Baseline Monitoring Document and As-Built Report
Final
Glade Creek
Stream Restoration Site

NCEEP Project Number: 854
Alleghany County, North Carolina

Submitted to
Ecosystem Enhancement Program
North Carolina Department of Environment and Natural Resources
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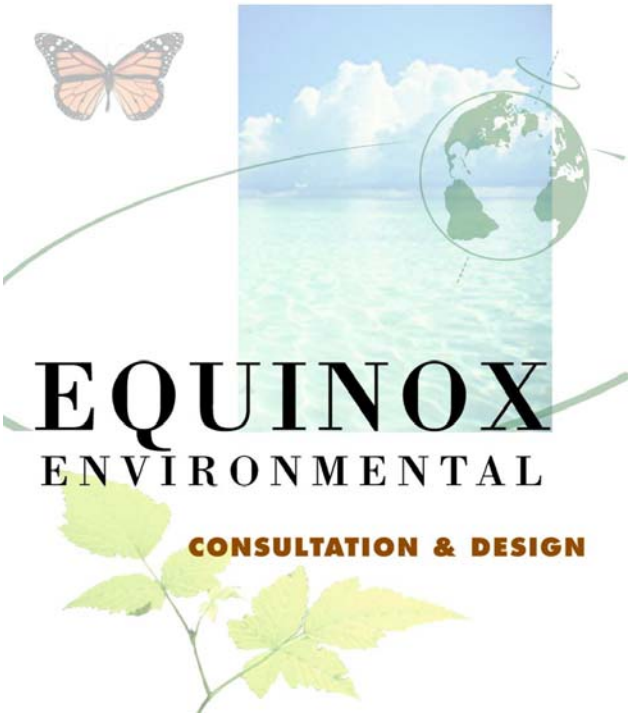
1652 Mail Service Center
Raleigh, NC 27699

Monitoring Firm



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1.0 EXECUTIVE SUMMARY

The project includes portions of Glade Creek and an Unnamed Tributary (UT) and involved the restoration and preservation of 3,562 linear feet of stream and 0.26 acre of wetlands. The goals of the project included channel stabilization and preservation, channel feature and aquatic habitat restoration and rehabilitation, riparian buffer rehabilitation, and existing wetland preservation. Project objectives to accomplish the goals involved constructing a channel with an appropriate pattern, longitudinal profile, and cross-sectional dimension for the impaired stream and re-establishing a continuous wooded riparian buffer along stream banks. Additionally, structures were installed to enhance the aquatic habitat within the restored reaches.

For monitoring purposes the project site was delineated into three primary stream reaches that include Glade Creek, Unnamed Tributary Lower (UT-Lower), and Unnamed Tributary Upper (UT-Upper). A total of 2,558 linear feet of restoration were implemented on Glade Creek. The UT-Lower reach included 265 linear feet of restoration and the UT-Upper reach included 784 linear feet of stream preservation.

The primary focus of the revegetation element of the project was to restore natural plant communities within the riparian corridor. Planting plans for the two planting zones were implemented to reflect both the Piedmont/Mountain Levee Forest (Shafale and Weakley 1990) and the species already present on site. Additionally, invasive species control was implemented during construction to minimize the impacts of multiflora rose *Rosa multiflora* on the restored plant communities.

Two separate wetland areas were identified within the project site, which included one along Glade Creek and one along UT1-Upper. These wetlands most closely resemble the High Elevation Seep community (Schafale and Weakley, 1990). All wetlands within the project boundary were considered functional and were preserved through inclusion within the conservation easement boundary.

Annual monitoring will begin in 2011 and will include stream and vegetation monitoring components as established within this document. Annual monitoring will occur for five years or until project success criteria have been achieved.

2.0 PROJECT BACKGROUND

2.1 Location and Setting

The Glade Creek Restoration Site is on a parcel owned by Stephen W. Faw (Figure 1). It is situated within the Little River watershed (14-digit HUC - 05050001030020) of the New River basin cataloging unit (8-digit HUC – 05050001). The Little River watershed was identified by the North Carolina Ecosystem Enhancement Program (NCEEP) as a Targeted Local Watershed with significant stream and wetland restoration needs (NCEEP 2009).

The Glade Creek stream and wetland project is part of the North Carolina Ecosystem Enhancement Program (NCEEP) Little River and Brush Creek Local Watershed Plan (LWP). The Little River and Brush Creek Watersheds (HUCs 05050001030020 and 05050001030030, respectively) were selected for the LWP study due to the presence of High Quality Waters (HQW) and abundant opportunities to conserve water quality by restoring riparian habitat on unforested stream buffers. The watersheds also contain rare bog habitat and significant trout populations.

The LWP assessment uncovered the following functional stressors within the study area:

- Unforested buffers;
- Livestock access to streams;
- Severe erosion on stream banks;
- Land-disturbing activities on steep slopes; and
- Non-point source pollution from the Town of Sparta and surrounding areas.

Detailed stream and wetland assessments for the Little River and Brush Creek LWP identified a variety of mitigation opportunities throughout the study area that would benefit the aquatic resources of the watersheds. Stream and buffer restoration and enhancement in particular offer opportunities to remediate serious stressors to the watershed functions of habitat, hydrology, and water quality. The Glade Creek project was designed and implemented to specifically address LWP goals and watershed-level stressors including inadequate riparian buffers and sedimentation. In addition the project was aimed at restoring aquatic habitat functions in trout waters.

The site is located in Alleghany County, North Carolina approximately 4 miles south of Sparta. Prior to project implementation, Glade Creek and the downstream portion of the Unnamed Tributary channel were unstable, exhibiting mid-channel sediment bars, incised beds, and steep, eroding, unvegetated banks throughout. The upper portion of the Unnamed Tributary and the small, existing wetlands within the project extent are fully functional and will be preserved within the conservation easement boundary.

The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (NCEEP) 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 therefor 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 NCEEP.

Glade Creek
Stream Restoration Site

Directions: The project site is located in Alleghany County, North Carolina, approximately 4 miles southeast of the town of Sparta. From the south and east, the site can be accessed by exiting Interstate 77 North at the US 21 Bypass exit in Elkin. Proceed on US 21 towards Sparta for 23.1 miles to Dewitt Road. Turn left on Dewitt Road and travel 0.7 miles to the site entrance on the left at 541 Dewitt Road.

Figure 1 - Vicinity Map

Glade Creek
Stream Restoration Site
Project No. 854

Alleghany County, North Carolina

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EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN

Ecosystem Enhancement PROGRAM

0 1,500 3,000 6,000 Feet

7.5 Minute Series
Glade Valley Quadrangle

2.2 Project Goals and Objectives

The goals and objectives stated in the Glade Creek Restoration Plan (NCEEP 2007) are as follows:

Project Goals:

- Rapidly stabilize the channel of Glade Creek relative to natural processes;
- Rapidly stabilize and preserve the channel of the Unnamed Tributary relative to natural process;
- Restore and rehabilitate channel features and aquatic habitat in Glade Creek and the Unnamed Tributary;
- Rehabilitate the riparian buffer along both streams; and
- Preserve the existing wetlands onsite.

Project Objectives:

- Restore approximately 2,430 linear feet of stream channel on Glade Creek;
- Restore approximately 275 linear feet of the Unnamed Tributary;
- Preserve 570 linear feet of the Unnamed Tributary; and
- Preserve the existing 0.33 acre wetlands within the project site.

2.3 Project Structure, Restoration Type, and Approach

Prior to project implementation, Glade Creek and the downstream portion of the Unnamed Tributary channel were unstable, exhibiting mid-channel sediment bars, incised beds, and steep, eroding, unvegetated banks throughout. Approximately 62% of the Glade Creek channel within the project boundary had a Bank Erosion Hazard Index (BEHI) rating of High, 33% had a rating of Very High, and 5% had a rating of Moderate (Rosgen 2001). The estimated total sediment export per year for the Glade Creek reach was 619 tons, based on the Rosgen (2001) sediment export curves. The UT-Lower reach had a BEHI rating of Very High, and the estimated total sediment export per year for the reach was estimated at 72 tons. Additionally, approximately 70% of the channel along Glade Creek had bank height ratios (BHR) of 2 or more and all of UT-Lower reach had a BHR of >2.

Work on Glade Creek and UT-Lower involved restoring a total of 2,823 linear feet of C stream type utilizing a Priority Level 2 approach (Rosgen 1997). This approach was used to restore the unstable channel geometry, sinuosity, and steep stream banks. In order to provide stabilization to the newly graded channel, especially along the outside of meander bends, in-stream structures including log vanes, root wads, and large woody debris bundles were utilized. Rock structures such as cross vanes and steps were incorporated into the restored reaches to provide grade control. The floodplain bench and upland planting zones were targeted for revegetation to establish native plant communities.

The project also included the preservation of 784 linear feet of stream within the UT-Upstream reach. Additionally, the two fully functional wetlands identified within the project site were preserved through a permanent conservation easement. The project components and summations are reported in Table 1 and illustrated in Figure 2.

Table 1. Project Components and Mitigation Credits
Glade Creek / Project No. 854

Mitigation Credits

	Stream		Riparian Wetland	Non-riparian Wetland	Buffer		Nitrogen Nutrient Offset		Phosphorous Nutrient Offset	
Type	Restoration	Preservation	Preservation	N/A						
Totals	2,778*	784	0.26	0	0	0	0	0	0	0

Project Components

Project Component or Reach ID	Stationing/Location	Existing Footage/Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage/Acreage	Mitigation Ratio
Glade Creek	0+00 - 25+58	2,569	P2	Restoration	2,513*	1:1
Unnamed Tributary	0+00 - 2+65	300	P2	Restoration	265	1:1
Unnamed Tributary	Not Established	784	N/A	Preservation	784	5:1
Wetlands	Adjacent to Streams	0.26	N/A	Preservation	0.26	5:1

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	2,778*	0	0	0		
Enhancement		0	0	0		
Enhancement I	0					
Enhancement II	0					
Creation		0	0	0		
Preservation	784	0.26	0	0		
High Quality Preservation	0	0	0	0		

BMP Elements

Element	Location	Purpose/Function	Notes
None			

*Excludes the 45 linear feet of stream associated with the private drive access location.

Figure 2: Project Components and Assets Map

Prepared for	**Project:**	Notes: 1) Base Map data provided by Biohabitats Inc.	Prepared by
Ecosystem Enhancement Program	Glade Creek Stream Restoration Project Componenets & Assets Alleghany County, North Carolina	2) 2010 Aerial Photo	EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN
	Sheet 1 of 1		
	Date	Project Number	
	December 2011	NCEEP # 854	

2.4 Project History, Contacts, and Attribute Data

The NCEEP contracted Biohabitats Southeast Bioregion Inc. (Biohabitats) to provide design and construction management services. The Restoration Plan was completed by Biohabitats in December 2007 (NCEEP 2007) and construction was initiated in September 2010. Project construction and planting were completed in April 2011 and baseline monitoring efforts were initiated.

The project activity and reporting history are detailed in Table 2. Project personnel and contact information for the design and monitoring components is presented in Table 3. Table 4 presents background project attribute information for the site.

Table 2. Project Activity and Reporting History
Glade Creek / Project No. 854

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	June 2007	Dec 2007
Final Design - Construction Plans	Aug 2007	Dec 2008
Construction	N/A	April 2011
Temporary S&E mix applied to entire project area	N/A	Sept - Nov 2010 March - April 2011
Permanent seed mix applied	N/A	Sept - Nov 2010 March - April 2011
Planting	May 2011	May 2011
Baseline Monitoring Document (Year 0 Monitoring - Baseline)	May 2011	Dec 2011
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

N/A - Item does not apply.

Table 3. Project Contacts Glade Creek / Project No. 854	
Designer Primary Project Design POC	Biohabitats Southeast Bioregion Inc. 8218 Creedmoor Road, Suite 200 Raleigh, North Carolina 27613 Kevin Nunnery (919) 518-0313
Construction Contractor Construction Contractor POC	Yadkin Valley Construction 2961 Old 60 Highway Ronda, North Carolina 28670 Terry Benton (336) 984-2219
Planting Contractor Planting Contractor POC	Foggy Mountain Nursery 2251 Ed Little Road Creston, North Carolina 28615 Glen Sullivan (336) 384-5323
Seeding Contractor Seeding Contractor POC	Yadkin Valley Construction 2961 Old 60 Highway Ronda, North Carolina 28670 Terry Benton (336) 984-2219
Seed Mix Sources	Hanes Geo (336) 747-1600
Nursery Stock Suppliers	Foggy Mountain Nursery Glen Sullivan (336) 384-5323
Monitoring Performers (Y0) - 2011	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Win Taylor (828) 253-6856
Vegetation Monitoring POC	Win Taylor (828) 253-6856
Monitoring Performers (Y1) - 2011	
Stream Monitoring POC	
Vegetation Monitoring POC	
Monitoring Performers (Y2) - 2012	
Stream Monitoring POC	
Vegetation Monitoring POC	
Monitoring Performers (Y3)- 2013	
Stream Monitoring POC	
Vegetation Monitoring POC	
Monitoring Performers (Y4)- 2014	
Stream Monitoring POC	
Vegetation Monitoring POC	
Monitoring Performers (Y5)- 2015	
Stream Monitoring POC	
Vegetation Monitoring POC	

Table 4. Project Baseline Information and Attributes Glade Creek / Project No. 854			
Project Information			
Project Name	Glade Creek		
County	Alleghany		
Project Area (acres)	15.86		
Project Coordinates (latitude and longitude)	Latitude 36.468090 / Longitude -81.066384		
Project Watershed Summary Information			
Physiographic Province	Blue Ridge		
River Basin	New River		
USGS Hydrologic Unit 8-dgit	05050001		
USGS Hydrologic Unit 14-dgit	05050001000801		
NCDWQ Sub-Basin	05-07-03		
Project Drainage Area (acres)	3,443		
Project Drainage Area Percentage of Impervious Cover	<1%		
CGIA Land Use Classification	Deciduous Forest Land		
Reach Summary Information			
Parameters	**Glade Creek**	**UT-Lower**	**UT-Upper**
Length of Reach (linear feet)	2,558	265	784
Valley Classification	-	-	-
Drainage Area (acres)	2,922	521	520
NCDWQ Stream Identification Score	59	50.5	50.5
NCDWQ Water Quality Classification	C-Tr	C-Tr	C-Tr
Morphological Description (stream type)	C	C	-
Evolutionary Trend	-	-	-
Underlying Mapped Soils	Alluvial	Alluvial	Alluvial
Drainage Class	-	-	-
Soil Hydric Status	-	-	-
Slope	0.0075	0.0075	0.0075
FEMA Classification	-	-	-
Native Vegetatation Community	Northern Hardwood Forest & Rich Cove Forest		
Percent Composition of Exotic Invasive Vegetation	14.5%		
Wetland Summary Information			
Parameters	**Wetland 1 (Glade Ck)**	**Wetland 2 (UT)**	
Size of Wetland (acres)	0.178	0.085	
Wetland Type	Riparian	Riparian	
Soil Series	Toxaway		
Soil Hydric Status	Hydric		
Source of Hydrology	-	-	
Hydrologic Impairment	-	-	
Native Vegetatation Community	High Elevation Seep		
Percent Composition of Exotic Invasive Vegetation	0.0%		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	Yes	N/A	-
Waters of the United States - Section 401	Yes	N/A	-
Endangered Species	No	N/A	N/A
Historic Preservation Act	No	N/A	N/A
Coastal Zone Management Act (CZMA) Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

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

3.0 SUCCESS CRITERIA

3.1 Morphometric Parameters and Channel Stability

Considering the typical 5-year timeframe for mitigation monitoring, the determination of success for stream projects is often based primarily on the degree of morphological stability. The complete absence of any change over these timeframes will certainly be interpreted as stability, but is not a pre-requisite. To the contrary, it is typical for streams to demonstrate variation over a 5-year monitoring period in the form of sustainable rates of change or stable patterns of variation (dynamic stability). Considering the young state of woody buffers and the fact that design parameters are estimates and therefore never a perfect match for the watershed regimes, restored streams typically adjust or shift to some extent after their exposure to varying flows in the years that immediately following construction. However, these changes should be moderate and exhibit little discernable trends. Annual morphological variation is to be expected, but over time and with buffer development should generally demonstrate a reduction in amplitude and demonstrate dynamic maintenance around some central tendency that represents acceptable distributions for design parameters and/or stable stream types. Key among these are parameters that indicate lateral and vertical stability and intended levels of floodplain connection. If trends or patterns become evident, they should be modest or indicate migration toward another stable channel form. Lastly, all of this must be evaluated in the context of hydrologic events to which the system is exposed over the monitoring period.

3.1.1 Dimension

Dimensional stability of the channel will be based on comparisons of overlays of annual cross-section plots and their calculated parameters to the as-built conditions, design distributions, and distributions for stable stream types. Parameters such as cross-sectional area and the channel's width to depth ratio should demonstrate modest overall change and patterns of variation that are in keeping with the previous description of dynamic stability. The stream dimensions should not demonstrate trends of enlargement either through downcutting or widening, however, modest year-to-year variation or oscillation in channel elevation or width demonstrating maintenance around baseline or design distributions is acceptable. Changes from depositional processes resulting in the development of constructive features on the banks and floodplain, such as an inner berm, channel narrowing, natural levees, and general floodplain deposition will be acceptable forms of change and indicative of stability.

The entire project will also be visually cataloged for areas of bank instability and presented as proportions of overall bank footage. The overall proportion, severity, spatial distribution, and temporal trends in this parameter will be assessed to serve as an additional indicator of dimensional stability. In general, stability proportions (stable bank/total bank) below 85% would be of concern. Considering temporal trends, a higher percentage in a given year may also be of concern if it represents a data point in a trend of decreasing stability. Bank instability dominated by surface scour versus mass wasting would be an example of differing severity and the latter would be more concerning than the former. Erosion in meanders versus riffle reaches would generate differing levels of concern because erosion in the former is more likely given greater

bank shear stress, whereas instability concentrated in riffle/run reaches might be more indicative of an overall design flaw.

3.1.2 Pattern and Profile

Reach profiles should not exhibit any consistent trends in thalweg degradation over any significant continuous portion of its length. Some aggradation will be acceptable and will not be actionable unless it is apparently causal for widening/bank erosion. Over the monitoring period, the profile should also demonstrate the maintenance or development of bedform (facets) in keeping with reference level diversity and distributions for the subject stream type. It should also provide a meaningful contrast in terms of bedform diversity against the pre-existing condition. Bedform distributions, riffle/pool lengths, and slopes will vary, but should do so with maintenance around design/as-built size distributions. This requires that the majority of pools are maintained at greater depths with lower water surface slopes and riffles are shallower with greater water surface slopes.

3.1.3 Substrate

Pebble count data should indicate the progression towards or the maintenance of the known particle size distributions from the design phase. The absence of any significant trends in bed aggradation or deposition should represent stable conditions in terms of sediment input and transport functionality.

While stream projects are designed to transport bedload in equilibrium and carry overall sediment loads at bankfull, fines can be transported even at low discharges. Channel instability upstream of the project can also lead to sediment deposition in the restored project reach as storm events recede. This can have the effect of obscuring bedform and fining of riffles especially in the first few years after the implementation of a stream project. In many cases subsequent narrowing and reduction of width/depth ratios as a project develops/stabilizes can then increase transport efficiency and return bedform to intended distributions, but some fining can persist due to upstream disturbance.

3.2 Hydrology

A minimum of two bankfull events must occur within separate years during the five-year monitoring period.

3.3 Vegetation

The success of the riparian and wetland vegetation plantings will be determined by planted stem densities within established monitoring plots. Survival of planted woody species must meet a minimum survival success criterion of 320 planted stems per acre through year three and 260 stems per acre after year five. (USACE 2003)

4.0 MAINTENANCE AND CONTINGENCY PLAN

During annual monitoring efforts any potential constraints to project success criteria will be documented and reported. Maintenance recommendations will be based on the severity of the problem and in consultation with NCEEP. In the event that maintenance activities are deemed necessary, corrective measures will be documented within the annual reports.

5.0 PROJECT MONITORING AND AS-BUILT CONDITIONS

5.1 Feature Monitoring Details

Features established for baseline data collection and future annual monitoring purposes included stream cross-sectional and longitudinal profiles, substrate assessment sites, stream hydrological monitoring stations, vegetation monitoring plots, and photographic monitoring stations (Appendix A – Monitoring Plan View).

5.1.1 Stream

Eight permanent cross-sections were established throughout the project site. Cross-sections transecting four riffles and two pools were established on the Glade Creek reach. Cross-sections for the Unnamed Tributary consisted of two riffles. Cross-section locations were marked on both banks with rebar and PVC conduit with fluorescent pink flagging tape. Cross-section data will be collected annually to document changes in dimensions such as area, width to depth ratios, and entrenchment ratios.

Longitudinal profile monitoring reaches were established for the majority of the restoration reaches and included a total of 2,811 linear feet. The Glade Creek profile reach included a total of 2,548 linear feet while the Unnamed Tributary reach included a total of 263 linear feet. The beginning and ending locations of the longitudinal profile reaches were marked on both banks with rebar and PVC conduit with blue flagging tape. Annual measurements will be compared with as-built conditions to document trends in the stream profile occurring throughout the monitoring period. A total station will be used to collect annual cross-sectional and longitudinal profile data. Visual monitoring will be conducted for all additional stream segments.

Bed material composition will be documented through annual pebble counts at each of the eight cross-section locations. Annual pebble counts will be collected utilizing methods adapted from Harrelson et al. (1994).

5.1.2 Hydrology

One crest gauge was installed within the project site at the downstream end of Glade Creek. Crest gauge readings will be collected during each site visit to document bankfull events.

5.1.3 Vegetation

A total of six vegetation monitoring plots were established based on the CVS-EEP protocol (Lee et al. 2008). They are comprised of four standard 10 x 10 meter and two non-standard 5 x 20 meter plots. Approximately 0.025-acre in size, vegetation plots were established and data was

collected to document baseline vegetation conditions. Annual monitoring will determine the success of planted vegetation and the overall trajectory of woody plant restoration and regeneration at the project site. Plots were placed within the riparian planting zone to capture the dominate vegetative community within the project site. Vegetation monitoring plot corners were marked with rebar, metal t-posts, and PVC conduit. Plot corners and planted stems were also marked with fluorescent orange flagging tape. The vegetation plot origin was labeled with the plot number. Data for the baseline report were collected according to the CVS-EEP Level I protocol and entered into the CVS-EEP Data Entry Tool (Version 4.2). Subsequent annual monitoring data collections will follow Level II (Lee et al. 2008).

5.1.4 Permanent Photo Locations

Permanent photo stations were established at each cross-section to digitally document annual conditions. Each vegetation monitoring plot includes a photo station taken diagonally from the origin towards the opposite plot corner. Additionally, seven 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 rebar, labeled wooden stakes, and red flagging tape.

5.1.5 Visual Assessment

Visual stream assessments will occur during annual monitoring to summarize performance percentages of morphological and structural feature categories. 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.

5.2 As-Built Conditions

The project's as-built conditions are included in Appendix B – As-built Plan View.

5.2.1 Streams

Baseline stream monitoring data were collected in May 2011. Data are summarized in Tables 5 and 6, while cross-section and longitudinal profile graphics are located in Appendices C and D. In general, the restored and enhanced stream pattern was similar to the proposed design. The design Rosgen classification was a C4 for the Glade Creek and unnamed tributary reaches. Based on the as-built conditions, the restored reaches classify as C stream types.

5.2.2 Vegetation

Baseline vegetation monitoring data were collected in May 2011. Vegetation plot attribute data are included in Tables 7 and 8, whereas individual plot photos are included in Appendix E. Individual plant species by plot and plot means are reported in Table 9. Stem counts for each of the eight vegetation monitoring plots were recorded by species.

Approved substitutions from the proposed planting plan included Southern crabapple *Malus angustifolia* for flowering dogwood *Cornus florida*, redbud *Cercis canadensis* for sourwood *Oxydendrum arboretum*, persimmon *Diospyros virginiana* for American hornbeam *Carpinus caroliniana*, and red chokeberry *Prunus virginiana* for serviceberry *Amelanchier arborea*. Additionally, mountain laurel *Kalmia latifolia* was planted in addition to the Rhododendron *Rhododendron sp*. The planted area consisted of approximately 4.31 acres, which combined

with the undisturbed forested areas within the project site results in a total of 14.24 vegetated acres within the easement area.

Results from the baseline data indicate a planted stem density ranging from 567 to 931 stems per acre. The average stem density for the entire restoration site is 715 stems per acre; of these, 100% were noted to have either good or excellent vigor values. In addition, invasive exotic plants such as oriental bittersweet *Celastrus orbiculatus*, Japanese honeysuckle *Lonicera japonica*, Japanese barberry *Berberis thunbergii*, Japanese spiraea *Spiraea japonica*, and multiflora rose *Rosa multiflora* were recorded at the project site.

5.2.3 Permanent Photo Stations

Photos were collected during April 2011 at the seven permanent photo stations established throughout the project area to provide representative digital documentation of baseline stream and vegetation conditions (Appendix F – Permanent Photo Station Photos). Representative pre-construction photos are included in Appendix F.

Table 5. Baseline Stream Data Summary
Glade Creek / Project No. 854 - Glade Creek (2,558 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)	-	-	-	-	44.7	-	-	-	-	-	30.7	-	-	-	-	-	34.0	-	35.2	43.2	44.9	47.7	5.9	4
Floodprone Width (ft)				-	45	-	-	-	-	-	70	-	-	-	-	-	>76	-	68.8	89.1	89.0	109.4	22.5	4
Bankfull Mean Depth (ft)	-	-	-	-	1.41	-	-	-	-	-	1.90	-	-	-	-	-	1.56	-	0.9	1.2	1.2	1.3	0.2	4
Bankfull Max Depth (ft)				-	2.3	-	-	-	-	-	2.5	-	-	-	-	-	2.2	-	1.7	1.8	1.9	1.9	0.1	4
Bankfull Cross Sectional Area (ft^2)		-		-	63.0	-	-	-	-	-	57.4	-	-	-	-	-	53.0	-	41.6	49.1	46.3	62.2	9.1	4
Width/Depth Ratio				-	31.7	-	-	-	-	-	16.4	-	-	-	-	-	22.0	-	27.6	39.0	36.9	62.2	11.3	4
Entrenchment Ratio				-	6.0	-	-	-	-	-	2.3	-	-	-	-	-	>2.2	-	1.5	2.1	2.2	2.6	0.5	4
Bank Height Ratio				1.2	-	-	3.0	-	-	-	1.0	-	-	-	-	-	1.0	-	1.0	1.0	1.0	1.0	0.0	4
d50 (mm)				-	12.5	-	-	-	-	-	58.0	-	-	-	-	-	-	-						
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.6	35.3	31.8	54.9	13.1	18
Riffle Slope (ft/ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.011	0.010	0.025	0.006	18
Pool Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.2	41.7	44.6	74.9	22.8	30
Pool Max Depth (ft)				-	5.7	-	-	-	-	-	3.1	-	-	-	-	-	4.4	-	3.2	4.1	4.1	5.6	0.7	31
Pool Spacing (ft)				110	-	-	228	-	7	-	224	-	-	-	-	91	-	155	10.7	84.5	98.5	162.5	51.0	29
Pool Volume (ft^3)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																								
Channel Belt Width (ft)				77	-	-	184	-	8	90	-	-	104	-	-	55	-	134	59.3	76.7	74.5	92.1	11.22	12
Radius of Curvature (ft)				34	-	-	118	-	8	76	-	-	135	-	-	53	-	172	41.7	57.9	50.3	101.0	17.80	15
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Wavelength (ft)				66	-	-	403	-	10	-	350	-	-	-	-	136	-	261	163.9	223.6	230.7	259.1	28.34	13
Meander Width Ratio				3.6	-	-	18.7	-	-	2.9	-	-	3.4	-	-	1.6	-	4.0	1.6	1.8	1.7	2.1	0.26	4
Substrate, Bed and Transport Parameters																								
Ri% / Ru% / P% / G% / S%						-						-									25% / 9% / 49% / 16% / 2%			
SC% / Sa% / G% / C% / B% / Be%						-						-												
d16 / d35 / d50 / d84 / d95 / di^p / di^{sp} (mm)						0.136 / 0.87 / 12.5 / 114 / - / - / -						0.17 / 29 / 58 / 180 / 300 / - / -												
Reach Shear Stress (Competency) lb/ft^2						0.41						-					0.39				0.36			
Max Part Size (mm) Mobilized at Bankfull						11						-					10				21			
Stream Power (Transport Capacity) W/m^2						-						-					-							
Additional Reach Parameters																								
Drainage Area (mi^2)						4.6						6.8												
Impervious Cover Estimate (%)						<1%						<1%												
Rosgen Classification						C_E4/F4/G4						C4					C4				C			
Bankfull Velocity (fps)		-				3.3						N/A					3.8							
Bankfull Discharge (cfs)		267 - 352				200						375					200							
Valley Length (ft)						2,180						-					2,180							
Channel Thalweg Length (ft)						2,569						-					2,555				2,558			
Sinuosity						1.18						1.10					1.17				1.17			
Water Surface Slope (ft/ft)						-						-					-				0.0055			
Bankfull Slope (ft/ft)						0.005						0.014					0.004				0.0050			
Bankfull Floodplain Area (acres)						-						-					-							
Proportion Over Wide (%)						-						-												
Entrenchment Class (ER Range)						-						-												
Incision Class (BHR Range)						-						-												
BEHI						Very High - 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
Glade Creek / Project No. 854 - Unnamed Tributary (265 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)	-	-	-	-	12.6	-	-	-	-	-	30.7	-	-	-	-	-	12.0	-	17.3	18.1	18.1	18.9	N/A	2
Floodprone Width (ft)				13	-	-	25	-	-	-	70	-	-	-	-	-	>44	-	33.5	37.7	37.7	41.8	N/A	2
Bankfull Mean Depth (ft)	-	-	-	-	0.8	-	-	-	-	-	1.9	-	-	-	-	-	0.7	-	0.7	0.8	0.8	0.8	N/A	2
Bankfull Max Depth (ft)				-	1.0	-	-	-	-	-	2.5	-	-	-	-	-	1.0	-	1.2	1.3	1.3	1.3	N/A	2
Bankfull Cross Sectional Area (ft^2)		-		-	9.9	-	-	-	-	-	57.4	-	-	-	-	-	8.2	-	12.7	13.0	13.0	13.2	N/A	2
Width/Depth Ratio				-	16.0	-	-	-	-	-	16.4	-	-	-	-	-	18.0	-	22.7	25.5	25.5	28.3	N/A	2
Entrenchment Ratio				1.1	-	-	2.0	-	-	-	2.3	-	-	-	-	-	>2.2	-	1.9	2.1	2.1	2.2	N/A	2
Bank Height Ratio				-	≥2.0	-	-	-	-	-	1.0	-	-	-	-	-	1.0	-	1.0	1.0	1.0	1.0	N/A	2
d50 (mm)				-	27	-	-	-	-	-	58	-	-	-	-	-	-	-						
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.8	10.3	10.3	14.6	4.0	6
Riffle Slope (ft/ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	0.017	0.015	0.034	0.011	6
Pool Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.6	13.3	10.8	29.5	8.5	9
Pool Max Depth (ft)				-	3.5	-	-	-	-	-	3.1	-	-	-	-	-	2.2	-	1.8	2.7	2.6	3.4	0.5	7
Pool Spacing (ft)				-	-	-	-	-	-	-	224	-	-	-	-	31	-	56	5.5	34.1	31.5	59.8	20.8	7
Pool Volume (ft^3)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																								
Channel Belt Width (ft)				57	-	-	79	-	7	90	-	-	104	-	-	30	-	45	28.6	34.3	36.1	37.1	3.51	5
Radius of Curvature (ft)				17	-	-	71	-	10	76	-	-	135	-	-	27	-	33	17.1	19.8	19.5	22.5	2.21	5
Rc: Bankfull Width (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Wavelength (ft)				66	-	-	93	-	6	-	350	-	-	-	-	75	-	84	66.4	77.7	82.7	83.9	9.78	3
Meander Width Ratio				4.5	-	-	6.3	-	-	2.9	-	-	3.4	-	-	2.5	-	3.8	1.9	2.0	2.0	2.1	N/A	2.0
Substrate, Bed and Transport Parameters																								
Ri% / Ru% / P% / G% / S%						-						-							24% / 11% / 47% / 16% / 2%					
SC% / Sa% / G% / C% / B% / Be%						-						-												
d16 / d35 / d50 / d84 / d95 / di^p / di^{sp} (mm)						0.3 / 11 / 27 / 85 / 115 / - / -						0.17 / 29 / 58 / 180 / 300 / - / -												
Reach Shear Stress (Competency) lb/ft^2						0.52						-					0.17				0.30			
Max Part Size (mm) Mobilized at Bankfull						15						-					3				65			
Stream Power (Transport Capacity) W/m^2						-						-					-							
Additional Reach Parameters																								
Drainage Area (mi^2)						0.8						6.8												
Impervious Cover Estimate (%)						<1%						<1%												
Rosgen Classification						C4						C4				C4			C					
Bankfull Velocity (fps)		-				2						N/A				2.4								
Bankfull Discharge (cfs)		76 - 98				20						375				20								
Valley Length (ft)						175						-				226								
Channel Thalweg Length (ft)						300						-				275					265			
Sinuosity						1.71						1.10				1.22					1.17			
Water Surface Slope (ft/ft)						-						-				-					0.0064			
Bankfull Slope (ft/ft)						0.011						0.014				0.006					0.0058			
Bankfull Floodplain Area (acres)						-						-				-								
Proportion Over Wide (%)						-						-												
Entrenchment Class (ER Range)						-						-												
Incision Class (BHR Range)						-						-												
BEHI						Very High						-												
Channel Stability or Habitat Metric						-						-												
Biological or Other						-						-												

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

Table 6. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross-Sections) Glade Creek / Project No. 854 - Glade Creek (2,558 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	2,613						2,612						2,611					
Bankfull Width (ft)	47.7						50.4						47.6					
Floodprone Width (ft)	109						69.1						70.4					
Bankfull Mean Depth (ft)	0.9						1.6						1.3					
Bankfull Max Depth (ft)	1.9						3.0						1.9					
Bankfull Cross Sectional Area (ft^2)	41.6						78.3						62.2					
Bankfull Width/Depth Ratio	54.7						32.5						36.5					
Bankfull Entrenchment Ratio	2.3						1.4						1.5					
Bankfull Bank Height Ratio	1.0						1.0						1.0					
Cross Sectional Area between End Pins (ft^2)	41.8						78.3						62.2					
d50 (mm)	N/A						N/A						N/A					
	Cross-Section 4 Riffle						Cross-Section 5 Pool						Cross-Section 6 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,607						2,606						2,605					
Bankfull Width (ft)	35.2						53.2						42.1					
Floodprone Width (ft)	68.8						117.9						107.6					
Bankfull Mean Depth (ft)	1.3						1.3						1.1					
Bankfull Max Depth (ft)	1.7						3.7						1.8					
Bankfull Cross Sectional Area (ft^2)	44.9						68.7						47.7					
Bankfull Width/Depth Ratio	27.6						41.1						37.2					
Bankfull Entrenchment Ratio	2.0						2.2						2.6					
Bankfull Bank Height Ratio	1.0						1.0						1.0					
Cross Sectional Area between End Pins (ft^2)	44.9						68.7						47.7					
d50 (mm)	N/A						N/A						N/A					

N/A - Item does not apply.

Table 6. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross-Sections) Glade Creek / Project No. 854 - Unnamed Tributary (265 feet)												
	Cross-Section 7 Riffle						Cross-Section 8 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,604						2,602					
Bankfull Width (ft)	17.3						18.9					
Floodprone Width (ft)	33.5						41.8					
Bankfull Mean Depth (ft)	0.8						0.7					
Bankfull Max Depth (ft)	1.3						1.2					
Bankfull Cross Sectional Area (ft^2)	13.2						12.7					
Bankfull Width/Depth Ratio	22.7						28.3					
Bankfull Entrenchment Ratio	1.9						2.2					
Bankfull Bank Height Ratio	1.0						1.0					
Cross Sectional Area between End Pins (ft^2)	13.2						12.7					
d50 (mm)	N/A						N/A					

N/A - Item does not apply.

Table 7. Vegetation Plot Attribute Data Glade Creek / Project No. 854					
Plot ID	**Community Type**	**Planting Zone ID**	**Reach ID**	**Associated Gauges**	**CVS Level**
VP 1	Piedmont/Mountain Levee Forest	1	Glade Creek	N/A	I
VP 2	Piedmont/Mountain Levee Forest	1	Glade Creek	N/A	I
VP 3	Piedmont/Mountain Levee Forest	1	Glade Creek	N/A	I
VP 4	Piedmont/Mountain Levee Forest	1	Glade Creek	N/A	I
VP 5	Piedmont/Mountain Levee Forest	1	Glade Creek	N/A	I
VP 6	Piedmont/Mountain Levee Forest	1	UT-Lower	N/A	I

Table 8. CVS Vegetation Plot Metadata Glade Creek / Project No. 854	
Report Prepared By	Kevin Mitchell
Date Prepared	5/12/2011 16:57
Database Name	Equinox-2011-A-GladeCreek-MY0.mdb
Database Location	Z:\ES\NRI&M\EEP Monitoring\Glade Creek\Glade-MY0-2011\Data\Veg
Computer Name	D16TNK71
File Size	48082944
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Species	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Species	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Species	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY	
Project Code	854
project Name	Glade Creek
Description	
River Basin	New
Length(ft)	
Stream-to-Edge Width (ft)	
Area (sq m)	
Required Plots (calculated)	
Sampled Plots	6

Table 9. Planted and Total Stem Counts (Species by Plot with Annual Means) Glade Creek / Project No. 854																							
			Current Plot Data (MY0 2011)																			Annual Means		
			854-01-0001			854-01-0002			854-01-0003			854-01-0004			854-01-0005			854-01-0006			MY0 (2011)		
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	PnoLS	P-all	T
Aronia arbutifolia	Red chokeberry	Shrub	2	2	2	4	4	4	2	2	2	2	2	2	1	1	1				11	11	11
Callicarpa americana	American beautyberry	Shrub	1	1	1	1	1	1							1	1	1	1	1	1	4	4	4
Calycanthus floridus	Eastern sweetshrub	Shrub				1	1	1				1	1	1	1	1	1				3	3	3
Carpinus caroliniana	American hornbeam	Shrub Tree				3	3	3	3	3	3	2	2	2	3	3	3	2	2	2	13	13	13
Cephalanthus occidentalis	Common buttonbush	Shrub Tree				3	3	3													3	3	3
Cercis canadensis	Eastern redbud	Shrub Tree	3	3	3				1	1	1				1	1	1	2	2	2	7	7	7
Diospyros virginiana	Common persimmon	Tree				1	1	1	1	1	1				3	3	3				5	5	5
Hamamelis virginiana	American witchhazel	Shrub Tree	1	1	1	1	1	1							1	1	1				3	3	3
Hydrangea arborescens	Wild hydrangea	Shrub	1	1	1	3	3	3				2	2	2	1	1	1	1	1	1	8	8	8
Kalmia latifolia	Mountain laurel	Shrub Tree	2	2	2													1	1	1	3	3	3
Lindera benzoin	Northern spicebush	Shrub Tree	2	2	2	1	1	1	1	1	1										4	4	4
Liriodendron tulipifera	Tuliptree	Tree	2	2	2				1	1	1	1	1	1				1	1	1	5	5	5
Malus angustifolia	Southern crabapple	Shrub Tree	1	1	1	1	1	1	1	1	1							3	3	3	6	6	6
Platanus occidentalis	American sycamore	Tree	2	2	2	3	3	3	2	2	2	3	3	3	1	1	1	3	3	3	14	14	14
Quercus rubra	Northern red oak	Tree	3	3	3	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	12	12	12
Rhododendron	Rhododendron	Shrub Tree							1	1	1	2	2	2							3	3	3
Salix	Willow	Shrub Tree														3	3					3	3
Unknown		Unknown							1	1	1				1	1	1				2	2	2
		Stem Count	20	20	20	23	23	23	15	15	15	14	14	14	17	20	20	17	17	17	106	109	109
		Size (ares)		1			1			1			1			1			1			6	
		Size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.15	
		Species Count	11	11	11	12	12	12	11	11	11	8	8	8	11	12	12	9	9	9	17	18	18
		Stems per ACRE	809	809	809	931	931	931	607	607	607	567	567	567	688	809	809	688	688	688	715	735	735

6.0 REFERENCES

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

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2.

NCEEP (North Carolina Ecosystem Enhancement Program). 2009. New River Basin. Restoration Priorities. Raleigh, NC.

NCEEP (North Carolina Ecosystem Enhancement Program). December 2007. Restoration Plan. Glade Creek Stream Restoration. Alleghany County North Carolina. Raleigh, NC.

Rosgen, D.L. 1997. A Geomorphological Approach to Restoration of Incised Rivers. In: Wang, S.S.Y, E.J. Langendoen, and F.D. Shields, Jr. (Eds.). Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision. pp. 12-22.

Rosgen, D.L. 2001. A Practical Method of Computing Streambank Erosion Rate. Wildland Hydrology, Inc. Pagosa Springs, CO.

Schafale, M.P. and A.S. Weakley. 1990. Classification of Natural Communities of North Carolina, 3rd Approximation. North Carolina Natural Heritage Program, NCDEHNR, Division of Parks and Recreation. Raleigh, NC.

USACE (U.S. Army Corps of Engineers). 2003. Stream Mitigation Guidelines. U.S. Army Corps of Engineers – Wilmington District, U.S. Environmental Protection Agency, North Carolina Wildlife Resources Commission, and North Carolina Department of Environment and Natural Resources Division of Water Quality. Wilmington, North Carolina.

Appendix A
Monitoring Plan View

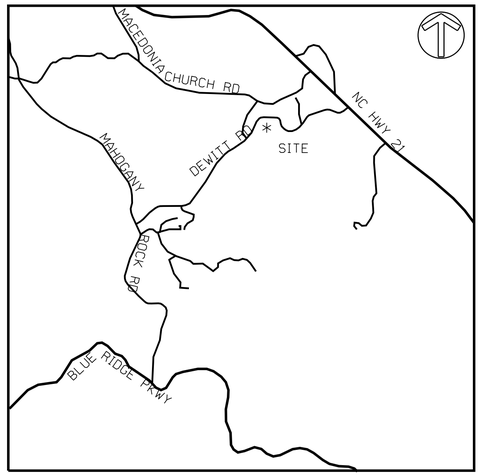
Monitoring Plan View

Prepared for Ecosystem Enhancement Program	**Project:** Glade Creek Stream Restoration Monitoring Plan View Alleghany County, North Carolina	Notes: 1) Base Map Data Provided by NCEEP & Biohabitats 2) 2010 Aerial Photo	Prepared by EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN
	Sheet 1 of 1		
	Date	Project Number	
	December 2011	NCEEP # 854	

Appendix B
As-Built Plan View

GLADE CREEK
STREAM RESTORATION
RECORD DRAWINGS
EEP ID 854

SITE VICINITY MAP



NOT TO SCALE

LATITUDE: 36 27'30"
LONGITUDE: 81°04'00"

DIRECTIONS TO SITE:

FROM RALEIGH, NC.
1) TAKE I-40 WEST TOWARD WINSTON SALEM (110 MILES)
2) TAKE EXIT 188 US-421N TOWARD YADKINVILLE/WILKESBORO (28 MILES).
3) MERGE ONTO I-77N VIA EXIT 265A TOWARD ELKIN (10 MILES).
4) MERGE ONTO US-21N BYPASS (BECOMES US-21) VIA EXIT 83 ON THE LEFT TOWARD ROARING GAP/SPARTA (34 MILES).
5) TAKE A LEFT ONTO DEWITT ROAD, THE PROJECT SITE IS LOCATED APPROX. 0.8 MILES ON THE LEFT.

INDEX OF SHEETS

SCALE: 1" = 150'

AS-BUILT SURVEY OF STREAM TOPOGRAPHY AND STRUCTURES BY THE SCHNEIDER CORPORATION NC LICENSE # F-1041, (704) 697-5900

NORTH CAROLINA PROFESSIONAL SEAL L-3577 MICHAEL S. MILLER LAND SURVEYOR

NOTES:

1. SURVEY PERFORMED BY CAVANAUGH IN MARCH 2007. NAVD88
2. AS-BUILT SURVEY PERFORMED BY SCHNEIDER CORP. IN MAY 2011.
3. TOTAL DISTURBED AREA = 6.3 AC.
4. RESTORED STREAM LENGTH GLADE CREEK = 2555 FT TRIBUTARY = 275 FT
5. STRUCTURE TABLES ARE FROM DESIGN PHASE ONLY. STRUCTURE LOCATIONS AND ELEVATIONS WERE FIELD VERIFIED BY DESIGNER.

THIS PROJECT IS FUNDED BY NC EEP.
EEP PROJECT MANAGER = HARRY TSOMIDES
EEP REVIEW COORDINATOR = WYATT BROWN
BIOHABITATS PROJECT MANAGER = KEVIN NUNNERY
BIOHABITATS DESIGNER = VINCE SORTMAN/J. KEITH BOWERS
SCO ID = 06-06830-01
DENR CONTRACT NO. = D07044S

REVISIONS

Mark	Description	Date	Appr.

North Carolina
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Tel:919-715-0476

YADKIN VALLEY CONSTRUCTION, INC.
2961 OLD 60 HWY, RONDA, NC 28670

Biohabitats
SOUTHEAST BIOREGION
8218 Creedmore Road Suite 200
Raleigh, NC 27613 / ph: 919.518.0311
fx: 919.518.0313 / www.biohabitats.com
Restore the Earth and Inspire Ecological Stewardship

GLADE CREEK
STREAM RESTORATION
RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

TITLE:

TITLE SHEET

PROJECT NO.: 06801.03	SCALE:
SEAL: NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1172 KEITH BOWERS	DESIGNED BY: VLS/KTN; DRAWN BY: SRH
	CHECKED: JXR/EMM; APPROVED: TKB
	DATE: AUGUST 2011
	DWG. NO.: 1 OF 11

100% SUBMITTAL

LEGEND

- EXISTING CONTOUR
- EXISTING THALWEG
- EXISTING OVERHEAD UTILITY LINE
- EXISTING CONSERVATION EASEMENT
- EXISTING RIGHT OF WAY
- EXISTING WETLAND
- EXISTING TREE TO BE SAVED
- EXISTING TREE TO BE REMOVED
- EXISTING TOP OF BANK
- EXISTING 25' TROUT BOUNDARY
- PROPOSED CONTOURS
- PROPOSED THALWEG
- PROPOSED BANKFULL LIMITS
- PROPOSED LIMIT OF DISTURBANCE
- TEMPORARY STOCKPILE AREA
- TEMPORARY TIMBER CROSSING
- SILT FENCE
- STABILIZED CONSTRUCTION ENTRANCE
- STRAW WATTLE
- LOG VANE
- ROCK J-VANE
- ROCK TOE PROTECTION
- ROCK CROSS VANE
- ROCK STEP
- ROOT WAD WITH LARGE WOODY DEBRIS DEFLECTOR
- RIFFLE STRUCTURE
- PLANTING ZONE 1 - RIPARIAN MESIC WOODLAND
- PLANTING ZONE 2 - FLOODPLAIN BENCH
- PLANTING ZONE 3 - EXCESS FILL AREA
- AS-BUILT ROOTWAD
- AS-BUILT LOG VANE
- AS-BUILT CROSS SECTION
- AS-BUILT CONTOUR
- AS-BUILT THALWEG
- AS-BUILT CENTERLINE
- AS-BUILT ROCK STRUCTURE
- AS-BUILT RIFFLE

NOTE: INDIVIDUAL AS-BUILT ROCK STRUCTURES ARE LABELED ON SHEETS 3-8.

LEGEND FOR CROSS SECTIONS

- AS-BUILT SURVEY

REVISIONS

Mark	Description	Date	Appr.

North Carolina
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Tel:919-715-0476

YADKIN VALLEY CONSTRUCTION, INC.
2961 OLD 60 HWY, RONDA, NC 28670

Biohabitats
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8218 Creedmoor Road Suite 200
Raleigh, NC 27613 / ph: 919.518.0311
fx: 919.518.0313 / www.biohabitats.com
Restore the Earth and Inspire Ecological Stewardship

GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

TITLE:

LEGEND AND SYMBOLS

PROJECT NO.: 06801.03

SCALE:

SEAL: NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1172 KEITH BOWERS

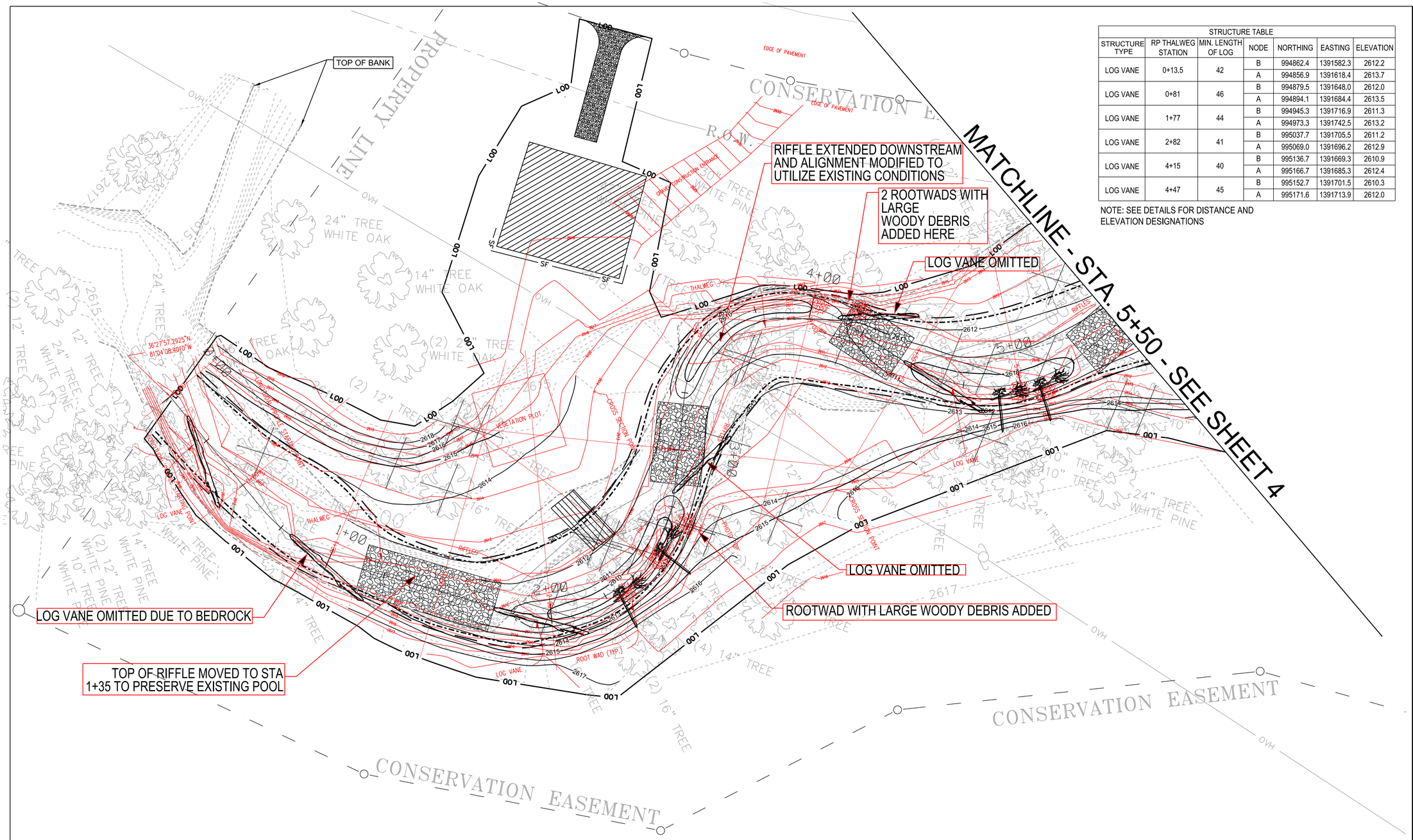
DESIGNED BY:	DRAWN BY:
VLS/KTN	SRH
CHECKED:	APPROVED:
JXR/EMM	TKB

DATE: AUGUST 2011

DWG. NO.:

2 OF 11

100% SUBMITTAL



STRUCTURE TABLE						
STRUCTURE TYPE	RP THALWEG STATION	MIN. LENGTH OF LOG	NODE	NORTHING	EASTING	ELEVATION
LOG VANE	0+13.5	42	B	994862.4	1391582.3	2612.2
			A	994856.9	1391618.4	2613.7
LOG VANE	0+81	46	B	994879.5	1391648.0	2612.0
			A	994894.1	1391684.4	2613.5
LOG VANE	1+77	44	B	994945.3	1391716.9	2611.3
			A	994973.3	1391742.5	2613.2
LOG VANE	2+82	41	B	995037.7	1391705.5	2611.2
			A	995069.0	1391696.2	2612.9
LOG VANE	4+15	40	B	995136.7	1391669.3	2610.9
			A	995166.7	1391685.3	2612.4
LOG VANE	4+47	45	B	995152.7	1391701.5	2610.3
			A	995171.6	1391713.9	2612.0

NOTE: SEE DETAILS FOR DISTANCE AND ELEVATION DESIGNATIONS

SCALE
0 20 40
N

REVISIONS			
Mark	Description	Date	Appr.

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GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

AS-BUILT SURVEY OF STREAM TOPOGRAPHY AND STRUCTURES BY THE SCHNEIDER CORPORATION
NC LICENSE # F-1041, (704) 697-5900

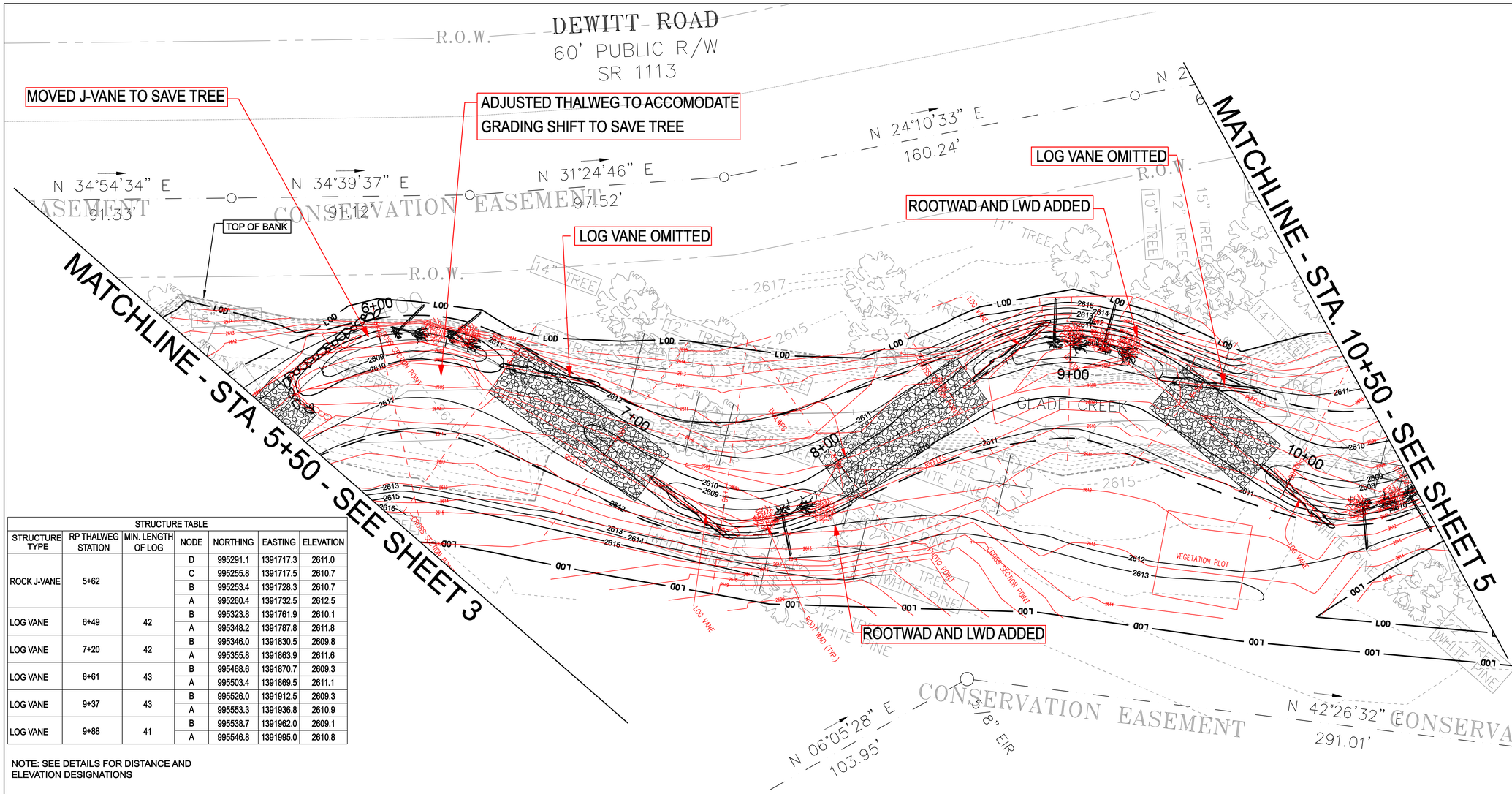
NORTH CAROLINA PROFESSIONAL SEAL L-3577 MICHAEL S. MILLER

TITLE:

RECORD DRAWING

PROJECT NO.: 06801.03	SCALE: HORIZONTAL 1" = 20' VERTICAL 1" = 2'
SEAL: NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1172 KEITH BOWERS	DESIGNED BY: VLS/KTN; DRAWN BY: SRH
	CHECKED: JXR/EMM; APPROVED: TKB
	DATE: AUGUST 2011
	DWG. NO.: 3 OF 11

100% SUBMITTAL



STRUCTURE TABLE						
STRUCTURE TYPE	RP THALWEG STATION	MIN. LENGTH OF LOG	NODE	NORTHING	EASTING	ELEVATION
ROCK J-VANE	5+62		D	995291.1	1391717.3	2611.0
			C	995255.8	1391717.5	2610.7
			B	995253.4	1391728.3	2610.7
			A	995260.4	1391732.5	2612.5
LOG VANE	6+49	42	B	995323.8	1391761.9	2610.1
			A	995348.2	1391787.8	2611.8
LOG VANE	7+20	42	B	995346.0	1391830.5	2609.8
			A	995355.8	1391863.9	2611.6
LOG VANE	8+61	43	B	995468.6	1391870.7	2609.3
			A	995503.4	1391869.5	2611.1
LOG VANE	9+37	43	B	995526.0	1391912.5	2609.3
			A	995553.3	1391936.8	2610.9
LOG VANE	9+88	41	B	995538.7	1391962.0	2609.1
			A	995546.8	1391995.0	2610.8

NOTE: SEE DETAILS FOR DISTANCE AND ELEVATION DESIGNATIONS

NOTE: THE APPARENT MOVEMENT DOWNSTREAM OF THE CONSTRUCTED RIFFLES IS DUE TO HIGH FLOWS EXPERIENCED AFTER CONSTRUCTION. THE RIFFLES ARE STILL FUNCTIONING PROPERLY.

AS-BUILT SURVEY OF STREAM TOPOGRAPHY AND STRUCTURES BY THE SCHNEIDER CORPORATION NC LICENSE # F-1041, (704) 697-5900

NORTH CAROLINA PROFESSIONAL SEAL L-3877 LAND SURVEYOR MICHAEL S. MILLER — 6-16-11

SCALE 0 20 40

N

REVISIONS

Mark	Description	Date	Appr.

North Carolina
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GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

TITLE:

RECORD DRAWINGS

PROJECT NO.: 06801.03

SCALE: 1" = 20'

SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036172 JOSEPH BOWERS

DESIGNED BY: VLS/KTN

DRAWN BY: SRH

CHECKED: JXR/EMM

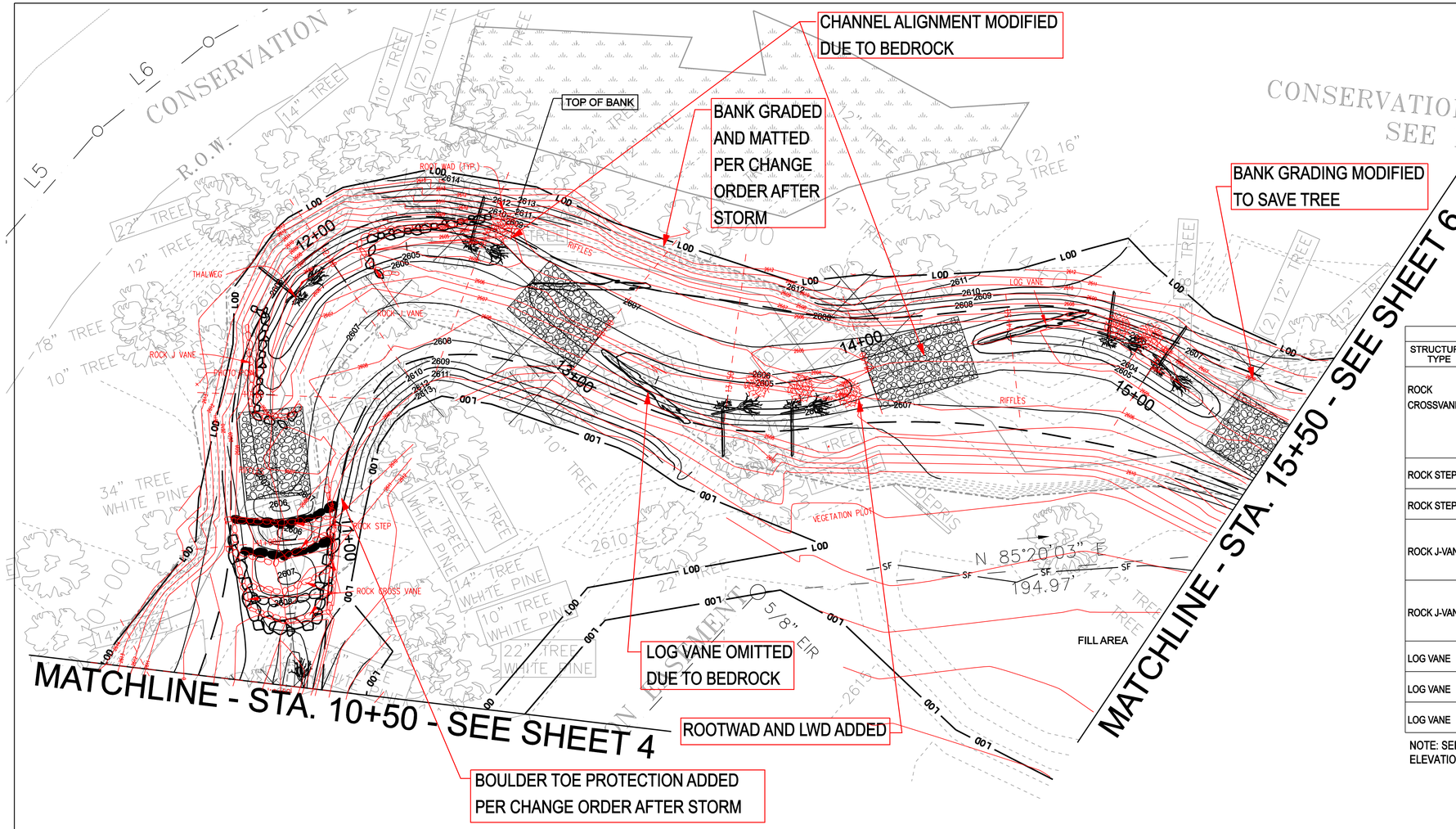
APPROVED: TKB

DATE: AUGUST 2011

DWG. NO. :

4 OF 11

100% SUBMITTAL



NOTE: THE APPARENT MOVEMENT DOWNSTREAM OF THE CONSTRUCTED RIFFLES IS DUE TO HIGH FLOWS EXPERIENCED AFTER CONSTRUCTION. THE RIFFLES ARE STILL FUNCTIONING PROPERLY.

STRUCTURE TABLE

STRUCTURE TYPE	RP THALWEG STATION	MIN. LENGTH OF LOG	NODE	NORTHING	EASTING	ELEVATION
ROCK CROSSVANE	10+70		F	995636.8	1392015.1	2609.9
			E	995615.4	1392010.2	2609.4
			D	995604.7	1392008.7	2609.1
			C	995602.4	1391988.0	2609.1
			B	995613.4	1391983.7	2609.4
			A	995632.5	1391979.5	2609.9
ROCK STEP	10+95		B	995630.1	1392011.9	2609.8
			A	995628.2	1391978.1	2609.8
ROCK STEP	11+00		B	995643.8	1392015.5	2609.7
			A	995639.6	1391979.2	2609.7
ROCK J-VANE	11+43		D	995679.7	1392002.3	2607.5
			C	995673.0	1391998.0	2607.2
			B	995675.9	1391987.4	2607.2
			A	995707.6	1391988.9	2608.8
ROCK J-VANE	12+12		D	995722.1	1392035.0	2607.0
			C	995723.9	1392027.1	2606.8
			B	995735.1	1392025.9	2606.8
			A	995740.6	1392060.6	2608.5
LOG VANE	12+70	43	B	995719.3	1392081.2	2606.0
			A	995718.2	1392121.0	2607.8
LOG VANE	13+04	45	B	995696.6	1392106.9	2605.7
			A	995672.6	1392134.8	2607.4
LOG VANE	14+39	45	B	995699.2	1392235.0	2605.3
			A	995710.1	1392271.0	2606.9

NOTE: SEE DETAILS FOR DISTANCE AND ELEVATION DESIGNATIONS

AS-BUILT SURVEY OF STREAM TOPOGRAPHY AND STRUCTURES BY THE SCHNEIDER CORPORATION NC LICENSE # F-1041, (704) 697-5900

SCALE 0 20 40

N

REVISIONS

Mark	Description	Date	Appr.

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Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Tel:919-715-0476

YADKIN VALLEY CONSTRUCTION, INC.
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GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

TITLE:

RECORD DRAWINGS

PROJECT NO.: 06801.03

SCALE: 1" = 20'

SEAL:

DESIGNED BY: VLS/KTN

DRAWN BY: SRH

CHECKED: JXR/EMM

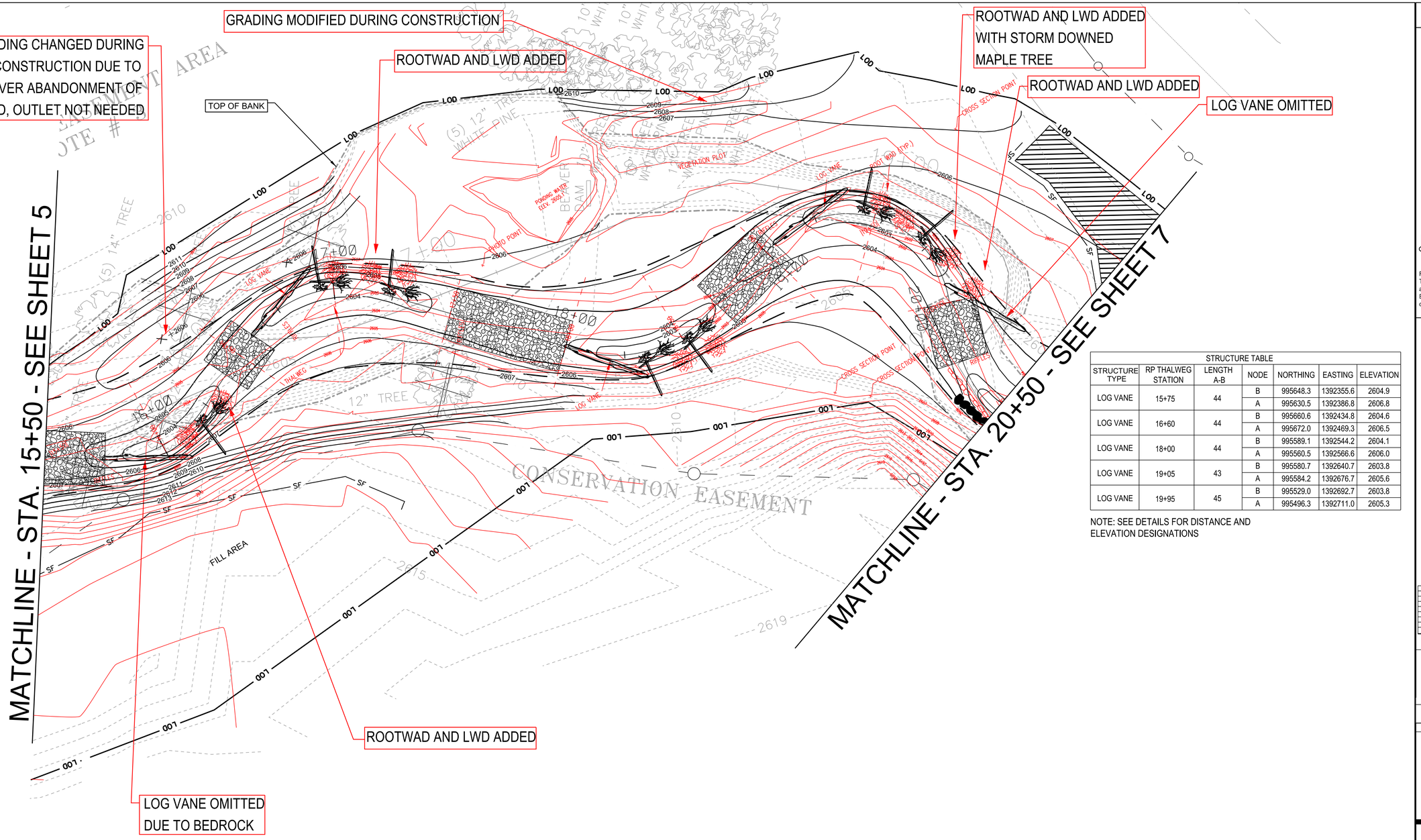
APPROVED: TKB

DATE: AUGUST 2011

DWG. NO.:

5 OF 11

100% SUBMITTAL



STRUCTURE TABLE						
STRUCTURE TYPE	RP THALWEG STATION	LENGTH A-B	NODE	NORTHING	EASTING	ELEVATION
LOG VANE	15+75	44	B	995648.3	1392355.6	2604.9
			A	995630.5	1392386.8	2606.8
LOG VANE	16+60	44	B	995660.6	1392434.8	2604.6
			A	995672.0	1392469.3	2606.5
LOG VANE	18+00	44	B	995589.1	1392544.2	2604.1
			A	995560.5	1392566.6	2606.0
LOG VANE	19+05	43	B	995580.7	1392640.7	2603.8
			A	995584.2	1392676.7	2605.6
LOG VANE	19+95	45	B	995529.0	1392692.7	2603.8
			A	995496.3	1392711.0	2605.3

NOTE: SEE DETAILS FOR DISTANCE AND ELEVATION DESIGNATIONS

SCALE
0 20 40

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REVISIONS			
Mark	Description	Date	Appr.

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GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

AS-BUILT SURVEY OF STREAM TOPOGRAPHY AND STRUCTURES BY THE SCHNEIDER CORPORATION NC LICENSE # F-1041, (704) 697-5900

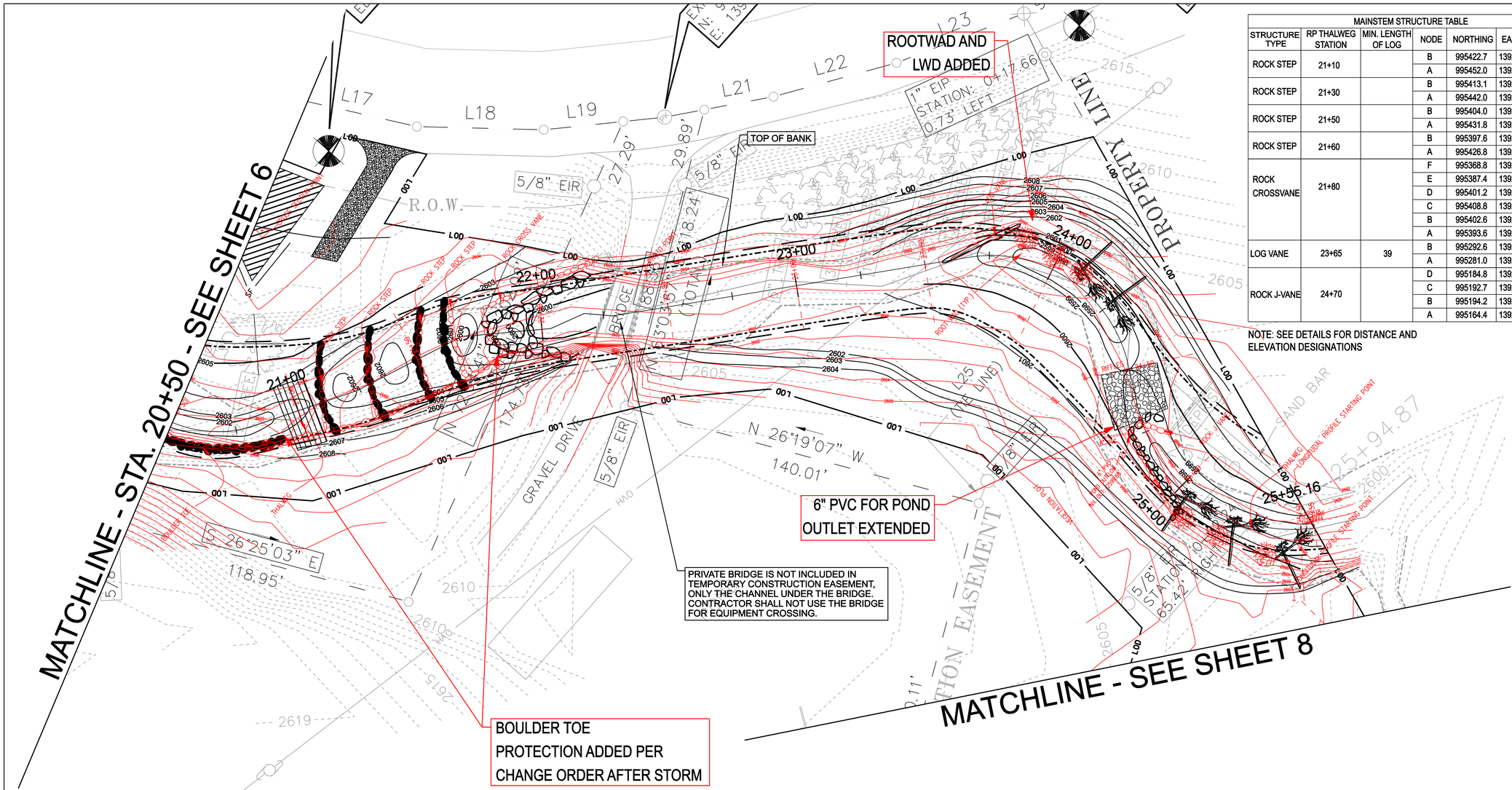
NORTH CAROLINA PROFESSIONAL SEAL L-3577 LAND SURVEYOR MICHAEL S. MILLER

TITLE:

RECORD DRAWINGS

PROJECT NO.: 06801.03	SCALE: 1" = 20'
SEAL: NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1172 KEITH BOWERS	DESIGNED BY: VLS/KTN; DRAWN BY: SRH
	CHECKED: JXR/EMM; APPROVED: TKB
	DATE: AUGUST 2011
	DWG. NO.: 6 OF 11

100% SUBMITTAL



MAINSTEM STRUCTURE TABLE						
STRUCTURE TYPE	RP THALWEG STATION	MIN. LENGTH OF LOG	NODE	NORTHING	EASTING	ELEVATION
ROCK STEP	21+10		B	995422.7	1392722.2	2605.5
			A	995452.0	1392744.7	2605.5
ROCK STEP	21+30		B	995413.1	1392738.2	2604.9
			A	995442.0	1392762.2	2604.9
ROCK STEP	21+50		B	995404.0	1392756.3	2604.3
			A	995431.8	1392780.2	2604.3
ROCK STEP	21+60		B	995397.6	1392767.8	2603.9
			A	995426.8	1392788.8	2603.9
ROCK CROSSVANE	21+80		F	995368.8	1392807.1	2602.1
			E	995387.4	1392794.7	2601.7
			D	995401.2	1392785.7	2601.5
			C	995408.8	1392794.0	2601.5
			B	995402.6	1392808.5	2601.7
			A	995393.6	1392829.5	2602.1
LOG VANE	23+65	39	B	995292.6	1392953.6	2599.5
			A	995281.0	1392953.6	2601.0
ROCK J-VANE	24+70		D	995184.8	1392935.9	2600.0
			C	995192.7	1392934.5	2599.7
			B	995194.2	1392923.6	2599.7
			A	995164.4	1392912.6	2600.7

NOTE: SEE DETAILS FOR DISTANCE AND ELEVATION DESIGNATIONS

SCALE 0 20 40

N

REVISIONS			
Mark	Description	Date	Appr.

North Carolina
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Tel:919-715-0476

YADKIN VALLEY CONSTRUCTION, INC.
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GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

AS-BUILT SURVEY OF STREAM TOPOGRAPHY AND STRUCTURES BY THE SCHNEIDER CORPORATION NC LICENSE # F-1041, (704) 697-5900

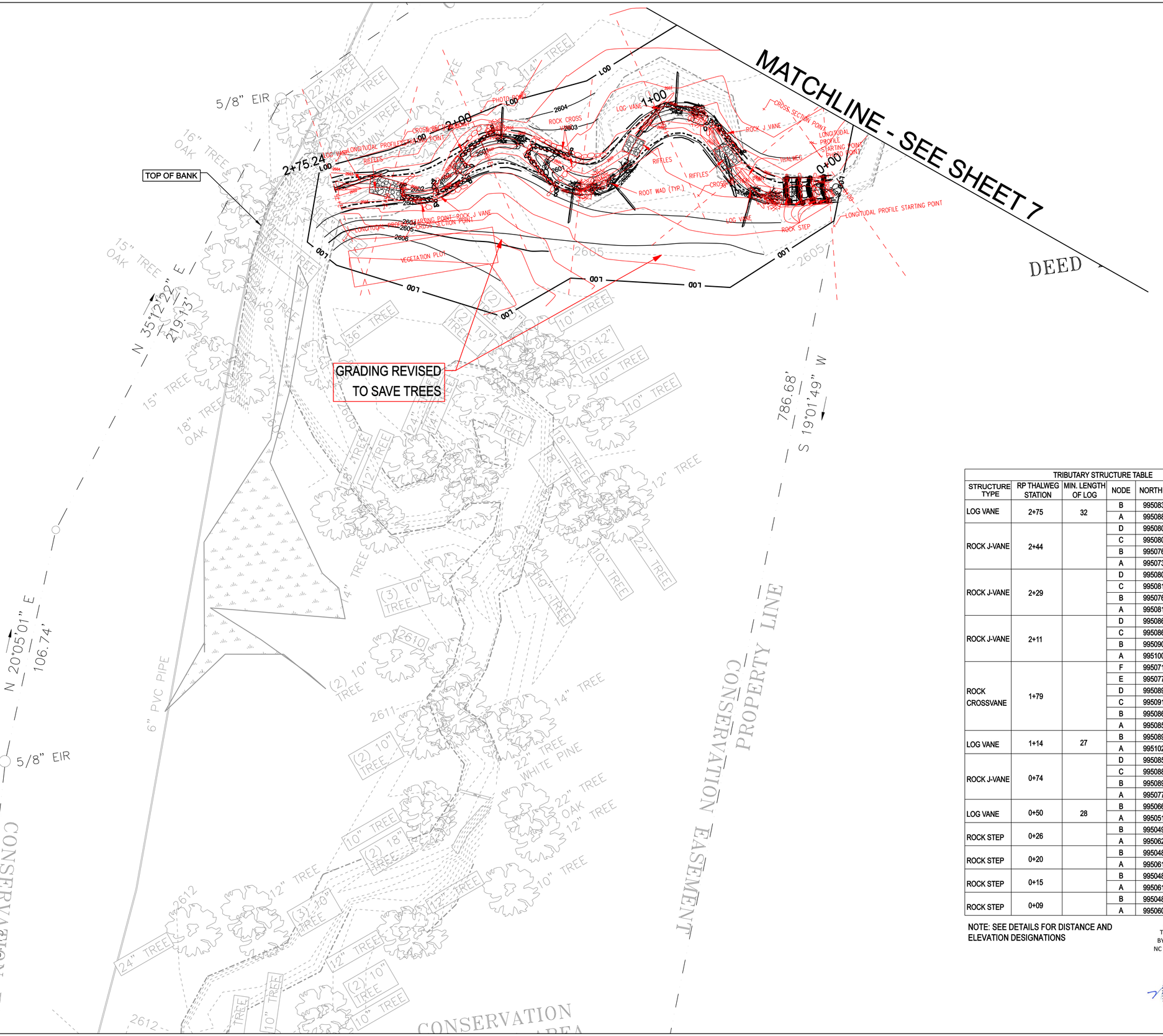
NORTH CAROLINA PROFESSIONAL SEAL L-3877 LAND SURVEYOR MICHAEL S. MILLER

TITLE:

RECORD DRAWINGS

PROJECT NO.: 06801.03	SCALE: 1" = 20'
SEAL: NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1172 KEITH BOWERS	DESIGNED BY: VLS/KTN; DRAWN BY: SRH
	CHECKED: JXR/EMM; APPROVED: TKB
	DATE: AUGUST 2011
	DWG. NO.: 7 OF 11

100% SUBMITTAL



TRIBUTARY STRUCTURE TABLE						
STRUCTURE TYPE	RP THALWEG STATION	MIN. LENGTH OF LOG	NODE	NORTHING	EASTING	ELEVATION
LOG VANE	2+75	32	B	995083.8	1392696.0	2602.0
			A	995088.9	1392720.2	2603.5
ROCK J-VANE	2+44		D	995080.6	1392728.3	2602.9
			C	995080.6	1392726.6	2602.7
			B	995076.7	1392725.8	2602.7
			A	995073.1	1392740.2	2603.3
ROCK J-VANE	2+29		D	995080.3	1392739.9	2602.7
			C	995081.1	1392741.0	2602.5
			B	995076.7	1392741.6	2602.5
			A	995081.1	1392757.5	2603.1
ROCK J-VANE	2+11		D	995086.8	1392758.4	2602.4
			C	995086.9	1392756.1	2602.2
			B	995090.6	1392754.4	2602.2
			A	995100.7	1392771.1	2603.0
ROCK CROSSVANE	1+79		F	995071.7	1392794.8	2602.9
			E	995077.4	1392790.5	2602.5
			D	995089.1	1392783.5	2601.7
			C	995091.4	1392786.8	2601.7
			B	995086.9	1392796.6	2602.5
			A	995085.3	1392802.8	2602.9
LOG VANE	1+14	27	B	995089.3	1392834.3	2601.3
			A	995102.7	1392848.3	2602.4
ROCK J-VANE	0+74		D	995085.7	1392866.6	2601.9
			C	995088.3	1392866.5	2601.6
			B	995089.2	1392870.3	2601.6
			A	995077.2	1392879.1	2602.2
LOG VANE	0+50	28	B	995066.4	1392876.4	2601.0
			A	995051.6	1392889.1	2602.0
ROCK STEP	0+26		B	995049.4	1392898.5	2602.0
			A	995062.3	1392898.5	2602.0
ROCK STEP	0+20		B	995048.8	1392903.6	2601.5
			A	995061.3	1392903.7	2601.5
ROCK STEP	0+15		B	995048.8	1392909.2	2601.2
			A	995061.2	1392909.0	2601.2
ROCK STEP	0+09		B	995048.7	1392915.0	2600.7
			A	995060.7	1392914.9	2600.7

NOTE: SEE DETAILS FOR DISTANCE AND ELEVATION DESIGNATIONS

AS-BUILT SURVEY OF STREAM TOPOGRAPHY AND STRUCTURES BY THE SCHNEIDER CORPORATION NC LICENSE # F-1041, (704) 697-5900

NORTH CAROLINA PROFESSIONAL SEAL L-3577 MICHAEL S. MILLER REGISTERED LAND SURVEYOR 3-16-11

SCALE 0 20 40

N

REVISIONS			
Mark	Description	Date	Appr.

North Carolina
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Tel:919-715-0476

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GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

TITLE:

RECORD DRAWINGS

PROJECT NO.: 06801.03

SCALE: 1" = 20'

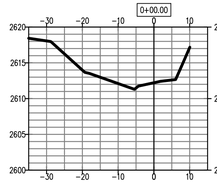
SEAL: NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1172 KENNETH BOWERS

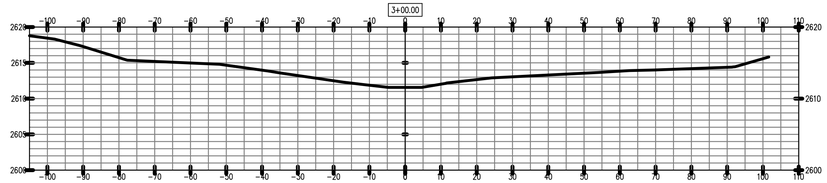
DESIGNED BY: VLS/KTN
DRAWN BY: SRH
CHECKED: JXR/EMM
APPROVED: TKB
DATE: AUGUST 2011

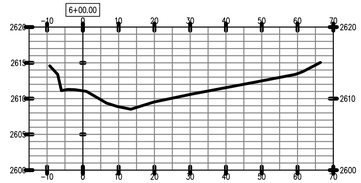
DWG. NO.:

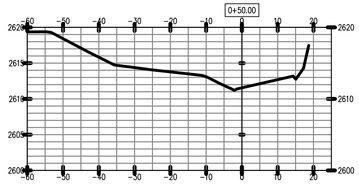
8 OF 11

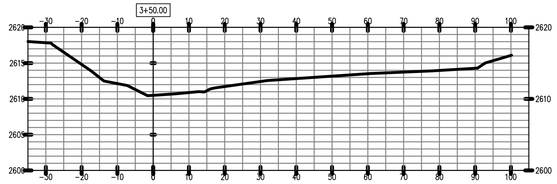
100% SUBMITTAL

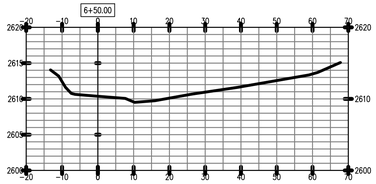


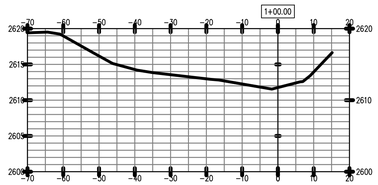


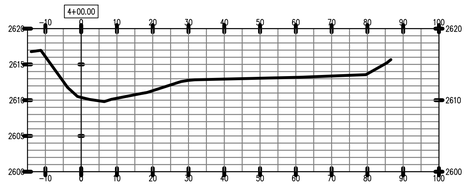


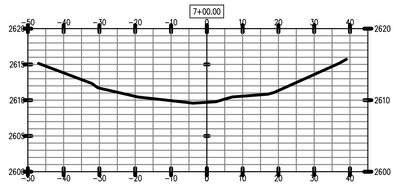


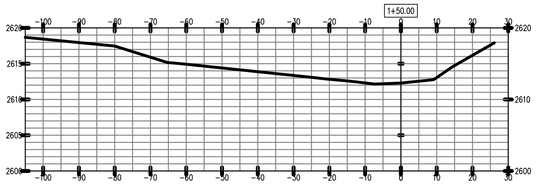


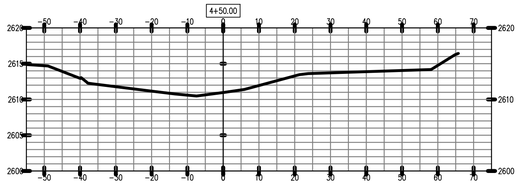


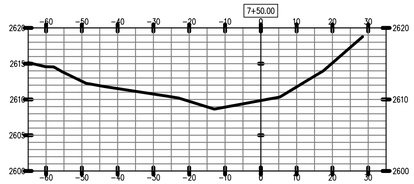


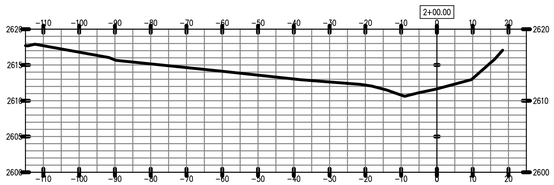


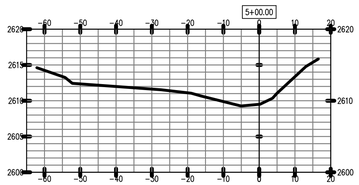


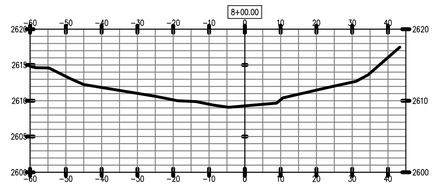


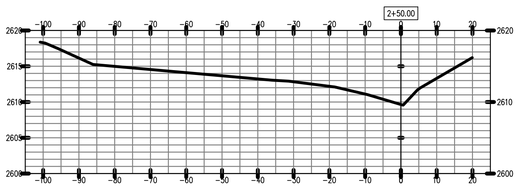


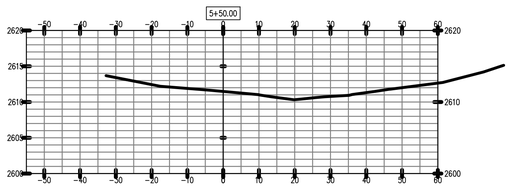


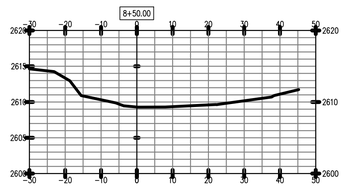












MAIN CHANNEL SECTIONS 0+00 – 8+50

AS-BUILT SURVEY OF STREAM TOPOGRAPHY AND STRUCTURES BY THE SCHNEIDER CORPORATION NC LICENSE # F-1041, (704) 697-5900

NORTH CAROLINA PROFESSIONAL SEAL L-3577 LAND SURVEYOR MICHAEL S. MILLER

3-16-11

REVISIONS			
Mark	Description	Date	Appr.

North Carolina
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Tel:919-715-0476

YADKIN VALLEY CONSTRUCTION, INC.
2961 OLD 60 HWY, RONDA, NC 28670

Biohabitats
8218 Creedmoore Road Suite 200
Raleigh, NC 27613 / ph: 919.518.0311
fx: 919.518.0313 / www.biohabitats.com
Restore the Earth and Inspire Ecological Stewardship

GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

TITLE:

AS-BUILT CROSS SECTIONS

PROJECT NO.: 06801.03

SCALE: 1":20' H 1":2' V

SEAL:

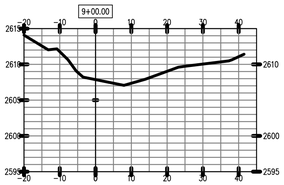
NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1172 KEITH BOWERS

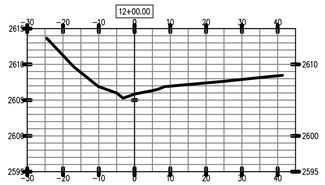
DESIGNED BY:	DRAWN BY:
VLS/KTN	SRH
CHECKED:	APPROVED:
JXR/EMM	TKB

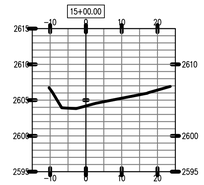
DATE: AS-BUILT HORIZONTAL 1"=20' VERTICAL 1"=2'

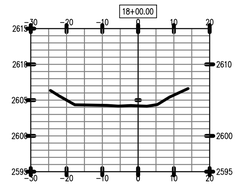
DWG. NO.:

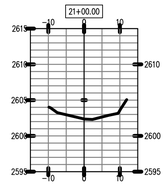
100% SUBMITTAL

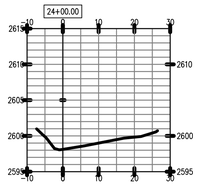


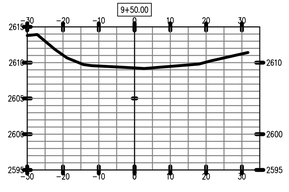


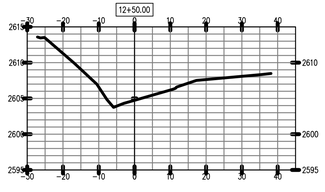


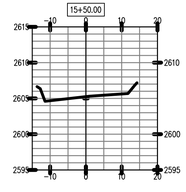


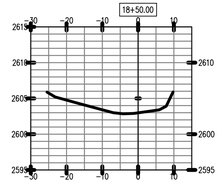


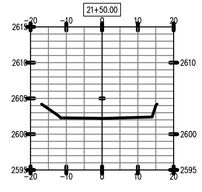


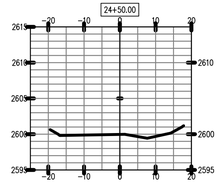


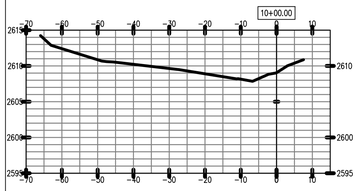


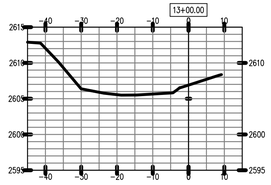


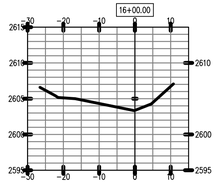


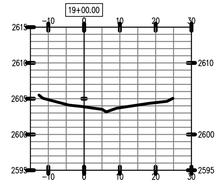


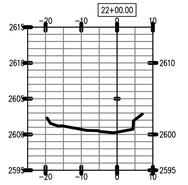


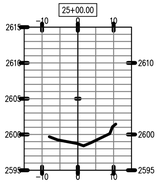


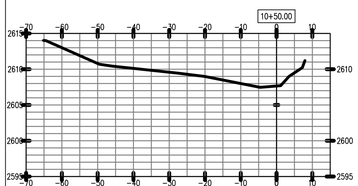


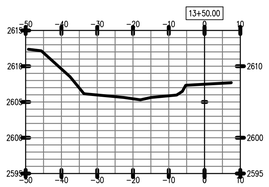


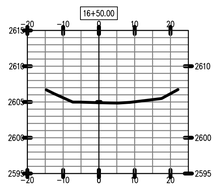


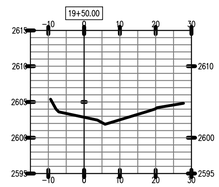


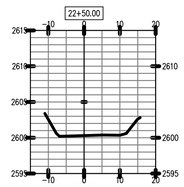


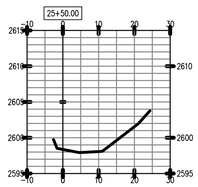


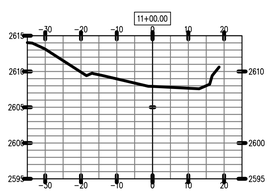


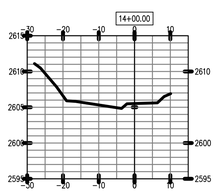


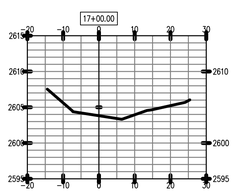


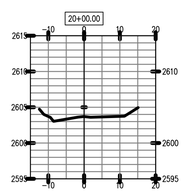


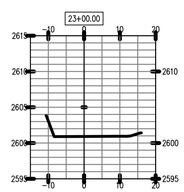


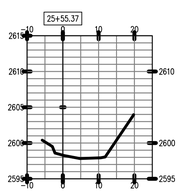


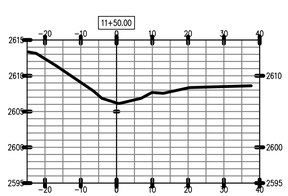


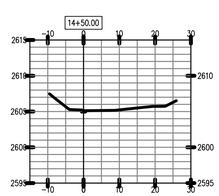


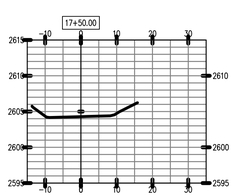


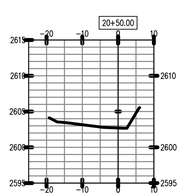


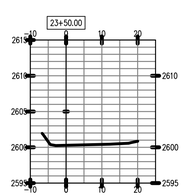








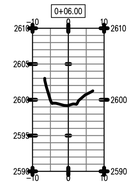


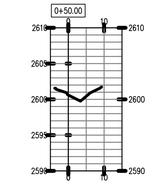


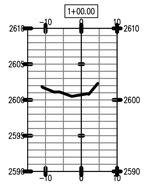
AS-BUILT SURVEY OF STREAM TOPOGRAPHY AND STRUCTURES BY THE SCHNEIDER CORPORATION NC LICENSE # F-1041, (704) 697-5900

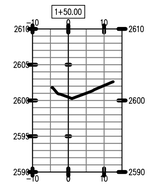
NORTH CAROLINA PROFESSIONAL SEAL L-3877 MICHAEL S. MILLER LAND SURVEYOR

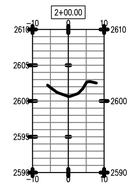
MAIN CHANNEL SECTIONS 9+00 – 25+55.37











TRIBUTARY SECTIONS 0+06 – 2+75

REVISIONS

Mark	Description	Date	Appr.

North Carolina
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Tel:919-715-0476

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Raleigh, NC 27613 / ph: 919.518.0311
fx: 919.518.0313 / www.biohabitats.com
Restore the Earth and Inspire Ecological Stewardship

GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

TITLE:

AS-BUILT CROSS SECTIONS

PROJECT NO.: 06801.03	SCALE: 1":20' H 1":2' V
SEAL:	DESIGNED BY: VLS/KTN; DRAWN BY: SRH
	CHECKED: JXR/EMM; APPROVED: TKB
	DATE: AUGUST 2011
	DWG. NO.: 10 OF 11

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT No. 1172 KEITH BOWERS

100% SUBMITTAL

PLANT COMPOSITION SCHEDULE[1]

NOTE: EACH TREE SPECIES SHOULD COMPRISE AT LEAST 10% AND NO MORE THAN 25% OF THE TOTAL STEMS PLANTED IN EACH VEGETATION STRATA.A MINIMUM OF 680 STEMS PER ACRE WILL BE OF PLANTED IN ZONE 1-A MINIMUM OF 1,210 STEMS PER ACRE WILL BE PLANTED IN ZONE 2. (The taxonomic standard follows Flora of the Carolinas, Virginia Georgia and Surrounding Areas by Alan S. Weakley)

Zone 1: Riparian Woodlands - Mesic — **Size (acres): 3.6**

Overall Spacing (feet off center)	Quantity per acre	Maximum Frequency (%)	Maximum Stem Quantity	Vegetation Strata/ Species Name	Common Name	Unit Type[2]	Size[3]	Spacing Type	Individual Spacing (ft.)
14	226			**TREES: Minimum of 5 Species, Minimum # of Trees = 230**					
		N/A	N/A	*Quercus alba*	White Oak	c, bb	2" dbh min	Random	200
		N/A	N/A	*Pinus strobus*	White Pine	c, bb	2" dbh min	Random	200
		N/A	N/A	*Tsuga canadensis*	Eastern Hemlock	c, bb	2" dbh min	Random	200
		20	163	*Quercus rubra*	N. Red Oak	br, c, t	18-36"	Random	31
		20	163	*Betula alleghanisensis*	Yellow Birch	br, c, t	18-36"	Random	31
		20	163	*Liriodendron tulipifera*	Yellow Poplar	br, c, t	18-36"	Random	31
		20	163	*Tilia americana*	Basswood	br, c, t	18-36"	Random	31
		20	163	*Platanus occidentalis*	Sycamore	br, c, t	18-36"	Random	31
		20	163	*Betula nigra*	River Birch	br, c, t	18-36"	Random	31
		20	163	*Acer saccharum*	Sugar Maple	br, c, t	18-36"	Random	31
		20	163	*Acer rubrum*	Red Maple	br, c, t	18-36"	Random	31
		20	163	*Prunus serotina*	Black Cherry	br, c, t	18-36"	Random	31
			815	**TOTAL**					
14	226			**MIDSTORY TREES: Minimum of 5 Species, Minimum # of Trees = 230**					
		20	163	*Carpinus caroliniana*	Ironwood	br, c, t	18-36"	Random	31
		20	163	*Ostrya virginiana*	American Hophornbeam	br, c, t	18-36"	Random	31
		20	163	*Ilex opaca*	Holly	br, c, t	18-36"	Random	31
		20	163	*Oxydendron arboretum*	Sourwood	br, c, t	18-36"	Random	31
		20	163	*Amelanchier arborea*	Serviceberry	br, c, t	18-36"	Random	31
		20	163	*Chionanthus virginicus*	Fringetree	br, c, t	18-36"	Random	31
		20	163	*Cornus florida*	Flowering Dogwood	br, c, t	18-36"	Random	31
			815	**TOTAL**					
14	226			**SHRUBS: Minimum of 5 Species, Minimum # of Shrubs = 230**					
		20	163	*Lindera benzoin*	Spicebush	br, c, t	18-36"	Random	31
		20	163	*Sambucus canadensis*	Elderberry	br, c, t	18-36"	Random	31
		20	163	*Calycanthus florida*	Sweetshrub	br, c, t	18-36"	Random	31
		20	163	*Callicarpa americana*	American Beautyberry	br, c, t	18-36"	Random	31
		20	163	*Hydrangea arborescens*	Wild Hydrangea	br, c, t	18-36"	Random	31
		20	163	*Symplocos tinctoria*	Horse Sugar	br, c, t	18-36"	Random	31
		20	163	*Rhododendron maximum*	Rhododendron	br, c, t	18-36"	Random	31
		20	163	*Hamamelis virginiana*	Witchhazel	br, c, t	18-36"	Random	31
			815	**TOTAL**					
8			**2,445**	**GRAND TOTAL**					

Zone 2: Floodplain Bench — **Size (acres): 2.1**

Overall Spacing (feet off center)	Quantity per acre	Maximum Frequency (%)	Stem Quantity	Vegetation Strata/ Species Name	Common Name	Unit Type	Size	Spacing Type	Individual Spacing (ft.)
7	870			**LIVE STAKES: Min. # of Stems = 870**					
		34	621	*Salix nigra*	Black Willow	live stake	2-3'	Random	12
		33	603	*Salix sericea*	Silky Willow	live stake	2-3'	Random	12
		33	603	*Cornus arromum*	Silky Dogwood	live stake	2-3'	Random	12
			1,627	**TOTAL**					
16	340			**SHRUB AND TREES: Minimum # = 340**					
		34	243	*Sambucus canadensis*	Elderberry	br, c, t	18-36"	Random	19
		33	236	*Alnus serrulata*	Tag Alder	br, c, t	18-36"	Random	20
		33	236	*Betula nigra*	River Birch	br, c, t	18-36"	Random	20
			715	**TOTAL**					
6			**2,542**	**GRAND TOTAL**					

[1]All planting stock provided shall be secured from a local producer located in the mountain physiographic province, not more than 200 miles from the site. Planting shall occur during the last full week of February through March. Bare root material must be stored in a refrigerated truck from nursery pick-up to no more than 30 minutes before planting. All planting stock

Fescue-Plant in Zone 3 — **Acres= 1**

Lbs./Ac	Frequency (%)	Lbs per Species	Species Name	Common Name	Unit	Additional Amendment	Quantity	LBS/AC
			ZONE 3 Fill Area-Pasture Re-establishment					
50	100	50.0	*Festuca arundinacea*	Tall Fescue	LB of P.L.S. 76 %	Ground Limestone	4,000	
					LB of P.L.S. 76 %	Organic Fertilizer	320	
					LB of P.L.S. 76 %	Straw Mulch	4,000	
	0	50.0	= Total LBS					

1. APPLY SOIL AMENDMENTS EVENLY AND INCORPORATE TO A DEPTH OF 4-6 INCHES. LOOSEN SURFACE JUST BEFORE BROADCASTING.
2. MULCH MUST COVER 75% OF THE GROUND SURFACE.

Acres= 3.6

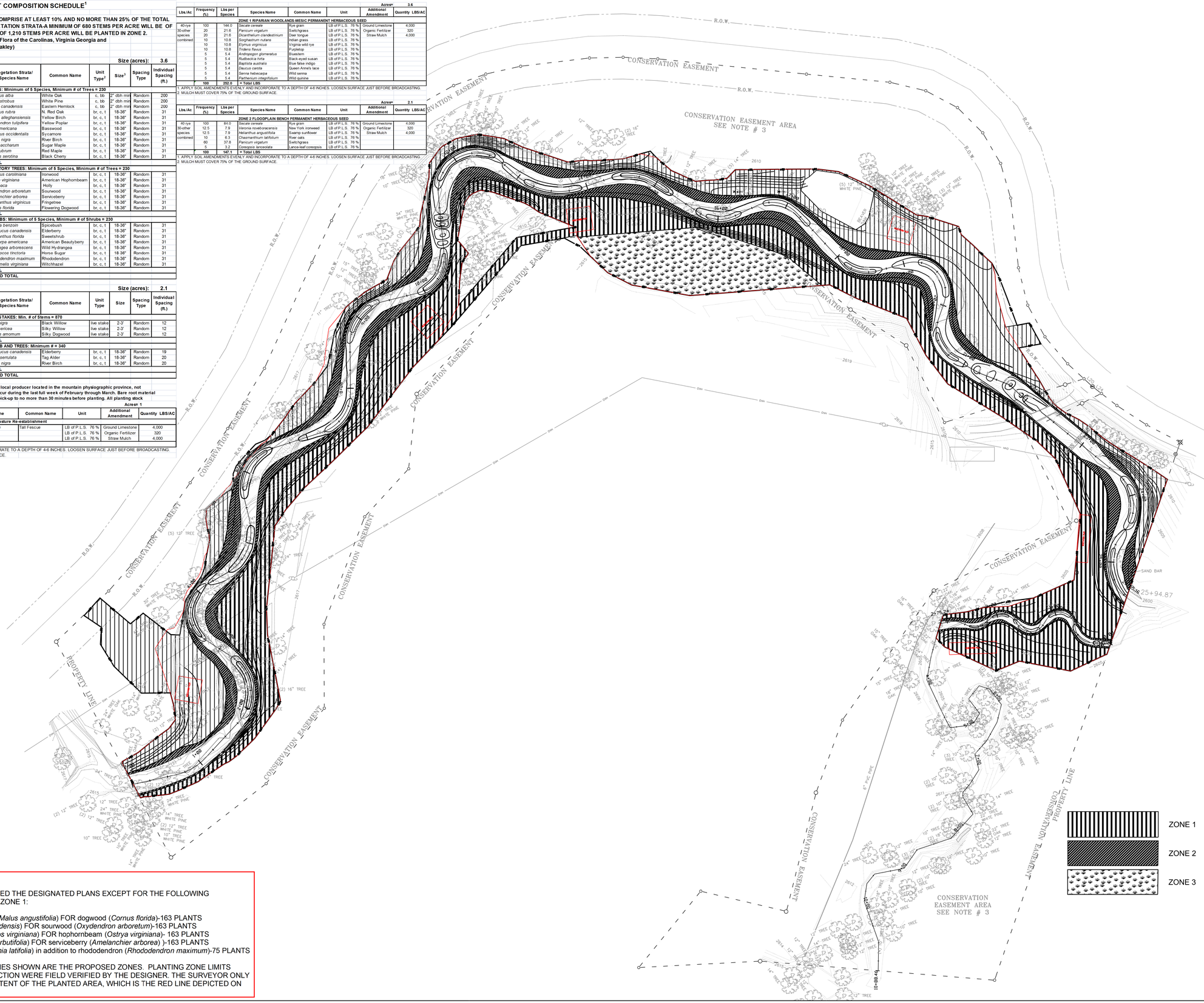
Lbs./Ac	Frequency (%)	Lbs per Species	Species Name	Common Name	Unit	Additional Amendment	Quantity	LBS/AC
			ZONE 1 RIPARIAN WOODLANDS-MESIC PERMANENT HERBACEOUS SEED					
40-rye	100	144.0	*Secale cereale*	Rye grain	LB of P.L.S. 76 %	Ground Limestone	4,000	
30-other	20	21.6	*Panicum virgatum*	Switchgrass	LB of P.L.S. 76 %	Organic Fertilizer	320	
species	20	21.6	*Dicanthelium clandestinum*	Deer tongue	LB of P.L.S. 76 %	Straw Mulch	4,000	
combined	10	10.8	*Sorghastrum nutans*	Indian grass	LB of P.L.S. 76 %			
	10	10.8	*Elymus virginicus*	Virginia wild rye	LB of P.L.S. 76 %			
	10	10.8	*Tridens flavus*	Purpletop	LB of P.L.S. 76 %			
	5	5.4	*Andropogon glomeratus*	Bluestem	LB of P.L.S. 76 %			
	5	5.4	*Rudbeckia hirta*	Black-eyed susan	LB of P.L.S. 76 %			
	5	5.4	*Baptista australis*	Blue false indigo	LB of P.L.S. 76 %			
	5	5.4	*Daucus carota*	Queen Anne's lace	LB of P.L.S. 76 %			
	5	5.4	*Senna hebecarpa*	Wild senna	LB of P.L.S. 76 %			
	5	5.4	*Parthenium integrifolium*	Wild quinine	LB of P.L.S. 76 %			
	100	252.0	= Total LBS					

1. APPLY SOIL AMENDMENTS EVENLY AND INCORPORATE TO A DEPTH OF 4-6 INCHES. LOOSEN SURFACE JUST BEFORE BROADCASTING.
2. MULCH MUST COVER 75% OF THE GROUND SURFACE.

Acres= 2.1

Lbs./Ac	Frequency (%)	Lbs per Species	Species Name	Common Name	Unit	Additional Amendment	Quantity	LBS/AC
			ZONE 2 FLOODPLAIN BENCH FERMANENT HERBACEOUS SEED					
40 rye	100	84.0	*Secale cereale*	Rye grain	LB of P.L.S. 76 %	Ground Limestone	4,000	
30-other	12.5	7.9	*Veronia noveboracensis*	New York ironweed	LB of P.L.S. 76 %	Organic Fertilizer	320	
species	12.5	7.9	*Helianthus angustifolia*	Swamp sunflower	LB of P.L.S. 76 %	Straw Mulch	4,000	
combined	10	6.3	*Chasmanthium latifolium*	River oats	LB of P.L.S. 76 %			
	60	37.8	*Panicum virgatum*	Switchgrass	LB of P.L.S. 76 %			
	5	3.2	*Coreopsis lanceolata*	Lance-leaf corecopsis	LB of P.L.S. 76 %			
	100	147.1	= Total LBS					

1. APPLY SOIL AMENDMENTS EVENLY AND INCORPORATE TO A DEPTH OF 4-6 INCHES. LOOSEN SURFACE JUST BEFORE BROADCASTING.
2. MULCH MUST COVER 75% OF THE GROUND SURFACE.



NOTES:

1) PLANTING FOLLOWED THE DESIGNATED PLANS EXCEPT FOR THE FOLLOWING SUBSTITUTIONS IN ZONE 1:

   Southern crabapple (*Malus angustifolia*) FOR dogwood (*Cornus florida*)-163 PLANTS
   Redbud (*Cercis canadensis*) FOR sourwood (*Oxydendron arboretum*)-163 PLANTS
   Persimmon (*Diospyros virginiana*) FOR hophornbeam (*Ostrya virginiana*)- 163 PLANTS
   Chokeberry (*Aronia arbutifolia*) FOR serviceberry (*Amelanchier arborea*))-163 PLANTS
   Mountain laurel (*Kalmia latifolia*) in addition to rhododendron (*Rhododendron maximum*)-75 PLANTS

2) THE PLANTING ZONES SHOWN ARE THE PROPOSED ZONES. PLANTING ZONE LIMITS DURING CONSTRUCTION WERE FIELD VERIFIED BY THE DESIGNER. THE SURVEYOR ONLY SURVEYED THE EXTENT OF THE PLANTED AREA, WHICH IS THE RED LINE DEPICTED ON THIS SHEET.

SCALE
0 60 120

N

REVISIONS

Mark	Description	Date	Appr.

North Carolina
Ecosystem Enhancement Program
2728 Capitol Blvd, Suite 1H 103
Raleigh, NC 27604
Tel:919-715-0476

YADKIN VALLEY CONSTRUCTION, INC.
2961 OLD 60 HWY, RONDA, NC 28670

Biohabitats
8218 Creedmore Road Suite 200
Raleigh, NC 27613 / ph: 919.518.0311
fx: 919.518.0313 / www.biohabitats.com
Restore the Earth and Inspire Ecological Stewardship

GLADE CREEK STREAM RESTORATION RECORD DRAWINGS

CHERRY LANE TOWNSHIP
ALLEGHANY COUNTY, NC.

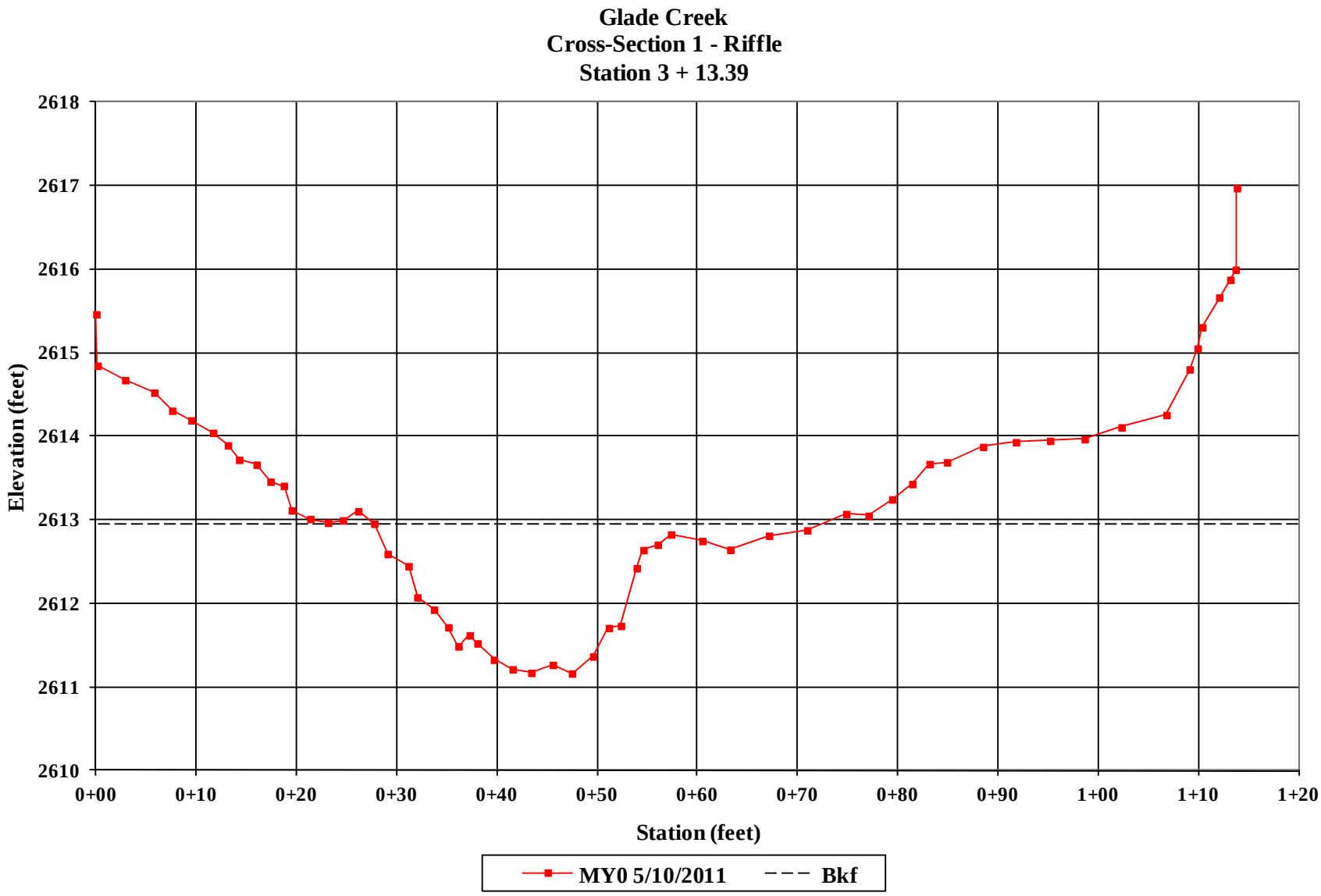
TITLE:

PLANTING PLAN

PROJECT NO.: 06801.03
SCALE: 1" = 60'
SEAL: NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1172 KEITH BOWERS
DESIGNED BY: VLS/KTN
DRAWN BY: SRH
CHECKED: JXR/EMM
APPROVED: TKB
DATE: AUGUST 2011
DWG. NO.: 11 OF 11

100% SUBMITTAL

Appendix C
Cross-Section Plots and Photos

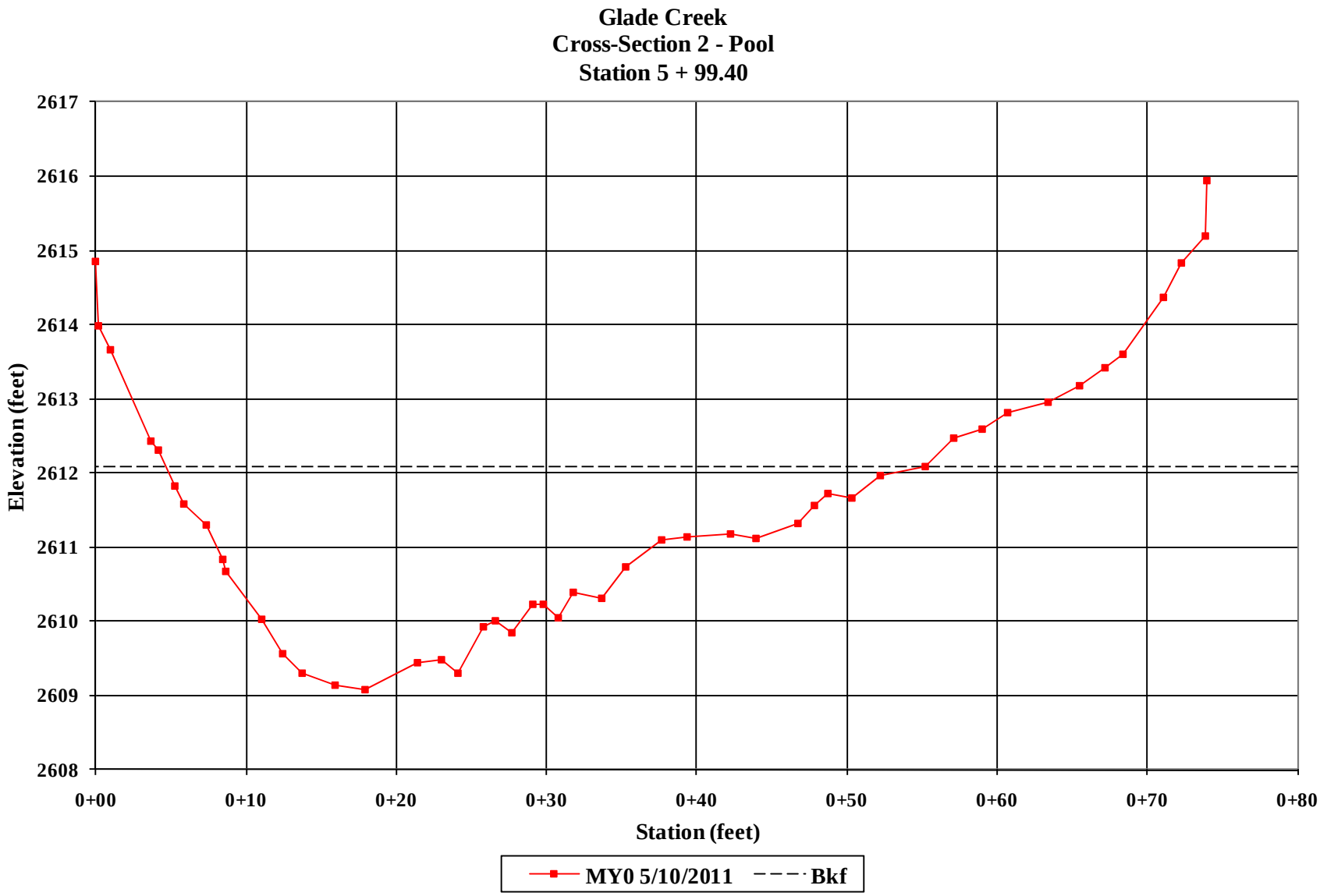

Glade Creek
Cross-Section 1 - Riffle
Station 3 + 13.39
Elevation (feet)
2618
2617
2616
2615
2614
2613
2612
2611
2610
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
0+80
0+90
1+00
1+10
1+20
Station (feet)
MY0 5/10/2011
Bkf

Glade Creek – Cross-Section 1 – Riffle
(Looking at Left Bank Descending)
Baseline – May 10, 2011

Glade Creek – Cross-Section 1 – Riffle
(Looking at Right Bank Descending)
Baseline – May 10, 2011

Glade Creek – Cross-Section 1 – Riffle
(Looking Downstream)
Baseline – May 10, 2011

Glade Creek – Cross-Section 1 – Riffle
(Looking Upstream)
Baseline – May 10, 2011

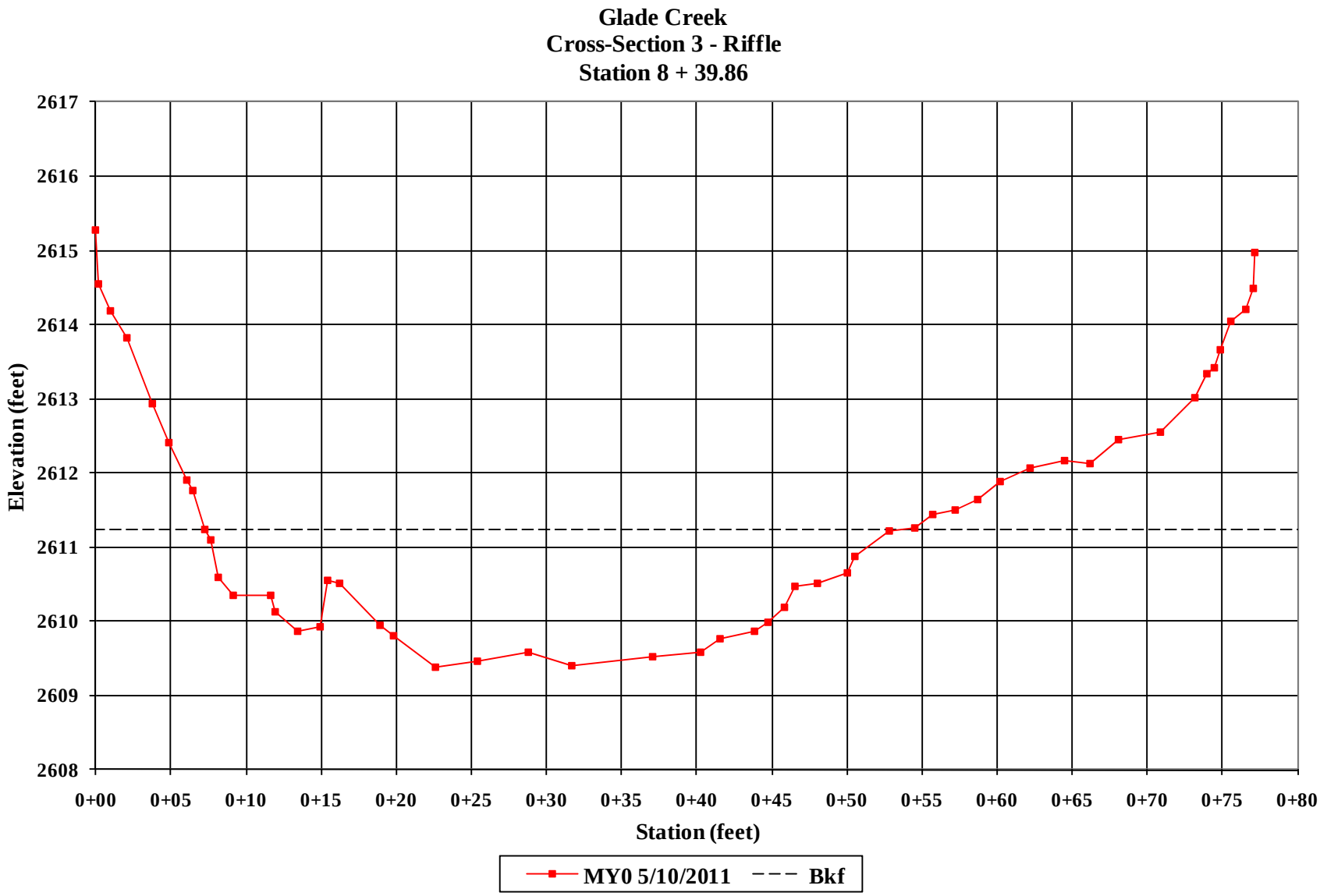

Glade Creek
Cross-Section 2 - Pool
Station 5 + 99.40
Elevation (feet)
2617
2616
2615
2614
2613
2612
2611
2610
2609
2608
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
0+80
Station (feet)
MY0 5/10/2011
Bkf

Glade Creek – Cross-Section 2 – Pool
(Looking at Left Bank Descending)
Baseline – May 10, 2011

Glade Creek – Cross-Section 2 – Pool
(Looking at Right Bank Descending)
Baseline – May 10, 2011

Glade Creek – Cross-Section 2 – Pool
(Looking Downstream)
Baseline – May 10, 2011

Glade Creek – Cross-Section 2 – Pool
(Looking Upstream)
Baseline – May 10, 2011

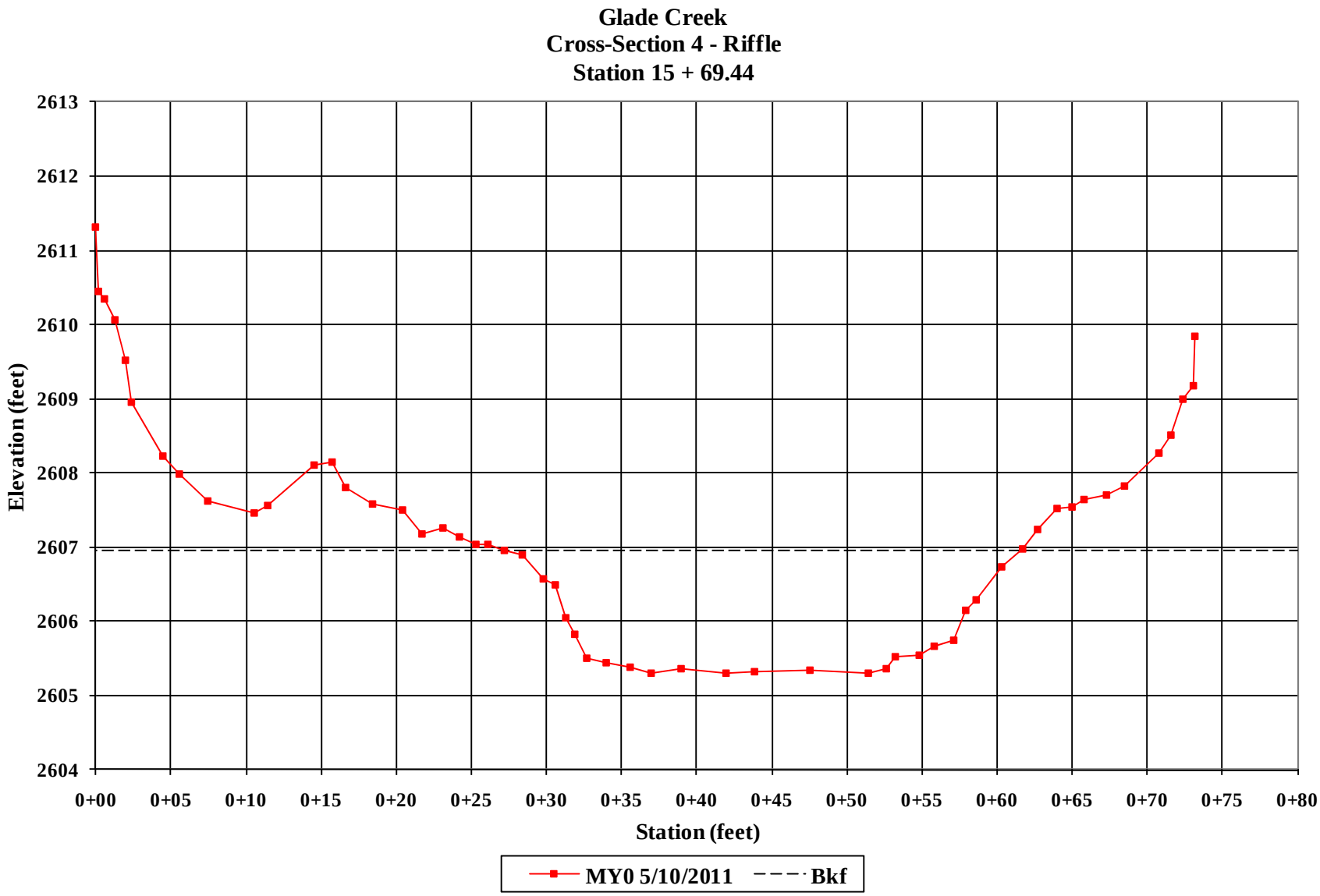

Glade Creek
Cross-Section 3 - Riffle
Station 8 + 39.86
Elevation (feet)
2617
2616
2615
2614
2613
2612
2611
2610
2609
2608
0+00
0+05
0+10
0+15
0+20
0+25
0+30
0+35
0+40
0+45
0+50
0+55
0+60
0+65
0+70
0+75
0+80
Station (feet)
MY0 5/10/2011
Bkf

Glade Creek – Cross-Section 3 – Riffle
(Looking at Left Bank Descending)
Baseline – May 10, 2011

Glade Creek – Cross-Section 3 – Riffle
(Looking at Right Bank Descending)
Baseline – May 10, 2011

Glade Creek – Cross-Section 3 – Riffle
(Looking Downstream)
Baseline – May 10, 2011

Glade Creek – Cross-Section 3 – Riffle
(Looking Upstream)
Baseline – May 10, 2011

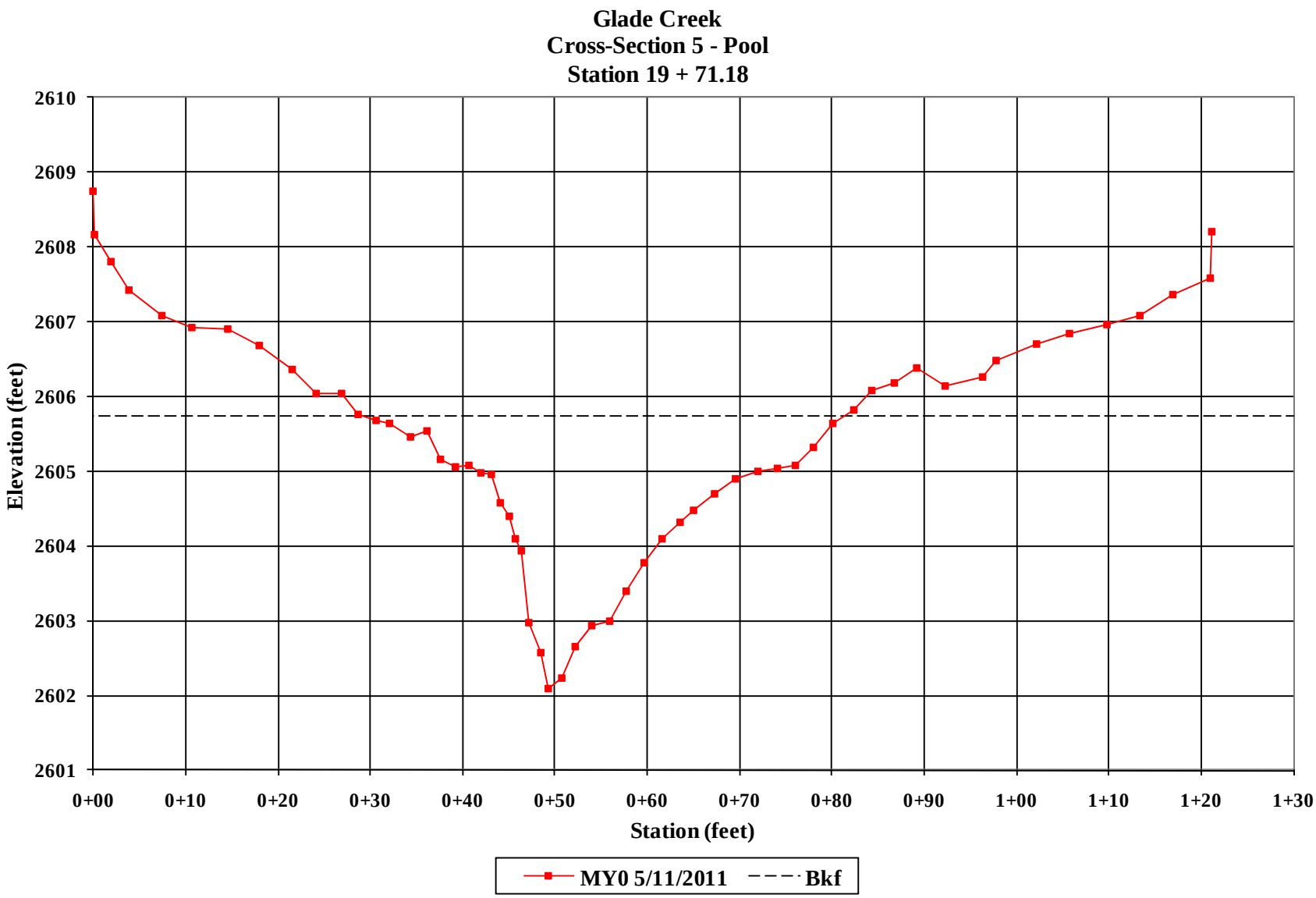

Glade Creek
Cross-Section 4 - Riffle
Station 15 + 69.44
Elevation (feet)
2613
2612
2611
2610
2609
2608
2607
2606
2605
2604
0+00
0+05
0+10
0+15
0+20
0+25
0+30
0+35
0+40
0+45
0+50
0+55
0+60
0+65
0+70
0+75
0+80
Station (feet)
MY0 5/10/2011
Bkf

Glade Creek – Cross-Section 4 – Riffle
(Looking at Left Bank Descending)
Baseline –May 10, 2011

Glade Creek – Cross-Section 4 – Riffle
(Looking at Right Bank Descending)
Baseline – May 10, 2011

Glade Creek – Cross-Section 4 – Riffle
(Looking Downstream)
Baseline – May 10, 2011

Glade Creek – Cross-Section 4 – Riffle
(Looking Upstream)
Baseline – May 10, 2011

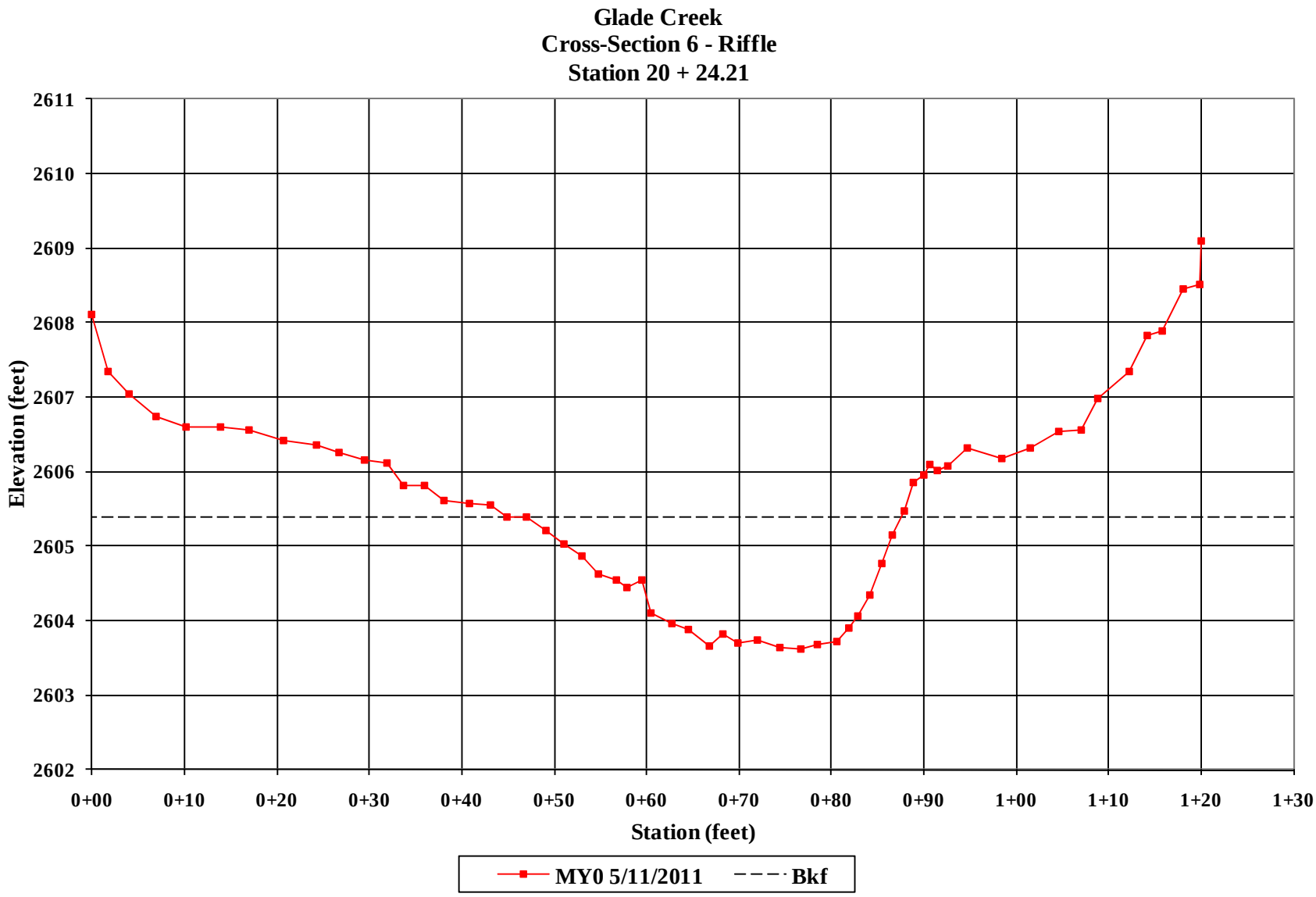

Glade Creek
Cross-Section 5 - Pool
Station 19 + 71.18
Elevation (feet)
2610
2609
2608
2607
2606
2605
2604
2603
2602
2601
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
0+80
0+90
1+00
1+10
1+20
1+30
Station (feet)
MY0 5/11/2011
Bkf

Glade Creek – Cross-Section 5 – Pool
(Looking at Left Bank Descending)
Baseline – May 11, 2011

Glade Creek – Cross-Section 5 – Pool
(Looking at Right Bank Descending)
Baseline – May 11, 2011

Glade Creek – Cross-Section 5 – Pool
(Looking Downstream)
Baseline – May 11, 2011

Glade Creek – Cross-Section 5 – Pool
(Looking Upstream)
Baseline – May 11, 2011

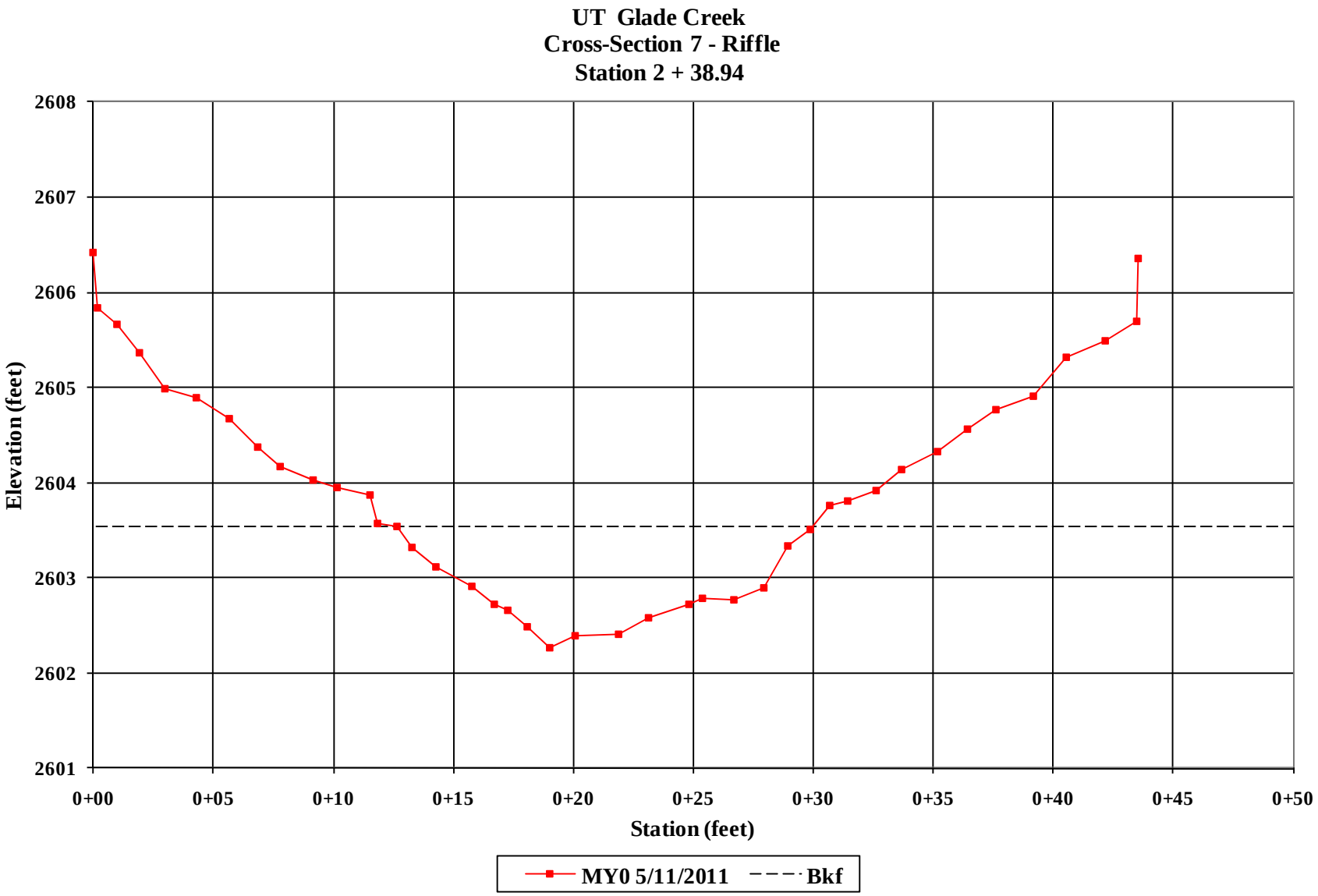

Glade Creek
Cross-Section 6 - Riffle
Station 20 + 24.21
Elevation (feet)
2611
2610
2609
2608
2607
2606
2605
2604
2603
2602
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
0+80
0+90
1+00
1+10
1+20
1+30
Station (feet)
MY0 5/11/2011
Bkf

Glade Creek – Cross-Section 6 – Riffle
(Looking at Left Bank Descending)
Baseline – May 11, 2011

Glade Creek – Cross-Section 6 – Riffle
(Looking at Right Bank Descending)
Baseline – May 11, 2011

Glade Creek – Cross-Section 6 – Riffle
(Looking Downstream)
Baseline – May 11, 2011

Glade Creek – Cross-Section 6 – Riffle
(Looking Upstream)
Baseline – May 11, 2011

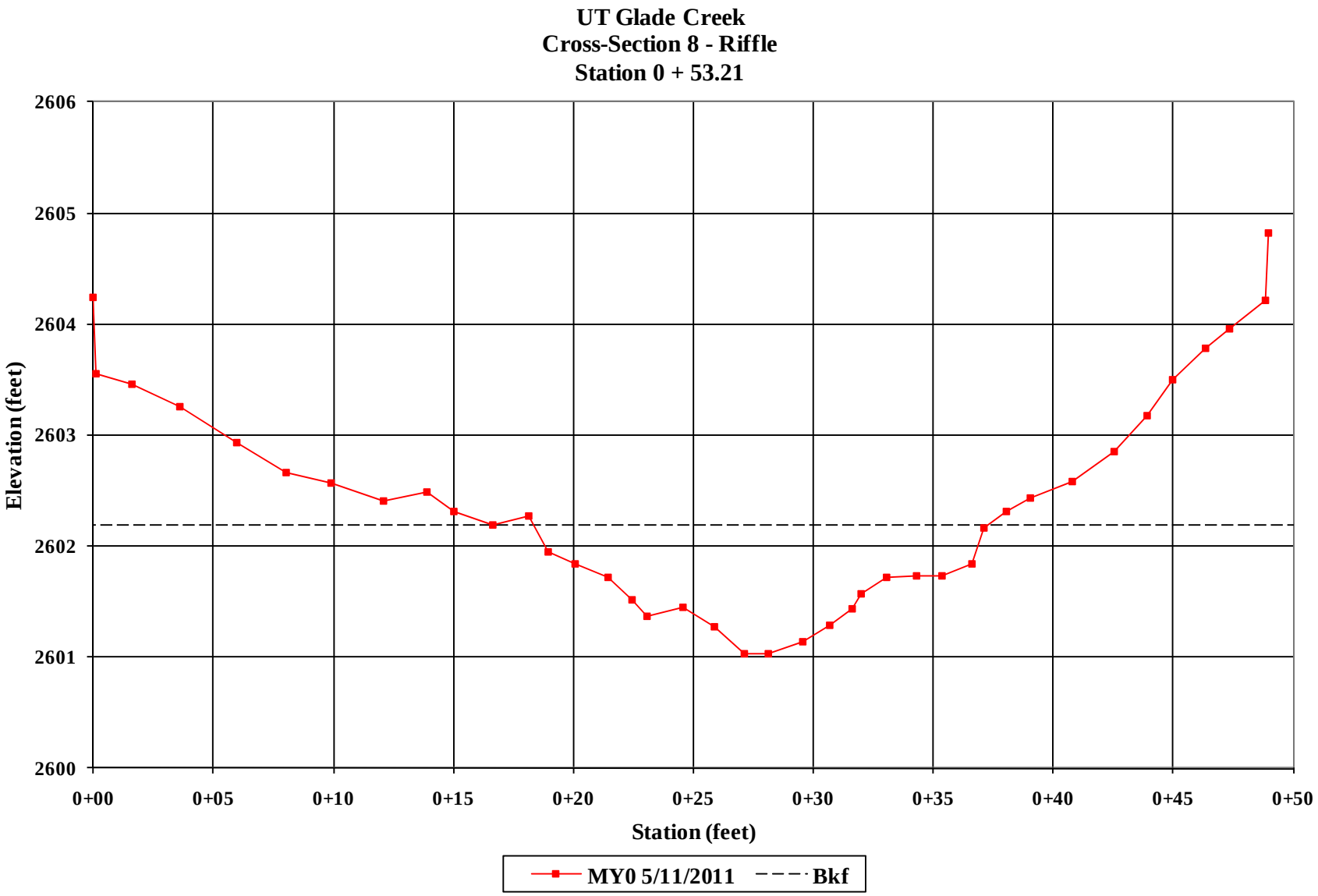

UT Glade Creek
Cross-Section 7 - Riffle
Station 2 + 38.94
Elevation (feet)
2608
2607
2606
2605
2604
2603
2602
2601
0+00
0+05
0+10
0+15
0+20
0+25
0+30
0+35
0+40
0+45
0+50
Station (feet)
MY0 5/11/2011
Bkf

Unnamed Tributary Downstream – Cross-Section 7 – Riffle
(Looking at Left Bank Descending)
Baseline – May 11, 2011

Unnamed Tributary Downstream – Cross-Section 7 – Riffle
(Looking at Right Bank Descending)
Baseline – May 11, 2011

Unnamed Tributary Downstream – Cross-Section 7 – Riffle
(Looking Downstream)
Baseline – May 11, 2011

Unnamed Tributary Downstream – Cross-Section 7 – Riffle
(Looking Upstream)
Baseline – May 11, 2011


UT Glade Creek
Cross-Section 8 - Riffle
Station 0 + 53.21
Elevation (feet)
2606
2605
2604
2603
2602
2601
2600
0+00
0+05
0+10
0+15
0+20
0+25
0+30
0+35
0+40
0+45
0+50
Station (feet)
MY0 5/11/2011
Bkf

Unnamed Tributary Downstream – Cross-Section 8 – Riffle
(Looking at Left Bank Descending)
Baseline – May 11, 2011

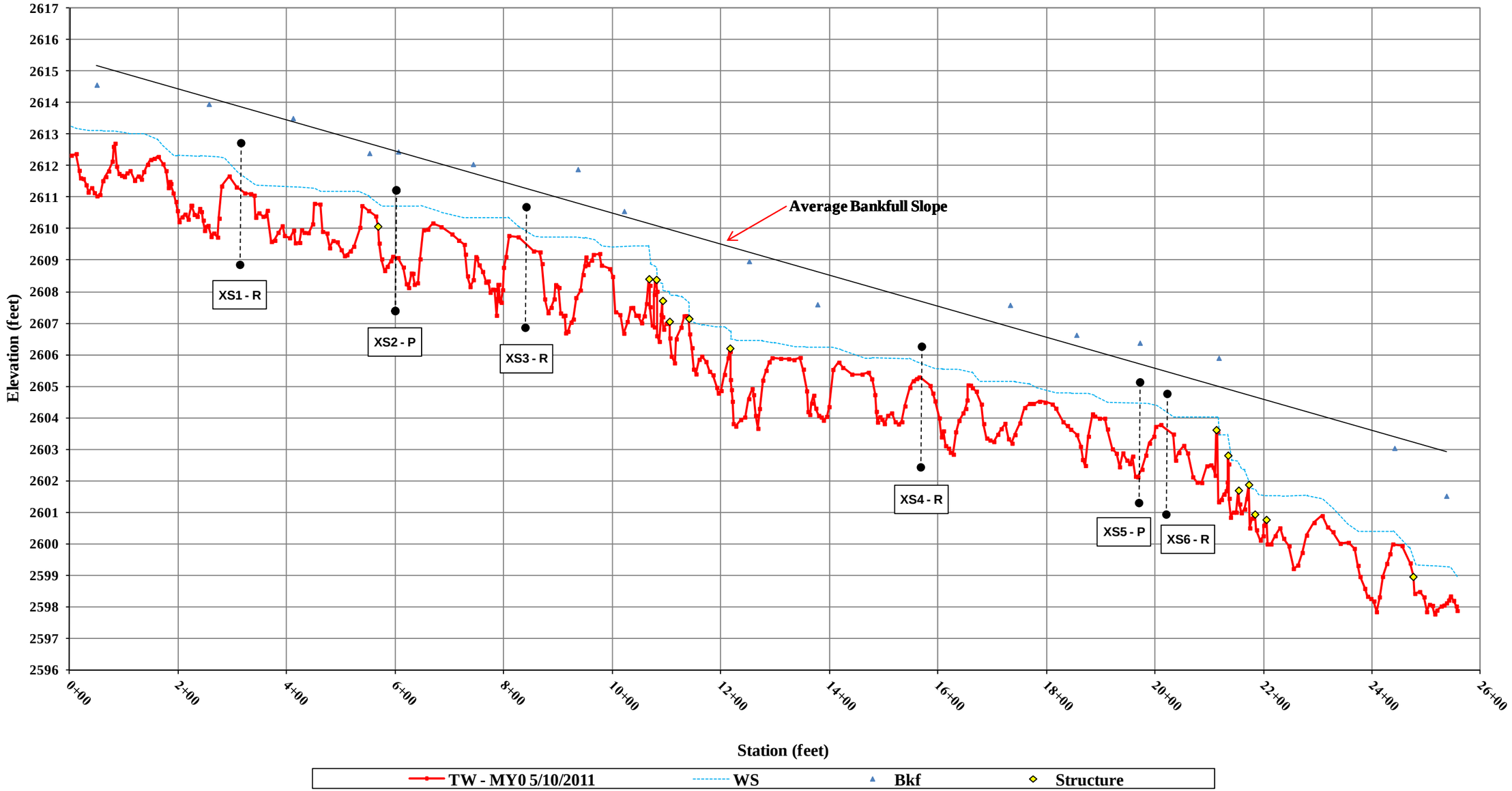
Unnamed Tributary Downstream – Cross-Section 8 – Riffle
(Looking at Right Bank Descending)
Baseline – May 11, 2011

Unnamed Tributary Downstream – Cross-Section 8 – Riffle
(Looking Downstream)
Baseline – May 11, 2011

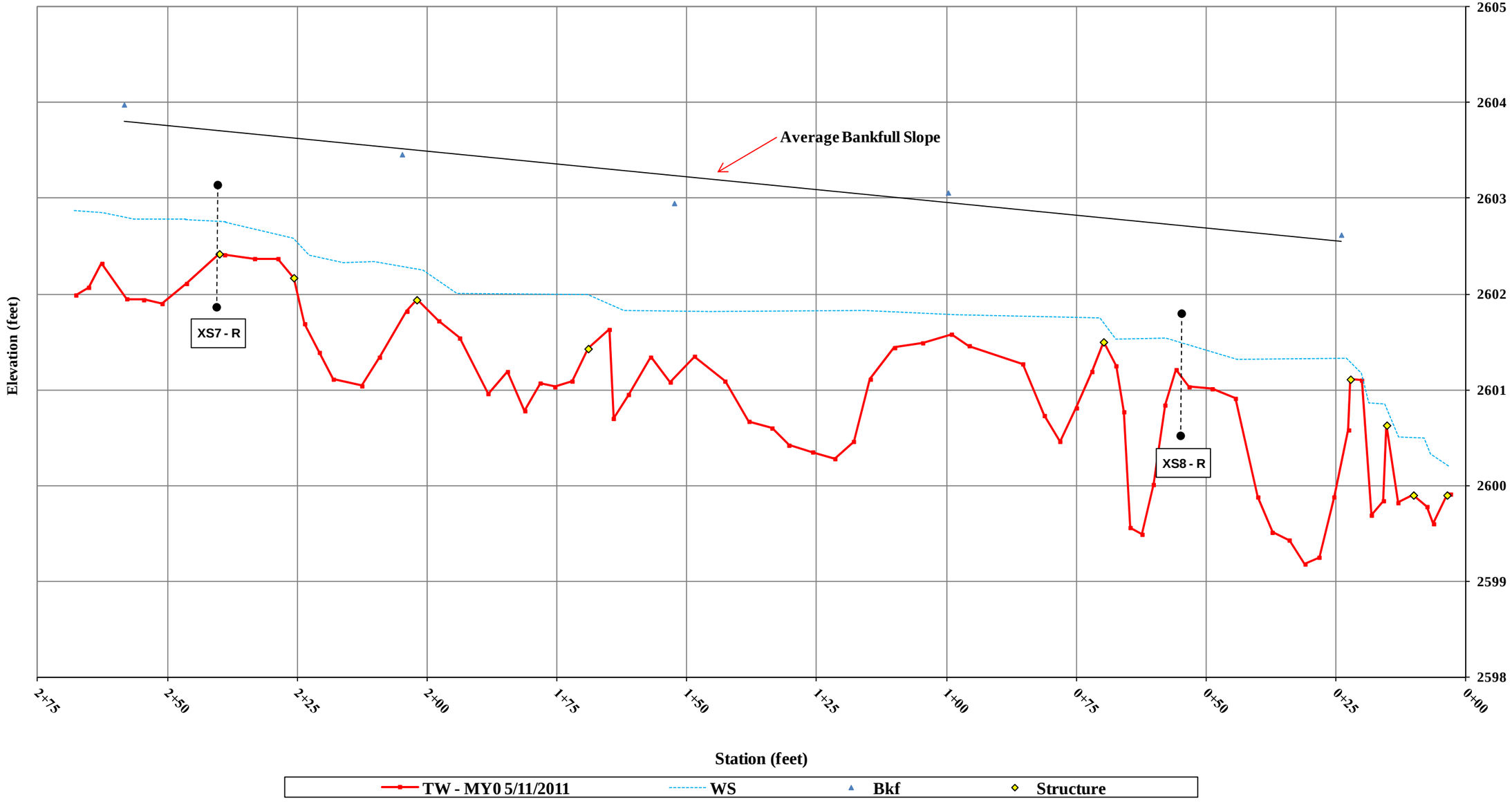
Unnamed Tributary Downstream – Cross-Section 8 – Riffle
(Looking Upstream)
Baseline – May 11, 2011

Appendix D
Longitudinal Profile Plots

Glade Creek Mainstem
Longitudinal Profile
Staioning 0+03 - 25+57



Glade Creek Tributary
Longitudinal Profile
Station 0+03 - 2+67



Stationing for this reach was established from downstream to upstream.

Appendix E
Vegetation Plot Photos

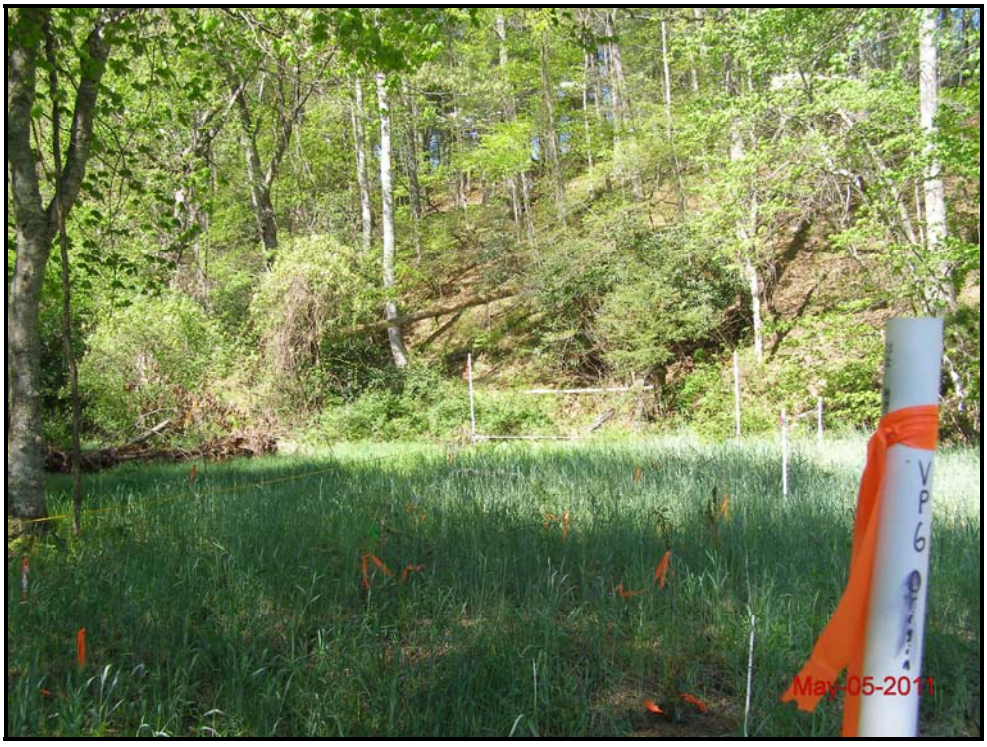
Vegetation Monitoring Plot 1
Baseline – May 5, 2011

Vegetation Monitoring Plot 2
Baseline – May 5, 2011

Vegetation Monitoring Plot 3
Baseline – May 5, 2011

Vegetation Monitoring Plot 4
Baseline – May 5, 2011

Vegetation Monitoring Plot 5
Baseline – May 5, 2011



Vegetation Monitoring Plot 6
Baseline – May 5, 2011

Appendix F
Permanent Photo Station Photos

Glade Creek
Pre-construction conditions in proximity to Photo Station 1

Glade Creek – Permanent Photo Station 1
Looking Upstream – April 28, 2011

Glade Creek
Pre-construction conditions in proximity to Photo Station 2

Glade Creek – Permanent Photo Station 2
Looking Upstream – April 28, 2011

Glade Creek
Pre-construction conditions in proximity to Photo Station 3

Glade Creek – Permanent Photo Station 3
Looking Upstream – April 28, 2011

Glade Creek
Pre-construction conditions in proximity to Photo Station 4

Glade Creek – Permanent Photo Station 4
Looking Upstream – April 28, 2011

Glade Creek
Pre-construction conditions looking upstream from Photo Station 5

Glade Creek – Permanent Photo Station 5
Looking Upstream – April 28, 2011

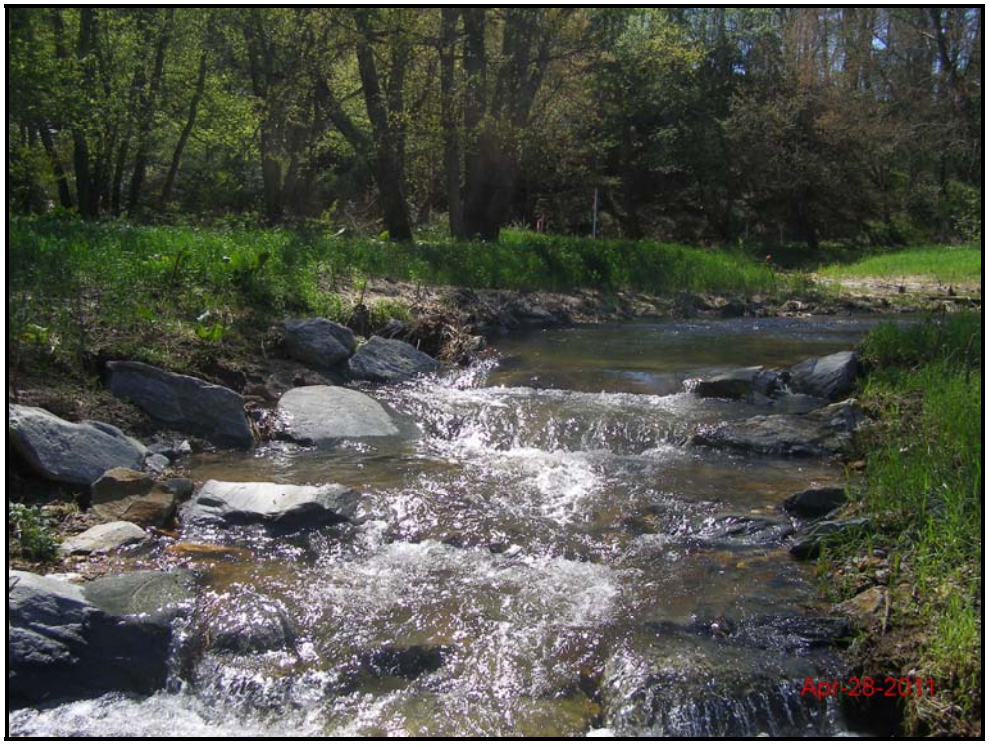
Glade Creek
Pre-construction conditions looking downstream from Photo Station 5

Glade Creek – Permanent Photo Station 5
Looking Downstream – April 28, 2011

Unnamed Tributary Lower
Pre-construction conditions in proximity to Photo Station 6

Unnamed Tributary Lower – Permanent Photo Station 6
Looking Upstream – April 28, 2011

Unnamed Tributary Lower
Pre-construction conditions in proximity to Photo Station 7



Unnamed Tributary Lower – Permanent Photo Station 7
Looking Upstream – April 28, 2011