Baseline Monitoring Document and As-Built Baseline Report

FINAL

Project Name: Junes Branch Stream Restoration
EEP Contract No.: 003979
EEP Project No.: 95027

Jackson County, North Carolina
Data Collected: 06/10/2014 – 06/24/2014
Date Submitted: 09/09/2014

Submitted to:

Ecosystem Enhancement PROGRAM

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EXECUTIVE SUMMARY

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 former agricultural land and consists of four streams: Bumgarner Branch, Junes Branch, Higdon Branch, and Doris Branch.

Through the North Carolina Ecosystem Enhancement Program full-delivery process, Environmental Banc and Exchange, LLC generated a total of 3, 162 stream mitigation units through Priority I restoration of the above listed streams. The goal of the project was to address stressors identified in the Targeted Local Watershed such as improving water quality, aquatic and terrestrial habitat, and flood flow attenuation. The goals were addressed by restoring stable channel morphology and sediment transport capacity, improving stream bed form and habitat, improving stream bank stabilization, and providing riparian buffer restoration by re-establishing a native plant community within the easement.

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 contributed to unstable channel characteristics and degraded water quality. Spoil piles observed on-site indicated that historic wetlands were likely drained in order to maximize agricultural production.

The project site was delineated into five components totaling 3,162 feet: Bumgarner Branch I (631 feet), Bumgarner Branch II (501 feet), Junes Branch (1,374 feet), Higdon Branch (376 feet), and Doris Branch (280 feet). All components were restored using a Priority I approach. All five components were designed as a Type B4 stream. These channel configurations provide a stable and natural form in the Type II colluvial valleys in which the streams are found. The installation of brush, rock, and wood structures were utilized throughout the restored reaches to provide bed and bank stability as well as aquatic habitat. Riparian buffer restoration consisted of planting native herbaceous and woody plants within the easement area.

A baseline stream and topographic survey was performed between June l0 and June 24, 2014 to document baseline conditions at the site. In general, stream pattern, profile, and dimension were relatively similar to those values outlined in the design. Bumgarner I had a noticeably steeper mean riffle slope of 0.039 than the design slope of 0.019. However, the as-built water surface slope of Bumgarner I was comparable to the design water surface slope at 0.023 and 0.024, respectively. Based on the as-built conditions, all channels classify as Type Bc streams with high entrenchment ratios pushing it towards a C.

Additionally a vegetation survey was conducted on June 6, 2014 to document planted vegetation after construction. Results from the initial vegetation survey indicate that planted stem density ranges between 526 to 850 stems per acre (Table 7). The mean stem density across all plots is 704 stems per acre. A total of 12 species were documented in the plots with the number of species within each plot ranging from 2 - 7.

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1.0 PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1. Location and Setting

The Junes Branch Restoration Site (Site) is located in central Jackson County approximately 2 miles east of Sylva, NC (Figure 1). The site encompasses 5.8 acres of formerly agricultural land and includes portions of Bumgarner Branch and three unnamed tributaries that for purposes of the project are referred to as Junes Branch, Higdon Branch, and Doris Branch. The 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. The site watershed is characteristic of the Blue Ridge region with moderate rainfall with annual precipitation averaging 52.9 inches. Elevation within the site ranges from 2,200 feet at the northwestern extent, to 2,150 feet along Junes Branch. The drainage area of Bumgarner Branch at the downstream end of the Site is 1.03 square miles (668 acres). Land use within the watershed is predominately forested (68%) with the remaining land use composed of low-density residential (21%) and agricultural (11%).

1.2. Project Goals and Objectives

The project goals address stressors identified in the Targeted Local Watershed (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.

1.3. Project Structure, Restoration Type and Approach

1.3.1. Project Structure

Construction of the Junes Branch Restoration Project produced a total of 3,162 feet of restoration as outlined in Table 1 and depicted in Figure 2. The project is split into five components consisting of Bumgarner Branch I (631 feet), Bumgarner Branch II (501 feet), June's Branch (1,374 feet), Higdon Branch (376 feet), and Doris Branch (280 feet). The approved mitigation plan indicated that a total of 3,093 feet of restoration would be produced by the Project, differing from the as-built length by 69 feet. The original footage included in the mitigation plan was an estimate based on the design. The overall footage likely increased as a result of the combination of a longer flow path of the thalweg through some structures at low-flow, as well as the inherent variability involved with the construction of a project.

1.3.2. Restoration Type and 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 used a 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 stemmed from the observations that this section of stream was not excessively incised and maintained 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 was the nature of the anticipated channel adjustments. Since the existing channel bed width was only 3 feet, it was expected that stable channel forms would not develop until the channel bed widened to at least 8 feet. Channel widening would have accelerated as successional woody vegetation replaced 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 has not reached a stable cross section and exhibits evidence of bank scour. If this progression in channel form was permitted to occur through Reach 1a, it is estimated that approximately 2,500 ft^3 of soil (150 tons) would be eroded from the banks and transported to downstream reaches. Additionally, a temporal loss in ecological recovery would have been associated with this scenario since it can be expected that this process would have likely taken years if not decades.

The approach taken was for complete reconstruction of a Type B4 stream. This provides for construction of the proper cross sectional geometry that reduces stress on the banks and eliminates bank scour. Additionally, reconstruction provides 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 provide immediate habitat features and a dramatic functional lift.

The case for restoration on Reach 1b was 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 raise the channel bed to reconnect the channel to the floodplain and restore connectivity for passage of aquatic life through the culvert.

Reach 2 utilized a 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 was not a stated goal of this project, a Priority I approach does provide the opportunity to enhance existing wetland and floodplain groundwater hydrology.

June's Branch

Junes Branch utilized a Priority I 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 utilized a Priority I and Priority II approach for restoration as a Type B4 and B4c stream. The case for restoration on Higdon Branch was 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 have been stabilized with local treatments. The overriding issue affecting ecological function on this reach was extreme topographic separation of Higdon Branch from the adjacent floodplains caused by the agricultural ditching of the stream. This separation was 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 was recommended for Higdon Branch. A Priority II approach was 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 was restored as a Type B4 stream. The case for restoration of Doris Branch was based solely on the potential to improve ecological conditions. Raising the bed of Doris Branch improved groundwater hydrology in the adjacent wetlands and removal of the adjacent spoil berm reconnected Doris Branch and associated wetlands to the Bumgarner Branch floodplain.

1.4. Project History, Contacts and Attribute Data

The project was first identified as a full-delivery mitigation project for the North Carolina Ecosystem Enhancement Program by Environmental Banc and Exchange, LLC. Project planning began in the fall of 2011 with the final mitigation plan completed in April 2013. Construction and planting of the site was completed in May 2014. Project activities, reporting dates, project contacts, and background information are outlined in Tables 2-4 (Appendix A).

2.0 SUCCESS CRITERIA

2.1. Morphological 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.

2.1.1. 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.

2.1.2. 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.

2.1.3. 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.

2.1.4. 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 vegetation 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.

2.1.5. 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.

2.2. Vegetation

Riparian vegetation monitoring shall be conducted for a minimum of five 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.

3.0 MONITORING PLAN

Monitoring for stream stability, stream hydrology, and vegetation will be monitored annually for five years following the initial Baseline and As-Built Report. Annual monitoring requirements are based on the U.S. Army Corp of Engineers *Stream Mitigation Guidelines* document (USACE 2003) and supplemental requirements listed in the NCEEP *Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for Stream and Wetland Mitigation* guidance document dated January 1, 2010 (NCEEP 2010). Establishment, collection, and summarization of data collected will be in accordance with the NCEEP guidance document *Monitoring Report Template Version 1.3 (1/15/10)*

3.1. Stream Channel Stability and Geomorphology

A total of 15 cross-sections, including 8 riffles and 7 pools, were installed upon completion of construction and will be monitored annually. The total number of cross-sections include three on Bumgarner I, two on Bumgarner II, six on Junes Branch, two on Higdon Branch, and two on Doris Branch.

A total of 3,050 feet of channel will be surveyed annually. This includes 631 feet on Bumgarner I, 543 feet on Bumgarner II, 1,212 feet on Junes Branch, 376 feet on Higdon Branch, and 288 on Doris Branch. Data collected from annual monitoring will be compared with the as-built conditions to document the current state of the channel and any trends in the stream profile occurring throughout the monitoring period. The start and finish locations of each longitudinal profile reach were marked with rebar and PVC conduit. Both cross-sections and longitudinal profile data will be collected using a total station.

3.2. Stream Hydrology

A total of two crest gauges were installed on site. Crest gauges will be monitored quarterly to document highest stage for the monitoring interval and verify occurrences of bankfull events. In addition, observations of wrack and depositional features in the floodplain will be documented with photos.

3.3. Vegetation

Five vegetation monitoring plots, approximately 0.025 acres individually, were established based on guidance given in the *CVS-EEP Protocol for Recording Vegetation Version 4.2* (Lee et al. 2008). Data was collected using the Level I protocol during initial baseline monitoring to document baseline conditions immediately after construction and planting. Subsequent annual vegetation will use the Level II protocol. Annual monitoring will determine planted vegetative success and the overall trajectory of woody plant restoration and regeneration at the site. Vegetation monitoring plot corners were marked with t-posts and PVC conduit.

3.4. Permanent Photo Locations

Permanent photo stations were established at each cross-section to digitally document annual conditions of the left and right banks. Each vegetation monitoring plot includes a photo station taken diagonally from the origin towards the opposite plot corner. Additionally, 14 permanent photo stations were established throughout the project area to provide representative digital documentation of stream features and vegetation conditions. Permanent photo stations were marked with labeled wooden stakes and red flagging tape.

3.5. Visual Assessment

Visual stream assessments will occur during annual monitoring to summarize performance percentages of morphological and structural features. Visual vegetation assessments will occur to catalog the extent and type of vegetation issue areas as compared to the total planted acreage within the project site.

3.6. Maintenance and Contingency

Equinox Environmental will monitor the site on behalf of EBX 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:

- *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.
- *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 Boundaries*- 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.

4.0 BASELINE CONDITIONS

A baseline survey was performed between June l0 and June 24, 2014 to document baseline conditions at the site. A vegetation survey was conducted on June 6, 2014 to document planted vegetation after construction for future comparison.

Summary tables, cross-section plots, and longitudinal plots related to stream morphology are located in Appendix B. In general, the pattern, profile, and dimension were relatively similar to those values outlined in the design. Bumgarner I had a noticeably steeper mean riffle slope of 0.039 than the design slope of 0.019. However, the as-built water surface slope of Bumgarner I was comparable to the design water surface slope at 0.023 and 0.024, respectively. All components of the project were designed as Type B4 and B4c channels based on the Rosgen classification system. As-built data indicates that all channels classify as Bc streams with high entrenchment ratios more similar to Type C streams. The substrate modifier will be added in MY1 when the initial substrate data is collected

Vegetation data, summary tables, and plot photos are located in Appendix C. Results from the initial vegetation survey indicate that planted stem density ranges between 526 to 850 stems per acre (Table 7). The mean stem density for the entire site is 704 stems per acre. A total of 12 species were documented within the plots with the number of species within each plot ranging from 2 - 7.

5.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm)

US Army Corps of Engineers (USACE). 2003. *Stream Mitigation Guidelines, April 2003,* Wilmington District, NC

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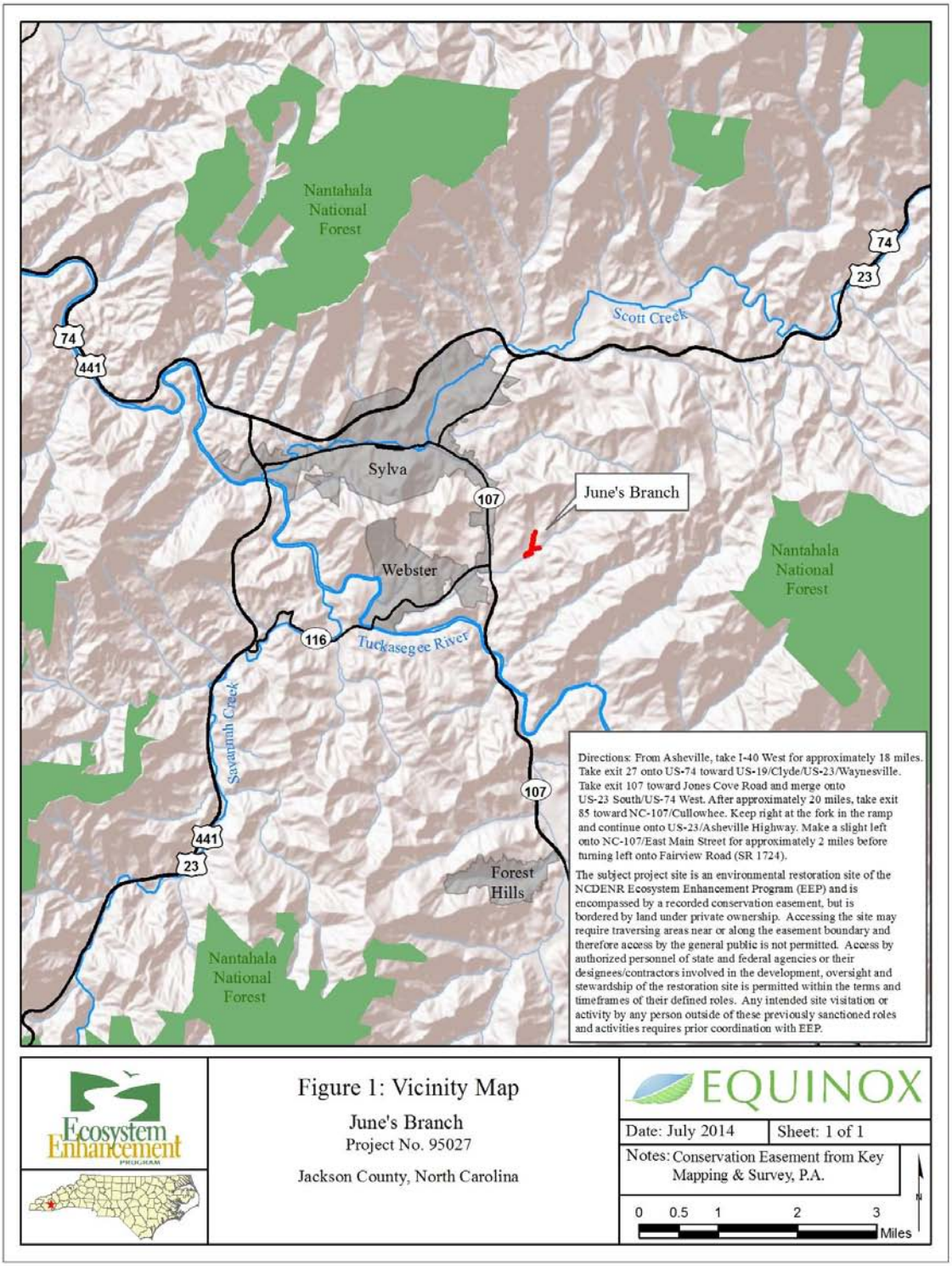
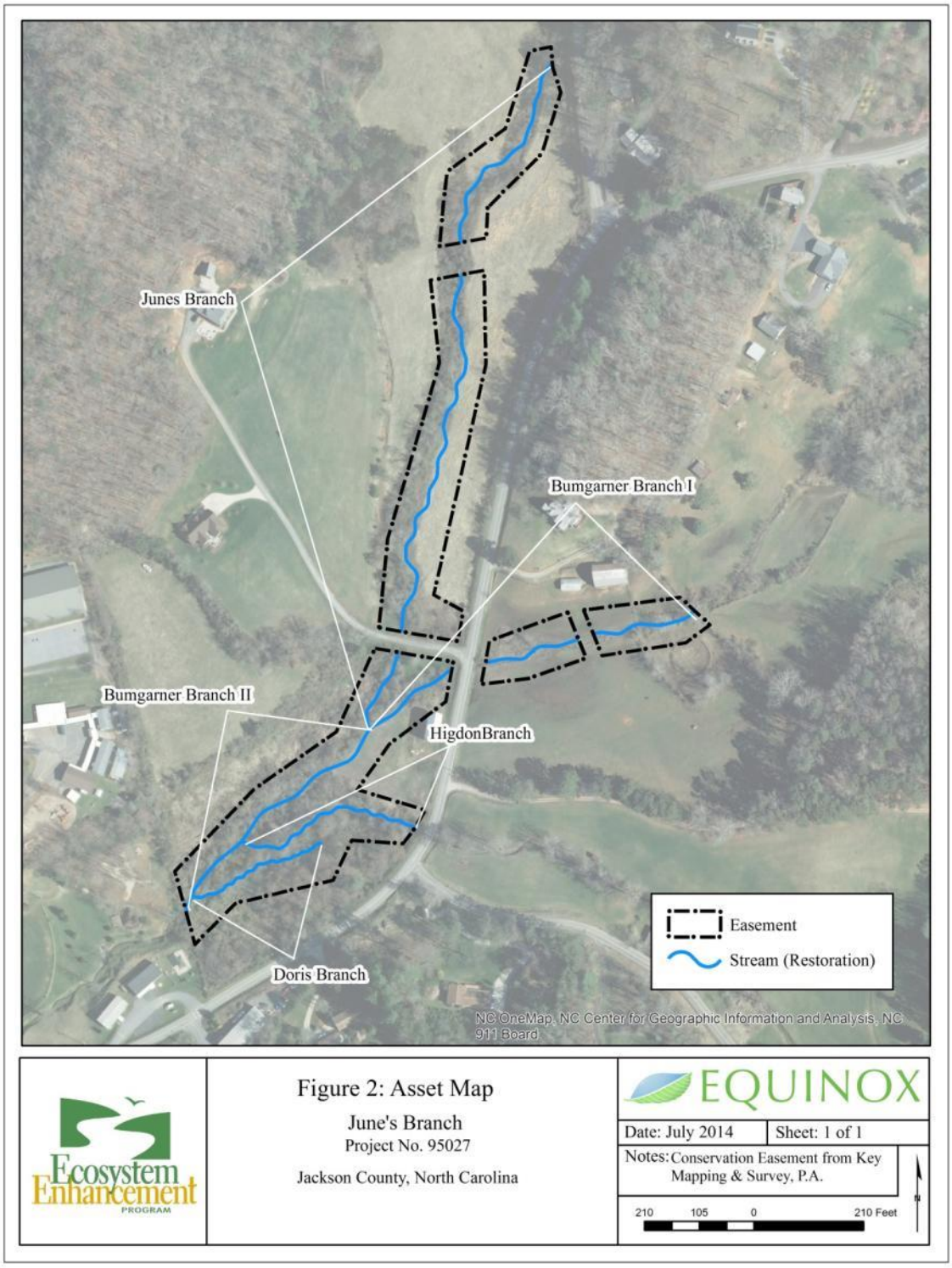
Appendix A
General Tables and Figures


Nantahala National Forest
74
23
Scott Creek
74
441
Sylva
107
June's Branch
Webster
Nantahala National Forest
116
Tuckasegee River
Savannah Creek
107
441
23
Forest Hills
Nantahala National Forest
Directions: 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 subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP.
Ecosystem Enhancement
Figure 1: Vicinity Map
June's Branch
Project No. 95027
Jackson County, North Carolina
EQUINOX
Date: July 2014
Sheet: 1 of 1
Notes: Conservation Easement from Key Mapping & Survey, P.A.
0 0.5 1 2 3
Miles


Junes Branch
Bumgarner Branch I
Bumgarner Branch II
HigdonBranch
Doris Branch
Easement
Stream (Restoration)
NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board
Ecosystem Enhancement PROGRAM
Figure 2: Asset Map
June's Branch
Project No. 95027
Jackson County, North Carolina
EQUINOX
Date: July 2014
Sheet: 1 of 1
Notes: Conservation Easement from Key Mapping & Survey, P.A.
210 105 0 210 Feet
N

Appendix A

Table 1. Project Components and Mitigation Credits
Junes Branch / Project Number 95027

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	**3,162**	-	-	-	-	-	-	-	-

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+21 - 107+49	610	PI	R	631	1:1
Bumgarner Branch 2	107+49 - 112+92	550	PI	R	501	1:1
June's Branch	200+97 - 215+77	1311	PI	R	1374	1:1
Higdon Branch	300+45 - 304+27	530	PI	R	376	1:1
Doris Branch	400+00 - 402+88	260	PI	R	280	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	3,162	-	-	-	-	-
Enhancement	-	-	-	-	-	-
Enhancement I	-	-	-	-	-	-
Enhancement II	-	-	-	-	-	-
Creation	-	-	-	-	-	-
Preservation	-	-	-	-	-	-
High Quality Preservation	-	-	-	-	-	-

BMP Elements

Element	Location	Purpose/Function	Notes
FB	Entire Site	Protect Stream	

[1]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

Table 2. Project Activity and Reporting History Junes Branch / Project Number 95027		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Mitigation Plan	Aug-12	April-2013
Final Design - Construction Plans	N/A	April-2013
Construction	N/A	June-2014
Temporary S&E Mix Applied to Entire Project Area		May-14
Permanent Seed Mix Applied		May-14
Containerized and B&B Plantings		May-14
Baseline Monitoring Document (Year 0 Monitoring - Baseline)	July-2014	July-2014
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contacts	
Junes Branch Stream Restoration Site – EEP Project # 95027	
Prime Contractor	Environmental Banc & Exchange, LLC 909 Capability Drive, Suite 3100 Raleigh, North Carolina 27606 David Godley (919) 829-9909
Designer	Wolf Creek Engineering 12-1/2 Wall St., Suite C Asheville, North Carolina 28801 Grant Ginn (828) 449-1930 ext 102
Construction Contractor	Northstate Environmental 2889 Lowery Street Winston Salem, North Carolina 27101 Darrell Westmoreland (336) 725-2010
Planting Contractor	Northstate Environmental 2889 Lowery Street Winston Salem, North Carolina 27101 Darrell Westmoreland (336) 725-2010
As-built Surveys	Kee Mapping and Surveying PO Box 2566 Asheville, North Carolina 28802 Phillip B. Key (828) 575-9021
Seeding Mix Source	Green Resource 5204 Highgreen Court Colfax, North Carolina 27235 (336) 855-6363
Bare Root Seedlings	Dykes & Son Nursery 825 Maude Etter Road McMinnville, Tennessee (931) 668-8833
Live Stakes	Foggy Mountain Nursery 797 Helton Creek Road Lansing, North Carolina 28643 (336) 384-5323
Monitoring Performers (Y0)- 2013	Equinox Environmental 37 Haywood St. Asheville, North Carolina 28801 Hunter Terrell (828) 253-6856

Appendix A

Table 4. Project Baseline Information and Attributes

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	6010203	USGS Hydrologic Unit 14-digit	6010203020010
DWQ Sub-basin	4/4/2002		
Project Drainage Area (acres)	668		
Project Drainage Area Percentage of Impervious Area	<5%		
CGIA Land Use Classification	2.01.03 Hay and Pasture Land		

Reach Summary Information

Parameters	Bumgarner Br. I	Bumgarner Br. II	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	2.20%	2.20%	2.30%		
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%

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%	

Regulatory Considerations

Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States – Section 404	Yes	Resolved	Action ID #2012-01101
Waters of the United States – Section 401	Yes	Resolved	NCDWR Project # 20120748
Endangered Species Act	No	Yes	ERTR
Historic Preservation Act	No	Yes	ERTR
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	
FEMA Floodplain Compliance	N/A	N/A	
Essential Fisheries Habitat	N/A	N/A	

Appendix B
Morphological Summary Data and Plots

Appendix B

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Table 5. Baseline Stream Data Summary
June's Branch / Project No. 95027- Bumgarner I (631 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	15.1	7.5	9.5	-	13.5	2.3	5	19.9	20.4	-	21.8	-	-	-	12.9	-	13.3	14.6	14.6	15.8	N/A	2
Floodprone Width (ft)				18.0	29.2	-	50.0	14.9	5	27.0	30.0	-	55.0	-	-	-	83.0	-	42.4	60.6	60.6	78.7	N/A	2
Bankfull Mean Depth (ft)	-	-	1.1	0.9	1.2	-	1.7	0.3	5	1.0	1.08	-	1.2	-	-	-	0.8	-	0.8	0.9	0.9	0.9	N/A	2
Bankfull Max Depth (ft)				1.2	1.5	-	1.9	0.3	5	1.4	1.5	-	1.6	-	-	-	1.1	-	1.2	1.4	1.4	1.5	N/A	2
Bankfull Cross Sectional Area (ft^2)	14.5			-	-	-	-	-	-	20.7	22.0	-	23.9	-	-	-	10.6	-	11.7	12.0	12.0	12.2	N/A	2
Width/Depth Ratio				5.2	8.7	-	14.1	3.3	5	16.8	18.9	-	21.0	-	-	-	15.6	-	15.2	17.8	17.8	20.4	N/A	2
Entrenchment Ratio				1.3	3.3	-	5.9	2.1	5	1.3	1.5	-	2.7	-	-	-	6.5	-	2.7	4.3	4.3	5.9	N/A	2
Bank Height Ratio				1.1	4.6	-	4.6	1.5	5	1.0	1.2	-	1.4	-	-	-	1.0	-	1.0	1.0	1.0	1.0	N/A	2
d50 (mm)				-	-	-	-	-	-	-	29.0	-	-	-	-									
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	20.0	31.0	-	45.0	-	-	-	-	-	0.5	13.7	14.4	23.0	7.4	14
Riffle Slope (ft/ft)				-	-	-	-	-	-	1.2	2.5	-	3.9	-	-	-	0.019	-	0.016	0.061	0.039	0.251	0.063	14
Pool Length (ft)				-	-	-	-	-	-	5.0	21.0	-	23.0	-	-	-	-	-	5.2	10.2	9.2	22.5	4.3	12
Pool Max Depth (ft)				-	-	-	-	-	-	1.8	2.1	-	2.6	-	-	-	1.7	-	2.1	2.8	2.8	3.6	0.5	14
Pool Spacing (ft)				-	-	-	-	-	-	61.0	82.0	-	98.0	-	-	33.8	-	59.2	24.2	45.2	44.1	60.3	10.3	11
Pattern																								
Channel Belt Width (ft)				-	-	-	-	-	-	-	40.0	-	-	-	-	-	23	-	24.5	25.3	25.3	26.2	N/A	2
Radius of Curvature				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41.6	48.3	41.6	60.1	10.3	3
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.8	3.3	2.9	4.1	0.7	3
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	69.8	81.7	75.9	105.4	16.6	4
Meander Width Ratio				-	-	-	-	-	-	-	2.0	-	-	-	-	-	1.8	-	1.9	2.0	2.0	2.1	N/A	2
Substrate, Bed and Transport Parameters																								
Ri% / Ru% / P% / G% / S%				-						-									37%/32%/24%/7%/0%					
SC% / Sa% / G% / C% / B% / Be%				-						0% / 18% / 54% / 25% / 2% / 1%														
d16 / D35 / d50 / d84 / d95 / di^p / di^{sp} (mm)				-						1.5 / 17 / 29 / 51 / 97 / 210 / - / 110														
Reach Shear Stress (Competency) lb/ft^2				-						1.997						1.02			2.06					
Max Part Size (mm) Mobilized at Bankfull				-						115.0						86			-					
Stream Power (Transport Capacity) W/m^2				-						-						-								
Additional Reach Parameters																								
Drainage Area (mi^2)				0.69						2.63														
Impervious Cover Estimate (%)				-						-														
Rosgen Classification				G / E						B4						B4			Bc					
Bankfull Velocity (fps)	-			-						5.4						-								
Bankfull Discharge (cfs)	-			-						119.0						-								
Valley Length (ft)				-						100.0						653								
Channel Thalweg Length (ft)				-						-						703			728					
Sinuosity				-						1.05						1.08			1.09					
Water Surface Slope (ft/ft)				-						-						0.024			0.0233					
Bankfull Slope (ft/ft)				-						-						-			0.0235					
Bankfull Floodplain Area (acres)				-						-						-								
Proportion Over Wide (%)				-						-														
Entrenchment Class (ER Range)				-						-														
Incision Class (BHR Range)				-						-														
BEHI				Moderate to Very High						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

- Information unavailable.
N/A - Item does not apply.
Non-Applicable.

Table 5. Baseline Stream Data Summary
June's Branch/ Project No.95027- Bumgarner II (543 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	17.7	8.1	10.4	-	12.0	1.8	5	19.9	20.4	-	21.8	-	-	-	15.1	-	-	16.3	-	-	N/A	1
Floodprone Width (ft)				17	17.8	-	18.0	0.4	5	27.0	30.0	-	55.0	-	-	-	80.0	-	-	>47	-	-	N/A	1
Bankfull Mean Depth (ft)	-	-	1.2	0.9	1.2	-	1.5	0.2	5	1.0	1.08	-	1.2	-	-	-	0.9	-	-	0.7	-	-	N/A	1
Bankfull Max Depth (ft)				1.2	1.4	-	1.8	0.2	5	1.4	1.5	-	1.6	-	-	-	1.2	-	-	1.2	-	-	N/A	1
Bankfull Cross Sectional Area (ft^2)	19.2			-	-	-	-	-	-	20.7	22	-	23.9	-	-	-	13.9	-	-	11.9	-	-	N/A	1
Width/Depth Ratio				7.5	8.8	-	10.1	1.1	5	16.8	18.9	-	21	-	-	-	16.4	-	-	22.2	-	-	N/A	1
Entrenchment Ratio				1.5	1.8	-	2.2	0.3	5	1.3	1.5	-	2.7	-	-	-	5.3	-	-	>3	-	-	N/A	1
Bank Height Ratio				2.0	3.5	-	4.4	1.1	5	1.0	1.2	-	1.4	-	-	-	1.0	-	-	1.0	-	-	N/A	1
d50 (mm)				-	-	-	-	-	-	-	29	-	-	-	-									
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	20	31	-	45	-	-	-	-	-	3.1	29	32.3	38.6	12	7
Riffle Slope (ft/ft)				-	-	-	-	-	-	1.2	2.5	-	3.9	-	-	-	0.018	-	0.016	0.026	0.020	0.064	0.017	7
Pool Length (ft)				-	-	-	-	-	-	5.0	21.0	-	23.0	-	-	-	-	-	12.1	17.8	19.2	22.4	4	7
Pool Max Depth (ft)				-	-	-	-	-	-	1.8	2.1	-	2.6	-	-	-	1.8	-	2.3	2.9	3.1	3.4	0.4	7
Pool Spacing (ft)				-	-	-	-	-	-	61.0	82.0	-	98.0	-	-	40.9	-	71.6	61.5	70.2	69.9	80.2	6	6
Pattern																								
Channel Belt Width (ft)				-	-	-	-	-	-	-	40.0	-	-	-	-	-	37	-	25.4	28.0	26.2	26.2	3.8	3
Radius of Curvature				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39.5	54.4	54.4	69.3	N/A	2
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.1	4.3	4.3	5.5	N/A	2
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	109.3	123.2	65.2	134.6	12.8	3
Meander Width Ratio				-	-	-	-	-	-	-	2	-	-	-	-	-	2.5	-	2.0	2.2	2.1	2.6	0.3	3
Substrate, Bed and Transport Parameters																								
Ri% / Ru% / P% / G% / S%				-						-									45% /18% /28% /8% /0%					
SC% / Sa% / G% / C% / B% / Be%				-						0% / 18% / 54% / 25% / 2% / 1%														
d16 / D35 / d50 / d84 / d95 / di^p / di^{sp} (mm)				-						1.5 / 17 / 29 / 51 / 97 / 210 / - / 110														
Reach Shear Stress (Competency) lb/ft^2				-						1.997						1.02			0.91334027					
Max Part Size (mm) Mobilized at Bankfull				-						115						86			-					
Stream Power (Transport Capacity) W/m^2				-						-						-								
Additional Reach Parameters																								
Drainage Area (mi^2)				1.05						2.63														
Impervious Cover Estimate (%)				-						-														
Rosgen Classification				G						B4						B4			Bc					
Bankfull Velocity (fps)	-			-						5.4						-								
Bankfull Discharge (cfs)	-			-						119						-								
Valley Length (ft)				-						100						473								
Channel Thalweg Length (ft)				-						-						523			543					
Sinuosity				-						1.05						1.11			1.07					
Water Surface Slope (ft/ft)				-						-						0.015			0.0140					
Bankfull Slope (ft/ft)				-						-						-			0.0152					
Bankfull Floodplain Area (acres)				-						-						-								
Proportion Over Wide (%)				-						-														
Entrenchment Class (ER Range)				-						-														
Incision Class (BHR Range)				-						-														
BEHI				Moderate to High						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

- Information unavailable.
N/A - Item does not apply.
Non-Applicable.

Table 5. Baseline Stream Data Summary
June's Branch / Project No. 95027- June's Branch (1375 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	10.2	5.0	6.6	-	8.5	1.5	6	19.9	20.4	-	21.8	-	-	-	8.7	-	8.6	9.6	9.7	10.5	0.8	4
Floodprone Width (ft)				11.0	15.8	-	22.0	4.5	6	27.0	30.0	-	55.0	-	-	-	30.0	-	38.0	60.2	54.4	94.2	29.2	4
Bankfull Mean Depth (ft)	-	-	0.8	0.6	0.9	-	1.2	0.2	6	1	1.08	-	1.2	-	-	-	0.6	-	0.4	0.7	0.7	1.0	0.3	4
Bankfull Max Depth (ft)				0.75	1.2	-	1.8	0.4	6	1.4	1.5	-	1.6	-	-	-	0.9	-	0.7	1.3	1.2	2.0	0.5	4
Bankfull Cross Sectional Area (ft^2)	7.2			-	-	-	-	-	-	20.7	22	-	23.9	-	-	-	5.3	-	3.7	6.6	6.1	10.5	2.8	4
Width/Depth Ratio				5	7.6	-	9.7	1.9	6	16.8	18.9	-	21	-	-	-	14.1	-	10.4	15.2	15.4	19.7	3.9	4
Entrenchment Ratio				1.8	2.4	-	3.4	0.7	6	1.3	1.5	-	2.7	-	-	-	3.5	-	3.9	6.4	5.4	11.0	3.1	4
Bank Height Ratio				1.1	2.3	-	3.3	0.8	6	1.0	1.2	-	1.4	-	-	-	1.0	-	1.0	1.0	1.0	1.0	0	4
d50 (mm)				-	-	-	-	-	-	-	29	-	-	-	-									
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	20.0	31.0	-	45.0	-	-	-	-	-	7.8	14.9	14.4	33.7	4.1	44
Riffle Slope (ft/ft)				-	-	-	-	-	-	1.2	2.5	-	3.9	-	-	-	0.02	-	0.007	0.029	0.030	0.052	0.010	44
Pool Length (ft)				-	-	-	-	-	-	5.0	21	-	23.0	-	-	-	-	-	4.7	10.7	10.4	19.5	3.0	42
Pool Max Depth (ft)				-	-	-	-	-	-	1.8	2.1	-	2.6	-	-	-	1.3	-	1.3	1.9	1.9	3.2	0.4	44
Pool Spacing (ft)				-	-	-	-	-	-	61.0	82.0	-	98.0	-	-	21.0	-	36.8	12.3	30.0	30.5	42.1	6.2	41
Pattern																								
Channel Belt Width (ft)				-	-	-	-	-	-	-	40.0	-	-	-	-	-	16.0	-	18.5	19.7	20.1	21.0	1.5	3
Radius of Curvature				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.9	35.8	36.7	38.9	3.6	3
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.3	3.7	3.8	4.0	0.4	3
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53.7	67.1	61.4	88.3	12.5	6
Meander Width Ratio				-	-	-	-	-	-	-	2.0	-	-	-	-	-	1.8	-	1.9	2.1	2.1	2.2	0.2	3
Substrate, Bed and Transport Parameters																								
Ri% / Ru% / P% / G% / S%				-						-									50% / 0% /34% / 9% / 7%					
SC% / Sa% / G% / C% / B% / Be%				-						0% / 18% / 54% / 25% / 2% / 1%														
d16 / D35 / d50 / d84 / d95 / di^p / di^{sp} (mm)				-						1.5 / 17 / 29 / 51 / 97 / 210 / - / 110														
Reach Shear Stress (Competency) lb/ft^2				-						1.997						0.79			1.25					
Max Part Size (mm) Mobilized at Bankfull				-						115						48			-					
Stream Power (Transport Capacity) W/m^2				-						-						-								
Additional Reach Parameters																								
Drainage Area (mi^2)				0.24						2.63														
Impervious Cover Estimate (%)				-						-														
Rosgen Classification				-						B4						B4			Bc					
Bankfull Velocity (fps)	-			-						5.4						-								
Bankfull Discharge (cfs)	-			-						119						-								
Valley Length (ft)				-						100						1,266								
Channel Thalweg Length (ft)				-						-						1,367			1,480					
Sinuosity				-						1.05						1.08			1.1					
Water Surface Slope (ft/ft)				-						-						0.025			0.0231					
Bankfull Slope (ft/ft)				-						-						-			0.0246					
Bankfull Floodplain Area (acres)				-						-						-								
Proportion Over Wide (%)				-						-														
Entrenchment Class (ER Range)				-						-														
Incision Class (BHR Range)				-						-														
BEHI				Moderate to High						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

- Information unavailable.
N/A - Item does not apply.
Non-Applicable.

Table 5. Baseline Stream Data Summary
June's Branch / Project No. 95027- Higdon Branch (376 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	6.8	-	-	4.5	-	-	1	19.9	20.4	-	21.8	-	-	-	6.4	-	-	8.0	-	-	N/A	1
Floodprone Width (ft)				-	-	15.0	-	-	1	27.0	30.0	-	55.0	-	-	-	20.0	-	-	29.6	-	-	N/A	1
Bankfull Mean Depth (ft)	-	-	0.6	-	-	0.6	-	-	1	1.0	1.08	-	1.2	-	-	-	0.4	-	-	0.7	-	-	N/A	1
Bankfull Max Depth (ft)				-	-	0.9	-	-	1	1.4	1.5	-	1.6	-	-	-	0.7	-	-	1.7	-	-	N/A	1
Bankfull Cross Sectional Area (ft^2)	3.5			-	-	-	-	-	1	20.7	22	-	23.9	-	-	-	2.8	-	-	5.9	-	-	N/A	1
Width/Depth Ratio				-	-	8.1	-	-	1	16.8	18.9	-	21.0	-	-	-	14.5	-	-	10.8	-	-	N/A	1
Entrenchment Ratio				-	-	3.3	-	-	1	1.3	1.5	-	2.7	-	-	-	3.1	-	-	3.7	-	-	N/A	1
Bank Height Ratio				-	-	3.5	-	-	1	1.0	1.2	-	1.4	-	-	-	1.0	-	-	1.0	-	-	N/A	1
d50 (mm)				-	-	-	-	-	1	-	29	-	-	-	-									
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	20.0	31.0	-	45.0	-	-	-	-	-	2.5	7.7	7.6	15	2.9	13
Riffle Slope (ft/ft)				-	-	-	-	-	-	1.2	2.5	-	3.9	-	-	-	0.029	-	0.002	0.021	0.017	0.047	0.012	13
Pool Length (ft)				-	-	-	-	-	-	5.0	21.0	-	23.0	-	-	-	-	-	4.6	8.1	8.4	11	1.8	14
Pool Max Depth (ft)				-	-	-	-	-	-	1.8	2.1	-	2.6	-	-	-	0.98	-	1.3	1.7	1.7	2	0.2	13
Pool Spacing (ft)				-	-	-	-	-	-	61.0	82.0	-	98.0	-	-	12.8	-	22.5	13.1	18.6	17.5	26.6	3.8	13
Pattern																								
Channel Belt Width (ft)				-	-	-	-	-	-	-	40.0	-	-	-	-	-	11.0	-	9.1	10.6	10.6	12.1	2.1	2
Radius of Curvature				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.2	19.7	20.1	22.9	3.4	3
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	2.5	2.5	2.9	0.4	3
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.8	31.1	31.5	39.5	9.3	7
Meander Width Ratio				-	-	-	-	-	-	-	2.0	-	-	-	-	-	1.7	-	1.1	1.3	1.3	1.5	N/A	2
Substrate, Bed and Transport Parameters																								
Ri% / Ru% / P% / G% / S%				-						-									42% / 1% / 47% / 7% / 2%					
SC% / Sa% / G% / C% / B% / Be%				-						0% / 18% / 54% / 25% / 2% / 1%														
d16 / D35 / d50 / d84 / d95 / di^p / di^{sp} (mm)				-						1.5 / 17 / 29 / 51 / 97 / 210 / - / 110														
Reach Shear Stress (Competency) lb/ft^2				-						1.997						0.74			0.74					
Max Part Size (mm) Mobilized at Bankfull				-						115						48			-					
Stream Power (Transport Capacity) W/m^2				-						-						-								
Additional Reach Parameters																								
Drainage Area (mi^2)				0.08						2.63														
Impervious Cover Estimate (%)				-						-														
Rosgen Classification				E						B4						B4			Bc					
Bankfull Velocity (fps)	-			-						5.4						-								
Bankfull Discharge (cfs)	-			-						119						-								
Valley Length (ft)				-						100						275								
Channel Thalweg Length (ft)				-						-						299			382					
Sinuosity				-						1.05						1.09			1.06					
Water Surface Slope (ft/ft)				-						-						0.016			0.020					
Bankfull Slope (ft/ft)				-						-						-			0.018					
Bankfull Floodplain Area (acres)				-						-						-								
Proportion Over Wide (%)				-						-														
Entrenchment Class (ER Range)				-						-														
Incision Class (BHR Range)				-						-														
BEHI				Moderate						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

- Information unavailable.
N/A - Item does not apply.
Non-Applicable.

Table 5. Baseline Stream Data Summary
June's Branch / Project No. 95027- Doris Branch (288 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	3.2	-	-	-	-	-	-	19.9	20.4	-	21.8	-	-	-	3.8	-	-	4.8	-	-	N/A	1
Floodprone Width (ft)				-	-	-	-	-	-	27.0	30.0	-	55.0	-	-	-	20.0	-	-	>23.37	-	-	N/A	1
Bankfull Mean Depth (ft)	-	-	0.3	-	-	-	-	-	-	1	1.1	-	1.2	-	-	-	0.2	-	-	0.3	-	-	N/A	1
Bankfull Max Depth (ft)				-	-	-	-	-	-	1.4	1.5	-	1.6	-	-	-	0.4	-	-	0.6	-	-	N/A	1
Bankfull Cross Sectional Area (ft^2)		0.9		-	-	-	-	-	-	20.7	22	-	23.9	-	-	-	0.9	-	-	1.6	-	-	N/A	1
Width/Depth Ratio				-	-	-	-	-	-	16.8	18.9	-	21	-	-	-	16.6	-	-	14.0	-	-	N/A	1
Entrenchment Ratio				-	-	-	-	-	-	1.3	1.5	-	2.7	-	-	-	5.3	-	-	>4.9	-	-	N/A	1
Bank Height Ratio				-	-	-	-	-	-	1.0	1.2	-	1.4	-	-	-	1.0	-	-	1.0	-	-	N/A	1
d50 (mm)				-	-	-	-	-	-	-	29	-	-	-	-									
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	20.0	31.0	-	45.0	-	-	-	-	-	2.5	6.1	6.3	11.4	2.5	18
Riffle Slope (ft/ft)				-	-	-	-	-	-	1.2	2.5	-	3.9	-	-	-	0.054	-	0.011	0.022	0.013	0.036	0.008	10
Pool Length (ft)				-	-	-	-	-	-	5.0	21.0	-	23.0	-	-	-	-	-	2.4	3.7	3.5	6.6	1	19
Pool Max Depth (ft)				-	-	-	-	-	-	1.8	2.1	-	2.6	-	-	-	0.6	-	1.2	1.6	1.6	2.3	0.3	18
Pool Spacing (ft)				-	-	-	-	-	-	61.0	82.0	-	98.0	-	-	5.0	-	8.8	7.2	12.4	12.6	19.9	2.9	18
Pattern																								
Channel Belt Width (ft)				-	-	-	-	-	-	-	40.0	-	-	-	-	-	6.6	-	9.4	9.9	10.0	10.3	0.5	3
Radius of Curvature				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.9	12.0	12.0	16.1	5.8	2
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.1	4.3	4.3	5.5	N/A	2
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.6	22.6	24.5	27.1	4.5	6
Meander Width Ratio				-	-	-	-	-	-	-	2.0	-	-	-	-	-	1.7	-	2.0	2.1	2.1	2.2	0.1	3
Substrate, Bed and Transport Parameters																								
Ri% / Ru% / P% / G% / S%				-						-									48% / 8% / 31% / 12% / 1%					
SC% / Sa% / G% / C% / B% / Be%				-						0% / 18% / 54% / 25% / 2% / 1%														
d16 / D35 / d50 / d84 / d95 / di^p / di^{sp} (mm)				-						1.5 / 17 / 29 / 51 / 97 / 210 / - / 110														
Reach Shear Stress (Competency) lb/ft^2				-						1.997						0.70			0.28					
Max Part Size (mm) Mobilized at Bankfull				-						115						48			-					
Stream Power (Transport Capacity) W/m^2				-						-						-								
Additional Reach Parameters																								
Drainage Area (mi^2)				0.01						2.63														
Impervious Cover Estimate (%)				-						-														
Rosgen Classification				-						B4						B4			Bc					
Bankfull Velocity (fps)		-		-						5.4						-								
Bankfull Discharge (cfs)		-		-						119						-								
Valley Length (ft)				-						100						224								
Channel Thalweg Length (ft)				-						-						237			288					
Sinuosity				-						1.05						1.06			1.06					
Water Surface Slope (ft/ft)				-						-						0.019			0.018					
Bankfull Slope (ft/ft)				-						-						-			0.018					
Bankfull Floodplain Area (acres)				-						-						-								
Proportion Over Wide (%)				-						-														
Entrenchment Class (ER Range)				-						-														
Incision Class (BHR Range)				-						-														
BEHI				-						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

- Information unavailable.
N/A - Item does not apply.
Non-Applicable.

Appendix B

Table 6. Monitoring Data - Dimensional Morphology Summary
(Dimensional Parameters - Cross-Sections)
Junes Branch / Project No. 95027 - Bumgarner I (631 feet)

	Cross-Section 1 Riffle						Cross-Section 2 Pool						Cross-Section 3 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,153						2,153						2,146					
Bankfull Width (ft)	13.3						13.4						15.8					
Floodprone Width (ft)	>78.7						>124.2						>42.4					
Bankfull Mean Depth (ft)	0.9						1.5						0.8					
Bankfull Max Depth (ft)	1.5						2.9						1.2					
Bankfull Cross Sectional Area (ft^2)	11.7						20.6						12.2					
Bankfull Width/Depth Ratio	15.2						8.7						20.4					
Bankfull Entrenchment Ratio	>5.9						>9.3						>2.7					
Bankfull Bank Height Ratio	1.0						1.0						1.0					
Cross Sectional Area between End Pins (ft^2)	33.8						43.1						28.4					
d50 (mm)	N/A						N/A						N/A					

N/A - Item does not apply.

Table 6 cont'd. Monitoring Data - Dimensional Morphology Summary
(Dimensional Parameters - Cross-Sections)
Junes Branch / Project No. 95027 - Bumgarner II (543 feet)

	Cross-Section 4 Pool						Cross-Section 5 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,140.17						2,139.55					
Bankfull Width (ft)	16.5						16.3					
Floodprone Width (ft)	>49.5						>47.99					
Bankfull Mean Depth (ft)	1.4						0.7					
Bankfull Max Depth (ft)	2.6						1.2					
Bankfull Cross Sectional Area (ft^2)	23.0						11.9					
Bankfull Width/Depth Ratio	11.9						22.2					
Bankfull Entrenchment Ratio	>3						>3					
Bankfull Bank Height Ratio	1.0						1.0					
Cross Sectional Area between End Pins (ft^2)	31.9						28.0					
d50 (mm)	N/A						N/A					

N/A - Item does not apply.

Table 6 cont'd. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross-Sections) Junes Branch / Project No. 95027 - Junes (1375 feet)																		
	Cross-Section 6 Riffle						Cross-Section 7 Pool						Cross-Section 8 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,173						2,171						2,163					
Bankfull Width (ft)	8.6						8.2						9.6					
Floodprone Width (ft)	>94.2						>111.2						>52.9					
Bankfull Mean Depth (ft)	0.4						1.0						0.7					
Bankfull Max Depth (ft)	0.7						2.1						1.2					
Bankfull Cross Sectional Area (ft^2)	3.7						8.6						6.4					
Bankfull Width/Depth Ratio	19.7						7.9						14.3					
Bankfull Entrenchment Ratio	>11						>13.5						>5.5					
Bankfull Bank Height Ratio	1.0						1.0						1.0					
Cross Sectional Area between End Pins (ft^2)	24.9						25.8						38.6					
d50 (mm)	N/A						N/A						N/A					

N/A - Item does not apply.

Table 6 cont'd. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross-Sections) Junes Branch / Project No. 95027 - Junes (1375 feet)																		
	Cross-Section 9 Riffle						Cross-Section 10 Pool						Cross-Section 11 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,163						2,144						2,144					
Bankfull Width (ft)	10.5						11.0						9.8					
Floodprone Width (ft)	>55.8						>38.6						>38.0					
Bankfull Mean Depth (ft)	1.0						0.8						0.6					
Bankfull Max Depth (ft)	2.0						1.7						1.2					
Bankfull Cross Sectional Area (ft^2)	10.5						9.0						5.8					
Bankfull Width/Depth Ratio	10.4						13.4						16.5					
Bankfull Entrenchment Ratio	>5.3						>3.5						>3.9					
Bankfull Bank Height Ratio	1.0						1.0						1.0					
Cross Sectional Area between End Pins (ft^2)	46.1						32.4						23.7					
d50 (mm)	N/A						N/A						N/A					

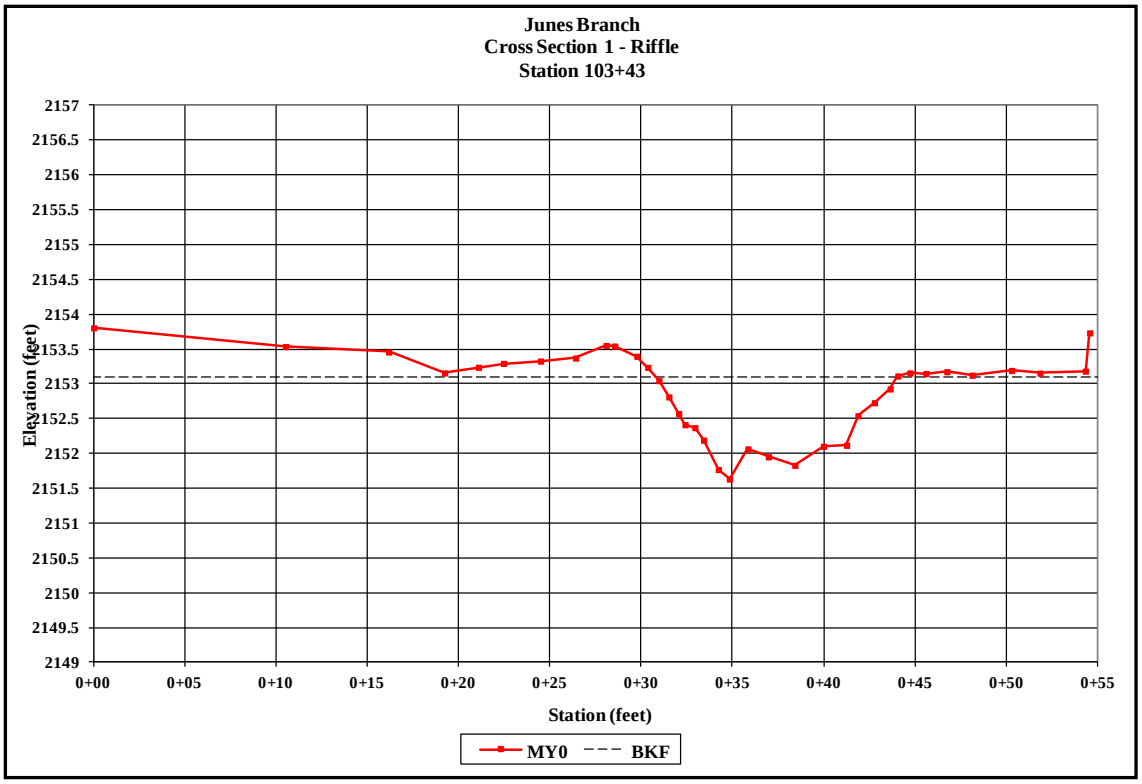
N/A - Item does not apply.

Table 6 cont'd. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross-Sections) Junes Branch / Project No. 95027 -Higdon Branch (376 feet)												
	Cross-Section 12 Pool						Cross-Section 13 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,141						2,140					
Bankfull Width (ft)	6.6						8.0					
Floodprone Width (ft)	>39.5						>29.6					
Bankfull Mean Depth (ft)	0.4						0.7					
Bankfull Max Depth (ft)	0.7						1.7					
Bankfull Cross Sectional Area (ft^2)	2.5						5.9					
Bankfull Width/Depth Ratio	17.6						10.8					
Bankfull Entrenchment Ratio	>6						>3.7					
Bankfull Bank Height Ratio	1.0						1.0					
Cross Sectional Area between End Pins (ft^2)	15.9						20.0					
d50 (mm)	N/A						N/A					

N/A - Item does not apply.

Table 6 cont'd Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross-Sections) Junes Branch / Project No. 95027 -Doris Branch (288 feet)												
	Cross-Section 14 Pool						Cross-Section 15 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,139						2,139					
Bankfull Width (ft)	6.2						11.6					
Floodprone Width (ft)	>23.4						>20.8					
Bankfull Mean Depth (ft)	0.4						0.8					
Bankfull Max Depth (ft)	0.7						2.3					
Bankfull Cross Sectional Area (ft^2)	2.3						9.4					
Bankfull Width/Depth Ratio	16.7						14.3					
Bankfull Entrenchment Ratio	>3.8						>1.8					
Bankfull Bank Height Ratio	1.0						1.0					
Cross Sectional Area between End Pins (ft^2)	11.5						18.7					
d50 (mm)	N/A						N/A					

N/A - Item does not apply.

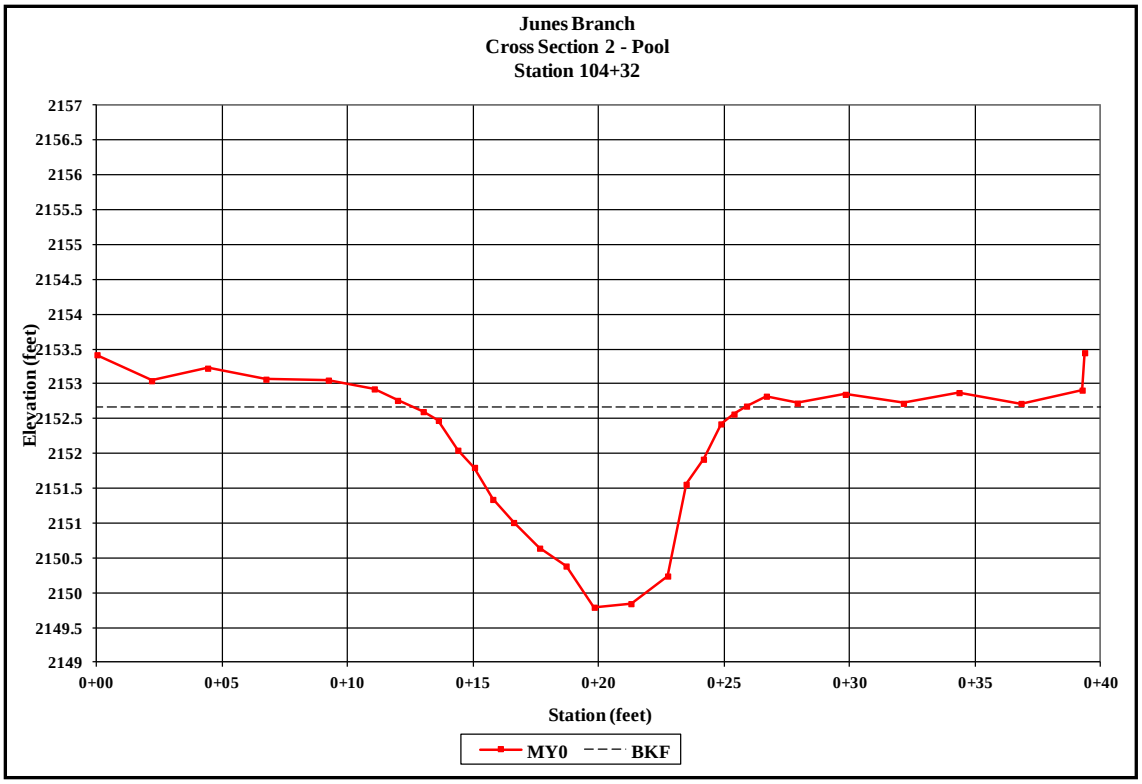


Left Descending Bank

Right Descending Bank

Upstream

Downstream

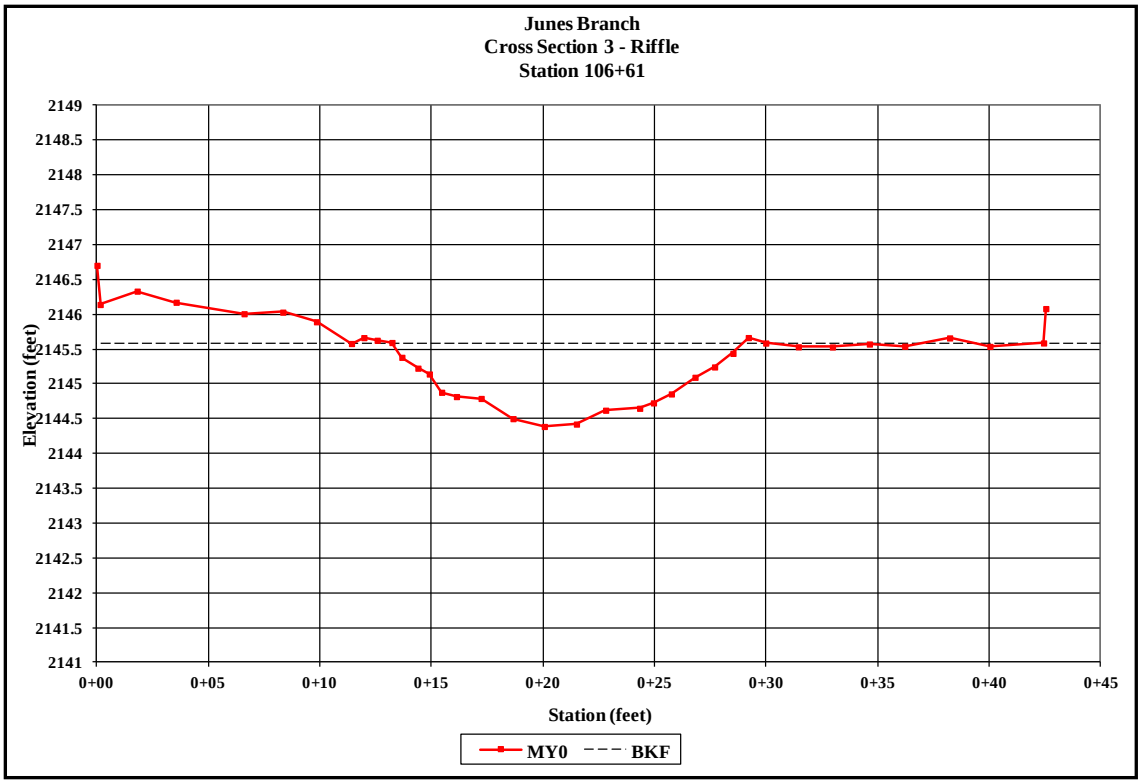


Left Descending Bank

Right Descending Bank

Upstream

Downstream

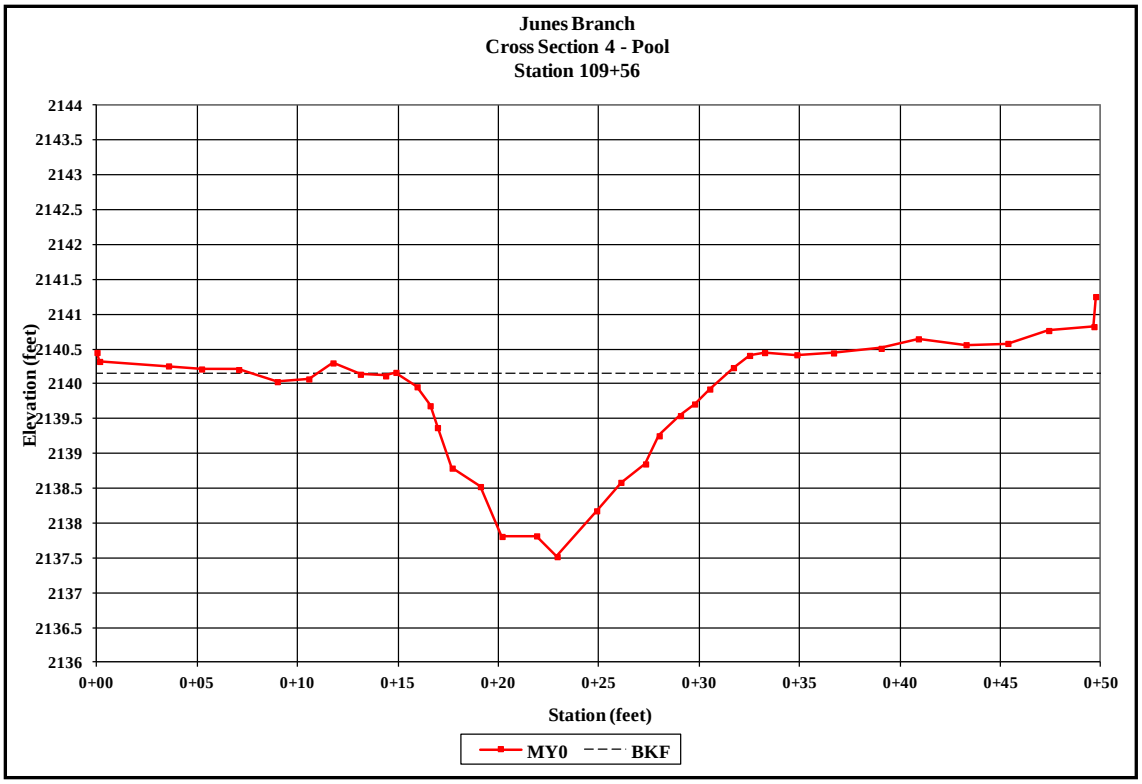


Left Descending Bank

Right Descending Bank

Upstream

Downstream

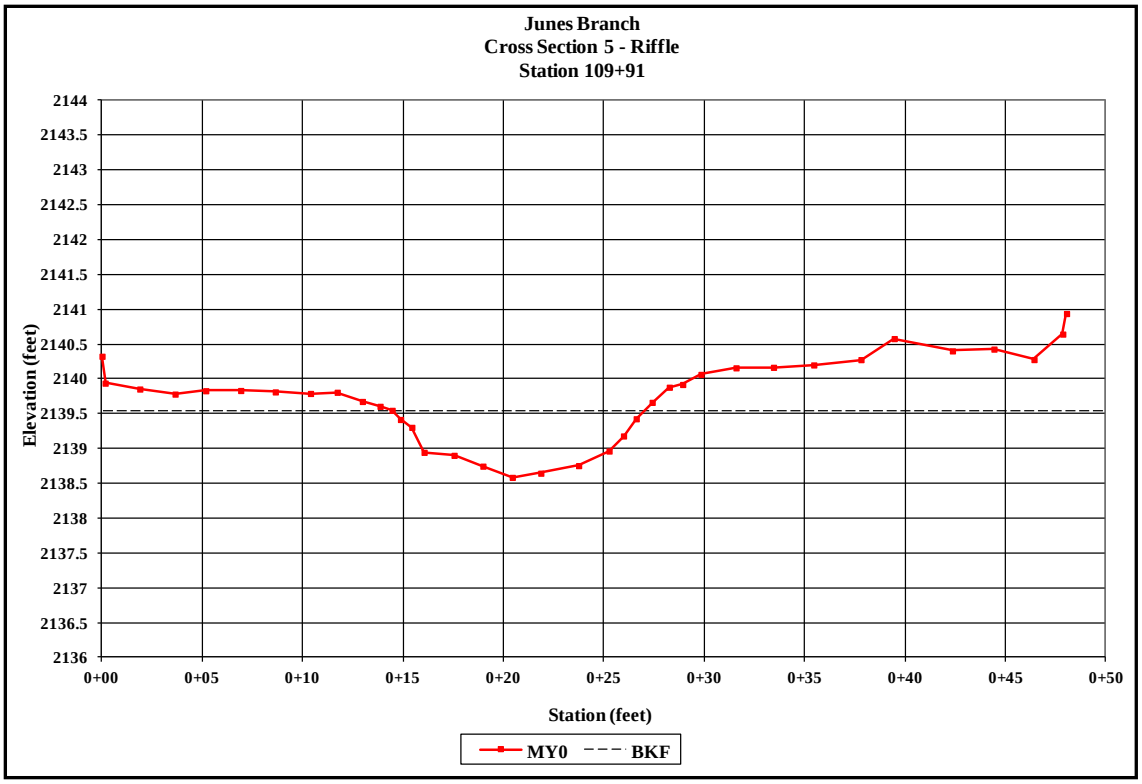


Left Descending Bank

Right Descending Bank

Upstream

Downstream



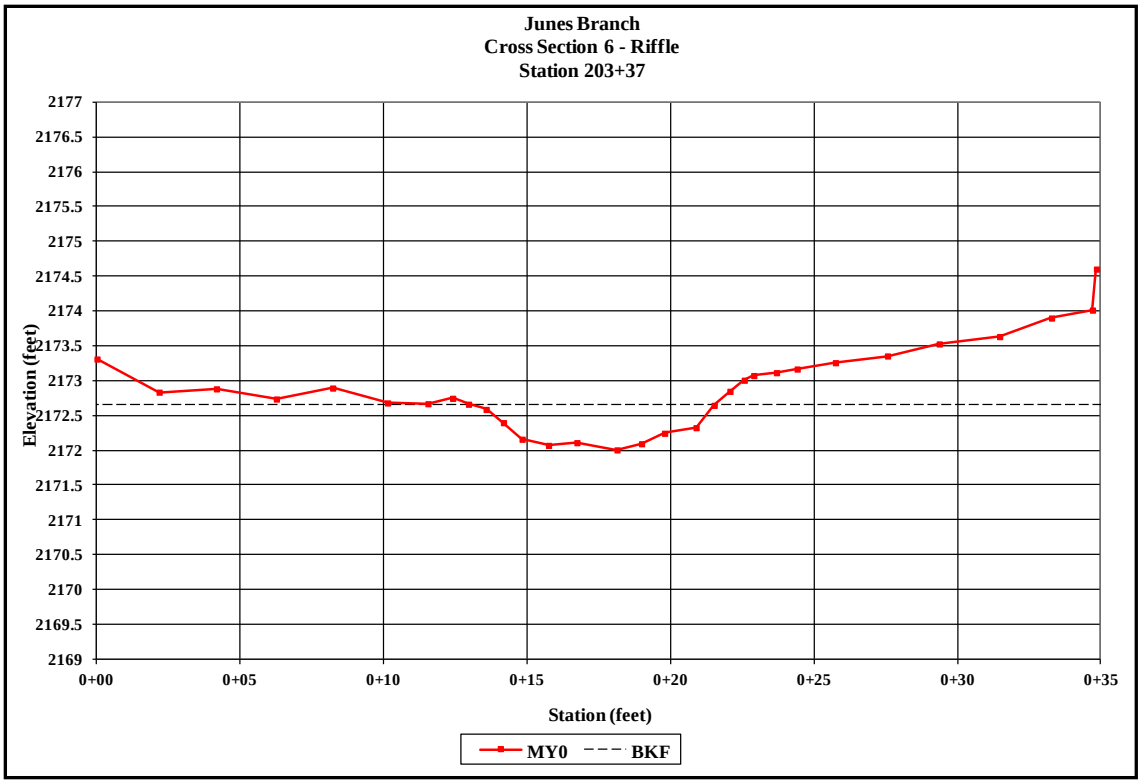
Left Descending Bank

Right Descending Bank

Upstream

Downstream

Appendix B

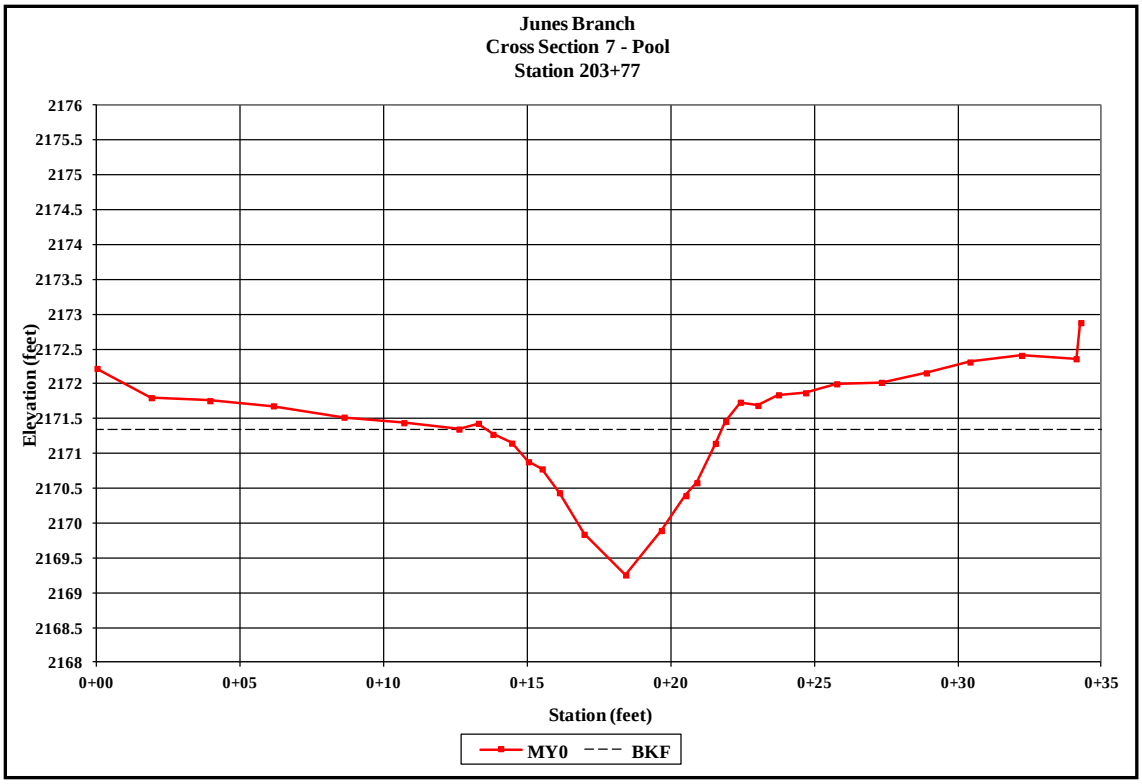


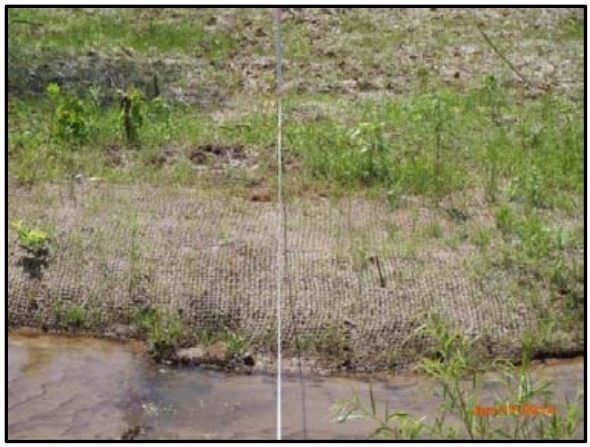
Left Descending Bank

Right Descending Bank

Upstream

Downstream





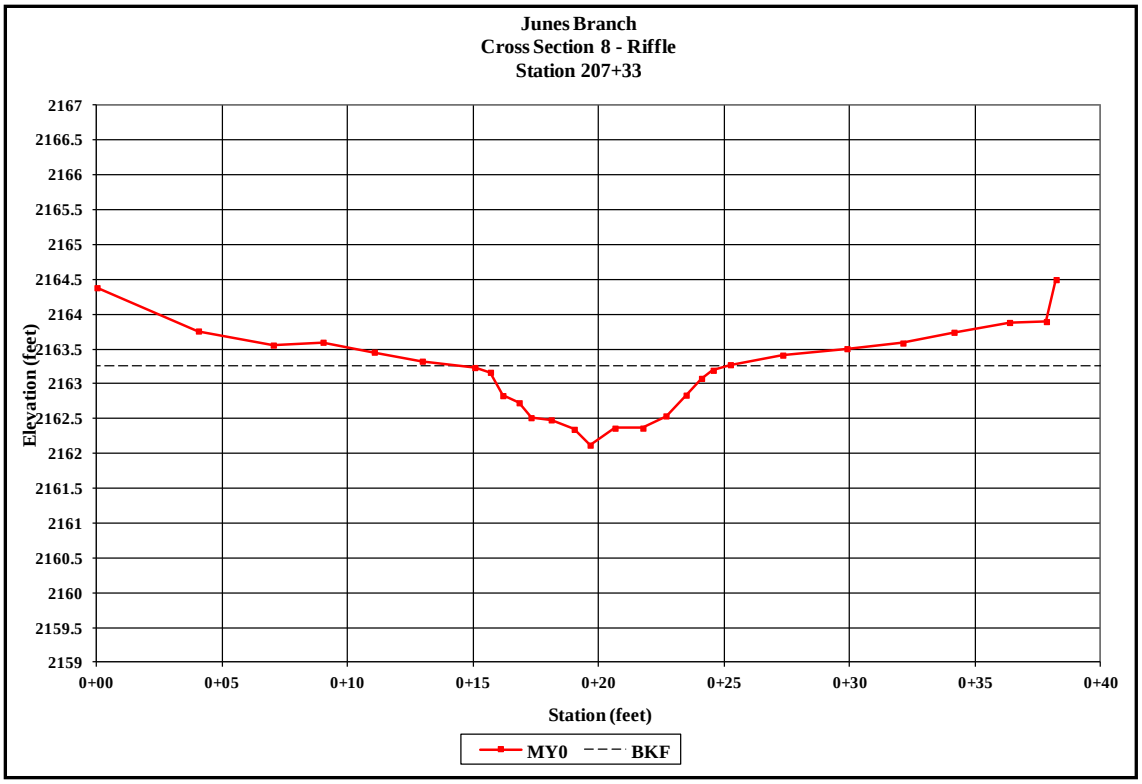
Left Descending Bank

Right Descending Bank

Upstream

Downstream

Appendix B

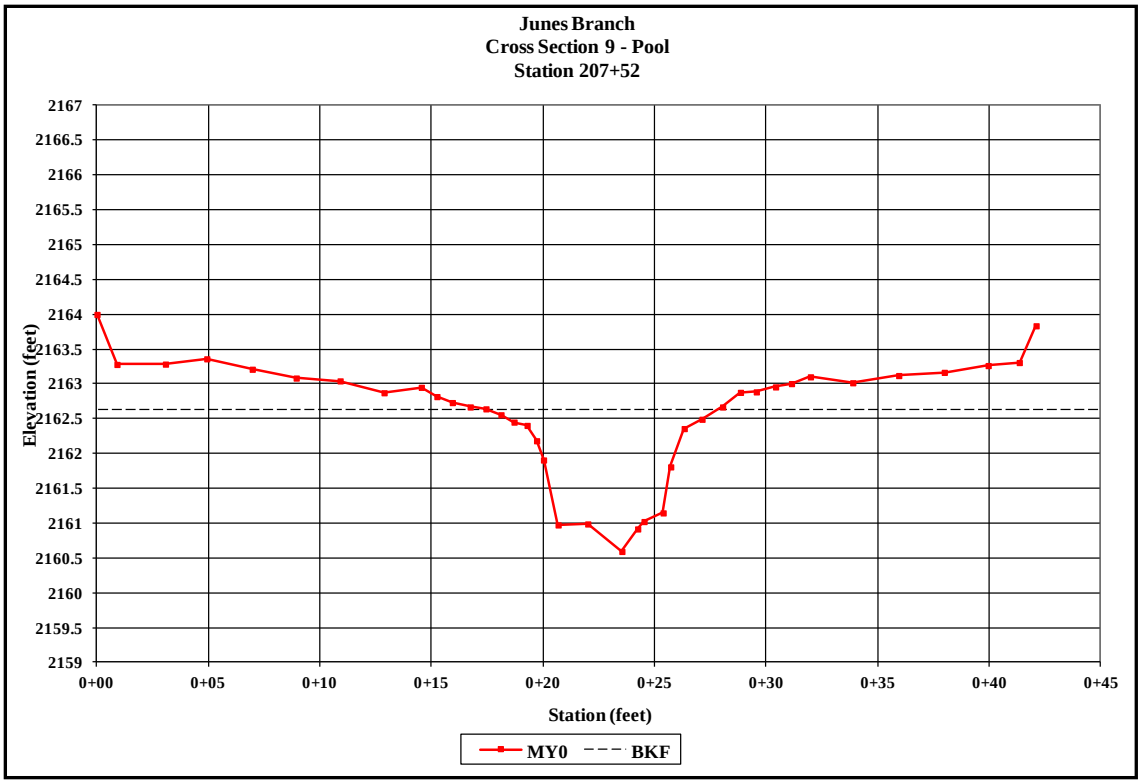


Left Descending Bank

Right Descending Bank

Upstream

Downstream



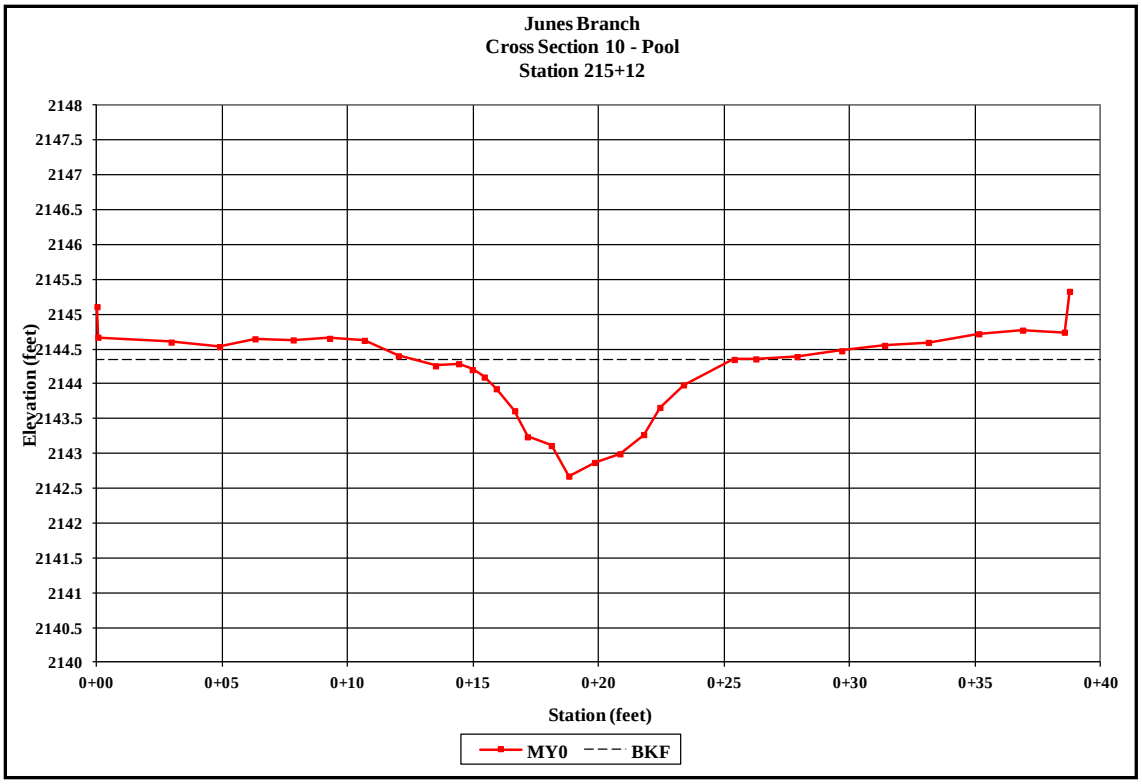
Left Descending Bank

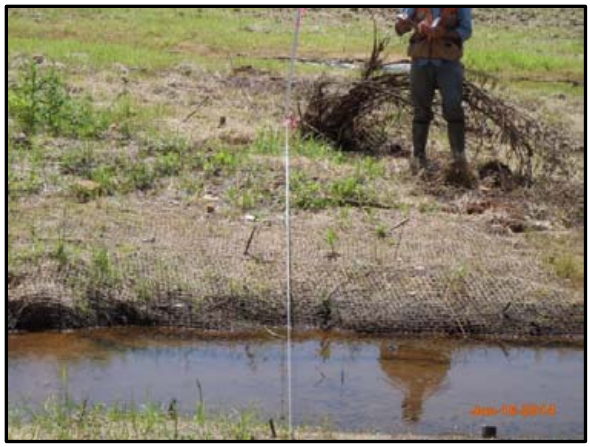
Right Descending Bank

Upstream

Downstream

Appendix B



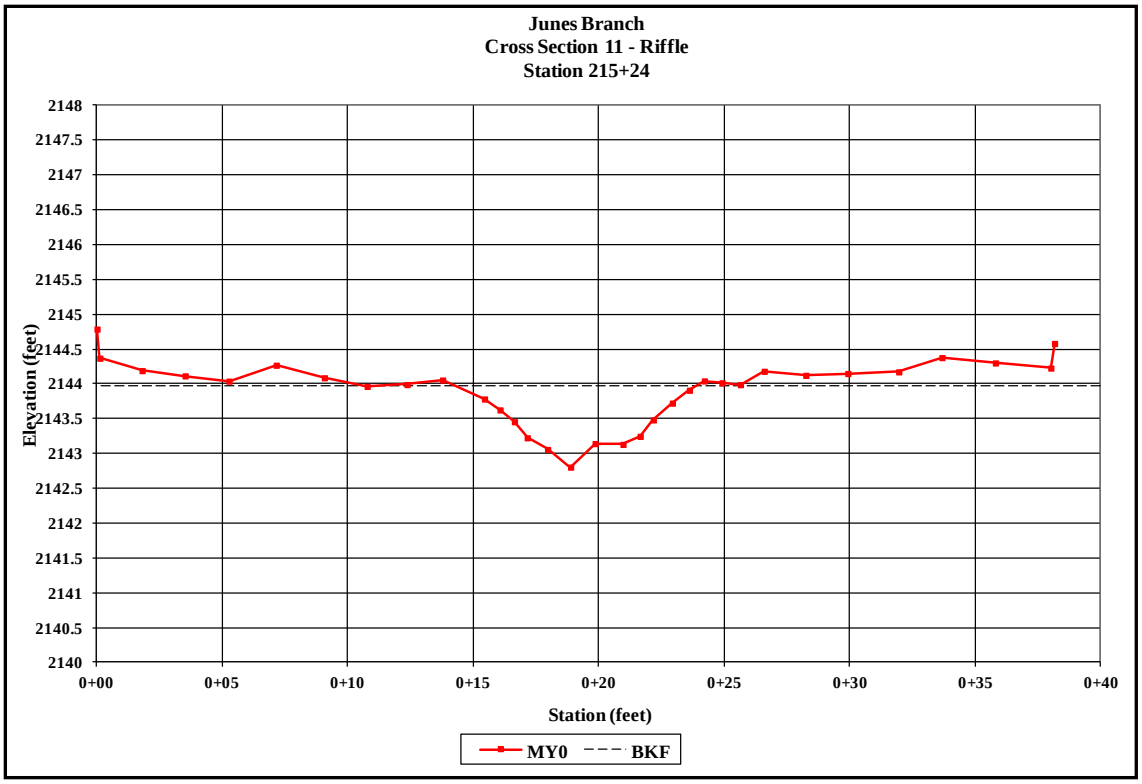


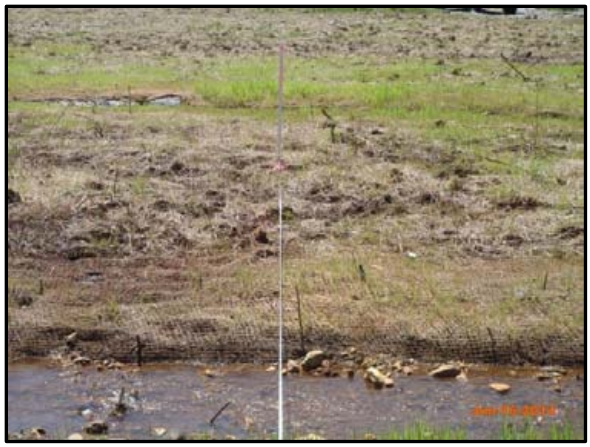
Left Descending Bank

Right Descending Bank

Upstream

Downstream



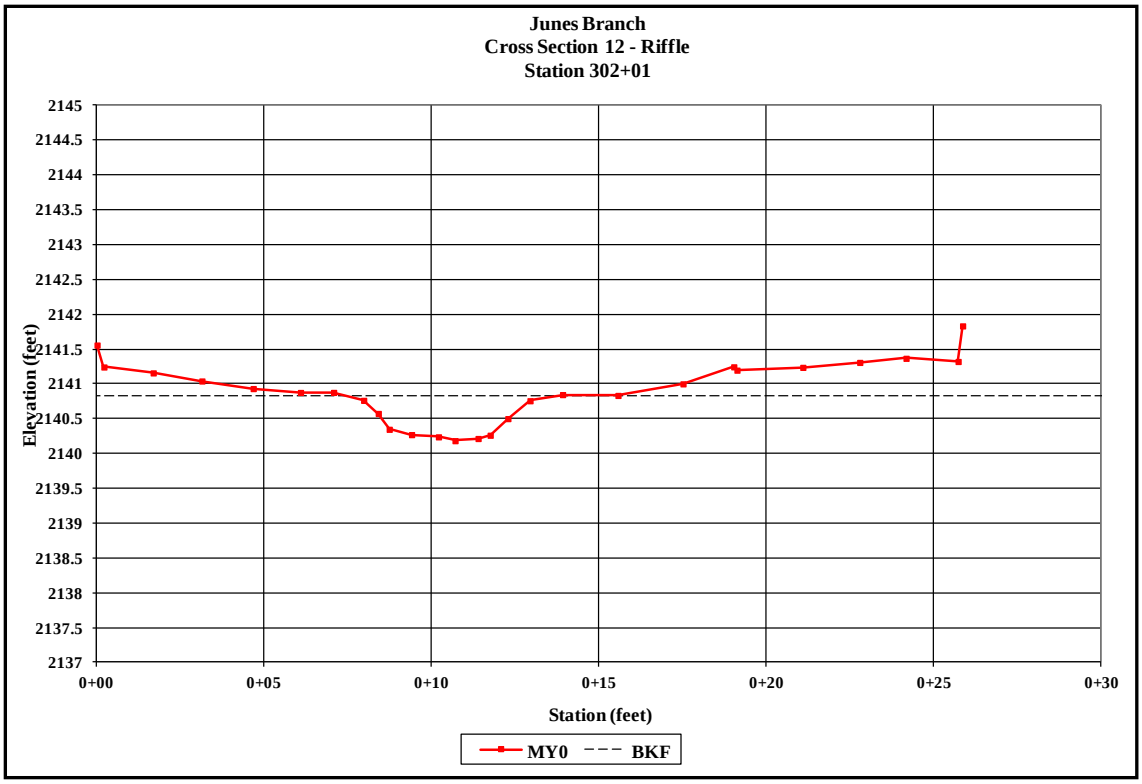


Left Descending Bank

Right Descending Bank

Upstream

Downstream

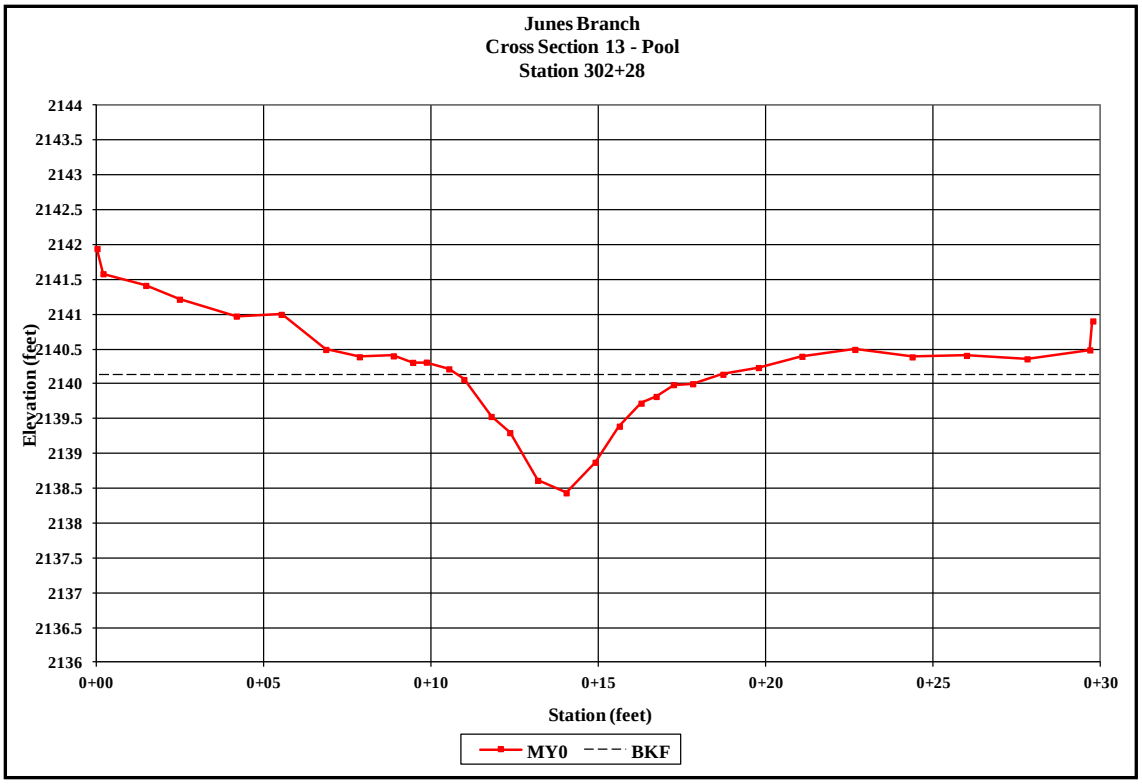


Left Descending Bank

Right Descending Bank

Upstream

Downstream



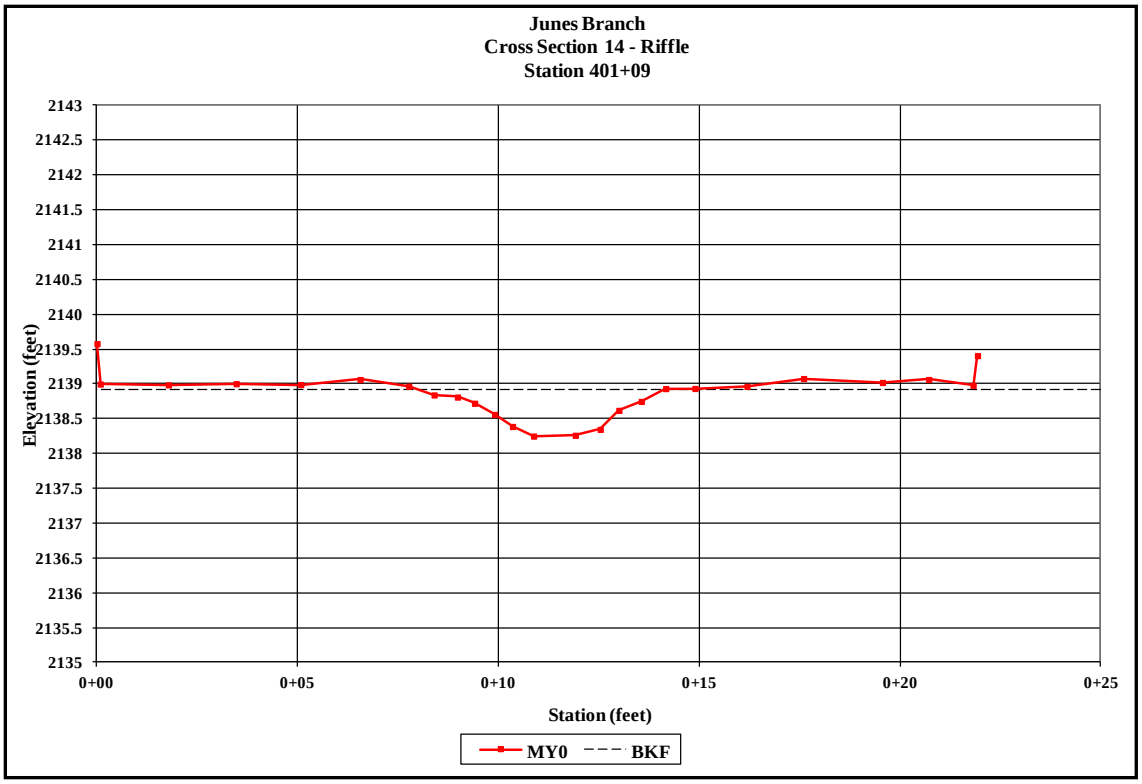
Left Descending Bank

Right Descending Bank

Upstream

Downstream

Appendix B

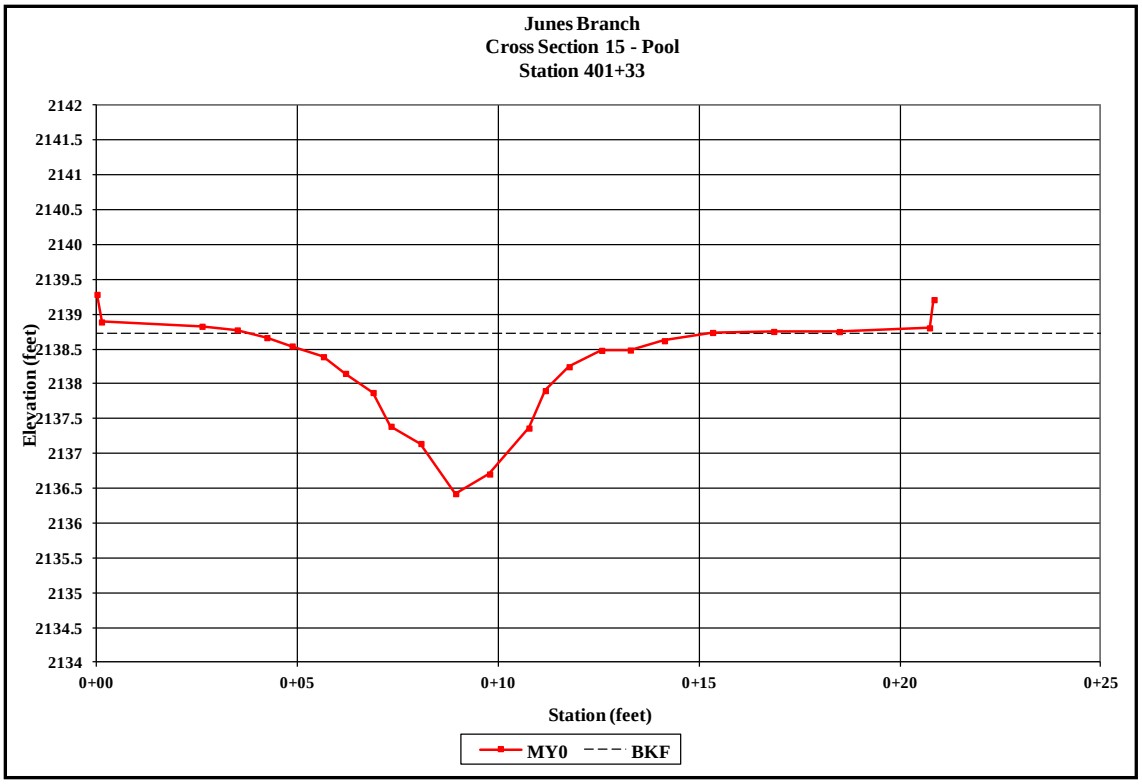


Left Descending Bank

Right Descending Bank

Upstream

Downstream



Left Descending Bank

Right Descending Bank

Upstream

Downstream

Appendix C
Vegetation Data

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Table 7. Vegetation Plot Criteria Attainment		
Junes Branch / Project No. 95027		
Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	

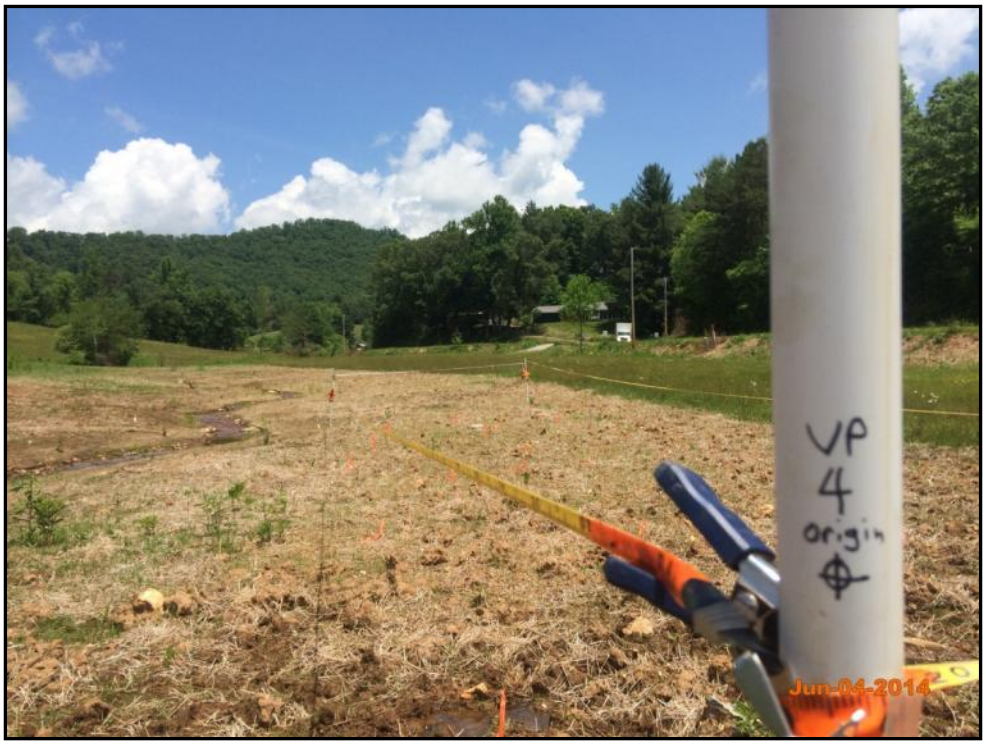
Table 7. Planted and Total Stem Counts (Species by Plot with Annual Means)

			Current Plot Data (MY0 2014)															Annual Means		
			95027-01-0001			95027-01-0002			95027-01-0003			95027-01-0004			95027-01-0005			MY0 (2014)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Betula nigra	River Birch	Tree	6	6	6	2	2	2				3	3	3				11	11	11
Carpinus caroliniana var. caroliniana	Coastal American Hornbeam	Tree										3	3	3	1	1	1	4	4	4
Cornus florida	Flowering Dogwood	Tree										3	3	3				3	3	3
Fraxinus pennsylvanica	Green Ash	Tree	10	10	10				3	3	3	3	3	3	5	5	5	21	21	21
Hamamelis virginiana var. virginiana	American witchhazel	Tree	1	1	1	2	2	2				1	1	1	1	1	1	5	5	5
Juglans nigra	Black Walnut	Tree													1	1	1	1	1	1
Liriodendron tulipifera var. tulipifera	Tulip-tree, Yellow Poplar, Whitewood	Tree	1	1	1							2	2	2	4	4	4	7	7	7
Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	Tree	1	1	1	5	5	5	10	10	10	1	1	1				17	17	17
Prunus serotina var. serotina	Black Cherry	Tree										1	1	1	2	2	2	3	3	3
Quercus	Oak	Tree	1	1	1	1	1	1				2	2	2	2	2	2	6	6	6
Quercus rubra var. rubra	Northern Red Oak	Tree	1	1	1							4	4	4				5	5	5
Unknown		Shrub or Tree				4	4	4										4	4	4
Stem count			21	21	21	14	14	14	13	13	13	23	23	23	16	16	16	87	87	87
size (ares)			1			1			1			1			1			5		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.12		
Species count			7	7	7	5	5	5	2	2	2	10	10	10	7	7	7	12	12	12
Stems per ACRE			849	849	849	566	566	566	526	526	526	930	930	930	647	647	647	704	704.2	704.2

Vegetation Monitoring Plot 1

Vegetation Monitoring Plot 2

Vegetation Monitoring Plot 3



Vegetation Monitoring Plot 4

Vegetation Monitoring Plot 5

Appendix D
Permanent Photo Stations

Junes Branch – Permanent Photo Station 1
Station 202+75 - Downstream

Junes Branch – Permanent Photo Station 1
Station 202+75 - Upstream

Junes Branch – Permanent Photo Station 2
Station 206+30 - Downstream

Junes Branch – Permanent Photo Station 2
Station 206+30 - Upstream

Junes Branch – Permanent Photo Station 3
Looking South/Downstream Junes Branch

Junes Branch – Permanent Photo Station 3
Looking South/Downstream - Upstream

Junes Branch – Permanent Photo Station 4
Station 210+60 - Downstream

Junes Branch – Permanent Photo Station 4
Station 210+60 - Upstream

Junes Branch – Permanent Photo Station 5
Station 211+10 - Upstream

Junes Branch – Permanent Photo Station 6
Station 214+00 - Downstream

Junes Branch – Permanent Photo Station 6
Station 214+00 - Upstream

Bumgarner Branch I – Permanent Photo Station 7
Station 100+21 - Downstream

Bumgarner Branch I – Permanent Photo Station 8
Station 102+20 - Downstream

Bumgarner Branch I – Permanent Photo Station 8
Station 102+20- Upstream

Bumgarner Branch I – Permanent Photo Station 9
Station 105+25 - Downstream

Bumgarner Branch I – Permanent Photo Station 9
Station 105+25 – Upstream

Bumgarner Branch I – Permanent Photo Station 10
Looking Upstream from Confluence with Junes Branch

Junes Branch – Permanent Photo Station 10
Looking Upstream from Confluence with Bumgarner Branch

Bumgarner Branch II – Permanent Photo Station 11
Looking Upstream from Confluence with Higdon Branch

Higdon Creek – Permanent Photo Station 11
Looking Upstream from Confluence with Bumgarner Branch II

Bumgarner Branch II – Permanent Photo Station 12
Looking Upstream from Confluence with Doris Branch

Doris Creek – Permanent Photo Station 12
Looking Upstream from Confluence with Bumgarner Branch II

Higdon Creek – Permanent Photo Station 13
Station 302+80 - Downstream

Higdon Creek – Permanent Photo Station 13
Station 302+80 - Upstream

Doris Creek – Permanent Photo Station 14
Station 400+00 - Downstream