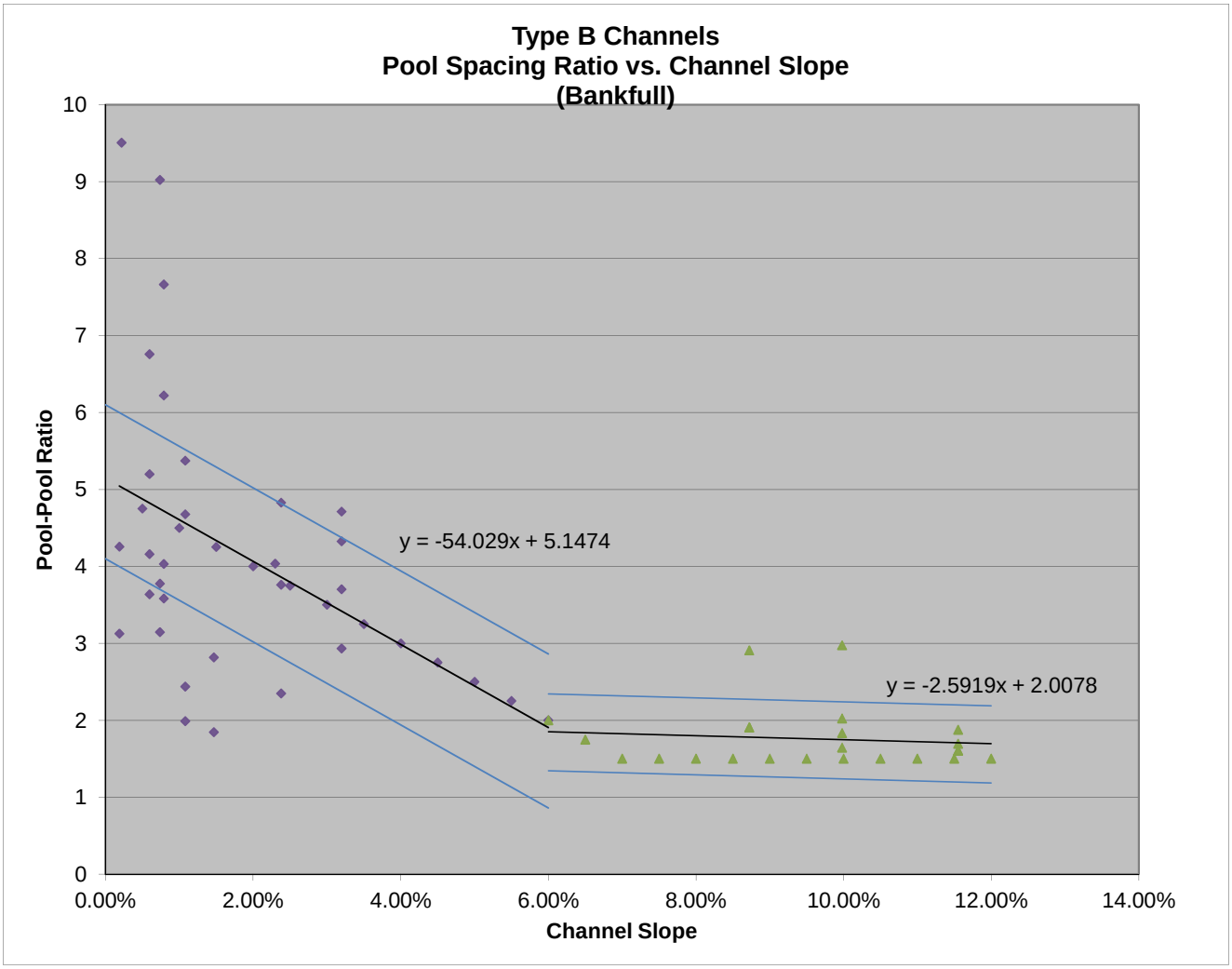
	Coefficient	Exponent
Design Line	10.0	0.45
Regional Curve	12.0	0.45
Watershed Curve	9.0	0.45

Design Line		Regional Curve		Watershed Curve	
X	Y	X	Y	X	Y
0.02	1.720	0.02	2.064	0.02	1.548
50	58.148	50	69.778	50	52.333



	Coefficient	Exponent
Design Line	1.20	0.24
Regional Curve	1.5	0.27
Watershed Curve	1.3	0.24

Design Line		Regional Curve		Watershed Curve	
X	Y	X	Y	X	Y
0.02	0.469	0.02	0.522	0.02	0.508
50	3.069	50	4.313	50	3.324



B Channels < 6%

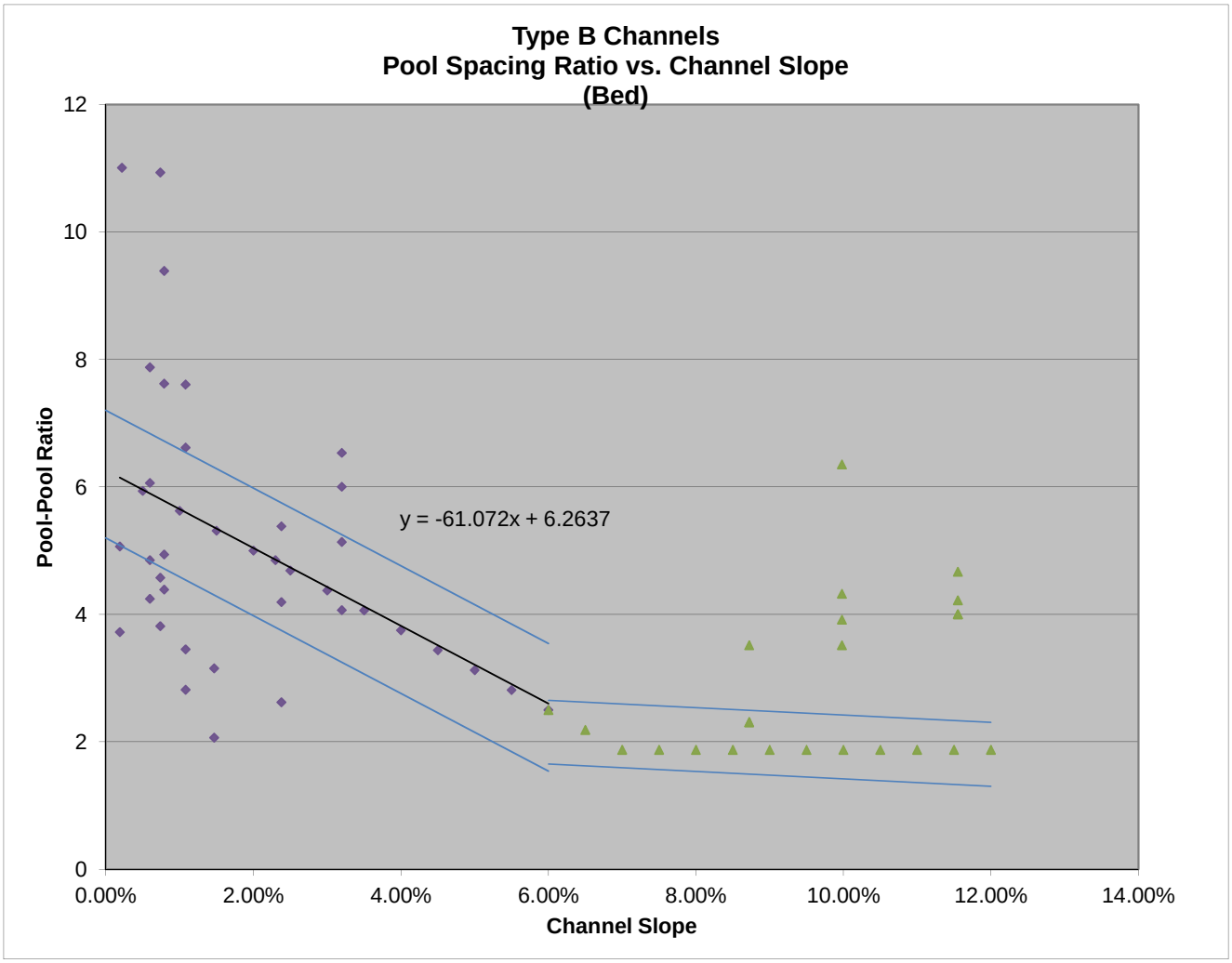
	Y-int	Slope
Trendline Coefficients	5.1	-54.0
Design Range (+/-)	1.0	
Upper Boundary Line	6.1	-54.0
Lower Boundary Line	4.1	-54.0

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



B Channels < 6%

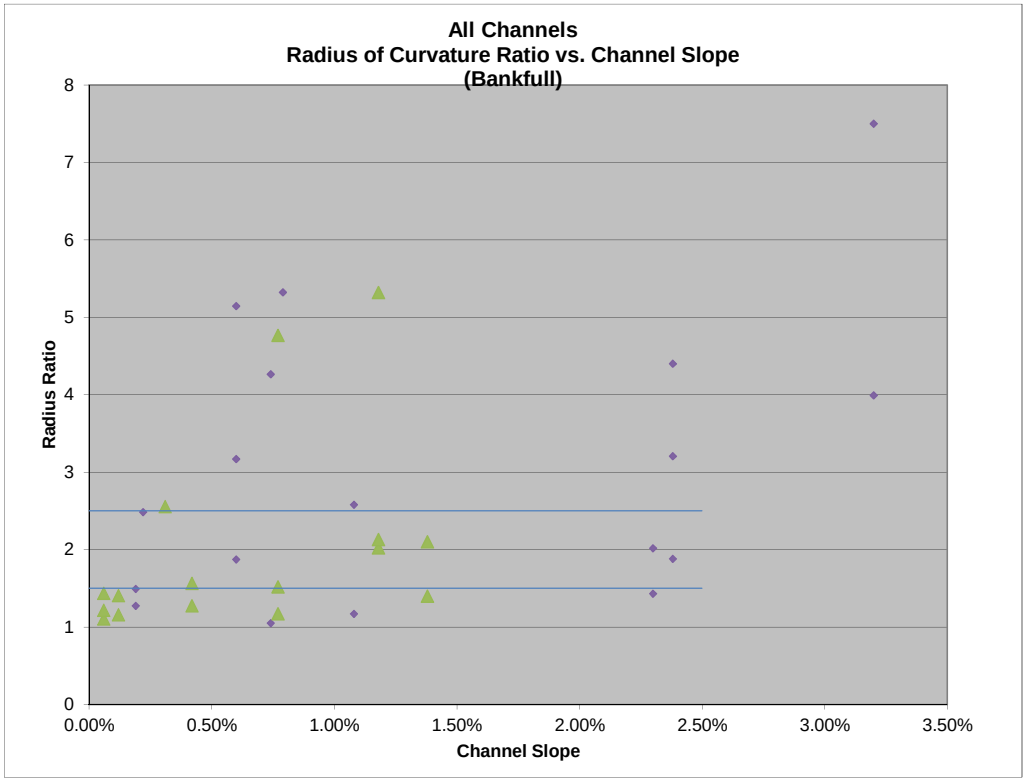
	Y-int	Slope
Trendline Coefficients	6.2	-61.0
Design Range (+/-)	1.0	
Upper Boundary Line	7.2	-61.0
Lower Boundary Line	5.2	-61.0

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

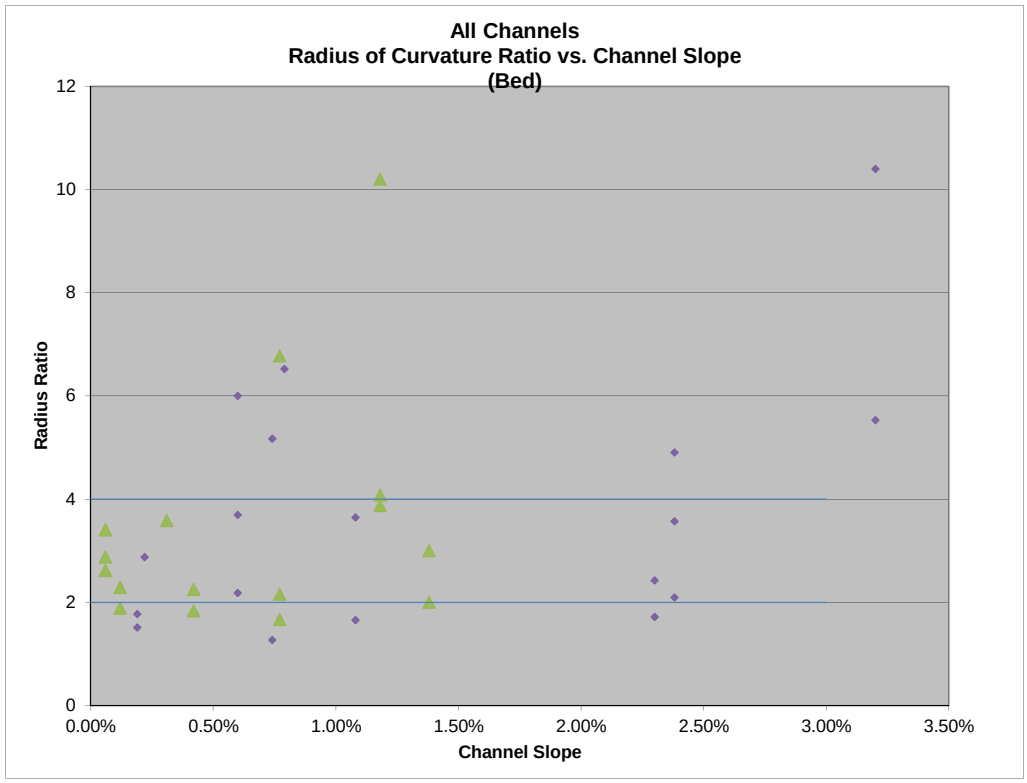
Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
6%	2.652	6%	1.652
12%	2.304	12%	1.304



All Channels

	Y-int	Slope
Trendline Coefficients	2.0	0.0
Design Range (+/-)	0.5	
Upper Boundary Line	2.5	0.0
Lower Boundary Line	1.5	0.0

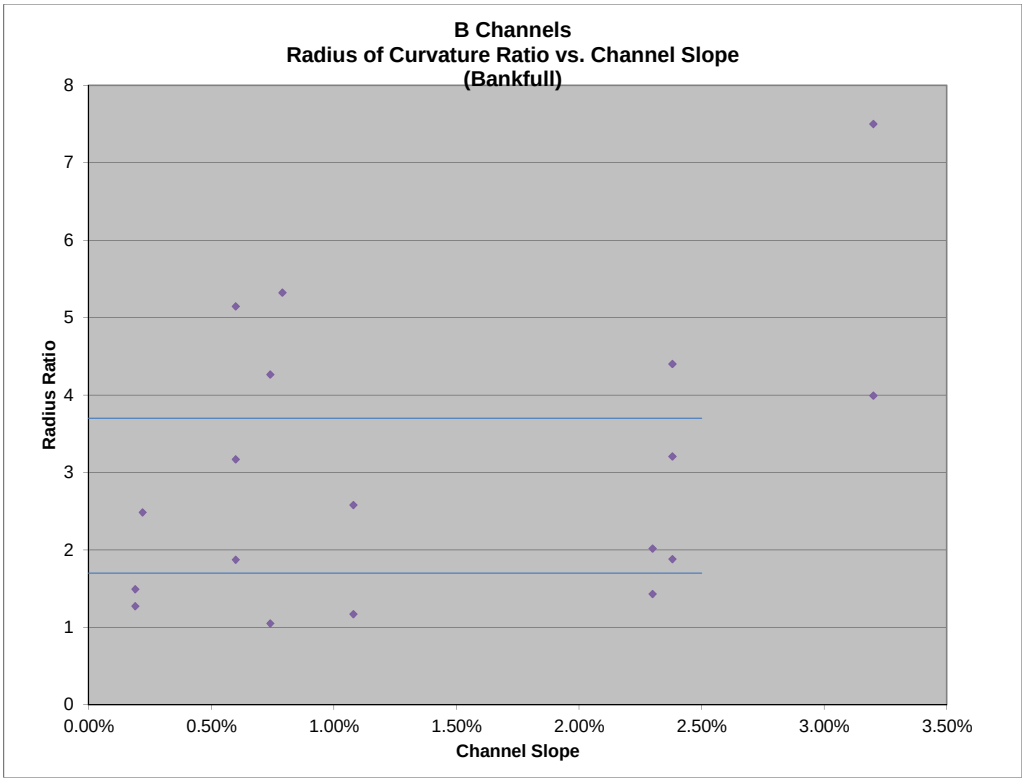
Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
0%	2.5	0%	1.5
3%	2.5	3%	1.5



All Channels

	Y-int	Slope
Trendline Coefficients	3.0	0.0
Design Range (+/-)	1.0	
Upper Boundary Line	4.0	0.0
Lower Boundary Line	2.0	0.0

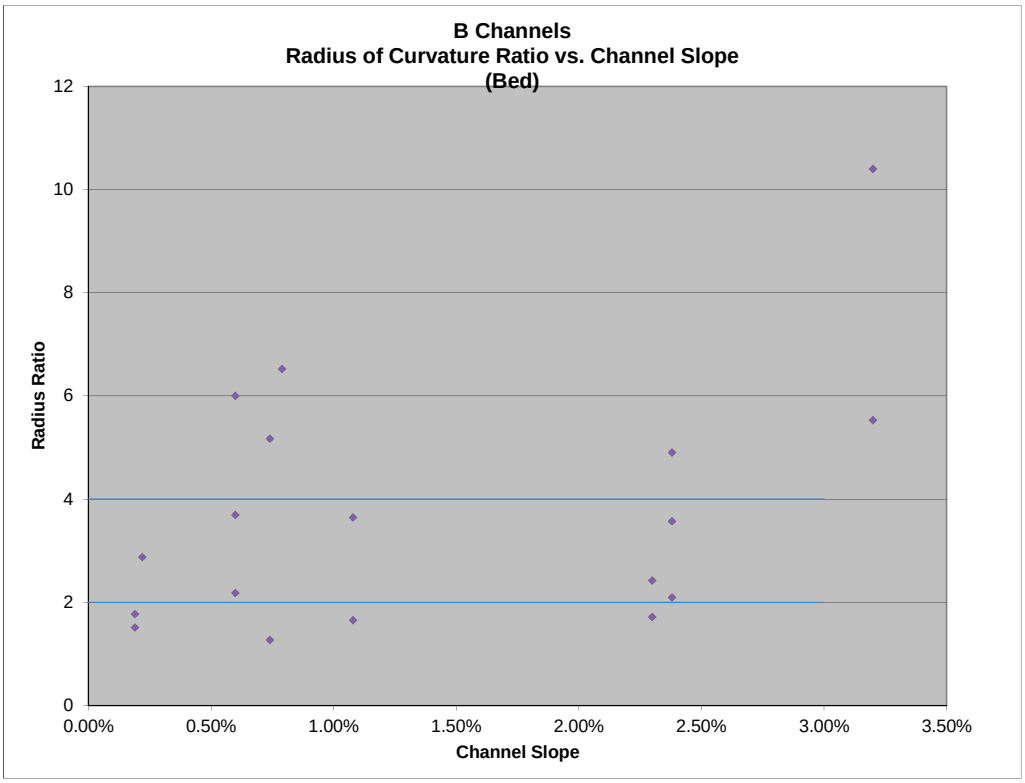
Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
0%	4	0%	2
3%	4	3%	2



B Channels

	Y-int	Slope
Trendline Coefficients	2.7	0.0
Design Range (+/-)	1.0	
Upper Boundary Line	3.7	0.0
Lower Boundary Line	1.7	0.0

Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
0%	3.7	0%	1.7
3%	3.7	3%	1.7



B Channels

	Y-int	Slope
Trendline Coefficients	3.0	0.0
Design Range (+/-)	1.0	
Upper Boundary Line	4.0	0.0
Lower Boundary Line	2.0	0.0

Upper Boundary Line		Lower Boundary Line	
X	Y	X	Y
0%	4	0%	2
3%	4	3%	2

APPENDIX C2

Design Calculations

Conceptual Design

Estimated Channel Values from Regional Curves

Project:	Junes Branch
Project No.:	1053-JUNE
Client:	EBX
Contract No.:	IPO NC-02-2011
County/State:	Jackson County, NC
Hyd-Physio Provence:	NC Mountains

Regional Curve

Province Code: NCMT

Dimension	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 W_{BED} :	14.53	0.388
Approximate d_{MAX} :	1.65	0.270

Feature Dimensions

Pool-Pool/W_{BKF} Ratio:	5
Rc / W_{BKF} Ratio:	2
Tan Len/W_{BKF} Ratio:	2
Use Approximate W_{BED} (Yes/No):	No
Use Approximate d_{MAX} (Yes/No):	No

Estimated Dimensions from Regional Curve Data

Reach	Drainage 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)
Bumgarner Reach 1	0.69	15.1	14.5	1.1	10.2	1.4	76	30	30
Bumgarner Reach 2	1.05	17.7	19.2	1.2	12.3	1.5	88	35	35
June's Branch	0.24	10.2	7.2	0.8	6.3	1.0	51	20	20
Higdon Branch	0.08	6.8	3.5	0.6	3.9	0.8	34	14	14
Doris Branch	0.01	3.2	0.9	0.3	1.5	0.4	16	6	6

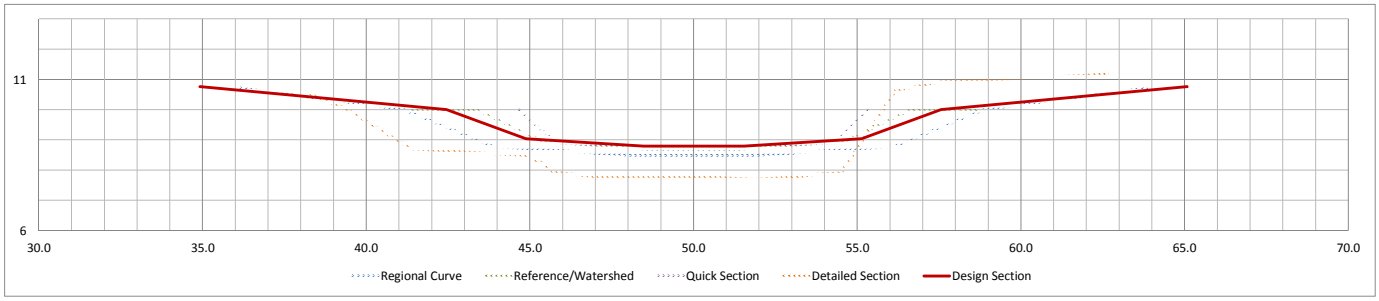
Sediment Regime

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC

Reach	Bumgarner Reach 1	Bumgarner Reach 2	June's Branch	Upstream Adjacent Forecast (Bumgrnr)	Upstream Extended Forecast Reach	Upstream Adjacent Forecast (June's)	Reference Reach Cold Springs	Reference Reach Cold Springs
Bed Material Nature								
Depth of Bed Probe (ft)	0.1 - 0.2	0.1 - 0.4	0.2 - 1.3	0.2	0.2	0.2 - 0.4	0.1	0.1
Matrix Bonding	Moderate	Moderate	Loose	Moderate	Moderate	Moderate	Dense	Dense
Parent Material Exposure	None	None	None	None	None	None	None	None
Well Graded	No	No	No	No	No	No	Yes	Yes
Depositional Patterns *(None-Minimal-Moderate-Extensive)*								
Point Bars	Minimal	Moderate	Minimal	Minimal	Mininal	None	Minimal	Minimal
Mid-channel Bars	Moderate	Moderate	Minimal	Moderate	Moderate	Moderate	Minimal	Minimal
Side-channel Bars	Extensive	Extensive	Moderate	Moderate	Moderate	Moderate	None	None
Diagonal Bars	None	Moderate	Minimal	None	None	None	Minimal	Minimal
Bar Length/W_{BED}	2	2	1	2	2	1	1	1
Dune Presentation of Bars	None	None	None	None	None	None	None	None
Channel Branching	None	None	None	None	None	None	None	None
Tributary Deltas	None	Moderate	None	N/a	N/a	None	None	None
Dune Length/Height (FT)	None	None	None	None	None	None	N/a	N/a
Ripple Length/Height (FT)	None	0.4/0.10	0.2/0.05	None	None	None	N/a	N/a
Sediment Measurements								
Riffle - Pebble Count								
% Sand	43%	38%	39%				14%	10%
D_{50}	0.7	0.7	0.2				39	45
D_{84}	80	49	6				120	130
D_{95}	150	85	97				210	190
Reach - Pebble Count								
% Sand	60%	55%	39%				11%	9%
D_{50}	0.4	0.4	0.2				46	31
D_{84}	50	47	6				160	120
D_{95}	110	83	97				270	170
Bar (Pavement)								
% Sand		26%		45%		30%	6%	
D_{50}		36		18		18	67	79
D_{84}		65		69		37	120	99
D_{95}		79		82		54	140	110
D_{MAX}		86		89		64	154	110
Bar (Sub-Pavement)								
% Sand								
D_{50}								33
D_{84}								66
D_{95}								82
Sediment Regime *(Low - Mod. Low - Moderate - Mod. High - High)*								
Sediment Load	Moderate	Moderate	Mod. Low	Moderate	Moderate	Mod. Low	Low	Low
Sediment Mobility	Moderate	Moderate	Mod. High	Moderate	Moderate	Mod. High	Mod. Low	Mod. Low

Design Section 1

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC



Regional Curve

	Coef	Exp
A_{BKF}	18.56	0.66
W_{BKF}	17.36	0.37
W_{BED}	12.00	0.450
d_{MAX}	1.50	0.270
d_{MEAN}	1.18	0.27
F/p-Bench Width	5	
F/p-Bench Slope	7	(H:1)
Thalweg Ratio	0.30	
Toe Depth Ratio	0.80	

W_{BKF}	17.7
W_{BED}	12.3
W_{THL}	3.7
d_{MAX}	1.5
d_{TOE}	1.2

Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	36.2	10.71429
2	41.2	10.0
3	43.9	8.8
4	48.2	8.5
5	51.8	8.5
6	56.1	8.8
7	58.8	10.0
8	63.8	10.71429

Reference/Watershed Curve

	Coef	Exp
A_{BKF}	11.50	0.70
W_{BKF}	13.00	0.37
W_{BED}	9.00	0.450
d_{MAX}	1.30	0.240
d_{MEAN}		
F/p-Bench Width	2	
F/p-Bench Slope	0	(H:1)
Thalweg Ratio	0.30	
Toe Depth Ratio	0.80	

W_{BKF}	13.2
W_{BED}	9.2
W_{THL}	2.8
d_{MAX}	1.3
d_{TOE}	1.1

Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	41.4	10
2	43.4	10.0
3	45.4	8.9
4	48.6	8.7
5	51.4	8.7
6	54.6	8.9
7	56.6	10.0
8	58.6	10

Existing Quick Section

F/p-Bench Width: 0
F/p-Bench Slope: 7 (H:1)

W_{BKF}	10.7
W_{BED}	8.4
W_{THL}	1.5
d_{MAX}	1.3
d_{TOE}	1.1

Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	44.7	10
2	44.7	10.0
3	45.8	8.9
4	49.3	8.8
5	50.8	8.8
6	54.2	8.9
7	55.4	10.0
8	55.4	10

Existing Detailed Section

Point No.	Offset	Elevation
1	-13.8694	2141.081
2	-12.6184	2140.529
3	-11.489	2139.779
4	-10.6299	2139.202
5	-8.38853	2139.062
6	-7.24644	2138.993
7	-6.67541	2138.766
8	-6.32286	2138.461
9	-6.13117	2138.414
10	-4.78059	2138.258
11	-3.54445	2138.266
12	-1.79405	2138.284
13	-0.33757	2138.201
14	-0.10942	2138.19
15	1.25137	2138.289
16	1.85573	2138.385
17	2.49977	2138.405
18	4.17135	2141.134
19	5.50953	2141.419
20	10.64371	2141.661

Center of Channel: -2 (Offset)
Bankfull Elevation: 2140.5
Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	38.1	10.58
2	39.4	10.03
3	40.5	9.28
4	41.4	8.70
5	43.6	8.56
6	44.8	8.49
7	45.3	8.27
8	45.7	7.96
9	45.9	7.91
10	47.2	7.76
11	48.5	7.77
12	50.2	7.78
13	51.7	7.70
14	51.9	7.69
15	53.3	7.79
16	53.9	7.89
17	54.5	7.90
18	56.2	10.63
19	57.5	10.92
20	62.6	11.16

Design Section

Drainage Area: 1.05 (sq. mi.)

	Coef	Exp
W_{BED}	10.00	0.450
d_{MAX}	1.20	0.240
Bank Slope	2.5	(H:1)
Thalweg Ratio	0.30	(Thalweg/Bed Width)
Toe Depth Ratio	0.80	(Toe/Max Depth)
Bench Width Ratio	0.5	(Bench/Bankfull)
Bench Slope	10	(H:1)

W_{BKF}	15.1
W_{BED}	10.2
W_{THL}	3.1
d_{MAX}	1.2
d_{TOE}	1.0
d_{MEAN}	0.92
W_{BENCH}	7.5

S_{TOE}: 14.7

Plot Section: yes (Yes/No)

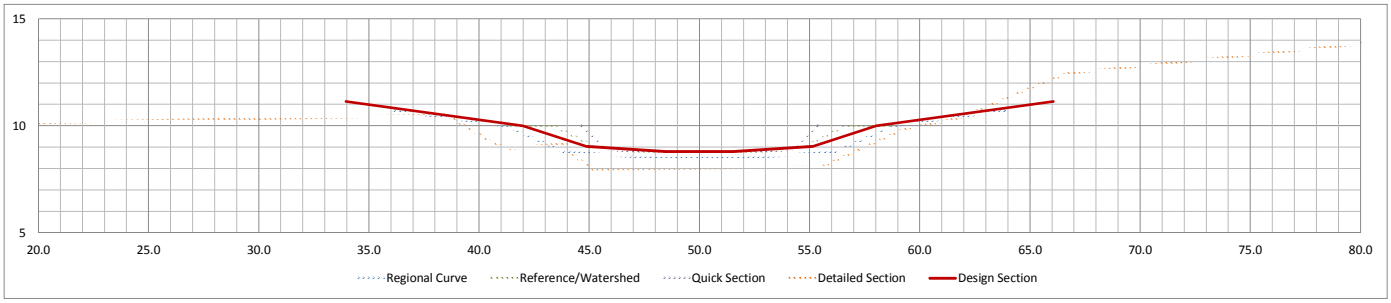
Point No.	X	Y
Center	50	10
1	34.9	10.8
2	42.5	10.0
3	44.9	9.0
4	48.5	8.8
5	51.5	8.8
6	55.1	9.0
7	57.5	10.0
8	65.1	10.8

Section Comparisons

	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
A_{BKF}	19.2	11.9	11.2	8.3	13.9
Difference	73%	117%	124%	168%	
d_{MEAN}	1.08	0.90	1.05	0.8	0.92
Difference	85%	103%	88%	114%	
P	18.22	13.77	11.59	14.1	15.47
Hydr. R	1.05	0.86	0.97	0.6	0.90
Difference	85%	104%	93%	154%	
W/d Ratio	16.3	14.7	10.2	12.6	16.4

Design Section 2

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC



Regional Curve

	Coef	Exp
A_{BKF}	18.56	0.66
W_{BKF}	17.36	0.37
W_{BED}	12.00	0.450
d_{MAX}	1.50	0.270
d_{MEAN}	1.18	0.27
F/p-Bench Width	5	
F/p-Bench Slope	7	(H:1)
Thalweg Ratio	0.30	
Toe Depth Ratio	0.80	

W_{BKF}	17.7
W_{BED}	12.3
W_{THL}	3.7
d_{MAX}	1.5
d_{TOE}	1.2

Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	36.2	10.71429
2	41.2	10.0
3	43.9	8.8
4	48.2	8.5
5	51.8	8.5
6	56.1	8.8
7	58.8	10.0
8	63.8	10.71429

Reference/Watershed Curve

	Coef	Exp
A_{BKF}	11.50	0.70
W_{BKF}	13.00	0.37
W_{BED}	9.00	0.450
d_{MAX}	1.30	0.240
d_{MEAN}		
F/p-Bench Width	2	
F/p-Bench Slope	0	(H:1)
Thalweg Ratio	0.30	
Toe Depth Ratio	0.80	

W_{BKF}	13.2
W_{BED}	9.2
W_{THL}	2.8
d_{MAX}	1.3
d_{TOE}	1.1

Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	41.4	10
2	43.4	10.0
3	45.4	8.9
4	48.6	8.7
5	51.4	8.7
6	54.6	8.9
7	56.6	10.0
8	58.6	10

Existing Quick Section

F/p-Bench Width	0
F/p-Bench Slope	7 (H:1)

W_{BKF}	10.7
W_{BED}	8.4
W_{THL}	1.5
d_{MAX}	1.3
d_{TOE}	1.1

Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	44.7	10
2	44.7	10.0
3	45.8	8.9
4	49.3	8.7
5	50.8	8.7
6	54.2	8.9
7	55.4	10.0
8	55.4	10

Existing Detailed Section

Point No.	Offset	Elevation
1	-45.6734	2139.727
2	-35.2011	2139.974
3	-13.4497	2140.396
4	-11.379	2139.112
5	-10.6469	2138.836
6	-8.06671	2139.062
7	-7.77373	2138.606
8	-6.90855	2137.876
9	0.39227	2137.941
10	3.0301	2137.952
11	3.25703	2137.948
12	3.48605	2137.95
13	3.92104	2138.167
14	7.2931	2139.756
15	9.13867	2140.132
16	9.78351	2140.275
17	10.04172	2140.375
18	13.0576	2141.704
19	14.66481	2142.347
20	35.65741	2144.535

Center of Channel: -2 (Offset)
Bankfull Elevation: 2139.9
Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	6.3	9.82713
2	16.8	10.07417
3	38.6	10.49612
4	40.6	9.21246
5	41.4	8.93552
6	43.9	9.16222
7	44.2	8.70566
8	45.1	7.97557
9	52.4	8.04129
10	55.0	8.05179
11	55.3	8.04785
12	55.5	8.0502
13	55.9	8.26738
14	59.3	9.85587
15	61.1	10.23168
16	61.8	10.37509
17	62.0	10.47547
18	65.1	11.80406
19	66.7	12.44686
20	87.7	14.63542

Design Section

Drainage Area: 1.05 (sq. mi.)

	Coef	Exp	
W_{BED}	10.00	0.450	
d_{MAX}	1.20	0.240	
Bank Slope	3	(H:1)	
Thalweg Ratio	0.30	(Thalweg/Bed Width)	
Toe Depth Ratio	0.80	(Toe/Max Depth)	
Bench Width Ratio	0.5	(Bench/Bankfull)	
Bench Slope	7	(H:1)	

W_{BKF}	16.0		
W_{BED}	10.2		
W_{THL}	3.1		
d_{MAX}	1.21		
d_{TOE}	0.97	S_{TOE}	14.7
d_{MEAN}	0.90		
W_{BENCH}	8.0		

Plot Section: yes (Yes/No)

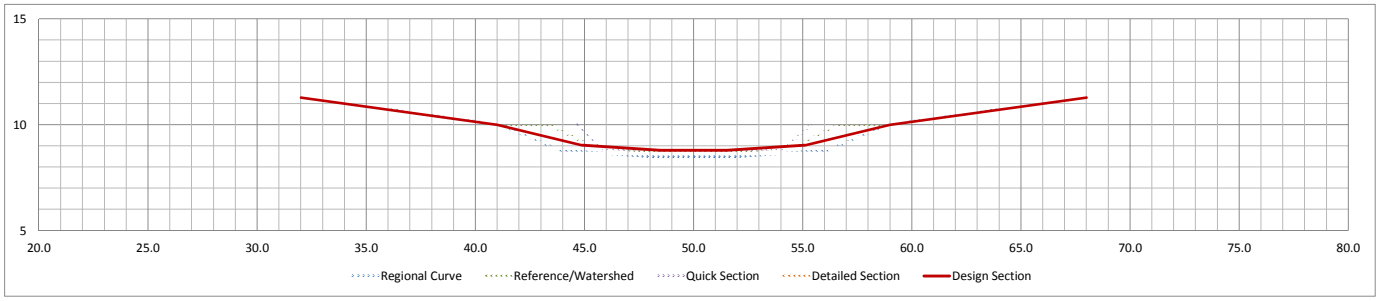
Point No.	X	Y
Center	50	10
1	34.0	11.1
2	42.0	10.0
3	44.9	9.0
4	48.5	8.8
5	51.5	8.8
6	55.1	9.0
7	58.0	10.0
8	66.0	11.1

Section Comparisons

	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
A_{BKF}	19.2	11.9	11.5		14.4
Difference	75%	121%	125%		
d_{MEAN}	1.08	0.90	1.07		0.90
Difference	83%	100%	83%		
P	18.22	13.77	11.59		16.38
Hydr. R	1.05	0.86	0.99		0.88
Difference	83%	102%	88%		
W/d Ratio	16.3	14.7	10.0		17.9

Design Section 3

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC



Regional Curve

	Coef	Exp
A_{BKF}	18.56	0.66
W_{BKF}	17.36	0.37
W_{BED}	12.00	0.450
d_{MAX}	1.50	0.270
d_{MEAN}	1.18	0.27
F/p-Bench Width	5	
F/p-Bench Slope	7	(H:1)
Thalweg Ratio	0.30	
Toe Depth Ratio	0.80	

W_{BKF}	17.7
W_{BED}	12.3
W_{THL}	3.7
d_{MAX}	1.5
d_{TOE}	1.2

Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	36.2	10.71429
2	41.2	10.0
3	43.9	8.8
4	48.2	8.5
5	51.8	8.5
6	56.1	8.8
7	58.8	10.0
8	63.8	10.71429

Reference/Watershed Curve

	Coef	Exp
A_{BKF}	11.50	0.70
W_{BKF}	13.00	0.37
W_{BED}	9.00	0.450
d_{MAX}	1.30	0.240
d_{MEAN}		
F/p-Bench Width	2	
F/p-Bench Slope	0	(H:1)
Thalweg Ratio	0.30	
Toe Depth Ratio	0.80	

W_{BKF}	13.2
W_{BED}	9.2
W_{THL}	2.8
d_{MAX}	1.3
d_{TOE}	1.1

Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	41.4	10
2	43.4	10.0
3	45.4	8.9
4	48.6	8.7
5	51.4	8.7
6	54.6	8.9
7	56.6	10.0
8	58.6	10

Existing Quick Section

F/p-Bench Width: 0
F/p-Bench Slope: 7 (H:1)

W_{BKF}	10.7
W_{BED}	8.4
W_{THL}	1.5
d_{MAX}	1.3
d_{TOE}	1.1

Plot Section: Yes (Yes/No)

Point No.	X	Y
Center	50	10
1	44.7	10
2	44.7	10.0
3	45.8	8.9
4	49.3	8.7
5	50.8	8.7
6	54.2	8.9
7	55.4	10.0
8	55.4	10

Existing Detailed Section

Point No.	Offset	Elevation
1	10	100
2	20	99
3	30	98
4	40	98
5	50	99
6	60	99
7	70	99
8	80	99
9	90	99
10	92	97
11	93	96.5
12	94	96
13	106	96
14	107	97
15	108	98
16	109	98.5
17	115	99
18	180	100
19	190	100
20	200	100

Center of Channel: 100 (Offset)
Bankfull Elevation: 99
Plot Section: no (Yes/No)

Point No.	X	Y
Center	50	10
1		
2	72.0	-2031.5
3	82.0	-2032.5
4	92.0	-2032.5
5	102.0	-2031.5
6	112.0	-2031.5
7	122.0	-2031.5
8	132.0	-2031.5
9	142.0	-2031.5
10	144.0	-2033.5
11	145.0	-2034
12	146.0	-2034.5
13	158.0	-2034.5
14	159.0	-2033.5
15	160.0	-2032.5
16	161.0	-2032
17	167.0	-2031.5
18	232.0	-2030.5
19	242.0	-2030.5
20	252.0	-2030.5

Design Section

Drainage Area: 1.05 (sq. mi.)

	Coef	Exp	
W_{BED}	10.00	0.450	
d_{MAX}	1.20	0.240	
Bank Slope	4	(H:1)	
Thalweg Ratio	0.30	(Thalweg/Bed Width)	
Toe Depth Ratio	0.80	(Toe/Max Depth)	
Bench Width Ratio	0.5	(Bench/Bankfull)	
Bench Slope	7	(H:1)	

W_{BKF}	18.0		
W_{BED}	10.2		
W_{THL}	3.1		
d_{MAX}	1.2		
d_{TOE}	1.0	S_{TOE}	14.7
d_{MEAN}	0.85		
W_{BENCH}	9.0		

Plot Section: yes (Yes/No)

Point No.	X	Y
Center	50	10
1	32.0	11.3
2	41.0	10.0
3	44.9	9.0
4	48.5	8.8
5	51.5	8.8
6	55.1	9.0
7	59.0	10.0
8	68.0	11.3

Section Comparisons

	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
A_{BKF}	19.2	11.9	11.5		15.3
Difference	80%	129%	133%		
d_{MEAN}	1.08	0.90	1.07		0.85
Difference	78%	95%	79%		
P	18.22	13.77	11.59		18.25
Hydr. R	1.05	0.86	0.99		0.84
Difference	80%	97%	85%		
W/d Ratio	16.3	14.7	10.0		21.1

Typical Section Dimensions

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC

Reach	Drainage Area (mi^2)	Design Section	W_{BKF}	W_{BED}	W_{THAL}	W_{BENCH}	d_{MAX}	d_{TOE}	Bank Slope (H:1)
Bumgarner Reach 1	0.69	1	12.9	8.5	2.5	6	1.10	0.88	2.5
Bumgarner Reach 2	1.05	1	15.1	10.2	3.1	8	1.21	0.97	2.5
June's Branch	0.24	1	8.7	5.3	1.6	4	0.85	0.68	2.5
Higdon Branch	0.08	2	6.4	3.2	1.0	3	0.65	0.52	3.0
Doris Branch	0.01	3	3.8	1.3	0.4	2	0.40	0.32	4.0

	P_{WIDTH} Ratio	d_{POOL}/d_{MAX} Ratio	Pool Spacing/Bed min	Pool Spacing/Bed max
Design Section 1	1.1	1.5	4	7
Design Section 2	1.1	1.5	4	7
Design Section 3	1.1	1.5	4	7
Design Section 4	1.1	1.5	5	8

Reach	A_{BKF}	P_{WET}	R_{HYD}	d_{MEAN}	W/D	Pool Dimensions W_{IN}	Pool Dimensions W_{OUT}	Pool Dimensions d_{POOL}
Bumgarner Reach 1	10.6	13.2	0.80	0.82	15.6	7.7	6.4	1.65
Bumgarner Reach 2	13.9	15.5	0.90	0.92	16.4	9.0	7.5	1.82
June's Branch	5.3	8.9	0.60	0.61	14.1	5.2	4.3	1.28
Higdon Branch	2.8	6.5	0.42	0.44	14.5	3.8	3.2	0.98
Doris Branch	0.9	3.9	0.22	0.23	16.6	2.3	1.9	0.60

Plan/Profile Measurements

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC

Reach	S_{AVG}	S_{VALLEY} Length	S_{VALLEY} Elev Change	Entrench F/p Width	Sinuosity Val Length	Sinuosity Channel Length	Meander Width
Bumgarner Reach 1	0.024	653	15	83	653	703	23
Bumgarner Reach 2	0.015	473	7	80	473	523	37
June's Branch	0.025	1266	35	30	1266	1367	16
Higdon Branch	0.016	275	6	20	275	299	11
Doris Branch	0.019	224	5	20	224	237	6.6

Morphologic Design Table

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC

Reach	Stream Type	Drainage Area (mi^2)	W_{BKF} (ft)	A_{BKF} (ft^2)	d_{MEAN} (ft)	d_{MAX} (ft)	S_{AVG} (ft/tf)	S_{VALLEY} (ft/tf)
Bumgarner Reach 1	B4	0.690	12.9	10.6	0.8	1.1	0.024	0.023
Bumgarner Reach 2	B4	1.050	15.1	13.9	0.9	1.2	0.015	0.015
June's Branch	B4	0.240	8.7	5.3	0.6	0.9	0.025	0.028
Higdon Branch	B4	0.080	6.4	2.8	0.4	0.7	0.016	0.022
Doris Branch	B4	0.010	3.8	0.9	0.2	0.4	0.019	0.022

Reach	W/D Ratio	Entrench Ratio	Sinuosity	Meander Width Ratio	Pool Spacing (ft) (min)	Pool Spacing (ft) (max)	P_{SPACE}/W_{BKF} (min)	P_{SPACE}/W_{BKF} (max)
Bumgarner Reach 1	15.6	6.5	1.08	1.8	33.8	59.2	2.6	4.6
Bumgarner Reach 2	16.4	5.3	1.11	2.5	40.9	71.6	2.7	4.7
June's Branch	14.1	3.5	1.08	1.8	21.0	36.8	2.4	4.2
Higdon Branch	14.5	3.1	1.09	1.7	12.8	22.5	2.0	3.5
Doris Branch	16.6	5.3	1.06	1.7	5.0	8.8	1.3	2.3

Structure Dimensions

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC

Arm Length Ratio	1.6	X W_{BED}
Throat Width	1/3	X W_{BKF}
Buried Length	1/3	X L_{ARM}
Minimum Buried Length	3	(ft)
Maximum Buried Length	8	(ft)

Reach	W_{BKF}	W_{BED}	Arm Length (L)	Throat Width (W)	Buried Length (X)	Total Log Length (ft)
Bumgarner Reach 1	12.9	8.5	14	4	5	24
Bumgarner Reach 2	15.1	10.2	16	5	5	26
June's Branch	8.7	5.3	8	3	3	14
Higdon Branch	6.4	3.2	5	2	3	11
Doris Branch	3.8	1.3	2	1	3	8

				Boulder Size Based on:			Recommended Boulder Size		
Reach	τ	Structure Drop	Structure Length	Bed Shear	Structure Shear	Bed Width	Length	Width	Depth
Bumgarner Reach 1	1.23	0.4	35	3.5	2.5	3.0	3	2	1.5
Bumgarner Reach 2	0.86	0.5	5	3.0	4.0	3.0	2.5	1.5	1
June's Branch	0.96	0.5	5	3.0	3.5	2.5	2.5	1.5	1
Higdon Branch	0.44	1	5	2.5	4.0	2.5	2.5	1.5	1
Doris Branch	0.27	1	5	2.5	3.5	2.5	2.5	1.5	1

Competence Calculations

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC

Bed Material Regime 1

Maximum Particle Critical Dimensionless Shear

D_{50}	40	Riffle Bed Material D_{50} (mm)
$D^{\wedge}_{50}$	36	Bar Sample D_{50} (mm)
D_{MAX}	86	Largest Particle from Bar Sample (mm)
D_{MAX}	0.28	Largest Particle from Bar Sample (ft)
Υ_S	1.65	Submerged Specific Wt. of Sediment
$D_{50}/D^{\wedge}_{50}$	1.1	No (In range: 3-7)
τ^*	0.076	
D_{MAX}/D_{50}	2.2	Yes (In range: 1.3-3.0)
τ^*	0.019	
τ^*	0.019	Dimensionless Shear for Max Particle

Representative Particle Critical Dimensionless Shear

D_{50}	73	Bed Material D_{50} (mm)
D_{84}	73	Sub-pavement D_{84} (mm)
D_{50}	0.24	Bed Material D_{50} (ft)
D_{84}	0.24	Sub-pavement D_{84} (ft)
Υ_S	1.65	Submerged Specific Wt. of Sediment
S	0.018	Estimated Channel Slope
τ^*	0.04	Typical Shield's Curve Value
τ^*	0.055	Slope based Lamb Equation
τ^*	0.04	Range: 0.03 - 0.06

Bed Material Regime 2

Maximum Particle Critical Dimensionless Shear

D_{50}	18	Riffle Bed Material D_{50} (mm)
$D^{\wedge}_{50}$	18	Bar Sample D_{50} (mm)
D_{MAX}	49	Largest Particle from Bar Sample (mm)
D_{MAX}	0.16	Largest Particle from Bar Sample (ft)
Υ_S	1.65	Submerged Specific Wt. of Sediment
$D_{50}/D^{\wedge}_{50}$	1.0	No (In range: 3-7)
τ^*	0.083	
D_{MAX}/D_{50}	2.7	Yes (In range: 1.3-3.0)
τ^*	0.016	
τ^*	0.016	Dimensionless Shear for Max Particle

Representative Particle Critical Dimensionless Shear

D_{50}	56	Bed Material D_{50} (mm)
D_{51}	0.18	Bed Material D_{50} (ft)
Υ_S	1.65	Submerged Specific Wt. of Sediment
S	0.013	Estimated Channel Slope
τ^*	0.04	Typical Shield's Curve Value
τ^*	0.051	Slope based Lamb Equation
τ^*	0.04	Range: 0.03 - 0.06

			Largest Particle Calculations				Representative Particle Calculations			
Reach	R_{HYD}	Bed Regime	τ^*	Υ_S	D_{MAX}	S	τ^*	Υ_S	D_{50}	S
Bumgarner Reach 1	0.80	1	0.019	1.65	0.28	0.0111	0.04	1.65	0.240	0.0198
Bumgarner Reach 2	0.90	1	0.019	1.65	0.28	0.0098	0.04	1.65	0.240	0.0176
June's Branch	0.60	2	0.016	1.65	0.16	0.0071	0.04	1.65	0.184	0.0204
Higdon Branch	0.42	2	0.016	1.65	0.16	0.0100	0.04	1.65	0.184	0.0286
Doris Branch	0.22	2	0.016	1.65	0.16	0.0190	0.04	1.65	0.184	0.0543

Transition Reach Design

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC

Υ_S :	1.65
τ^* :	0.04

Reach	Transition Slope (ft/ft)	d_{MAX}	Twice Max Depth	Υ_S	τ^*	D_{50} (ft)	τ	Armor Stone (in)	Armor Stone Size
Bumgarner Reach 1	0.011	1.10	2.20	1.65	0.04	0.37	1.51	4	6 in Stone
Bumgarner Reach 2	0.011	1.21	2.43	1.65	0.04	0.40	1.67	5	6 in Stone
June's Branch	0.007	0.85	1.70	1.65	0.04	0.18	0.74	2	6 in Stone
Higdon Branch									
Doris Branch									

Supplemental Bed Material Design

Project: Junes Branch
Project No.: 1053-JUNE
Client: EBX
Contract No.: IPO NC-02-2011
County/State: Jackson County, NC

Material Gradation Percentage of Total by Weight								
Material Size	Sand/Clay	ABC(M)	1/2" Stone (No. 57)	3/4" Stone (No. 5)	2" Stone (Surge)	6" Stone NCDOT (Class A)	12" Stone NCDOT (Class B)	18" Stone NCDOT (Class I)
Sand	100							
#16		12						
#10		9	2					
#8		9	3					
#4		16	12	2				
3/8"		16	25	3				
1/2"		13	48	32				
3/4"		12	7	58				
1"		13	3	5				
1.5"						19		
2"					50	19		
3"					50	19		
4"						19	19	13
5"						19	19	13
6"						5	19	14
8"							19	14
9"							19	14
10"							5	13
12"								14
14"								5
16"								
18"								
24"								
Total %	100	100	100	100	100	100	100	100

Material Composition								
Reach	Sand/Clay	ABC(M)	1/2" Stone (No. 57)	3/4" Stone (No. 5)	2" Stone (Surge)	6" Stone NCDOT (Class A)	12" Stone NCDOT (Class B)	18" Stone NCDOT (Class I)
Bumgarner Reach 1	20%			20%	30%	30%		
Bumgarner Reach 2	20%			20%	30%	30%		
June's Branch	20%			40%	40%			
Higdon Branch	20%			40%	40%			
Doris Branch	20%			40%	40%			

Design Size Distribution (mm)						
Reach	D_{16}	D_{35}	D_{50}	D_{65}	D_{84}	D_{95}
Bumgarner Reach 1	<1	17	41	50	72	112
Bumgarner Reach 2	<1	17	41	50	72	112
June's Branch	<1	13	17	41	56	70
Higdon Branch	<1	13	17	41	56	70
Doris Branch	<1	13	17	41	56	70

APPENDIX C3

Hydraulic Modeling

HEC-RAS OUTPUT EXISTING CONDITIONS

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El(ft)	W.S. Elev (ft)	E.G. Elev (ft)	Froude # Chl	Vel Chnl (ft/s)	Shear Chan(lb/sq ft)	Power Chan(lb/ft s)	Power Total (lb/ft s)
Junes Br	June	8.1	BKF	18.02	2174.6	2175.7	2175.89	0.69	3.53	0.79	2.78	2.78
Junes Br	June	8.1	2 yr	49.57	2174.6	2176.55	2176.85	0.66	4.35	1.03	4.47	4.47
Junes Br	June	8.1	5yr	92.09	2174.6	2177.27	2177.66	0.68	5.05	1.28	6.47	6.47
Junes Br	June	8.1	10yr	129.85	2174.6	2177.76	2178.22	0.68	5.46	1.43	7.8	7.8
Junes Br	June	8.1	100 yr	305.34	2174.6	2179.64	2179.9	0.54	4.13	0.82	3.38	3.32
Junes Br	June	8	BKF	18.02	2173.7	2174.96	2175.35	1	5.02	1.7	8.52	8.52
Junes Br	June	8	2 yr	49.57	2173.7	2175.74	2176.37	1.01	6.36	2.35	14.95	14.95
Junes Br	June	8	5yr	92.09	2173.7	2176.77	2177.3	0.8	5.89	1.8	10.61	10.61
Junes Br	June	8	10yr	129.85	2173.7	2177.2	2177.86	0.83	6.52	2.13	13.87	13.73
Junes Br	June	8	100 yr	305.34	2173.7	2178.61	2179.6	0.81	8.21	2.82	23.17	9.65
Junes Br	June	7	BKF	18.02	2163.86	2165.24	2165.4	0.64	3.23	0.67	2.16	2.16
Junes Br	June	7	2 yr	49.57	2163.86	2165.93	2166.22	0.71	4.34	1.06	4.61	4.61
Junes Br	June	7	5yr	92.09	2163.86	2166.18	2166.86	1.01	6.61	2.37	15.63	15.63
Junes Br	June	7	10yr	129.85	2163.86	2166.56	2167.35	1.01	7.17	2.65	19	19
Junes Br	June	7	100 yr	305.34	2163.86	2167.84	2169.01	1	8.69	3.43	29.8	29.58
Junes Br	June	6	BKF	18.02	2154.04	2155.08	2155.4	1.01	4.56	1.43	6.55	6.55
Junes Br	June	6	2 yr	49.57	2154.04	2155.74	2156.26	1.01	5.76	1.97	11.32	11.32
Junes Br	June	6	5yr	92.09	2154.04	2156.59	2156.97	0.71	5.04	1.3	6.55	1.38
Junes Br	June	6	10yr	129.85	2154.04	2156.87	2157.19	0.66	5.08	1.25	6.35	1.27
Junes Br	June	6	100 yr	305.34	2154.04	2157.37	2157.82	0.78	6.8	2.07	14.06	2.93
Junes Br	June	5.2	BKF	18.02	2145.83	2148.14	2148.15	0.12	0.51	0.02	0.01	0.01
Junes Br	June	5.2	2 yr	49.57	2145.83	2150.25	2150.25	0.03	0.2	0	0	0
Junes Br	June	5.2	5yr	92.09	2145.83	2154.01	2154.01	0.01	0.11	0	0	0
Junes Br	June	5.2	10yr	129.85	2145.83	2154.01	2154.01	0.01	0.16	0	0	0
Junes Br	June	5.2	100 yr	305.34	2145.83	2154.01	2154.01	0.03	0.36	0	0	0
Junes Br	June	5.12		Culvert								
Junes Br	June	5.1	BKF	18.02	2144.52	2145.7	2145.9	0.71	3.62	0.83	3.01	2.45
Junes Br	June	5.1	2 yr	49.57	2144.52	2146.6	2146.8	0.57	3.8	0.78	2.96	1.98
Junes Br	June	5.1	5yr	92.09	2144.52	2147.05	2147.4	0.68	5.06	1.29	6.51	3.96
Junes Br	June	5.1	10yr	129.85	2144.52	2147.13	2147.75	0.9	6.8	2.3	15.64	8.95
Junes Br	June	5.1	100 yr	305.34	2144.52	2148.4	2148.85	0.68	6.72	1.89	12.71	2.12
Junes Br	June	5	BKF	18.02	2144.1	2145.49	2145.6	0.44	2.67	0.42	1.12	1.12
Junes Br	June	5	2 yr	49.57	2144.1	2146.2	2146.5	0.6	4.37	1.02	4.43	3.04
Junes Br	June	5	5yr	92.09	2144.1	2146.35	2146.91	0.85	6.43	2.14	13.79	4.83
Junes Br	June	5	10yr	129.85	2144.1	2146.82	2147.2	0.69	5.83	1.63	9.51	2.22
Junes Br	June	5	100 yr	305.34	2144.1	2147.48	2147.92	0.75	7.22	2.3	16.6	3.52
Bumgarner Branch	Bum1	4.4	BKF	41.38	2157.99	2159.87	2160.12	0.75	4.02	0.99	3.98	3.98
Bumgarner Branch	Bum1	4.4	2 yr	104.04	2157.99	2160.37	2160.94	0.98	6.06	2.04	12.36	9.84
Bumgarner Branch	Bum1	4.4	5yr	188.24	2157.99	2160.98	2161.67	0.9	6.83	2.26	15.45	8.32
Bumgarner Branch	Bum1	4.4	10yr	261.26	2157.99	2161.42	2162.14	0.85	7.18	2.32	16.62	6.95
Bumgarner Branch	Bum1	4.4	100 yr	590.8	2157.99	2162.71	2163.3	0.71	7.52	2.19	16.47	3.18
Bumgarner Branch	Bum1	4.3	BKF	41.38	2151.95	2153.44	2153.89	0.94	5.4	1.71	9.23	6.5
Bumgarner Branch	Bum1	4.3	2 yr	104.04	2151.95	2154.44	2154.71	0.61	4.91	1.13	5.53	0.77
Bumgarner Branch	Bum1	4.3	5yr	188.24	2151.95	2154.93	2155.11	0.53	4.77	0.99	4.72	0.82
Bumgarner Branch	Bum1	4.3	10yr	261.26	2151.95	2155.07	2155.32	0.62	5.71	1.39	7.96	1.44
Bumgarner Branch	Bum1	4.3	100 yr	590.8	2151.95	2155.58	2156.02	0.83	8.38	2.83	23.69	4.38
Bumgarner Branch	Bum1	4.2	BKF	41.38	2148	2150.4	2150.45	0.25	1.85	0.17	0.32	0.32
Bumgarner Branch	Bum1	4.2	2 yr	104.04	2148	2152.58	2152.59	0.08	0.85	0.03	0.02	0.01
Bumgarner Branch	Bum1	4.2	5yr	188.24	2148	2155.03	2155.03	0.04	0.53	0.01	0.01	0
Bumgarner Branch	Bum1	4.2	10yr	261.26	2148	2155.21	2155.21	0.05	0.7	0.02	0.01	0
Bumgarner Branch	Bum1	4.2	100 yr	590.8	2148	2155.78	2155.79	0.09	1.31	0.05	0.07	0.02
Bumgarner Branch	Bum1	4.12		Culvert								

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El(ft)	W.S. Elev (ft)	E.G. Elev (ft)	Froude # Chl	Vel Chnl (ft/s)	Shear Chan(lb/sq ft)	Power Chan(lb/ft s)	Power Total (lb/ft s)
Bumgarner Branch	Bum1	4.1	BKF	41.38	2146.19	2147.69	2147.89	0.58	3.58	0.72	2.57	2.57
Bumgarner Branch	Bum1	4.1	2 yr	104.04	2146.19	2148.79	2149.04	0.6	4	0.84	3.37	3.37
Bumgarner Branch	Bum1	4.1	5yr	188.24	2146.19	2149.58	2149.89	0.56	4.46	0.93	4.17	4.06
Bumgarner Branch	Bum1	4.1	10yr	261.26	2146.19	2149.25	2150.11	1	7.42	2.72	20.15	20.15
Bumgarner Branch	Bum1	4.1	100 yr	590.8	2146.19	2150.55	2151.88	0.97	9.32	3.63	33.84	29.41
Bumgarner Branch	Bum1	4	BKF	41.38	2145.71	2146.98	2147.46	1	5.61	1.91	10.72	10.72
Bumgarner Branch	Bum1	4	2 yr	104.04	2145.71	2147.9	2148.61	1	6.8	2.48	16.86	16.38
Bumgarner Branch	Bum1	4	5yr	188.24	2145.71	2148.75	2149.57	0.86	7.38	2.51	18.5	8.69
Bumgarner Branch	Bum1	4	10yr	261.26	2145.71	2149.42	2149.58	0.43	4.23	0.76	3.19	0.75
Bumgarner Branch	Bum1	4	100 yr	590.8	2145.71	2149.66	2150.2	0.79	8.03	2.65	21.31	4.97
Bumgarner Branch	Bum1	3	BKF	41.38	2142.92	2144.58	2144.78	0.55	3.58	0.71	2.55	2.55
Bumgarner Branch	Bum1	3	2 yr	104.04	2142.92	2145.43	2145.85	0.67	5.22	1.36	7.1	7
Bumgarner Branch	Bum1	3	5yr	188.24	2142.92	2145.72	2146.51	0.9	7.49	2.69	20.13	7.1
Bumgarner Branch	Bum1	3	10yr	261.26	2142.92	2146.25	2146.58	0.62	5.71	1.46	8.32	1.41
Bumgarner Branch	Bum1	3	100 yr	590.8	2142.92	2146.77	2147.24	0.76	7.74	2.52	19.51	3.9
Bumgarner Branch	Bum2	2	BKF	57.6	2138.19	2139.43	2139.78	0.9	4.76	1.39	6.6	6.6
Bumgarner Branch	Bum2	2	2 yr	139.7	2138.19	2140.22	2140.75	0.84	5.87	1.77	10.39	10.39
Bumgarner Branch	Bum2	2	5yr	250.13	2138.19	2140.95	2141.37	0.7	5.72	1.54	8.79	3.52
Bumgarner Branch	Bum2	2	10yr	344.96	2138.19	2141.39	2141.81	0.67	5.91	1.55	9.16	2.24
Bumgarner Branch	Bum2	2	100 yr	768.07	2138.19	2142.37	2142.75	0.61	6.44	1.64	10.59	3.32
Bumgarner Branch	Bum2	1	BKF	57.6	2134.3	2136.31	2136.46	0.46	3.1	0.5	1.56	1.56
Bumgarner Branch	Bum2	1	2 yr	139.7	2134.3	2137.36	2137.62	0.5	4.04	0.75	3.05	2.22
Bumgarner Branch	Bum2	1	5yr	250.13	2134.3	2137.96	2138.39	0.58	5.4	1.24	6.68	3.08
Bumgarner Branch	Bum2	1	10yr	344.96	2134.3	2138.34	2138.88	0.63	6.17	1.55	9.58	3.19
Bumgarner Branch	Bum2	1	100 yr	768.07	2134.3	2139.52	2140.19	0.66	7.66	2.14	16.36	4.38
Bumgarner Branch	Bum2	0.1	BKF	57.6	2133.41	2134.91	2135.26	0.8	4.77	1.29	6.16	6.16
Bumgarner Branch	Bum2	0.1	2 yr	139.7	2133.41	2135.77	2136.37	0.84	6.23	1.92	11.99	11.99
Bumgarner Branch	Bum2	0.1	5yr	250.13	2133.41	2136.56	2137.09	0.78	6.25	1.83	11.47	4.51
Bumgarner Branch	Bum2	0.1	10yr	344.96	2133.41	2136.83	2137.45	0.83	7	2.22	15.54	6.71
Bumgarner Branch	Bum2	0.1	100 yr	768.07	2133.41	2137.74	2138.67	0.92	9.07	3.38	30.67	16.08

HEC-RAS OUTPUT PROPOSED CONDITIONS

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El(ft)	W.S. Elev (ft)	E.G. Elev (ft)	Froude # Chl	Vel Chnl (ft/s)	Shear Chan(lb/sq ft)	Power Chan(lb/ft s)	Power Total (lb/ft s)
Junes Br	June	8.1	BKF	18.02	2174.6	2176.97	2176.99	0.17	1.18	0.07	0.09	0.09
Junes Br	June	8.1	2 yr	49.57	2174.6	2177.63	2177.71	0.28	2.22	0.24	0.53	0.53
Junes Br	June	8.1	5yr	92.09	2174.6	2178.21	2178.37	0.37	3.12	0.45	1.41	1.41
Junes Br	June	8.1	10yr	129.85	2174.6	2178.74	2178.89	0.47	3.11	0.51	1.6	1.6
Junes Br	June	8.1	100 yr	305.34	2174.6	2180	2180.18	0.42	3.4	0.54	1.82	1.76
Junes Br	June	8	BKF	18.02	2175.95	2176.7	2176.92	0.9	3.78	1.01	3.8	3.41
Junes Br	June	8	2 yr	49.57	2175.95	2177.23	2177.58	0.83	4.87	1.33	6.5	4.05
Junes Br	June	8	5yr	92.09	2175.95	2177.59	2178.17	0.95	6.47	2.14	13.84	8.62
Junes Br	June	8	10yr	129.85	2175.95	2177.88	2178.61	0.98	7.31	2.57	18.78	11.56
Junes Br	June	8	100 yr	305.34	2175.95	2179.12	2179.96	0.87	8.5	2.89	24.59	7.41
Junes Br	June	7	BKF	18.02	2166.45	2167.3	2167.45	0.76	3.11	0.69	2.14	2.14
Junes Br	June	7	2 yr	49.57	2166.45	2167.64	2167.99	0.99	4.75	1.45	6.9	5.74
Junes Br	June	7	5yr	92.09	2166.45	2168.04	2168.46	0.9	5.35	1.59	8.54	4.34
Junes Br	June	7	10yr	129.85	2166.45	2168.3	2168.76	0.86	5.72	1.7	9.71	4.11
Junes Br	June	7	100 yr	305.34	2166.45	2169.03	2169.63	0.87	7.15	2.3	16.44	5.69
Junes Br	June	6	BKF	18.02	2155.11	2155.83	2156.09	1	4.12	1.21	5	4.84
Junes Br	June	6	2 yr	49.57	2155.11	2156.43	2156.76	0.8	4.82	1.29	6.21	1.86
Junes Br	June	6	5yr	92.09	2155.11	2156.82	2157.14	0.75	5.23	1.37	7.18	1.43
Junes Br	June	6	10yr	129.85	2155.11	2157.01	2157.35	0.77	5.73	1.59	9.08	1.7
Junes Br	June	6	100 yr	305.34	2155.11	2157.59	2157.95	0.8	6.83	2.04	13.95	2.57
Junes Br	June	5.2	BKF	18.02	2145.76	2147.25	2147.27	0.21	1.21	0.08	0.1	0.08
Junes Br	June	5.2	2 yr	49.57	2145.76	2148.32	2148.34	0.15	1.27	0.07	0.09	0.02
Junes Br	June	5.2	5yr	92.09	2145.76	2149.48	2149.49	0.09	0.95	0.04	0.03	0.01
Junes Br	June	5.2	10yr	129.85	2145.76	2150.92	2150.93	0.06	0.68	0.02	0.01	0
Junes Br	June	5.2	100 yr	305.34	2145.76	2154.11	2154.11	0.04	0.65	0.01	0.01	0
Junes Br	June	5.12		Culvert								
Junes Br	June	5.1	BKF	18.02	2145.23	2146.39	2146.45	0.37	2.06	0.25	0.51	0.3
Junes Br	June	5.1	2 yr	49.57	2145.23	2146.75	2146.95	0.58	3.78	0.75	2.84	1.27
Junes Br	June	5.1	5yr	92.09	2145.23	2147.05	2147.42	0.74	5.33	1.4	7.44	2.9
Junes Br	June	5.1	10yr	129.85	2145.23	2147.22	2147.75	0.86	6.51	2.02	13.13	4.81
Junes Br	June	5.1	100 yr	305.34	2145.23	2148.41	2148.86	0.7	6.89	1.9	13.07	1.89
Junes Br	June	5	BKF	18.02	2145.23	2145.94	2146.2	1	4.06	1.19	4.82	4.54
Junes Br	June	5	2 yr	49.57	2145.23	2146.32	2146.59	0.89	4.75	1.35	6.43	2.33
Junes Br	June	5	5yr	92.09	2145.23	2146.65	2146.97	0.87	5.49	1.62	8.9	2.42
Junes Br	June	5	10yr	129.85	2145.23	2146.87	2147.19	0.84	5.74	1.68	9.68	2.49
Junes Br	June	5	100 yr	305.34	2145.23	2147.4	2147.86	0.96	7.61	2.66	20.27	5.06
Bumgarner Branch	Bum1	4.4	BKF	41.38	2157.99	2159.91	2160.14	0.71	3.84	0.9	3.47	3.47
Bumgarner Branch	Bum1	4.4	2 yr	104.04	2157.99	2160.38	2160.94	0.97	6	1.99	11.95	9.42
Bumgarner Branch	Bum1	4.4	5yr	188.24	2157.99	2160.98	2161.67	0.9	6.83	2.26	15.45	8.32
Bumgarner Branch	Bum1	4.4	10yr	261.26	2157.99	2161.42	2162.14	0.85	7.18	2.32	16.62	6.95
Bumgarner Branch	Bum1	4.4	100 yr	590.8	2157.99	2162.7	2163.3	0.71	7.53	2.19	16.52	3.19
Bumgarner Branch	Bum1	4.3	BKF	41.38	2152.52	2153.46	2153.82	1.01	4.82	1.5	7.25	7.25
Bumgarner Branch	Bum1	4.3	2 yr	104.04	2152.52	2154.24	2154.58	0.82	4.7	1.26	5.94	2
Bumgarner Branch	Bum1	4.3	5yr	188.24	2152.52	2154.98	2155.11	0.45	3.41	0.56	1.89	0.61
Bumgarner Branch	Bum1	4.3	10yr	261.26	2152.52	2155.19	2155.35	0.49	3.91	0.7	2.76	0.86
Bumgarner Branch	Bum1	4.3	100 yr	590.8	2152.52	2155.78	2156.08	0.64	5.76	1.4	8.07	2.3
Bumgarner Branch	Bum1	4.2	BKF	41.38	2148.16	2150.42	2150.45	0.18	1.46	0.1	0.14	0.07
Bumgarner Branch	Bum1	4.2	2 yr	104.04	2148.16	2152.58	2152.59	0.08	0.92	0.03	0.03	0.01
Bumgarner Branch	Bum1	4.2	5yr	188.24	2148.16	2155.05	2155.05	0.04	0.64	0.01	0.01	0
Bumgarner Branch	Bum1	4.2	10yr	261.26	2148.16	2155.27	2155.28	0.06	0.83	0.02	0.02	0
Bumgarner Branch	Bum1	4.2	100 yr	590.8	2148.16	2155.89	2155.91	0.1	1.59	0.07	0.12	0.03
Bumgarner Branch	Bum1	4.12		Culvert								

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El(ft)	W.S. Elev (ft)	E.G. Elev (ft)	Froude # Chl	Vel Chnl (ft/s)	Shear Chan(lb/sq ft)	Power Chan(lb/ft s)	Power Total (lb/ft s)
Bumgarner Branch	Bum1	4.1	BKF	41.38	2146.19	2147.87	2147.94	0.33	2.23	0.26	0.58	0.37
Bumgarner Branch	Bum1	4.1	2 yr	104.04	2146.19	2148.66	2148.81	0.39	3.29	0.48	1.59	0.91
Bumgarner Branch	Bum1	4.1	5yr	188.24	2146.19	2149.37	2149.6	0.43	4.2	0.71	2.99	1.59
Bumgarner Branch	Bum1	4.1	10yr	261.26	2146.19	2149.75	2150.07	0.48	4.97	0.96	4.76	2.46
Bumgarner Branch	Bum1	4.1	100 yr	590.8	2146.19	2150.04	2151.34	0.94	10.12	3.87	39.22	19.74
Bumgarner Branch	Bum1	4	BKF	41.38	2146.47	2147.53	2147.79	0.8	4.08	1.04	4.23	4.23
Bumgarner Branch	Bum1	4	2 yr	104.04	2146.47	2148.05	2148.61	0.93	6.05	1.93	11.69	7.87
Bumgarner Branch	Bum1	4	5yr	188.24	2146.47	2148.57	2149.37	0.97	7.44	2.62	19.5	11
Bumgarner Branch	Bum1	4	10yr	261.26	2146.47	2149.11	2149.86	0.85	7.43	2.4	17.81	6.29
Bumgarner Branch	Bum1	4	100 yr	590.8	2146.47	2149.58	2150.14	0.84	8.02	2.62	21.02	4.89
Bumgarner Branch	Bum1	3	BKF	41.38	2144.07	2145.02	2145.37	0.99	4.76	1.46	6.94	6.94
Bumgarner Branch	Bum1	3	2 yr	104.04	2144.07	2145.66	2146.21	0.92	6	1.9	11.4	7.63
Bumgarner Branch	Bum1	3	5yr	188.24	2144.07	2146.18	2146.48	0.69	5.33	1.34	7.17	1.19
Bumgarner Branch	Bum1	3	10yr	261.26	2144.07	2146.35	2146.68	0.73	5.87	1.58	9.27	1.65
Bumgarner Branch	Bum1	3	100 yr	590.8	2144.07	2146.88	2147.33	0.85	7.69	2.5	19.25	3.9
Bumgarner Branch	Bum2	2	BKF	57.6	2139.62	2140.66	2140.73	0.46	2.33	0.34	0.78	0.79
Bumgarner Branch	Bum2	2	2 yr	139.7	2139.62	2141.24	2141.39	0.58	3.8	0.76	2.89	1.07
Bumgarner Branch	Bum2	2	5yr	250.13	2139.62	2141.7	2141.87	0.58	4.37	0.91	3.98	1.13
Bumgarner Branch	Bum2	2	10yr	344.96	2139.62	2141.94	2142.13	0.59	4.76	1.03	4.91	1.5
Bumgarner Branch	Bum2	2	100 yr	768.07	2139.62	2142.8	2143.05	0.6	5.81	1.37	7.94	2.91
Bumgarner Branch	Bum2	1	BKF	57.6	2135.83	2137.02	2137.3	0.78	4.23	1.07	4.51	4.51
Bumgarner Branch	Bum2	1	2 yr	139.7	2135.83	2137.73	2138.19	0.77	5.55	1.52	8.43	4.7
Bumgarner Branch	Bum2	1	5yr	250.13	2135.83	2138.32	2138.94	0.79	6.65	1.96	13.03	3.98
Bumgarner Branch	Bum2	1	10yr	344.96	2135.83	2138.71	2139.33	0.77	7.02	2.07	14.54	3.86
Bumgarner Branch	Bum2	1	100 yr	768.07	2135.83	2139.66	2140.39	0.8	8.53	2.76	23.52	6.39
Bumgarner Branch	Bum2	0.1	BKF	57.6	2133.41	2134.91	2135.26	0.8	4.77	1.29	6.16	6.16
Bumgarner Branch	Bum2	0.1	2 yr	139.7	2133.41	2135.77	2136.37	0.84	6.23	1.93	12	12
Bumgarner Branch	Bum2	0.1	5yr	250.13	2133.41	2136.58	2137.09	0.77	6.17	1.79	11.03	4.36
Bumgarner Branch	Bum2	0.1	10yr	344.96	2133.41	2136.83	2137.45	0.83	7	2.22	15.54	6.71
Bumgarner Branch	Bum2	0.1	100 yr	768.07	2133.41	2137.74	2138.67	0.92	9.07	3.38	30.67	16.08

HEC-RAS OUTPUT COMPARISON

River	Reach	River Sta	Profile	WSEL Diff	Power ch Diff	Power ch % Diff	Power Tot Diff	Power Tot % Diff
Junes Br	June	8.1	BKF	1.27	-2.69	-0.96763	-2.69	-0.9676259
Junes Br	June	8.1	2 yr	1.08	-3.94	-0.88143	-3.94	-0.88143177
Junes Br	June	8.1	5yr	0.94	-5.06	-0.78207	-5.06	-0.7820711
Junes Br	June	8.1	10yr	0.98	-6.2	-0.79487	-6.2	-0.79487179
Junes Br	June	8.1	100 yr	0.36	-1.56	-0.46154	-1.56	-0.46987952
Junes Br	June	8	BKF	1.74	-4.72	-0.55399	-5.11	-0.59976526
Junes Br	June	8	2 yr	1.49	-8.45	-0.56522	-10.9	-0.72909699
Junes Br	June	8	5yr	0.82	3.23	0.30443	-1.99	-0.18755891
Junes Br	June	8	10yr	0.68	4.91	0.354001	-2.17	-0.15804807
Junes Br	June	8	100 yr	0.51	1.42	0.061286	-2.24	-0.23212435
Junes Br	June	7	BKF	2.06	-0.02	-0.00926	-0.02	-0.00925926
Junes Br	June	7	2 yr	1.71	2.29	0.496746	1.13	0.245119306
Junes Br	June	7	5yr	1.86	-7.09	-0.45361	-11.29	-0.72232885
Junes Br	June	7	10yr	1.74	-9.29	-0.48895	-14.89	-0.78368421
Junes Br	June	7	100 yr	1.19	-13.36	-0.44832	-23.89	-0.8076403
Junes Br	June	6	BKF	0.75	-1.55	-0.23664	-1.71	-0.2610687
Junes Br	June	6	2 yr	0.69	-5.11	-0.45141	-9.46	-0.83568905
Junes Br	June	6	5yr	0.23	0.63	0.096183	0.05	0.036231884
Junes Br	June	6	10yr	0.14	2.73	0.429921	0.43	0.338582677
Junes Br	June	6	100 yr	0.22	-0.11	-0.00782	-0.36	-0.12286689
Junes Br	June	5.2	BKF	-0.89	0.09	9	0.07	7
Junes Br	June	5.2	2 yr	-1.93	0.09	NA	0.02	NA
Junes Br	June	5.2	5yr	-4.53	0.03	NA	0.01	NA
Junes Br	June	5.2	10yr	-3.09	0.01	NA	0	NA
Junes Br	June	5.2	100 yr	0.1	0.01	NA	0	NA
Junes Br	June	5.12		0	0	NA	0	NA
Junes Br	June	5.1	BKF	0.69	-2.5	-0.83056	-2.15	-0.87755102
Junes Br	June	5.1	2 yr	0.15	-0.12	-0.04054	-0.71	-0.35858586
Junes Br	June	5.1	5yr	0	0.93	0.142857	-1.06	-0.26767677
Junes Br	June	5.1	10yr	0.09	-2.51	-0.16049	-4.14	-0.46256983
Junes Br	June	5.1	100 yr	0.01	0.36	0.028324	-0.23	-0.10849057
Junes Br	June	5	BKF	0.45	3.7	3.303571	3.42	3.053571429
Junes Br	June	5	2 yr	0.12	2	0.451467	-0.71	-0.23355263
Junes Br	June	5	5yr	0.3	-4.89	-0.3546	-2.41	-0.4989648
Junes Br	June	5	10yr	0.05	0.17	0.017876	0.27	0.121621622
Junes Br	June	5	100 yr	-0.08	3.67	0.221084	1.54	0.4375
Bumgarner Branch	Bum1	4.4	BKF	0.04	-0.51	-0.12814	-0.51	-0.1281407
Bumgarner Branch	Bum1	4.4	2 yr	0.01	-0.41	-0.03317	-0.42	-0.04268293
Bumgarner Branch	Bum1	4.4	5yr	0	0	0	0	0
Bumgarner Branch	Bum1	4.4	10yr	0	0	0	0	0
Bumgarner Branch	Bum1	4.4	100 yr	-0.01	0.05	0.003036	0.01	0.003144654
Bumgarner Branch	Bum1	4.3	BKF	0.02	-1.98	-0.21452	0.75	0.115384615
Bumgarner Branch	Bum1	4.3	2 yr	-0.2	0.41	0.074141	1.23	1.597402597
Bumgarner Branch	Bum1	4.3	5yr	0.05	-2.83	-0.59958	-0.21	-0.25609756
Bumgarner Branch	Bum1	4.3	10yr	0.12	-5.2	-0.65327	-0.58	-0.40277778
Bumgarner Branch	Bum1	4.3	100 yr	0.2	-15.62	-0.65935	-2.08	-0.47488584
Bumgarner Branch	Bum1	4.2	BKF	0.02	-0.18	-0.5625	-0.25	-0.78125
Bumgarner Branch	Bum1	4.2	2 yr	0	0.01	0.5	0	0
Bumgarner Branch	Bum1	4.2	5yr	0.02	0	0	0	NA
Bumgarner Branch	Bum1	4.2	10yr	0.06	0.01	1	0	NA
Bumgarner Branch	Bum1	4.2	100 yr	0.11	0.05	0.714286	0.01	0.5
Bumgarner Branch	Bum1	4.12		0	0	NA	0	NA
Bumgarner Branch	Bum1	4.1	BKF	0.18	-1.99	-0.77432	-2.2	-0.85603113

River	Reach	River Sta	Profile	WSEL Diff	Power ch Diff	Power ch % Diff	Power Tot Diff	Power Tot % Diff
Bumgarner Branch	Bum1	4.1	2 yr	-0.13	-1.78	-0.52819	-2.46	-0.72997033
Bumgarner Branch	Bum1	4.1	5yr	-0.21	-1.18	-0.28297	-2.47	-0.60837438
Bumgarner Branch	Bum1	4.1	10yr	0.5	-15.39	-0.76377	-17.69	-0.87791563
Bumgarner Branch	Bum1	4.1	100 yr	-0.51	5.38	0.158983	-9.67	-0.32879973
Bumgarner Branch	Bum1	4	BKF	0.55	-6.49	-0.60541	-6.49	-0.60541045
Bumgarner Branch	Bum1	4	2 yr	0.15	-5.17	-0.30664	-8.51	-0.51953602
Bumgarner Branch	Bum1	4	5yr	-0.18	1	0.054054	2.31	0.265822785
Bumgarner Branch	Bum1	4	10yr	-0.31	14.62	4.583072	5.54	7.386666667
Bumgarner Branch	Bum1	4	100 yr	-0.08	-0.29	-0.01361	-0.08	-0.01609658
Bumgarner Branch	Bum1	3	BKF	0.44	4.39	1.721569	4.39	1.721568627
Bumgarner Branch	Bum1	3	2 yr	0.23	4.3	0.605634	0.63	0.09
Bumgarner Branch	Bum1	3	5yr	0.46	-12.96	-0.64382	-5.91	-0.83239437
Bumgarner Branch	Bum1	3	10yr	0.1	0.95	0.114183	0.24	0.170212766
Bumgarner Branch	Bum1	3	100 yr	0.11	-0.26	-0.01333	0	0
Bumgarner Branch	Bum2	2	BKF	1.23	-5.82	-0.88182	-5.81	-0.88030303
Bumgarner Branch	Bum2	2	2 yr	1.02	-7.5	-0.72185	-9.32	-0.89701636
Bumgarner Branch	Bum2	2	5yr	0.75	-4.81	-0.54721	-2.39	-0.67897727
Bumgarner Branch	Bum2	2	10yr	0.55	-4.25	-0.46397	-0.74	-0.33035714
Bumgarner Branch	Bum2	2	100 yr	0.43	-2.65	-0.25024	-0.41	-0.12349398
Bumgarner Branch	Bum2	1	BKF	0.71	2.95	1.891026	2.95	1.891025641
Bumgarner Branch	Bum2	1	2 yr	0.37	5.38	1.763934	2.48	1.117117117
Bumgarner Branch	Bum2	1	5yr	0.36	6.35	0.950599	0.9	0.292207792
Bumgarner Branch	Bum2	1	10yr	0.37	4.96	0.517745	0.67	0.210031348
Bumgarner Branch	Bum2	1	100 yr	0.14	7.16	0.437653	2.01	0.45890411
Bumgarner Branch	Bum2	0.1	BKF	0	0	0	0	0
Bumgarner Branch	Bum2	0.1	2 yr	0	0.01	0.000834	0.01	0.000834028
Bumgarner Branch	Bum2	0.1	5yr	0.02	-0.44	-0.03836	-0.15	-0.03325942
Bumgarner Branch	Bum2	0.1	10yr	0	0	0	0	0
Bumgarner Branch	Bum2	0.1	100 yr	0		0	0	0

HEC-RAS Sediment Data- Existing Bankfull

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Bumgarner Branch	Bum1	4.4	262	0.02	17	17
Bumgarner Branch	Bum1	4.3	215	-0.05	22	17
Bumgarner Branch	Bum1	4.2	53	0.02	20	22
Bumgarner Branch	Bum1	4.1	22	0.15	18	20
Bumgarner Branch	Bum1	4	100.47	-0.42	26	18
Bumgarner Branch	Bum1	3	291.27	0.10	24	26
Bumgarner Branch	Bum2	2	289.5	-0.07	35	30
Bumgarner Branch	Bum2	1	116	0.14	22	35
Bumgarner Branch	Bum2	0.1	0	0.09	19	19
Junes Br	June	8.1	20	0.03	9	9
Junes Br	June	8	398.5	-0.22	19	9
Junes Br	June	7	431.7	0.02	17	19
Junes Br	June	6	391	0.00	17	17
Junes Br	June	5.2	43	0.00	18	17
Junes Br	June	5.1	25	1.13	8	18
Junes Br	June	5	95.64	0.54	6	8

HEC-RAS Sediment Data - Existing 10yr

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Bumgarner Branch	Bum1	4.4	262	0.00	77	77
Bumgarner Branch	Bum1	4.3	215	0.51	36	77
Bumgarner Branch	Bum1	4.2	53	0.27	14	36
Bumgarner Branch	Bum1	4.1	22	-1.00	32	14
Bumgarner Branch	Bum1	4	100.47	0.13	30	32
Bumgarner Branch	Bum1	3	291.27	0.30	23	30
Bumgarner Branch	Bum2	2	289.5	0.18	50	60
Bumgarner Branch	Bum2	1	116	-0.28	73	50
Bumgarner Branch	Bum2	0.1	0	0.04	102	102
Junes Br	June	8.1	20	0.03	41	41
Junes Br	June	8	398.5	-1.00	92	41
Junes Br	June	7	431.7	0.18	78	92
Junes Br	June	6	391	0.21	58	78
Junes Br	June	5.2	43	0.81	24	58
Junes Br	June	5.1	25	-0.97	32	24
Junes Br	June	5	95.64	-1.00	36	32

HEC-RAS Sediment Data -Proposed Bnkfull

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Bumgarner Branch	Bum1	4.4	262	0.00	16	16
Bumgarner Branch	Bum1	4.3	162.69	-0.14	28	16
Bumgarner Branch	Bum1	4.2	74.74	0.04	26	28
Bumgarner Branch	Bum1	4.1	20.68	0.22	2	26
Bumgarner Branch	Bum1	4	91.73	-0.26	8	2
Bumgarner Branch	Bum1	3	88.35	-0.27	13	8
Bumgarner Branch	Bum2	2	266.8	0.19	2	14
Bumgarner Branch	Bum2	1	103.16	-0.12	13	2
Bumgarner Branch	Bum2	0.1	0	0.12	22	22
Junes Br	June	8.1	20	0.02	0	0
Junes Br	June	8	375.93	-0.20	10	0
Junes Br	June	7	405.26	-0.03	12	10
Junes Br	June	6	352.22	-0.02	15	12
Junes Br	June	5.2	46.28	0.02	14	15
Junes Br	June	5.1	24.66	0.17	1	14
Junes Br	June	5	128.74	-0.20	1	1

HEC-RAS Sediment Data -Proposed 10yr

River	Reach	RS	Ch Dist	Invert Change (ft)	Mass Out Cum: All (tons)	Mass In Cum: All (tons)
Bumgarner Branch	Bum1	4.4	262	0.00	78	78
Bumgarner Branch	Bum1	4.3	162.69	0.22	28	78
Bumgarner Branch	Bum1	4.2	74.74	0.22	8	28
Bumgarner Branch	Bum1	4.1	20.68	-0.05	10	8
Bumgarner Branch	Bum1	4	91.73	-0.27	16	10
Bumgarner Branch	Bum1	3	88.35	-0.27	21	16
Bumgarner Branch	Bum2	2	266.8	0.24	17	44
Bumgarner Branch	Bum2	1	103.16	-0.25	40	17
Bumgarner Branch	Bum2	0.1	0	0.06	94	94
Junes Br	June	8.1	20	0.03	11	11
Junes Br	June	8	375.93	-0.20	21	11
Junes Br	June	7	405.26	-0.18	38	21
Junes Br	June	6	352.22	0.04	32	38
Junes Br	June	5.2	46.28	0.17	21	32
Junes Br	June	5.1	24.66	-0.14	22	21
Junes Br	June	5	128.74	-0.19	23	22

APPENDIX C4

Assessment Data

Erosion Rate Calculations

Project: 1053-JUNE Date: 11/7/2011

Stream: Bumgarner Branch/Higdon Crew:

Reach/Description: 1,2 Page: 1 Of: 4

Feature	Units							
Reach Name		Bumgarner	Bumgarner	HIGDON	HIGDON	Bumgarner	Bumgarner	
Station/Location		1-Lower	1-Lower	Higdon Br	Higdon Br.	2-Lower	2-Lower	
Photo No.								
Reach Length	ft	74	74	341	341	168	168	
Bank	RT-LT-Both	RT	LT	RT	LT	RT	LT	
Bank Height	ft	4	1.1	0.7	0.9	5	1.1	
Bankfull Height	ft	1.1	1.1	0.7	0.7	1.1	1.1	
Root Depth	ft	0.4	0.1	0.3	0.3	0.5	0.3	
Root Density	%	10%	20%	20%	20%	5%	20%	
Bank Angle	Degrees	70	40	30	30	80	30	
Surface Protection	%	70%	40%	70%	70%	70%	70%	
Bank Material	C-G-S-SC	SC	SC	SC	SC	SC	SC	
Stratification	N-M-E	N	N	N	N	N	N	
Thalweg Position	C-OC-Toe	OC	C	C	C	C	C	
D_{TOE}/D_{MEAN}	<1 or >1	>1	<1	<1	<1	<1	<1	
Local Slope > Avg	Yes-No	NO	NO	NO	NO	NO	NO	
BEHI Calculation								
Bnk Ht / Bkf Ht		3.64	1.00	1.00	1.29	4.55	1.00	
BEHI Score		10.00	1.00	1.00	4.11	10.00	1.00	
Root Depth / Bnk Ht		0.10	0.09	0.43	0.33	0.10	0.27	
BEHI Score		8.80	8.91	4.86	6.00	8.80	6.73	
Weighted Root Density		1.0%	1.8%	8.6%	6.7%	0.5%	5.5%	
BEHI Score		9.87	9.76	8.86	9.11	9.93	9.27	
Bank Angle		70	40	30	30	80	30	
BEHI Score		5.00	3.00	2.50	2.50	6.00	2.50	
Surface Protection		70%	40%	70%	70%	70%	70%	
BEHI Score		2.57	5.14	2.57	2.57	2.57	2.57	
Bank Material Adjustment		0	0	0	0	0	0	
Stratification Adjustment		0	0	0	0	0	0	
Total BEHI Score		36.24	27.81	19.78	24.30	37.30	22.07	
Rating		High	Moderate	Moderate	Moderate	High	Moderate	
NBS Calculation								
Thalweg Position Score		1.5	1	1	1	1	1	
Toe Depth Ratio Score		1	0	0	0	0	0	
Local Slope Score		0	0	0	0	0	0	
Total NBS Rating		2.5	1	1	1	1	1	
WARSS NBS Rating		4	1	1	1	1	1	
Rating		High	Very Low	Very Low	Very Low	Very Low	Very Low	
Erosion Rate Prediction								
NC or CO		NC						
Erosion Rate (ft/yr)		0.1	0.0	0.0	0.0	0.1	0.0	**Sheet Total**
Erosion Total (ft^3/yr)		36	1	4	5	79	3	129

Erosion Rate Calculations

Project:	1053-JUNE	Date:	11/7/2011
Stream:	Bumgarner Branch	Crew:	
Reach/Description:	3,4,5	Page: 2	Of: 4

Feature	Units							
Reach Name		Bumgarner	Bumgarner	Bumgarner	Bumgarner	Bumgarner	Bumgarner	
Station/Location		3-Middle	3-Middle	4-Middle	4-Middle	5- Upper	5-Upper	
Photo No.								
Reach Length	ft	350	350	119	119	427	427	
Bank	RT-LT-Both	RT	LT	RT	LT	RT	LT	
Bank Height	ft	3.5	1.5	3	1.5	1.6	1.6	
Bankfull Height	ft	1.5	1.5	1.6	1.6	1	1	
Root Depth	ft	0.5	0.3	0.5	0.3	0.5	0.5	
Root Density	%	5%	30%	15%	30%	50%	50%	
Bank Angle	Degrees	90	30	90	30	80	80	
Surface Protection	%	30%	80%	45%	80%	80%	80%	
Bank Material	C-G-S-SC	SC	SC	SC	SC	SC	SC	
Stratification	N-M-E	N	N	N	N	N	N	
Thalweg Position	C-OC-Toe	TOE	OC	TOE	OC	OC	OC	
D_{TOE}/D_{MEAN}	<1 or >1	>1	<1	>1	<1	>1	>1	
Local Slope > Avg	Yes-No	NO	NO	NO	NO	NO	NO	
BEHI Calculation								
Bnk Ht / Bkf Ht		2.33	1.00	1.88	0.94	1.60	1.60	
BEHI Score		8.53	1.00	7.24	1.00	5.78	5.78	
Root Depth / Bnk Ht		0.14	0.20	0.17	0.20	0.31	0.31	
BEHI Score		8.29	7.60	8.00	7.60	6.25	6.25	
Weighted Root Density		0.7%	6.0%	2.5%	6.0%	15.6%	15.6%	
BEHI Score		9.90	9.20	9.67	9.20	7.92	7.92	
Bank Angle		90	30	90	30	80	80	
BEHI Score		8.00	2.50	8.00	2.50	6.00	6.00	
Surface Protection		30%	80%	45%	80%	80%	80%	
BEHI Score		6.00	1.71	4.71	1.71	1.71	1.71	
Bank Material Adjustment		0	0	0	0	0	0	
Stratification Adjustment		0	0	0	0	0	0	
Total BEHI Score		40.72	22.01	37.62	22.01	27.66	27.66	
Rating		Very High	Moderate	High	Moderate	Moderate	Moderate	
NBS Calculation								
Thalweg Position Score		2	1.5	2	1.5	1.5	1.5	
Toe Depth Ratio Score		1	0	1	0	1	1	
Local Slope Score		0	0	0	0	0	0	
Total NBS Rating		3	1.5	3	1.5	2.5	2.5	
WARSS NBS Rating		5	2	5	2	4	4	
Rating		Very High	Low	Very High	Low	High	High	
Erosion Rate Prediction								
NC or CO		NC						
Erosion Rate (ft/yr)		1.0	0.0	0.1	0.0	0.1	0.1	**Sheet Total**
Erosion Total (ft^3/yr)		1225	17	46	6	77	77	1448

Erosion Rate Calculations

Project:	1053-JUNE	Date:	11/7/2011
Stream:	Junes Branch	Crew:	
Reach/Description:	6,7,9	Page: 3	Of: 4

Feature	Units							
Reach Name		Junes	Junes	Junes	Junes	Junes	Junes	
Station/Location		6 - Lower	6 -Lower	7 -Middle	7-Middle	9-Upper	9-Upper	
Photo No.								
Reach Length	ft	300	300	478	478	447	447	
Bank	RT-LT-Both	RT	LT	RT	LT	RT	LT	
Bank Height	ft	2	2	7	3	4	2	
Bankfull Height	ft	1.4	1.4	1.2	1.2	1.2	1.2	
Root Depth	ft	0.3	0.3	4.5	0.5	0.5	0.5	
Root Density	%	10%	5%	20%	10%	40%	5%	
Bank Angle	Degrees	75	75	90	90	70	85	
Surface Protection	%	75%	70%	60%	60%	60%	60%	
Bank Material	C-G-S-SC	SC	SC	SC	SC	SC	SC	
Stratification	N-M-E	N	N	N	N	N	N	
Thalweg Position	C-OC-Toe	OC	OC	C	C	OC	TOE	
D_{TOE}/D_{MEAN}	<1 or >1	<1	<1	<1	<1	<1	1	
Local Slope > Avg	Yes-No	NO	NO	NO	NO	NO	NO	
BEHI Calculation								
Bnk Ht / Bkf Ht		1.43	1.43	5.83	2.50	3.33	1.67	
BEHI Score		4.87	4.87	10.00	8.80	10.00	6.13	
Root Depth / Bnk Ht		0.15	0.15	0.64	0.17	0.13	0.25	
BEHI Score		8.20	8.20	3.29	8.00	8.50	7.00	
Weighted Root Density		1.5%	0.8%	12.9%	1.7%	5.0%	1.3%	
BEHI Score		9.80	9.90	8.29	9.78	9.33	9.83	
Bank Angle		75	75	90	90	70	85	
BEHI Score		5.50	5.50	8.00	8.00	5.00	7.00	
Surface Protection		75%	70%	60%	60%	60%	60%	
BEHI Score		2.14	2.57	3.43	3.43	3.43	3.43	
Bank Material Adjustment		0	0	0	0	0	0	
Stratification Adjustment		0	0	0	0	0	0	
Total BEHI Score		30.51	31.04	33.00	38.01	36.26	33.39	
Rating		High	High	High	High	High	High	
NBS Calculation								
Thalweg Position Score		1.5	1.5	1	1	1.5	2	
Toe Depth Ratio Score		0	0	0	0	0	FALSE	
Local Slope Score		0	0	0	0	0	0	
Total NBS Rating		1.5	1.5	1	1	1.5	2	
WARSS NBS Rating		2	2	1	1	2	3	
Rating		Low	Low	Very Low	Very Low	Low	Moderate	
Erosion Rate Prediction								
NC or CO		NC						
Erosion Rate (ft/yr)		0.1	0.1	0.1	0.1	0.1	0.1	**Sheet Total**
Erosion Total (ft^3/yr)		61	61	316	135	183	99	855

Erosion Rate Calculations

Project:	1053-JUNE	Date:	11/7/2011
Stream:	Junes Branch	Crew:	
Reach/Description:	8	Page: 4	Of: 4

Feature	Units							
Reach Name		Junes	Junes					
Station/Location		8 - Upper	8 -Upper					
Photo No.								
Reach Length	ft	100	100					
Bank	RT-LT-Both	RT	LT					
Bank Height	ft	1	5					
Bankfull Height	ft	1	1					
Root Depth	ft	0.3	0.3					
Root Density	%	5%	10%					
Bank Angle	Degrees	20	80					
Surface Protection	%	20%	60%					
Bank Material	C-G-S-SC	SC	SC					
Stratification	N-M-E	N	N					
Thalweg Position	C-OC-Toe	OC	oc					
D_{TOE}/D_{MEAN}	<1 or >1	<1	<1					
Local Slope > Avg	Yes-No	NO	NO					
BEHI Calculation								
Bnk Ht / Bkf Ht		1.00	5.00					
BEHI Score		1.00	10.00					
Root Depth / Bnk Ht		0.30	0.06					
BEHI Score		6.40	9.28					
Weighted Root Density		1.5%	0.6%					
BEHI Score		9.80	9.92					
Bank Angle		20	80					
BEHI Score		2.00	6.00					
Surface Protection		20%	60%					
BEHI Score		7.33	3.43					
Bank Material Adjustment		0	0					
Stratification Adjustment		0	0					
Total BEHI Score		26.53	38.63					
Rating		Moderate	High					
NBS Calculation								
Thalweg Position Score		1.5	1.5					
Toe Depth Ratio Score		0	0					
Local Slope Score		0	0					
Total NBS Rating		1.5	1.5	0	0	0	0	
WARSS NBS Rating		2	2					
Rating		Low	Low					
Erosion Rate Prediction								
NC or CO		NC						
Erosion Rate (ft/yr)		0.0	0.1					**Sheet Total**
Erosion Total (ft^3/yr)		3	51					54

Site Assessment Calculations

Project:	1053-JUNE	Date:	2/21/2012
Stream:	All	Crew:	
Reach/Description:	All	Page: 1	Of: 3

Feature	Units							
Section Number		1	2	3	4	5	6	
Reach Name		Bumgarner	Higdon	Bumgarner	Bumgarner	Bumgarner	Bumgarner	
Location		d/s end	mid	u/s of higdon	u/s erding bnk	u/s june confluence	u/s road	
D_A	square miles	1.03	0.08	0.93	0.9	0.9	0.75	
W_{BKF}	ft	9	4.5	12	12	9	7.5	
W_{BED}	ft	5.7	1.5	8.5	8.5	7.5	2.8	
D_{BKF}	ft	1.1	0.7	1.1	1.5	1.6	1	
$D_{TOE\ LT}$	ft	-0.1	0	-0.1	-0.2	0	0	
$D_{TOE\ RT}$	ft	-0.1	0.1	0	0	0.1	0	
Field D_{THAL}	ft	0.35	0.15	0.25	0.25	0.25	0.3	
W_{THAL}	ft	2	1	3	2.5	2.5	1.5	
Bank Height	ft	4	3	5.5	3.5	2.2	2	
Flood Prone Width	ft	17	15	18	18	18	40	
Quick XST Calculation								
D_{MAX}		1.45	0.85	1.35	1.75	1.85	1.30	
Average D_{TOE}		1.00	0.75	1.05	1.40	1.65	1.00	
D_{THAL}		0.45	0.10	0.30	0.35	0.20	0.30	
A_{BKF}		10.8	2.5	14.2	18.2	15.6	6.4	
D_{MEAN}		1.20	0.56	1.18	1.52	1.73	0.86	
W/D ratio		7.5	8.1	10.1	7.9	5.2	8.7	
Bank Height Ratio		2.8	3.5	4.1	2.0	1.2	1.5	
Entrenchment Ratio		1.9	3.3	1.5	1.5	2.0	5.3	
Index Calculations								
Ref Bed Width Coef		12	12	12	12	12	12	
Ref Bed Width Exp		0.45	0.45	0.45	0.45	0.45	0.45	
Ref Max Depth Coef		1.50	1.5	1.5	1.5	1.5	1.5	
Ref Max Depth Exp		0.27	0.27	0.27	0.27	0.27	0.27	
Reference Bed Width		12.2	3.9	11.6	11.4	11.4	10.5	
Bed Width Index (BWI)		0.5	0.4	0.7	0.7	0.7	0.3	
Reference D_{MAX}		1.5	0.8	1.5	1.5	1.5	1.4	
Max Depth Index (MDI)		1.0	1.1	0.9	1.2	1.3	0.9	
Stream Type (Rosgen)								
Stream Type		G	E	G	G	G	E	

Site Assessment Calculations

Project: 1053-JUNE Date: 2/21/2012

Stream: All Crew:

Reach/Description: All Page: 2 Of: 3

Feature	Units							
Section Number		7	8	9	10	11	12	
Reach Name		Bumgarner	Junes	Junes	Junes	Junes	Bumgarner	
Location		mid horse pasture	u/s drive	moving u/s	canyon	u/s wetland	at pit traps	
D_A	square miles	0.71	0.23	0.23	0.23	0.2	1.03	
W_{BKF}	ft	8.5	7	8.5	8	5	8.1	
W_{BED}	ft	3	3	4.5	3	2.5	5.7	
D_{BKF}	ft	1.5	1.4	1.05	1.2	1.2	0.9	
$D_{TOE\ LT}$	ft	0	0.1	0.1	0	0	0.1	
$D_{TOE\ RT}$	ft	0.2	0.3	0	0.15	0.2	0	
Field D_{THAL}	ft	0.3	0.35	0.15	0.15	0.15	0.3	
W_{THAL}	ft	1.5	1.5	2	2	1.5	1.5	
Bank Height	ft	2	2	2.6	3	2.5	5	
Flood Prone Width	ft	50	22	15.5	15	11	18	
Quick XST Calculation								
D_{MAX}		1.80	1.75	1.20	1.35	1.35	1.20	
Average D_{TOE}		1.60	1.60	1.10	1.28	1.30	0.95	
D_{THAL}		0.20	0.15	0.10	0.08	0.05	0.25	
A_{BKF}		9.7	8.3	7.5	7.2	5.0	7.5	
D_{MEAN}		1.14	1.19	0.88	0.90	1.00	0.92	
W/D ratio		7.5	5.9	9.7	8.9	5.0	8.8	
Bank Height Ratio		1.1	1.1	2.2	2.2	1.9	4.2	
Entrenchment Ratio		5.9	3.1	1.8	1.9	2.2	2.2	
Index Calculations								
Ref Bed Width Coef		12	12	12	12	12	12	
Ref Bed Width Exp		0.45	0.45	0.45	0.45	0.45	0.45	
Ref Max Depth Coef		1.50	1.5	1.5	1.5	1.5	1.5	
Ref Max Depth Exp		0.27	0.27	0.27	0.27	0.27	0.27	
Reference Bed Width		10.3	6.2	6.2	6.2	5.8	12.2	
Bed Width Index (BWI)		0.3	0.5	0.7	0.5	0.4	0.5	
Reference D_{MAX}		1.4	1.0	1.0	1.0	1.0	1.5	
Max Depth Index (MDI)		1.3	1.7	1.2	1.3	1.4	0.8	
Stream Type (Rosgen)								
Stream Type		E	E	G	G	G	G	

Site Assessment Calculations

Project:	1053-JUNE	Date:	2/21/2012
Stream:	All	Crew:	
Reach/Description:	All	Page: 3	Of: 3

Feature	Units							
Section Number		13	14	15	16	17		
Reach Name		Bumgarner	Junes	Junes	Bumgarner	Bumgarner		
Location		u/s conf w higdon	d/s of wetland	u/s junes	u/s end bumgarner	15' d/s of P16		
D_A	square miles	0.93	0.23	0.19	0.69	0.93		
W_{BKF}	ft	10.7	5.8	5	9	13.5		
W_{BED}	ft	8.4	4.2	2.8	6.5	8		
D_{BKF}	ft	1	0.75	0.6	1.1	0.95		
$D_{TOE\ LT}$	ft	-0.1	0	0	0	0.1		
$D_{TOE\ RT}$	ft	-0.1	0	0	-0.1	0		
Field D_{THAL}	ft	0.25	0.2	0.15	0.2	0.25		
W_{THAL}	ft	1.5	0.5	0.5	1.5	3		
Bank Height	ft	5.5	3	2.5	2	5.5		
Flood Prone Width	ft	18	20	11	20	18		
Quick XST Calculation								
D_{MAX}		1.25	0.95	0.75	1.30	1.20		
Average D_{TOE}		0.90	0.75	0.60	1.05	1.00		
D_{THAL}		0.35	0.20	0.15	0.25	0.20		
A_{BKF}		12.1	4.7	2.8	10.1	13.0		
D_{MEAN}		1.13	0.81	0.57	1.13	0.96		
W/D ratio		9.5	7.2	8.8	8.0	14.1		
Bank Height Ratio		4.4	3.2	3.3	1.5	4.6		
Entrenchment Ratio		1.7	3.4	2.2	2.2	1.3		
Index Calculations								
Ref Bed Width Coef		12	12	12	12	12		
Ref Bed Width Exp		0.45	0.45	0.45	0.45	0.45		
Ref Max Depth Coef		1.50	1.5	1.5	1.5	1.5		
Ref Max Depth Exp		0.27	0.27	0.27	0.27	0.27		
Reference Bed Width		11.6	6.2	5.7	10.2	11.6		
Bed Width Index (BWI)		0.7	0.7	0.5	0.6	0.7		
Reference D_{MAX}		1.5	1.0	1.0	1.4	1.5		
Max Depth Index (MDI)		0.8	0.9	0.8	1.0	0.8		
Stream Type (Rosgen)								
Stream Type		G	G	G	G	G		

2) Weighted Pebble Count

Feature Percent of Reach

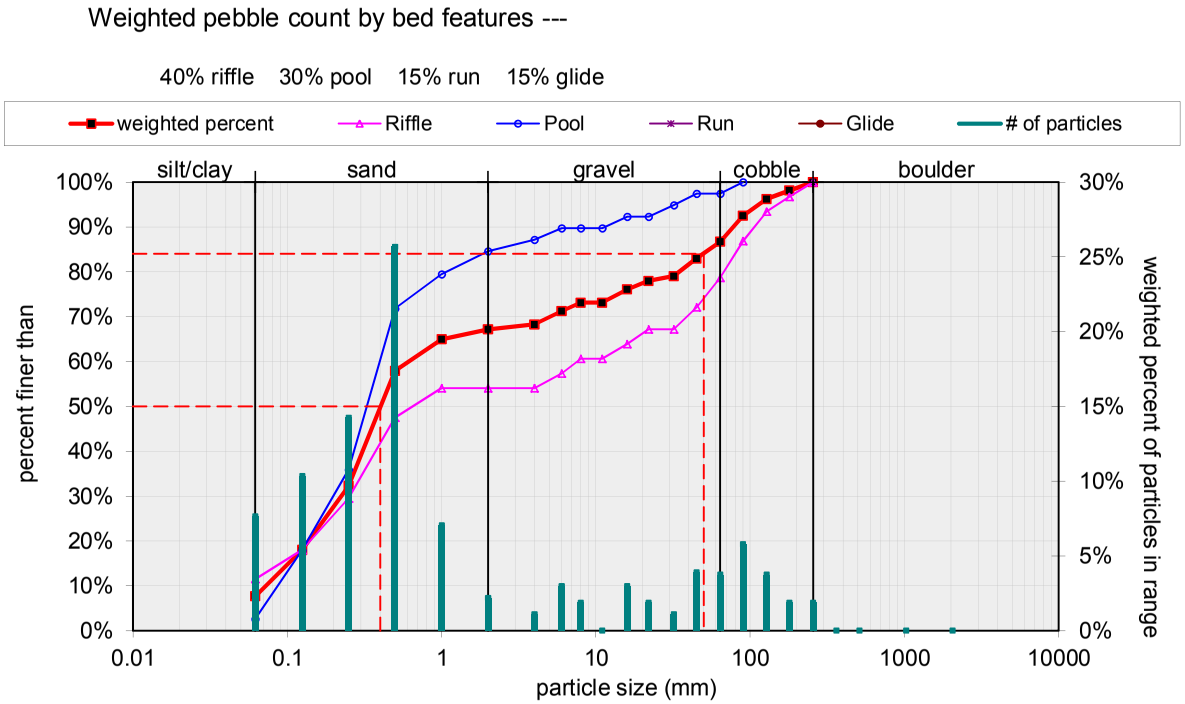
Riffle, Pool, Run, Glide

Riffle	40	%	Run	15	%
Pool	30	%	Glide	15	%

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	5.4
very fine sand	0.062 - 0.125	7.2
fine sand	0.125 - 0.25	10.0
medium sand	0.25 - 0.5	18.0
coarse sand	0.5 - 1	4.9
very coarse sand	1 - 2	1.5
very fine gravel	2 - 4	0.8
fine gravel	4 - 6	2.1
fine gravel	6 - 8	1.3
medium gravel	8 - 11	0.0
medium gravel	11 - 16	2.1
coarse gravel	16 - 22	1.3
coarse gravel	22 - 32	0.8
very coarse gravel	32 - 45	2.7
very coarse gravel	45 - 64	2.6
small cobble	64 - 90	4.0
medium cobble	90 - 128	2.6
large cobble	128 - 180	1.3
very large cobble	180 - 256	1.3
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:		70
bedrock		0.0
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
total weighted count:		70.0

Note: us bumgarner



Size (mm)	
D16	0.11
D35	0.27
D50	0.4
D65	1
D84	50
D95	110

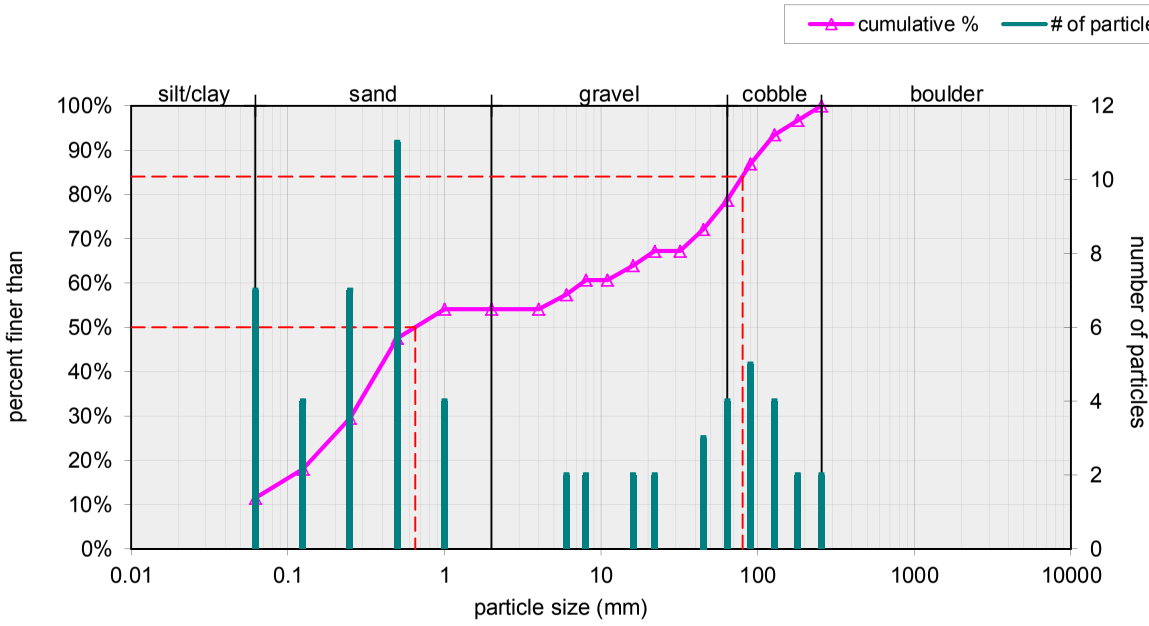
Size Distribution	
mean	2.3
dispersion	64.3
skewness	0.47

Type	
silt/clay	8%
sand	60%
gravel	20%
cobble	13%
boulder	0%

Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	7
very fine sand	0.062 - 0.125	4
fine sand	0.125 - 0.25	7
medium sand	0.25 - 0.5	11
coarse sand	0.5 - 1	4
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	2
fine gravel	6 - 8	2
medium gravel	8 - 11	
medium gravel	11 - 16	2
coarse gravel	16 - 22	2
coarse gravel	22 - 32	
very coarse gravel	32 - 45	3
very coarse gravel	45 - 64	4
small cobble	64 - 90	5
medium cobble	90 - 128	4
large cobble	128 - 180	2
very large cobble	180 - 256	2
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		61
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		61

Note: us bumgarner



Size (mm)	
D16	0.1
D35	0.31
D50	0.65
D65	18
D84	80
D95	150

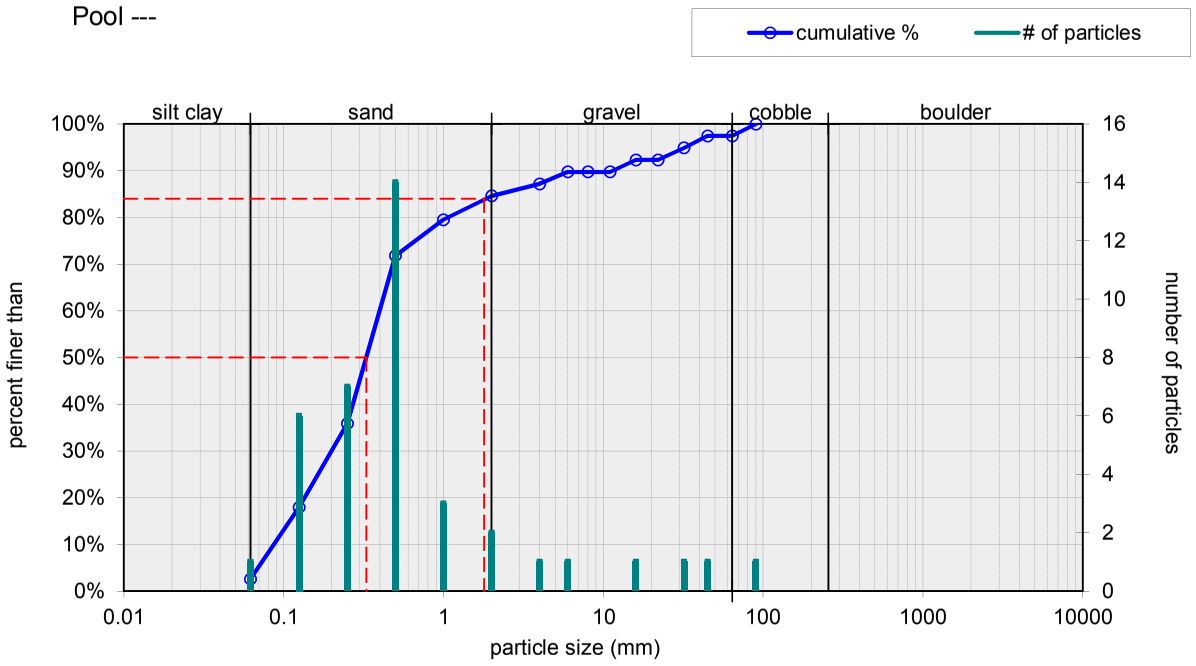
Size Distribution	
mean	2.8
dispersion	64.8
skewness	0.37

Type	
silt/clay	11%
sand	43%
gravel	25%
cobble	21%
boulder	0%

Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	6
fine sand	0.125 - 0.25	7
medium sand	0.25 - 0.5	14
coarse sand	0.5 - 1	3
very coarse sand	1 - 2	2
very fine gravel	2 - 4	1
fine gravel	4 - 6	1
fine gravel	6 - 8	
medium gravel	8 - 11	
medium gravel	11 - 16	1
coarse gravel	16 - 22	
coarse gravel	22 - 32	1
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	
small cobble	64 - 90	1
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:		39
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		39

Note: us bumgarner



Size (mm)	
D16	0.11
D35	0.24
D50	0.33
D65	0.44
D84	1.8
D95	33

Size Distribution	
mean	0.4
dispersion	4.2
skewness	0.12

Type	
silt/clay	3%
sand	82%
gravel	13%
cobble	3%
boulder	0%

3) Bulk Sample Sieve Analysis

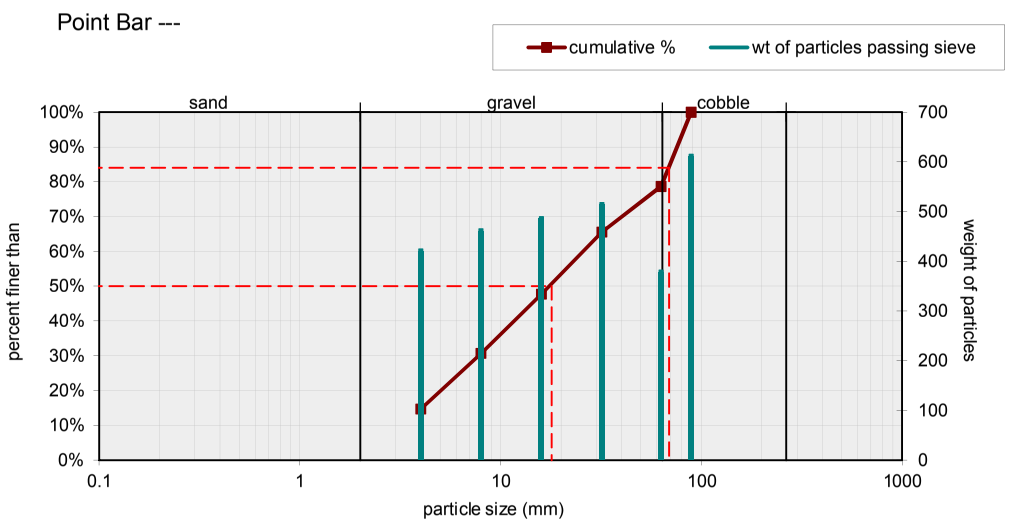
Two samples may be entered below. Select sample type for each.

Point Bar

Sieve Size (mm)	Sieve Weight (g)	Sieve & Sample Weight (g)	Retained on Sieve (g)		Passing Sieve	
2		421	421	15%	---	---
4		461	461	16%	15%	15%
8		486	486	17%	16%	31%
16		514	514	18%	17%	48%
32		378	378	13%	18%	66%
63		611	611	21%	13%	79%
89			0	0%	21%	100%

total wt retained in sieves: 2871

Note: Sand 2370 g (45%), us bumgarner



Size (mm)					
D16	4.2	D65	31	sand	100%
D35	9.5	D84	69		
D50	18	D95	82		

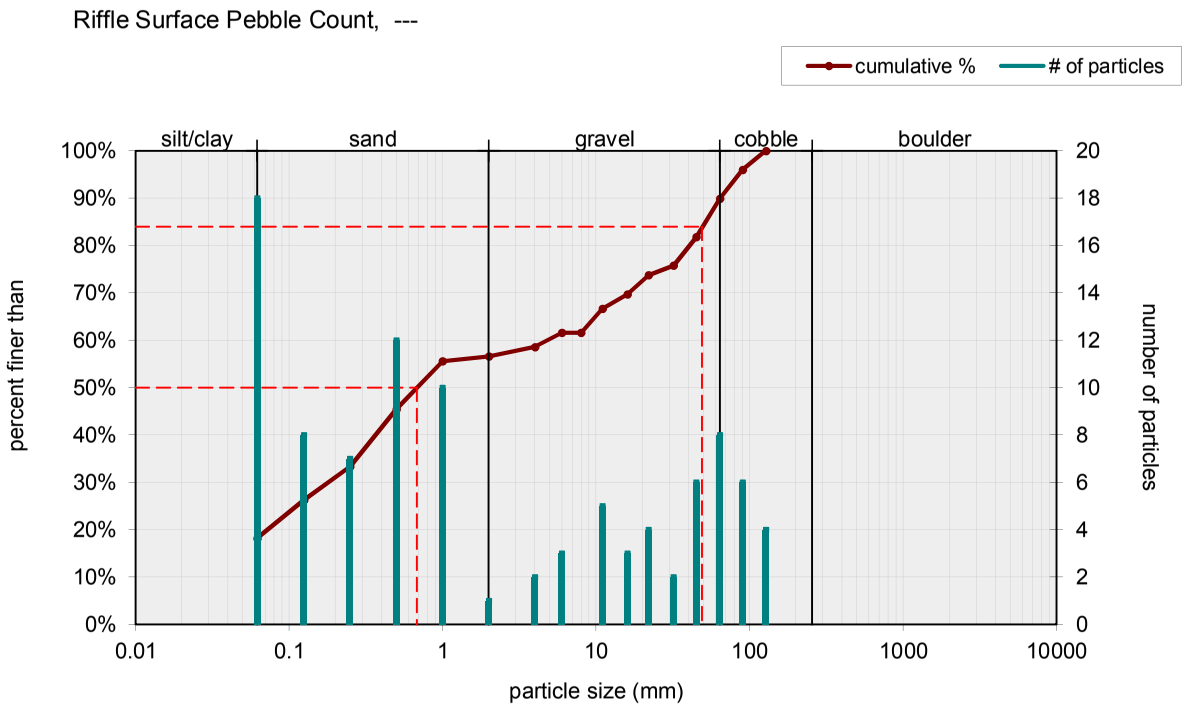
1) Individual Pebble Count

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

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	18
very fine sand	0.062 - 0.125	8
fine sand	0.125 - 0.25	7
medium sand	0.25 - 0.5	12
coarse sand	0.5 - 1	10
very coarse sand	1 - 2	1
very fine gravel	2 - 4	2
fine gravel	4 - 6	3
fine gravel	6 - 8	
medium gravel	8 - 11	5
medium gravel	11 - 16	3
coarse gravel	16 - 22	4
coarse gravel	22 - 32	2
very coarse gravel	32 - 45	6
very coarse gravel	45 - 64	8
small cobble	64 - 90	6
medium cobble	90 - 128	4
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:		99
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		99

Note: ds bumgarner



Size (mm)	
D16	0.062
D35	0.27
D50	0.68
D65	9.9
D84	49
D95	85

Size Distribution	
mean	1.7
dispersion	41.5
skewness	0.24

Type	
silt/clay	18%
sand	38%
gravel	33%
cobble	10%
boulder	0%

2) Weighted Pebble Count

Feature Percent of Reach

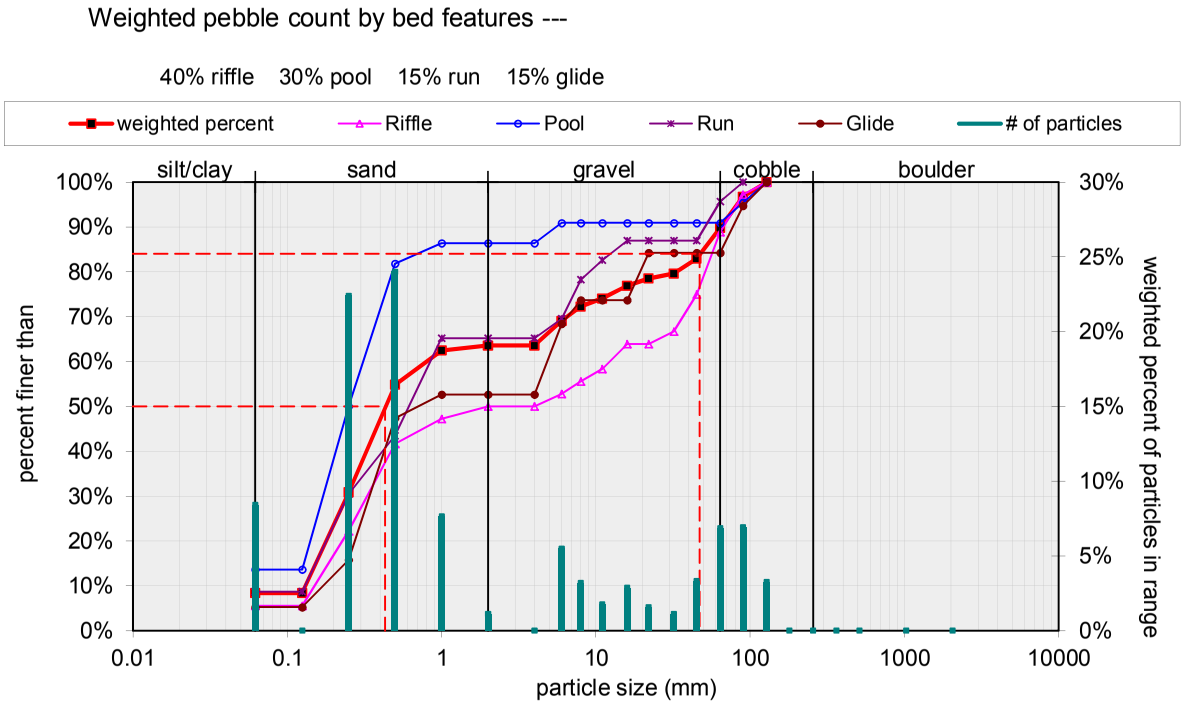
Riffle, Pool, Run, Glide

Riffle	40	%	Run	15	%
Pool	30	%	Glide	15	%

Weighted pebble count by bed features

Material	Size Range (mm)		weighted
silt/clay	0	- 0.062	8.4
very fine sand	0.062	- 0.125	0.0
fine sand	0.125	- 0.25	22.4
medium sand	0.25	- 0.5	24.0
coarse sand	0.5	- 1	7.6
very coarse sand	1	- 2	1.1
very fine gravel	2	- 4	0.0
fine gravel	4	- 6	5.5
fine gravel	6	- 8	3.2
medium gravel	8	- 11	1.8
medium gravel	11	- 16	2.9
coarse gravel	16	- 22	1.6
coarse gravel	22	- 32	1.1
very coarse gravel	32	- 45	3.3
very coarse gravel	45	- 64	6.9
small cobble	64	- 90	6.9
medium cobble	90	- 128	3.3
large cobble	128	- 180	0.0
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: ds bumgarner



Size (mm)	
D16	0.16
D35	0.28
D50	0.43
D65	4.4
D84	47
D95	83

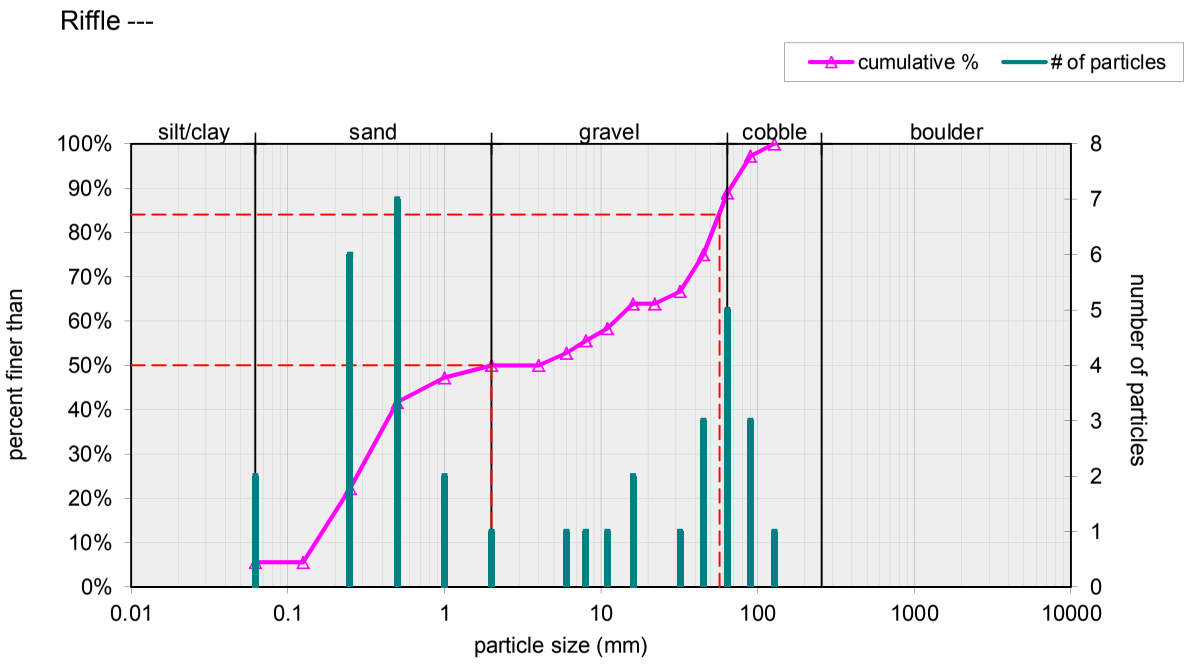
Size Distribution	
mean	2.7
dispersion	56.0
skewness	0.51

Type	
silt/clay	8%
sand	55%
gravel	26%
cobble	10%
boulder	0%

Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	2
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	6
medium sand	0.25 - 0.5	7
coarse sand	0.5 - 1	2
very coarse sand	1 - 2	1
very fine gravel	2 - 4	
fine gravel	4 - 6	1
fine gravel	6 - 8	1
medium gravel	8 - 11	1
medium gravel	11 - 16	2
coarse gravel	16 - 22	
coarse gravel	22 - 32	1
very coarse gravel	32 - 45	3
very coarse gravel	45 - 64	5
small cobble	64 - 90	3
medium cobble	90 - 128	1
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:		36
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		36

Note: ds bumgarner



Size (mm)	
D16	0.19
D35	0.39
D50	2
D65	26
D84	57
D95	82

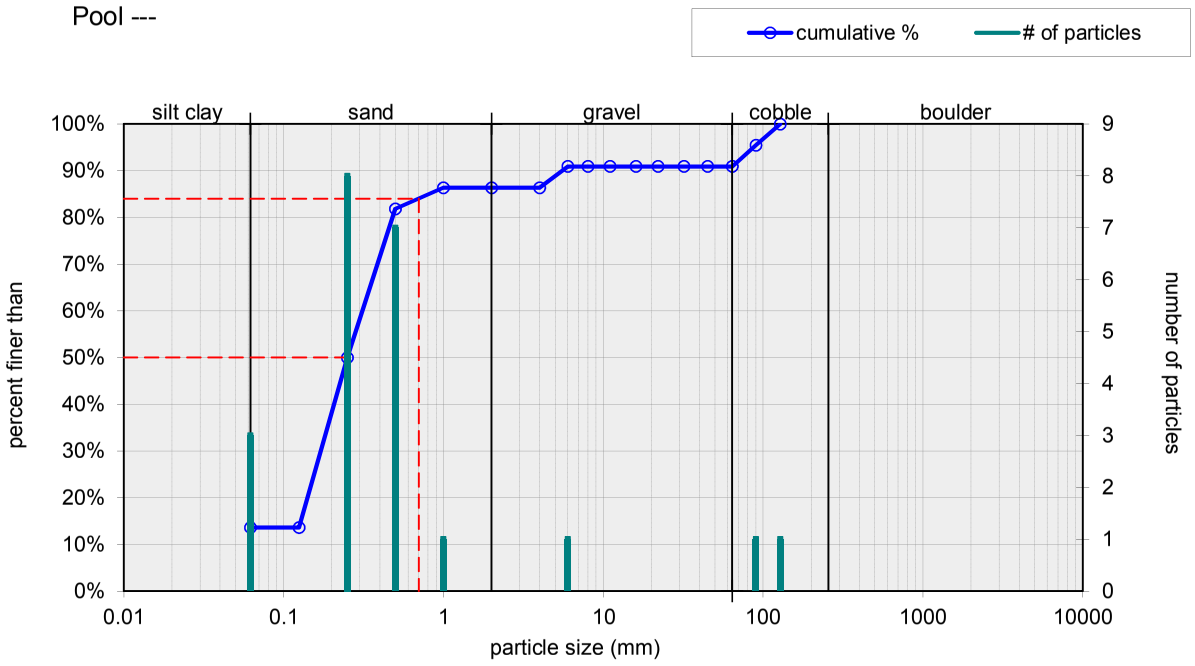
Size Distribution	
mean	3.3
dispersion	19.5
skewness	0.14

Type	
silt/clay	6%
sand	44%
gravel	39%
cobble	11%
boulder	0%

Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	3
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	8
medium sand	0.25 - 0.5	7
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	1
fine gravel	6 - 8	
medium gravel	8 - 11	
medium gravel	11 - 16	
coarse gravel	16 - 22	
coarse gravel	22 - 32	
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	
small cobble	64 - 90	1
medium cobble	90 - 128	1
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:		22
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		22

Note: ds bumgarner



Size (mm)	
D16	0.13
D35	0.19
D50	0.25
D65	0.35
D84	0.7
D95	87

Size Distribution	
mean	0.3
dispersion	2.4
skewness	0.10

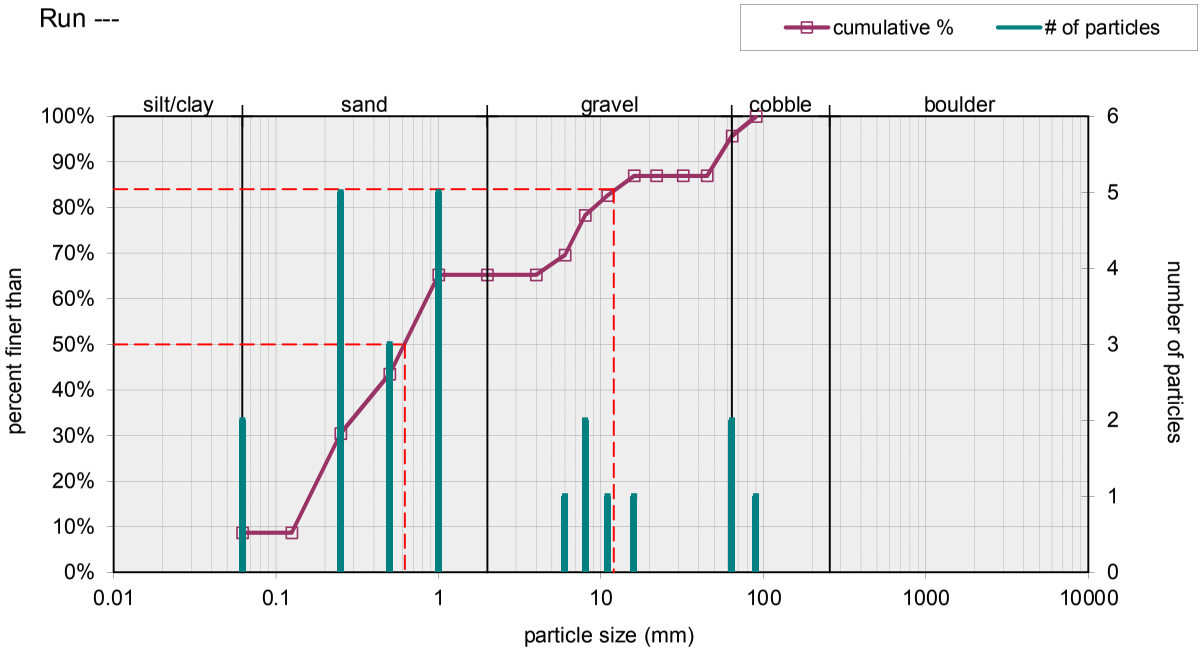
Type	
silt/clay	14%
sand	73%
gravel	5%
cobble	9%
boulder	0%

Run

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	2
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	5
medium sand	0.25 - 0.5	3
coarse sand	0.5 - 1	5
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	1
fine gravel	6 - 8	2
medium gravel	8 - 11	1
medium gravel	11 - 16	1
coarse gravel	16 - 22	
coarse gravel	22 - 32	
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	2
small cobble	64 - 90	1
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:		23
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		23

Note: ds bumgarner

Run ---



Size (mm)	
D16	0.16
D35	0.32
D50	0.62
D65	0.99
D84	12
D95	62

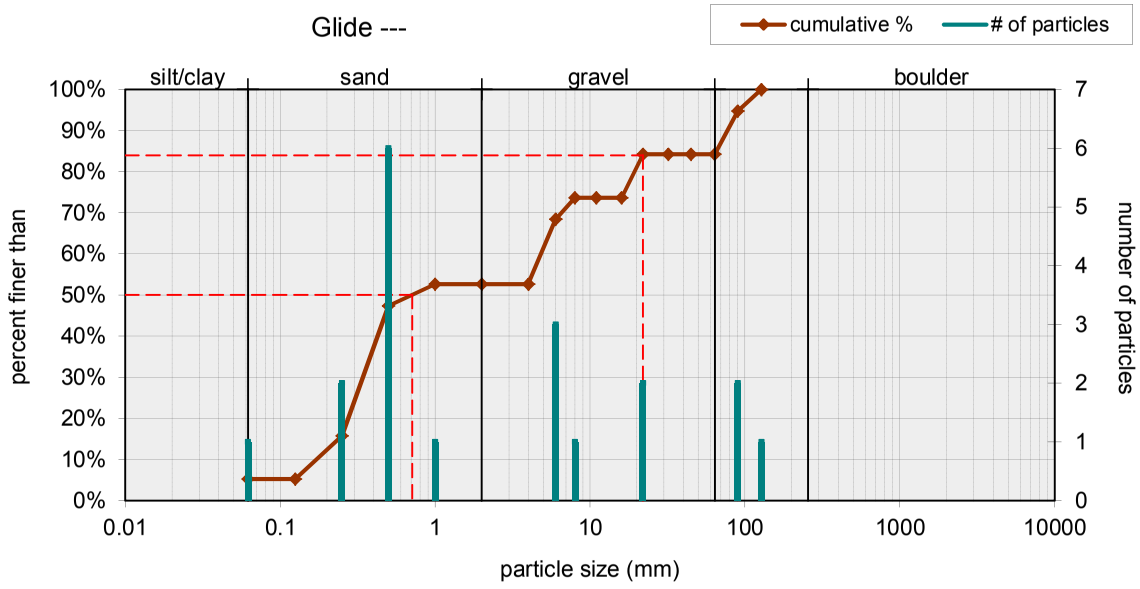
Size Distribution	
mean	1.4
dispersion	11.6
skewness	0.26

Type	
silt/clay	9%
sand	57%
gravel	30%
cobble	4%
boulder	0%

Glide

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	6
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	3
fine gravel	6 - 8	1
medium gravel	8 - 11	
medium gravel	11 - 16	
coarse gravel	16 - 22	2
coarse gravel	22 - 32	
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	
small cobble	64 - 90	2
medium cobble	90 - 128	1
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:		19
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		19

Note: ds bumgarner



Size (mm)	
D16	0.25
D35	0.38
D50	0.71
D65	5.5
D84	22
D95	92

Size Distribution	
mean	2.3
dispersion	16.9
skewness	0.37

Type	
silt/clay	5%
sand	47%
gravel	32%
cobble	16%
boulder	0%

3) Bulk Sample Sieve Analysis

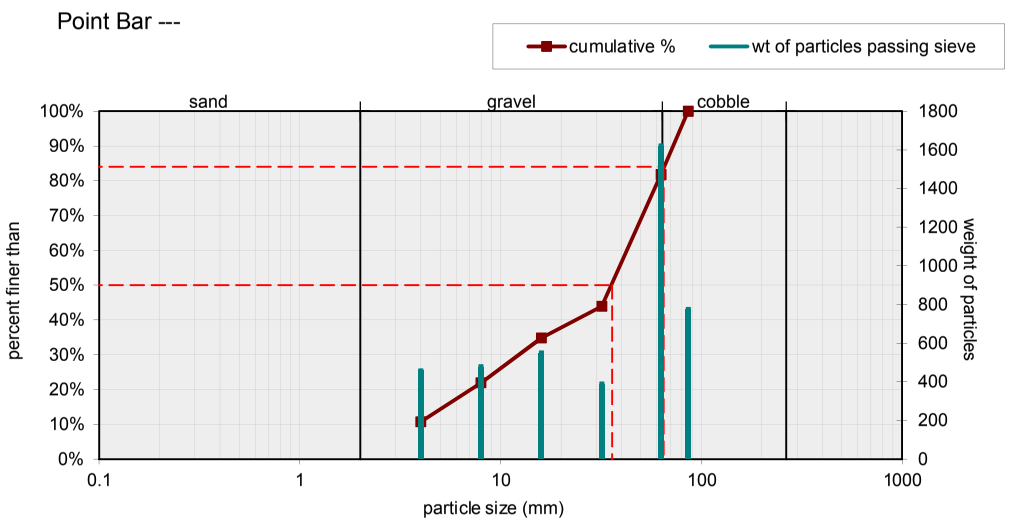
Two samples may be entered below. Select sample type for each.

Point Bar

Sieve Size (mm)	Sieve Weight (g)	Sieve & Sample Weight (g)	Retained on Sieve (g)		Passing Sieve	
2		457	457	11%	---	---
4		478	478	11%	11%	11%
8		549	549	13%	11%	22%
16		388	388	9%	13%	35%
32		1619	1619	38%	9%	44%
63		774	774	18%	38%	82%
86			0	0%	18%	100%

total wt retained in sieves: 4265

Note: Sand 1470 g (26%), ds bumgarner



Size (mm)					
D16	5.5	D65	47	sand	100%
D35	16	D84	65		
D50	36	D95	79		

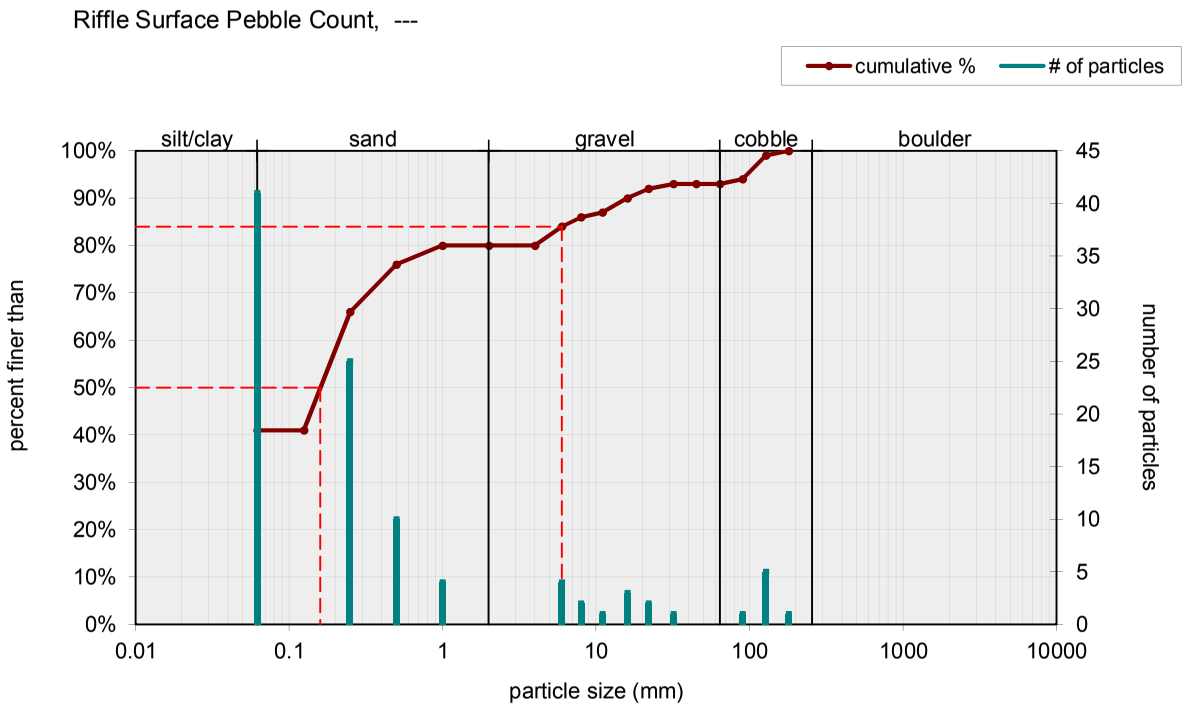
1) Individual Pebble Count

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

Riffle Surface

Material	Size Range (mm)		Count
silt/clay	0	- 0.062	41
very fine sand	0.062	- 0.125	
fine sand	0.125	- 0.25	25
medium sand	0.25	- 0.5	10
coarse sand	0.5	- 1	4
very coarse sand	1	- 2	
very fine gravel	2	- 4	
fine gravel	4	- 6	4
fine gravel	6	- 8	2
medium gravel	8	- 11	1
medium gravel	11	- 16	3
coarse gravel	16	- 22	2
coarse gravel	22	- 32	1
very coarse gravel	32	- 45	
very coarse gravel	45	- 64	
small cobble	64	- 90	1
medium cobble	90	- 128	5
large cobble	128	- 180	1
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	----------		
clay hardpan	----------		
detritus/wood	----------		
artificial	----------		
total count:			100

Note: Junes



Size (mm)	
D16	0.062
D35	0.062
D50	0.16
D65	0.24
D84	6
D95	97

Size Distribution	
mean	0.6
dispersion	20.0
skewness	0.41

Type	
silt/clay	41%
sand	39%
gravel	13%
cobble	7%
boulder	0%

3) Bulk Sample Sieve Analysis

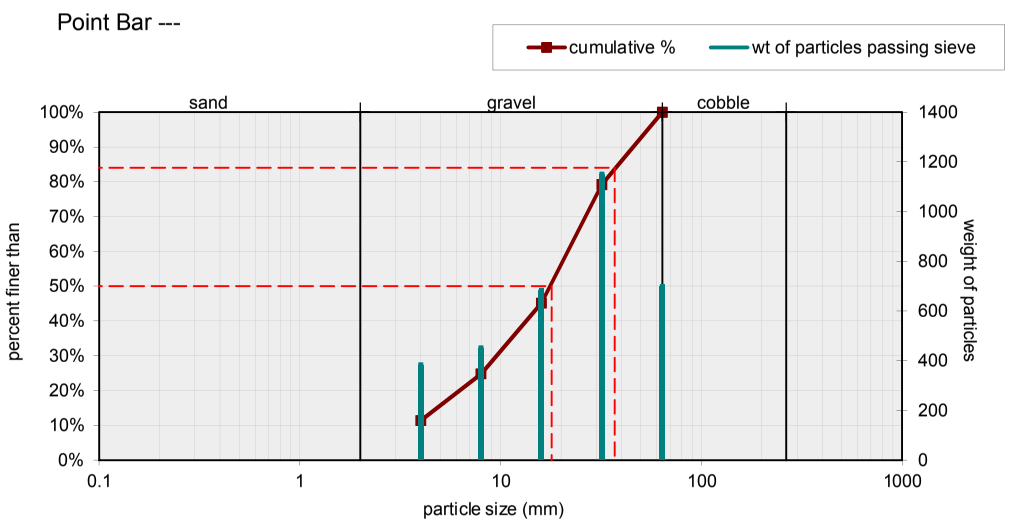
Two samples may be entered below. Select sample type for each.

Point Bar

Sieve Size (mm)	Sieve Weight (g)	Sieve & Sample Weight (g)	Retained on Sieve (g)		Passing Sieve	
2		383	383	11%	---	---
4		452	452	13%	11%	11%
8		683	683	20%	13%	25%
16		1151	1151	34%	20%	45%
32		698	698	21%	34%	79%
64			0	0%	21%	100%

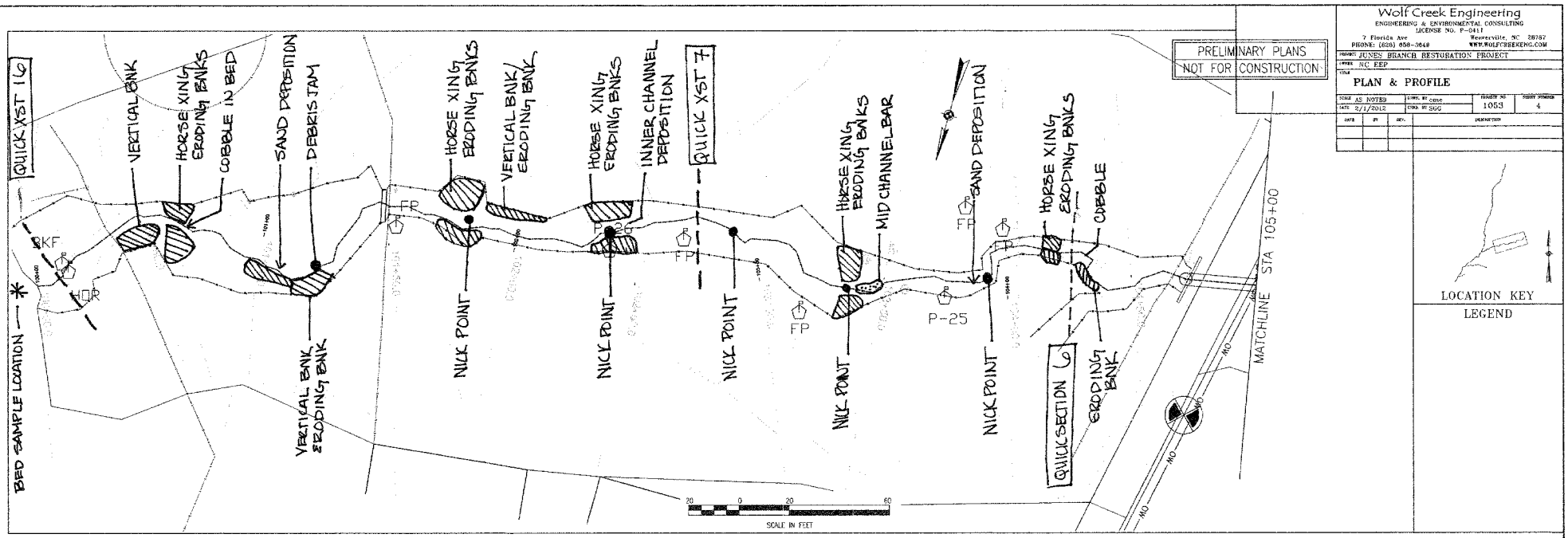
total wt retained in sieves: 3367

Note: Sand 1409 g (30%), Junes



	Size (mm)		
D16	5.1	D65	24
D35	11	D84	37
D50	18	D95	54

sand 100%



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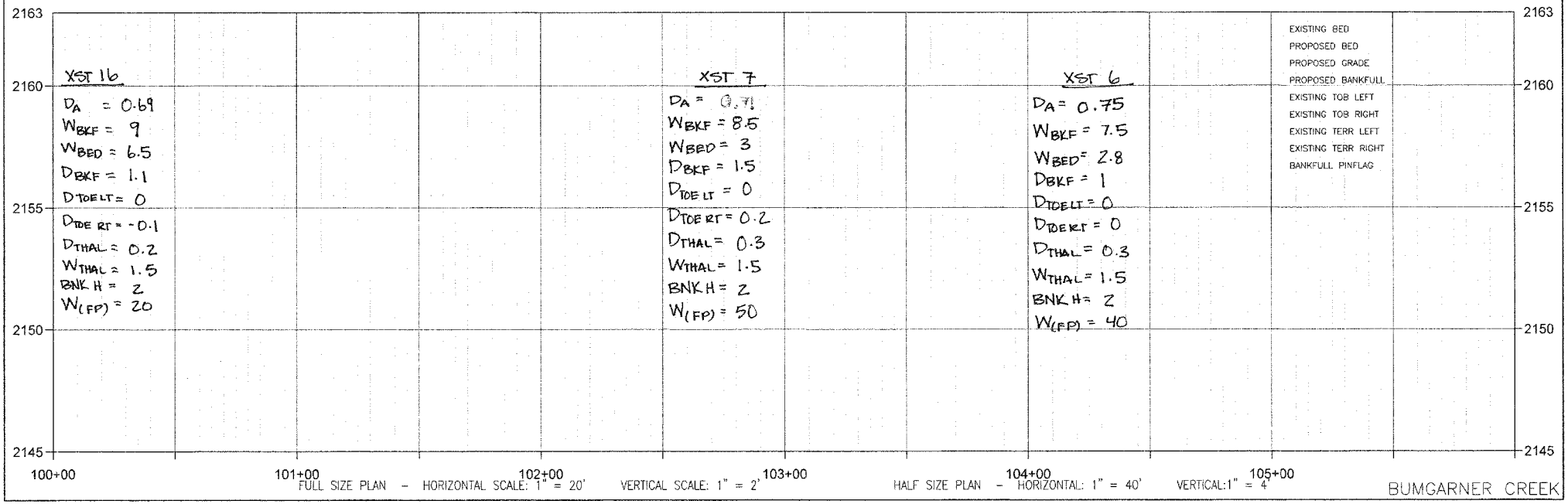
7 Florida Ave Mooresville, NC 28787
PHONE: (828) 850-3640 WWW.WOLFCREEKENG.COM

PROJECT: JONES BRANCH RESTORATION PROJECT
OWNER: NC EEP
TITLE: PLAN & PROFILE

SCALE	AS NOTED	CHKD. BY	cene	PROJECT NO	SHEET NUMBER
DATE	2/1/2012	DRWN. BY	SGG	1053	4

DATE	BY	REV.	DESCRIPTION



BUMGARNER CREEK

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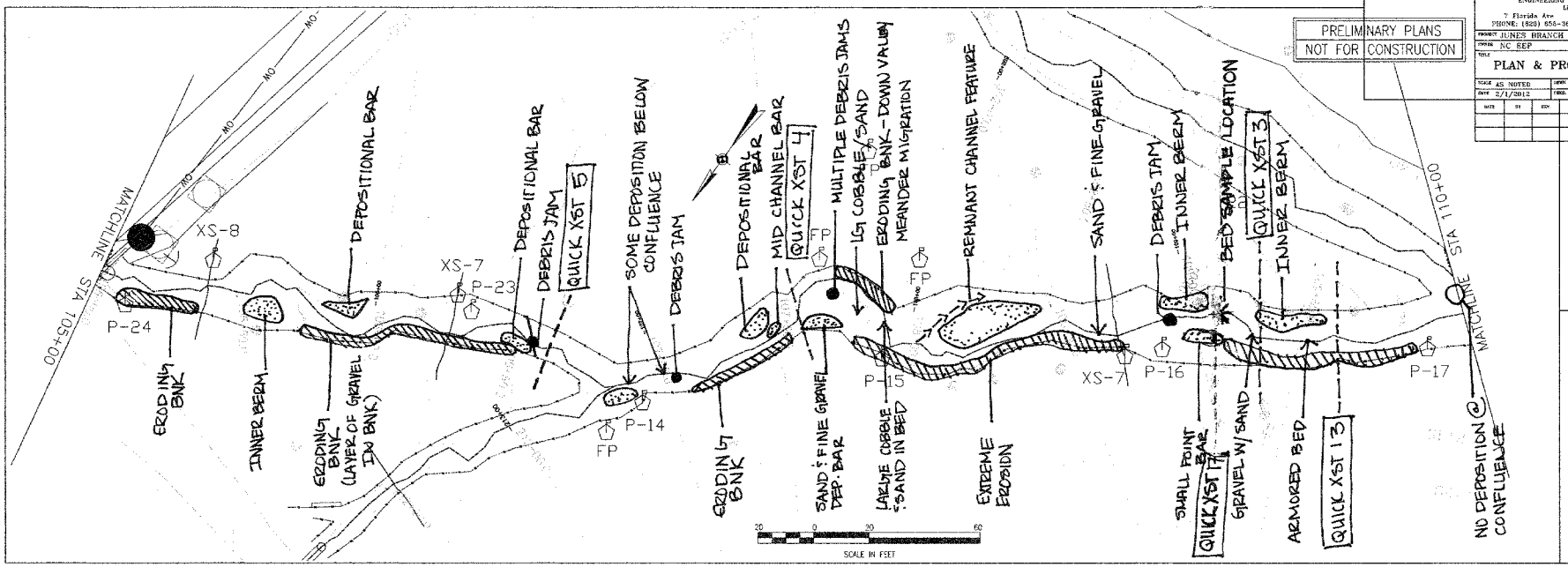
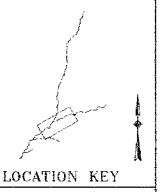
PROJECT: JONES BRANCH RESTORATION PROJECT
OWNER: NC EEP
TITLE: PLAN & PROFILE

SCALE	DRWN BY	PROJECT NO	SHEET NUMBER
AS NOTED	cmw	1053	5
DATE: 2/1/2012	CHKD BY: SCG		

DATE	BY	REV	DESCRIPTION

PRELIMINARY PLANS
NOT FOR CONSTRUCTION





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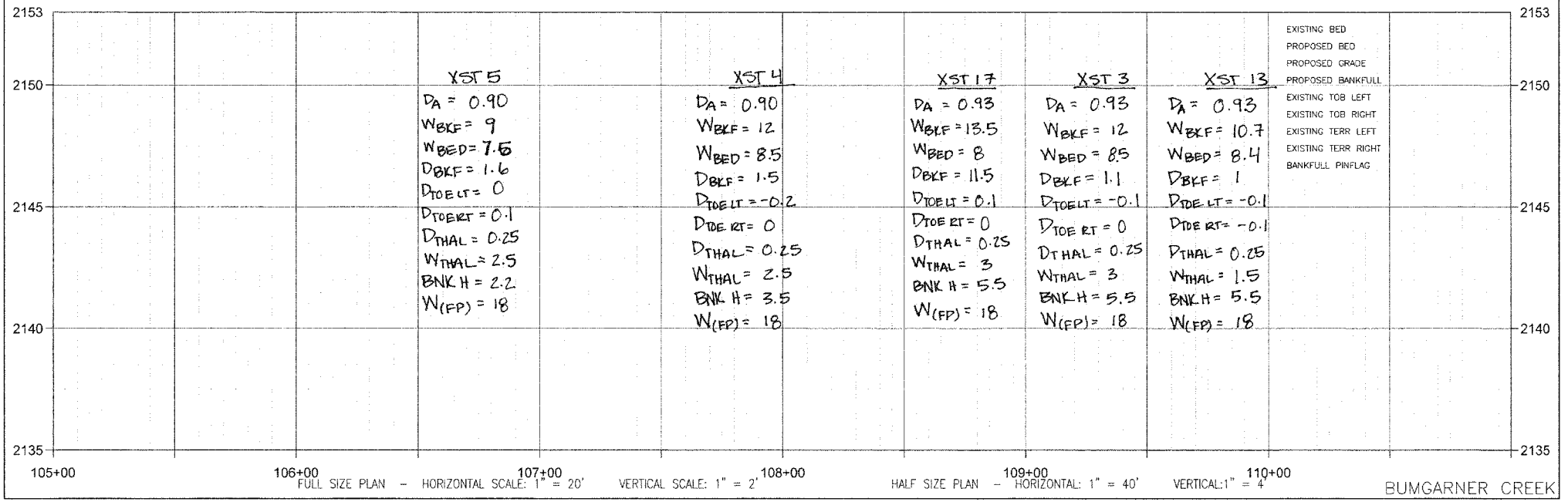

FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'
HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

BUMGARNER CREEK

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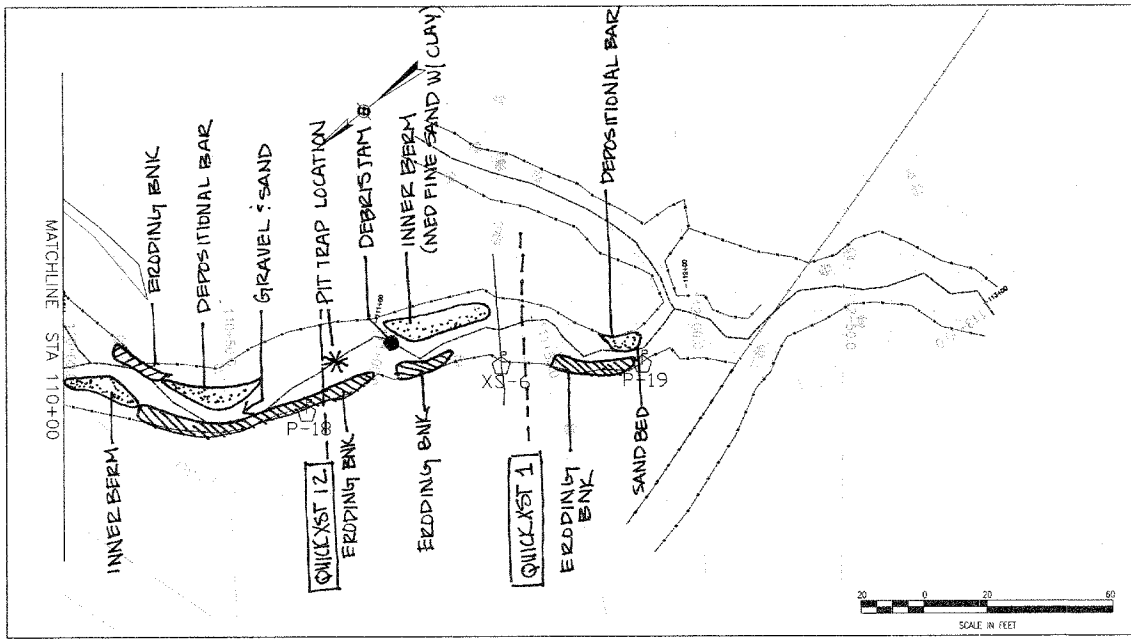
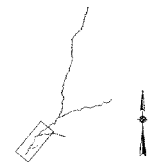
PRELIMINARY PLANS
NOT FOR CONSTRUCTION

PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER NC EEP
TITLE **PLAN & PROFILE**

SCALE AS NOTED	DWN. BY cme	PROJECT NO. 1050	SHEET NUMBER 6
DATE 2/1/2012	CHKD. BY SCC		

DATE	BY	REV.	DESCRIPTION





LOCATION KEY

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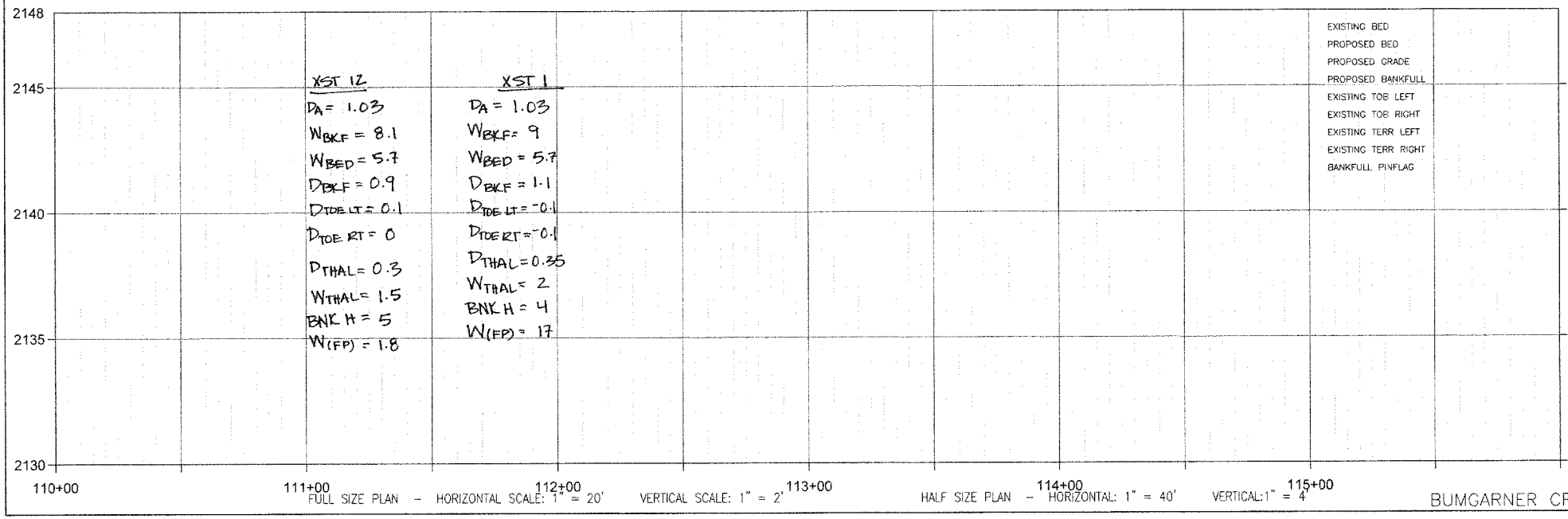
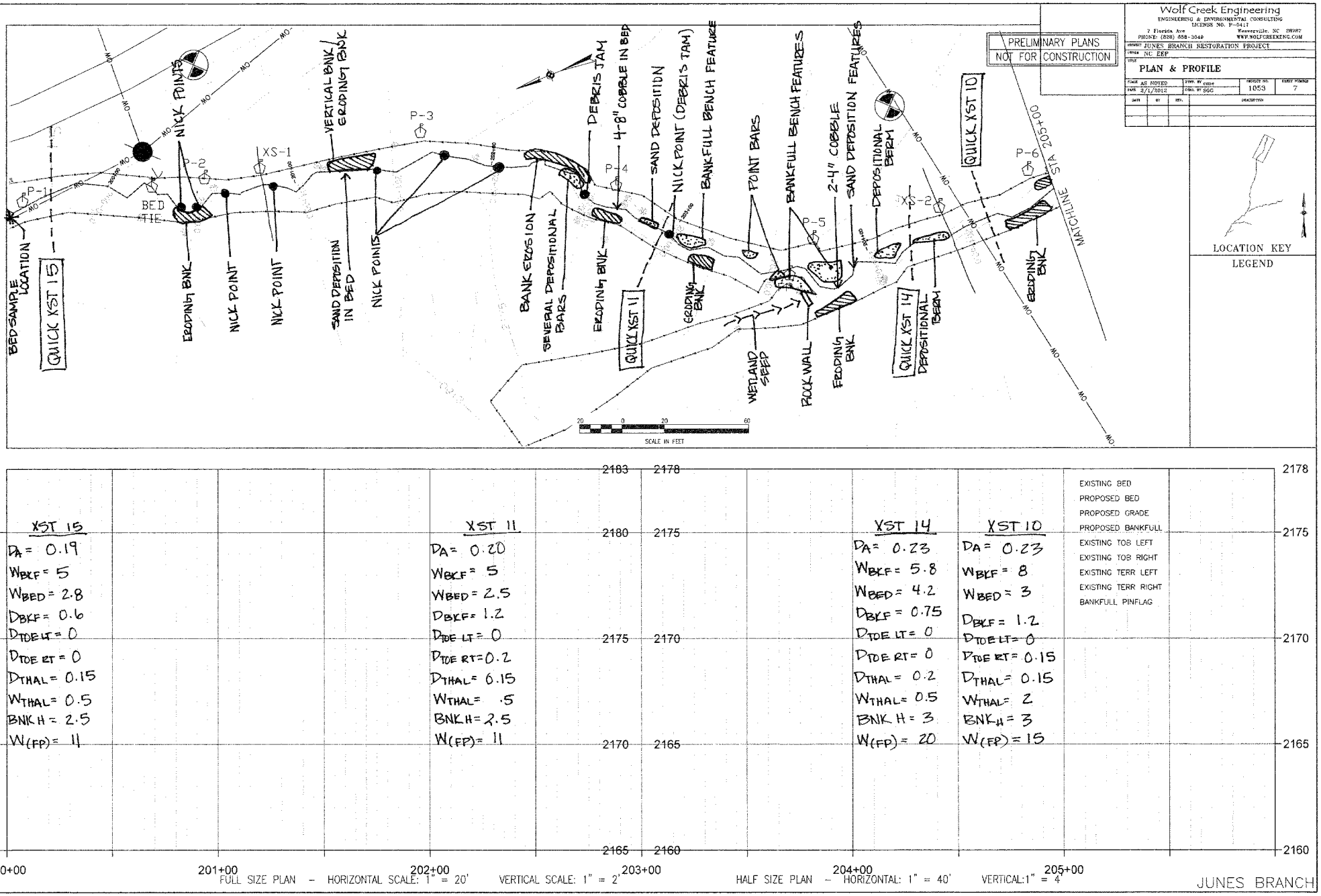


FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'

HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

BUMGARNER CREEK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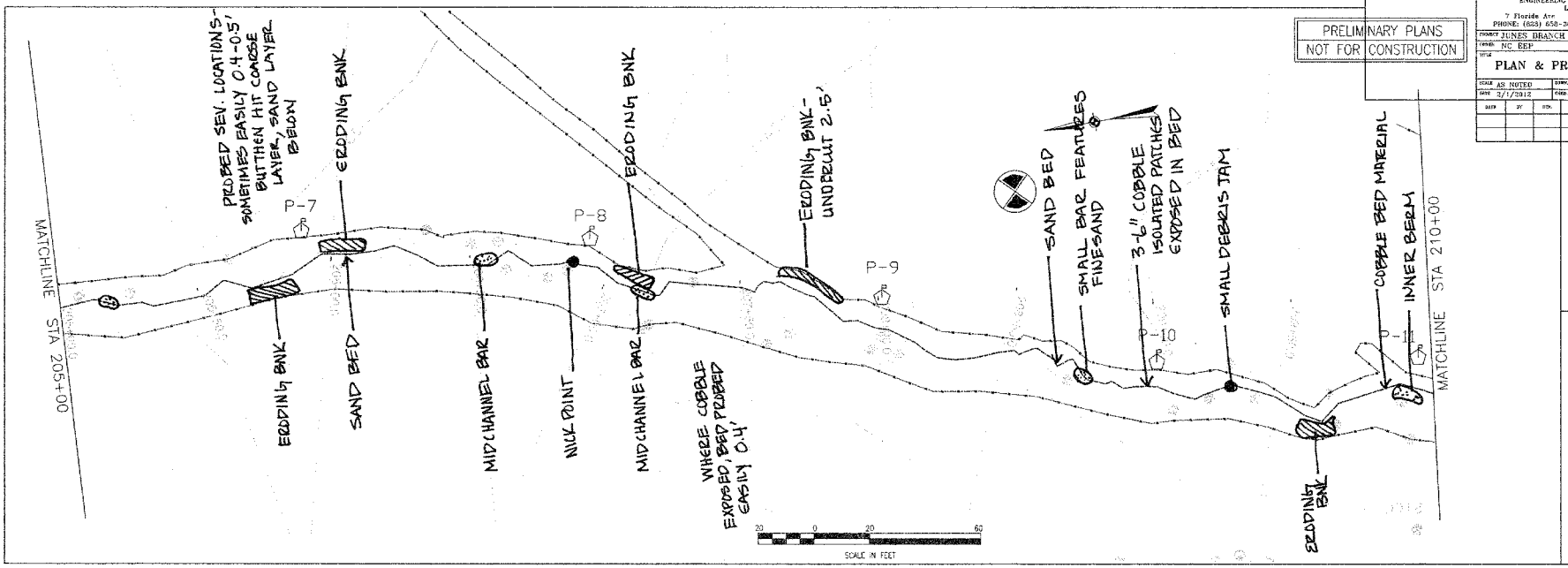
PROJECT JUNES BRANCH RESTORATION PROJECT
STATUS NC EEP
TITLE PLAN & PROFILE
PRELIMINARY PLANS
NOT FOR CONSTRUCTION
PROJECT NO. 1053
SHEET NUMBER 7
LOCATION KEY
LEGEND
BED SAMPLE LOCATION
QUICK XST 15
BED TIE
NICK POINTS
ERODING BNK
NICK POINT
NICK POINT
XS-1
VERTICAL BNK / ERODING BNK
SAND DEPOSITION IN BED
NICK POINTS
P-1
P-2
P-3
P-4
P-5
P-6
BANK EROSION
GENERAL DEPOSITIONAL BARS
DEBRIS JAM
4-8" COBBLE IN BED
ERODING BNK
QUICK XST 11
SAND DEPOSITION
NICK POINT (DEBRIS JAM)
ERODING BNK
BANKFULL BENCH FEATURE
POINT BARS
WETLAND SEEP
BANKFULL BENCH FEATURES
ROCK WALL
2-4" COBBLE
SAND DEPOSITION FEATURES
ERODING BNK
DEPOSITIONAL BEAM
QUICK XST 14
DEPOSITIONAL BEAM
XS-2
QUICK XST 10
ERODING BNK
STA 205+00
MATCHLINE
SCALE IN FEET

XST 15
DA = 0.19
WBKF = 5
WBED = 2.8
DBKF = 0.6
DTOE LT = 0
DTOE RT = 0
DTHAL = 0.15
WTHAL = 0.5
BNK H = 2.5
W(FP) = 11
XST 11
DA = 0.20
WBKF = 5
WBED = 2.5
DBKF = 1.2
DTOE LT = 0
DTOE RT = 0.2
DTHAL = 0.15
WTHAL = .5
BNK H = 2.5
W(FP) = 11
XST 14
DA = 0.23
WBKF = 5.8
WBED = 4.2
DBKF = 0.75
DTOE LT = 0
DTOE RT = 0
DTHAL = 0.2
WTHAL = 0.5
BNK H = 3
W(FP) = 20
XST 10
DA = 0.23
WBKF = 8
WBED = 3
DBKF = 1.2
DTOE LT = 0
DTOE RT = 0.15
DTHAL = 0.15
WTHAL = 2
BNK H = 3
W(FP) = 15
EXISTING BED
PROPOSED BED
PROPOSED GRADE
PROPOSED BANKFULL
EXISTING TOB LEFT
EXISTING TOB RIGHT
EXISTING TERR LEFT
EXISTING TERR RIGHT
BANKFULL PINFLAG
2183
2180
2175
2170
2165
2178
2175
2170
2165
2160
200+00
201+00
202+00
203+00
204+00
205+00
FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'
HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'
JUNES BRANCH



PRELIMINARY PLANS
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LICENSE NO. P-0411
7 Florida Ave Mooresville, NC 28787
PHONE: (828) 658-3849 WWW.WOLFCREEKENG.COM

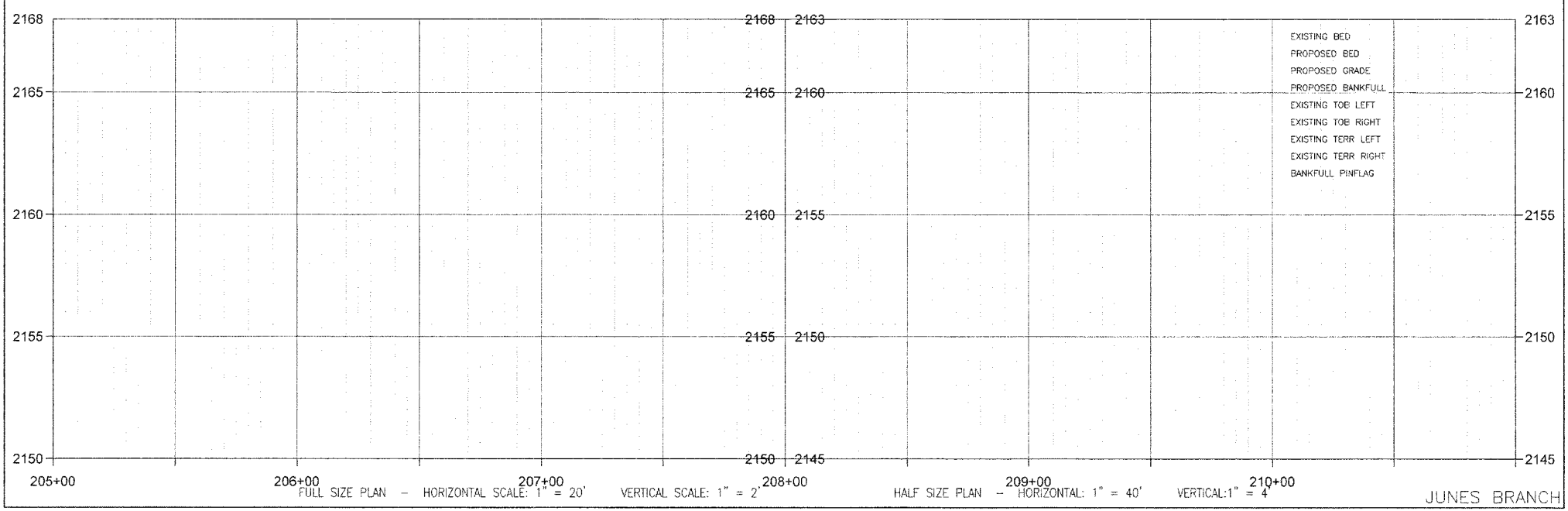
PROJECT: JUNES BRANCH RESTORATION PROJECT
CONTR: NC EEP
TITLE: PLAN & PROFILE

SCALE	AS NOTED	DRWN. BY	CHKD	PROJECT NO.	SHEET NUMBER
DATE	2/1/2012	FIELD BY	SGG	1053	8

DATE	BY	DES.	DESCRIPTION

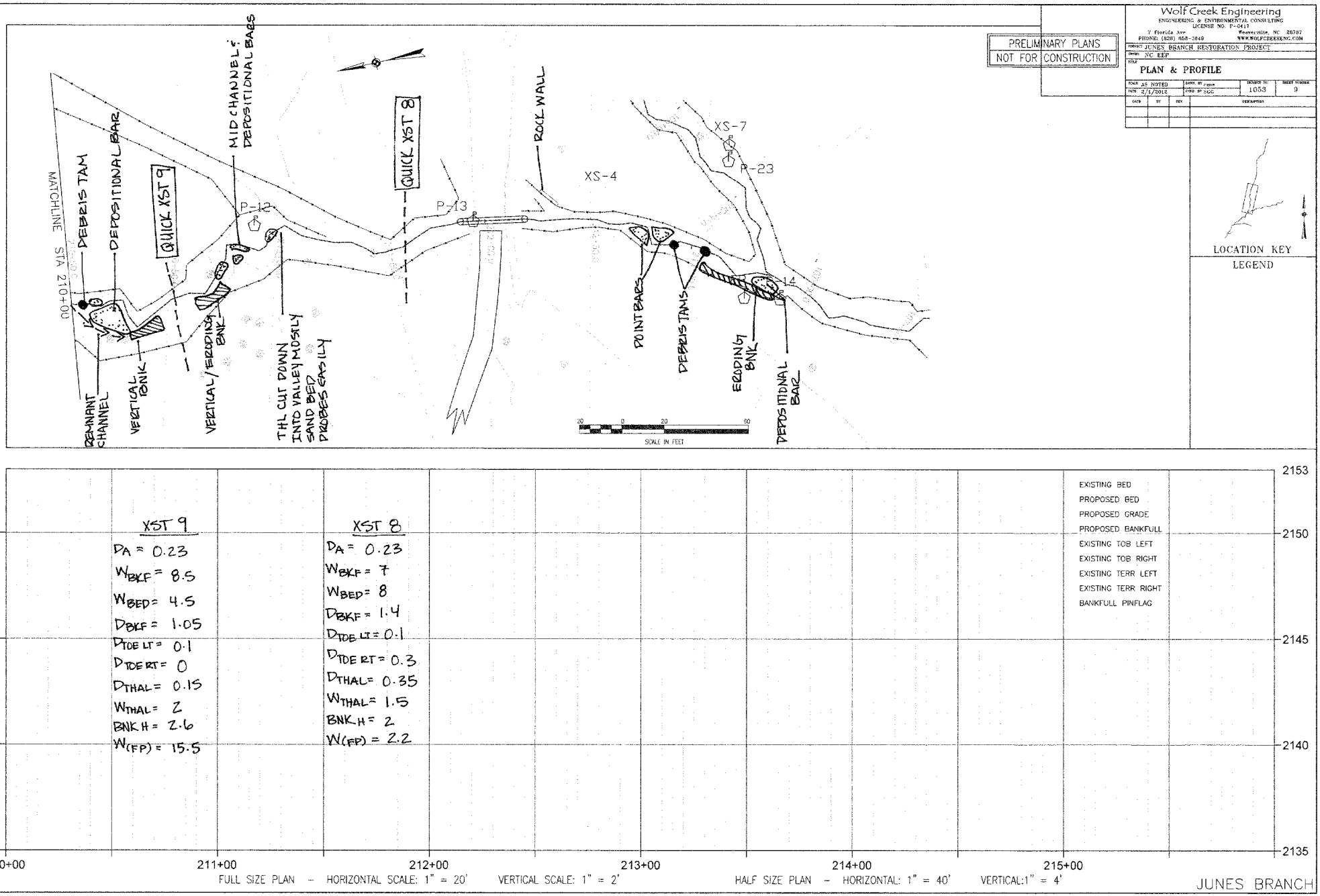
LOCATION KEY

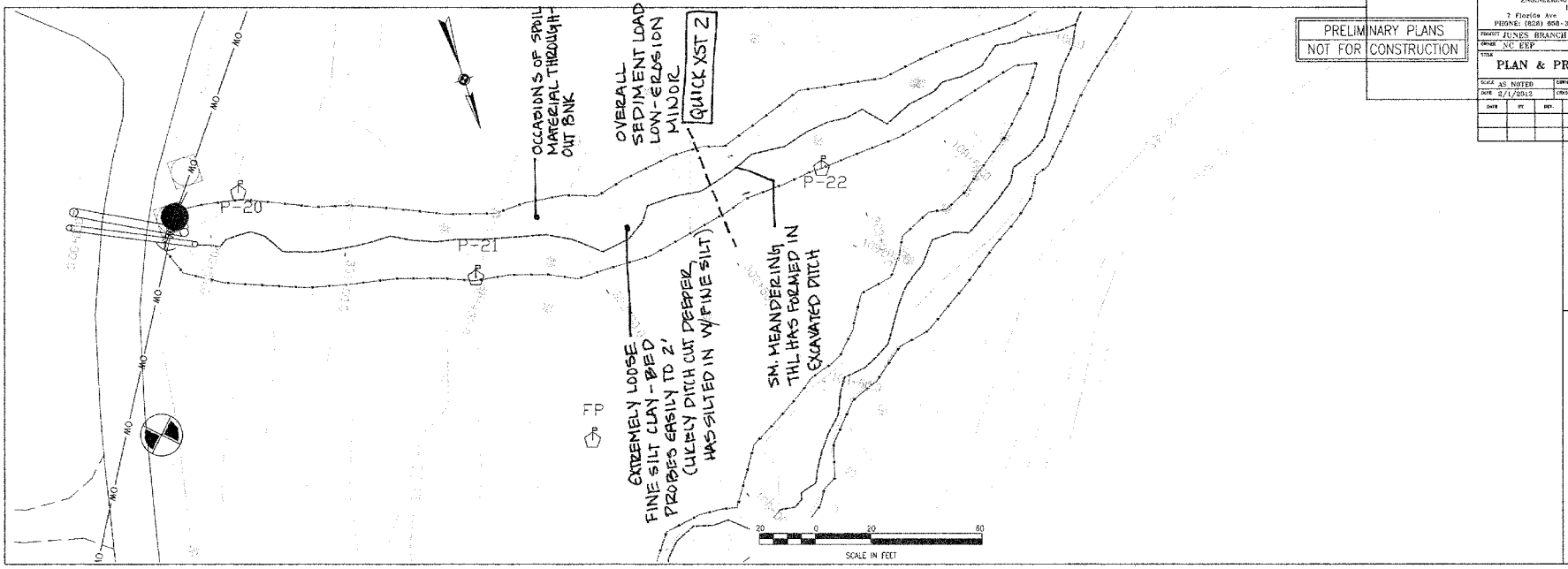
LEGEND



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

JUNES BRANCH


PRELIMINARY PLANS
NOT FOR CONSTRUCTION
Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
7 Florida Ave Weaverville, NC 28787
PHONE: (828) 658-3049 WWW.WOLFCREEKENG.COM
PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER NC EEP
TITLE PLAN & PROFILE
SCALE AS NOTED
DATE 2/1/2018
PROJECT NO 1053
SHEET NUMBER 9
MATCHLINE STA 210+00
DEBRIS JAM
DEPOSITIONAL BAR
QUICK XST 9
MID CHANNEL DEPOSITIONAL BARS
QUICK XST 8
ROCK WALL
XS-7
XS-4
P-23
P-12
P-13
P-14
REMNANT CHANNEL
VERTICAL BANK
VERTICAL/ERODING BANK
THL CUT DOWN INTO VALLEY MOSTLY SAND BED PROBBES EASILY
POINT BARS
DEBRIS JAMS
ERODING BNK
DEPOSITIONAL BARS
20 0 20 60
SCALE IN FEET
LOCATION KEY
LEGEND
EXISTING BED
PROPOSED BED
PROPOSED GRADE
PROPOSED BANKFULL
EXISTING TOB LEFT
EXISTING TOB RIGHT
EXISTING TERR LEFT
EXISTING TERR RIGHT
BANKFULL PINFLAG
XST 9
DA = 0.23
WBKF = 8.5
WBED = 4.5
DBKF = 1.05
DTOE LT = 0.1
DTOE RT = 0
DTHAL = 0.15
WTHAL = 2
BNK H = 2.6
W(FP) = 15.5
XST 8
DA = 0.23
WBKF = 7
WBED = 8
DBKF = 1.4
DTOE LT = 0.1
DTOE RT = 0.3
DTHAL = 0.35
WTHAL = 1.5
BNK H = 2
W(FP) = 2.2
2153
2150
2145
2140
2135
210+00
211+00
212+00
213+00
214+00
215+00
FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2'
HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'
JUNES BRANCH



PRELIMINARY PLANS
NOT FOR CONSTRUCTION

Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0413
7 Florida Ave Weaverville, NC 28787
PHONE: (828) 658-3040 WWW.WOLFCREEKENG.COM

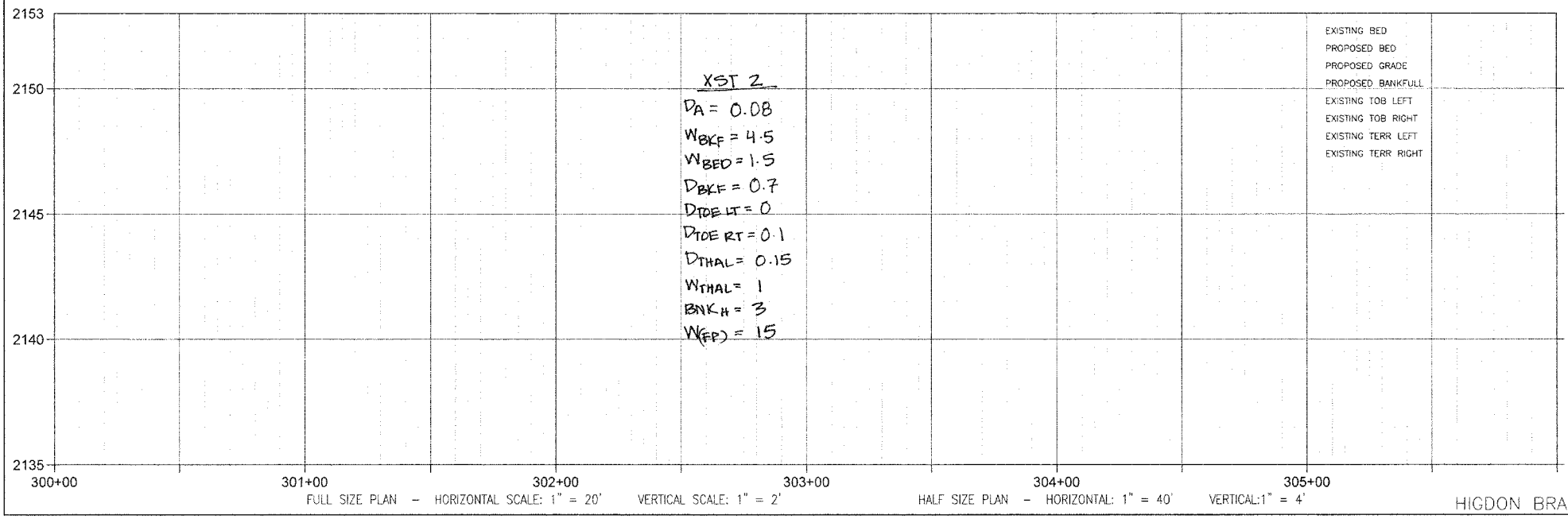
PROJECT: JONES BRANCH RESTORATION PROJECT
OWNER: NC EEP
TITLE: PLAN & PROFILE

SCALE: AS NOTED	DSGN. BY: cmc	PROJECT NO.	SHEET NUMBER
DATE: 8/1/2012	CHKD. BY: SGC	1053	10

DATE	BY	REV.	DESCRIPTION

LOCATION KEY

LEGEND



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

HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

HIGDON BRANCH

APPENDIX C5

Reference Reach Data

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:	---

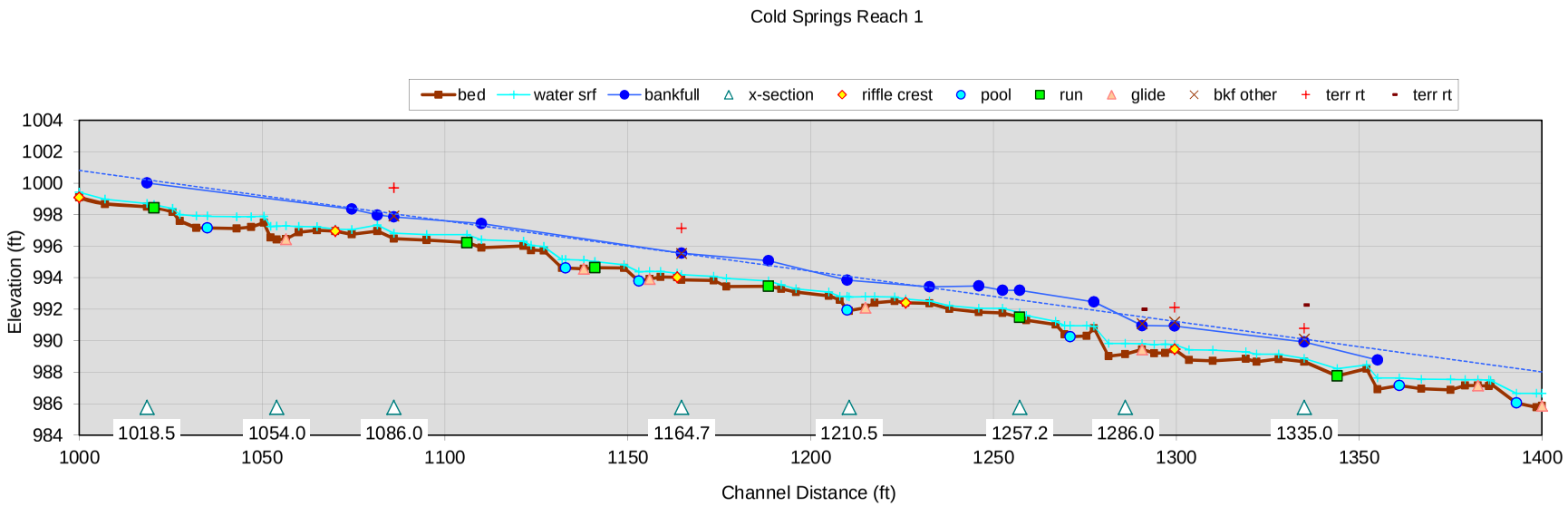
Dimension		bankfull channel typical	min	max	
floodplain:	width flood prone area (ft)	30.0	27.0	55.0	
	low bank height (ft)	1.8	1.4	2.1	
riffle-run:	x-area bankfull (sq.ft.)	22.0	20.7	23.9	
	width bankfull (ft)	20.4	19.9	21.8	
	mean depth (ft)	1.08	1.0	1.2	
	max depth (ft)	1.5	1.4	1.6	
	hydraulic radius (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)	105.0		
valley length (ft)	100.0		
Sinuosity	1.05		
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 (%)	3.4		
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

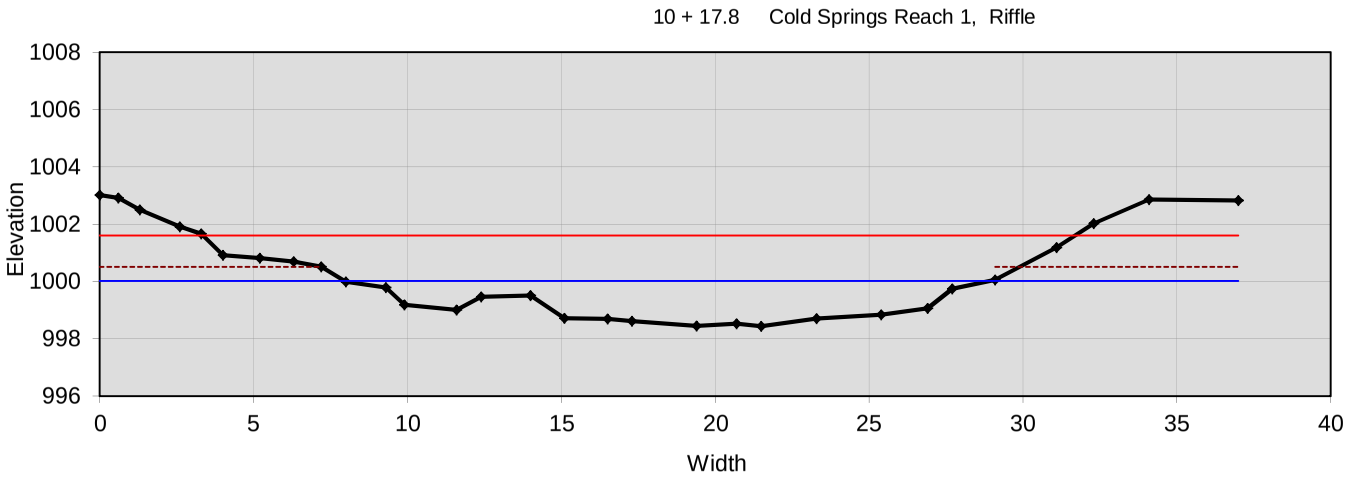
Channel Materials	Riffle Surface		Sub Pavement	BkF Channel
D16 (mm)	1.5	---	7.2	1
D35 (mm)	17	---	32	10
D50 (mm)	29	---	50	20
D65 (mm)	51	---	70	40
D84 (mm)	97	---	92	84
D95 (mm)	210	---	110	180
mean (mm)	12.1			9.2
dispersion	11.3			12.1
skewness	-0.3			-0.2
Shape Factor	---			
% Silt/Clay	0%	---	0%	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

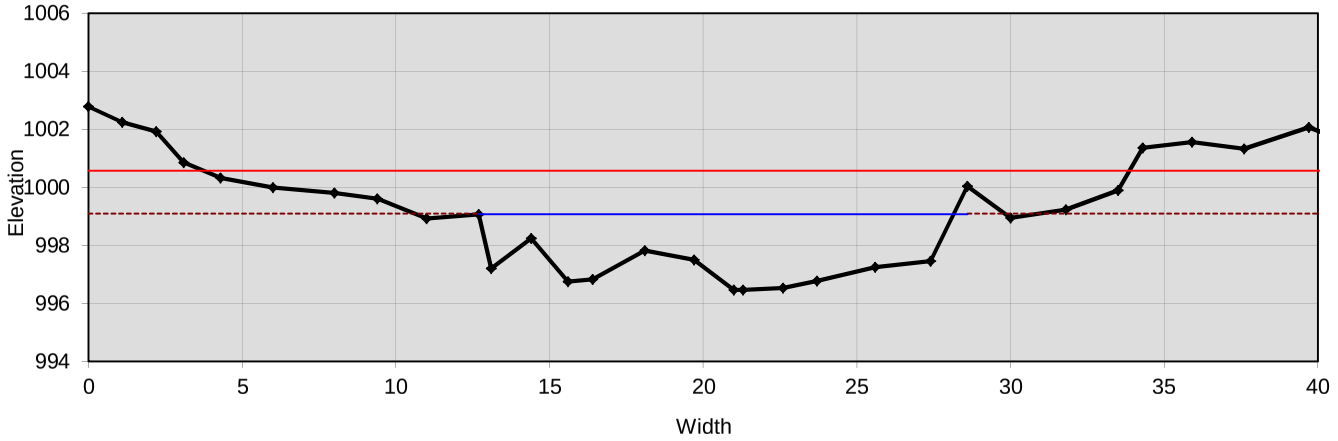


Bankfull Dimensions		Flood Dimensions		Materials	
21.3	x-section area (ft.sq.)	28.0	W flood prone area (ft)	29	D50 Riffle (mm)
21.0	width (ft)	1.3	entrenchment ratio	97	D84 Riffle (mm)
1.0	mean depth (ft)	2.1	low bank height (ft)	95	threshold grain size (mm):
1.6	max depth (ft)	1.3	low bank height ratio		
22.0	wetted parimeter (ft)				
1.0	hyd radi (ft)				
20.7	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
5.6	velocity (ft/s)	0.047	Manning's roughness	3.2	channel slope (%)
118.6	discharge rate (cfs)	0.26	D'Arcy-Weisbach fric.	1.94	shear stress (lb/sq.ft.)
0.99	Froude number	6.0	resistance factor u/u*	1.00	shear velocity (ft/s)
		3.2	relative roughness	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

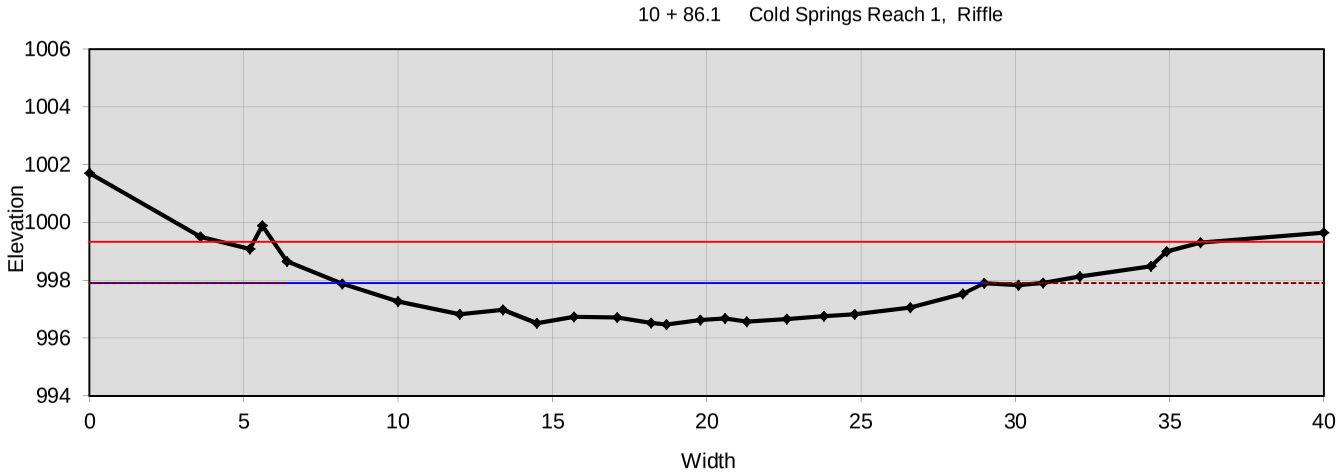
Materials	
29	D50 Riffle (mm)
97	D84 Riffle (mm)
139	threshold grain size (mm):

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

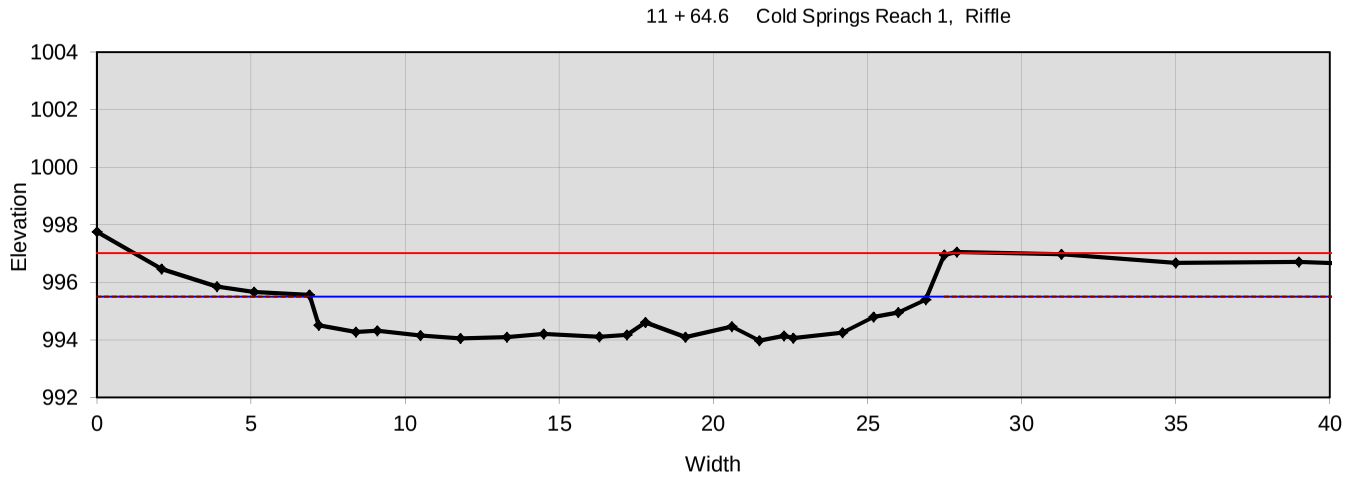
Materials	
29	D50 Riffle (mm)
97	D84 Riffle (mm)
95	threshold grain size (mm):

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)

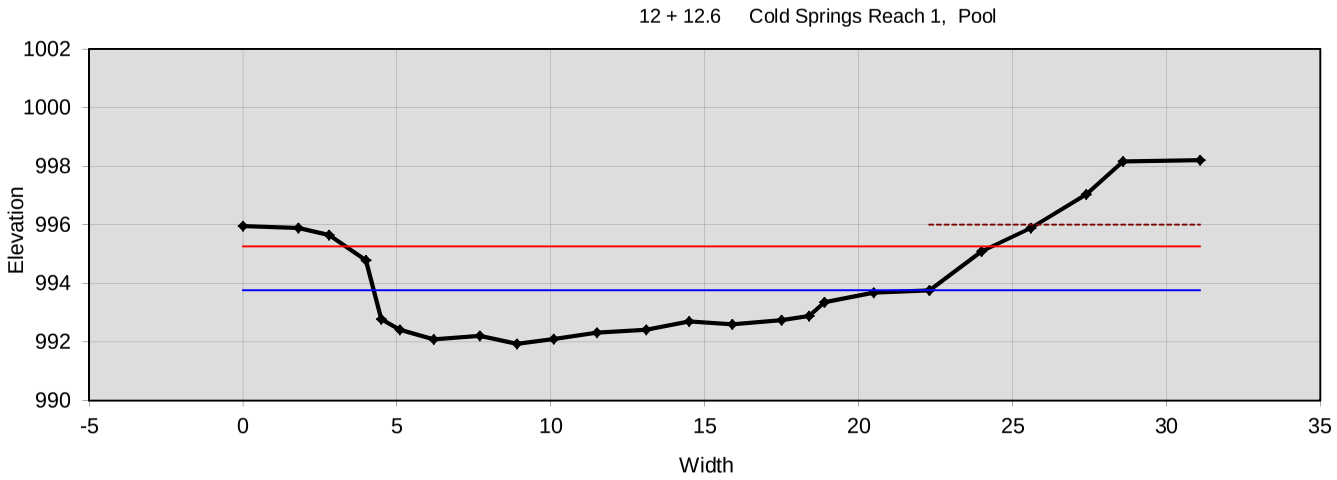
Cross Section RF3



Bankfull Dimensions		Flood Dimensions		Materials	
23.9	x-section area (ft.sq.)	27.0	W flood prone area (ft)	29	D50 Riffle (mm)
20.0	width (ft)	1.3	entrenchment ratio	97	D84 Riffle (mm)
1.2	mean depth (ft)	1.5	low bank height (ft)	92	threshold grain size (mm):
1.5	max depth (ft)	1.0	low bank height ratio		
21.6	wetted parimeter (ft)				
1.1	hyd radi (ft)				
16.8	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
5.5	velocity (ft/s)	0.048	Manning's roughness	2.7	channel slope (%)
130.4	discharge rate (cfs)	0.26	D'Arcy-Weisbach fric.	1.86	shear stress (lb/sq.ft.)
0.91	Froude number	6.2	resistance factor u/u*	0.98	shear velocity (ft/s)
		3.8	relative roughness	11	unit strm power (lb/ft/s)

Cross Section PL3

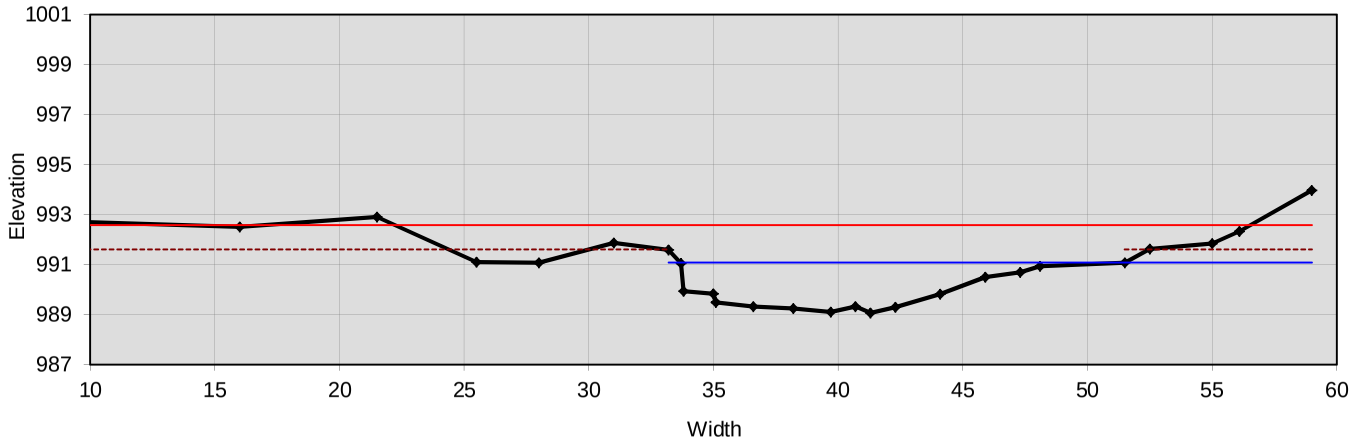


Bankfull Dimensions		Flood Dimensions		Materials	
20.0	x-section area (ft.sq.)	24.0	W flood prone area (ft)	29	D50 Riffle (mm)
18.0	width (ft)	1.3	entrenchment ratio	97	D84 Riffle (mm)
1.1	mean depth (ft)	4.1	low bank height (ft)	86	threshold grain size (mm):
1.8	max depth (ft)	2.2	low bank height ratio		
19.3	wetted parimeter (ft)				
1.0	hyd radi (ft)				
16.3	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
5.6	velocity (ft/s)	0.045	Manning's roughness	2.7	channel slope (%)
111.7	discharge rate (cfs)	0.23	D'Arcy-Weisbach fric.	1.75	shear stress (lb/sq.ft.)
0.96	Froude number	6.3	resistance factor u/u*	0.95	shear velocity (ft/s)
		3.5	relative roughness	10.4	unit strm power (lb/ft/s)

Cross Section PL4

12 + 85 Cold Springs Reach 1, Pool



Bankfull Dimensions	
20.4	x-section area (ft.sq.)
17.8	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
19.5	wetted parimeter (ft)
1.0	hyd radi (ft)
15.6	width-depth ratio

Flood Dimensions	
36.0	W flood prone area (ft)
2.0	entrenchment ratio
2.5	low bank height (ft)
1.3	low bank height ratio

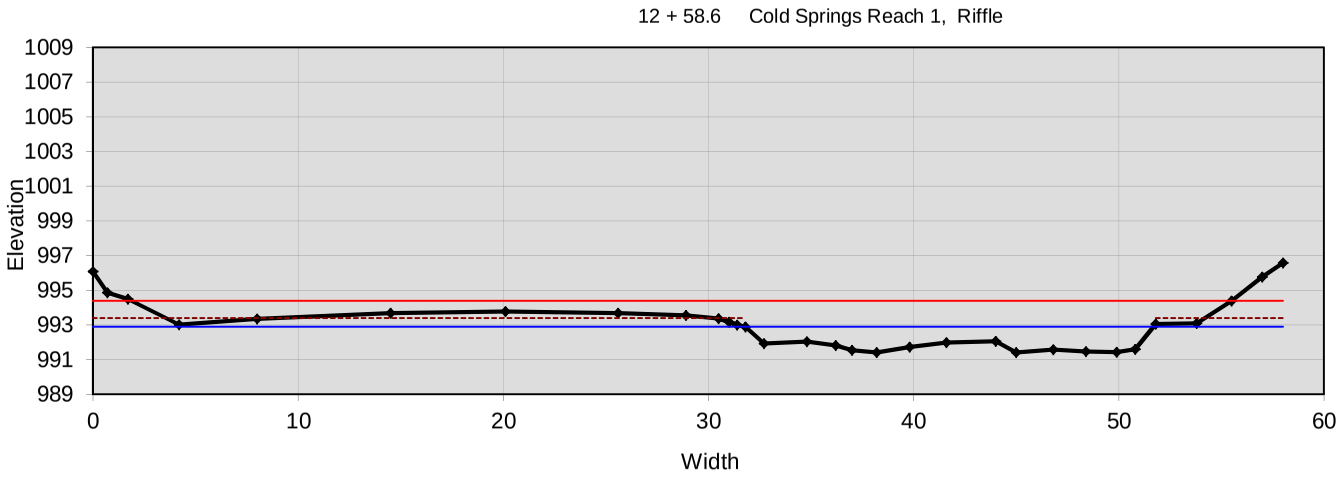
Materials	
29	D50 Riffle (mm)
97	D84 Riffle (mm)
86	threshold grain size (mm):

Bankfull Flow	
5.6	velocity (ft/s)
113.9	discharge rate (cfs)
0.97	Froude number

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

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

Cross Section RF4



Bankfull Dimensions	
22.3	x-section area (ft.sq.)
19.9	width (ft)
1.1	mean depth (ft)
1.5	max depth (ft)
21.3	wetted parimeter (ft)
1.0	hyd radi (ft)
17.7	width-depth ratio

Flood Dimensions	
55.0	W flood prone area (ft)
2.8	entrenchment ratio
2.0	low bank height (ft)
1.3	low bank height ratio

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

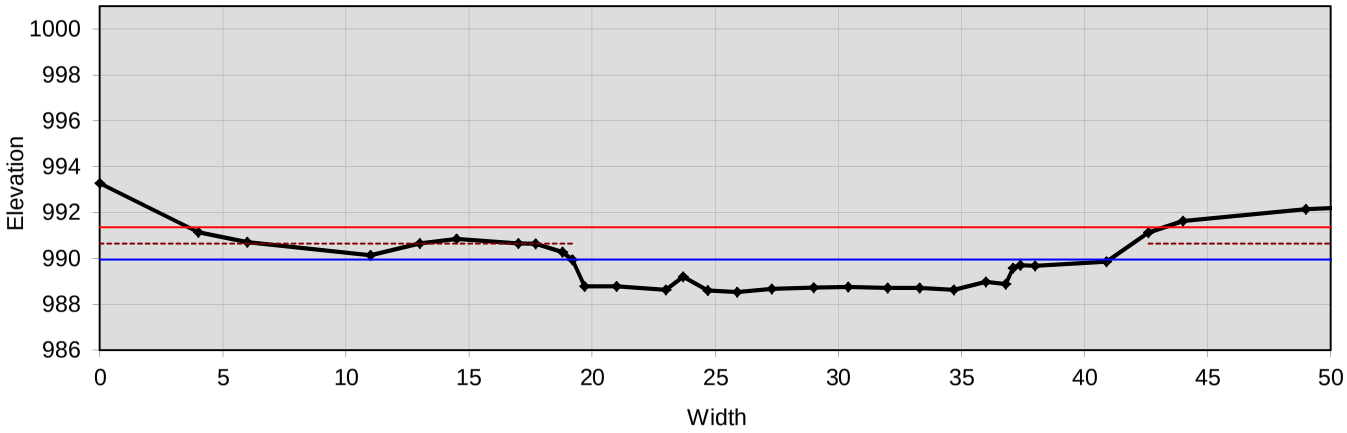
Bankfull Flow	
5.6	velocity (ft/s)
125.4	discharge rate (cfs)
0.97	Froude number

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

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

Cross Section RF5

13 + 34.5 Cold Springs Reach 1, Riffle



Bankfull Dimensions	
21.9	x-section area (ft.sq.)
21.8	width (ft)
1.0	mean depth (ft)
1.4	max depth (ft)
23.5	wetted parimeter (ft)
0.9	hyd radi (ft)
21.7	width-depth ratio

Flood Dimensions	
39.0	W flood prone area (ft)
1.8	entrenchment ratio
2.1	low bank height (ft)
1.5	low bank height ratio

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

Bankfull Flow	
5.0	velocity (ft/s)
109.0	discharge rate (cfs)
0.91	Froude number

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

Forces & Power	
2.47	channel slope (%)
1.44	shear stress (lb/sq.ft.)
0.86	shear velocity (ft/s)
7.7	unit strm power (lb/ft/s)

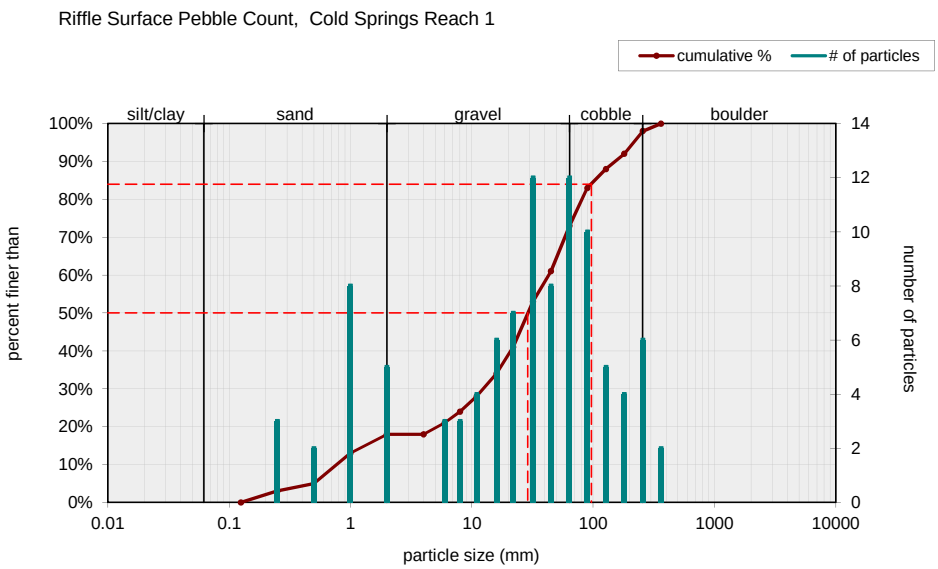
1) Individual Pebble Count

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

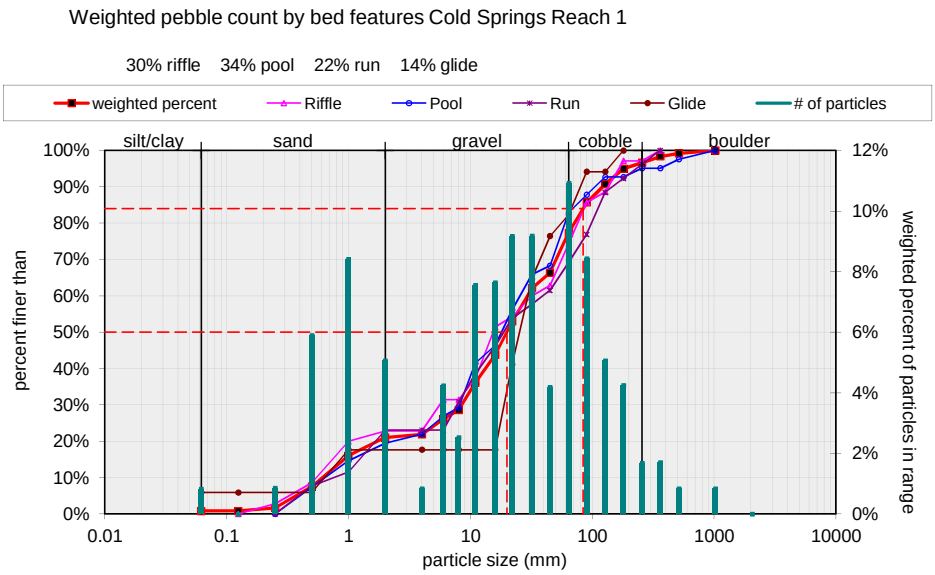
Riffle, Pool, Run, Glide

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

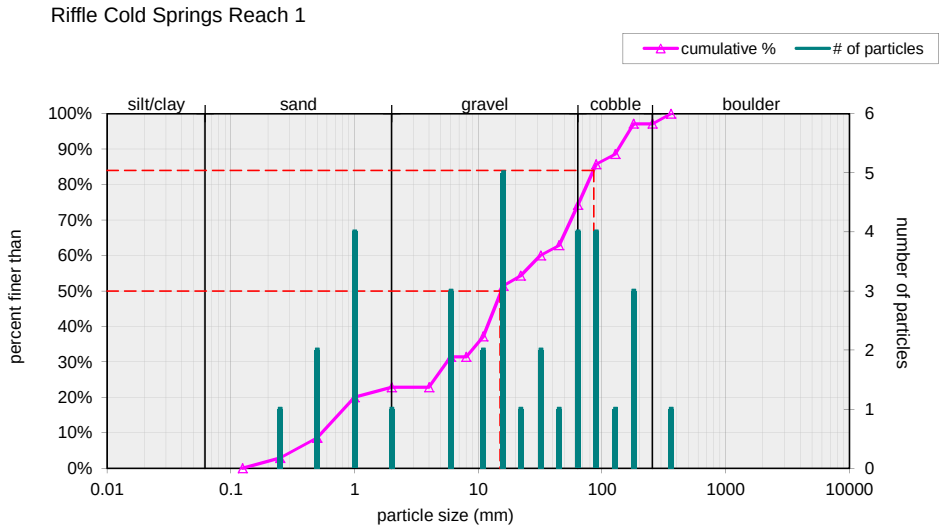
Size Distribution	
mean	9.2
dispersion	12.1
skewness	-0.24

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

Riffle

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	4
very coarse sand	1 - 2	1
very fine gravel	2 - 4	
fine gravel	4 - 6	3
fine gravel	6 - 8	
medium gravel	8 - 11	2
medium gravel	11 - 16	5
coarse gravel	16 - 22	1
coarse gravel	22 - 32	2
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	4
small cobble	64 - 90	4
medium cobble	90 - 128	1
large cobble	128 - 180	3
very large cobble	180 - 256	
small boulder	256 - 362	1
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		35
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		35

Note:



Size (mm)	
D16	0.78
D35	9.8
D50	15
D65	48
D84	86
D95	170

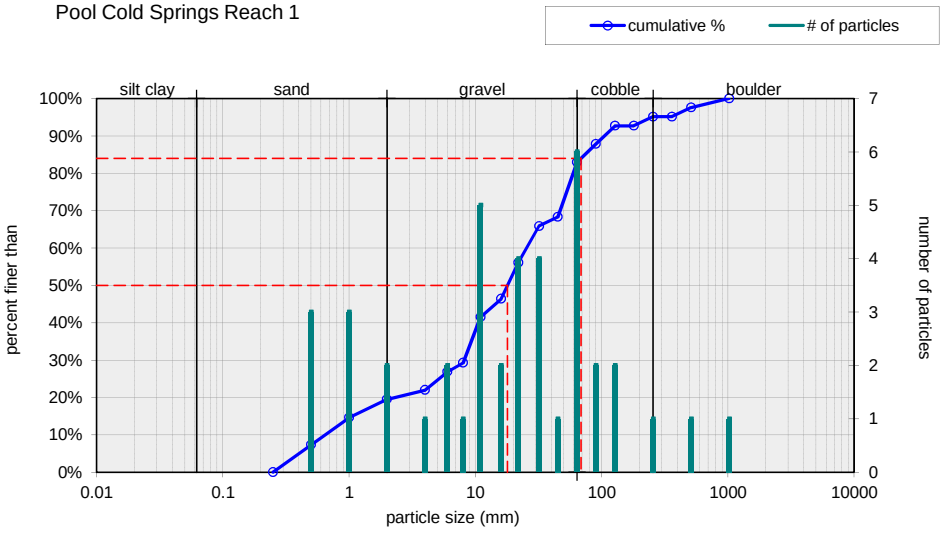
Size Distribution	
mean	8.2
dispersion	12.5
skewness	-0.18

Type	
silt/clay	0%
sand	23%
gravel	51%
cobble	23%
boulder	3%

Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	3
coarse sand	0.5 - 1	3
very coarse sand	1 - 2	2
very fine gravel	2 - 4	1
fine gravel	4 - 6	2
fine gravel	6 - 8	1
medium gravel	8 - 11	5
medium gravel	11 - 16	2
coarse gravel	16 - 22	4
coarse gravel	22 - 32	4
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	6
small cobble	64 - 90	2
medium cobble	90 - 128	2
large cobble	128 - 180	
very large cobble	180 - 256	1
small boulder	256 - 362	
small boulder	362 - 512	1
medium boulder	512 - 1024	1
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		41
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		41

Note:



Size (mm)	
D16	1.2
D35	9.3
D50	18
D65	31
D84	69
D95	250

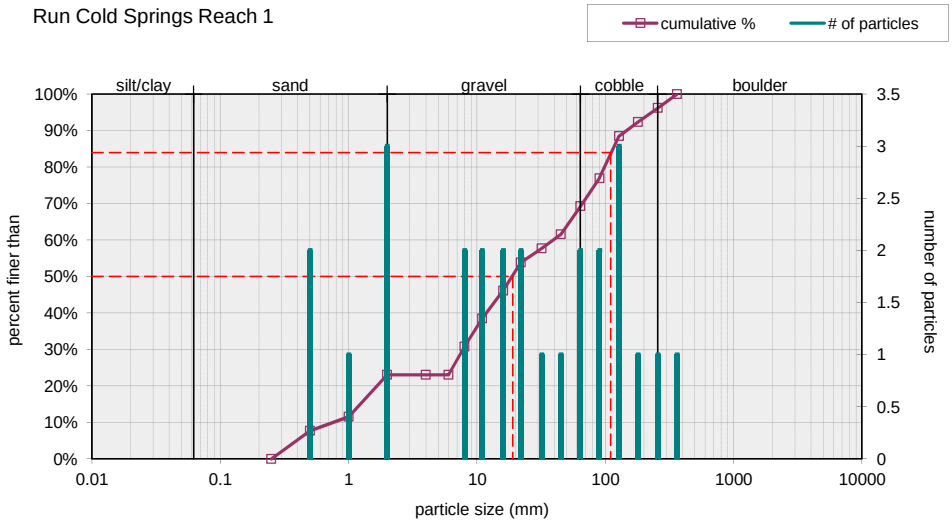
Size Distribution	
mean	9.1
dispersion	9.4
skewness	-0.22

Type	
silt/clay	0%
sand	20%
gravel	63%
cobble	12%
boulder	5%

Run

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	2
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	3
very fine gravel	2 - 4	
fine gravel	4 - 6	
fine gravel	6 - 8	2
medium gravel	8 - 11	2
medium gravel	11 - 16	2
coarse gravel	16 - 22	2
coarse gravel	22 - 32	1
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	2
small cobble	64 - 90	2
medium cobble	90 - 128	3
large cobble	128 - 180	1
very large cobble	180 - 256	1
small boulder	256 - 362	1
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		26
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		26

Note:



Size (mm)	
D16	1.3
D35	9.5
D50	19
D65	53
D84	110
D95	230

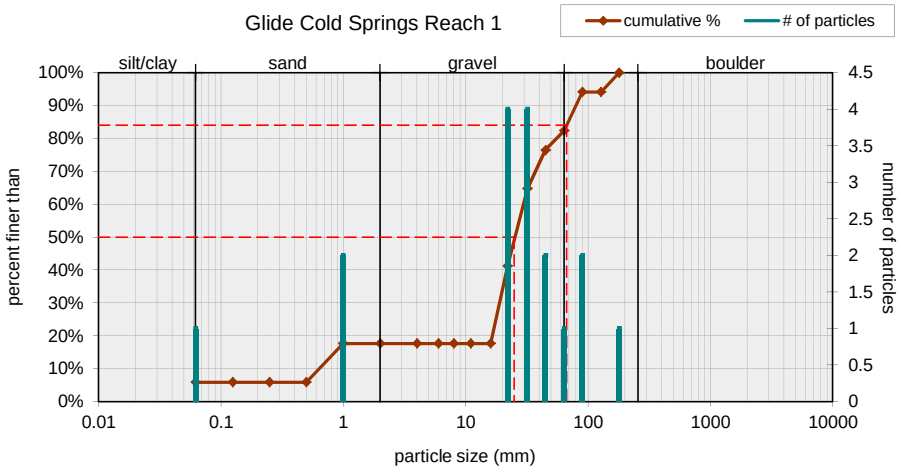
Size Distribution	
mean	12.0
dispersion	10.2
skewness	-0.14

Type	
silt/clay	0%
sand	23%
gravel	46%
cobble	27%
boulder	4%

Glide

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	2
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	
fine gravel	6 - 8	
medium gravel	8 - 11	
medium gravel	11 - 16	
coarse gravel	16 - 22	4
coarse gravel	22 - 32	4
very coarse gravel	32 - 45	2
very coarse gravel	45 - 64	1
small cobble	64 - 90	2
medium cobble	90 - 128	
large cobble	128 - 180	1
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:		17
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		17

Note:



Size (mm)	
D16	0.91
D35	20
D50	25
D65	32
D84	67
D95	130

Size Distribution	
mean	7.8
dispersion	15.1
skewness	-0.37

Type	
silt/clay	6%
sand	12%
gravel	65%
cobble	18%
boulder	0%

3) Bulk Sample Sieve Analysis

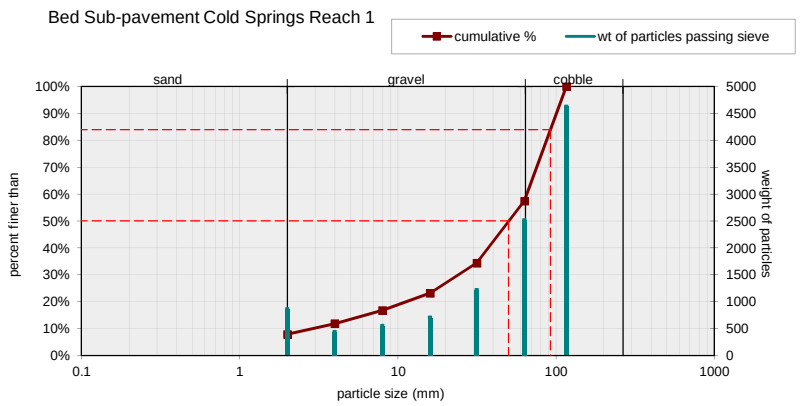
Two samples may be entered below. Select sample type for each.

Bed Sub-pavement

Sieve Size (mm)	Sieve Weight (g)	Sieve & Sample Weight (g)	Retained on Sieve (g)		Passing Sieve	
1		853	853	8%	---	---
2		431	431	4%	8%	8%
4		542	542	5%	4%	12%
8		699	699	6%	5%	17%
16		1214	1214	11%	6%	23%
31.5		2514	2514	23%	11%	34%
63		4628	4628	43%	23%	57%
116		0	0	0%	43%	100%

total wt retained in sieves: 10881

Note: bed sample



Size (mm)					
D16	7.2	D65	70	sand	100%
D35	32	D84	92		
D50	50	D95	110		

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:	---

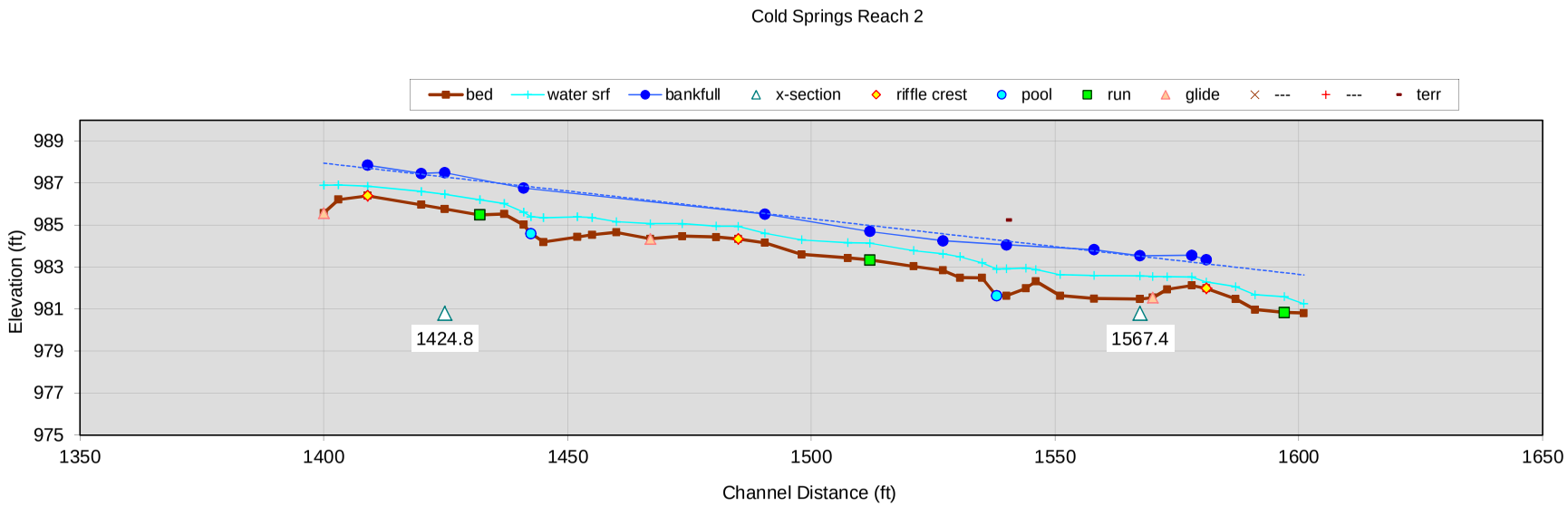
Dimension		bankfull channel typical	min	max
floodplain:	width flood prone area (ft)	43.0	---	---
	low bank height (ft)	1.9	---	---
riffle-run:	x-area bankfull (sq.ft.)	26.7	---	---
	width bankfull (ft)	23.8	---	---
	mean depth (ft)	1.12	---	---
	max depth (ft)	1.6	---	---
	hydraulic radius (ft)	1.1		
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			

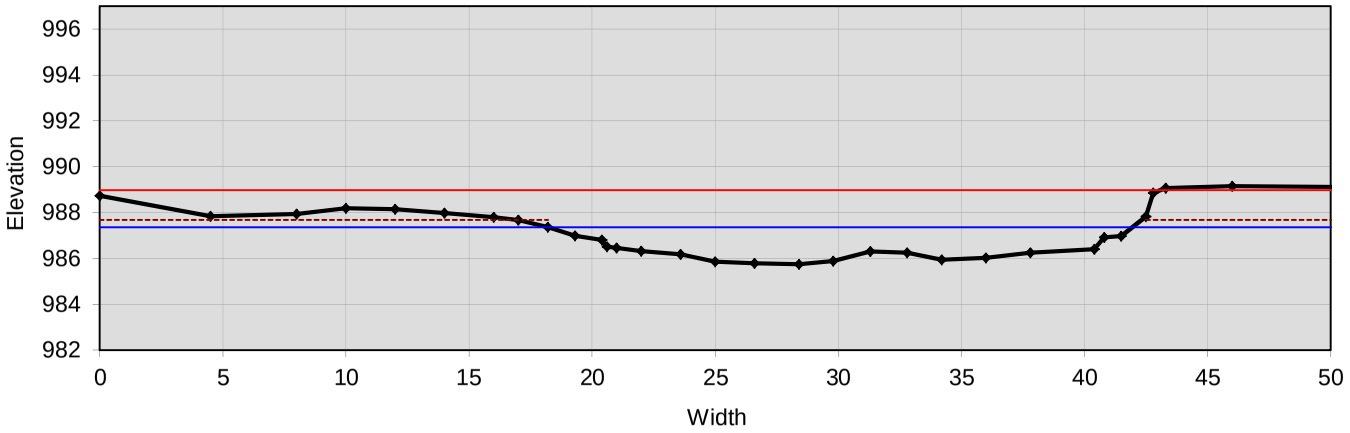
Longitudinal Slope Profile



	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):

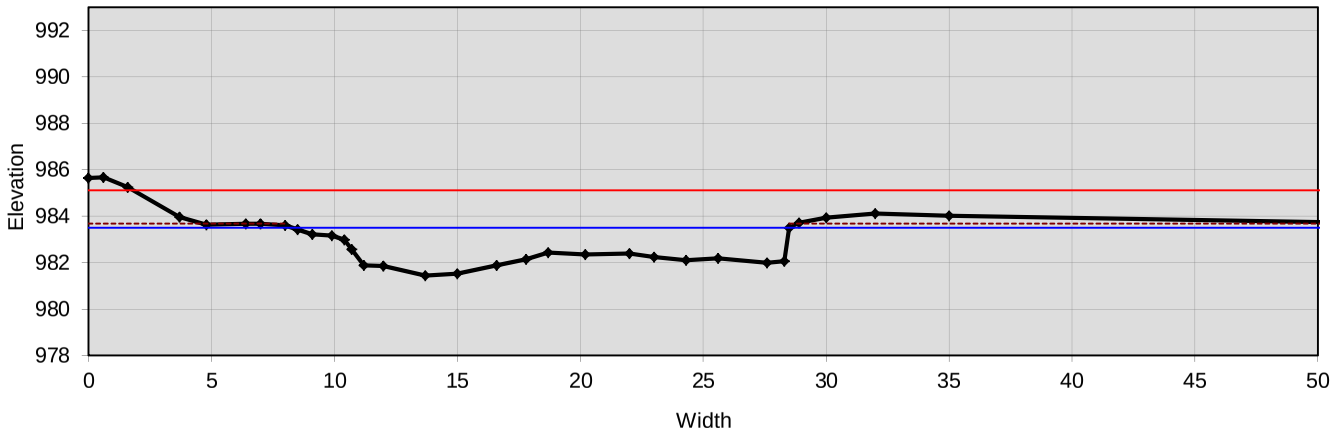
Bankfull Flow	
5.2	velocity (ft/s)
138.6	discharge rate (cfs)
0.88	Froude number

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)

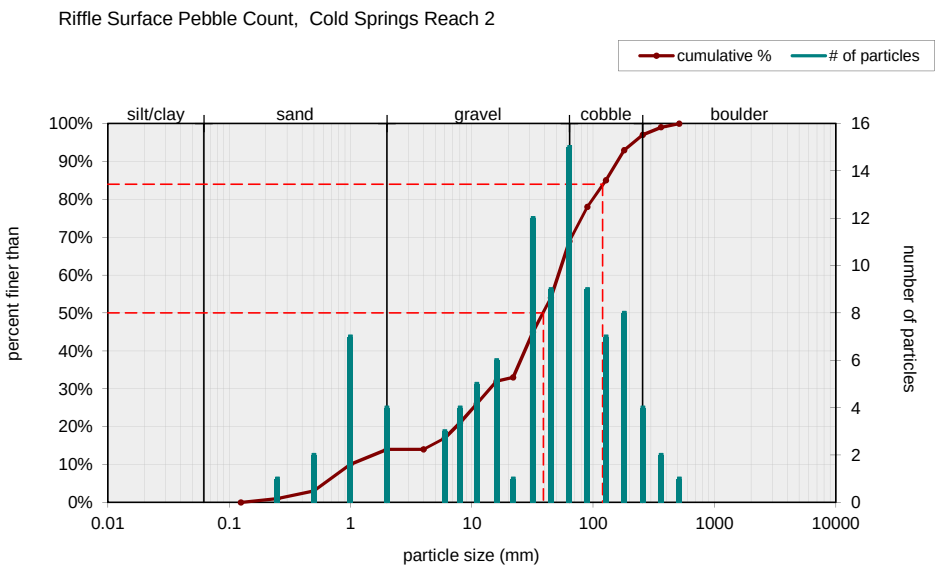
1) Individual Pebble Count

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

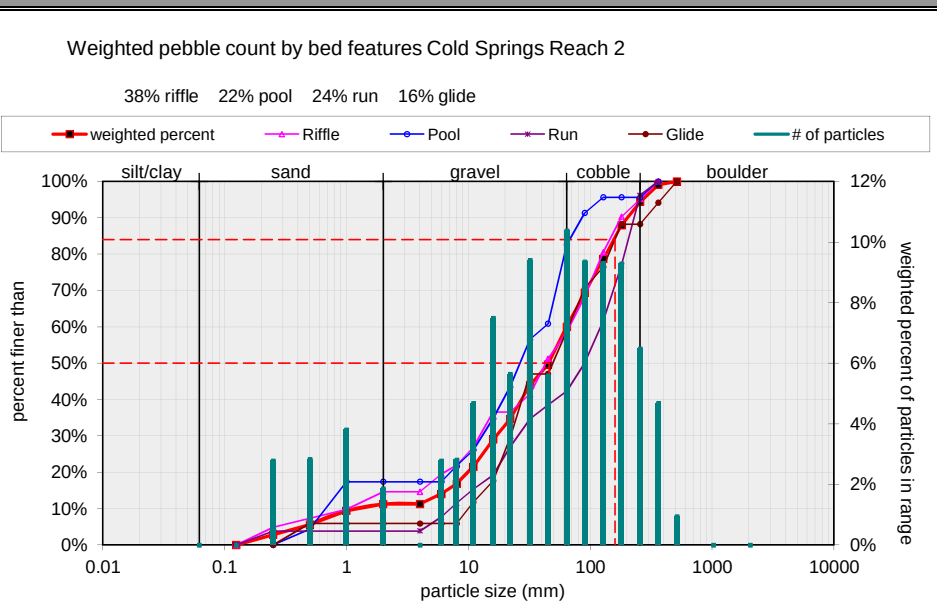
Riffle, Pool, Run, Glide

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

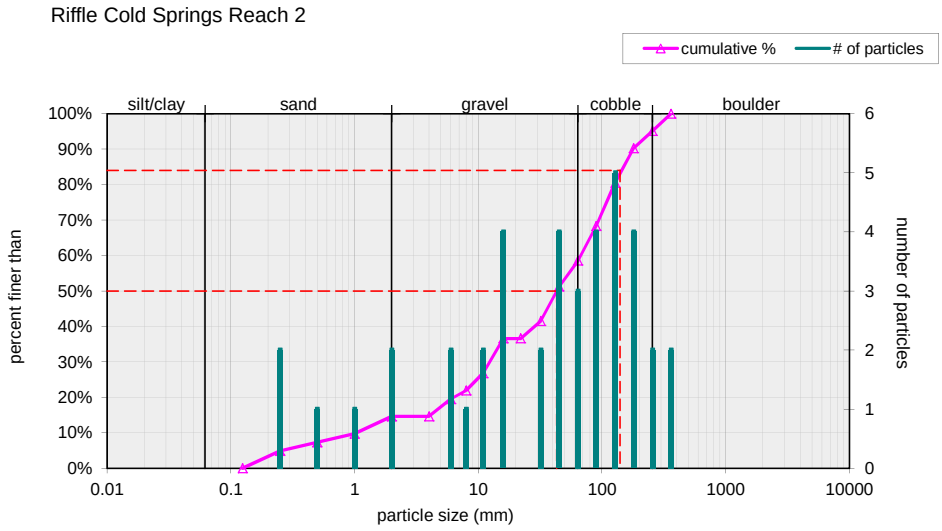
Size Distribution	
mean	34.2
dispersion	4.9
skewness	-0.11

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

Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
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	1
very coarse sand	1 - 2	2
very fine gravel	2 - 4	
fine gravel	4 - 6	2
fine gravel	6 - 8	1
medium gravel	8 - 11	2
medium gravel	11 - 16	4
coarse gravel	16 - 22	
coarse gravel	22 - 32	2
very coarse gravel	32 - 45	4
very coarse gravel	45 - 64	3
small cobble	64 - 90	4
medium cobble	90 - 128	5
large cobble	128 - 180	4
very large cobble	180 - 256	2
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:		41
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		41

Note:



Size (mm)	
D16	4.5
D35	15
D50	43
D65	80
D84	140
D95	250

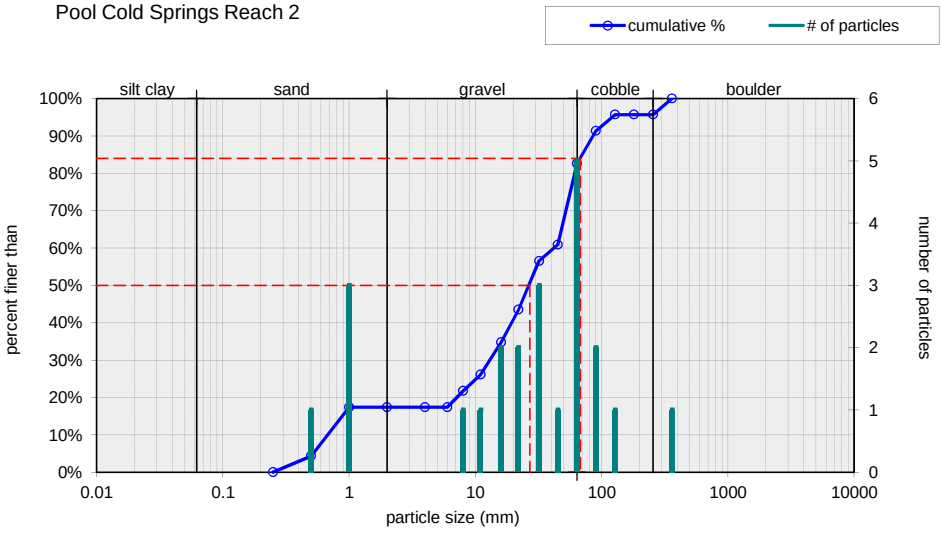
Size Distribution	
mean	25.1
dispersion	6.4
skewness	-0.19

Type	
silt/clay	0%
sand	15%
gravel	44%
cobble	37%
boulder	5%

Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	1
coarse sand	0.5 - 1	3
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	
fine gravel	6 - 8	1
medium gravel	8 - 11	1
medium gravel	11 - 16	2
coarse gravel	16 - 22	2
coarse gravel	22 - 32	3
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	5
small cobble	64 - 90	2
medium cobble	90 - 128	1
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	1
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		23
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		23

Note:



Size (mm)	
D16	0.93
D35	16
D50	27
D65	48
D84	68
D95	120

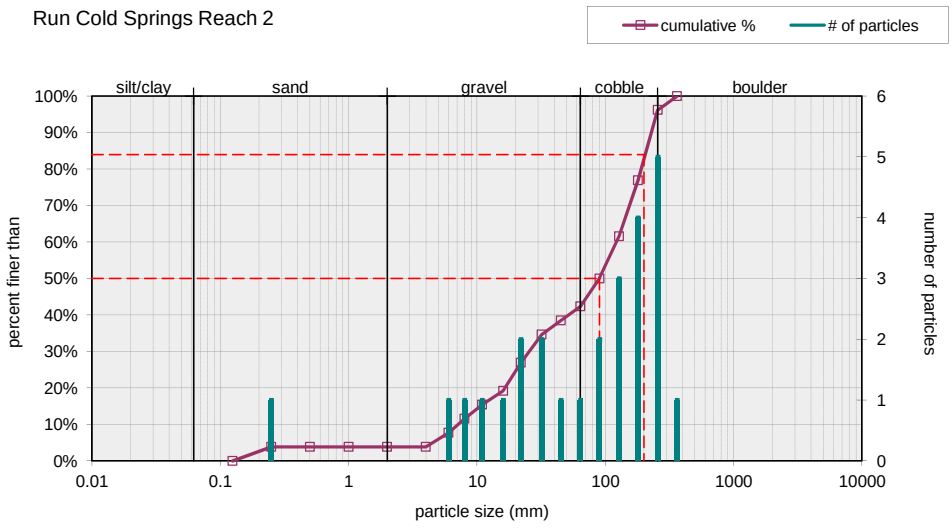
Size Distribution	
mean	8.0
dispersion	15.8
skewness	-0.39

Type	
silt/clay	0%
sand	17%
gravel	65%
cobble	13%
boulder	4%

Run

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	
coarse sand	0.5 - 1	
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	1
fine gravel	6 - 8	1
medium gravel	8 - 11	1
medium gravel	11 - 16	1
coarse gravel	16 - 22	2
coarse gravel	22 - 32	2
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	1
small cobble	64 - 90	2
medium cobble	90 - 128	3
large cobble	128 - 180	4
very large cobble	180 - 256	5
small boulder	256 - 362	1
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		26
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		26

Note:



Size (mm)	
D16	12
D35	33
D50	90
D65	140
D84	200
D95	250

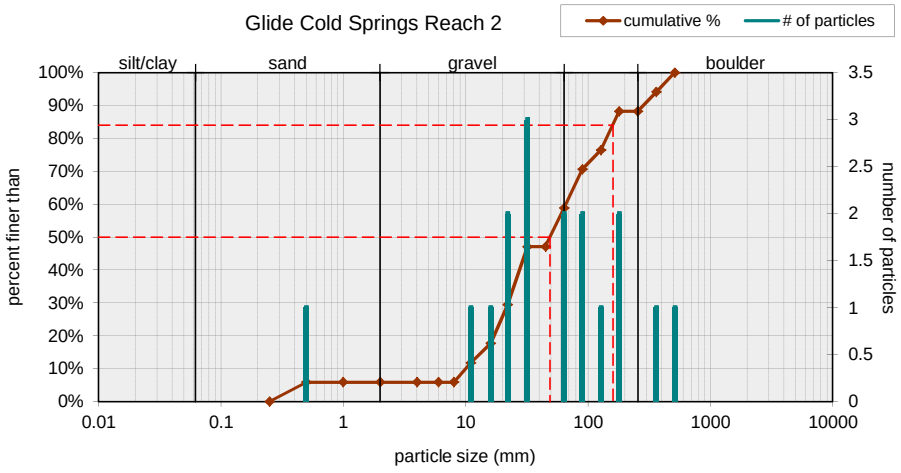
Size Distribution	
mean	49.0
dispersion	4.9
skewness	-0.24

Type	
silt/clay	0%
sand	4%
gravel	38%
cobble	54%
boulder	4%

Glide

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

Note:



Size (mm)	
D16	14
D35	25
D50	49
D65	77
D84	160
D95	380

Size Distribution	
mean	47.3
dispersion	3.4
skewness	-0.01

Type	
silt/clay	0%
sand	6%
gravel	53%
cobble	29%
boulder	12%

3) Bulk Sample Sieve Analysis

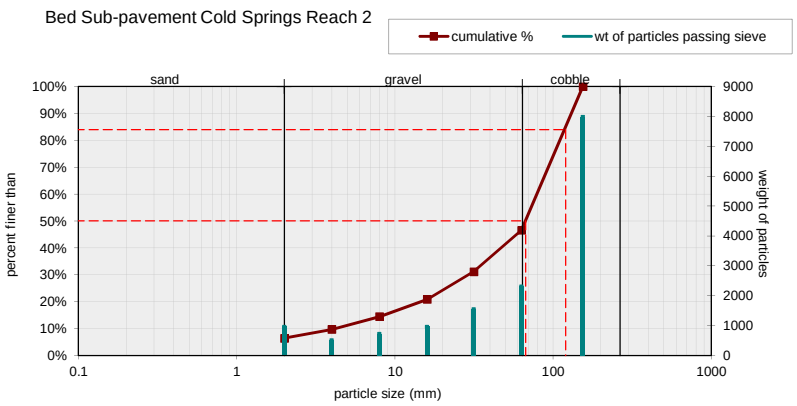
Two samples may be entered below. Select sample type for each.

Bed Sub-pavement

Sieve Size (mm)	Sieve Weight (g)	Sieve & Sample Weight (g)	Retained on Sieve (g)		Passing Sieve	
1		952	952	6%	---	---
2		494	494	3%	6%	6%
4		713	713	5%	3%	10%
8		951	951	6%	5%	14%
16		1539	1539	10%	6%	21%
31.5		2300	2300	15%	10%	31%
63		7979	7979	53%	15%	47%
154			0	0%	53%	100%

total wt retained in sieves: 14928

Note: Largest Particle 154 mm



Size (mm)					
D16	9.5	D65	86	sand	100%
D35	37	D84	120		
D50	67	D95	140		

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:	---

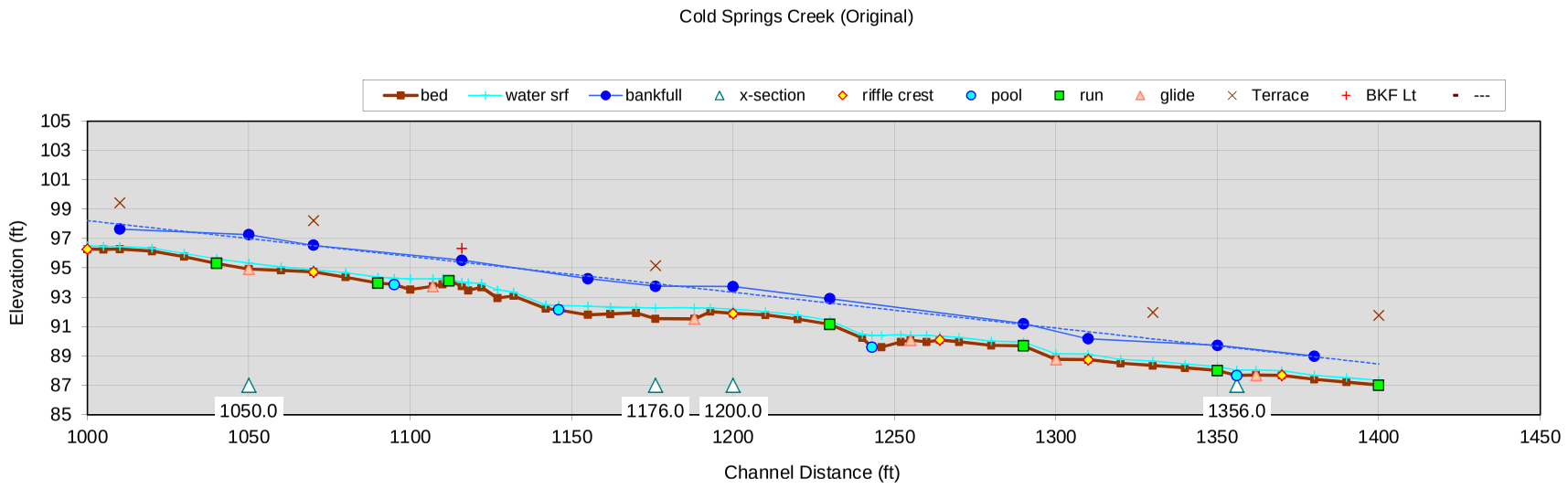
Dimension		bankfull channel typical	min	max
floodplain:	width flood prone area (ft)	48.0	43.0	52.0
	low bank height (ft)	2.1	1.8	2.4
riffle-run:	x-area bankfull (sq.ft.)	33.4	33.4	34.6
	width bankfull (ft)	24.7	23.4	24.7
	mean depth (ft)	1.35	1.3	1.5
	max depth (ft)	1.8	1.8	2.2
	hydraulic radius (ft)	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

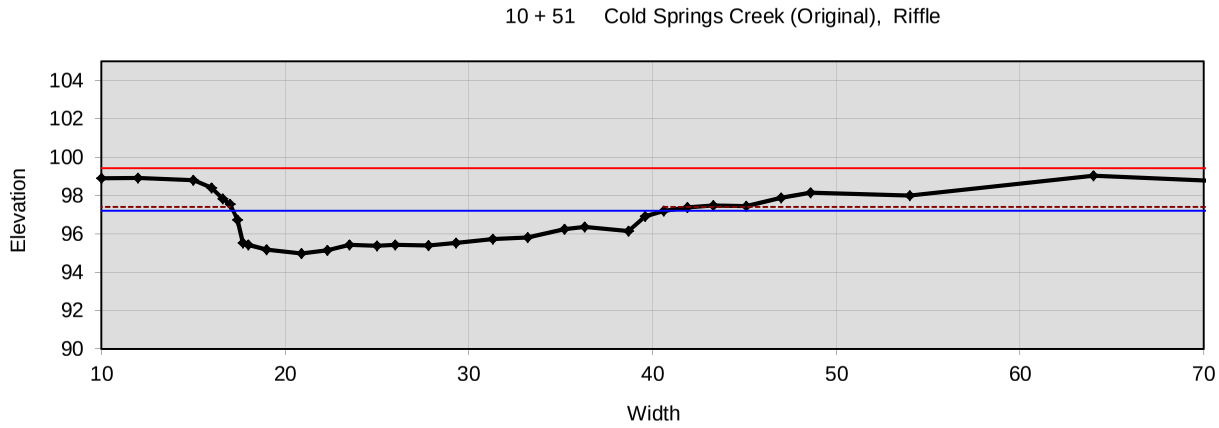
Channel Materials	Riffle Surface		Point Bar	BkF Channel
D16 (mm)	5.2	---	30	3.3
D35 (mm)	22	---	71	15
D50 (mm)	45	---	79	31
D65 (mm)	75	---	87	62
D84 (mm)	130	---	99	120
D95 (mm)	190	---	110	170
mean (mm)	26.0			19.9
dispersion	5.8			6.6
skewness	-0.2			-0.2
Shape Factor	---			
% Silt/Clay	1%	---	0%	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



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):

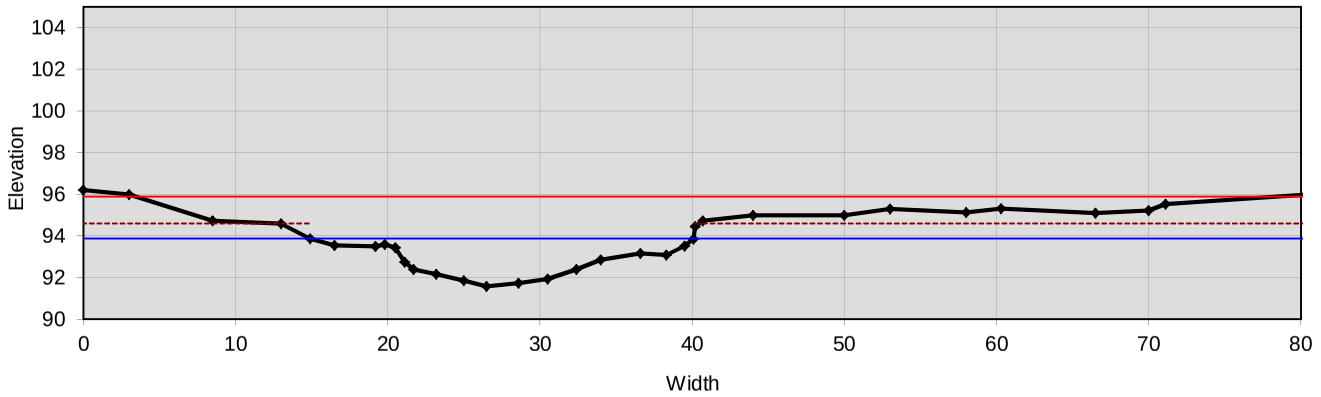
Bankfull Flow	
6.3	velocity (ft/s)
218.6	discharge rate (cfs)
0.95	Froude number

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):

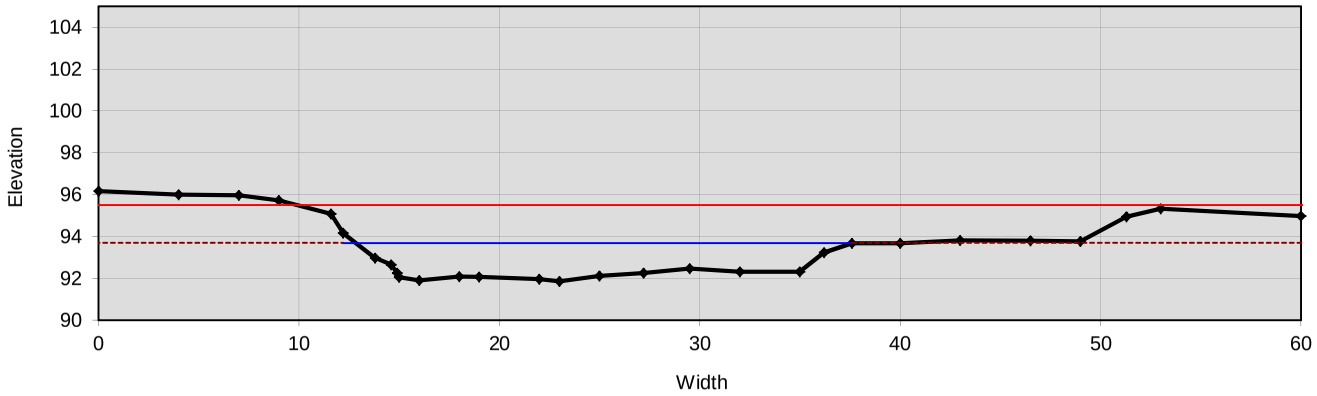
Bankfull Flow	
5.6	velocity (ft/s)
168.0	discharge rate (cfs)
0.92	Froude number

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):

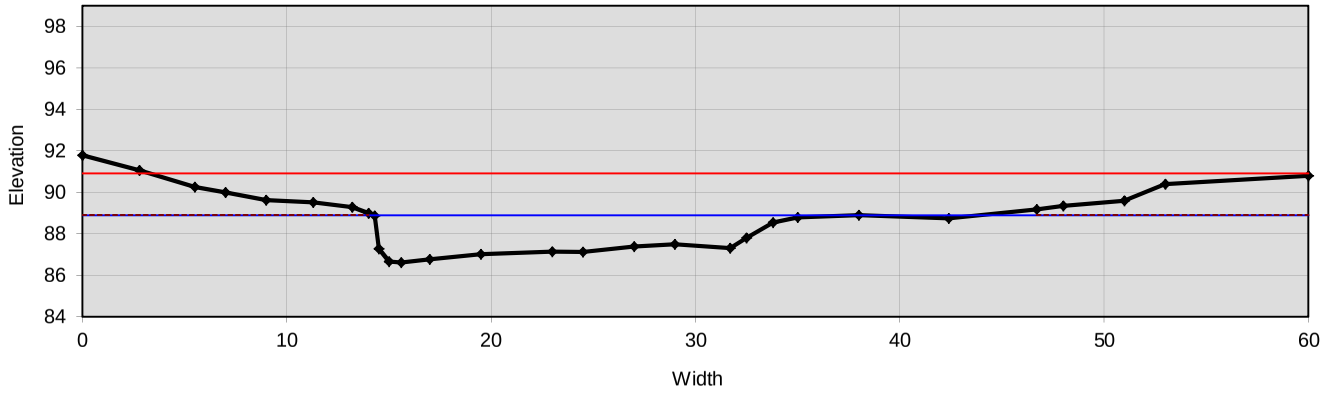
Bankfull Flow	
6.1	velocity (ft/s)
202.1	discharge rate (cfs)
0.94	Froude number

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)

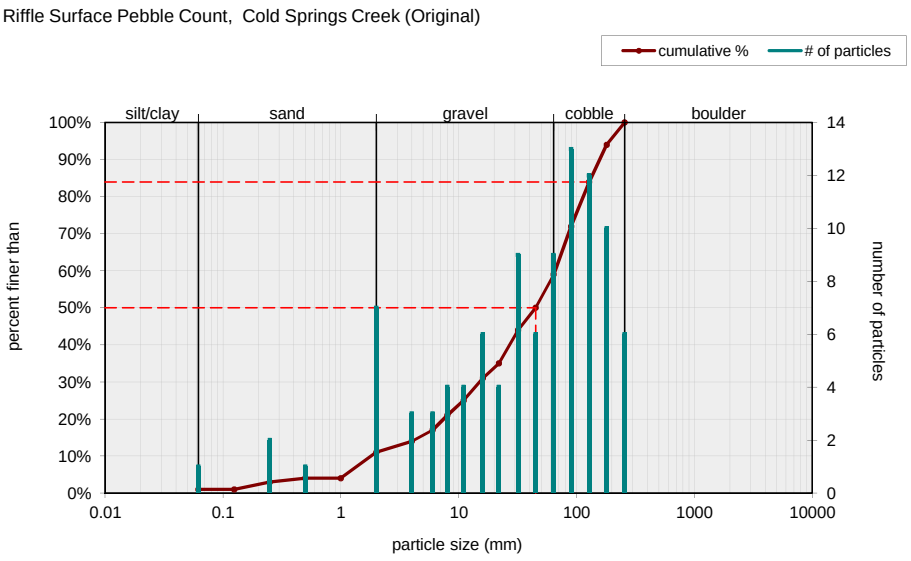
1) Individual Pebble Count

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

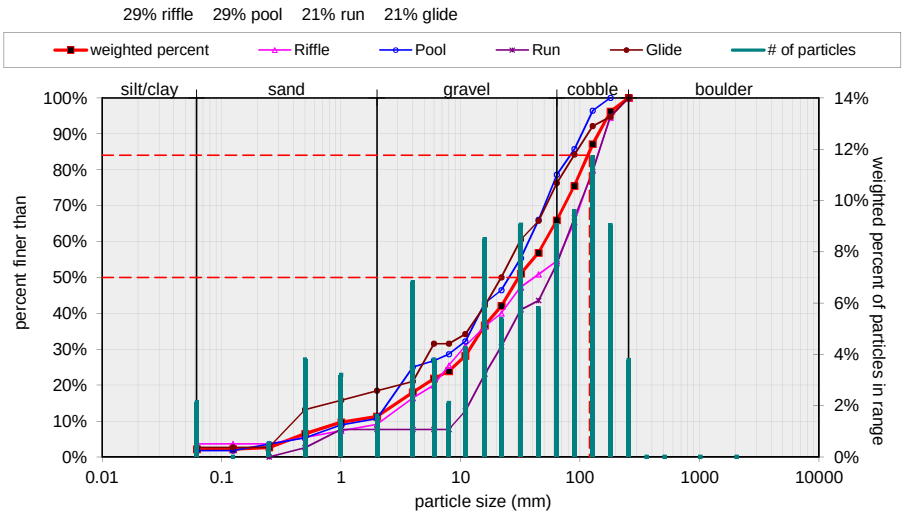
Riffle	29	%	Run	21	%
Pool	29	%	Glide	21	%

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

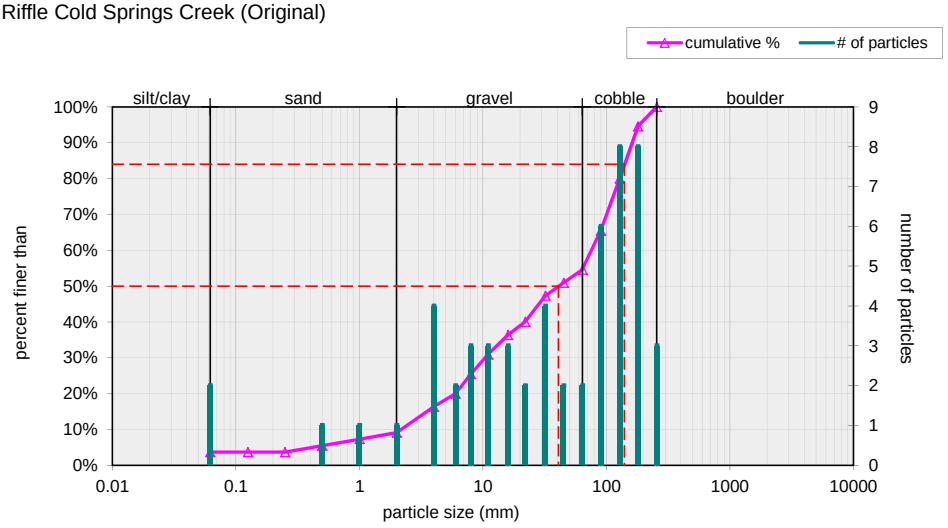
Size Distribution	
mean	19.9
dispersion	6.6
skewness	-0.15

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

Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	2
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	1
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	1
very fine gravel	2 - 4	4
fine gravel	4 - 6	2
fine gravel	6 - 8	3
medium gravel	8 - 11	3
medium gravel	11 - 16	3
coarse gravel	16 - 22	2
coarse gravel	22 - 32	4
very coarse gravel	32 - 45	2
very coarse gravel	45 - 64	2
small cobble	64 - 90	6
medium cobble	90 - 128	8
large cobble	128 - 180	8
very large cobble	180 - 256	3
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		55
bedrock		1
clay hardpan		
detritus/wood		
artificial		
total count:		56

Note:



Size (mm)	
D16	3.9
D35	15
D50	41
D65	89
D84	140
D95	190

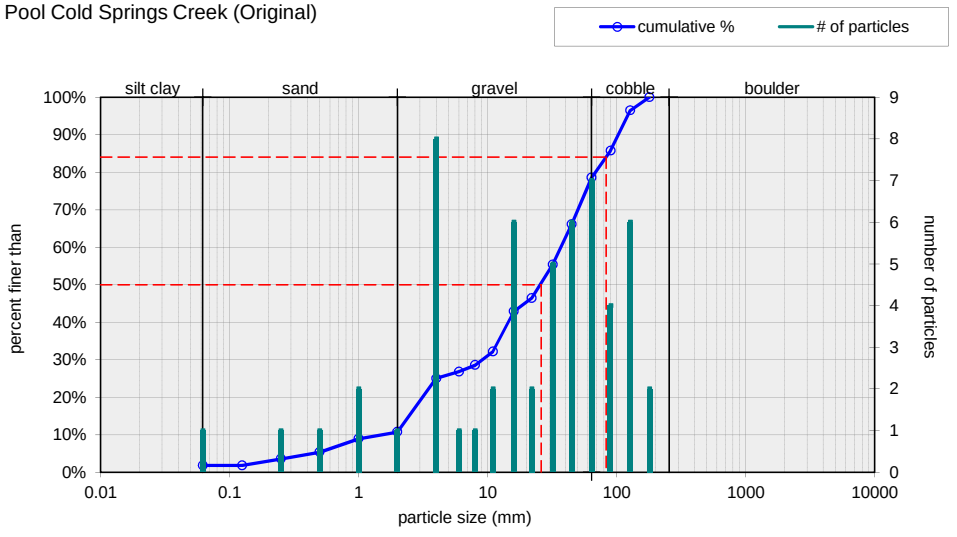
Size Distribution	
mean	23.4
dispersion	7.0
skewness	-0.20

Type			
silt/clay	4%	bedrock	2%
sand	5%		
gravel	45%		
cobble	45%		
boulder	0%		

Pool

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	1
medium sand	0.25 - 0.5	1
coarse sand	0.5 - 1	2
very coarse sand	1 - 2	1
very fine gravel	2 - 4	8
fine gravel	4 - 6	1
fine gravel	6 - 8	1
medium gravel	8 - 11	2
medium gravel	11 - 16	6
coarse gravel	16 - 22	2
coarse gravel	22 - 32	5
very coarse gravel	32 - 45	6
very coarse gravel	45 - 64	7
small cobble	64 - 90	4
medium cobble	90 - 128	6
large cobble	128 - 180	2
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:		56
bedrock		1
clay hardpan		
detritus/wood		
artificial		
total count:		57

Note:



Size (mm)	
D16	2.6
D35	12
D50	26
D65	43
D84	83
D95	120

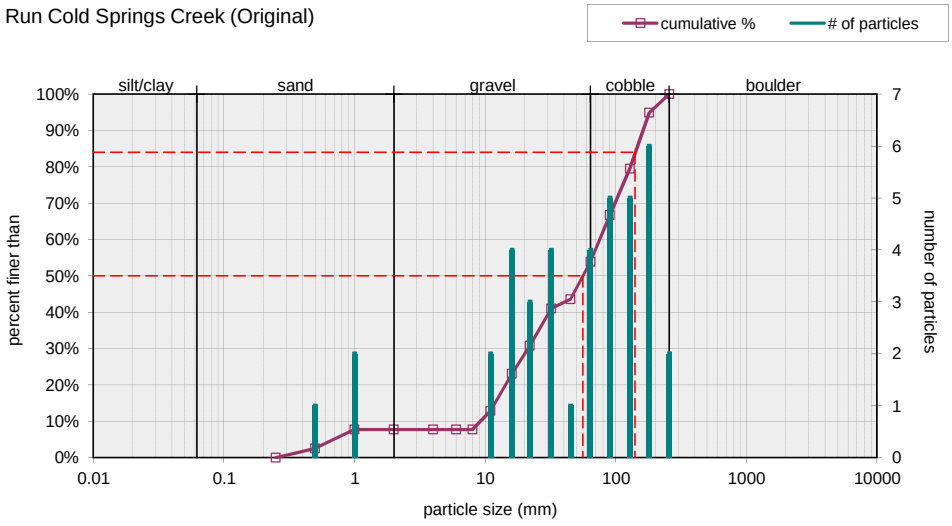
Size Distribution	
mean	14.7
dispersion	6.6
skewness	-0.20

Type			
silt/clay	2%	bedrock	2%
sand	9%		
gravel	67%		
cobble	21%		
boulder	0%		

Run

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	1
coarse sand	0.5 - 1	2
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	
fine gravel	6 - 8	
medium gravel	8 - 11	2
medium gravel	11 - 16	4
coarse gravel	16 - 22	3
coarse gravel	22 - 32	4
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	4
small cobble	64 - 90	5
medium cobble	90 - 128	5
large cobble	128 - 180	6
very large cobble	180 - 256	2
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		39
bedrock		3
clay hardpan		
detritus/wood		
artificial		
total count:		42

Note:



Size (mm)	
D16	12
D35	26
D50	56
D65	86
D84	140
D95	180

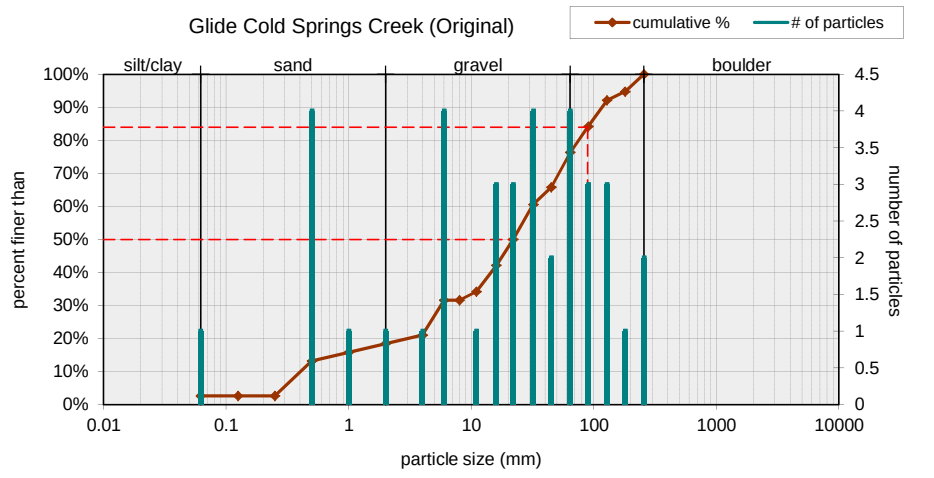
Size Distribution	
mean	41.0
dispersion	3.6
skewness	-0.13

Type			
silt/clay	0%	bedrock	7%
sand	7%		
gravel	43%		
cobble	43%		
boulder	0%		

Glide

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	4
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	1
very fine gravel	2 - 4	1
fine gravel	4 - 6	4
fine gravel	6 - 8	
medium gravel	8 - 11	1
medium gravel	11 - 16	3
coarse gravel	16 - 22	3
coarse gravel	22 - 32	4
very coarse gravel	32 - 45	2
very coarse gravel	45 - 64	4
small cobble	64 - 90	3
medium cobble	90 - 128	3
large cobble	128 - 180	1
very large cobble	180 - 256	2
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		38
bedrock		2
clay hardpan		
detritus/wood		
artificial		
total count:		40

Note:



Size (mm)	
D16	1.1
D35	11
D50	22
D65	43
D84	89
D95	180

Size Distribution	
mean	9.9
dispersion	12.0
skewness	-0.25

Type			
silt/clay	3%	bedrock	5%
sand	15%		
gravel	55%		
cobble	23%		
boulder	0%		

3) Bulk Sample Sieve Analysis

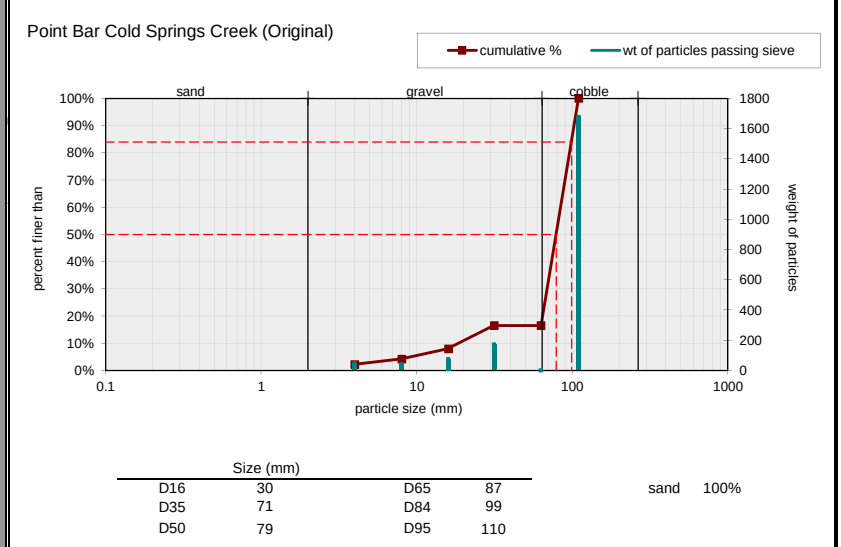
Two samples may be entered below. Select sample type for each.

Point Bar

Sieve Size (mm)	Sieve Weight (g)	Sieve & Sample Weight (g)	Retained on Sieve (g)		Passing Sieve	
2	682	728	46	2%	---	---
4	739	779	40	2%	2%	2%
8	739	814	75	4%	2%	4%
16	811	983	172	9%	4%	8%
31.5	820	820	0	0%	9%	17%
63	706	2383				
110			0	0%	83%	100%

total wt retained in sieves: 2010

Note: Pavement Largest Particles: 95 and 110 mm



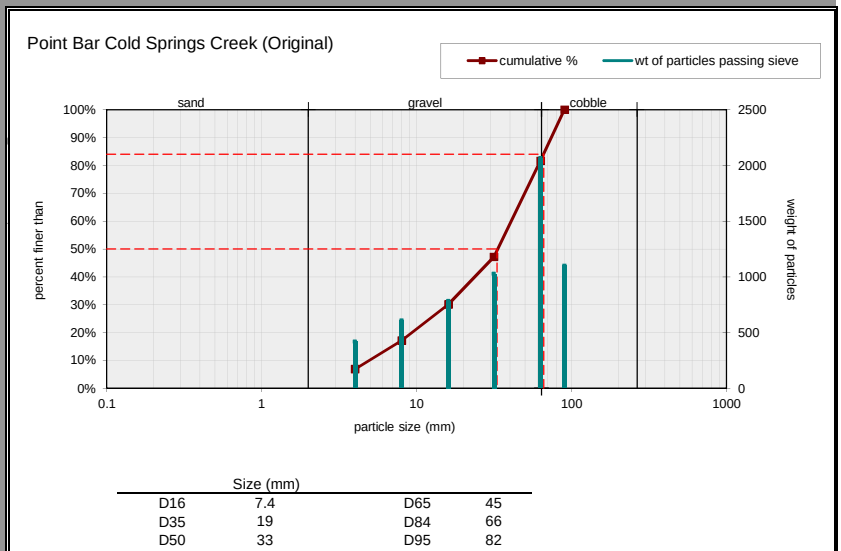
Size (mm)				
D16	30	D65	87	sand 100%
D35	71	D84	99	
D50	79	D95	110	

Point Bar

Sieve Size (mm)	Sieve Weight (g)	Sieve & Sample Weight (g)	Retained on Sieve (g)		Passing Sieve	
2	682	1097	415	7%	---	---
4	739	1346	607	10%	7%	7%
8	739	1520	781	13%	10%	17%
16	811	1835	1024	17%	13%	30%
31.5	820	2883	2063	34%	17%	47%
63	706	1807	1101	18%	34%	82%
90			0	0%	18%	100%

total: 5991

Note: Sub-Pavement Largest Particles: 68 and 90 mm



Size (mm)			
D16	7.4	D65	45
D35	19	D84	66
D50	33	D95	82

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

Photo No. 11

Cold Springs Reach 3 facing downstream 1/17/2012

APPENDIX D
PROJECT PLAN SHEETS (11”x17”)

NC EEP PROJECT #95027

ENVIRONMENTAL BANC AND EXCHANGE

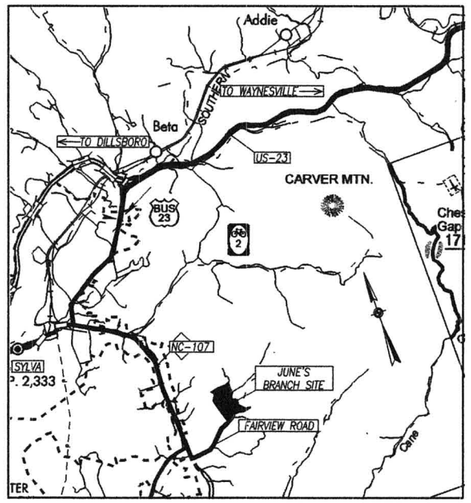
STATE	EEP PROJECT NO.	SHEET NO.	TOTAL SHEETS
NC	95027	1	38

NO.	DESCRIPTION	DATE
A	FINAL PLANS	12/12/2012
B	REVISION 1	1/25/2013
C	REVISION 2	4/16/2013

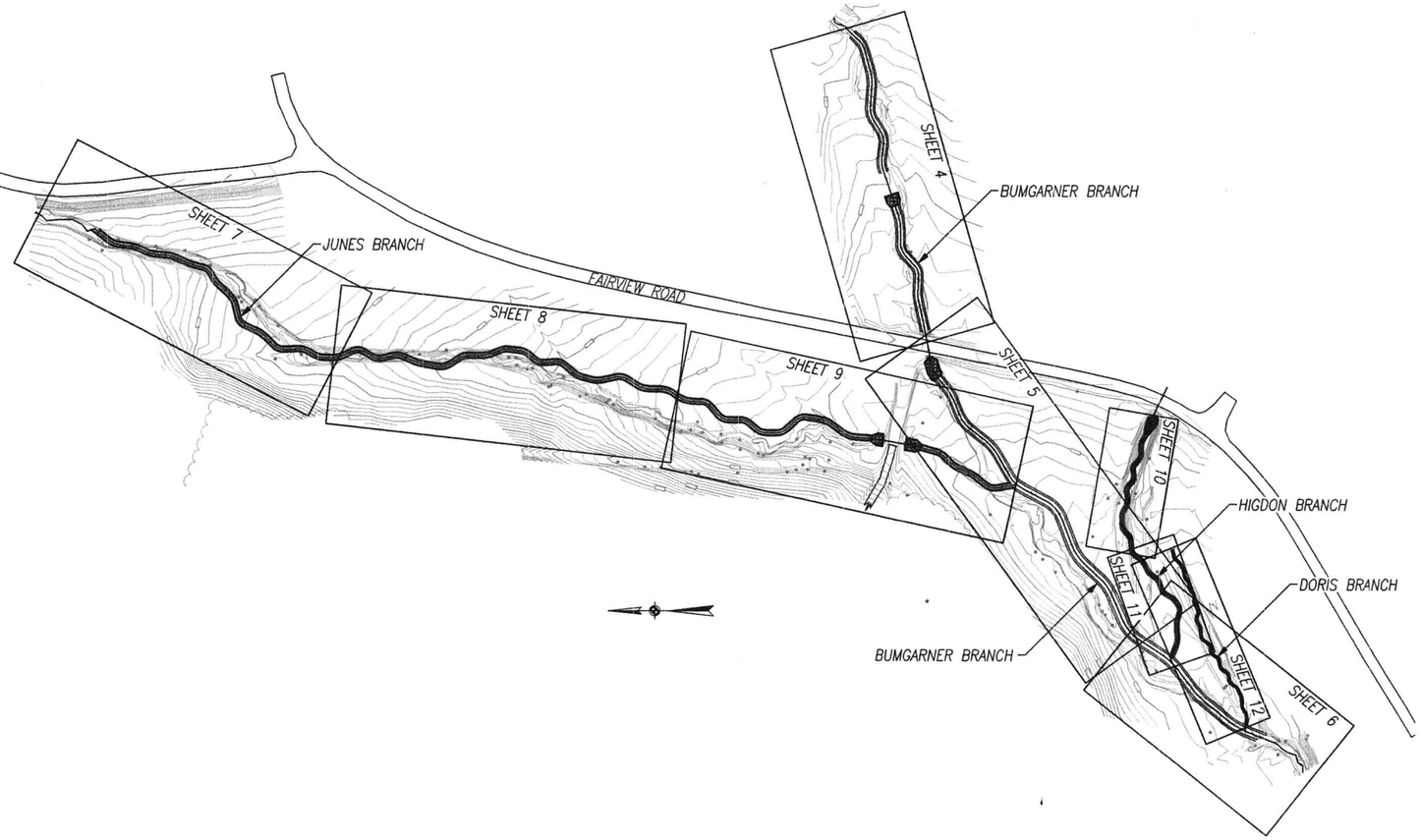
REVISIONS

JUNES BRANCH STREAM RESTORATION PROJECT

JUNES BRANCH
JACKSON COUNTY, NORTH CAROLINA



VICINITY MAP
NOT TO SCALE



SHEET INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET
1A	SITE PLAN
2	TYPICAL SECTIONS
3-3B	DETAILS
4-12	PLAN AND PROFILE
P1-P3	PLANTING PLAN
EC1-EC5	EROSION CONTROL PLANS
XS-1 - XS-15	CROSS SECTIONS

FINAL PLANS

GRAPHIC SCALES (SCALE IN FEET)

20 0 20 60
PLANS SHEETS 4-9

10 0 10 30
PLANS SHEET 10-12

20 0 20 60
HORIZONTAL PROFILE

2 0 2 6
VERTICAL PROFILE

PROJECT LENGTHS

PROPOSED RESTORATION:

BUMGARNER BRANCH	= 1,069 FT
JUNES BRANCH	= 1,319 FT
HIGDON BRANCH	= 422 FT
DORIS BRANCH	= 282 FT
TOTAL LENGTH	= 3,092 FT

Prepared by:

Wolf Creek ENGINEERING

Wolf Creek Engineering, Pllc
License No. P-0417
7 Florida Avenue
Weaverville, North Carolina 28787
Phone: 828-658-3649
www.wolfcreekeng.com

NORTH CAROLINA PROFESSIONAL SEAL 031787 ENGINEER J. GRANT GINN
4/16/13

NORTH CAROLINA PROFESSIONAL SEAL 030505 ENGINEER CHRISTOPHER M. ENGLE

4-16-13
PROJECT ENGINEER

Prepared for:

EBX

Martin Hovis
PROJECT MANAGER

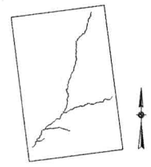
Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
7 Florida Ave Weaverville, NC 28787
PHONE: (828) 658-3649 WWW.WOLFCREEKENG.COM

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. EAGLE
4-16-13

PROJECT	JUNES BRANCH RESTORATION PROJECT
OWNER	ENVIRONMENTAL BANC AND EXCHANGE
TITLE	SITE PLAN

SCALE	DSGN. BY	PROJECT NO.	DRAWING NUMBER
AS NOTED	cme	1053	1A
DATE 12/12/2012	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION
1/25/13	CME	1	LINE WORK EDIT
4/16/13	CME	2	BUMGARNER 1A STREAM CROSSING



LOCATION KEY

MO

CONSERVATION EASEMENT BOUNDARY

EXISTING OVERHEAD UTILITY

60' EASEMENT BREAK

FAIRVIEW ROAD

EXISTING WETLANDS 1

TEMPORARY TREE PROTECTION FENCE

JUNES BRANCH

PROPOSED PERMANENT STREAM CROSSING (PIPE)

PROPOSED AGRICULTURAL GATES 2 @ 8' & 2 @ 10' (BY OTHERS)

PROPOSED FENCE (BY OTHERS)

BUMGARNER BRANCH REACH 1A

PROPOSED AGRICULTURAL GATE – 2 @ 8' (BY OTHERS)

EXISTING 60" CMP TO REMAIN

BUMGARNER BRANCH REACH 1B

EXISTING 36" & 24" CMPs TO REMAIN

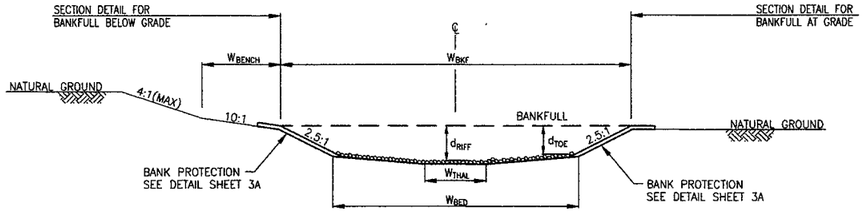
HIGDON BRANCH

DORIS BRANCH

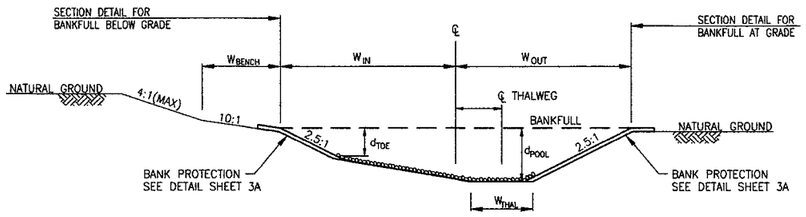
EXISTING WETLANDS 2

BUMGARNER BRANCH REACH 2

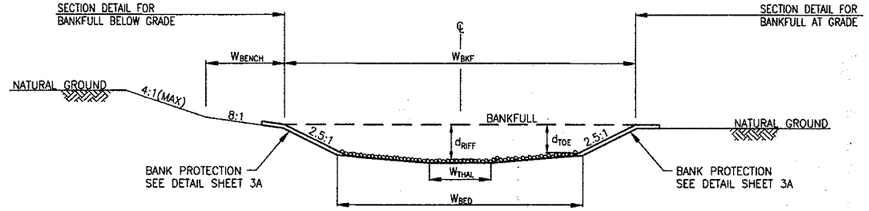
60 0 60 180
SCALE IN FEET



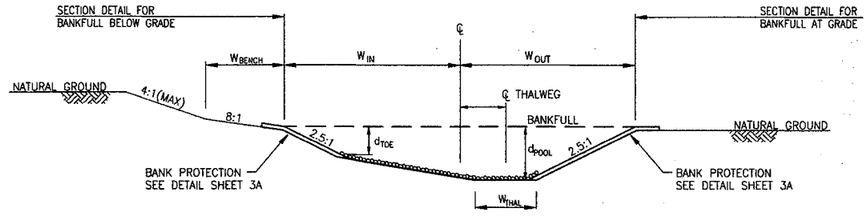
SECTION 1
TYPICAL RIFFLE
NOT TO SCALE



SECTION 1
TYPICAL POOL
NOT TO SCALE



SECTION 2
TYPICAL RIFFLE
NOT TO SCALE



SECTION 2
TYPICAL POOL
NOT TO SCALE

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

PROJECT: JUNES BRANCH RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC AND EXCHANGE
TITLE: **TYPICAL SECTIONS**

SCALE	DRWN. BY	PROJECT NO.	DRAWING NUMBER
AS NOTED	CME	1053	2
DATE 12/12/2012	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION
1/25/2013	CME	1	LINE WORK EDIT

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036596 CHRISTOPHER M. EAGLE
1-25-13

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.

SURVEY:
THE COORDINATE SYSTEM IS THE NAD83(2007) STATE PLANE GRID.

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)
BUMGARNER BRANCH – 1	1	100+37 TO 107+27	12.9	8.5	2.5	6	1.10	0.88	7.7	6.4	1.65
BUMGARNER BRANCH – 2	1	107+27 TO 112+35	15.1	10.2	3.1	8	1.21	0.97	9.0	7.5	1.82
JUNES BRANCH	2	200+97 TO 215+15	8.7	5.3	1.6	8	0.85	0.68	5.2	4.3	1.28
HIGDON BRANCH	1	300+46 TO 304+22	6.4	3.2	1.0	3	0.65	0.52	3.8	3.2	0.98
DORIS BRANCH	1	400+00 TO 402+82	3.8	1.3	0.4	2	0.40	0.32	2.3	1.9	0.60

NOTE: IN LOCATIONS WHERE MATURE VEGETATION EXISTS ADJACENT TO PROPOSED CHANNEL, THE BENCH WIDTH (W_{BENCH}) SHALL BE REDUCED AS DIRECTED BY THE ENGINEER

TABLE 2A: SUPPLEMENTAL BED MATERIAL WITH HARVESTED GRAVEL

REACH	PERCENT OF TOTAL MAX						
	HARVESTED GRAVEL	1/2" STONE	3/4" STONE	2" STONE	6" STONE	12" STONE	DEPTH OF BED MATERIAL
BUMGARNER BRANCH – 1	40	–	–	–	60	–	0.5
BUMGARNER BRANCH – 2	40	–	–	–	60	–	0.5
JUNES BRANCH	40	–	–	–	60	–	0.4
HIGDON BRANCH	40	–	–	–	60	–	0.3
DORIS BRANCH	100	–	–	–	–	–	0.3

TABLE 2B: SUPPLEMENTAL BED MATERIAL WITHOUT HARVESTED GRAVEL

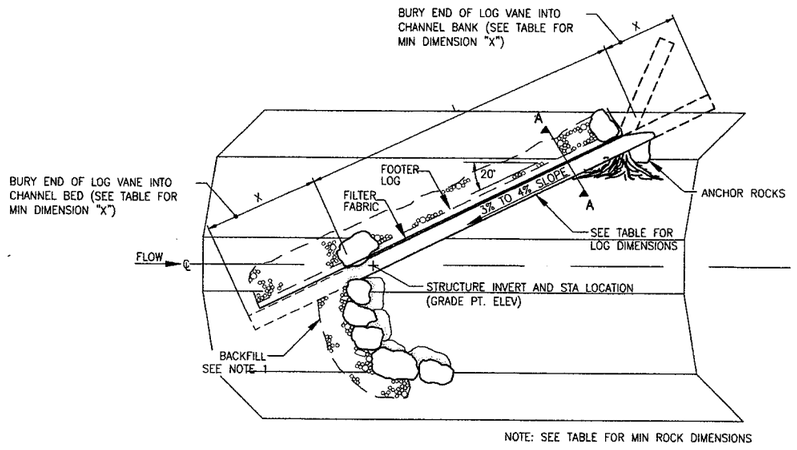
REACH	PERCENT OF TOTAL MAX						
	HARVESTED SAND/CLAY	1/2" STONE	3/4" STONE	2" STONE	6" STONE	12" STONE	DEPTH OF BED MATERIAL
BUMGARNER BRANCH – 1	20	–	–	20	60	–	0.5
BUMGARNER BRANCH – 2	20	–	–	20	60	–	0.5
JUNES BRANCH	20	–	–	20	60	–	0.4
HIGDON BRANCH	20	–	–	20	60	–	0.3
DORIS BRANCH	50	–	–	50	–	–	0.3

TABLE 3: MORPHOLOGIC TABLE

REACH	BUMGARNER BRANCH 1	BUMGARNER BRANCH 2	JUNES BRANCH	HIGDON BRANCH	DORIS BRANCH
STREAM TYPE	B4c	B4c	B4	B4c	B4c
DRAINAGE AREA (mi^2)	0.69	1.05	0.24	0.08	0.01
W_{BKF} (ft)	12.9	15.1	8.7	6.4	3.8
XS_{BKF} (ft^2)	10.6	13.9	5.3	2.8	0.9
d_{MEAN} (ft)	0.8	0.9	0.6	0.4	0.2
d_{MAX} (ft)	1.1	1.2	0.9	0.7	0.4
S_{AVG} (ft/ft)	0.024	0.015	0.025	0.016	0.019
S_{VALLEY} (ft/ft)	0.023	0.015	0.028	0.022	0.022
W/D RATIO	15.6	16.4	14.1	14.5	16.6
ENTRENCHMENT RATIO	6.5	5.5	3.5	3	5.5
SINUOSITY	1.08	1.11	1.08	1.09	1.06
POOL-TO-POOL RATIO	2.6 – 4.6	2.7 – 4.7	2.4 – 4.2	2.0 – 3.5	1.3 – 2.3
MEANDER WIDTH RATIO	1.8	2.5	1.8	1.7	1.7

CHANNEL CONSTRUCTION NOTES:
1. BED MATERIAL ON RIFFLE SECTIONS SHALL CONSIST OF BED MATERIAL EXCAVATED FROM EXISTING CHANNEL AND SUPPLEMENTED WITH MATERIAL ACCORDING TO TABLE 2A AND AS DIRECTED BY THE ENGINEER. WHERE EXISTING BED MATERIAL IS NOT PRESENT SUPPLEMENTAL BED MATERIAL SHALL BE PROVIDED ACCORDING TO TABLE 2B AND AS DIRECTED BY THE ENGINEER.
2. THE CHANNEL BANKS SHALL BE STABILIZED ACCORDING TO THE BANK PROTECTION DETAILS ON SHEET 3A. PRIORITY SHALL BE GIVEN TO IMPLEMENTATION OF METHOD 1. IF SUITABLE TRANSPLANT MATERIAL IS NOT AVAILABLE, THEN METHODS 2 AND 3 SHALL BE IMPLEMENTED AS DIRECTED BY THE ENGINEER.
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 2-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 EXCEPT AS ALLOWED BY THE ENGINEER. ALL EXCAVATION SHALL BE PERFORMED IN THE DRY OR IN ISOLATED REACHES EXCEPT AS ALLOWED BY THE ENGINEER.

TREE SURVEY HARVEST 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.



LOG VANE W/ HOOK
PLAN VIEW
NOT TO SCALE

TABLE 4: STRUCTURE DIMENSIONS

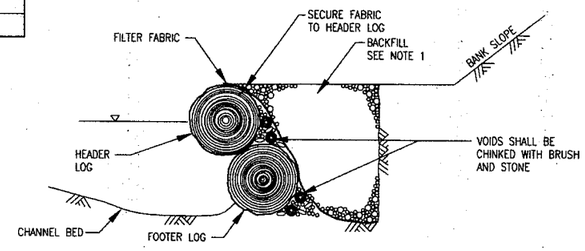
REACH	STRUCTURES			BOULDERS			TOTAL LOG LENGTH (FT)
	L (FT)	W (FT)	X (FT)	LENGTH (FT)	WIDTH (FT)	DEPTH (FT)	
BUMGARNER BRANCH 1	14	4	5	2.5–3.5	2.0–2.5	1.5–2.0	24
BUMGARNER BRANCH 2	16	5	5	2.5–3.5	2.0–2.5	1.5–2.0	26
JUNES BRANCH	8	3	3	2.0–3.0	1.5–2.0	1.0–1.5	14
HIGDON BRANCH	5	2	3	2.0–3.0	1.5–2.0	1.0–1.5	11
DORIS BRANCH	2	1	3	2.0–3.0	1.5–2.0	1.0–1.5	8

NOTE: TOTAL LOG LENGTH INCLUDES THE ROOTBALL

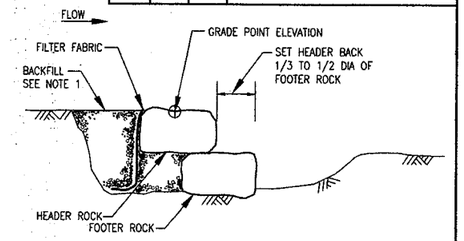
TABLE 5: LOG DIAMETERS

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

NOTES:
1. STRUCTURE BACKFILL MATERIAL SHALL CONSIST OF 6" STONE, 2" STONE AND SOIL MIXED IN EQUAL PARTS. WHERE EXISTING BED MATERIAL IS AVAILABLE AND OF SUFFICIENT SIZE IT MAY BE USED IN PLACE OF QUARRY STONE, AS APPROVED BY THE ENGINEER.
2. ALL VOIDS AND GAPS BETWEEN BOULDERS SHALL BE CHINKED WITH STONE PRIOR TO INSTALLATION OF FILTER FABRIC.



SECTION A–A
NOT TO SCALE



SECTION B–B
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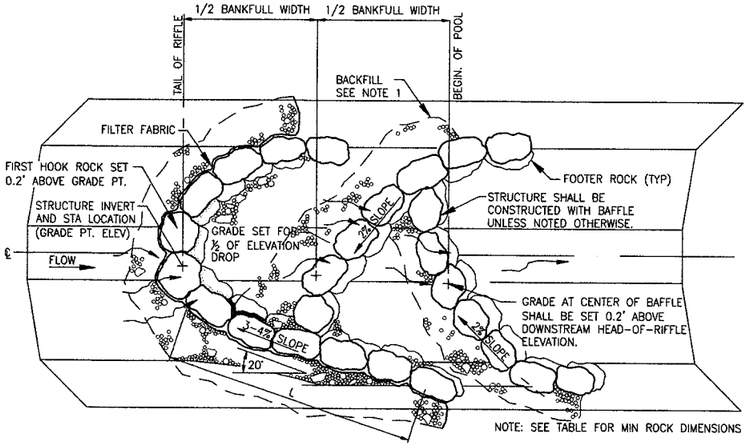
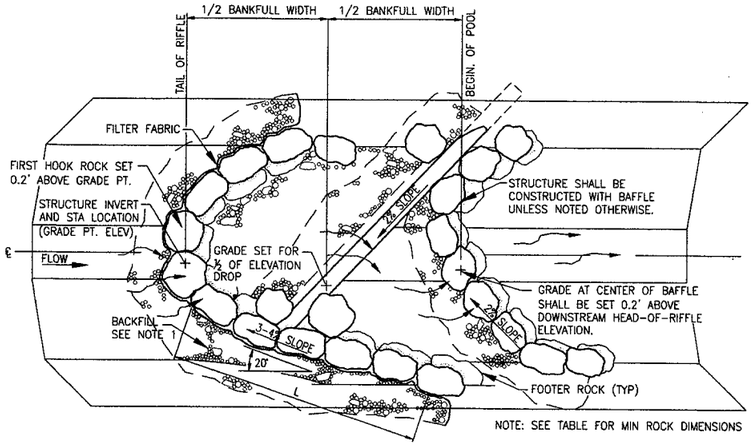
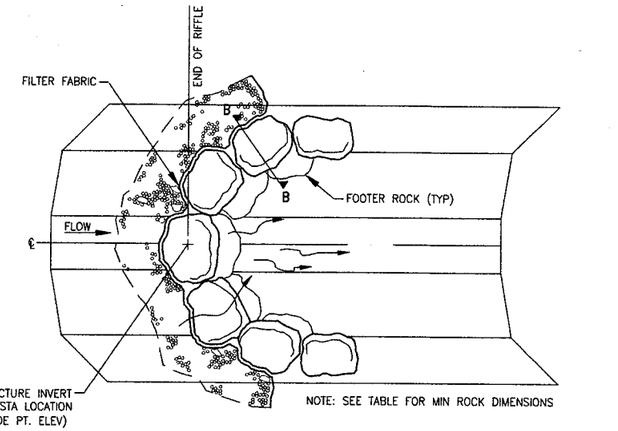


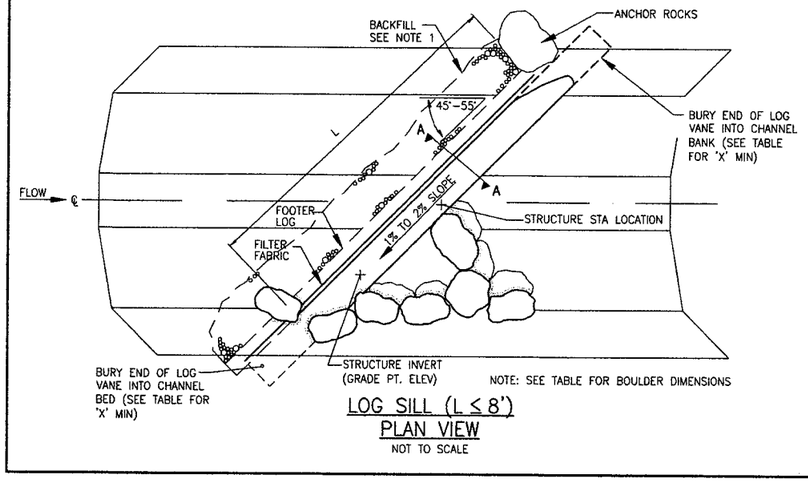
HOOK RUN
PLAN VIEW
NOT TO SCALE



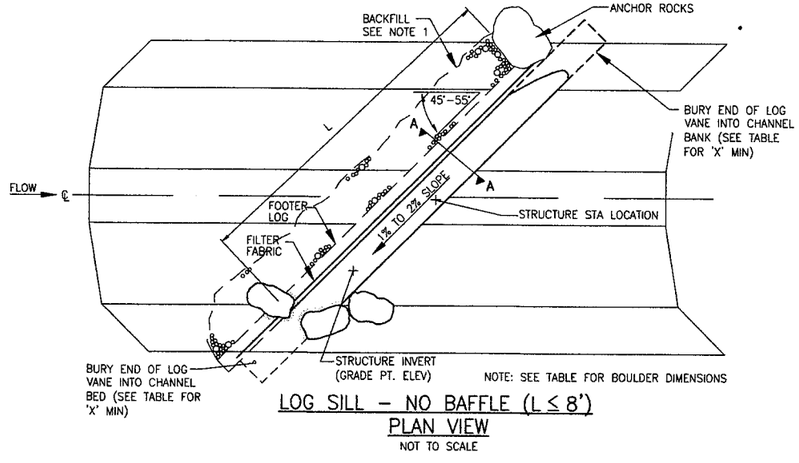
HOOK–LOG RUN
PLAN VIEW
NOT TO SCALE



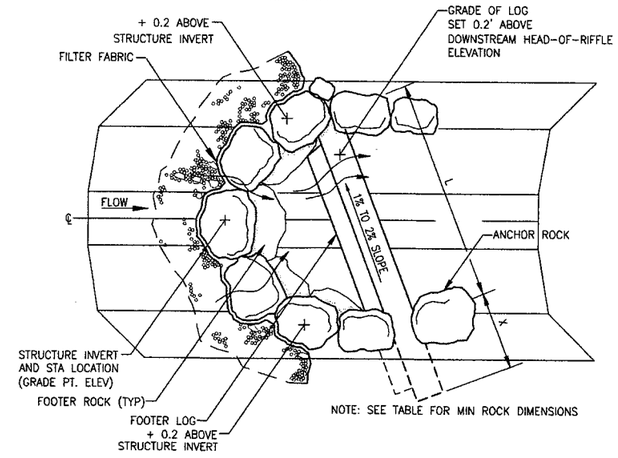
BOULDER ARCH
PLAN VIEW
NOT TO SCALE



LOG SILL (L ≤ 8')
PLAN VIEW
NOT TO SCALE



LOG SILL – NO BAFFLE (L ≤ 8')
PLAN VIEW
NOT TO SCALE



BOULDER ARCH W/ LOG
PLAN VIEW
NOT TO SCALE

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

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038595 CHRISTOPHER W. ENGLE 1-25-13

PROJECT: JUNES BRANCH RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC AND EXCHANGE
TITLE: DETAILS

SCALE	AS NOTED	DESN. BY	CME	PROJECT NO.	DRAWING NUMBER
DATE	12/12/2012	CHKD. BY	SGG	1053	3

DATE	BY	REV.	DESCRIPTION
1/25/2013	CME	1	STRUCTURE EDIT

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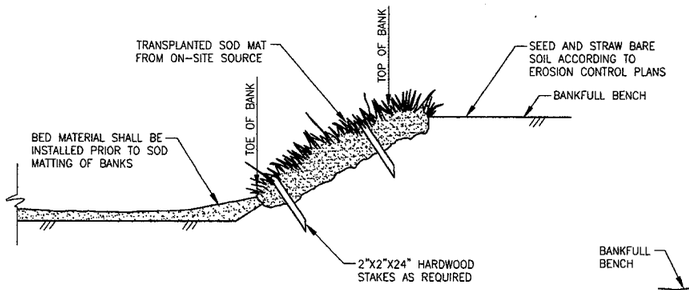
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
7 Florida Ave Weaverville, NC 28787
PHONE: (828) 658-3649 WWW.WOLFCREEKENG.COM

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE 12-12-12

PROJECT	JUNES BRANCH RESTORATION PROJECT
OWNER	ENVIRONMENTAL BANC AND EXCHANGE
TITLE	DETAILS

SCALE	DRWN. BY	PROJECT NO.	DRAWING NUMBER
AS NOTED	CME	1053	3A
DATE 12/12/2012	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION



BANK PROTECTION – METHOD 1
SOD MATTING
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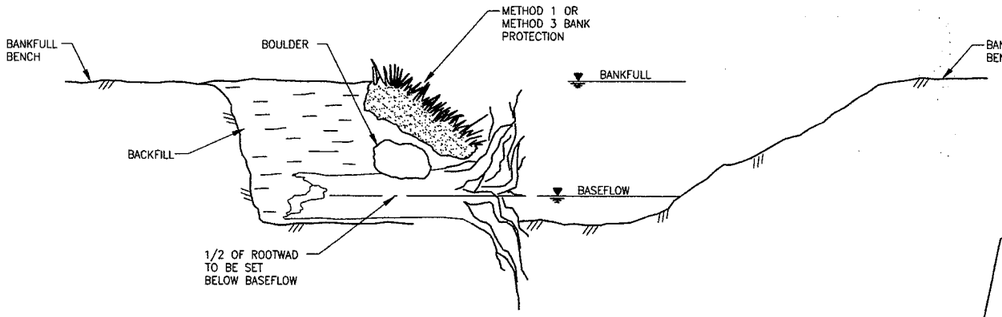

ROOTWAD SECTION
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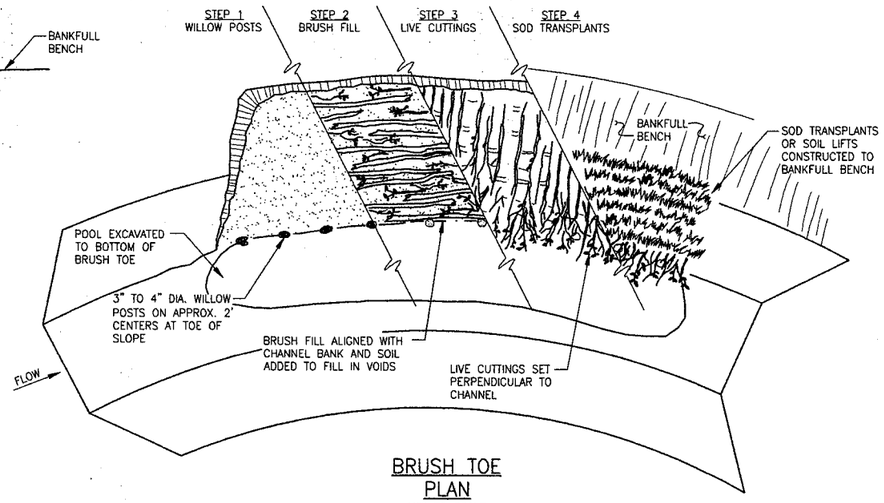

BRUSH TOE PLAN
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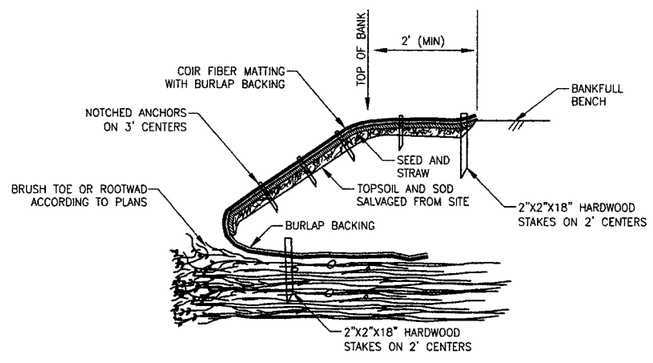
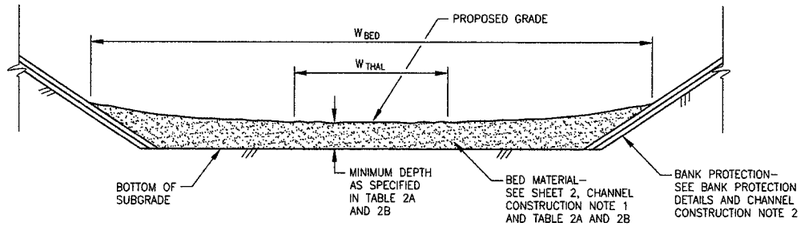


BANK PROTECTION – METHOD 2
SOD AND MAT
NOT TO SCALE

BANK PROTECTION – METHOD 3
NOT TO SCALE



BED MATERIAL DETAIL
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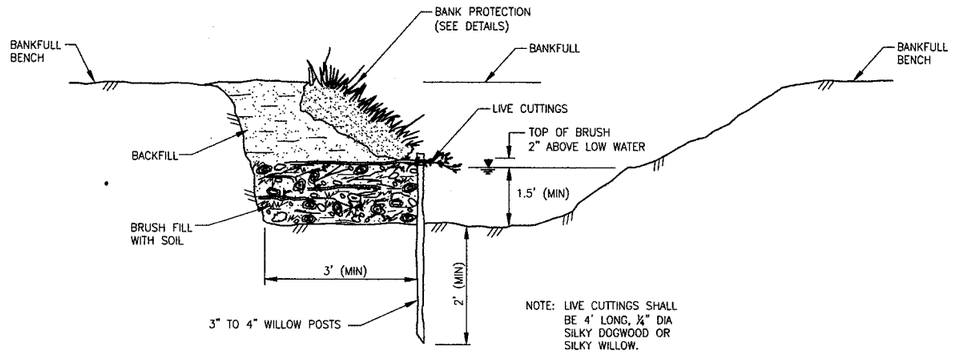

BRUSH TOE SECTION
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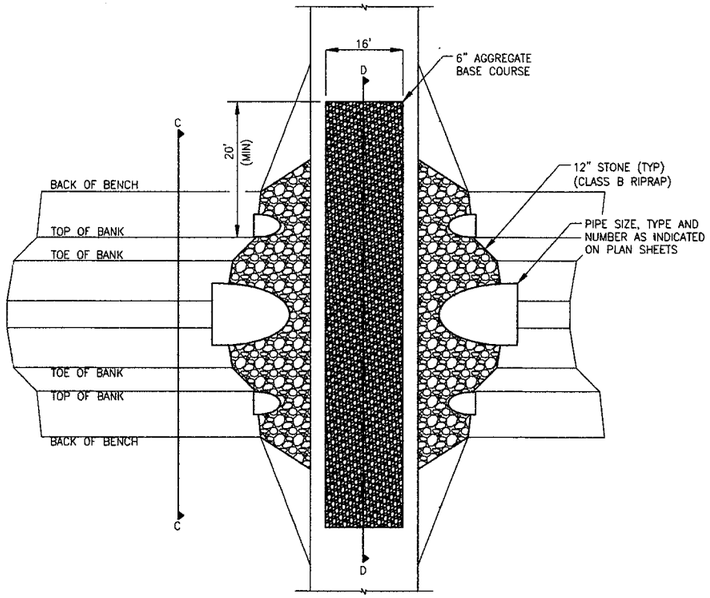
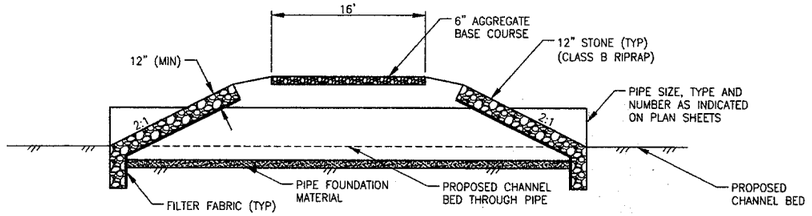


PERMANENT CROSSING (PIPE)
PLAN VIEW
NOT TO SCALE



PERMANENT CROSSING (PIPE)
SECTION
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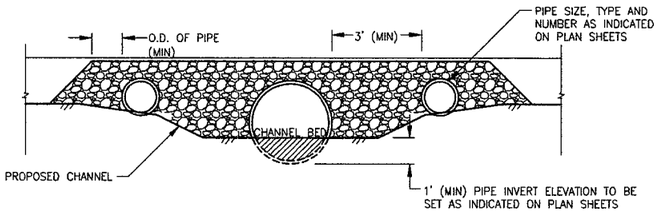
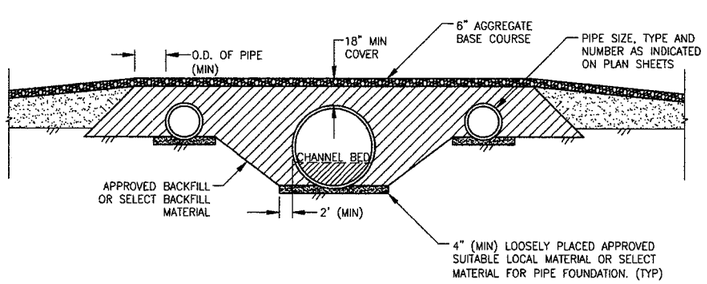
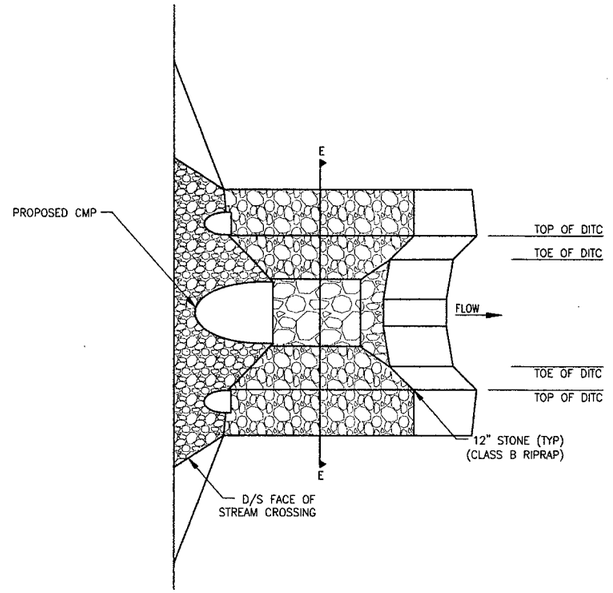


PERMANENT CROSSING (PIPE)
ELEVATION C-C
NOT TO SCALE



PERMANENT CROSSING (PIPE)
SECTION D-D
NOT TO SCALE



RIPRAP OUTLET PROTECTION - PLAN
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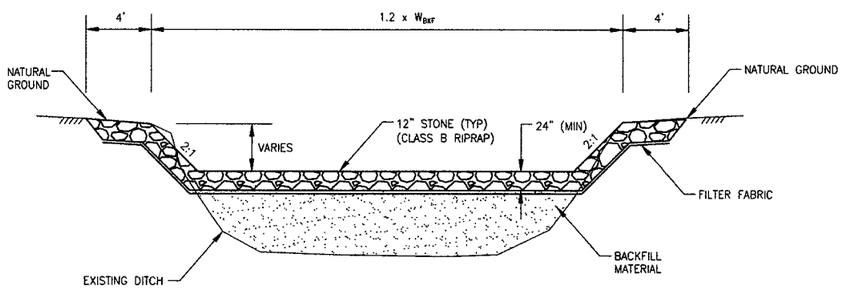

RIPRAP OUTLET PROTECTION - SECTION E-E
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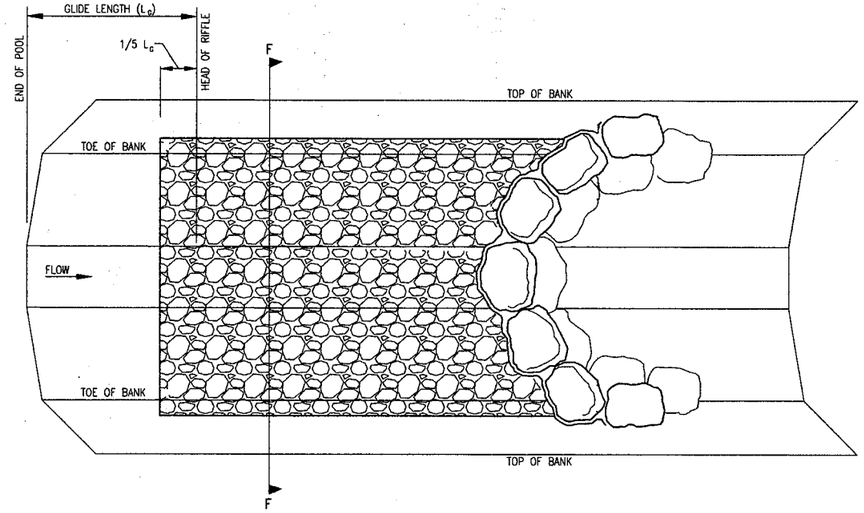
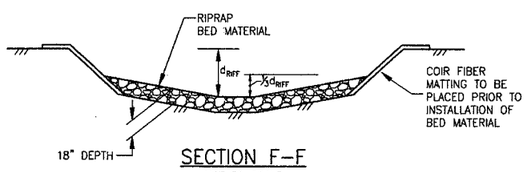


ARMORED RIFFLE DETAIL
NOT TO SCALE



SECTION F-F
NOT TO SCALE

NOTES:
1. ARMORED RIFFLE BED MATERIAL SHALL BE COMPOSED OF MATERIAL IN THE FOLLOWING PROPORTIONS AS DIRECTED BY THE ENGINEER.

MATERIAL	% BY VOLUME
12-IN STONE	60
2-IN STONE	30
ONSITE SOIL	10

NORTH CAROLINA PROFESSIONAL SEAL 036895 ENGINEER CHRISTOPHER M. ENGLE 1/15/2013

Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
7 Florida Ave Weaverville, NC 28787
PHONE: (828) 658-3640 WWW.WOLFCREEKENG.COM

PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC AND EXCHANGE
TITLE **DETAILS**

SCALE	AS NOTED	DRWN. BY	MAM	PROJECT NO.	DRAWING NUMBER
DATE	12/12/2012	CKED. BY	SGG	1053	3B

DATE	BY	REV.	DESCRIPTION
1/15/2013	CME	1	ARMORED RIFFLE COMPOSITION

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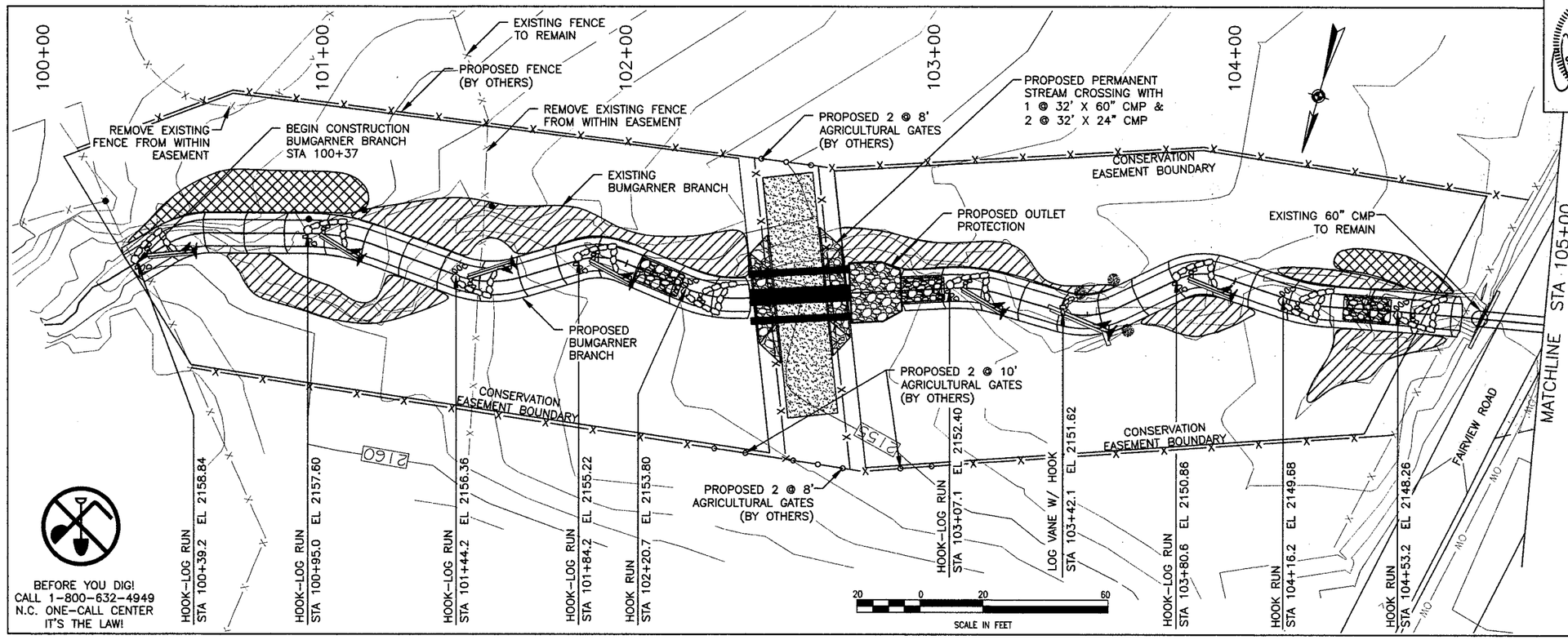
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
7 Florida Ave Weaverville, NC 28787
PHONE: (828) 658-3649 WWW.WOLFCREEKENG.COM

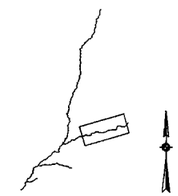
NORTH CAROLINA PROFESSIONAL SEAL 018509 ENGINEER CHRISTOPHER M. ENGLE 4-16-13

PROJECT: JUNES BRANCH RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC AND EXCHANGE
TITLE: **PLAN & PROFILE**

SCALE	DRWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	cme	1053	4
DATE 12/12/2012	CHKD. BY SGC		

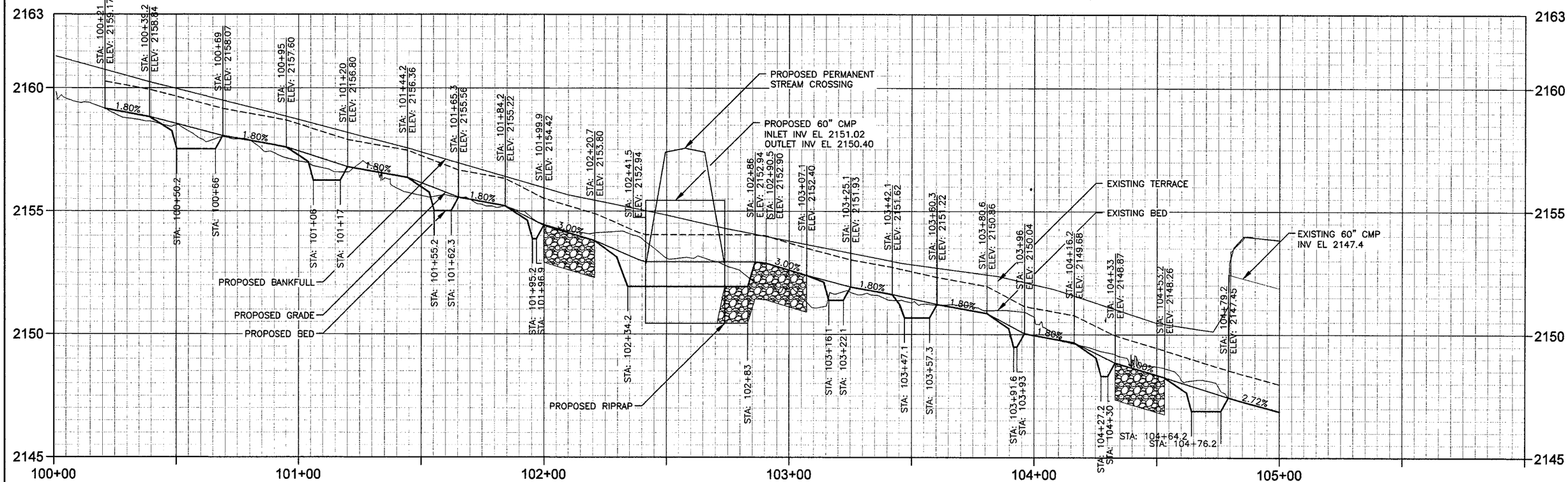
DATE	BY	REV.	DESCRIPTION
1/25/13	CME	1	STREAM CROSSING
4/16/13	CME	2	ALIGNMENT, CROSSING & STRUCTURES





LEGEND

- PROPOSED STREAM RESTORATION
- CUT
- FILL
- PROPOSED ARMORED RIFFLE
- EXISTING FENCE
- TREE



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

BUMGARNER BRANCH

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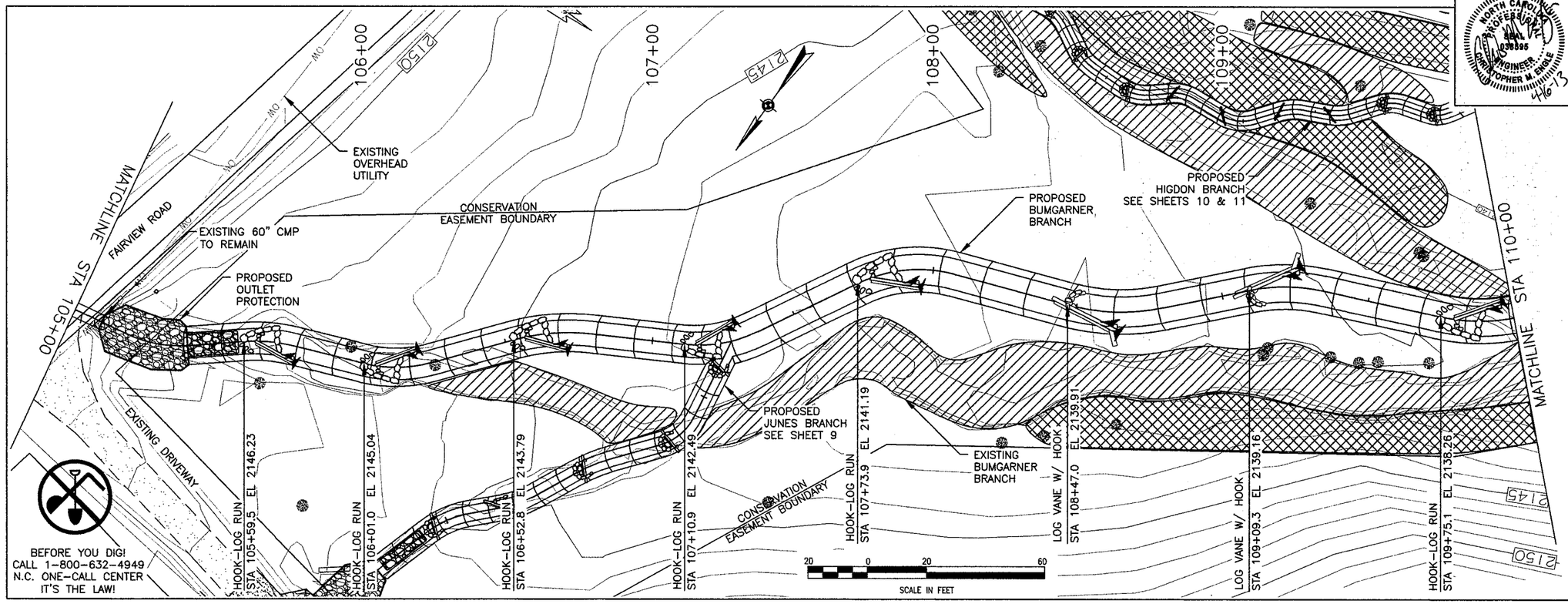
PHONE: (828) 658-3649 WWW.WOLFCREEKENG.COM

NORTH CAROLINA PROFESSIONAL SEAL 036595 ENGINEER CHRISTOPHER M. ENGLE 4-16-13

PROJECT	JUNES BRANCH RESTORATION PROJECT
OWNER	ENVIRONMENTAL BANC AND EXCHANGE
TITLE	PLAN & PROFILE

SCALE	AS NOTED	DRWN. BY	cme	PROJECT NO.	SHEET NUMBER
DATE	12/12/2012	CHKD. BY	SGG	1053	5

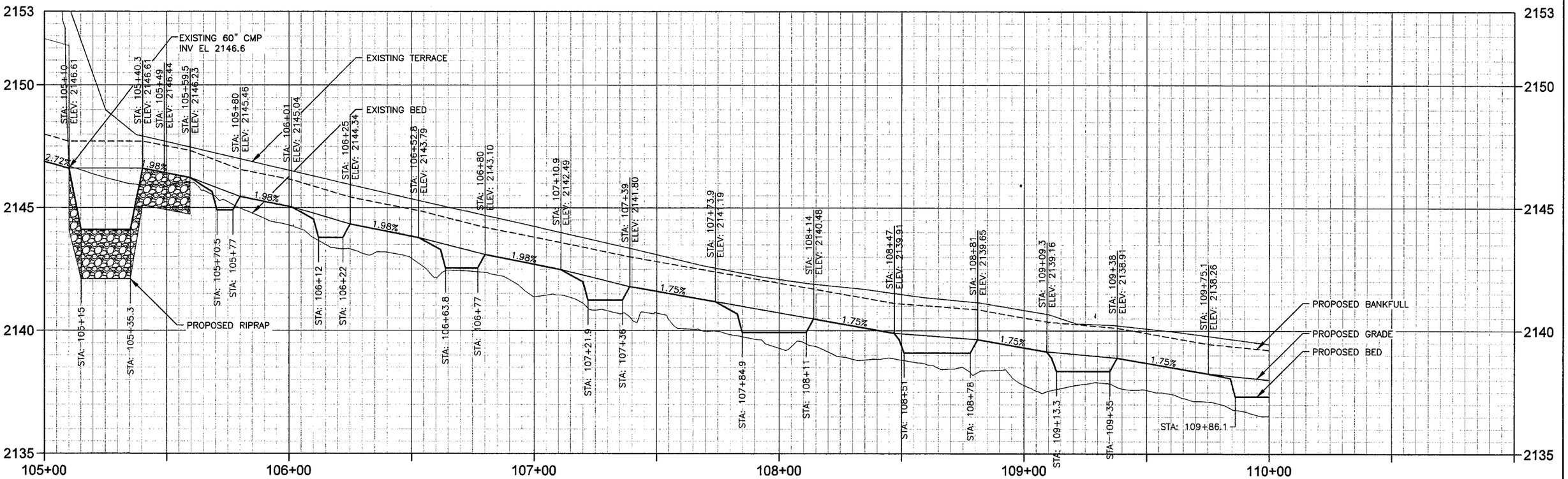
DATE	BY	REV.	DESCRIPTION
1/25/13	CME	1	ARMORED RIFFLE
4/16/13	CME	2	PROFILE LABELS



LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- CUT
- FILL
- PROPOSED ARMORED RIFFLE
- EXISTING FENCE
- TREE



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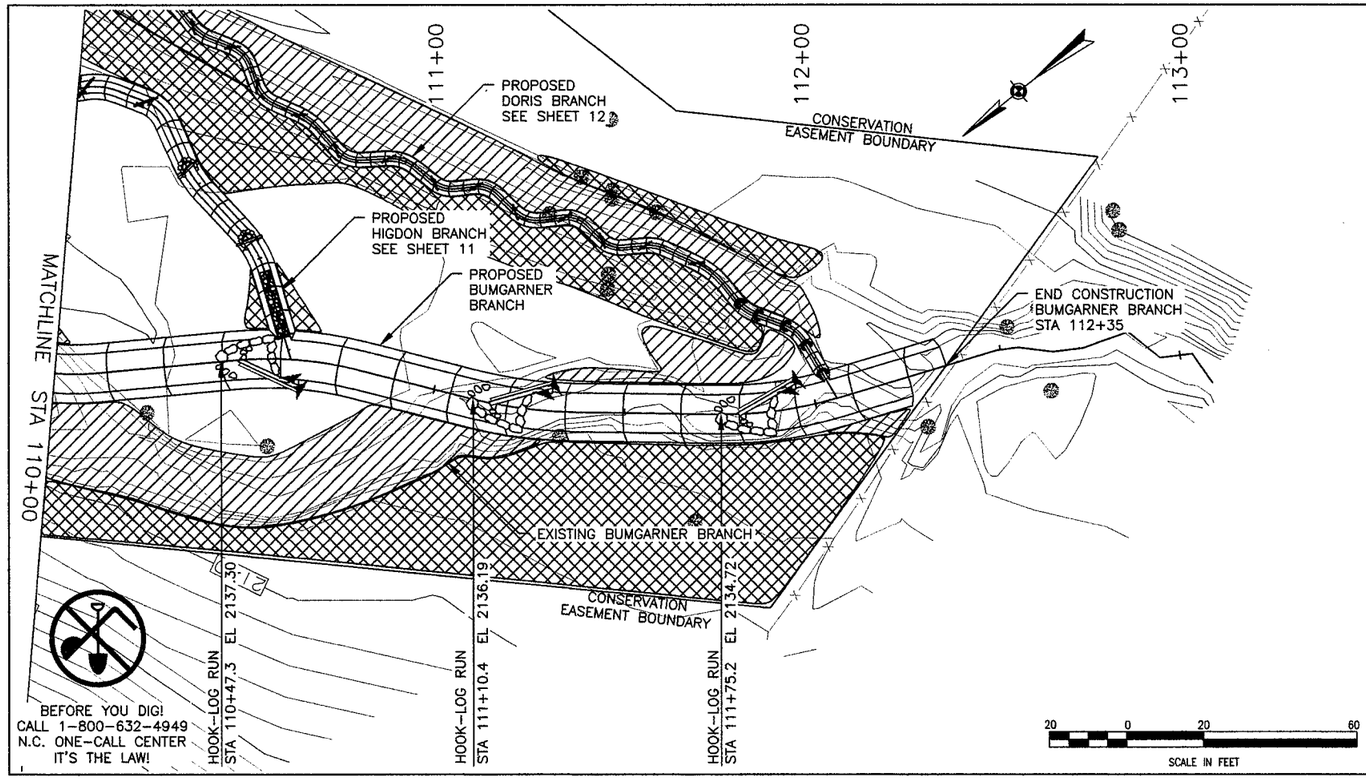
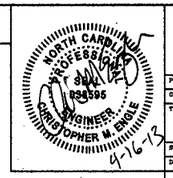
BUMGARNER BRANCH





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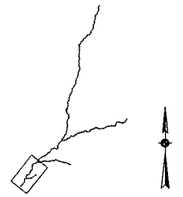
PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC AND EXCHANGE
TITLE **PLAN & PROFILE**

SCALE	AS NOTED	DRWN. BY cme	PROJECT NO. 1053	SHEET NUMBER 6
DATE	12/12/2012	CHKD. BY SGG		

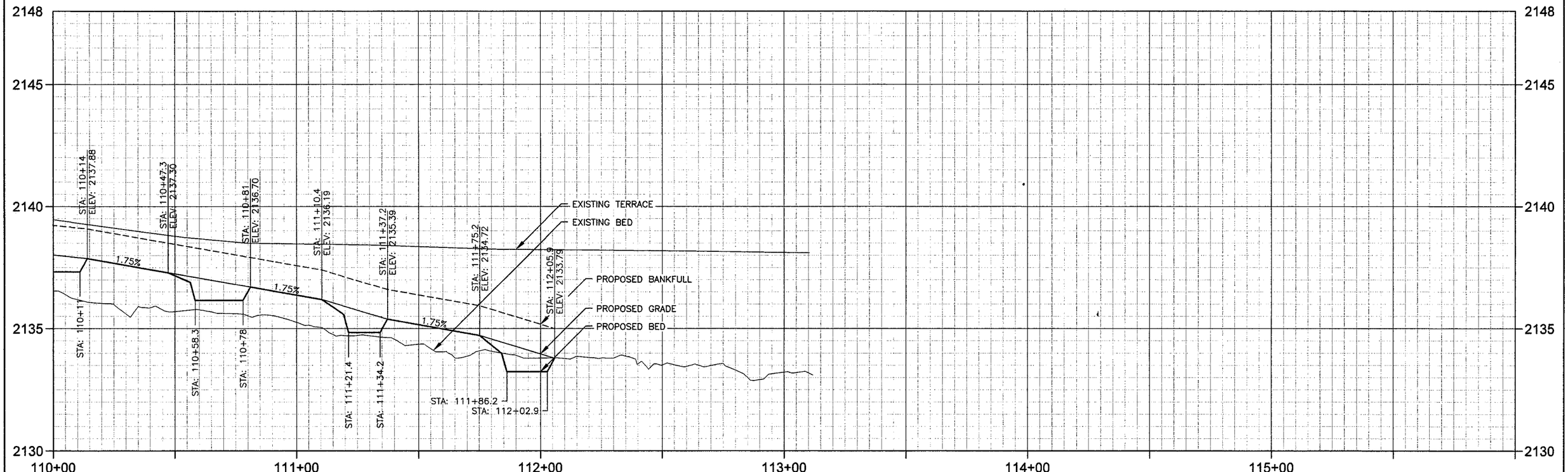
DATE	BY	REV.	DESCRIPTION
4/16/13	CME	2	PROFILE LABELS

LOCATION KEY



LEGEND

- PROPOSED STREAM RESTORATION
- CUT
- FILL
- PROPOSED ARMORED RIFFLE
- EXISTING FENCE
- TREE



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HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

BUMGARNER BRANCH

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PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC AND EXHANGE
TITLE **PLAN & PROFILE**

SCALE	AS NOTED	DRWN. BY	cme	PROJECT NO.	SHEET NUMBER
DATE	12/12/2012	CHKD. BY	SGG	1053	7

DATE	BY	REV.	DESCRIPTION
4/16/13	CME	2	PROFILE LABELS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 040150 CHRISTOPHER M. EAGLE 4-16-13

201+00 202+00 203+00 204+00

FAIRVIEW ROAD

BEGIN CONSTRUCTION JUNES BRANCH STA 200+97

CONSERVATION EASEMENT BOUNDARY

PROPOSED JUNES BRANCH

EXISTING JUNES BRANCH

MATCHLINE STA 205+00

EXISTING OVERHEAD UTILITY

BEFORE YOU DIG!
CALL 1-800-632-4949
N.C. ONE-CALL CENTER
IT'S THE LAW!

LOG SILL STA 201+18.3 EL 2176.68
LOG SILL STA 201+48.4 EL 2176.08
BOULDER ARCH W/ LOG STA 201+72.6 EL 2175.60
LOG SILL STA 202+01.3 EL 2174.72
LOG SILL STA 202+11.8 EL 2174.46
BOULDER ARCH W/ LOG STA 202+28.0 EL 2173.92
BOULDER ARCH W/ LOG STA 202+54.0 EL 2173.07
LOG SILL STA 202+77.8 EL 2172.30
LOG SILL STA 203+08.0 EL 2171.70
BOULDER ARCH W/ LOG STA 203+41.5 EL 2171.03
BOULDER ARCH W/ LOG STA 203+74.0 EL 2169.96
LOG SILL STA 204+07.1 EL 2168.94
BOULDER ARCH W/ LOG STA 204+40.3 EL 2168.28
LOG SILL STA 204+67.7 EL 2167.73
BOULDER ARCH W/ LOG STA 204+92.4 EL 2167.24

20 0 20 60
SCALE IN FEET

LOCATION KEY

LEGEND
- PROPOSED STREAM RESTORATION
- CUT
- FILL
- PROPOSED ARMORED RIFFLE
- EXISTING FENCE
- TREE

PROPOSED BANKFULL
PROPOSED GRADE
PROPOSED BED

STA: 200+97 ELEV: 2177.11
STA: 201+18.3 ELEV: 2176.68
STA: 201+36 ELEV: 2176.33
STA: 201+48.4 ELEV: 2176.08
STA: 201+60 ELEV: 2175.85
STA: 201+72.6 ELEV: 2175.60
STA: 201+88 ELEV: 2174.99
STA: 202+01.3 ELEV: 2174.72
STA: 202+14 ELEV: 2174.20
STA: 202+28 ELEV: 2173.92
STA: 202+41 ELEV: 2173.33
STA: 202+54 ELEV: 2173.07
STA: 202+67 ELEV: 2172.52
STA: 202+77.8 ELEV: 2172.30
STA: 202+88 ELEV: 2172.10
STA: 203+08 ELEV: 2171.70
STA: 203+26 ELEV: 2171.34
STA: 203+41.5 ELEV: 2171.03
STA: 203+57 ELEV: 2170.30
STA: 203+74 ELEV: 2169.96
STA: 203+91 ELEV: 2169.26
STA: 204+07.1 ELEV: 2168.94
STA: 204+22 ELEV: 2168.64
STA: 204+40.3 ELEV: 2168.28
STA: 204+56 ELEV: 2167.96
STA: 204+67.7 ELEV: 2167.73
STA: 204+79 ELEV: 2167.50
STA: 204+92.4 ELEV: 2167.24

STA: 201+22.3
STA: 201+33
STA: 201+52.4
STA: 201+57
STA: 201+79.6
STA: 201+85
STA: 202+08.5
STA: 202+11
STA: 202+35
STA: 202+38
STA: 202+60
STA: 202+64
STA: 202+81.8
STA: 202+85
STA: 203+12
STA: 203+23
STA: 203+48.5
STA: 203+54
STA: 203+81
STA: 203+86
STA: 204+11
STA: 204+19
STA: 204+44.3
STA: 204+53
STA: 204+71.7
STA: 204+76
STA: 204+86.4

EXISTING TERRACE
EXISTING BED

2.00%

2183 2180 2175 2170 2165 2178 2175 2170 2165 2160

200+00 201+00 202+00 203+00 204+00 205+00

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

HALF SIZE PLAN – HORIZONTAL: 1" = 40' VERTICAL:1" = 4'

JUNES BRANCH

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PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC AND EXCHANGE
TITLE **PLAN & PROFILE**

SCALE	AS NOTED	DRWN. BY	cme	PROJECT NO.	SHEET NUMBER
DATE	12/12/2012	CHKD. BY	SGG	1053	8

DATE	BY	REV.	DESCRIPTION
4/16/13	CME	2	PROFILE LABELS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 24805 CHRISTOPHER M. ENGLE 4-16-13

LOCATION KEY

LEGEND
- PROPOSED STREAM RESTORATION
- CUT
- FILL
- PROPOSED ARMORED RIFFLE
- EXISTING FENCE
- TREE

BEFORE YOU DIG!
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N.C. ONE-CALL CENTER
IT'S THE LAW!

SCALE IN FEET 20 0 20 60

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

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JUNES BRANCH

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PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC AND EXCHANGE
TITLE **PLAN & PROFILE**

SCALE	DESN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	cme	1053	9
DATE 12/12/2012	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION
1/25/13	CME	1	STREAM CROSSING

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. EAGLE 1-25-13

LOCATION KEY

LEGEND
- PROPOSED STREAM RESTORATION
- CUT
- FILL
- PROPOSED ARMORED RIFFLE
- EXISTING FENCE
- TREE

211+00 212+00 213+00 214+00 215+00

CONSERVATION EASEMENT BOUNDARY

EXISTING WETLANDS

PROPOSED JUNES BRANCH

PROPOSED TEMPORARY TREE PROTECTION FENCE

EXISTING JUNES BRANCH

PROPOSED PERMANENT STREAM CROSSING WITH 1 X 32' X 60" CMP & 2 X 32' X 24" CMP

PROPOSED OUTLET PROTECTION

PROPOSED BUMGARNER BRANCH SEE SHEET 5

REMOVE EXISTING 36" CMP

REMOVE APPROX 20' OF EXISTING ASPHALT DRIVEWAY

EXISTING DRIVEWAY

MATCHLINE STA 210+00

255

BEFORE YOU DIG!
CALL 1-800-632-4949
N.C. ONE-CALL CENTER
IT'S THE LAW!

BOULDER ARCH W/ LOG STA 210+07.6 EL 2153.59
BOULDER ARCH W/ LOG STA 210+37.3 EL 2152.57
LOG SILL STA 210+68.8 EL 2151.48
LOG SILL STA 211+00.3 EL 2151.09
LOG SILL STA 211+28.1 EL 2150.66
LOG SILL STA 211+56.4 EL 2150.23
BOULDER ARCH W/ LOG STA 211+87.9 EL 2149.74
BOULDER ARCH W/ LOG STA 212+24.0 EL 2148.48
BOULDER ARCH W/ LOG STA 212+60.8 EL 2147.16
BOULDER ARCH W/ LOG STA 212+96.7 EL 2145.94
BOULDER ARCH W/ LOG STA 213+92.0 EL 2144.86
LOG SILL STA 214+19.9 EL 2144.17
BOULDER ARCH W/ LOG STA 214+46.8 EL 2143.54
BOULDER ARCH W/ LOG STA 214+77.2 EL 2142.82
BOULDER ARCH W/ LOG STA 215+08.9 EL 2142.01

216
216

20 0 20 60
SCALE IN FEET

2158 2155 2150 2145 2140

STA: 210+07.6 ELEV: 2153.59
STA: 210+14.6
STA: 210+20
STA: 210+23 ELEV: 2152.85
STA: 210+37.3 ELEV: 2152.57
STA: 210+44.3
STA: 210+50
STA: 210+53 ELEV: 2151.79
STA: 210+68.8 ELEV: 2151.48
STA: 210+72.8
STA: 210+82
STA: 210+85 ELEV: 2151.32
STA: 211+00.3 ELEV: 2151.09
STA: 211+04.3
STA: 211+11
STA: 211+14 ELEV: 2150.88
STA: 211+28.1 ELEV: 2150.66
STA: 211+32.1
STA: 211+39
STA: 211+42 ELEV: 2150.45
STA: 211+56.4 ELEV: 2150.23
STA: 211+60.4
STA: 211+66
STA: 211+69 ELEV: 2150.03
STA: 211+87.9 ELEV: 2148.74
STA: 211+94.9
STA: 212+03
STA: 212+06 ELEV: 2149.04
STA: 212+24 ELEV: 2148.48
STA: 212+31
STA: 212+38
STA: 212+41 ELEV: 2147.78
STA: 212+60.8 ELEV: 2147.16
STA: 212+67.8
STA: 212+77
STA: 212+80 ELEV: 2146.46
STA: 212+96.7 ELEV: 2145.94
STA: 213+03.7 ELEV: 2144.23
STA: 213+63 ELEV: 2144.23
STA: 213+73.7 ELEV: 2145.23
STA: 213+92 ELEV: 2144.86
STA: 213+99
STA: 214+05
STA: 214+08 ELEV: 2144.40
STA: 214+19.9 ELEV: 2144.17
STA: 214+23.9
STA: 214+28.5
STA: 214+31.5 ELEV: 2143.85
STA: 214+46.8 ELEV: 2143.54
STA: 214+50.8
STA: 214+57
STA: 214+60 ELEV: 2143.16
STA: 214+77.2 ELEV: 2142.82
STA: 214+84.2
STA: 214+89
STA: 214+98 ELEV: 2142.35
STA: 215+08.9 ELEV: 2142.01
STA: 215+12.9
STA: 215+15.7 ELEV: 2141.71

2.00% 1.53% 3.10% 0.92%

EXISTING TERRACE
EXISTING BED

PROPOSED DRIVEWAY
EXISTING DRIVEWAY
REMOVE EXISTING 36" CMP
PROPOSED 60" CMP
INLET INV EL 2143.19
OUTLET INV EL 2142.73

PROPOSED RIPRAP

PROPOSED BANKFULL
PROPOSED GRADE
PROPOSED BED

PROPOSED WATER SURFACE ELEVATION BUMGARNER BRANCH

210+00 211+00 212+00 213+00 214+00 215+00

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

JUNES BRANCH

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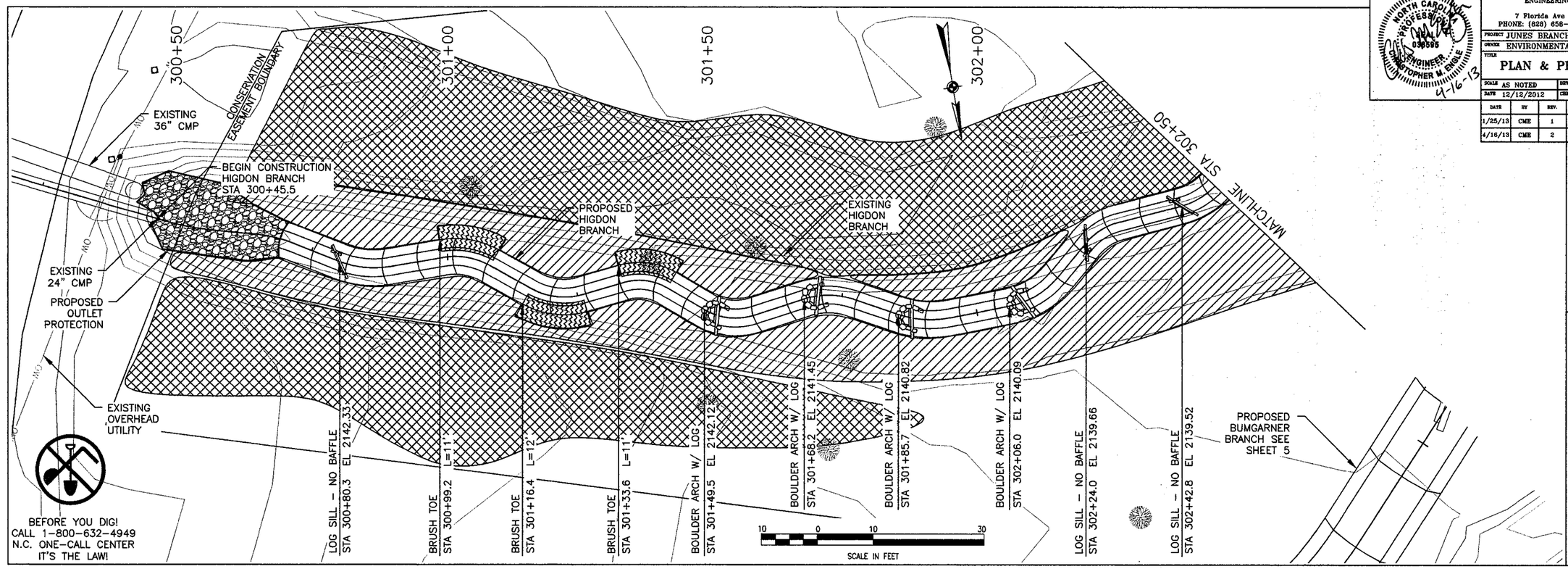
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036595 CHRISTOPHER M. ENGLE 4-16-13

PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC AND EXCHANGE
TITLE **PLAN & PROFILE**

SCALE	AS NOTED	DRWN. BY	cme	PROJECT NO.	SHEET NUMBER
DATE	12/12/2012	CHKD. BY	SGG	1053	10

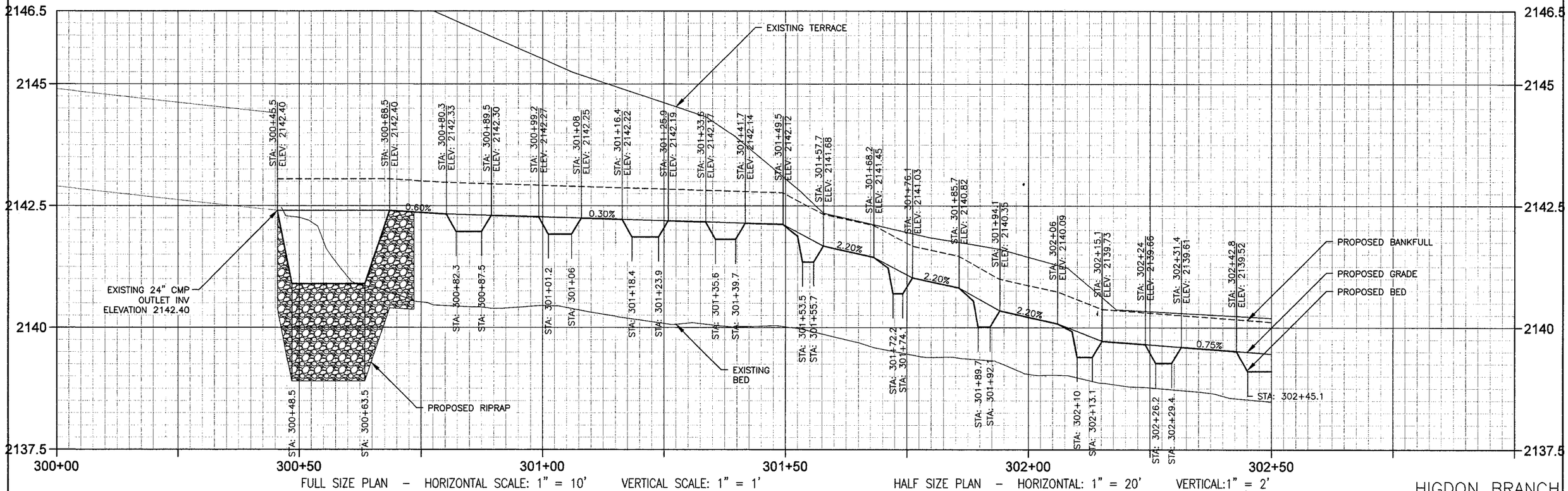
DATE	BY	REV.	DESCRIPTION
1/25/13	CME	1	OUTLET PROTECTION
4/16/13	CME	2	GRADING



LOCATION KEY

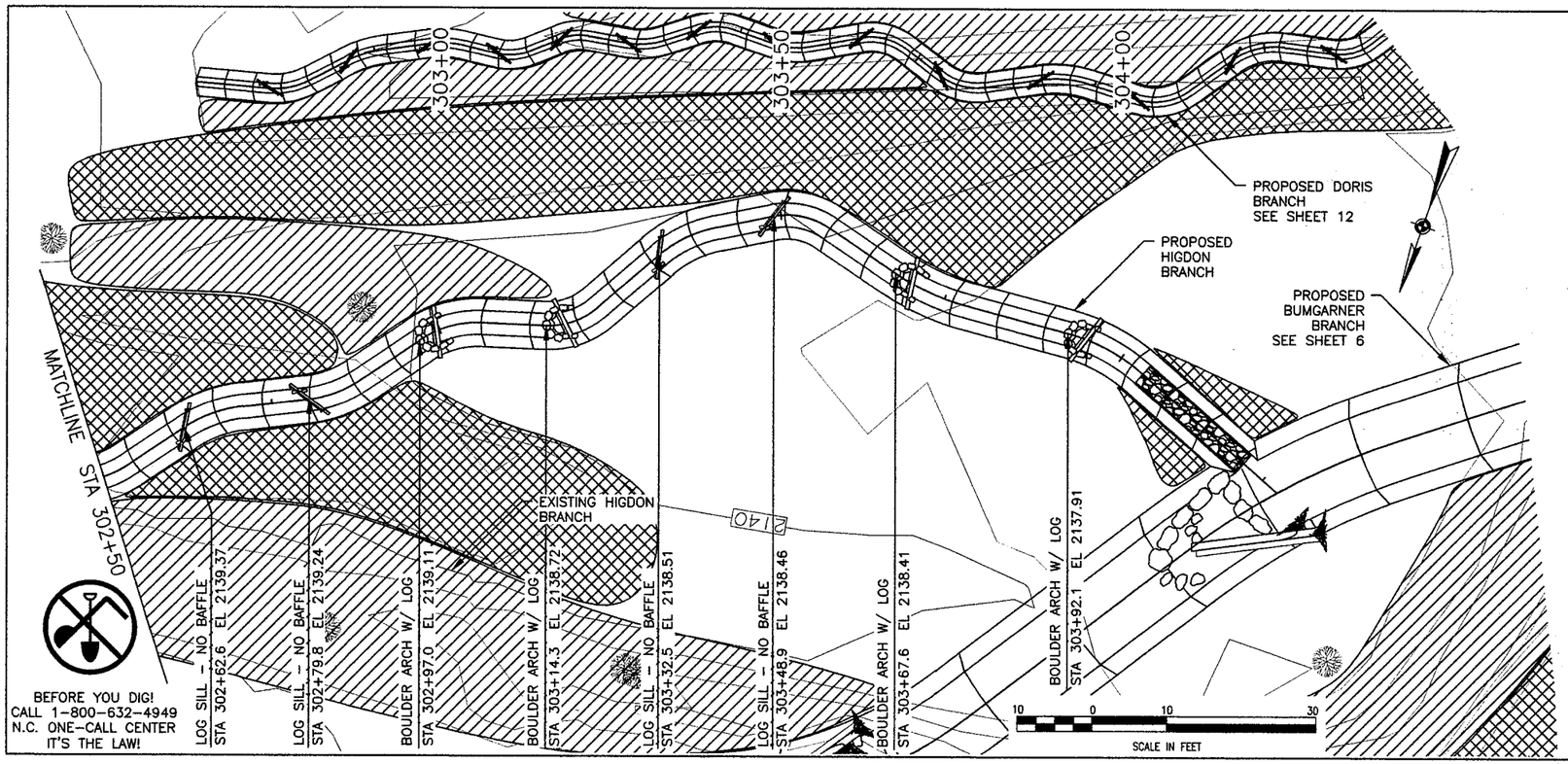
LEGEND

- PROPOSED STREAM RESTORATION
- CUT
- FILL
- PROPOSED ARMORED RIFFLE
- EXISTING FENCE
- TREE



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

HIGDON BRANCH



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PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC AND EXCHANGE
TITLE **PLAN & PROFILE**

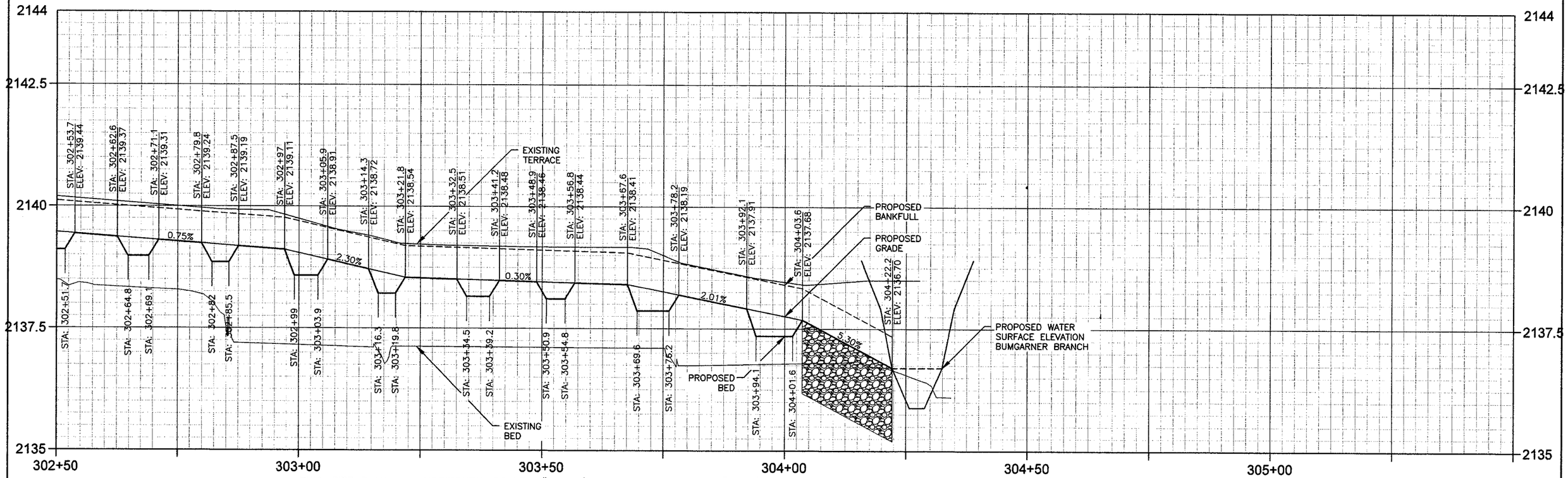
SCALE	AS NOTED	DRWN. BY	cme	PROJECT NO.	SHEET NUMBER
DATE	12/12/2012	CHKD. BY	SGG	1053	11

DATE	BY	REV.	DESCRIPTION
1/25/13	CME	1	ARMORED RIFFLE

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038595 CHRISTOPHER M. ENGLE 1-25-13

LOCATION KEY

LEGEND
- PROPOSED STREAM RESTORATION
- CUT
- FILL
- PROPOSED ARMORED RIFFLE
- EXISTING FENCE
- TREE



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

HIGDON BRANCH

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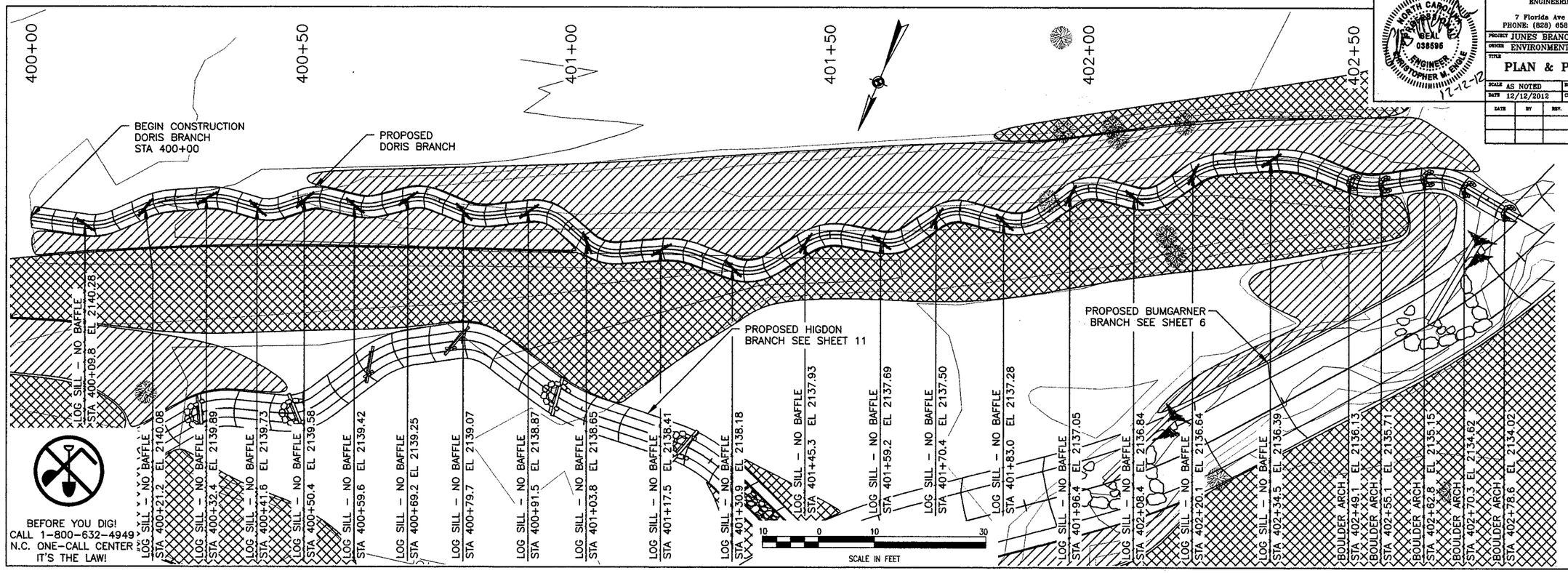
NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. EAGLE 12-12-12

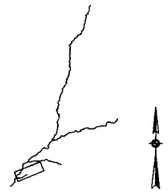
PROJECT	JUNES BRANCH RESTORATION PROJECT
OWNER	ENVIRONMENTAL BANC AND EXCHANGE
TITLE	PLAN & PROFILE

SCALE	AS NOTED	DRWN. BY	cjne	PROJECT NO.	SHEET NUMBER
DATE	12/12/2012	CHKD. BY	SGC	1053	12

DATE	BY	REV.	DESCRIPTION

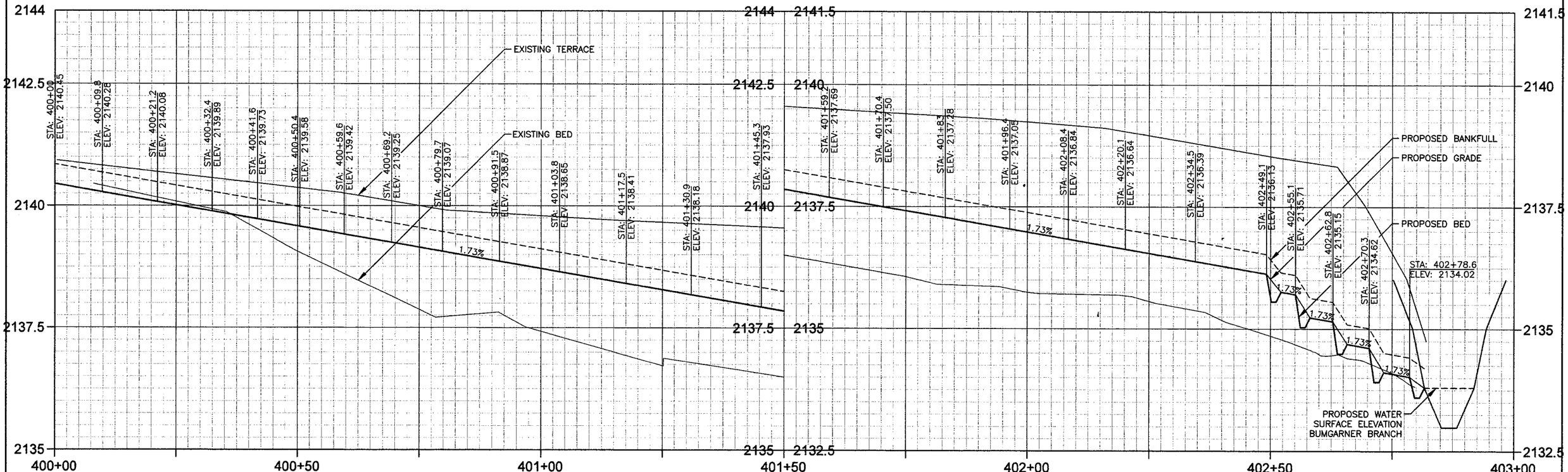


LOCATION KEY



LEGEND

- PROPOSED STREAM RESTORATION
- CUT
- FILL
- PROPOSED ARMORED RIFFLE
- EXISTING FENCE
- TREE



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

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

DORIS BRANCH

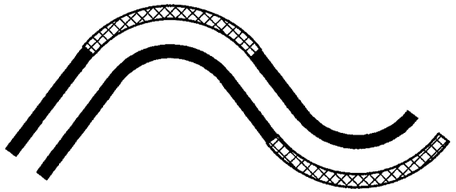
Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
LICENSE NO. P-0417
7 Florida Ave Waynesville, NC 28787
PHONE: (828) 658-3649 WWW.WOLFCREEKENG.COM

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE 12-12-12

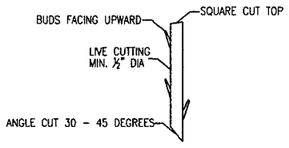
PROJECT: JUNES BRANCH RESTORATION PROJECT
OWNER: ENVIRONMENTAL BANC AND EXCHANGE
TITLE: **PLANTING DETAILS**

SCALE	AS NOTED	DRWN. BY	cme	PROJECT NO.	DRAWING NUMBER
DATE	12/12/2012	CHKD. BY	SGG	1049	P-1

DATE	BY	REV.	DESCRIPTION

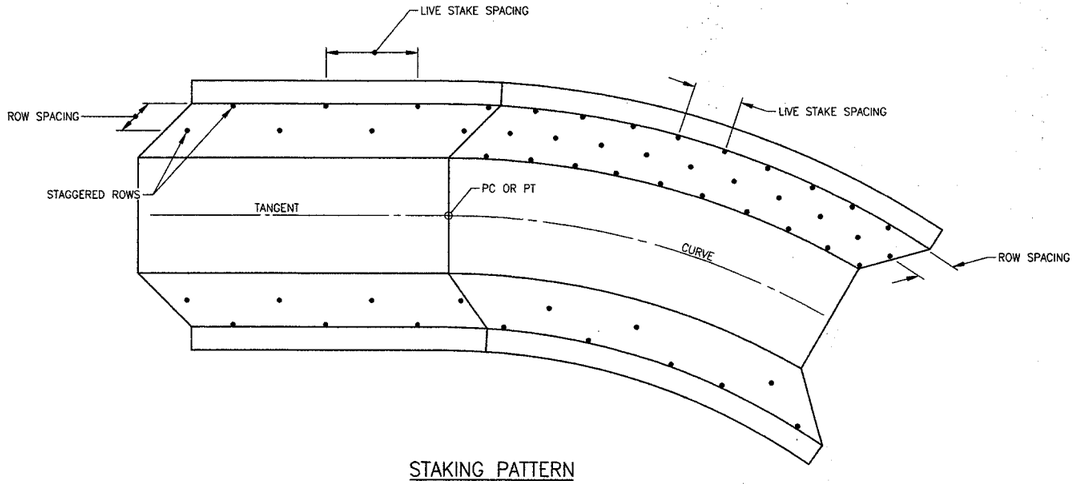


PLAN VIEW



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



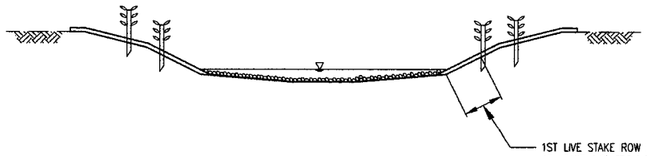
STAKING PATTERN
NOT TO SCALE

PLANTING NOTES:

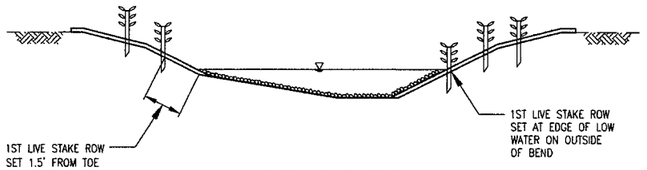
TEMPORARY AND PERMANENT SEED
1. ALL DISTURBED AREAS WILL BE STABILIZED USING MULCH AND TEMPORARY SEED TO PROVIDE ADEQUATE GROUND COVER AND CONDITION THE SOIL.
2. MULCH MUST BE ADDED TO ACHIEVE 80% COVERAGE (ROUGHLY 2 TONS/ACRE FOR WHEAT STRAW)
3. A FERTILITY SOIL TEST SHALL BE USED TO DETERMINE FERTILIZER 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	-	-	-
TOTAL						
BUFFER						
Black Cherry	*Prunus serotina*	overstory	Bare Root	68	5.58	379
Red Oak	*Quercus rubra*	overstory	Bare Root	68	5.58	379
Dogwood	*Cornus florida*	overstory	Bare Root	68	5.58	379
Green Ash	*Fraxinus pennsylvanica*	overstory	Bare Root	68	5.58	379
Ironwood	*Carpinus caroliniana*	overstory	Bare Root	68	5.58	379
River Birch	*Betula nigra*	overstory	Bare Root	68	5.58	379
Sycamore	*Plantanus occidentalis*	overstory	Bare Root	68	5.58	379
Tulip Poplar	*Liriodendron tulipifera*	overstory	Bare Root	68	5.58	379
White Oak	*Quercus alba*	overstory	Bare Root	68	5.58	379
Witch Hazel	*Hamamelis virginiana*	midstory	Bare Root	68	5.58	379
TOTAL				680		3794

COMMON NAME	SCIENTIFIC NAME	SEEDING DENSITY (lbs/acre)	% MIX
PERMANENT MIX			
Switchgrass	*Panicum virgatum*	6	15
Broom Sedge	*Andropogon viginicus*	6	15
Indian Grass	*Sorhgastrum nutans*	8	20
Eastern Gamma Grass	*Tripsacum dactyoides*	10	25
Joe-Pye Weed	*Eupatorium fistulosum*	4	10
Deer tongue	*Panicum clandestinum*	6	15
	Totals	40	100%

PLANTING DATES	SEED TYPE	SEEDING DENSITY lbs/acre
TEMPORARY MIX		
Jan 1 - May1	Wheat or Rye Grain	50
May 1 - August 15	Brown Top Millet	20
Aug 15-Dec 31	Wheat or Rye Grain	50

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

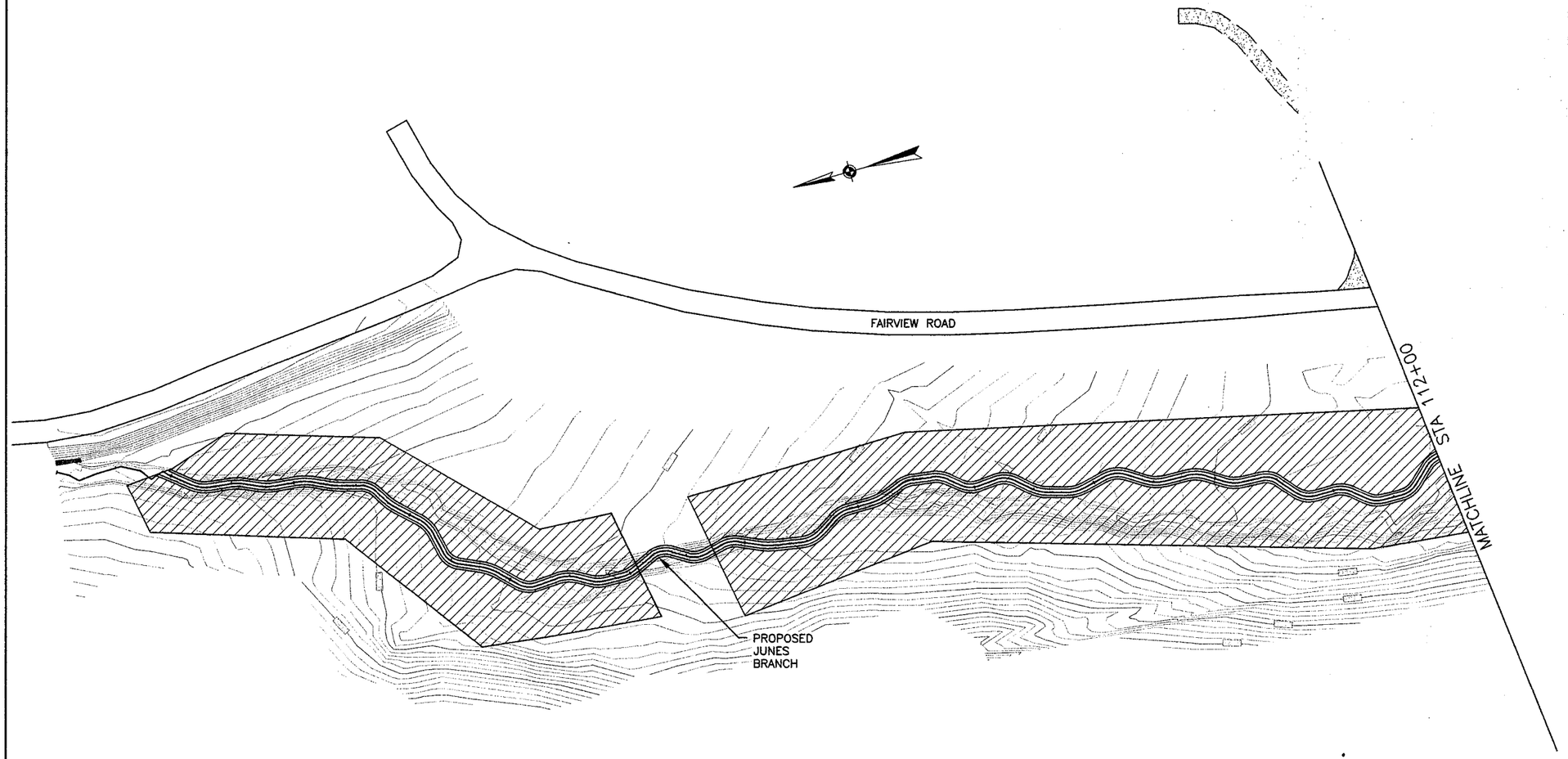
PROJECT JUNES BRANCH RESTORATION PROJECT
OWNER ENVIRONMENTAL BANC AND EXCHANGE
TITLE **PLANTING PLANS**

SCALE	DRWN. BY	PROJECT NO.	DRAWING NUMBER
AS NOTED	cjne	1053	P-2
DATE 12/12/2012	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE
12-12-12

LOCATION KEY



BUFFER PLANTING AREA

EXISTING WETLAND VEGETATION, NO ADDITIONAL PLANTINGS REQUIRED

50 0 50 150
SCALE IN FEET

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NORTH CAROLINA PROFESSIONAL SEAL 038695 ENGINEER CHRISTOPHER W. ENGLE
4-16-13

PROJECT	JUNES BRANCH RESTORATION PROJECT
OWNER	ENVIRONMENTAL BANC AND EXCHANGE
TITLE	PLANTING PLANS

SCALE	DRWN. BY	PROJECT NO.	DRAWING NUMBER
AS NOTED	mam	1053	P-3
DATE 12/12/2012	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION
4/16/13	MAM	2	BUMGARNER CROSSING

LOCATION KEY

BUFFER PLANTING AREA

EXISTING WETLAND VEGETATION, NO ADDITIONAL PLANTINGS REQUIRED

PROPOSED PERMANENT STREAM CROSSING (PIPED)

PROPOSED BUMGARNER BRANCH

EXISTING 60" CMP

FAIRVIEW ROAD

EXISTING 24" AND 36" CMP

PROPOSED HIGDON BRANCH

EXISTING WETLANDS 1

EXISTING WETLANDS 2

PROPOSED DORIS BRANCH

NO PLANTINGS WITHIN EASEMENT EXCLUSION

MATCHLINE STA 112+00

PROPOSED JUNES BRANCH

PROPOSED PERMANENT STREAM CROSSING (PIPED)

PROPOSED BUMGARNER BRANCH

50 0 50 150
SCALE IN FEET