

MYO FINAL MONITORING REPORT

LAUREL SPRINGS STREAM AND WETLAND MITIGATION SITE

Avery County, North Carolina

French Broad River Basin

Cataloging Unit 06010108

DMS Project No. 100122

Full Delivery Contract No. 7890

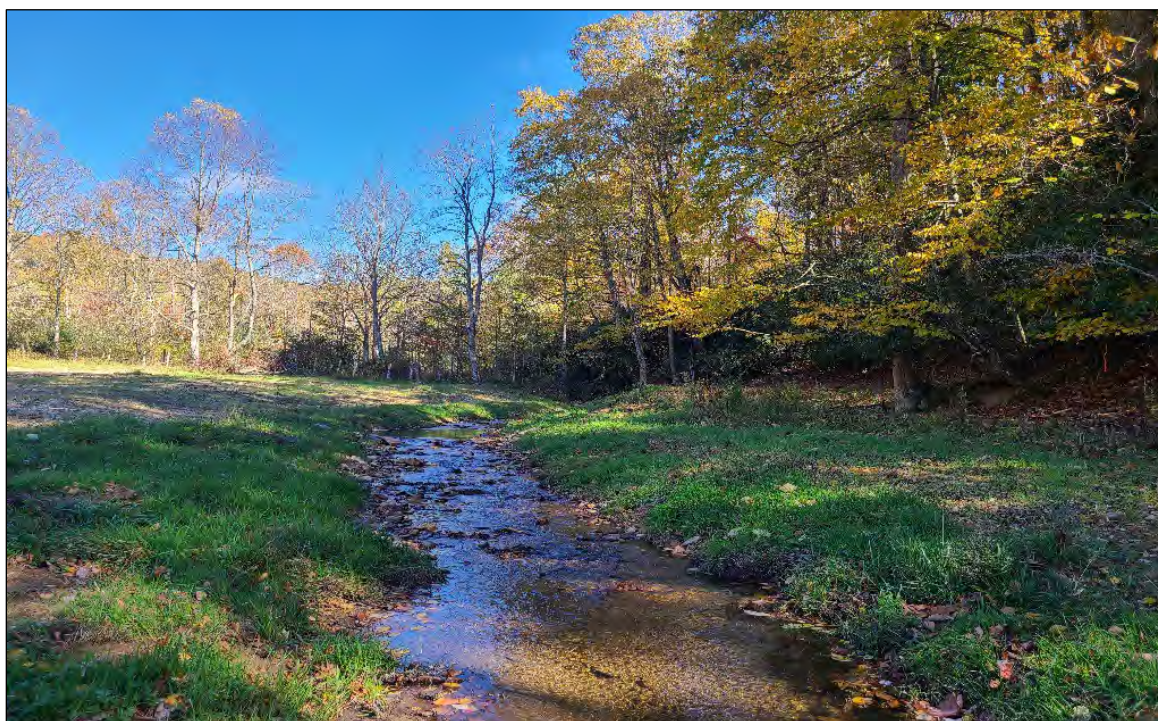
DMS RFP No. 16-007725 (issued 11/13/18)

USACE Action ID No. SAW-2019-00835

DWR Project No. 2019-0865

Data Collection: October 2021-February 2022

Submission: October 2022



Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY

DIVISION OF MITIGATION SERVICES

1652 MAIL SERVICE CENTER

RALEIGH, NORTH CAROLINA 27699-1652



October 5, 2022

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Kimberly Isenhour
Mitigation Project Manager, Regulatory Division
U.S. Army Corps of Engineers

Subject: Laurel Springs Mitigation Site - request to count replacement tree species towards site success criteria
DMS Project ID No. 100122
Full Delivery Contract No. 7890
RFP No. 16-007725
USACE Action ID No. SAW-2019-00835
DWR Project No. 2019-0865

Mrs. Isenhour,

Restoration Systems, LLC (RS), Sponsor of the Laurel Springs Mitigation Site (Site), is requesting a modification of the Site's Mitigation Plan to include planted tree/shrub species that were not included in the Site's approved Mitigation Plan. A lack of availability from nurseries of approved Mitigation Plan tree/shrub species required RS to adjust the number of stems plated for some approved species and include four additional species not included in the approved Mitigation Plan. Table A below is a list of tree/shrub species detailed in the approved Mitigation Plan that were not planted at the Site.

Table A. Non-planted Species Specified in the Mitigation Plan

Species (Mitigation Plan)	Mit. Plan Stems
Basswood (<i>Tilia americana</i>)	300
White Ash (<i>Fraxinus americana</i>)	400
Yellow birch (<i>Betula alleghaniensis</i>)	900
Black Gum (<i>Nyssa sylvatica</i>)	1,200
Persimmon (<i>Diosporos virginiana</i>)	500
Shadbush (<i>Amelanchier arborea</i>)	500
American elm (<i>Ulmus americana</i>)	1,200
Hackberry (<i>Celtis laevigata</i>)	1,100
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1,000
Tag alder (<i>Alnus serrulata</i>)	700
Total =	7,800

Species summarized in Table A, as with others in the approved Mitigation Plan, were selected based on Reference Forest Ecosystem (RFE) data, on-site observations, and community descriptions from Classification of the Natural Communities of North Carolina (Schafale and Weakley 1990) – Montane Alluvial and Acidic Cove Forests.

To replace the 7,800 stems detailed in Table A, 3,150 were supplemented by four species not included in the approved Mitigation Plan: Arrowwood viburnum, Bitternut hickory, American hazelnut, and Red spruce. RS selected these species based on their availability and that they were observed in nearby forest communities. The additional 4,650 stems needed to complete the targeted planting density were comprised of Mitigation Plan approved species. Table B summarizes planted species and their individual quantity.



Table B. As-Built Planted Species and Stems

Replacement Species & Final Planting Numbers (As-built)	Mit. Plan Stems	Planted Stems	Percentage of Total
Arrowwood viburnum (<i>Viburnum dentatum</i>) *	--	1,500	8.90%
Bitternut hickory (<i>Carya cordiformis</i>) *	--	800	4.75%
American hazelnut (<i>Corylus americana</i>) *	--	600	3.56%
Red spruce (<i>Picea rubens</i>) *	--	250	1.48%
River birch (<i>Betula nigra</i>)	1,100	1,450	8.61%
Tulip poplar (<i>Liriodendron tulipifera</i>)	1,300	2,150	12.76%
Sycamore (<i>Platanus occidentalis</i>)	1,100	2,100	12.46%
White oak (<i>Quercus alba</i>)	500	1,100	6.53%
Northern Red oak (<i>Quercus rubra</i>)	300	1,100	6.53%
Scarlet oak (<i>Quercus coccinea</i>)	300	1,100	6.53%
Sweet birch (<i>Betula lenta</i>)	1000	2,600	15.43%
Eastern white pine (<i>Pinus strobus</i>)	500	600	3.56%
Swamp birch (<i>Betula alleghaniensis</i>)	900	500	2.97%
Eastern hemlock (<i>Tsuga canadensis</i>)	200	1,000	5.93%
TOTALS	7,200	16,850	100%

*Replacement species not included in the approved Mitigation Plan

RS included all planted species in the data collection for the MY0 Monitoring Report. Table 8 within the MY0 Monitoring Report, the DMS vegetation tool, requires providers to select from five options regarding the species status for inclusion in meeting performance standards, "Performance Standard Approval" column:

1. Approved Mit Plan
2. Approved Post Mit Plan
3. Proposed
4. Not Approved – Not Invasive or Exotic
5. Not Approved – Invasive or Exotic

The four additional species detailed in Table B were included in the MY 0 Report as "Proposed" species for inclusion in meeting performance standards – Vegetation Plot Data Table from Vegetation Data Entry Tool, MY 0 Report Table 8, Appendix B. If the IRT concurs that these species may be included to count toward the Site's performance standards, RS will update the four species as "Approved Post Mit Plan" in the MY1 (2022) report.

Please let me know if you have any questions or if I can provide any additional information.

Sincerely,

A handwritten signature in black ink, appearing to read 'Raymond Holz'.

Raymond Holz
Operations Manager
Restoration Systems, LLC



Response to DMS Comments

DMS Project ID No. 100122
Full Delivery Contract No. 7890
RFP No. 16-007725
USACE Action ID No. SAW-2019-00835
DWR Project No. 2019-0865

DMS Comments Received (Black Text) & Responses (Blue Text)

1. General: Please continue to provide photos of the upstream and downstream project crossing areas to confirm crossing stability and aquatic organism passage in the MY1 (2022) monitoring report and all future monitoring reports.
Response: These photos will be provided in each year's monitoring report.
2. General: A supplemental planting effort in the dormant season of 2022/ 2023 was discussed during the August 25, 2022 site visit. If the supplemental planting effort is greater than 20% of the entire project site and/ or the proposed species to be planted were not approved in the mitigation plan, further IRT discussion will be warranted. Any current areas of encroachment should also be replanted during this 2022/ 2023 effort. Please discuss the proposed supplemental planting effort/ planting plan in the MY1 (2022) report.
Response: Visual observations made in 2022 between site planning the submission of the MY0 report suggest 2.93 acres of upland planting (including small portions of encroachment along the northern easement edge of Tributary 2 - Enhancement I and II areas) may benefit from additional planting to ensure the site is primed to achieve the Site's vegetation success criteria by the conclusion of monitoring period. These areas, totaling 2.93 acres, account of 18.09% of the total planting area 16.2 acres, and was added the MY0 CCPV Figure. Upon review of Year 1 (2022) vegetation monitoring data, RS will finalize any additional planting efforts which would occur in February of 2023.
3. Cover pages: Please also include the issuance date of the RFP on the report covers: RFP 16-007725 (issued 11/13/18).
Response: This date was added to the cover pages.
4. Table 2 - Summary: Goals, Performance, and Results: The page footer is incorrect and references the Swamp Grape project. Please review and update the report as necessary.
Response: The page footer was edited.
5. Table 3 - Project Attributes: The Supporting Documentation for the Regulatory Considerations section references incorrect Appendices for this report. Please update.
Response: The references were clarified by indicating they are found in the Appendices of the Mitigation Plan document.
6. Section 1.2 – Success Criteria Table: The success criteria in the report should match the IRT approved mitigation plan. Please review and update accordingly.
Response: The success criteria table was updated to match the approved mitigation plan.
7. Section 2 As-Built Condition (Baseline): As discussed during the August 25, 2022 site visit, please provide additional discussion and details about the rock sills added to the site during construction. Additional report discussion of the sills, photos, and typical drawing details should be added to the MY0 report and record drawings as necessary to relay the necessity and function of the added sill structures.
Response: Section 2.1 was added to explain the necessity and function of the rock sills. It was explained that the sills consist of additional large cobble, they are not engineered or designed to hold grade, and are expected to shift and naturalize with the stream over time. Therefore, typical drawings were not included in the record drawings. Photos of sills have been added to the photo log in Appendix A.

8. Section 4 – Monitoring Year 0 – Data Assessment: The hydrology assessment section references 16 groundwater gauges; however, Figure 1 shows 13 ground water gauges. Please review this section and update as necessary. Please also document any significant monitoring device location changes from the IRT approved mitigation plan (if any).
Response: The text was updated to reflect that 13 groundwater gauges were installed. There were no significant changes in monitoring device locations from what was depicted in the Mitigation Plan.
9. Table 6A: Please also include common species names and percentages planted in the table.
Response: Common names and percentages were added to the table.
10. Table 6B: Please provide the common species names in the table.
Response: Common names were added to the table.
11. Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool: Please review the table in detail and update as necessary. There appears to be species included in the first section of the table that were not identified in the IRT approved mitigation plan.
Response: Table 8 was updated to indicate that *Viburnum dentatum*, *Carya cordiformis*, and *Corylus americana* were planted and counted during as-built vegetation measurements but were not included in the planting list in the approved mitigation plan. Table 8, the DMS vegetation tool, requires providers to select from five options regarding the species status for inclusion in meeting performance standards, “Performance Standard Approval” column:
1. Approved Mit Plan
 2. Approved Post Mit Plan
 3. Proposed
 4. Not Approved – Not Invasive or Exotic
 5. Not Approved – Invasive or Exotic
- The four additional species detailed in Table B were included as “Proposed” species for inclusion in meeting performance standards – Vegetation Plot Data Table from Vegetation Data Entry Tool, MY 0 Report Table 8, Appendix B. If the IRT concurs that these species may be included to count toward the Site’s performance standards, RS will update the four species as “Approved Post Mit Plan” in the MY1 (2022) report.
12. Table 11. Project Timeline: Please update the completion date for the MY-0 Baseline report (September 2022).
Response: Table 11 was updated.

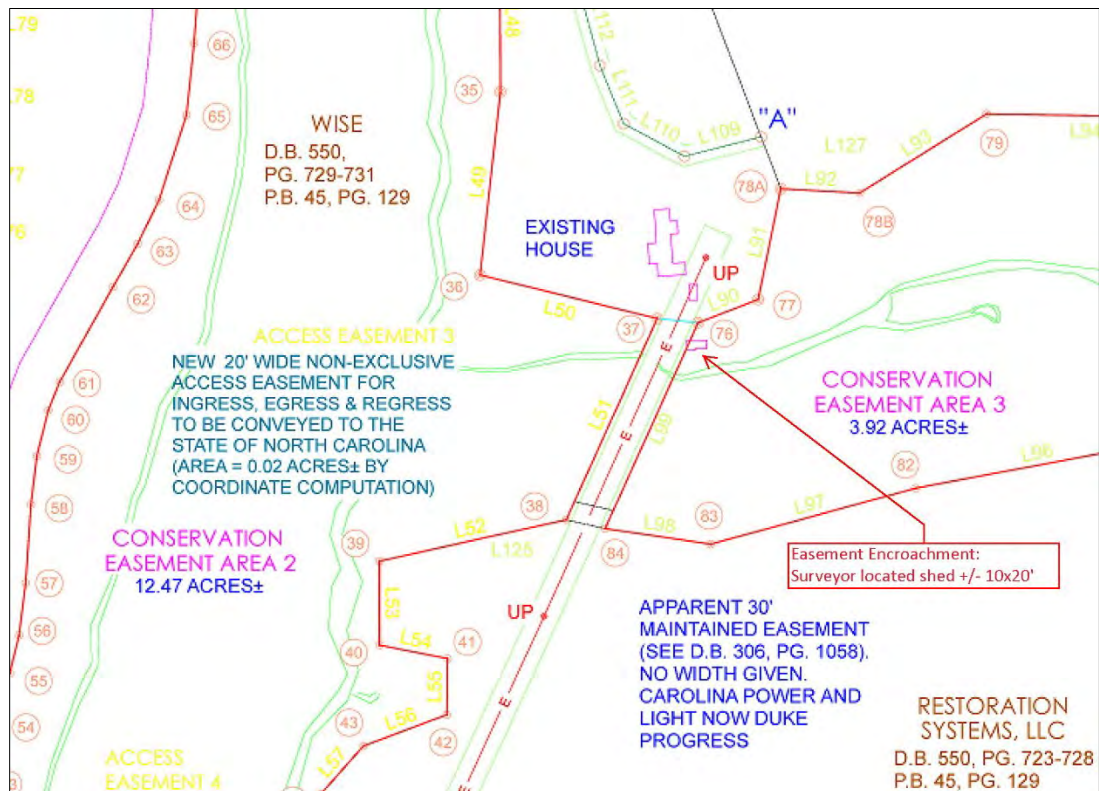
Comments Based on August 25, 2022 DMS Site Visit:

13. Existing mowing and lawn maintenance encroachment was observed near the residence adjacent to UT3. In addition, this area was not clearly marked as specified in the RFP (16- 007725). Please conduct a full boundary assessment and walk the entire conservation easement boundary to confirm that rebar and stamped aluminum caps are installed on all easement corners. Any missing corners identified, or corners disturbed during construction should be reinstalled by a PLS and stamped per the recorded plat.
Response: K2 Designs, our contracted surveyor, visited the Site on 9/22 to verify the integrity of the site boundary, locate rebar/stamped caps, and replace/add easement signage as needed.
14. The boundary assessment should also confirm that 6-foot-tall durable witness posts and conservation easement signs are located at each corner of the conservation easement boundary. Posts must be made of material that will last a minimum of 20 years. Please refer to RFP 16-007725 (Task 2 Property) for the required boundary marking specifications.
Response: On most boundary lines, NC DMS signs were attached to either a treated wooden posts or metal T-posts to mark the boundary and corner caps. In heavily wooded or rocky terrain, NC DMS

signage was affixed to mature hardwood trunks in close proximity to the corner or boundary.

15. Lastly, a residential shed and equipment were noted in the vicinity of UT3 near the mowing and lawn maintenance encroachment. Please confirm that the shed and equipment are not located within the conservation easement. Please complete the full boundary assessment during MY1 (2022) and report findings and completed survey monumentation and marking updates in the MY1 (2022) report. This boundary assessment and marking effort should be completed before requested payment for Task 6 (MY0).

Response: K2 Designs, our contracted surveyor, visited the Site on 9/22 to verify the integrity of the site boundary, locate rebar/stamped caps, and replace/add easement signage as needed. During this review, it was confirmed, that the small (approximately 10x20) shed identified by DMS during the site visit is currently located within the easement. RS has offered, and the landowner has agreed, to construct a new shed, outside of the easement boundary, and to remove the old shed and equipment from the easement. This work is being schedule and will be completed before the final Year 1 Monitoring Report.



16. Areas of straw waddles were utilized to stabilize the site during and after construction. Once these areas are fully stabilized, please remove the plastic netting associated with the straw waddles from the site.

Response: Straw waddles in areas that were deemed stable were removed.

17. Several tires were observed within the conservation easement along UT3. In addition, t- posts and areas of barbed wire were observed along UT3 within the conservation easement. Please remove any debris or internal fencing from within the conservation easement during MY1 (2022).

Response: Debris and internal fencing were removed from the easement.

18. DMS observed minimal woody stems along the soil farm road that was decommissioned along UT3. Please assess this area during the MY1 (2022) monitoring effort and supplementally plant this area if

warranted.

Response: Please see response to Comment No. 2

19. Some areas of Japanese knotweed and multiflora rose were observed on the site. Japanese knotweed was noted near the top of Fork Creek and minimal amounts of multiflora rose were observed during the site visit. Please continue to treat invasives during MY1 (2022) and the monitoring term. Japanese knotweed is considered a high threat invasive by the IRT.

Response: Site-wide invasive species treatment occurred during the week of September 12. RS will provide a full account of invasive species treatment during MY1 (2022) within the annual monitoring report.

Digital Deliverable Comments:

20. The spatial data submission is complete and accurate; of note is the location of groundwater gauges not located in credited wetlands and a majority of the others on the edge of credited wetlands. The spatial data is consistent with the locations depicted in the MY 0 Map. If these locations are adjusted during the review phase or additional wells are requested by the IRT, please submit a revised file.

Response: If gauges are moved or added, a revised shapefile will be submitted to DMS.

21. Photos were submitted for vegetation plots and cross sections only, please verify there are no additional photo points required per the approved monitoring plan. Recommend adding project photo points of the upstream and downstream project crossing areas in the revised submittal.

Response: There are no additional photo points required per the approved monitoring plan, however, the IRT has requested crossing photos which were included in the photo log (Appendix F). These photos are included in the digital submittal.

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French Broad River Basin
Cataloging Unit 06010108

DMS Project No. 100122
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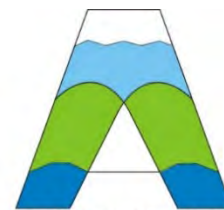


Prepared by:



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And



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- Figure 1. Current Conditions Plan View
- Table 4A-E. Visual Stream Morphology Stability Assessment Table
- Table 5. Vegetation Condition Assessment Table
- Vegetation Plot Photographs
- Photo Log

Appendix B. Vegetation Plot Data

- Table 6A. Planted Bare-Root Woody Vegetation
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- Table 7. Vegetation Plot Counts and Densities
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Appendix C. Stream Geomorphology Data

- Cross-Sections with Annual Overlays
- Longitudinal Profile
- Table 9A-D. Baseline Stream Data Summary Tables
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Appendix D. Hydrologic Data

- Groundwater Gauge Soil Profiles
- Appendix E. Project Timeline and Contact Info
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Appendix F. Other Data

- Fork Creek Culvert to Bridge Revision – Email with exchange with IRT members, May 19, 2021
- Preconstruction Benthic Results
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Appendix E: Project Timeline and Contact Info

- Table 11. Project Timeline
- Table 12. Project Contacts

Appendix G. Record Drawings (As-built Survey)

1 PROJECT SUMMARY

Restoration Systems, LLC has established the North Carolina Division of Mitigation Services (NCDMS) Laurel Springs Stream and Wetland Mitigation Site (Site). The Site is on two contiguous parcels along the cold-water Fork Creek and unnamed tributaries to Fork Creek in the Southern Crystalline Ridge and Mountains Ecoregion of North Carolina. Located in the French Broad River Basin, cataloging unit 06010108, the Site is in the Targeted Local Watershed (TLW) 06010108010020 and North Carolina Division of Water Resources (NCDWR) subbasin number 04-03-06. The Site is not located in a Local Watershed Plan (LWP), Regional Watershed Plan (RWP), or Targeted Resource Area (TRA). Site watersheds range from approximately 0.02 of a square mile (12 acres) on UT2 to 1.32 square miles (847 acres) at the Site's outfall.

1.1 Project Background, Components, and Structure

Located approximately 8 miles southwest of Linville and 7 miles northeast of Spruce Pine in southern Avery County, the Site encompasses 29.19 acres. Mitigation work within the Site included 1) stream restoration, 2) stream enhancement (Level I), 3) stream enhancement (Level II), 4) stream preservation, 5) wetland reestablishment, 6) wetland rehabilitation, 7) wetland enhancement, 8) wetland preservation, and 9) vegetation planting. The Site is expected to provide 4231.827 cold water stream credits and 3.688 riparian wetland credits by closeout (Table 1, Page 2). A conservation easement was granted to the State of North Carolina and recorded at the Avery County Register of Deeds on October 19, 2020.

Before construction, land use at the Site was characterized by disturbed forest, cow pasture, and hay fields. Site design was completed in February 2021. Construction started on July 12, 2021 and ended within a final walkthrough on October 15, 2021. The Site was planted on January 12-13, 2022. Completed project activities, reporting history, completion dates, and project contacts are summarized in Tables 11-12 (Appendix E).

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Table 1. Laurel Springs Stream and Wetland Mitigation Site (ID-100122) Project Mitigation Quantities and Credits

Project Segment	Original Mitigation Plan Ft/Ac	As-Built Ft/Ac	Original Mitigation Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Credits	Comments
Stream							
Fork Cr - A	91	92	Cold	EI	1.50000	60.667	
Fork Cr - B	2250	2242	Cold	R	1.00000	2,250.000	
UT 1	234	233	Cold	R	1.00000	234.000	
UT 2A	25	25	Cold	P	10.00000	2.500	
UT 2 - A	184	184	Cold	P	10.00000	18.400	
UT 2 - B	198	199	Cold	EII	2.50000	79.200	
UT 2 - C	467	463	Cold	R	1.00000	467.000	
UT 3A	103	103	Cold	P	10.00000	10.300	
UT 3 - A	265	265	Cold	P	10.00000	26.500	
UT 3 - B	248	250	Cold	EII	5.00000	49.600	
UT 3 - C	183	183	Cold	EI	1.50000	122.000	
UT 3 - D	233	223	Cold	R	1.00000	233.000	
UT 4 - A	541	541	Cold	P	10.00000	54.100	
UT 4 - B	112	110	Cold	R	1.00000	112.000	
UT 5 - A	60	60	Cold	P	10.00000	6.000	
UT 5 - B	67	67	Cold	P	10.00000	6.700	
					Total:	3,731.967	
Wetland							
Wetland Reestablish	7.656	7.656	R	REE	1.00000	7.656	
Wetland Rehabilitation	1.845	1.845	R	RH	NA*	0.000	
Wetland Enhancement	0.148	0.148	R	E	NA*	0.000	
Wetland Preservation	0.198	0.198	R	P	NA*	0.000	
					Total:	7.656	

*Wetland Rehabilitation, Enhancement, and Preservation acreage are not being included in credit calculations. These areas are being utilized by the wider buffer tool to generate additional stream credit

Project Credits

Restoration Level	Stream			Riparian	Non-Rip	Coastal
	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration			3,296.000			
Re-establishment				3.688**		
Rehabilitation						
Enhancement						
Enhancement I			182.667			
Enhancement II			128.800			
Creation						
Preservation			124.500			
Wider Buffer Tool			499.860			

Totals **0.000** **0.000** **4,231.827** **3.688** **0.000** **0.000**

** DMS contract is for 3.688 WMUs; therefore, excess wetland credit has been used for wider buffer tool calculations.

Total Stream Credit 4,231.827

Total Wetland Credit 3.688

Table 2. Summary: Goals, Performance, and Results

Goals	Objectives	Success Criteria
(1) HYDROLOGY		
Minimize downstream flooding to the maximum extent possible.	<ul style="list-style-type: none"> Construct a new channel at historic floodplain elevation to restore overbank flows Remove drain tiles and agriculture ditches Plant woody riparian buffer Deep rip floodplain soils to reduce compaction and increase soil surface roughness Protect riparian buffers with a perpetual conservation easement 	<ul style="list-style-type: none"> BHR not to exceed 1.2 Document four overbank events in separate monitoring years Livestock excluded from the easement Attain Wetland Hydrology Success Criteria Attain Vegetation Success Criteria Conservation Easement recorded
Increase stream stability within the Site so that channels are neither aggrading nor degrading.	<ul style="list-style-type: none"> Construct channels with the proper pattern, dimension, and longitudinal profile Remove livestock from the property Construct stable channels with the appropriate substrate Upgrade piped channel crossings Plant woody riparian buffer Stabilize stream banks 	<ul style="list-style-type: none"> Cross-section measurements indicate a stable channel with the appropriate substrate Visual documentation of stable channels and structures BHR not to exceed 1.2 < 10% change in BHR in any given year Livestock excluded from the easement Attain Vegetation Success Criteria
(1) WATER QUALITY		
Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	<ul style="list-style-type: none"> Remove agricultural livestock and reduce agricultural land/inputs Install marsh treatment areas Plant woody riparian buffer Restore/enhance jurisdictional wetlands adjacent to Site streams Provide surface roughness and reduce compaction through deep ripping/plowing. Restore overbank flooding by constructing channels at historic floodplain elevation. 	<ul style="list-style-type: none"> Livestock excluded from the easement Attain Wetland Hydrology Success Criteria Attain Vegetation Success Criteria
(1) HABITAT		
Improve instream and streamside habitat.	<ul style="list-style-type: none"> Construct stable channels with the appropriate substrate Plant woody riparian buffer to provide organic matter and shade Construct a new channel at historic floodplain elevation to restore overbank flows Protect riparian buffers with a perpetual conservation easement Restore/enhance jurisdictional wetlands adjacent to Site streams Stabilize stream banks Install in-stream structures 	<ul style="list-style-type: none"> Cross-section measurements indicate a stable channel with the appropriate substrate Visual documentation of stable channels and in-stream structures Attain Wetland Hydrology Success Criteria Attain Vegetation Success Criteria Conservation Easement recorded

Table 3. Project Attributes

Project Information					
Project Name	Laurel Springs Site				
Project County	Avery County, North Carolina				
Project Area (acres)	29.19				
Project Coordinates (latitude & latitude)	35.9913, -81.9837				
Planted Area (acres)	16.2				
Project Watershed Summary Information					
Physiographic Province	Blue Ridge				
Project River Basin	French Broad				
USGS HUC for Project (14-digit)	6010108010020				
NCDWR Sub-basin for Project	04-03-06				
Project Drainage Area (acres)	846.7				
Percentage of Project Drainage Area that is Impervious	<2%				
CGIA Land Use Classification	Managed Herbaceous Cover & Hardwood Swamps				
Reach Summary Information					
Parameters	Fork Cr	UT 1	UT 2	UT3	UT 4
Pre-Project Length (linear feet)	2401	234	926	1002	685
Post-Project Length (linear feet)	2334	233	870	1024	650
Valley Classification & Confinement	Alluvial, moderately confined	Alluvial, moderately confined	Alluvial, confined	Alluvial, confined	Alluvial, confined
Drainage Area (acres)	847	193	12	23	13
NCDWR Stream ID Score	--	--	25.5	22.5	33.5
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial/ Intermittent	Perennial/ Intermittent	Perennial
Thermal Regime	Cold	Cold	Cold	Cold	Cold
NCDWR Water Quality Classification	WS-IV, Tr				
Existing Morphological Description (Rosgen 1996)	Cg 4	Eg 4	Bg 5/6	Bg 5	B 4
Proposed Stream Classification (Rosgen 1996)	Ce 3/4	Ce 3/4	B 3/4	B 3/4	B 4
Existing Evolutionary Stage (Simon and Hupp 1986)	II/III	II/III	IV	II	I/II
Underlying Mapped Soils	Nikwasi loam, Reddies fine sandy loam,	Nikwasi loam	Chandler-Micaville complex	Chandler-Micaville complex	Chandler-Micaville complex
Drainage Class	poorly, moderately well	poorly	somewhat excessively	somewhat excessively	somewhat excessively
Hydric Soil Status	hydric, nonhydric (may contain hydric inclusions)	hydric	nonhydric	nonhydric	nonhydric
Parameters	Fork Cr	UT 1	UT 2	UT3	UT 4
Valley Slope	0.0271	0.0291	0.1047	0.0992	0.0992
FEMA Classification	NA	NA	NA	NA	NA
Native Vegetation Community	Montane Alluvial Forest and Swamp Forest-Bog Complex				
Watershed Land Use/Land Cover (Site)	87% forest, 11% agricultural land, <2% low density residential/impervious surface				
Watershed Land Use/Land Cover (Reference Channel)	95% forest, 3% agricultural land, <2% low density residential/impervious surface				
Percent Composition of Exotic Invasive Vegetation	<5%				
Wetland Summary Information					
Parameters	Wetlands				
Wetland acreage	8.3 acre drained & 2.61 acres degraded				
Wetland Type	Riparian riverine				
Mapped Soil Series	Nikwasi				
Drainage Class	Poorly drained				
Hydric Soil Status	Hydric				
Source of Hydrology	Groundwater, stream overbank				
Hydrologic Impairment	Incised streams, compacted soils, livestock, ditches, drain tile				
Native Vegetation Community	Montane Alluvial Forest and Swamp Forest-Bog Complex				
% Composition of Exotic Invasive Vegetation	<5%				
Restoration Method	Hydrologic, vegetative, livestock				
Enhancement Method	Vegetative, livestock				
Regulatory Considerations					
Regulation	Applicable?	Resolved?	Supporting Documentation		
Waters of the United States-Section 401	Yes	Yes	JD Package (Mitigation Plan, App D)		
Waters of the United States-Section 404	Yes	Yes	JD Package (Mitigation Plan, App D)		
Endangered Species Act	Yes	Yes	CE Document (Mitigation Plan, App E)		
Historic Preservation Act	Yes	Yes	CE Document (Mitigation Plan, App E)		
Coastal Zone Management Act	No	--	NA		
FEMA Floodplain Compliance	Yes	Yes	CE Document (Mitigation Plan, App E)		
Essential Fisheries Habitat	No	--	CE Document (Mitigation Plan, App E)		

1.2 Success Criteria

Monitoring and success criteria for stream restoration should relate to project goals and objectives identified from on-site NC SAM and NC WAM data collection. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving success criteria. The following summarizes Site success criteria.

Table A. Success Criteria

Streams
<ul style="list-style-type: none">• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05.• Continuous surface flow must be documented in intermittent reaches each year for at least 30 consecutive days.• Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section.• BHR at any measure riffle cross-section should not change by more than 10% from baseline condition during any given monitoring period.• The stream shall remain stable, and all other performance standards shall be met through four separate bankfull events, occurring in separate years, during the monitoring years 1-7.• Intermittent streams will demonstrate at least 30-days consecutive flow.
Wetland Hydrology
<ul style="list-style-type: none">• Annual saturation or inundation within the upper 12 inches of the soil surface for, at a minimum, 12 percent of the growing season during average climatic conditions.
Vegetation
<ul style="list-style-type: none">• Within planted portions of the Site, a minimum of 320 stems per acre must be present at year 3; a minimum of 260 stems per acre must be present at year 5; and a minimum of 210 stems per acre must be present at year 7.• Trees must average 6 feet in height at year 5 and 8 feet in height at year 7 in each plot.• Planted and volunteer stems are counted, provided they are included in the approved planting list for the Site; natural recruits not on the planting list may be considered by the IRT on a case-by-case basis.• Areas of herbaceous vegetation establishment will have a minimum of four species present.

2 AS-BUILT CONDITION (BASELINE)

Construction started on July 12, 2021 and ended within a final walkthrough on October 15, 2021. The Site was planted on January 12-13, 2022. As-built and MY0 data collection occurred between October 2021 and February 2022.

In general, no significant issues arose during the construction of the Site. A sealed half-size set of record drawings are provided in Appendix G, which includes the post-construction survey, alignments, structures, and monitoring features. These include redlines for any significant field adjustments made during construction that differ from the design plans. Where needed, adjustments were made during construction based on field evaluations and are listed below.

Table B. Deviations from Construction Plans

Location	Deviation	Explanation
Fork Creek sta. 0+32	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 1+08	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 1+72	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 2+37	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 3+22	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 7+32	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 7+83	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 8+28	Log vane added	Field conditions required additional bank protection
Fork Creek sta. 8+68	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 9+35	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 10+01	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 10+98	J-hook constructed instead of cross vane	Conflict with the UT-1 confluence necessitated the removal of the right arm of the cross vane.
Fork Creek sta. 11+11	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 11+65	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 12+17	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 12+99	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 13+49	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 14+20	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 14+65	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 15+25	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 16+19	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 16+64	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 17+13	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 17+96	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 18+63	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 20+02	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 20+53	Log vane added	Field conditions required additional bank protection
Fork Creek sta. 20+73	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 21+28	Log vane not constructed; rock sill constructed instead	Field conditions did not require bank protection, but slope required structure.
Fork Creek sta. 21+83	Rock sill added	Slope in field conditions required structure
Fork Creek sta. 22+37	Rock sill added	Slope in field conditions required structure
UT-1 sta. 0+05	Log cross vane not constructed	Structure header in conflict with pipe outlet
UT-1 sta. 0+09	Rock sill added	Slope in field conditions required structure
UT-1 sta. 0+13	Cross vane added	Slope in field conditions required structure
UT-2 sta. 9+18	Rock sill added	Slope in field conditions required structure

Additional activities that occurred at the Site included the following.

- Planting 16.2 acres of the Site with 16,850 stems on January 12-13, 2022 – planted species are included in Table 6A (Appendix B).
- Applying a permanent seed mix at 1 lb. per acre across the Site. A species list is included in Table 6B (Appendix B).

2.1 Inclusion of Rock Sills on Fork Creek

During the final stages of construction, several large-scale rain events began to move riffle bed material on Fork Creek, especially at the tops of riffles. Concerned by the amount of movement of newly constructed riffle systems, onsite construction managers decided to install large cobble (#1 stone and larger) at the tops of riffles along the reach. These are not engineered structures and are not designed to hold grade. Their purpose is to reduce the movement of riffle bed material until roots take hold, and they are expected to shift and naturalize with the stream over time. Thus far, the sills are functioning as designed and all reach riffles are stable. Sample photos of rock sills are included in Appendix A.

2.2 Modification of Fork Creek Crossings

During construction, concern grew regarding the Fork Creek engineered aluminum box culvert crossing and the amount of fill required to construct the crossing; in essence its construction would require the placement of 5-6 feet of fill on the Fork Creek floodplain would be required to install the culvert and have an approximate amount of fill on top of the culvert for the access road. After discussions/investigations with the construction contractor and engineer, Worth Creech from Restoration Systems discussed the situation with Travis Wilson (NC Wildlife Resources Commission) and a proposed a modification of the aluminum box culvert to a spanned bridge crossing which would reduce the amount of fill by 3.8-feet. Subsequently, Mr. Creech sent the Inter-Agency Review Team an email on May 18, 2021 (Appendix F) which included modified construction sheets.

3 PROJECT MONITORING – METHODS

Monitoring will be conducted by Axiom Environmental, Inc. Annual monitoring reports of the data collected will be submitted to the NCDMS by Restoration Systems no later than December 31st of each monitoring year data is collected. The monitoring schedule is summarized in the following table.

Table C. Monitoring Schedule

Resource	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Streams	X	X	X		X		X
Wetlands	X	X	X	X	X	X	X
Vegetation	X	X	X		X		X
Visual Assessment	X	X	X	X	X	X	X
Report Submittal	X	X	X	X	X	X	X

3.1 Monitoring

The monitoring parameters are summarized in the following table.

Table D. Monitoring Summary

Stream Parameters				
Parameter	Method	Schedule/Frequency	Number/Extent	Data Collected/Reported
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 16 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern will be depicted on a plan view figure with a written assessment and photograph of the area included in the report.
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Bankfull Events	Continuous monitoring of surface water gauges and/or trail camera	Continuous recording through the monitoring period	One surface water gauge on UT2	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through the monitoring period	One crest gauge on Fork Creek	Visual evidence, photo documentation, and/or rain data.
Wetland Parameters				
Parameter	Method	Schedule/Frequency	Number/Extent	Data Collected/Reported
Wetland Reestablishment	Groundwater gauges	Yearly with the growing season defined as March 1-October 22	13 gauges spread throughout restored wetlands	Soil temperature at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period
Vegetation Parameters				
Parameter	Method	Schedule/Frequency	Number/Extent	Data Collected/Reported
Vegetation establishment and vigor	Permanent vegetation plots 0.0247 acres (100 square meters) in size; <i>CVS-EEP Protocol for Recording Vegetation, Version 4.2</i> (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	16 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre

Note: Volunteer species on the approved planting list must be established for 2 years to count towards success and will be subject to height standards.

4 MONITORING YEAR 0 – DATA ASSESSMENT

Annual monitoring and site visits were conducted between October 2021 and February 2022 to assess the condition of the project. Stream, wetland, and vegetation criteria for the Site follow the approved success criteria presented in the Mitigation Plan and summarized in Section 1.3; monitoring methods are detailed in Section 3.0.

4.1 Stream Assessment

Morphological surveys for MY0 were conducted on October 26-27, 2021. All streams within the Site are stable and functioning as designed. Refer to Appendix A for the Visual Stream Morphology Stability Assessment Table and Stream Photographs. Refer to Appendix C for Stream Geomorphology Data. No stream areas of concern were identified during MY0.

4.2 Hydrology Assessment

13 groundwater monitoring gauges were installed throughout the Site's wetlands. Hydrologic data will be collected and reported during MY1 (2022).

4.3 Vegetative Assessment

The MY0 vegetative survey was completed on February 1, 2022. Ten of the fourteen species planted were included in the approved Mitigation Plan planting list. RS is requesting a modification of the Site's Mitigation Plan to include planted tree/shrub species that were not included in the Site's approved Mitigation Plan. A lack of availability from nurseries of approved Mitigation Plan tree/shrub species required RS to adjust the number of stems plated for some approved species and include four additional species not included in the approved Mitigation Plan. Table E below is a list of tree/shrub species detailed in the approved Mitigation Plan that were not planted at the Site.

Table E. Non-planted Species Specified in the Mitigation Plan

Species (Mitigation Plan)	Mit. Plan Stems
Basswood (<i>Tilia americana</i>)	300
White Ash (<i>Fraxinus americana</i>)	400
Yellow birch (<i>Betula alleghaniensis</i>)	900
Black Gum (<i>Nyssa sylvatica</i>)	1,200
Persimmon (<i>Diosporos virginiana</i>)	500
Shadbush (<i>Amelanchier arborea</i>)	500
American elm (<i>Ulmus americana</i>)	1,200
Hackberry (<i>Celtis laevigata</i>)	1,100
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1,000
Tag alder (<i>Alnus serrulata</i>)	700
Total =	7,800

Species summarized in Table E, as with others in the approved Mitigation Plan, were selected based on Reference Forest Ecosystem (RFE) data, on-site observations, and community descriptions from Classification of the Natural Communities of North Carolina (Schafale and Weakley 1990) – Montane Alluvial and Acidic Cove Forests.

To replace the 7,800 stems detailed in Table A, 3,150 were supplemented by four species not included in the approved Mitigation Plan: Arrowwood viburnum, Bitternut hickory, American hazelnut, and Red

spruce. RS selected these species based on their availability and that they were observed in nearby forest communities. The additional 4,650 stems needed to complete the targeted planting density were comprised of Mitigation Plan approved species. Table B summarizes planted species and their individual quantity. Table B summarizes planted species and their individual quantity.

Table F. As-Built Planted Species and Stems

Replacement Species & Final Planting Numbers (As-built)	Mit. Plan Stems	Planted Stems	Percentage of Total
Arrowwood viburnum (<i>Viburnum dentatum</i>) *	--	1,500	8.90%
Bitternut hickory (<i>Carya cordiformis</i>) *	--	800	4.75%
American hazelnut (<i>Corylus americana</i>) *	--	600	3.56%
Red spruce (<i>Picea rubens</i>) *	--	250	1.48%
River birch (<i>Betula nigra</i>)	1,100	1,450	8.61%
Tulip poplar (<i>Liriodendron tulipifera</i>)	1,300	2,150	12.76%
Sycamore (<i>Platanus occidentalis</i>)	1,100	2,100	12.46%
White oak (<i>Quercus alba</i>)	500	1,100	6.53%
Northern Red oak (<i>Quercus rubra</i>)	300	1,100	6.53%
Scarlet oak (<i>Quercus coccinea</i>)	300	1,100	6.53%
Sweet birch (<i>Betula lenta</i>)	1000	2,600	15.43%
Eastern white pine (<i>Pinus strobus</i>)	500	600	3.56%
Swamp birch (<i>Betula alleghaniensis</i>)	900	500	2.97%
Eastern hemlock (<i>Tsuga canadensis</i>)	200	1,000	5.93%
TOTALS	7,200	16,850	100%

*Replacement species not included in the approved Mitigation Plan

When including 3 species that are currently proposed for IRT approval, vegetation monitoring resulted in a sitewide stem density average of 688 planted stems per acre, well above the interim requirement of 320 stems per acre required at MY3. Additionally, all 16 fixed vegetation plots met the interim success criteria. Please refer to Appendix A for Vegetation Plot Photographs and the Vegetation Condition Assessment Table, and Appendix B for Vegetation Plot Data. No vegetation areas of concern were identified during MY0.

4.4 Monitoring Year 0 Summary

Overall, the Site looks good, is performing as intended, and is on track to meet success criteria. All vegetation plots are on track to exceed the MY3 interim requirement of 320 planted stems per acre, and all streams within the Site are stable and are meeting project goals.

During the MY0 site visit with the NCDMS, it was noted that a small (approximately 10'x20') shed was located within the easement and UT3. Through discussions with DMS and the landowner, it was agreed the best course of action was to decommission and remove the shed as opposed to modifying the conservation easement. RS has offered, and the landowner has agreed, to construct a new shed, outside of the easement boundary, and to remove the old shed and equipment from the easement. This work is being schedule and will be completed before the final Year 1 Monitoring Report.

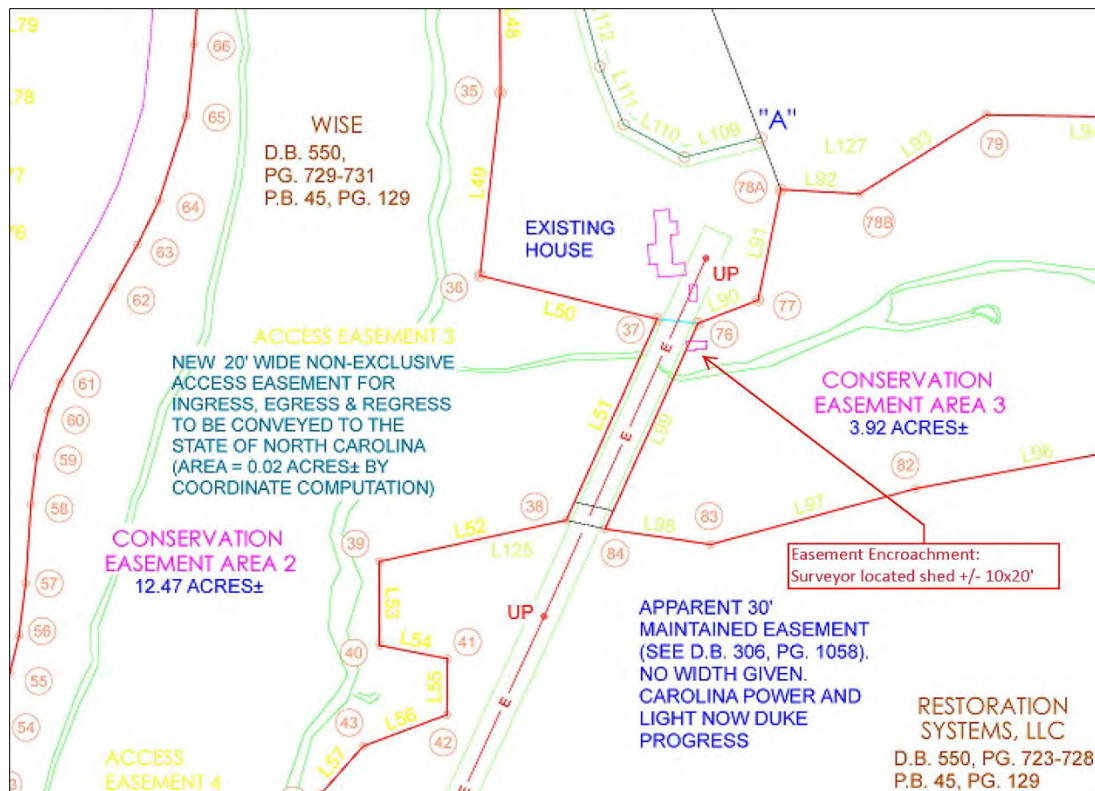


Figure 1 – Location of shed within the Site's conservation easement

5 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

North Carolina Ecosystem Enhancement Program (NCEEP). 2008. Lumber River Basin Restoration Priorities (online). Available: https://files.nc.gov/ncdeq/Mitigation%20Services/Watershed_Planning/Lumber_River_Basin/Lumber_R_BRP_2008_FINAL.pdf (January 9, 2018).

North Carolina Stream Functional Assessment Team. (NC SFAT 2015). N.C. Stream Assessment Method (NC SAM) User Manual. Version 2.1.

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Appendix A: Visual Assessment Data

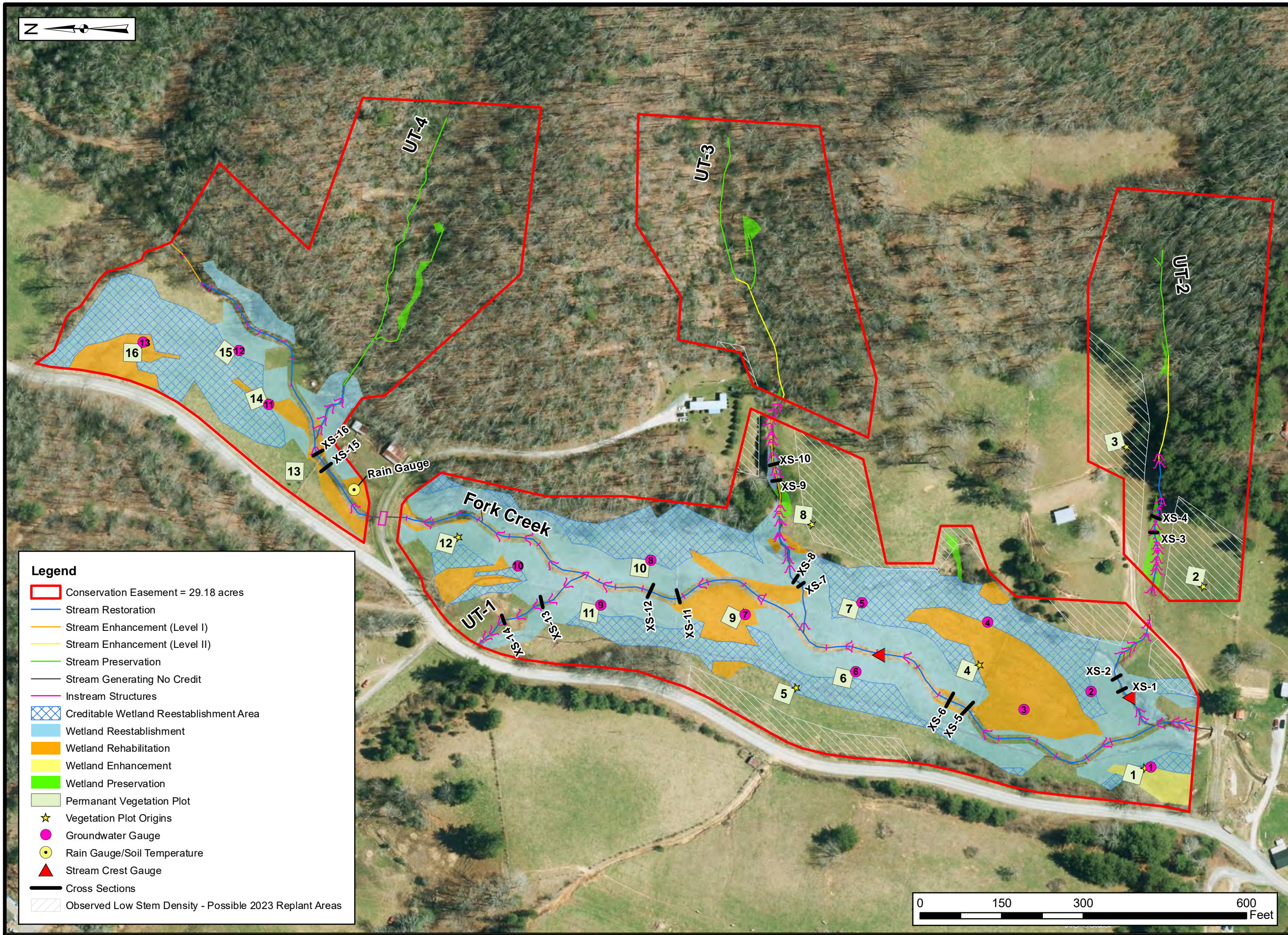
Figure 1. Current Conditions Plan View

Table 4A-E. Visual Stream Morphology Stability Assessment Table

Table 5. Vegetation Condition Assessment Table

Vegetation Plot Photographs

Photo Log



Prepared for:



Project:

**LAUREL SPRINGS
MITIGATION SITE**

Avery County, NC

Title:

**CURRENT
CONDITIONS
PLAN VIEW**

Notes:

1. Background Imagery Source:
2018 aerial photography
provided by the NC OneMap
program (online, provided by
the NC Geographic Information
Coordination Council)

Drawn by: PHP

Date: SEP 2022

Scale: 1:2000

Project No.: 19-006

FIGURE

1

Table 4A. Visual Stream Stability Assessment

Reach Fork Creek

Assessed Stream Length 2334

Assessed Bank Length 4668

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	45	45		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	45	45		100%

Table 4B. Visual Stream Stability Assessment

Reach UT 1

Assessed Stream Length 233

Assessed Bank Length 466

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	8	8		100%

Table 4C. Visual Stream Stability Assessment

Reach UT 2

Assessed Stream Length 662

Assessed Bank Length 1324

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	18	18		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	18	18		100%

Table 4D. Visual Stream Stability Assessment

Reach UT 3

Assessed Stream Length 656

Assessed Bank Length 1312

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	16	16		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	16	16		100%

Table 4E. Visual Stream Stability Assessment

Reach UT 4

Assessed Stream Length 110

Assessed Bank Length 220

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	3	3		100%

Table 5. Visual Vegetation Assessment**Planted acreage****16.2**

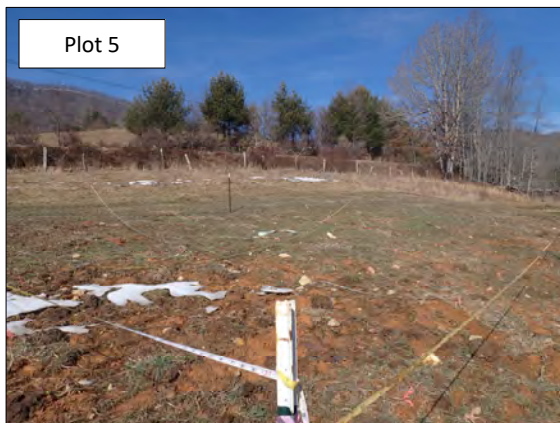
Survey Date: February 1, 2022

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10acres	2.67	16.5%
Total			2.67	16.5%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.00	0.0%
Cumulative Total			2.67	16.5%

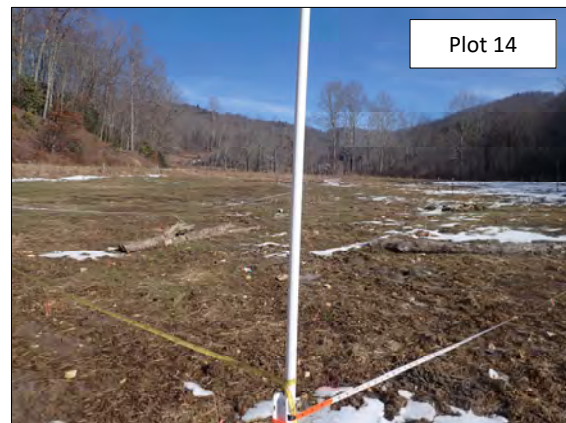
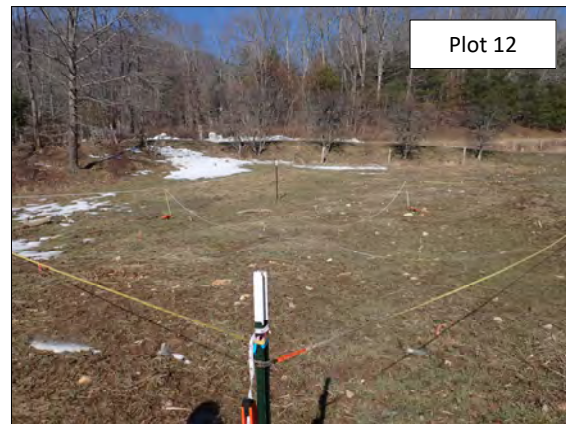
Easement Acreage**29.19**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.10 acres	0.00	0.0%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	none	0 Encroachments noted	

Laurel Springs Site
MYO (2022) Vegetation Monitoring Photographs (taken February 1, 2022)



Laurel Springs Site
MYO (2022) Vegetation Monitoring Photographs (taken February 1, 2022)



Laurel Springs Mitigation Site: Task 6 – As-built / MY0

DMS Contract #: 7890; DMS Project ID: 100122; RFP # 16-007725



Fork Creek crossing facing downstream – October 2021



Fork Creek crossing facing upstream – October 2021

Laurel Springs Mitigation Site: Task 6 – As-built / MY0

DMS Contract #: 7890; DMS Project ID: 100122; RFP # 16-007725



UT-2 crossing facing downstream – October 2021



UT-2 crossing facing upstream – October 2021

Laurel Springs Mitigation Site: Task 6 – As-built / MY0

DMS Contract #: 7890; DMS Project ID: 100122; RFP # 16-007725



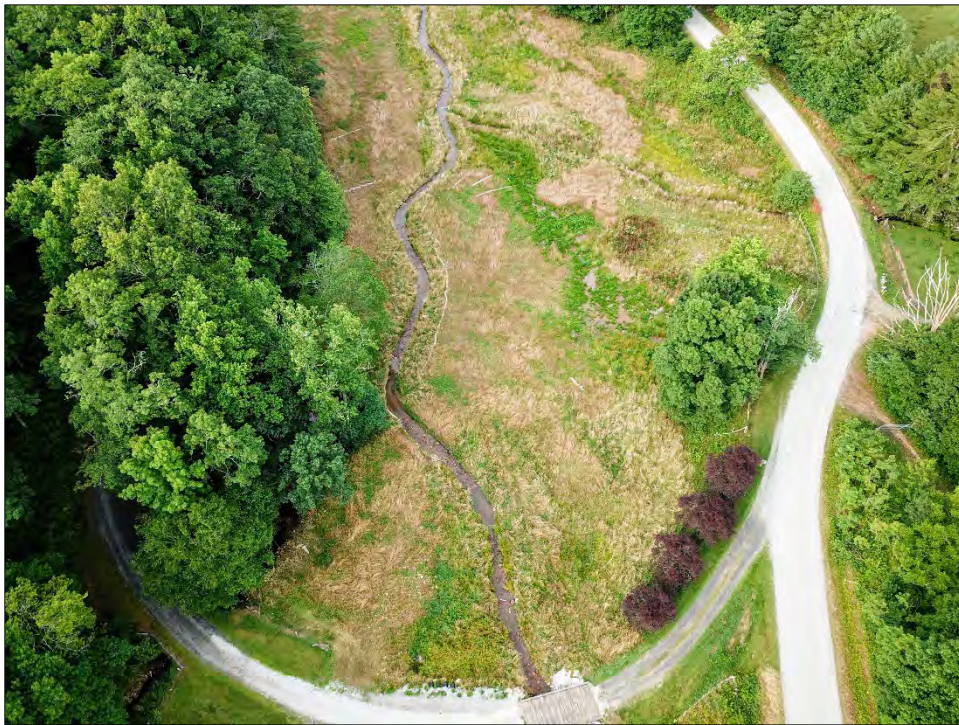
Upper extent of Site (Fork Creek), facing downstream – July 13, 2022



Upper extent of Site (Fork Creek), facing downstream – July 13, 2022

Laurel Springs Mitigation Site: Task 6 – As-built / MY0

DMS Contract #: 7890; DMS Project ID: 100122; RFP # 16-007725



Downstream of Fork Creek crossing & UT1 confluence, facing downstream – July 13, 2022



UT3 facing upstream – July 13, 2022

Laurel Springs Mitigation Site: Task 6 – As-built / MY0

DMS Contract #: 7890; DMS Project ID: 100122; RFP # 16-007725



Downstream extent of Site (Fork Creek), UT2 confluence, facing downstream – July 13, 2022



Downstream extent of Site (Fork Creek), UT2 confluence, facing downstream – July 13, 2022

Laurel Springs Mitigation Site: Task 6 – As-built / MY0

DMS Contract #: 7890; DMS Project ID: 100122; RFP # 16-007725



Fork Creek and UT2 confluence – July 13, 2022



Upstream of UT2 – July 13, 2022



Fork Creek – Rock sill, typical – August 25, 2022



Fork Creek – Rock sill, typical – August 25, 2022



Fork Creek – Rock sill, typical – August 25, 2022



Fork Creek – Rock sill, typical – August 25, 2022



Fork Creek – Rock sill, typical – August 25, 2022



Fork Creek – Rock sill, typical – August 25, 2022

Appendix B: Vegetation Data

Table 6A. Planted Bare-Root Woody Vegetation

Table 6B. Permanent Seed Mix

Table 7. Vegetation Plot Counts and Densities

Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool

**Table 6A. Planted Bare Root Woody Vegetation
Laurel Springs Mitigation Site**

Scientific Name	Common Name	Total	Percent (%)
	Acres	16.2	
<i>Betula nigra</i>	River birch	1,450	8.6
<i>Liriodendron tulipifera</i>	Tulip poplar	2,150	12.8
<i>Platanus occidentalis</i>	Sycamore	2,100	12.5
<i>Quercus alba</i>	White oak	1,100	6.5
<i>Quercus rubra</i>	Northern Red oak	1,100	6.5
<i>Quercus coccinea</i>	Scarlet oak	1,100	6.5
<i>Carya cordiformis</i> *	Bitternut hickory	800	4.7
<i>Betula lenta</i>	Sweet birch	2,600	15.4
<i>Corylus americana</i> *	American hazelnut	600	3.6
<i>Picea rubens</i> *	Red spruce	250	1.5
<i>Pinus strobus</i>	Eastern white pine	600	3.6
<i>Viburnum dentatum</i> *	Arrowwood viburnum	1,500	8.9
<i>Betula alleghaniensis</i>	Swamp birch	500	3.0
<i>Tsuga canadensis</i>	Eastern hemlock	1,000	5.9
TOTALS		16,850	100
Average Stems/Acre		1,040	

* These species were not included in the planting plan in the approved mitigation plan; however, they were observed in nearby forest communities and were included due to lack of availability of approved Mitigation Plan species/quantities. Restoration Systems has requested these species be approved for inclusion and added to the approved species to be counted towards Site success.

**Table 6B. Permanent Seed Mix
Laurel Springs Stream and Wetland Mitigation Site**

Scientific Name	Common Name	%	Scientific Name	Common Name	%
<i>Asclepias incarnata</i>	Swamp milkweed	0.3	<i>Helianthus angustifolius</i>	Narrowleaf sunflower	0.8
<i>Agrostis gigantea</i>	Redtop	16	<i>Heliopsis helianthoides</i>	False sunflower	1.2
<i>Agrostis hyemalis</i>	Winter bentgrass	4	<i>Hibiscus moscheutos</i>	Swamp rose mallow	0.8
<i>Agrostis stolonifera</i>	Creeping bentgrass	4	<i>Juncus effusus</i>	Soft rush	0.6
<i>Carex lurida</i>	Shallow sedge	3.22	<i>Lespedeza capitata</i>	Round-headed bush clover	0.8
<i>Carex vulpinoidea</i>	Fox sedge	10	<i>Lespedeza virginica</i>	Slender lespedeza	0.8
<i>Chamaecrista fasciculata</i>	Partridge pea	1.6	<i>Liatris spicata</i>	Dense blazing star	0.8
<i>Chamaecrista nictitans</i>	Sensitive partridge pea	0.8	<i>Mimulus ringens</i>	Allegheny monkeyflower	0.06
<i>Chrysanthemum leucanthemum</i>	Oxeye daisy	4	<i>Monarda fistulosa</i>	Wild bergamot	0.2
<i>Coreopsis lanceolata</i>	Lance-leaved coreopsis	4	<i>Panicum virgatum</i>	Switchgrass	4
<i>Coreopsis tinctoria</i>	Plains coreopsis	4	<i>Pycnanthemum tenuifolium</i>	Slender mountain mint	0.2
<i>Cosmos bipinnatus</i>	Garden cosmos	0.8	<i>Rhexia virginica</i>	Handsome-Harry	0.06
<i>Desmodium canadense</i>	Showy tick-trefoil	0.8	<i>Rudbeckia hirta</i>	Black-eyed Susan	4
<i>Echinacea purpurea</i>	Purple coneflower	2.4	<i>Scirpus cyperinus</i>	Woolgrass	0.06
<i>Elymus virginicus</i>	Virginia wildrye	8.6	<i>Silphium perfoliatum</i>	Cup plant	0.8
<i>Eupatorium coelestinum</i>	Blue mistflower	0.4	<i>Symphyotrichum puniceum</i>	Purplestem aster	0.1
<i>Eupatorium perfoliatum</i>	Common boneset	2.5	<i>Tridens flavus</i>	Purpletop tridens	16
<i>Glyceria striata</i>	Fowl manna grass	0.1	<i>Vernonia noveboracensis</i>	New York ironweed	0.2
<i>Helenium autumnale</i>	Common sneezeweed	0.2	<i>Verbena hastata</i>	Blue vervain	0.8
			Total		100

Table 7. Planted Vegetation Totals
Laurel Springs Stream and Wetland Mitigation Site

Plot #	Planted Stems/Acre	Success Criteria Met?
1	648	Yes
2	810	Yes
3	364	Yes
4	1093	Yes
5	769	Yes
6	364	Yes
7	810	Yes
8	810	Yes
9	810	Yes
10	688	Yes
11	729	Yes
12	567	Yes
13	607	Yes
14	688	Yes
15	648	Yes
16	607	Yes
Average Planted Stems/Acre	688	Yes

Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool

Planted Acreage	16.2
Date of Initial Plant	2022-01-12
Date(s) of Supplemental Plant(s)	
Date(s) Mowing	
Date of Current Survey	2022-02-01
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/S hrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	<i>Betula alleghaniensis</i>	yellow birch	Tree	FAC													1	1	1	1
	<i>Betula lenta</i>	sweet birch	Tree	FACU	1	1					2	2								
	<i>Betula nigra</i>	river birch	Tree	FACW	10	10					3	3								
	<i>Betula sp.</i>						1	1			2	2	2	2	5	5	7	7	4	4
	<i>Liriodendron tulipifera</i>	tuliptree	Tree	FACU	2	2	4	4	3	3	2	2	2	2						
	Other												1	1						
	<i>Pinus strobus</i>	eastern white pine	Tree	FACU			1	1	4	4	4	4							1	1
	<i>Platanus occidentalis</i>	American sycamore	Tree	FACW							6	6	1	1			1	1	5	5
	<i>Quercus coccinea</i>	scarlet oak	Tree								1	1					2	2		
	<i>Quercus nigra</i>	water oak	Tree	FAC															3	3
	<i>Quercus sp.</i>						12	12			2	2	3	3	2	2	1	1	4	4
	<i>Tsuga canadensis</i>	eastern hemlock	Tree	FACU			1	1	2	2			4	4					2	2
Sum	Performance Standard				13	13	19	19	9	9	22	22	13	13	7	7	12	12	20	20
Post Mitigation Plan Species	<i>Carya cordiformis</i>	bitternut hickory	Tree	FACU			1	1			4	4	5	5	1	1				
	<i>Corylus americana</i>	American hazelnut	Shrub	FACU													7	7		
	<i>Viburnum dentatum</i>	southern arrowwood	Tree	FAC	3	3					1	1	1	1	1	1	1	1		
	Sum	Proposed Standard			16	16	20	20	9	9	27	27	19	19	9	9	20	20	20	20
Mitigation Plan Performance Standard	Current Year Stem Count					13		19		9		22		13		7		12		20
	Stems/Acre					364		648		364		891		526		202		445		810
	Species Count					3		5		3		8		6		2		5		7
	Dominant Species Composition (%)					77		63		44		27		31		71		58		25
	Average Plot Height (ft.)					2		1		1		1		1		2		2		1
	% Invasives					0		0		0		0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					16		20		9		27		19		9		20		20
	Stems/Acre					486		688		364		1093		769		283		769		810
	Species Count					4		6		3		10		8		4		7		7
	Dominant Species Composition (%)					77		63		44		27		31		71		58		25
	Average Plot Height (ft.)					2		1		1		1		1		1		1		1
	% Invasives					0		0		0		0		0		0		0		0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.

2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).

3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool (continued)

Planted Acreage	16.2
Date of Initial Plant	2022-01-12
Date(s) of Supplemental Plant(s)	
Date(s) Mowing	
Date of Current Survey	2022-02-01
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/S hrub	Indicator Status	Veg Plot 9 F		Veg Plot 10 F		Veg Plot 11 F		Veg Plot 12 F		Veg Plot 13 F		Veg Plot 14 F		Veg Plot 15 F		Veg Plot 16 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	<i>Betula alleghaniensis</i>	yellow birch	Tree	FAC																
	<i>Betula lenta</i>	sweet birch	Tree	FACU																
	<i>Betula nigra</i>	river birch	Tree	FACW											1	1	3	3	7	7
	<i>Betula sp.</i>				4	4	4	4			3	3	4	4	3	3			3	3
	<i>Liriodendron tulipifera</i>	tuliptree	Tree	FACU	8	8	1	1			5	5	1	1	2	2	4	4	3	3
	Other				1	1														
	<i>Pinus strobus</i>	eastern white pine	Tree	FACU																
	<i>Platanus occidentalis</i>	American sycamore	Tree	FACW	2	2	2	2					6	6	2	2	1	1	2	2
	<i>Quercus coccinea</i>	scarlet oak	Tree																	
	<i>Quercus nigra</i>	water oak	Tree	FAC																
	<i>Quercus sp.</i>				3	3	3	3	2	2	2	2	2	2	1	1	3	3		
	<i>Tsuga canadensis</i>	eastern hemlock	Tree	FACU											1	1	2	2		
Sum	Performance Standard				18	18	10	10	2	2	10	10	13	13	10	10	13	13	15	15
Post Mitigation Plan Species	<i>Carya cordiformis</i>	bitternut hickory	Tree	FACU			1	1			4	4								
	<i>Corylus americana</i>	American hazelnut	Shrub	FACU	1	1	2	2	3	3			2	2	2	2	2	2		
	<i>Viburnum dentatum</i>	southern arrowwood	Tree	FAC	1	1	4	4	13	13					5	5	1	1		
Sum	Proposed Standard				20	20	17	17	18	18	14	14	15	15	17	17	16	16	15	15
Mitigation Plan Performance Standard	Current Year Stem Count					18		10		2		10		13		10		13		15
	Stems/Acre					729		405		40		405		526		405		526		607
	Species Count					5		4		1		3		4		5		5		4
	Dominant Species Composition (%)					44		40		100		50		46		30		31		47
	Average Plot Height (ft.)					1		1		1		1		1		2		1		2
	% Invasives					0		0		0		0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					20		17		18		14		15		17		16		15
	Stems/Acre					810		688		688		567		607		688		648		607
	Species Count					7		7		3		4		5		8		7		4
	Dominant Species Composition (%)					44		40		100		50		46		30		31		47
	Average Plot Height (ft.)					1		2		2		1		1		2		1		2
	% Invasives					0		0		0		0		0		0		0		0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.

2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).

3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Appendix C: Stream Geomorphology Data

Cross-Sections with Annual Overlays

Longitudinal Profile

Table 9A-D. Baseline Stream Data Summary Tables

Table 10A-B. Cross-Section Morphology Monitoring Summary

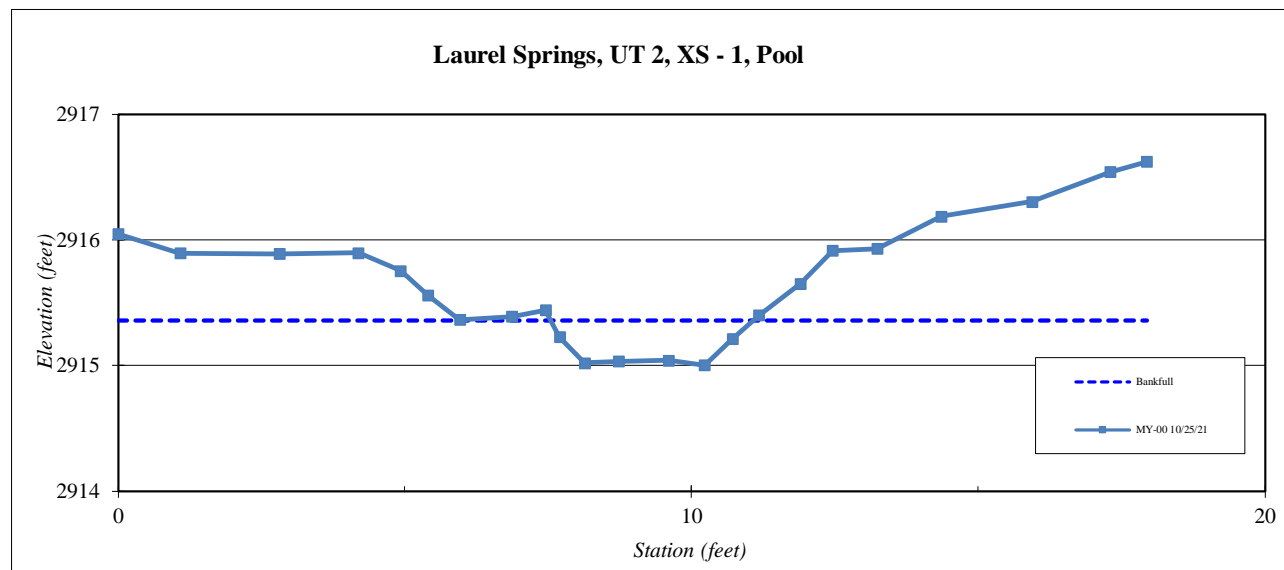
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT2, XS -1, Pool
Feature	Pool
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2915.9
1.1	2915.7
2.8	2915.7
4.2	2915.7
4.9	2915.5
5.4	2915.3
6.0	2915.1
6.9	2915.1
7.5	2915.2
7.7	2914.9
8.1	2914.7
8.7	2914.7
9.6	2914.7
10.2	2914.7
10.7	2914.9
11.2	2915.1
11.9	2915.4
12.5	2915.7
13.2	2915.7
14.4	2916.0
15.9	2916.16
17.3	2916.4
17.9	2916.5

SUMMARY DATA	
Bankfull Elevation:	2915.1
Bank Height Ratio:	1.0
Thalweg Elevation:	2914.7
LTOB Elevation:	2915.1
LTOB Max Depth:	0.4
LTOB Cross Sectional Area:	1.1



Stream Type	E/C 5
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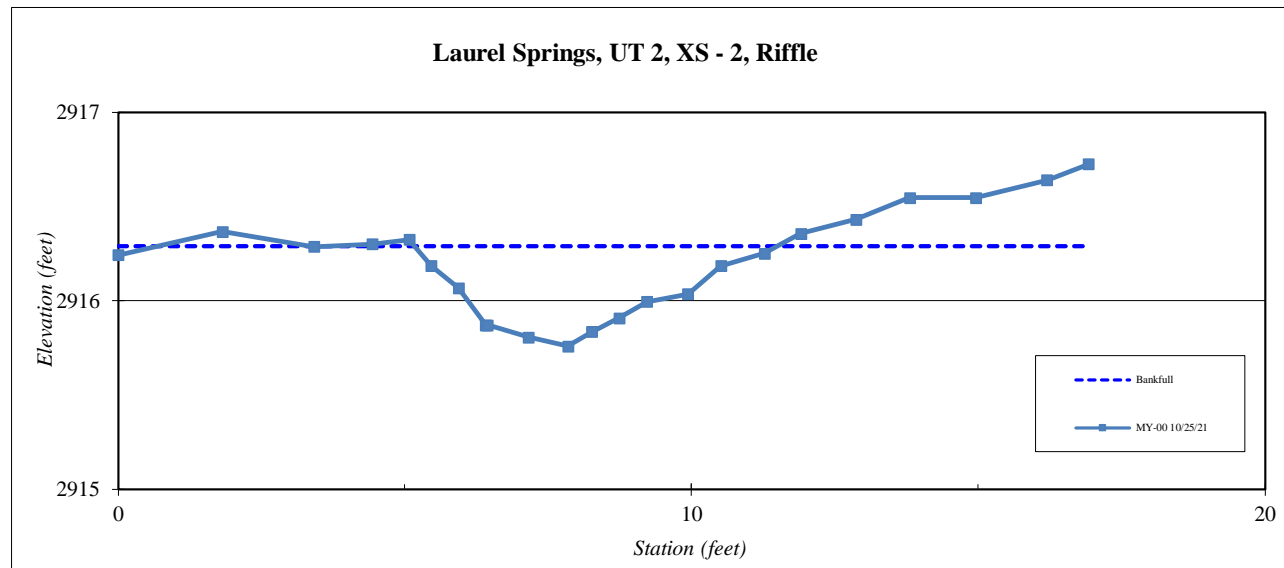
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT2, XS -2, Riffle
Feature	Riffle
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2916.1
1.8	2916.2
3.4	2916.1
4.4	2916.2
5.1	2916.2
5.5	2916.0
5.9	2915.9
6.4	2915.7
6.4	2915.7
7.2	2915.6
7.8	2915.5
8.3	2915.6
8.7	2915.7
9.2	2915.8
9.9	2915.9
10.5	2916.0
11.3	2916.1
11.9	2916.2
12.9	2916.3
13.8	2916.4
15.0	2916.43
16.2	2916.5
16.9	2916.6

SUMMARY DATA	
Bankfull Elevation:	2916.1
Bank Height Ratio:	1.0
Thalweg Elevation:	2915.5
LTOB Elevation:	2916.1
LTOB Max Depth:	0.6
LTOB Cross Sectional Area:	2.1



Stream Type	E/C 5
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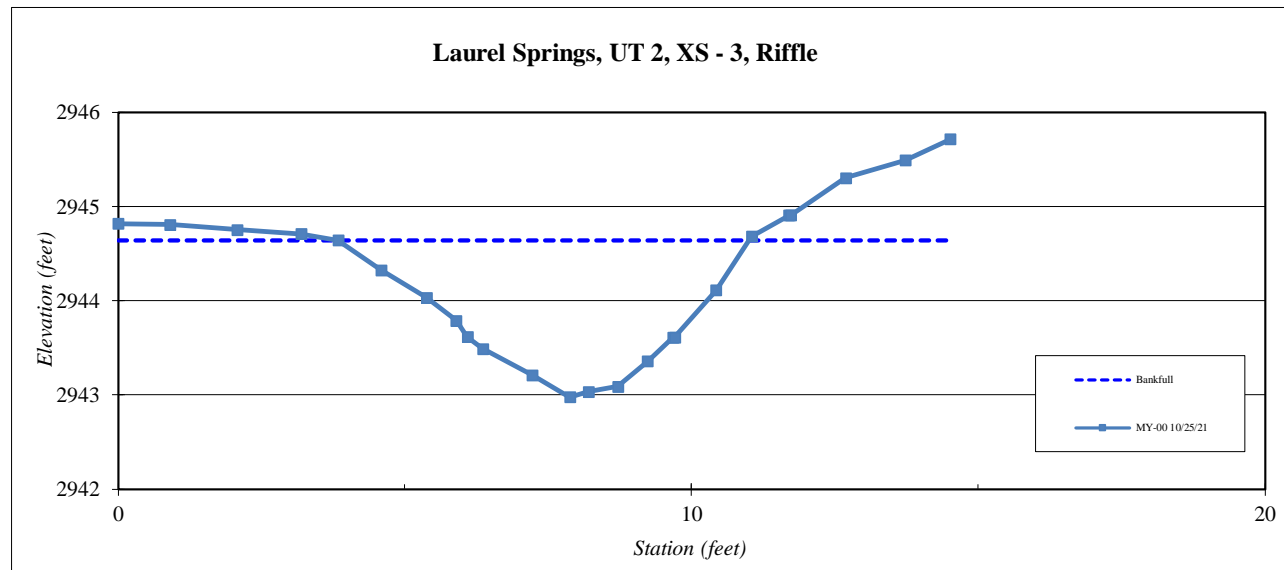
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT2, XS -3, Riffle
Feature	Riffle
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2945.0
0.9	2945.0
2.1	2944.9
3.2	2944.9
3.8	2944.8
4.6	2944.4
5.4	2944.1
5.9	2943.8
6.1	2943.6
6.4	2943.5
7.2	2943.2
7.9	2942.9
8.2	2943.0
8.7	2943.0
9.2	2943.3
9.7	2943.6
9.7	2943.6
10.4	2944.2
11.0	2944.8
11.7	2945.1
11.7	2945.10
12.7	2945.5
13.7	2945.8
14.5	2946.0

SUMMARY DATA	
Bankfull Elevation:	2944.8
Bank Height Ratio:	1.0
Thalweg Elevation:	2942.9
LTOB Elevation:	2944.8
LTOB Max Depth:	1.9
LTOB Cross Sectional Area:	7.7



Stream Type	E/C 5
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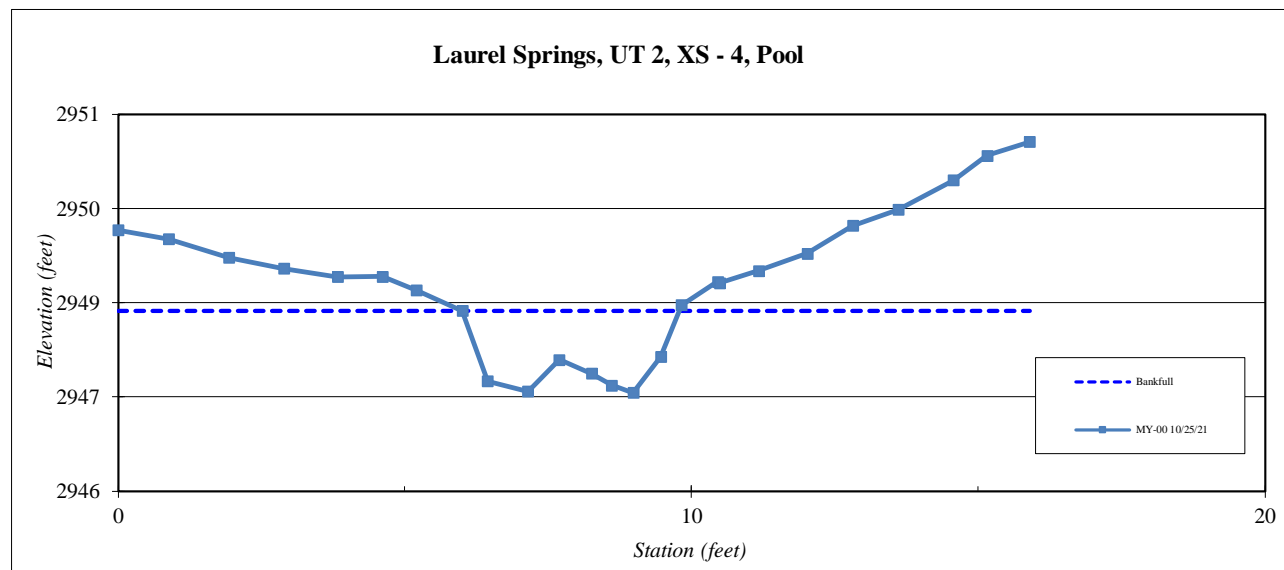
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT2, XS -4, Pool
Feature	Pool
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2949.5
0.9	2949.4
1.9	2949.1
2.9	2949.0
3.8	2948.9
4.6	2948.9
5.2	2948.7
6.0	2948.5
6.4	2947.7
7.1	2947.5
7.7	2947.9
8.3	2947.8
8.6	2947.6
9.0	2947.5
9.5	2947.9
9.8	2948.6
10.5	2948.8
10.5	2948.8
11.2	2949.0
12.0	2949.2
12.8	2949.52
13.6	2949.7
14.6	2950.1
15.2	2950.4
15.9	2950.5

SUMMARY DATA	
Bankfull Elevation:	2948.5
Bank Height Ratio:	1.0
Thalweg Elevation:	2947.5
LTOB Elevation:	2915.1
LTOB Max Depth:	1.0
LTOB Cross Sectional Area:	2.7



Stream Type	E/C 5
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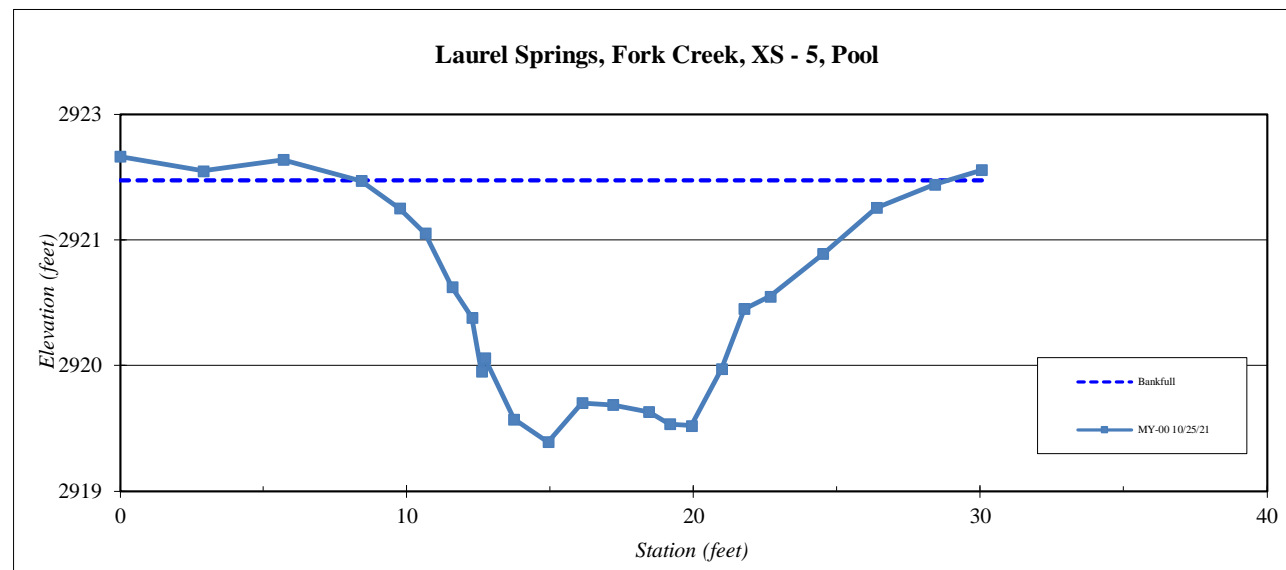
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -5, Pool
Feature	Pool
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2922.2
2.9	2922.1
5.7	2922.2
8.4	2922.0
9.8	2921.7
10.6	2921.5
11.6	2921.0
12.3	2920.8
12.6	2920.3
12.7	2920.4
13.7	2919.8
14.9	2919.6
16.1	2920.0
17.2	2920.0
18.4	2919.9
19.2	2919.8
19.9	2919.8
21.0	2920.3
21.8	2920.8
22.7	2921.0
24.5	2921.34
26.4	2921.8
28.4	2922.0
30.1	2922.1

SUMMARY DATA	
Bankfull Elevation:	2922.0
Bank Height Ratio:	1.0
Thalweg Elevation:	2919.6
LTOB Elevation:	2922.0
LTOB Max Depth:	2.4
LTOB Cross Sectional Area:	24.6



Stream Type	E/C 5
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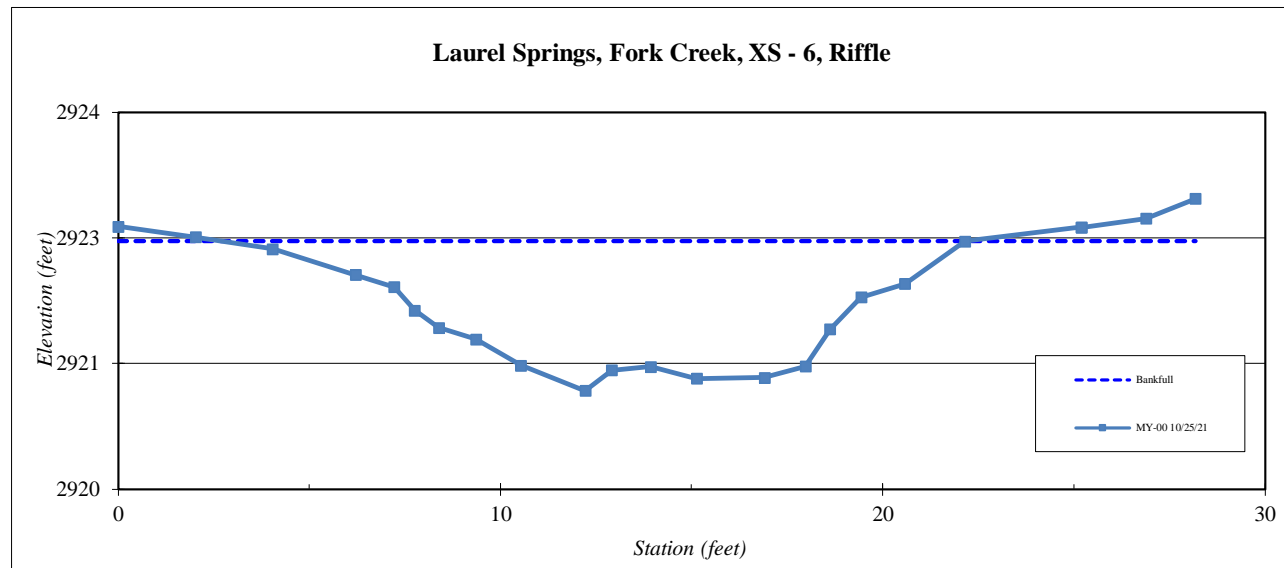
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -6, Riffle
Feature	Riffle
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2922.7
2.0	2922.6
4.0	2922.5
6.2	2922.3
7.2	2922.2
7.8	2921.9
8.4	2921.8
9.4	2921.7
10.5	2921.4
12.2	2921.2
12.9	2921.4
13.9	2921.4
15.1	2921.3
16.9	2921.3
18.0	2921.4
18.6	2921.8
19.4	2922.1
20.6	2922.2
22.2	2922.6
25.2	2922.7
25.2	2922.69
26.9	2922.8
28.2	2923.0

SUMMARY DATA	
Bankfull Elevation:	2922.6
Bank Height Ratio:	1.0
Thalweg Elevation:	2921.2
LTOB Elevation:	2922.6
LTOB Max Depth:	1.3
LTOB Cross Sectional Area:	14.6



Stream Type	E/C 5
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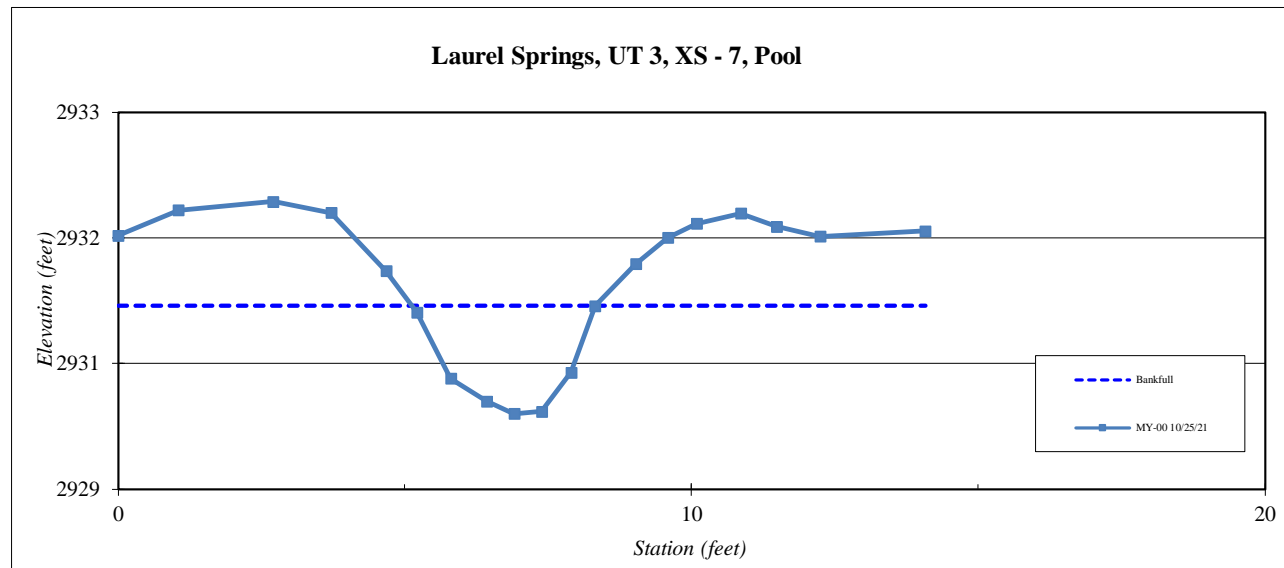
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT3, XS -7, Pool
Feature	Pool
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2931.7
1.1	2931.9
2.7	2932.0
3.7	2931.9
4.7	2931.3
5.2	2931.0
5.8	2930.4
6.4	2930.2
6.9	2930.1
7.4	2930.1
7.9	2930.4
8.3	2931.0
9.0	2931.4
9.6	2931.6
10.1	2931.8
10.9	2931.9
11.5	2931.7
12.2	2931.7
14.1	2931.7

SUMMARY DATA	
Bankfull Elevation:	2931.0
Bank Height Ratio:	1.0
Thalweg Elevation:	2930.1
LTOB Elevation:	2931.0
LTOB Max Depth:	1.0
LTOB Cross Sectional Area:	2.1



Stream Type	E/C 5
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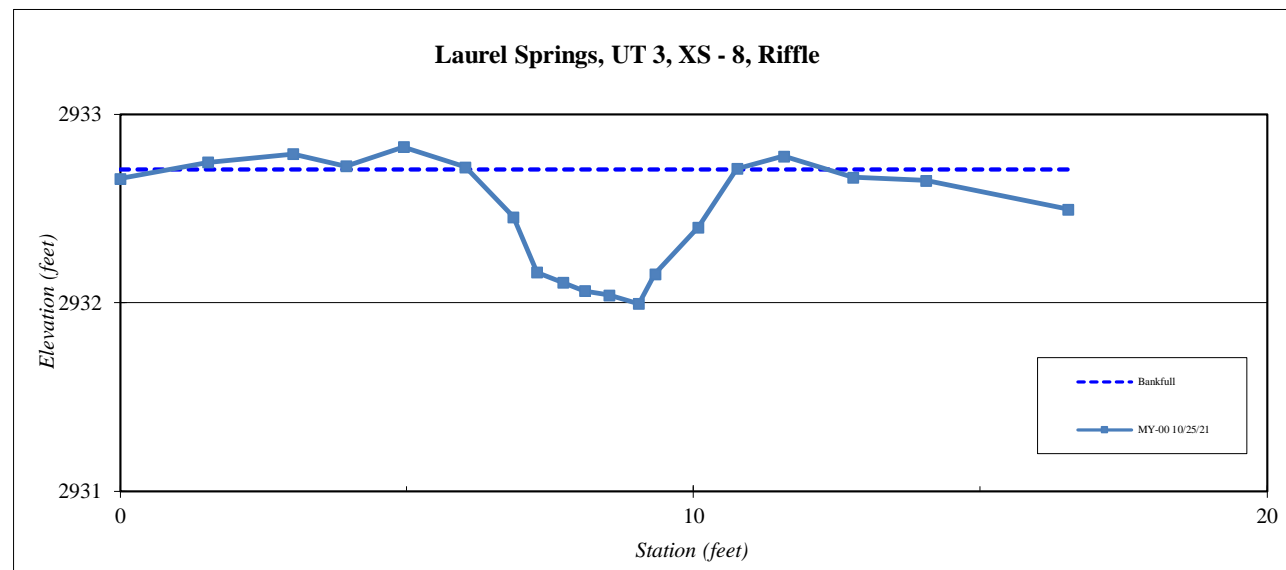
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT3, XS -8, Riffle
Feature	Riffle
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2932.4
1.5	2932.5
3.0	2932.5
3.9	2932.5
4.9	2932.6
6.0	2932.5
6.9	2932.2
7.3	2931.8
7.7	2931.8
8.1	2931.7
8.5	2931.7
9.0	2931.6
9.3	2931.8
10.1	2932.1
10.8	2932.4
11.6	2932.5
12.8	2932.4
14.1	2932.4
16.5	2932.2

SUMMARY DATA	
Bankfull Elevation:	2932.4
Bank Height Ratio:	1.0
Thalweg Elevation:	2931.6
LTOB Elevation:	2932.4
LTOB Max Depth:	0.8
LTOB Cross Sectional Area:	2.3



Stream Type	E/C 5
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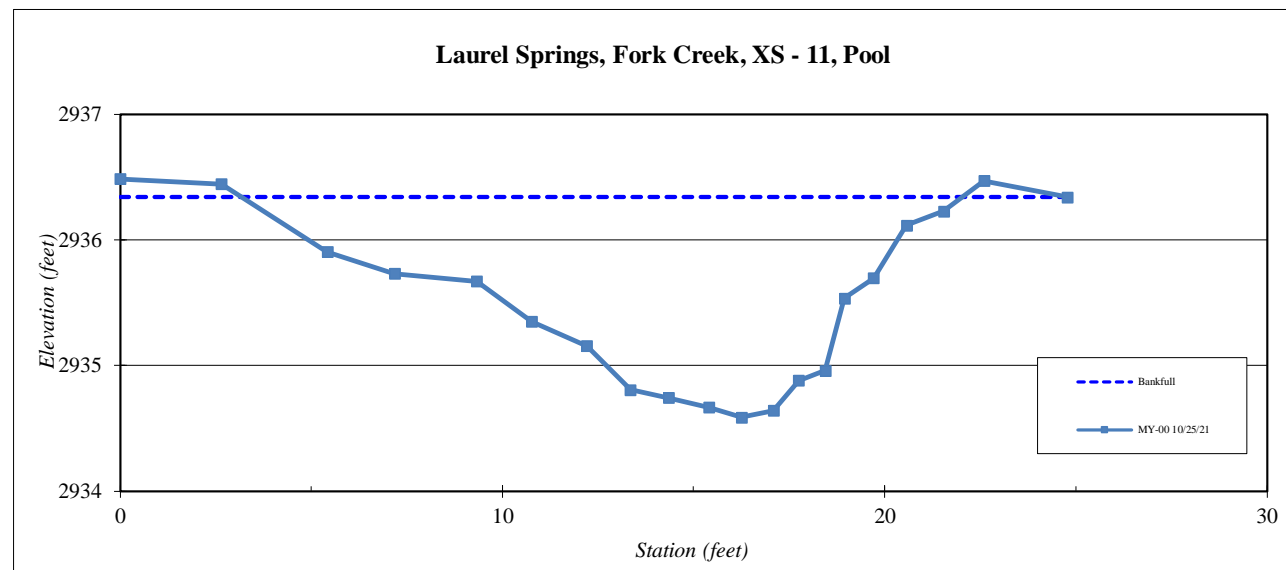
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -11, Pool
Feature	Pool
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2936.7
2.6	2936.7
5.4	2936.1
7.2	2935.9
9.3	2935.8
10.8	2935.4
12.2	2935.2
13.4	2934.8
14.3	2934.7
15.4	2934.7
16.3	2934.6
17.1	2934.6
17.7	2934.9
18.4	2935.0
19.0	2935.6
19.7	2935.8
20.6	2936.3
21.5	2936.4
22.6	2936.7
24.8	2936.5

SUMMARY DATA	
Bankfull Elevation:	2936.6
Bank Height Ratio:	1.0
Thalweg Elevation:	2934.6
LTOB Elevation:	2936.6
LTOB Max Depth:	2.0
LTOB Cross Sectional Area:	19.3



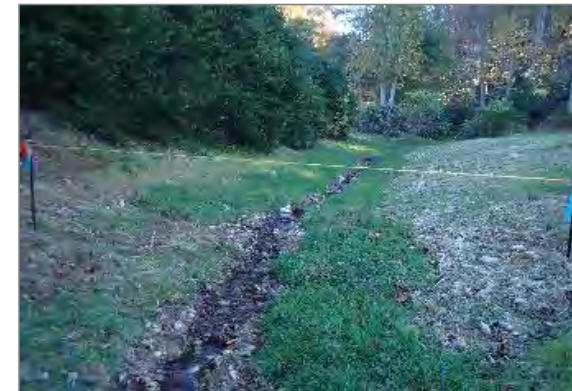
Stream Type	E/C 5
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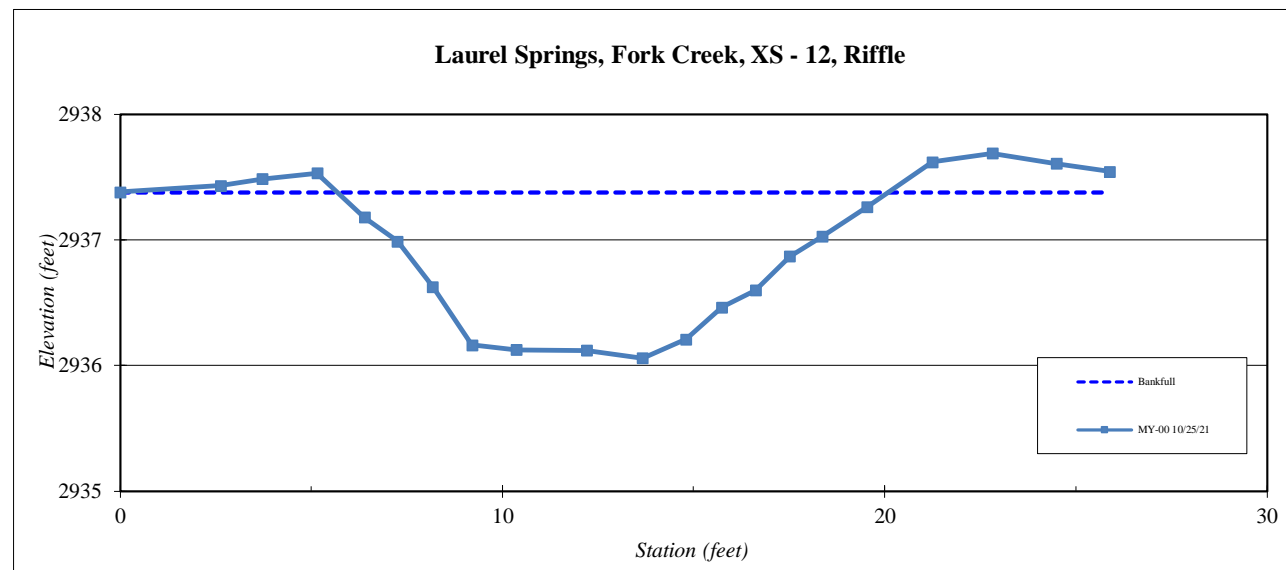
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -12, Riffle
Feature	Riffle
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2937.7
2.6	2937.8
3.7	2937.8
5.1	2937.9
6.4	2937.5
7.3	2937.3
8.2	2936.9
9.2	2936.3
10.4	2936.3
12.2	2936.3
13.7	2936.2
14.8	2936.4
15.7	2936.7
16.6	2936.8
17.5	2937.1
18.4	2937.3
19.5	2937.6
21.2	2938.0
22.8	2938.1
24.5	2938.0
25.9	2937.91

SUMMARY DATA	
Bankfull Elevation:	2937.7
Bank Height Ratio:	1.0
Thalweg Elevation:	2936.2
LTOB Elevation:	2937.7
LTOB Max Depth:	1.5
LTOB Cross Sectional Area:	13.4



Stream Type	E/C 5
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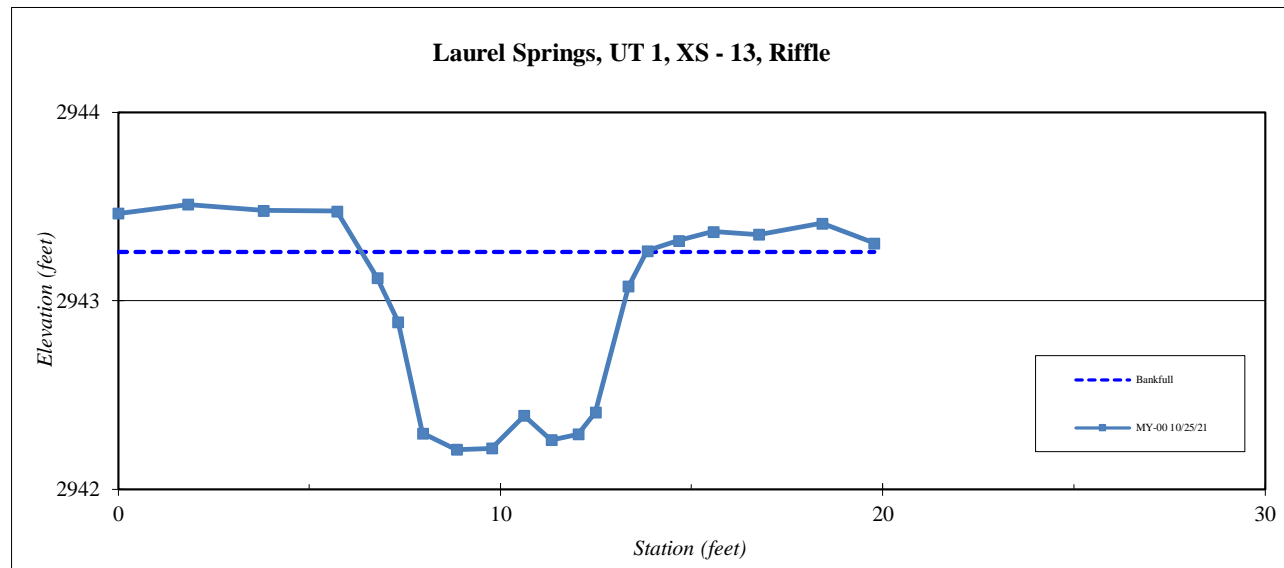
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT1, XS -13, Riffle
Feature	Riffle
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2943.5
1.8	2943.5
3.8	2943.5
5.7	2943.5
6.8	2943.1
7.3	2942.8
8.0	2942.2
8.9	2942.1
9.8	2942.1
10.6	2942.3
11.3	2942.1
12.0	2942.1
12.5	2942.3
13.3	2943.0
13.8	2943.2
14.7	2943.3
15.6	2943.4
16.8	2943.3
18.4	2943.4
19.8	2943.3

SUMMARY DATA	
Bankfull Elevation:	2943.2
Bank Height Ratio:	1.0
Thalweg Elevation:	2942.1
LTOB Elevation:	2943.2
LTOB Max Depth:	1.2
LTOB Cross Sectional Area:	6.2



Stream Type	E/C 5
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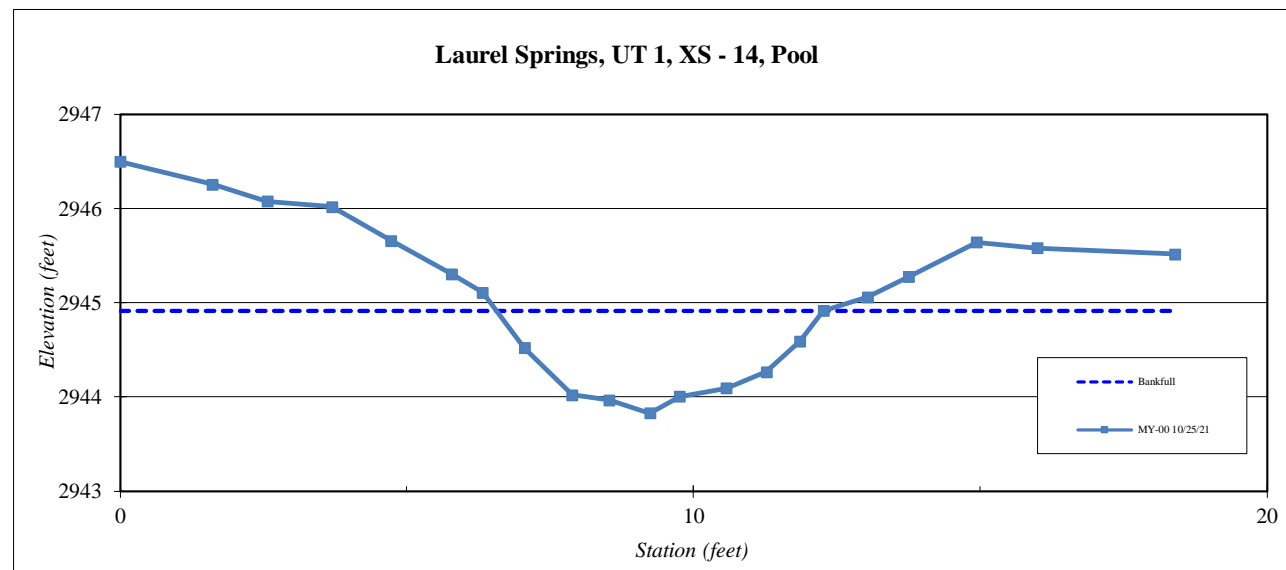
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT1, XS -14, Pool
Feature	Pool
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2946.9
1.6	2946.6
2.6	2946.4
3.7	2946.4
4.7	2946.0
5.8	2945.6
6.3	2945.3
7.1	2944.7
7.9	2944.1
8.5	2944.0
9.2	2943.9
9.8	2944.1
10.6	2944.2
11.3	2944.4
11.9	2944.7
12.3	2945.1
13.0	2945.3
13.8	2945.5
14.9	2945.9
16.0	2945.9
18.4	2945.79

SUMMARY DATA	
Bankfull Elevation:	2945.1
Bank Height Ratio:	1.0
Thalweg Elevation:	2943.9
LTOB Elevation:	2945.1
LTOB Max Depth:	1.2
LTOB Cross Sectional Area:	4.6



Stream Type	E/C 5
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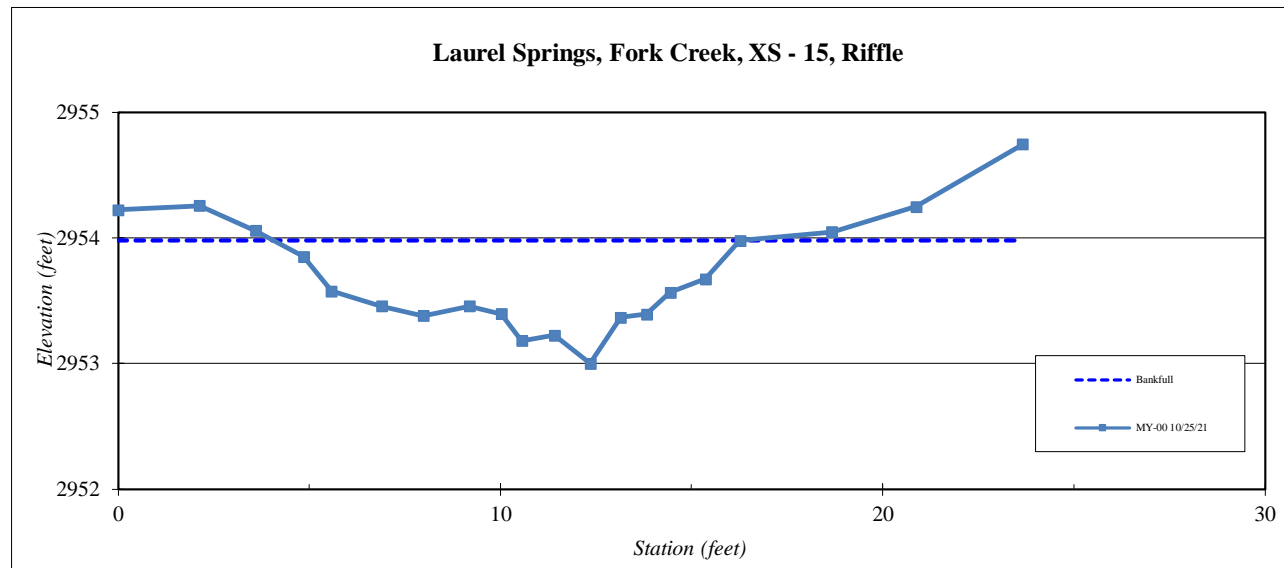
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -15, Riffle
Feature	Riffle
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2954.5
2.1	2954.5
3.6	2954.3
4.9	2954.1
5.6	2953.8
6.9	2953.6
8.0	2953.6
9.2	2953.6
10.0	2953.6
10.6	2953.3
11.4	2953.4
12.4	2953.1
13.1	2953.5
13.8	2953.6
14.4	2953.8
15.4	2953.9
16.3	2954.2
18.7	2954.3
20.9	2954.5
23.7	2955.1

SUMMARY DATA	
Bankfull Elevation:	2954.2
Bank Height Ratio:	1.0
Thalweg Elevation:	46.9
LTOB Elevation:	2954.2
LTOB Max Depth:	1.1
LTOB Cross Sectional Area:	7.1



Stream Type	E/C 5
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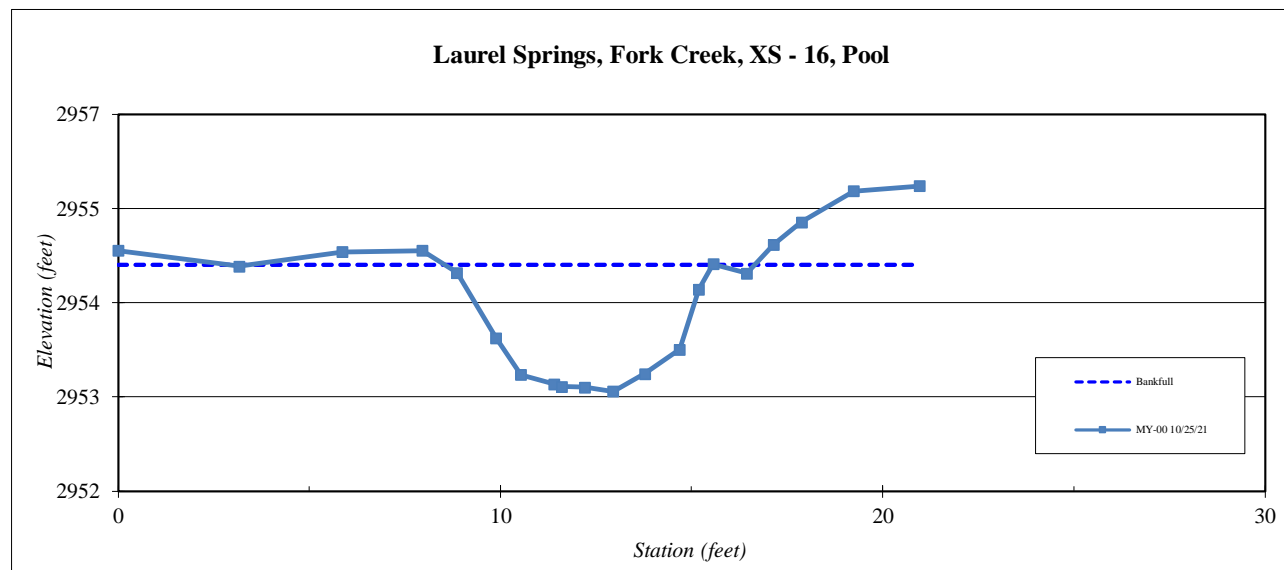
Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -16, Pool
Feature	Pool
Date:	10/25/2021
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	2954.9
3.2	2954.7
5.9	2954.9
8.0	2954.9
8.9	2954.6
9.9	2953.8
10.5	2953.4
11.4	2953.3
11.6	2953.2
12.2	2953.2
12.9	2953.2
13.8	2953.4
14.7	2953.7
15.2	2954.4
15.6	2954.7
16.4	2954.6
17.1	2954.9
17.9	2955.2
19.2	2955.6
21.0	2955.7

SUMMARY DATA	
Bankfull Elevation:	2954.7
Bank Height Ratio:	1.0
Thalweg Elevation:	2953.2
LTOB Elevation:	2954.7
LTOB Max Depth:	1.5
LTOB Cross Sectional Area:	7.4

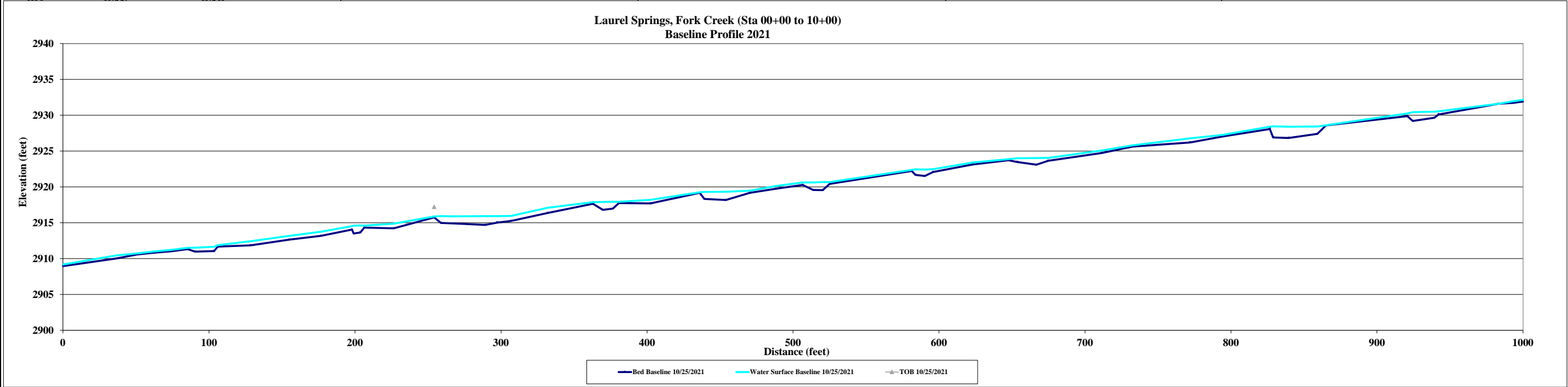


Stream Type	E/C 5
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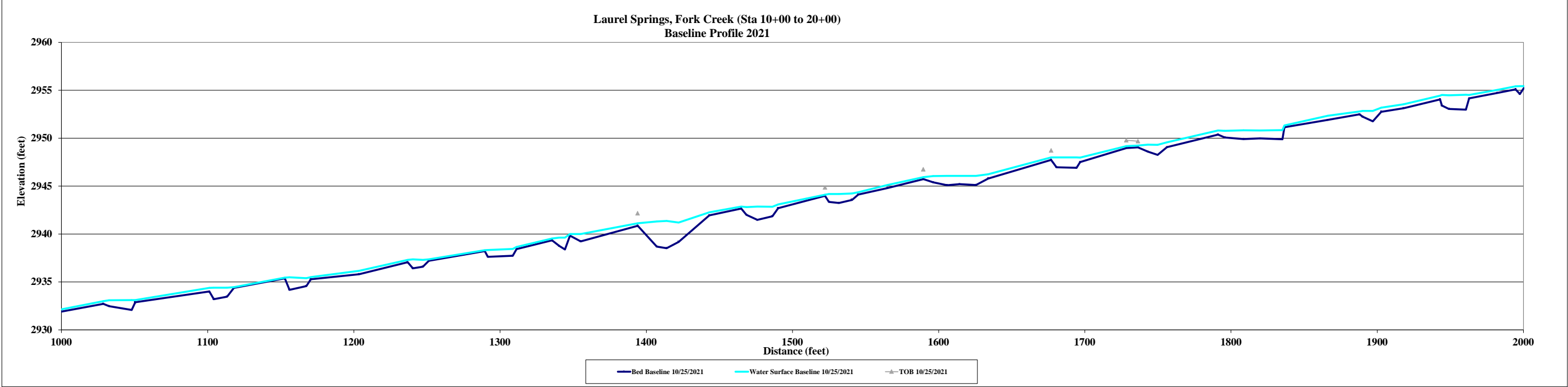


Project Name	Laurel Springs - Baseline (2021) Profile
Reach	Fork Creek (Sta 00+00 to 10+00)
Feature	Profile
Date	10/25/21
Crew	Perkinson, Keith

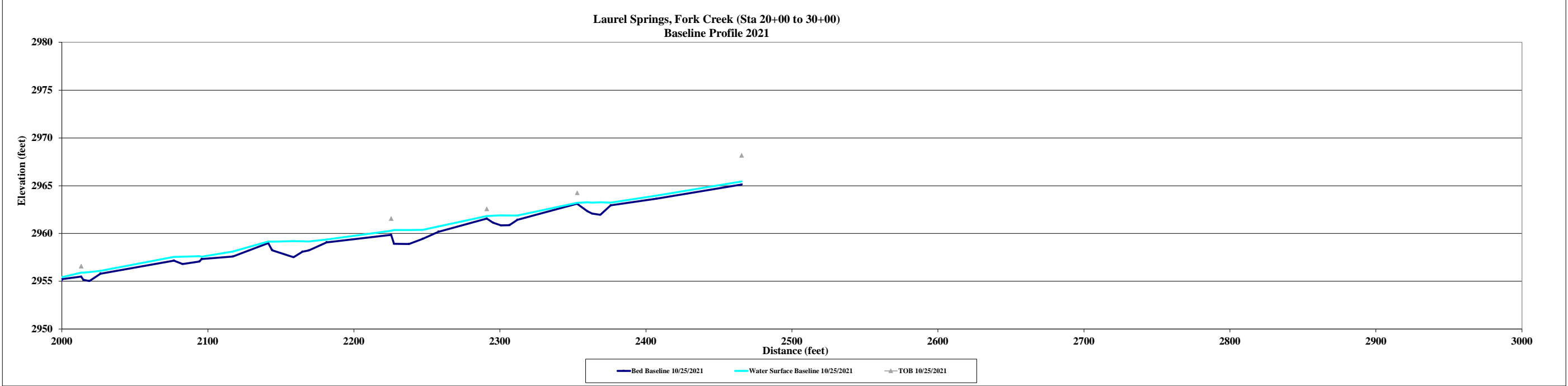
2021 Baseline Survey				As needed				As needed				As needed			
Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB
0.0	2908.95	2909.17													
36.7	2910.01	2910.44													
50.7	2910.57	2910.73													
62.3	2910.82	2910.99													
74.4	2911.03	2911.21													
85.3	2911.32	2911.50													
90.4	2910.97	2911.53													
103.4	2911.05	2911.66													
106.1	2911.67	2911.87													
128.5	2911.86	2912.43													
155.0	2912.65	2913.18													
176.6	2913.18	2913.75													
197.9	2914.05	2914.51													
199.1	2913.50	2914.59													
203.6	2913.64	2914.62													
206.3	2914.32	2914.60													
226.6	2914.22	2914.88													
254.2	2915.74	2915.88	2917.21												
258.8	2914.97	2915.92													
268.3	2914.90	2915.90													
289.1	2914.70	2915.92													
297.4	2915.02	2915.92													
306.8	2915.26	2915.95													
332.2	2916.38	2917.09													
363.0	2917.66	2917.88													
369.7	2916.80	2917.89													
376.6	2916.97	2917.92													



Project NameLaurel Springs - Baseline (2021) Profile																			
ReachFork Creek (Sta 10+00 to 20+00)																			
FeatureProfile																			
Date10/25/21																			
CrewPerkinson, Keith																			
2021 Baseline Survey					As needed					As needed					As needed				
Station	Bed Elevation	Water Elevation	TOB		Station	Bed Elevation	Water Elevation	TOB		Station	Bed Elevation	Water Elevation	TOB		Station	Bed Elevation	Water Elevation	TOB	
993.5	2931.72	2931.94																	
1028.5	2932.71	2933.00																	
1032.5	2932.48	2933.09																	
1048.0	2932.07	2933.11																	
1050.4	2932.89	2933.10																	
1101.1	2934.00	2934.38																	
1104.2	2933.19	2934.39																	
1113.2	2933.47	2934.40																	
1117.9	2934.37	2934.45																	
1152.7	2935.36	2935.45																	
1155.9	2934.17	2935.49																	
1167.4	2934.57	2935.40																	
1170.5	2935.28	2935.50																	
1203.5	2935.81	2936.15																	
1236.7	2937.06	2937.29																	
1240.3	2936.41	2937.35																	
1247.2	2936.60	2937.30																	
1251.3	2937.20	2937.35																	
1289.5	2938.22	2938.31																	
1291.6	2937.62	2938.32																	
1308.6	2937.73	2938.45																	
1311.3	2938.43	2938.66																	
1335.5	2939.35	2939.53																	
1340.4	2938.76	2939.63																	
1344.4	2938.39	2939.62																	
1347.7	2939.84	2939.99																	
1355.1	2939.24	2940.00																	
1394.1	2940.87	2941.12	2942.15																

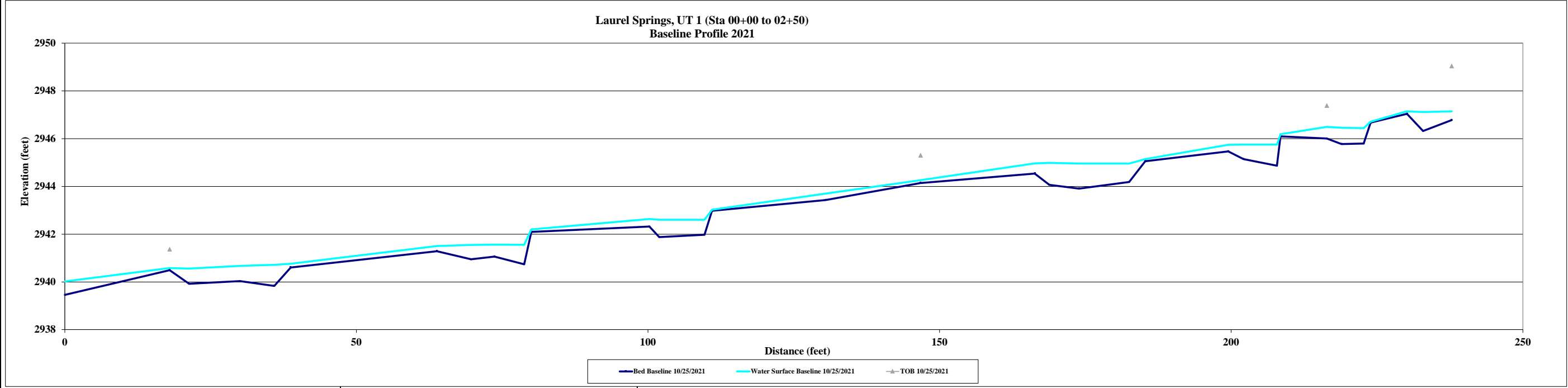


Project Name	Laurel Springs - Baseline (2021) Profile														
Reach	Fork Creek (Sta 20+00 to 30+00)														
Feature	Profile														
Date	10/25/21														
Crew	Perkinson, Keith														
2021 Baseline Survey				As needed				As needed				As needed			
Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB
1997.5	2954.62	2955.44	2956.57												
2000.3	2955.23	2955.44													
2013.2	2955.49	2955.91													
2014.7	2955.15	2955.91													
2018.8	2955.04	2955.96													
2026.5	2955.80	2956.09													
2076.7	2957.16	2957.55													
2082.6	2956.81	2957.58													
2094.2	2957.08	2957.63													
2095.7	2957.33	2957.58													
2117.0	2957.60	2958.12	2961.55												
2141.3	2959.01	2959.16													
2144.0	2958.25	2959.15													
2158.7	2957.52	2959.21													
2164.7	2958.10	2959.18													
2169.1	2958.24	2959.17													
2181.3	2959.08	2959.37													
2225.4	2959.87	2960.29													
2227.4	2958.92	2960.36													
2237.7	2958.91	2960.37													
2247.2	2959.45	2960.38	2962.56												
2257.9	2960.18	2960.74													
2291.0	2961.57	2961.83													
2295.3	2961.14	2961.86													
2300.6	2960.85	2961.89													
2306.4	2960.87	2961.89													
2312.0	2961.44	2961.89													
2352.8	2963.12	2963.21		2964.25											



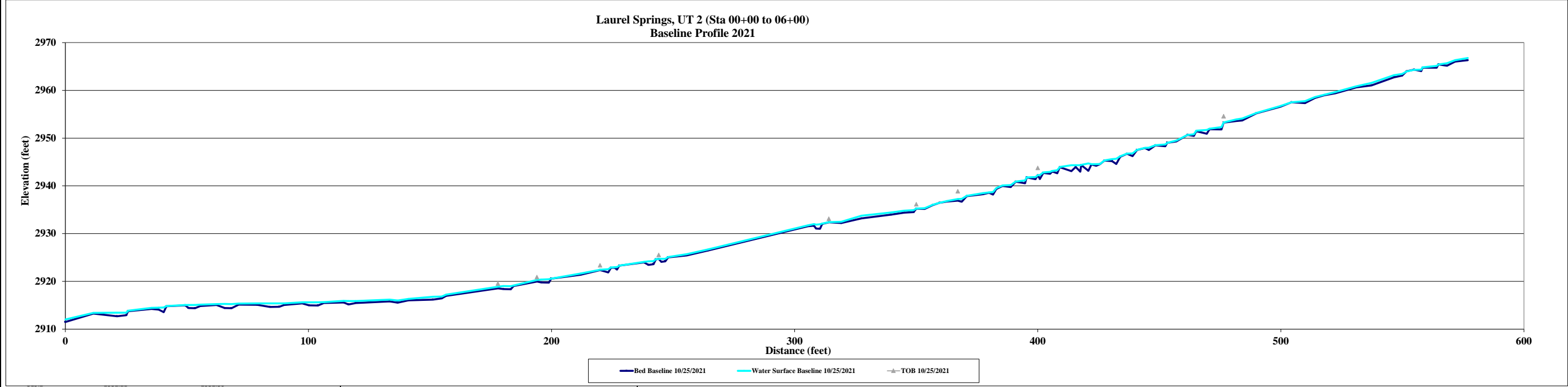
Project Name	Laurel Springs - Baseline (2021) Profile
Reach	UT 1 (Sta 00+00 to 02+50)
Feature	Profile
Date	10/25/21
Crew	Perkinson, Keith

2021 Baseline Survey				As needed				As needed				As needed			
Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB
0.0	2939.46	2940.02	2941.37												
18.0	2940.50	2940.58													
21.3	2939.92	2940.56													
30.0	2940.03	2940.67													
35.9	2939.83	2940.72													
38.7	2940.61	2940.76													
63.8	2941.29	2941.50													
69.7	2940.95	2941.55													
73.7	2941.07	2941.57													
78.8	2940.74	2941.56													
80.0	2942.10	2942.20													
100.2	2942.32	2942.63													
101.9	2941.88	2942.61													
109.7	2941.98	2942.61													
111.0	2942.98	2943.03	2945.30												
130.5	2943.43	2943.70													
146.7	2944.14	2944.26													
166.3	2944.54	2944.97													
168.8	2944.07	2944.99													
173.9	2943.91	2944.96													
182.5	2944.19	2944.96													
185.3	2945.06	2945.15													
199.5	2945.47	2945.75													
202.1	2945.15	2945.76													
207.8	2944.87	2945.75													
208.4	2946.10	2946.19													
216.4	2946.01	2946.50													
218.9	2945.78	2946.46													

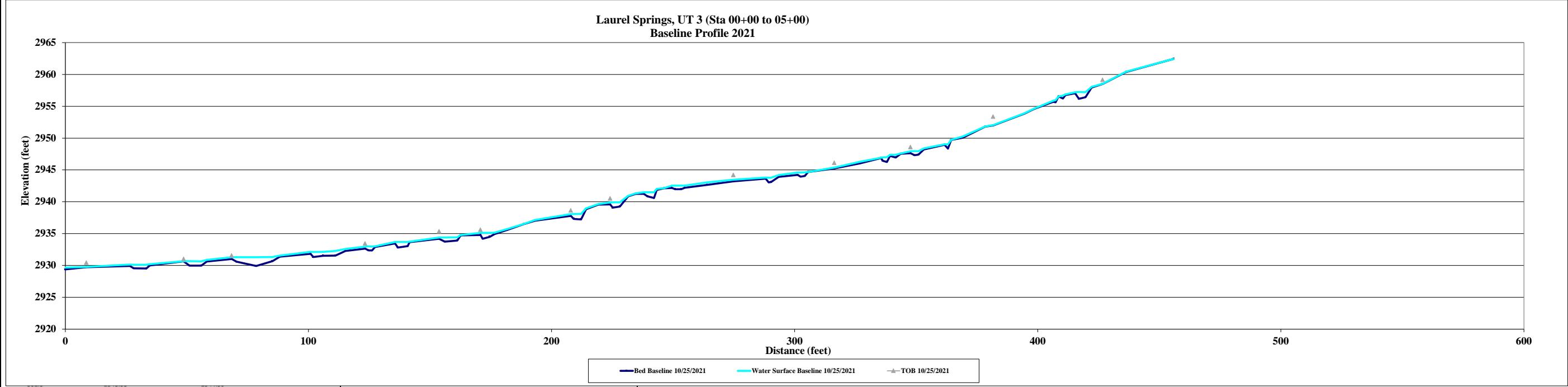


Project Name	Laurel Springs - Baseline (2021) Profile		
Reach	UT 2 (Sta 00+00 to 06+00)		
Feature	Profile		
Date	10/25/21		
Crew	Perkinson, Keith		

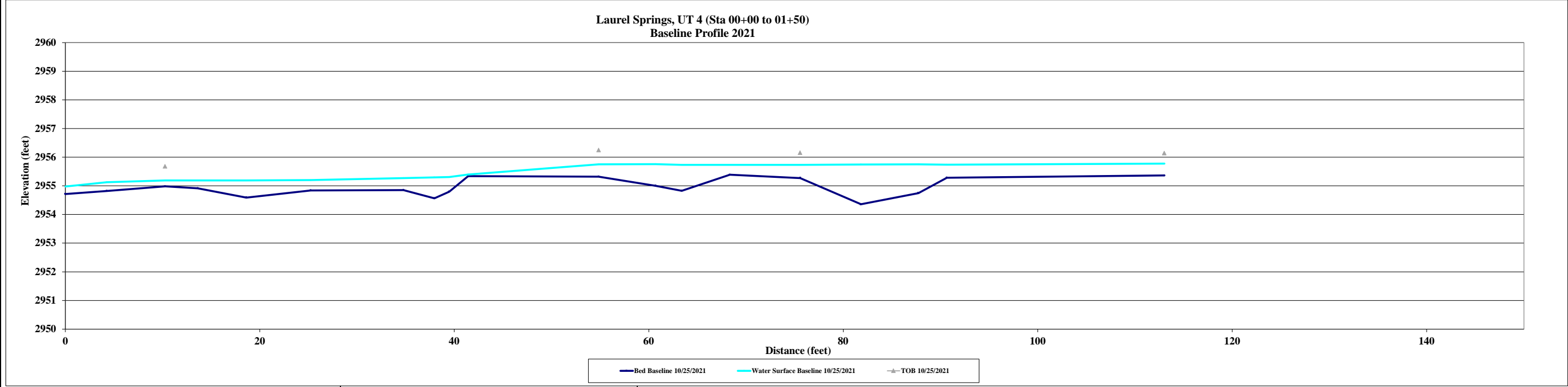
2021 Baseline Survey				As needed				As needed				As needed			
Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB
0.0	2911.49	2912.01													
11.5	2913.26	2913.41													
21.2	2912.69	2913.43													
25.1	2912.92	2913.42													
25.7	2913.75	2913.84													
35.4	2914.23	2914.45													
38.4	2914.09	2914.50													
40.5	2913.56	2914.54													
41.5	2914.77	2914.81													
49.3	2914.97	2915.05													
50.7	2914.43	2915.06													
53.3	2914.38	2915.05													
55.5	2914.82	2915.13													
62.1	2915.04	2915.25													
65.6	2914.40	2915.26													
68.4	2914.39	2915.25													
71.3	2915.13	2915.35													
79.0	2915.08	2915.37													
84.2	2914.64	2915.37													
88.0	2914.69	2915.38													
90.0	2915.07	2915.40													
97.4	2915.37	2915.59													
100.2	2914.97	2915.62													
103.9	2914.94	2915.60													
106.3	2915.46	2915.63													
114.5	2915.56	2915.89													
116.4	2915.17	2915.89													
119.5	2915.47	2915.88													



Project Name	Laurel Springs - Baseline (2021) Profile														
Reach	UT 3 (Sta 00+00 to 05+00)														
Feature	Profile														
Date	10/25/21														
Crew	Perkinson, Keith														
2021 Baseline Survey				As needed				As needed				As needed			
Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB
0.0	2929.37	2929.67	2930.44												
8.7	2929.73	2929.78													
26.6	2929.92	2930.13													
28.1	2929.55	2930.12													
33.3	2929.51	2930.11													
34.7	2929.99	2930.21	2931.02												
48.7	2930.64	2930.67													
51.1	2929.98	2930.67													
55.9	2929.98	2930.66													
58.2	2930.63	2930.86													
68.4	2931.00	2931.30	2931.55												
70.4	2930.58	2931.29													
78.5	2929.90	2931.28													
85.2	2930.68	2931.33													
88.2	2931.38	2931.54													
100.9	2931.84	2932.13	2933.44												
102.0	2931.32	2932.11													
106.1	2931.53	2932.14													
111.1	2931.55	2932.26													
115.2	2932.29	2932.60													
123.3	2932.64	2932.96													
124.7	2932.36	2933.00													
126.2	2932.35	2932.95													
127.4	2932.90	2933.02													
135.6	2933.46	2933.68													
136.8	2932.80	2933.68													
140.9	2933.05	2933.68													
141.6	2933.66	2933.72													



Project Name	Laurel Springs - Baseline (2021) Profile														
Reach	UT 4 (Sta 00+00 to 01+50)														
Feature	Profile														
Date	10/25/21														
Crew	Perkinson, Keith														
2021 Baseline Survey				As needed				As needed				As needed			
Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB	Station	Bed Elevation	Water Elevation	TOB
0.0	2954.71	2954.97													
4.3	2954.82	2955.13													
10.3	2954.98	2955.19	2955.68												
13.6	2954.92	2955.19													
18.6	2954.59	2955.19													
25.2	2954.84	2955.20													
34.8	2954.85	2955.27													
38.0	2954.57	2955.30													
39.5	2954.80	2955.31													
41.4	2955.34	2955.40													
54.8	2955.32	2955.75	2956.25												
60.7	2955.00	2955.76													
63.4	2954.83	2955.73													
68.3	2955.39	2955.74													
75.6	2955.27	2955.74	2956.15												
81.8	2954.36	2955.75													
87.7	2954.75	2955.75													
90.7	2955.28	2955.74													
113.0	2955.36	2955.77	2956.14												



**Table 9A. Baseline Stream Data Summary
Laurel Springs - Fork Creek**

Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	11.7	17.2		25.1		15.1	17.4	12.3	19.7	3
Floodprone Width (ft)	18	100		100		50	150	200	200	3
Bankfull Mean Depth (ft)	0.8	1.1		1.6		1.1	1.3	0.6	0.9	3
Bankfull Max Depth (ft)	1.2	2.1		2.5		1.4	1.9	1.1	1.5	3
Bankfull Cross Sectional Area (ft ²)	18.9	18.9		18.9		7.3	18.9	7.1	14.6	3
Width/Depth Ratio	7.3	15.9		31.4		12	16	15.5	26.6	3
Entrenchment Ratio	0.9	5.1		8.5		3.3	8.6	10.2	16.2	3
Bank Height Ratio	1	1.3		2.8		1	1.2	1.0	1.0	3
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Cg					Ce		Ce		
Bankfull Discharge (cfs)	99					99		99		
Sinuosity (ft)	1.05					1.15		1.15		
Water Surface Slope (Channel) (ft/ft)	0.0258					0.0236		0.0236		
Other										

**Table 9B. Baseline Stream Data Summary
Laurel Springs - UT 1**

Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	6.4	8.1		15.36		9.9	11.4	7.5	7.5	1
Floodprone Width (ft)	16	100		100		50	150	100.0	100.0	1
Bankfull Mean Depth (ft)	0.5	1		1.3		0.7	0.8	0.8	0.8	1
Bankfull Max Depth (ft)	1.4	2		2.4		0.9	1.2	1.2	1.2	1
Bankfull Cross Sectional Area (ft ²)	8.1	8.1		8.1		8.1	8.1	6.2	6.2	1
Width/Depth Ratio	4.9	8.2		30.6		12	16	8.9	8.9	1
Entrenchment Ratio	2	8.8		15.6		5.1	13.2	13.4	13.4	1
Bank Height Ratio	1	1.5		2.1		1	1.2	1.0	1.0	1
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Eg					Ce		Ce		
Bankfull Discharge (cfs)	39.5					39.5		39.5		
Sinuosity (ft)	1.01					1.15		1.15		
Water Surface Slope (Channel) (ft/ft)	0.0288					0.0253		0.0253		
Other										

**Table 9C. Baseline Stream Data Summary
Laurel Springs - UT 2**

Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	4.4	5.8		9.8		4.6	5.4	6.7	7.2	2
Floodprone Width (ft)	11	17		22		20	30	75.0	75.0	2
Bankfull Mean Depth (ft)	0.2	0.4		0.4		0.3	0.4	0.3	1.1	2
Bankfull Max Depth (ft)	0.5	0.8		0.8		0.4	0.6	0.6	1.9	2
Bankfull Cross Sectional Area (ft ²)	1.8	1..8		1.8		1.8	1.8	2.1	7.7	2
Width/Depth Ratio	11	17.4		49		12	16	7.7	21.3	2
Entrenchment Ratio	2	2.3		4.5		4.3	5.6	10.5	11.2	2
Bank Height Ratio	1	1.5		2		1	1.2	1.0	1.0	2
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Bg					B		Bc		
Bankfull Discharge (cfs)	7.7					7.7		7.7		
Sinuosity (ft)	1.02					1.05		1.05		
Water Surface Slope (Channel) (ft/ft)	0.1026					0.0997		0.0997		
Other										

**Table 9D. Baseline Stream Data Summary
Laurel Springs - UT 3**

Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	3	3.7		4.2		4.9	5.7	3.3	4.7	2
Floodprone Width (ft)	5.5	6		50		20	30	7.0	75.0	2
Bankfull Mean Depth (ft)	0.5	0.6		0.7		0.4	0.4	0.3	0.5	2
Bankfull Max Depth (ft)	0.7	0.8		1.4		0.5	0.6	0.4	0.8	2
Bankfull Cross Sectional Area (ft ²)	2	2		2		2	2	0.9	2.3	2
Width/Depth Ratio	4.3	6.2		8.4		12	16	9.7	12.1	2
Entrenchment Ratio	1.5	2		11.9		4.1	5.3	2.1	16.0	2
Bank Height Ratio	1.4	1.7		2.6		1	1.2	1.0	1.0	2
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Bg					B		Bc		
Bankfull Discharge (cfs)	8.7					8.7		8.7		
Sinuosity (ft)	1.04					1.05		1.05		
Water Surface Slope (Channel) (ft/ft)	0.0954					0.0945		0.0945		
Other										

**Table 10A. Monitoring Data - Cross Section Morphology Monitoring Summary
(Laurel Springs/ DMS:100122)**

	UT 2 - Cross Section 1 (Pool)							UT 2 - Cross Section 2 (Riffle)							UT 2 - Cross Section 3 (Riffle)							UT 2 - Cross Section 4 (Pool)							Fork Cr - Cross Section 5 (Pool)								
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+		
Bankfull Elevation (ft) - Based on AB-Bankfull Area	2915.09							2916.14							2944.80							2948.50						2921.99									
Bank Height Ratio - Based on AB Bankfull Area	1.00							1.00							1.00							1.00						1.00									
Thalweg Elevation	2914.69							2915.539							2942.9							2947.52						2919.647									
LTOb ² Elevation	2915.09							2916.136							2944.80							2948.50						2921.994									
LTOb ² Max Depth (ft)	0.40							0.60							1.88							0.99						2.35									
LTOb ² Cross Sectional Area (ft ²)	1.1							2.1							7.7							2.7						24.5									
	Fork Cr - Cross Section 6 (Pool)							UT 3 - Cross Section 7 (Pool)							UT 3 - Cross Section 8 (Riffle)							UT 3 - Cross Section 9 (Pool)							UT 3 - Cross Section 10 (Riffle)								
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+		
Bankfull Elevation (ft) - Based on AB-Bankfull Area	2922.56							2930.97							2932.44							2943.97						2946.02									
Bank Height Ratio - Based on AB Bankfull Area	1.00							1.00							1.00							1.00						1.00									
Thalweg Elevation	2921.22							2930.078							2931.64							2943.12						2945.65									
LTOb ² Elevation	2922.56							2930.97							2932.44							2943.97						2946.02									
LTOb ² Max Depth (ft)	1.34							0.89							0.81							0.85						0.37									
LTOb ² Cross Sectional Area (ft ²)	14.4							1.9							2.3							1.8						0.9									
	Fork Cr - Cross Section 11 (Pool)							<p>The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:</p> <p>¹ - Bank Height Ratio (BHR) takes the As-built bankfull area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft², then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft². The BHR would then be calculated with the difference between the low top of bank (LTOb) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.</p> <p>² - LTOb Area and Max depth - These are based on the LTOb elevation for each years survey (The same elevation used for the LTOb in the BHR calculation). Area below the LTOb elevation will be used and tracked for each year as above. The difference between the LTOb elevation and the thalweg elevation (same as in the BHR calculation) will be recorded and tracked above as LTOb max depth.</p>																													
	MY0	MY1	MY2	MY3	MY5	MY7	MY+																														
Bankfull Elevation (ft) - Based on AB-Bankfull Area	2936.55																																				
Bank Height Ratio - Based on AB Bankfull Area	1.00																																				
Thalweg Elevation	2934.57																																				
LTOb ² Elevation	2936.55																																				
LTOb ² Max Depth (ft)	1.98																																				
LTOb ² Cross Sectional Area (ft ²)	19.2																																				

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decreases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

**Table 10B. Monitoring Data - Cross Section Morphology Monitoring Summary
(Laurel Springs/ DMS:100122)**

	Fork Cr - Cross Section 12 (Riffle)							UT 1 - Cross Section 13 (Riffle)							UT 1 - Cross Section 14 (Pool)							Fork Cr - Cross Section 15 (Riffle)							Fork Cr - Cross Section 16 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull Area	2937.72							2943.24							2945.11							2954.23							2954.72						
Bank Height Ratio_Based on AB Bankfull Area	1.00							1.00							1.00							1.00							1.00						
Thalweg Elevation	2936.23							2942.061							2943.9							2953.12							2953.19						
LT0B ² Elevation	2937.72							2943.244							2945.11							2954.23							2954.72						
LT0B ² Max Depth (ft)	1.49							1.18							1.23							1.10							1.53						
LT0B ² Cross Sectional Area (ft ²)	13.5							6.2							4.6							7.1							7.4						
Bankfull Elevation (ft) - Based on AB-Bankfull Area																																			
Bank Height Ratio_Based on AB Bankfull Area																																			
Thalweg Elevation																																			
LT0B ² Elevation																																			
LT0B ² Max Depth (ft)																																			
LT0B ² Cross Sectional Area (ft ²)																																			
Bankfull Elevation (ft) - Based on AB-Bankfull Area																																			
Bank Height Ratio_Based on AB Bankfull Area																																			
Thalweg Elevation																																			
LT0B ² Elevation																																			
LT0B ² Max Depth (ft)																																			
LT0B ² Cross Sectional Area (ft ²)																																			

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

1 - Bank Height Ratio (BHR) takes the As-built bankfull area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LT0B) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.

2 - LT0B Area and Max depth - These are based on the LT0B elevation for each years survey (The same elevation used for the LT0B in the BHR calculation). Area below the LT0B elevation will be used and tracked for each year as above. The difference between the LT0B elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LT0B max depth.

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decreases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

Appendix D: Hydrologic Data

Groundwater Gauge Soil Profiles

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-1 35.992426, -81.982968

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-8	10YR 3/1	98	10YR 4/6	2	Loam
8-14	10YR 5/1	85	10YR 4/6	15	Silt Loam
14+	10YR 3/1	98	10YR 4/6	2	Loamy Sand

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-2 35.992716, -81.982503

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-8	10YR 4/1	90	10YR 5/6	5	Fine sandy loam
			10YR 3/3	5	
8-14	10YR 5/1	85	10YR 4/6	15	Silt loam
14+	10YR 3/1	98	10YR 4/6	2	Loamy sand

North Carolina Licensed Soil Scientist

Number: 1233

Signature: *W Grant Lewis*

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-3 35.993052, -81.982629

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10YR 4/1	90	10YR 5/1	10	Fine Sandy Loam
6-9	10YR 3/4	95	10YR 5/1	5	Fine Sandy Loam
9-18	10YR 5/1	90	10YR 5/6	10	Sandy Clay

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-4 35.993248, -81.981995

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10YR 4/1	80	10YR 5/1	15	Fine Sandy Loam
			10yr 5/6	5	
6-15	10YR 4/1	90	10YR 6/1	10	Sand
15	10YR 5/1	100	-	-	Sandy Clay

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-5 35.993883, -81.981995

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-8	10YR 6/1	60	10YR 6/6	40	Saprolite
8-16	10YR 5/1	95	10YR 5/6	5	Sandy Clay Loam
16+	10YR 4/1	100	-	-	Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-6 35.993906, -81.982422

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-3	10YR 4/1	95	10YR 4/1	5	Sandy Loam
3-9	10YR 6/1	80	10YR 6/6	20	Fine Sandy Loam
9-18	10YR 5/1	95	10YR 4/6	5	Sandy Loam
18+	10 YR 3/1	100	-	-	Silt Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-7 35.994471, -81.98209

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-3	10YR 4/1	90	10YR 5/6	10	
3-18	10YR 6/1	60	10YR 6/6	40	Sand
18+	10YR 5/1	100	-	-	Loamy Sand

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-8 35.994956, -81.981771

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10YR 5/6	100	-	-	Loam
10-18	10YR 5/1	95	10YR 5/6	5	Silt Loam
18+	10YR 5/1	95	10YR 5/6	5	Clay Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-9 35.995203, -81.982058

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-22+	10yr 4/1	95	10YR 5/6	5	Sandy Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-10 35.995626, -81.981828

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-15	10YR 4/3	40	10YR 3/1	40	Loam
			10YR 5/1	20	
15-22	10YR 4/2	80	10YR 5/6	20	Silty Clay Loam
22+	10YR 3/1	100	-	-	Silt Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-11 35.996909, -81.980872

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10YR 4/1	95	10YR 4/6	5	Silt Clay
6-26	10YR 4/1	95	10YR 4/6	5	Sandy Clay Loam
26+	10YR 4/1	100	-	-	Silt Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-12 35.997065, -81.980544

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-20	10YR 4/1	80	10YR 5/4	20	Silty Loam
20+	10yr 3/1	100	-	-	Sandy Clay Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC

218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693



SOIL BORING LOG

Project/Site: Laurel Springs 19-009

County, State: Avery, North Carolina

Sampling Point/
Coordinates: GW-13 35.997551, -81.980512

Investigator: G. Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-8	10YR 2/1	95	10YR 5/6	5	Silt Loam
8-20	10YR 4/1	90	10YR 4/6	10	Silt Loam
20+	10YR 4/1	100	-	-	Silty Clay Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

Appendix E: Project Timeline and Contact Info

Table 11. Project Timeline

Table 12. Project Contacts

Table 11. Project Timeline

Activity or Deliverable	Data Collection Complete	Task Completion or Deliverable Submission
Technical Proposal (RFP No. 16-007725)	Mar-19	Mar-19
Institution Date (NCDMS Contract No. 100122)	NA	17-May-19
Mitigation Plan	Jul-20	11-Feb-21
Construction Plan (Grading) Completed	NA	18-Feb-21
Planting Completed	NA	13-Jan-22
As-built Survey Completed	25-Oct-20	Jun-22
MY-0 Baseline Report	Feb-22	Sep-22
MY1+ Monitoring Reports		
Remediation Items (e.g. beaver removal, supplements, repairs etc.)		
Encroachment		

Table 12. Project Contacts

Laurel Springs/100115	
Provider	Restoration Systems, LLC 1101 Haynes Street, Suite 211 Raleigh, NC 27604
Mitigation Provider POC	Worth Creech 919-755-9490
Designer	Axiom Environmental, Inc. 218 Snow Ave Raleigh, NC 27603
Primary project design POC	Grant Lewis 919-215-1693
Construction Contractor	Land Mechanics Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Charles Hill 919-639-6132

Appendix F: Other Data

Fork Creek Culvert to Bridge Revision – Email with exchange with IRT members, May 19, 2021

Preconstruction Benthic Results

Preconstruction Benthic Habitat Assessment Data Forms

Ray Holz

From: Leslie, Andrea J <andrea.leslie@ncwildlife.org>
Sent: Wednesday, May 19, 2021 4:04 PM
To: Worth Creech; Todd Tugwell; Kim Browning; Davis, Erin B; Haywood, Casey M CIV (USA)
Cc: Wiesner, Paul; John Hamby; 'Grant Lewis'; Kenan Jernigan; Wilson, Travis W.; Stubbs, Rebecca; Alex Baldwin; Ray Holz
Subject: RE: [External] DMS 100122 Laurel Springs Site Crossing update

Much better solution, thanks Worth.

Andrea Leslie
Mountain Habitat Conservation Coordinator
NC Wildlife Resources Commission
645 Fish Hatchery Rd., Building B
Marion, NC 28752
828-400-4223 (cell)
www.ncwildlife.org



Get [NC Wildlife Update](#) delivered to your inbox from the N.C. Wildlife Resources Commission.

Email correspondence to and from this sender is subject to the N.C. Public Records Law and may be disclosed to third parties.

From: Worth Creech <worth@restorationsystems.com>
Sent: Wednesday, May 19, 2021 3:47 PM
To: Todd Tugwell <todd.tugwell@usace.army.mil>; Kim Browning <Kimberly.D.Browning@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>; Leslie, Andrea J <andrea.leslie@ncwildlife.org>; Haywood, Casey M CIV (USA) <Casey.M.Haywood@usace.army.mil>
Cc: Wiesner, Paul <paul.wiesner@ncdenr.gov>; John Hamby <jhamby@restorationsystems.com>; 'Grant Lewis' <glewis@axiomenvironmental.org>; Kenan Jernigan <kjernigan@axiomenvironmental.org>; Wilson, Travis W. <travis.wilson@ncwildlife.org>; Stubbs, Rebecca <rstubbs@mcadamsco.com>; Alex Baldwin <abaldwin@restorationsystems.com>; Ray Holz <rholtz@restorationsystems.com>
Subject: [External] DMS 100122 Laurel Springs Site Crossing update

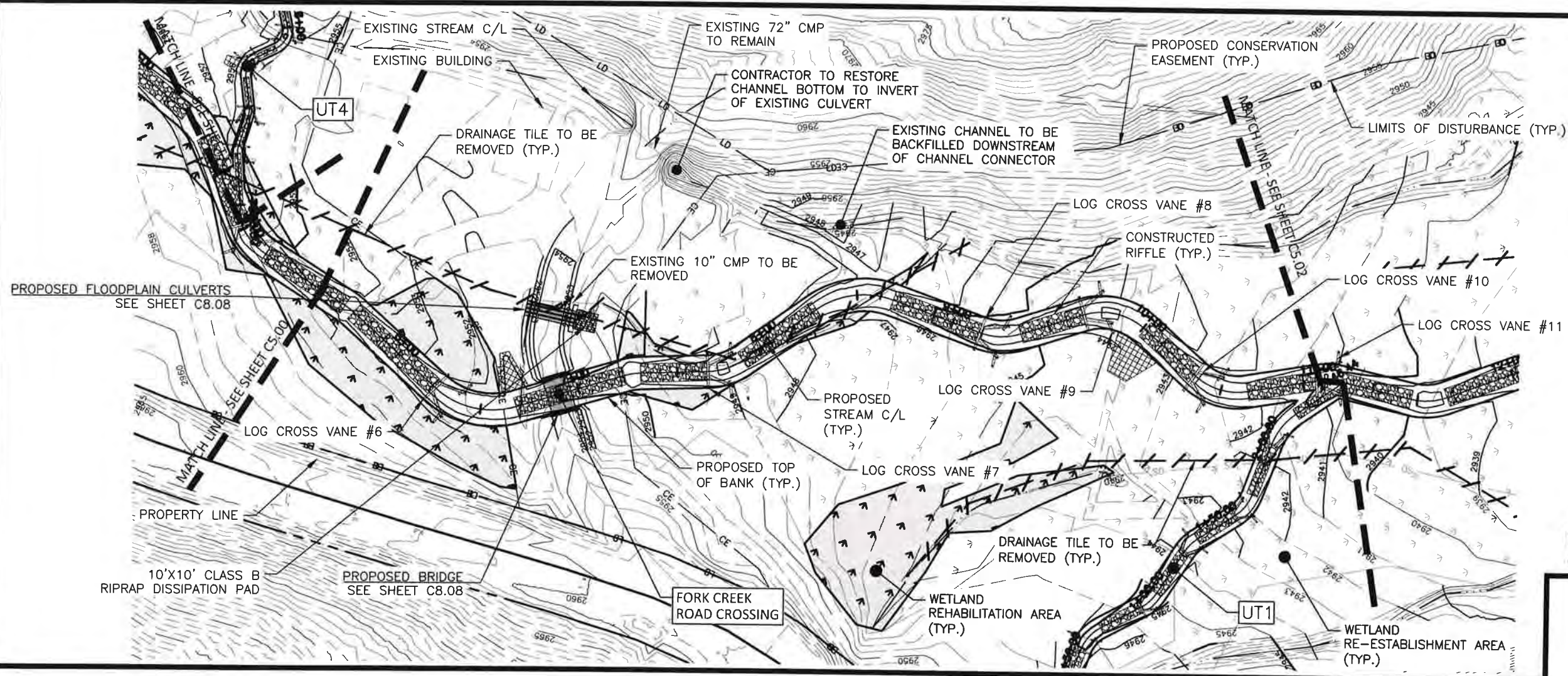
CAUTION: External email. Do not click links or open attachments unless you verify. Send all suspicious email as an attachment to [Report Spam](#).

Hello,

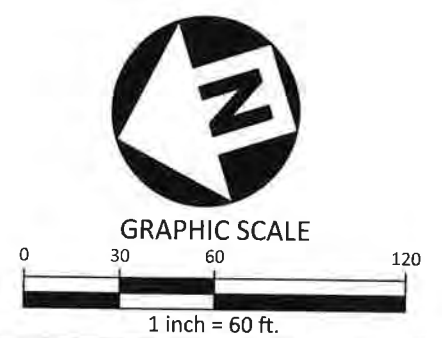
Through some discussions with our contractor, engineer and Travis Wilson, we have revised the main crossing on Fork Creek from a rather oversized aluminum arched crossing to an engineered bridge with flood plain pipes. The bridge eliminates the need to raise the driveway across the floodplain another 3' which would have created an artificial dam across the entire floodplain. The new crossing will raise the existing road elevations ½ to 1', and will include 4- 18" floodplain pipes. All flood modeling shows this is the best option. The stream will be fully restored under the bridge. We have updated the plan sheets for construction (attached). Updates are the Cover Sheet, C5.01, C6.04, C6.05, and C8.08. The bridge and footers are being designed by a separate NC Licensed structural engineer and will be presented in the as-built.

Please let me know if you have any questions, Worth

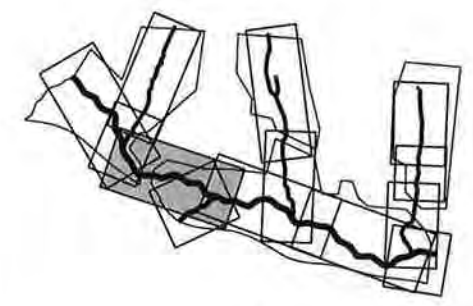
Worth Creech | Restoration Systems, LLC
1101 Haynes St. Suite 211 | Raleigh, NC 27604
office: 919.334.9114 | mobile: 919.389.3888
email: worth@restorationsystems.com



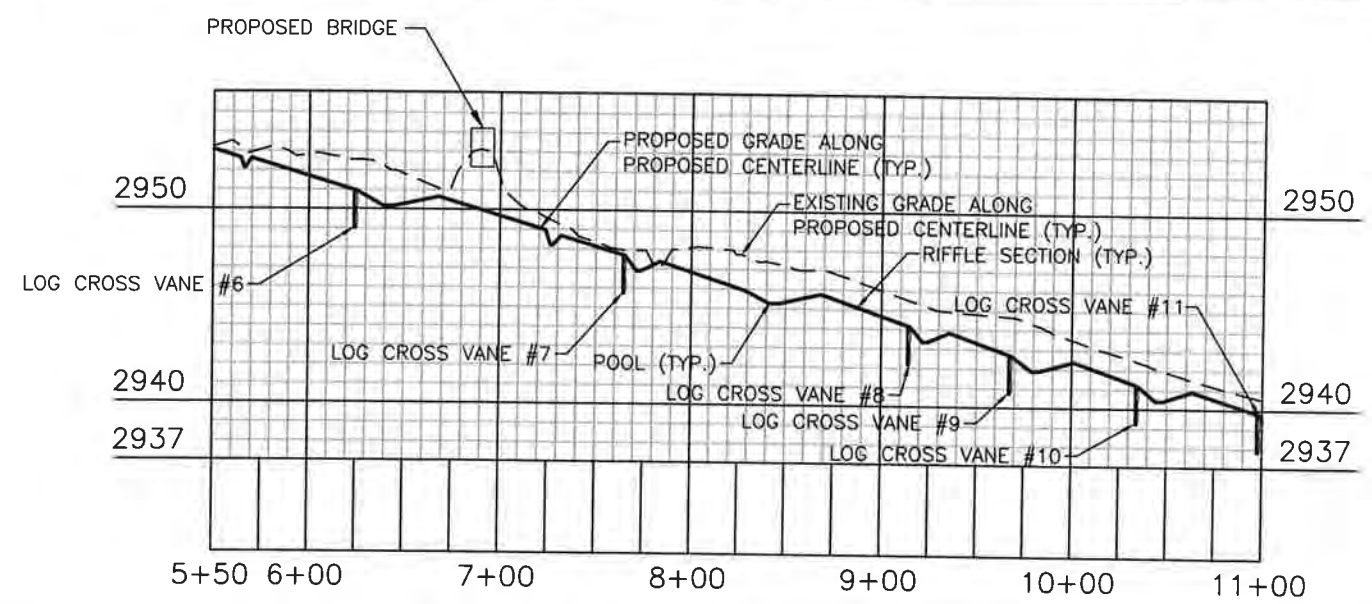
FORK CREEK STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #6	6+24.77	2950.95
LOG CROSS VANE #7	7+65.04	2947.68
LOG CROSS VANE #8	9+14.60	2944.14
LOG CROSS VANE #9	9+67.85	2942.70
LOG CROSS VANE #10	10+34.80	2941.22
LOG CROSS VANE #11	10+98.31	2939.79



TOTAL DISTURBED AREA = 27.53 AC.



VICINITY MAP
1" = 1000'





The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919 361.5000
fax 919 361.2269
license number: C-0293, C-187

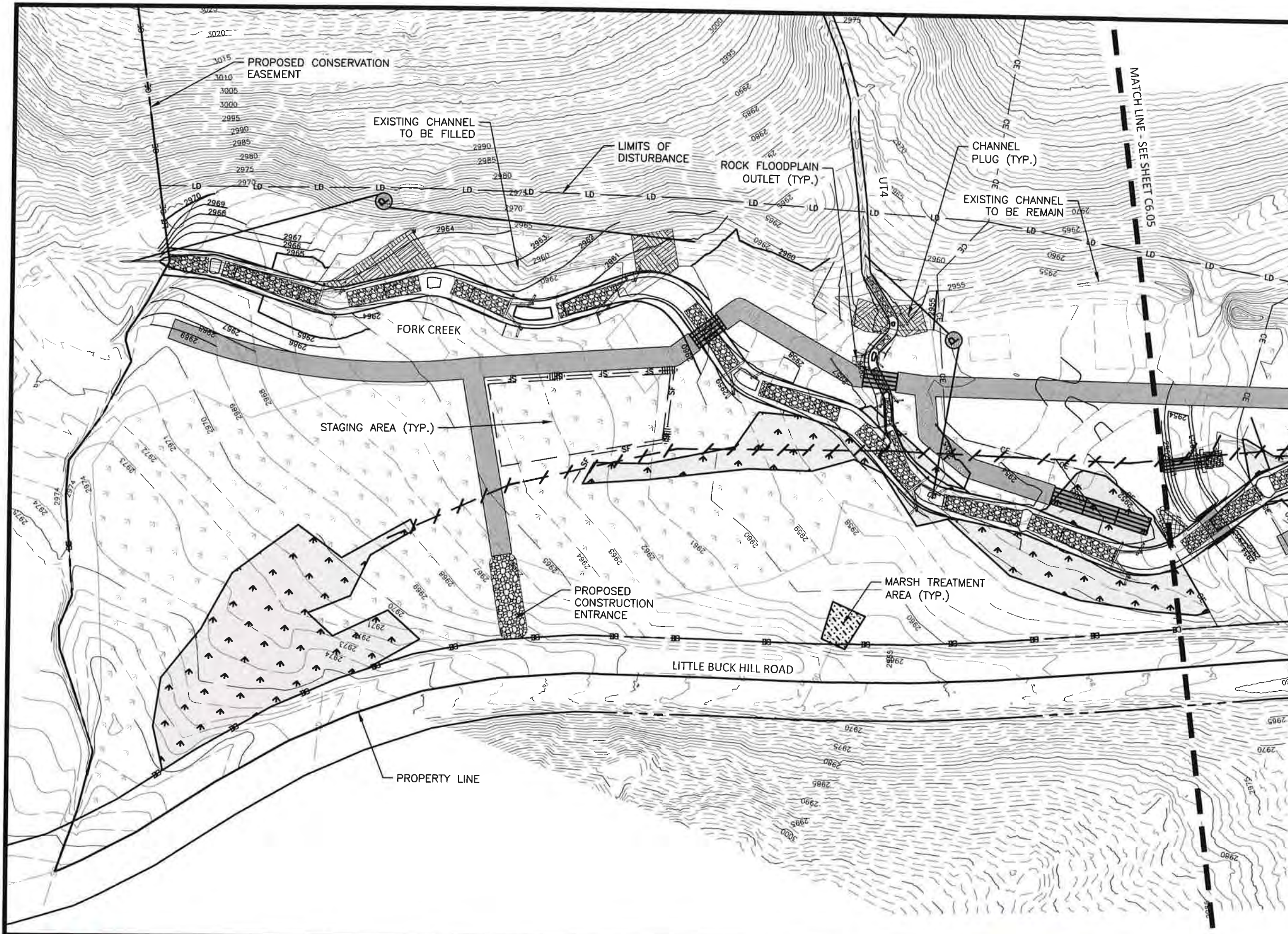
www.mcadamsco.com

LAUREL SPRINGS MITIGATION PLAN **CONSTRUCTION DRAWINGS** AVERY COUNTY, NORTH CAROLINA

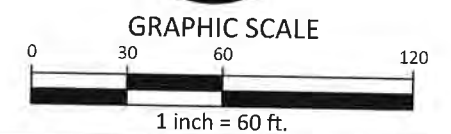


PLAN INFORMATION
 PROJECT NO. AXI-19000
 FILENAME AXI19000-P1
 CHECKED BY RAS
 DRAWN BY RHW
 SCALE 1"=60' / 1"=100'
 DATE 05.14.2021

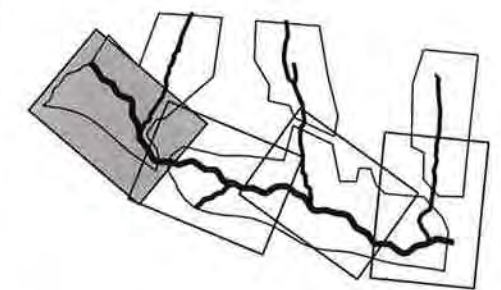
PLAN AND PROFILE
 FORK CREEK
 STA. 05+00 THRU STA. 11+00
C5.01



NOTE:
TWO ROWS OF SILT FENCE SHALL BE INSTALLED AROUND STAGING/STOCKPILE AREAS PER THE E&SC NOTES.



TOTAL DISTURBED AREA = 27.53 AC.



VICINITY MAP
1" = 1000'





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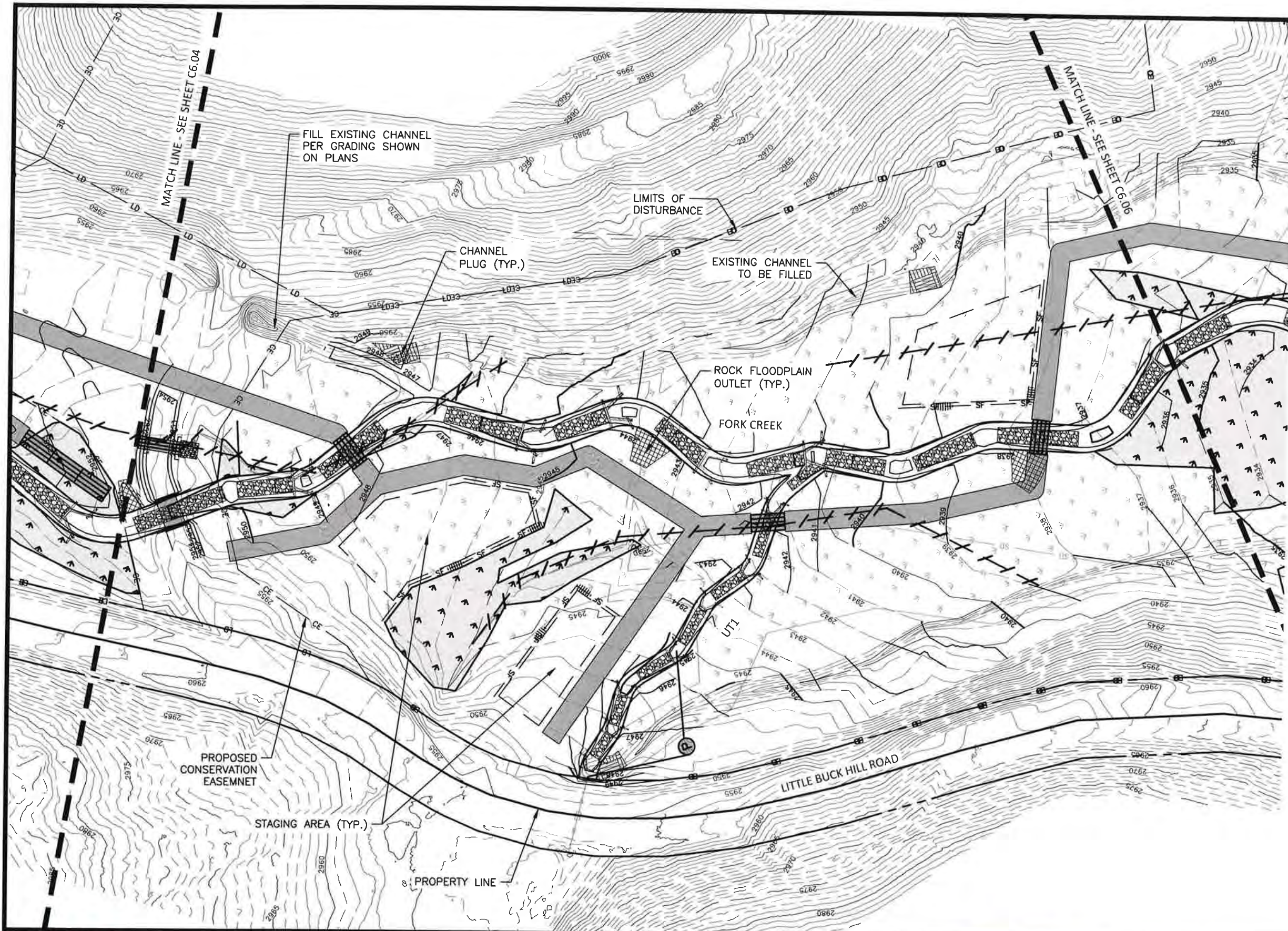
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LAUREL SPRINGS MITIGATION PLAN CONSTRUCTION DRAWINGS AVERY COUNTY, NORTH CAROLINA

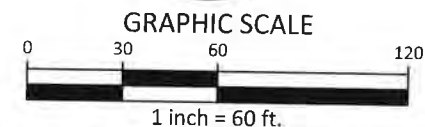


PLAN INFORMATION	
PROJECT NO.	AXI-19000
FILENAME	AXI19000-EC1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=60'
DATE	05.14.2021

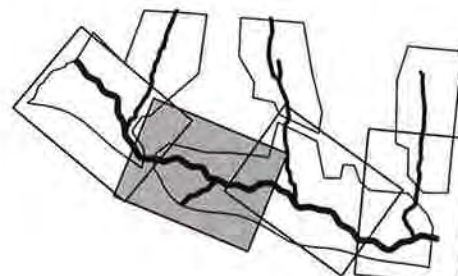
EROSION CONTROL PLAN **C6.04**



NOTE:
TWO ROWS OF SILT FENCE SHALL BE INSTALLED AROUND STAGING/STOCKPILE AREAS PER THE E&SC NOTES.



TOTAL DISTURBED AREA = 27.53 AC.



VICINITY MAP
1" = 1000'





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LAUREL SPRINGS MITIGATION PLAN

CONSTRUCTION DRAWINGS

AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION	
PROJECT NO.	AXI-19000
FILENAME	AXI19000-EC1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=60'
DATE	05.14.2021

EROSION CONTROL PLAN

C6.05

4 X 18" PROPOSED HDPE FLOODPLAIN CULVERTS.
LOCATION TO BE DETERMINED AT TIME OF CONSTRUCTION
AND APPROVED BY DESIGN ENGINEER.
LENGTH = 26'
APPROX INV. IN = 2951.0'
APPROX. INV. OUT = 2950.5'

MIN. 1.0' OF COVER
OVER FLOODPLAIN CULVERTS

PROPOSED ACCESS ROAD
APPROX. ROAD CREST ELEV. = 2954.2'

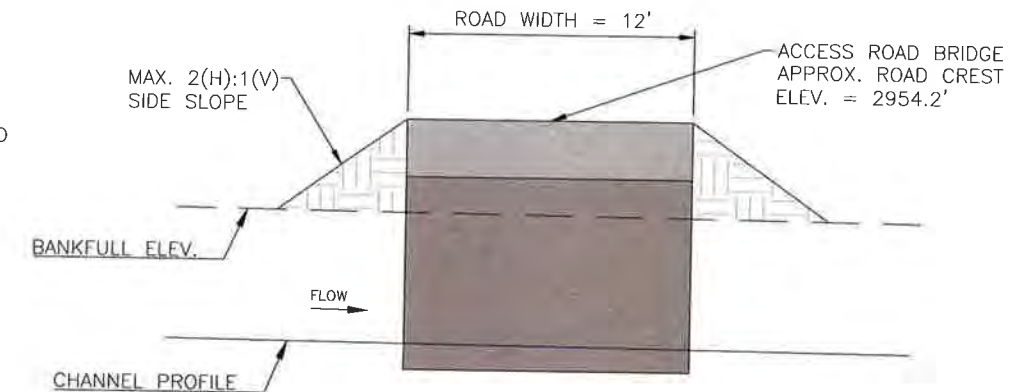
PROPOSED GROUND
(TYP.)

4" BED #57 STONE

ACCESS ROAD BRIDGE
MIN. LOW CHORD ELEV. = 2952.2'
*APPROX. HIGH CHORD ELEV. = 2954.2'
WIDTH = 12.0'

*BRIDGE AND FOOTERS TO BE DESIGNED BY OTHERS

ARMOR SIDE SLOPES
WITH MIN. CLASS B
RIPRAP OR STONE OF
EQUIVALENT SIZE.



FORK CREEK BRIDGE CROSSING

N.T.S.

GENERAL NOTES

1. INSTALL PERMANENT CROSSING WHILE CONSTRUCTION LOCATION WITHIN STREAM HAS BEEN DEWATERED.
2. IF UNABLE TO INSTALL WHILE LOCATION IS DRY, PLACE MATTING ON EXPOSED SOILS.
3. CONTRACTOR TO INSTALL CROSSING PIPE AND HEADWALL TO MANUFACTURER'S SPECIFICATION THIS INCLUDES SPECIFIED BEDDING AND BACKFILL REQUIREMENTS.
4. ALL MATERIAL TO BE PLACED AND COMPACTED WITHIN ROAD EMBANKMENT SHALL BE FREE FROM ROOTS, STUMPS, WOOD, STONES GREATER THAN 6", AND FROZEN OR OTHER OBJECTIONABLE MATERIAL.

PROPOSED GROUND
(TYP.)

MIN. 1.0' OF COVER
OVER CULVERT

ACCESS ROAD CROSSING

PROPOSED ROAD ELEV = EL. 2936.00

UT2 CULVERT NOT TO BE
EMBEDDED DUE TO THE STEEPNESS
CHANNEL IN VICINITY OF CROSSING.

NO FLOODPLAIN CULVERTS ARE
PROPOSED FOR FOR THE UT2
CROSSING DUE TO THE STEEPNESS
AND LACK OF DEFINED FLOODPLAIN
TOPOGRAPHY IN THE TRIBUTARY.

ELLIPTICAL CMP
SPAN = 3.167'
RISE = 2'
INV IN = 2931.15
INV OUT = 2927.78

SEE DETAIL SHEET
C8.09 FOR
VELOCITY
DISSIPATER PAD

ELLIPTICAL CMP
SPAN = 3.167'
RISE = 2'
LENGTH = 40 LF
INV IN = 2931.15
INV OUT = 2927.78

UT 2 CULVERT CROSSING

N.T.S.



PLAN INFORMATION

PROJECT NO.	AXI-19000
FILENAME	AXI19000-D1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	N.T.S.
DATE	05.14.2021

CULVERT DETAILS

C8.08

PAI ID NO			54834	54835	54836
STATION			UT-1	T-2	Fork Crk
DATE			7/10/2020	7/10/2020	7/10/2020
SPECIES	T.V.	F.F.G.			
MOLLUSCA					
Gastropoda					
Mesogastropoda					
Pleuroceridae	2.7				
<i>Elmia</i> sp.	2.7	SC			1
ARTHROPODA					
Insecta					
Ephemeroptera					
Baetidae		CG			
<i>Baetis pluto</i>	3.4		3		4
<i>Baetis tricaudatus</i>	1.5	CG	3		11
<i>Labiobaetis frondalis</i>	4.6				1
<i>Plauditus</i> sp.		CG	6		7
Ephemerellidae		SC			
<i>Drunella tuberculata</i>	0	SC	27		24
<i>Ephemerella</i> sp.	2.1	SC	1		
<i>Eurylophella</i> sp.	4	SC			2
<i>Teloganopsis deficiens</i>	2.6	SC			8
Heptageniidae		SC			
<i>Heptagenia julia</i>	1.9	SC	2		1
Odonata					
Cordulegastridae		P			
<i>Cordulegaster</i> sp.	5.7	P		8	
Plecoptera					
Leuctridae		SH			
<i>Leuctra</i> sp.	1.5	SH	2	2	3
Peltoperlidae		SH			
<i>Peltoperla</i> sp.				1	2
Perlodidae		P			
<i>Isoperla</i> sp.	3.2	P	2		
<i>Malirekus hastatus</i>	1	P			2
Trichoptera					
Hydropsychidae		FC			
<i>Diplectrona modesta</i>	2.3	FC		1	
<i>Hydropsyche</i> sp.		FC	1		1
Lepidostomatidae		SH			
<i>Lepidostoma</i> sp.	1	FC	2	1	
Philopotamidae		FC			
<i>Dolophilodes distinctus</i>	1	FC	1		1
Rhyacophilidae		P			
<i>Rhyacophila fuscula</i>	1.6	P			1
Coleoptera					
Dryopidae					
<i>Helichus basalis</i>	0.5	SC	1		
Elmidae		CG			
<i>Optioservus ovalis</i>	2.1	SC	1		
<i>Optioservus</i> sp.	2.1	SC			4
<i>Stenelmis crenata</i>	7.8		1		
Diptera					
Chironomidae					
<i>Cricotopus</i> sp.					1
<i>Eukiefferiella claripennis</i> sp.	6.2	CG			1
<i>Paralauterborniella nigrohalteralis</i>	4.9	CG		1	
<i>Parametrioctenus</i> sp.	3.9	CG			1
<i>Polypedilum aviceps</i>	3.6	SH			1
<i>Tanytarsus</i> sp.	6.6	FC	1		
Dixidae		CG			
<i>Dixa</i> sp.	2.5	CG		1	1
Simuliidae		FC			
<i>Simulium</i> sp.	4.9	FC			3
<i>Simulium venustum</i> complex	7.3			2	
Tabanidae		PI		1	
Tipulidae		SH			
<i>Hexatoma</i> sp.	3.5	P	1		1
TOTAL NO. OF ORGANISMS			55	18	82
TOTAL NO. OF TAXA			16	9	23
EPT TAXA			11	4	14
BIOTIC INDEX ASSIGNED VALUES			1.70	4.07	2.02

Habitat Assessment Field Data Sheet

Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ

TOTAL SCORE

Directions for use: The observer is to survey a minimum of 100 meters with 200 meters preferred of stream, preferably in an upstream direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream Fork Creek Location/road: Little Buck Hill (Road Name) County Avery

Date 7/10/20 CC# 06010108 Basin French Branch Subbasin 04-03-06

Observer(s) AXE Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe)

Latitude 35.99948 Longitude -81.982287 Ecoregion: ☒ MT ☐ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature °C DO mg/l Conductivity (corr.) µS/cm pH

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 55 %Forest 5 %Residential 40 %Active Pasture % Active Crops
 %Fallow Fields % Commercial %Industrial %Other - Describe:

Watershed land use: ☒ Forest ☒ Agriculture ☐ Urban ☐ Animal operations upstream

Width: (meters) Stream 2 Channel (at top of bank) 2.5 Stream Depth: (m) Avg 1 Max
☒ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 1

Bank Angle: 70 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☒ Channelized Ditch

☒ Deeply incised-steep, straight banks ☐ Both banks undercut at bend ☐ Channel filled in with sediment
☐ Recent overbank deposits ☒ Bar development ☐ Buried structures ☐ Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐ Green tinge ☐ Sewage smell

Manmade Stabilization: ☒ N ☒ Y: ☐ Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐ Berm/levee

Flow conditions: ☐ High ☒ Normal ☐ Low

Turbidity: ☒ Clear ☒ Slightly Turbid ☐ Turbid ☐ Tannic ☒ Milky ☐ Colored (from dyes)

Good potential for Wetlands Restoration Project?? ☒ YES ☐ NO Details

Channel Flow Status

Useful especially under abnormal or low flow conditions.

- A. Water reaches base of both lower banks, minimal channel substrate exposed ☐
 B. Water fills >75% of available channel, or <25% of channel substrate is exposed..... ☒
 C. Water fills 25-75% of available channel, many logs/snags exposed..... ☐
 D. Root mats out of water..... ☐
 E. Very little water in channel, mostly present as standing pools..... ☐

Weather Conditions: warm & humid Photos: ☒ N ☐ Y ☐ Digital ☐ 35mm

Remarks: pre construction sampling for proposed stream
and wetland restoration

I. Channel Modification

- CSC
- | | |
|---|-------|
| A. channel natural, frequent bends..... | Score |
| B. channel natural, infrequent bends (channelization could be old)..... | 5 |
| C. some channelization present..... | 4 |
| D. more extensive channelization, >40% of stream disrupted..... | 3 |
| E. no bends, completely channelized or rip rapped or gabioned, etc..... | 2 |
| | 0 |
- ☒ Evidence of dredging ☒ Evidence of desnagging=no large woody debris in stream ☐ Banks of uniform shape/height
- Remarks _____ Subtotal 2

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

C Rocks R Macrophytes F Sticks and leafpacks R Snags and logs C Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70%	40-70%	20-40%	<20%
	Score	Score	Score	Score
4 or 5 types present.....	20	16	12	8
3 types present.....	19	15	11	7
2 types present.....	18	14	10	6
1 type present.....	17	13	9	5
No types present.....	0			

☒ No woody vegetation in riparian zone Remarks _____ Subtotal 14

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

- | | |
|--|-------|
| A. substrate with good mix of gravel, cobble and boulders | Score |
| 1. embeddedness <20% (very little sand, usually only behind large boulders)..... | 15 |
| 2. embeddedness 20-40%..... | 12 |
| 3. embeddedness 40-80%..... | 8 |
| 4. embeddedness >80%..... | 3 |
| B. substrate gravel and cobble | |
| 1. embeddedness <20%..... | 14 |
| 2. embeddedness 20-40%..... | 11 |
| 3. embeddedness 40-80%..... | 6 |
| 4. embeddedness >80%..... | 2 |
| C. substrate mostly gravel | |
| 1. embeddedness <50%..... | 8 |
| 2. embeddedness >50%..... | 4 |
| D. substrate homogeneous | |
| 1. substrate nearly all bedrock..... | 3 |
| 2. substrate nearly all sand..... | 3 |
| 3. substrate nearly all detritus..... | 2 |
| 4. substrate nearly all silt/ clay..... | 1 |

Remarks _____ Subtotal 12

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

- | | |
|--|-------|
| A. Pools present | Score |
| 1. Pools Frequent (>30% of 200m area surveyed) | |
| a. variety of pool sizes..... | 10 |
| b. pools about the same size (indicates pools filling in)..... | 8 |
| 2. Pools Infrequent (<30% of the 200m area surveyed) | |
| a. variety of pool sizes..... | 6 |
| b. pools about the same size..... | 4 |
| B. Pools absent..... | 0 |

Subtotal 10

☒ Pool bottom boulder-cobble=hard ☐ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks _____

Page Total 38

CSFE

V. Riffle Habitats

Definition: Riffle is area of reeration-can be debris dam, or narrow channel area.

	Riffles Frequent Score	Riffles Infrequent Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	
Channel Slope: <input checked="" type="checkbox"/> Typical for area <input checked="" type="checkbox"/> Steep=fast flow <input type="checkbox"/> Low=like a coastal stream		Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM

A. Banks stable

1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion.. 7 7

B. Erosion areas present

1. diverse trees, shrubs, grass; plants healthy with good root systems..... 6 6
 2. few trees or small trees and shrubs; vegetation appears generally healthy..... 5 5
 3. sparse mixed vegetation; plant types and conditions suggest poorer soil binding..... 3 3
 4. mostly grasses, few if any trees and shrubs, high erosion and failure potential at high flow.. 2 2
 5. little or no bank vegetation, mass erosion and bank failure evident..... 0 0

Total 4

Remarks

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with good canopy with some breaks for light penetration	10
B. Stream with full canopy - breaks for light penetration absent.....	8
C. Stream with partial canopy - sunlight and shading are essentially equal.....	7
D. Stream with minimal canopy - full sun in all but a few areas.....	2
E. No canopy and no shading.....	0

Subtotal 0

Remarks

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

	FACE UPSTREAM	Lft. Bank Score	Rt. Bank Score
Dominant vegetation: <input type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Weeds/old field <input type="checkbox"/> Exotics (kudzu, etc)			
A. Riparian zone intact (no breaks)			
1. width > 18 meters.....	5	5	
2. width 12-18 meters.....	4	4	
3. width 6-12 meters.....	3	3	
4. width < 6 meters.....	2	2	
B. Riparian zone not intact (breaks)			
1. breaks rare			
a. width > 18 meters.....	4	4	
b. width 12-18 meters.....	3	3	
c. width 6-12 meters.....	2	2	
d. width < 6 meters.....	1	1	
2. breaks common			
a. width > 18 meters.....	3	3	
b. width 12-18 meters.....	2	2	
c. width 6-12 meters.....	1	1	
d. width < 6 meters.....	0	0	

Total 10

Remarks

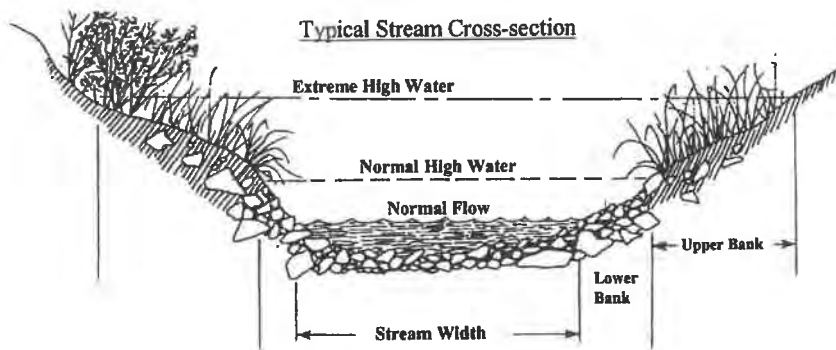
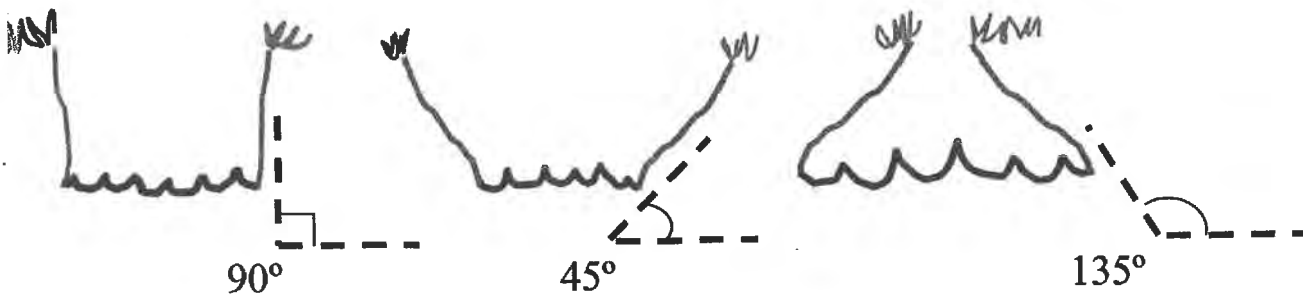
Page Total 14

TOTAL SCORE 52

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:



This side is 45° bank angle.

Site Sketch:

Other comments:

TOTAL SCORE	61
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TOTAL SCORE	61
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TOTAL SCORE	61
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TOTAL SCORE	61
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TOTAL SCORE	61
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TOTAL SCORE	61
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TOTAL SCORE	61
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TOTAL SCORE	61
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- | | |
|--------------------|----|
| TOTAL SCORE | 61 |
|--------------------|----|

TOTAL SCORE	61
--------------------	----

TOTAL SCORE	61
--------------------	----

LS 97

I. Channel Modification

- | | |
|---|--------------|
| | <u>Score</u> |
| A. channel natural, frequent bends..... | 5 |
| B. channel natural, infrequent bends (channelization could be old)..... | 4 |
| C. some channelization present..... | 3 |
| D. more extensive channelization, >40% of stream disrupted..... | <u>2</u> |
| E. no bends, completely channelized or rip rapped or gabioned, etc..... | 0 |

☒ Evidence of dredging ☒ Evidence of desnagging=no large woody debris in stream ☐ Banks of uniform shape/height

Remarks _____

Subtotal 2

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

A Rocks R Macrophytes R Sticks and leafpacks R Snags and logs L Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70%	40-70%	20-40%	<20%
	Score	Score	Score	Score
4 or 5 types present.....	20	16	12	8
3 types present.....	19	15	11	7
2 types present.....	18	<u>14</u>	10	6
1 type present.....	17	13	9	5
No types present.....	0			

☐ No woody vegetation in riparian zone

Remarks _____

Subtotal 14

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

A. substrate with good mix of gravel, cobble and boulders

- | | |
|--|--------------|
| 1. embeddedness <20% (very little sand, usually only behind large boulders)..... | <u>Score</u> |
| 2. embeddedness 20-40%..... | 15 |
| 3. embeddedness 40-80%..... | 12 |
| 4. embeddedness >80%..... | 8 |
| | 3 |

B. substrate gravel and cobble

- | | |
|------------------------------|-----------|
| 1. embeddedness <20%..... | 14 |
| 2. embeddedness 20-40%..... | <u>11</u> |
| 3. embeddedness 40-80% | 6 |
| 4. embeddedness >80%..... | 2 |

C. substrate mostly gravel

- | | |
|---------------------------|---|
| 1. embeddedness <50%..... | 8 |
| 2. embeddedness >50%..... | 4 |

D. substrate homogeneous

- | | |
|---|---|
| 1. substrate nearly all bedrock..... | 3 |
| 2. substrate nearly all sand | 3 |
| 3. substrate nearly all detritus..... | 2 |
| 4. substrate nearly all silt/ clay..... | 1 |

Remarks _____

Subtotal 1

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

A. Pools present

- | | |
|--|--------------|
| 1. Pools Frequent (>30% of 200m area surveyed) | <u>Score</u> |
| a. variety of pool sizes..... | 10 |
| b. pools about the same size (indicates pools filling in)..... | 8 |
| 2. Pools Infrequent (<30% of the 200m area surveyed) | |
| a. variety of pool sizes..... | <u>6</u> |
| b. pools about the same size..... | 4 |

B. Pools absent.....

0

Subtotal 6

☒ Pool bottom boulder-cobble=hard ☐ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks _____

Page Total 33

LSUT

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area. Riffles Frequent Riffles Infrequent

	Score	Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	
Channel Slope: <input checked="" type="checkbox"/> Typical for area <input checked="" type="checkbox"/> Steep=fast flow <input type="checkbox"/> Low=like a coastal stream		Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM

Left Bank Rt. Bank
Score Score

A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse trees, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and shrubs; vegetation appears generally healthy.....	5	5
3. sparse mixed vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly grasses, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
		Total 4

Remarks

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with good canopy with some breaks for light penetration	10
B. Stream with full canopy - breaks for light penetration absent.....	8
C. Stream with partial canopy - sunlight and shading are essentially equal.....	7
D. Stream with minimal canopy - full sun in all but a few areas.....	2
E. No canopy and no shading.....	0

Remarks

Subtotal 0

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: <input type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Weeds/old field <input type="checkbox"/> Exotics (kudzu, etc)	Lft. Bank Score	Rt. Bank Score
A. Riparian zone intact (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone not intact (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0
		Total 8

Remarks

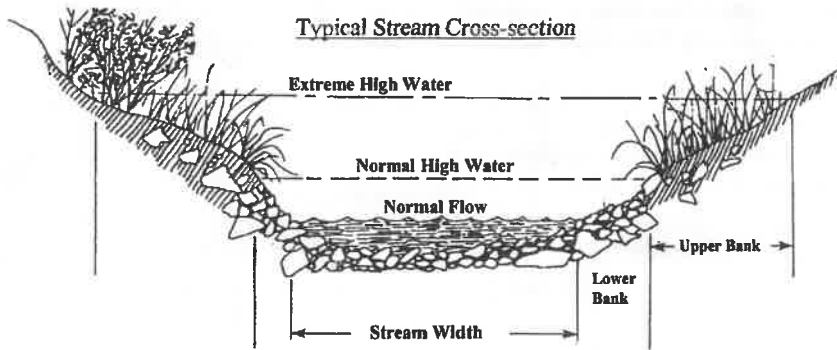
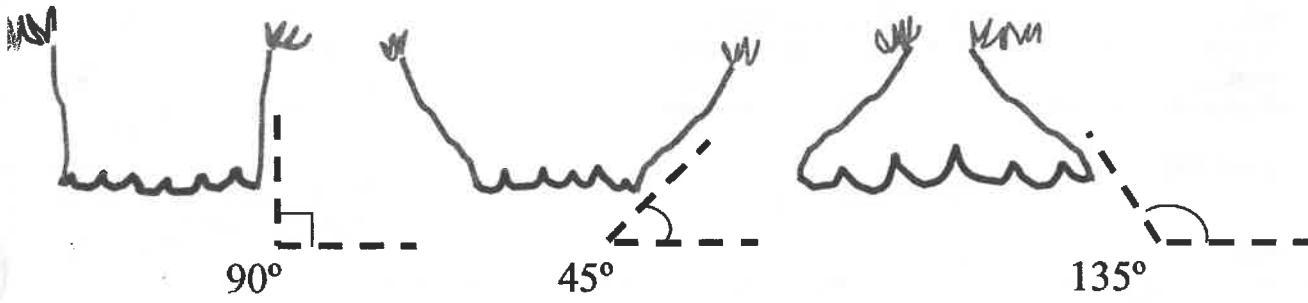
Page Total 28

TOTAL SCORE 61

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:



This side is 45° bank angle.

Site Sketch:

Other comments: _____

TOTAL SCORE	55
--------------------	----

39

I. Channel Modification

- CS 472
- | | |
|---|---------|
| A. channel natural, frequent bends..... | Score 5 |
| B. channel natural, infrequent bends (channelization could be old)..... | 4 |
| C. some channelization present..... | 3 |
| D. more extensive channelization, >40% of stream disrupted..... | (2) |
| E. no bends, completely channelized or rip rapped or gabioned, etc..... | 0 |
- ☒ Evidence of dredging ☒ Evidence of desnagging=no large woody debris in stream ☐ Banks of uniform shape/height
- Remarks _____ Subtotal 2

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

R Rocks R Macrophytes F Sticks and leafpacks R Snags and logs R Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70%	40-70%	20-40%	<20%
	Score	Score	Score	Score
4 or 5 types present.....	20	16	12	8
3 types present.....	19	15	11	7
2 types present.....	18	14	10	6
1 type present.....	17	13	9	(5)
No types present.....	0			

☒ No woody vegetation in riparian zone Remarks _____ Subtotal 5

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

- | | |
|--|--------------|
| A. substrate with good mix of gravel, cobble and boulders | Score |
| 1. embeddedness <20% (very little sand, usually only behind large boulders)..... | 15 |
| 2. embeddedness 20-40%..... | 12 |
| 3. embeddedness 40-80%..... | 8 |
| 4. embeddedness >80%..... | 3 |
| B. substrate gravel and cobble | |
| 1. embeddedness <20%..... | 14 |
| 2. embeddedness 20-40%..... | 11 |
| 3. embeddedness 40-80%..... | 6 |
| 4. embeddedness >80%..... | 2 |
| C. substrate mostly gravel | |
| 1. embeddedness <50%..... | 8 |
| 2. embeddedness >50%..... | 4 |
| D. substrate homogeneous | |
| 1. substrate nearly all bedrock..... | 3 |
| 2. substrate nearly all sand..... | (3) |
| 3. substrate nearly all detritus..... | 2 |
| 4. substrate nearly all silt/ clay..... | 1 |

Remarks _____ Subtotal 3

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

- | | |
|--|--------------|
| A. Pools present | Score |
| 1. Pools Frequent (>30% of 200m area surveyed) | |
| a. variety of pool sizes..... | 10 |
| b. pools about the same size (indicates pools filling in)..... | 8 |
| 2. Pools Infrequent (<30% of the 200m area surveyed) | |
| a. variety of pool sizes..... | 6 |
| b. pools about the same size..... | (4) |
| B. Pools absent..... | 0 |

Subtotal 4

☐ Pool bottom boulder-cobble=hard ☒ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks _____

Page Total 14

V. Riffle Habitats

Definition: Riffle is area of reacreation-can be debris dam, or narrow channel area.

Riffles Frequent	Riffles Infrequent
<u>Score</u>	<u>Score</u>
Stream.... 16	12
..... 14	7
..... 10	3
..... 0	

Channel Slope: ☐ Typical for area ☒ Steep=fast flow ☐ Low=like a coastal stream

Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM

A. Banks stable

1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion.. 7 7

B. Erosion areas present

1. diverse trees, shrubs, grass; plants healthy with good root systems..... 6 6
 2. few trees or small trees and shrubs; vegetation appears generally healthy..... 5 5
 3. sparse mixed vegetation; plant types and conditions suggest poorer soil binding..... 3 3
 4. mostly grasses, few if any trees and shrubs, high erosion and failure potential at high flow.. 2 2
 5. little or no bank vegetation, mass erosion and bank failure evident..... 0 0

Total 4

Remarks _____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with good canopy with some breaks for light penetration	10
B. Stream with full canopy - breaks for light penetration absent.....	8
C. Stream with partial canopy - sunlight and shading are essentially equal.....	7
D. Stream with minimal canopy - full sun in all but a few areas.....	2
E. No canopy and no shading.....	0

Remarks _____

Subtotal 2

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☒ Weeds/old field ☐ Exotics (kudzu, etc)

A. Riparian zone intact (no breaks)

1. width > 18 meters..... 5 5
 2. width 12-18 meters..... 4 4
 3. width 6-12 meters..... 3 3
 4. width < 6 meters..... 2 2

B. Riparian zone not intact (breaks)

1. breaks rare
 a. width > 18 meters..... 4 4
 b. width 12-18 meters..... 3 3
 c. width 6-12 meters..... 2 2
 d. width < 6 meters..... 1 1
 2. breaks common
 a. width > 18 meters..... 3 3
 b. width 12-18 meters..... 2 2
 c. width 6-12 meters..... 1 1
 d. width < 6 meters..... 0 0

Total 19

Remarks _____

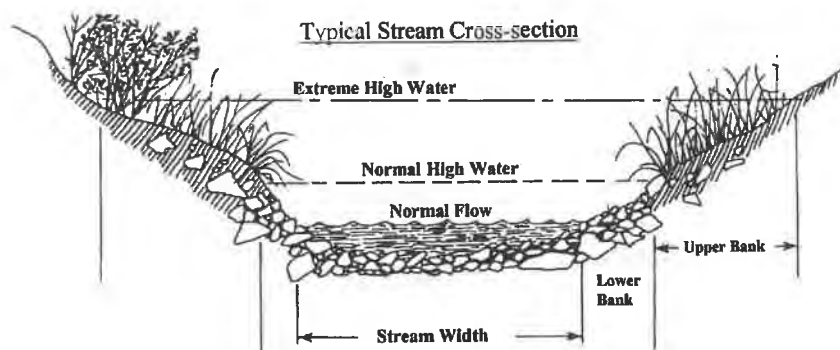
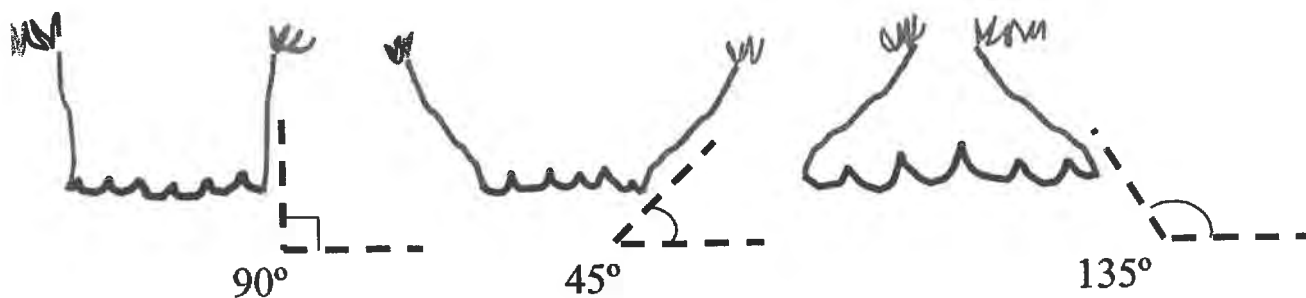
Page Total 41

TOTAL SCORE 55

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:



This side is 45° bank angle.

Site Sketch:

Other comments:

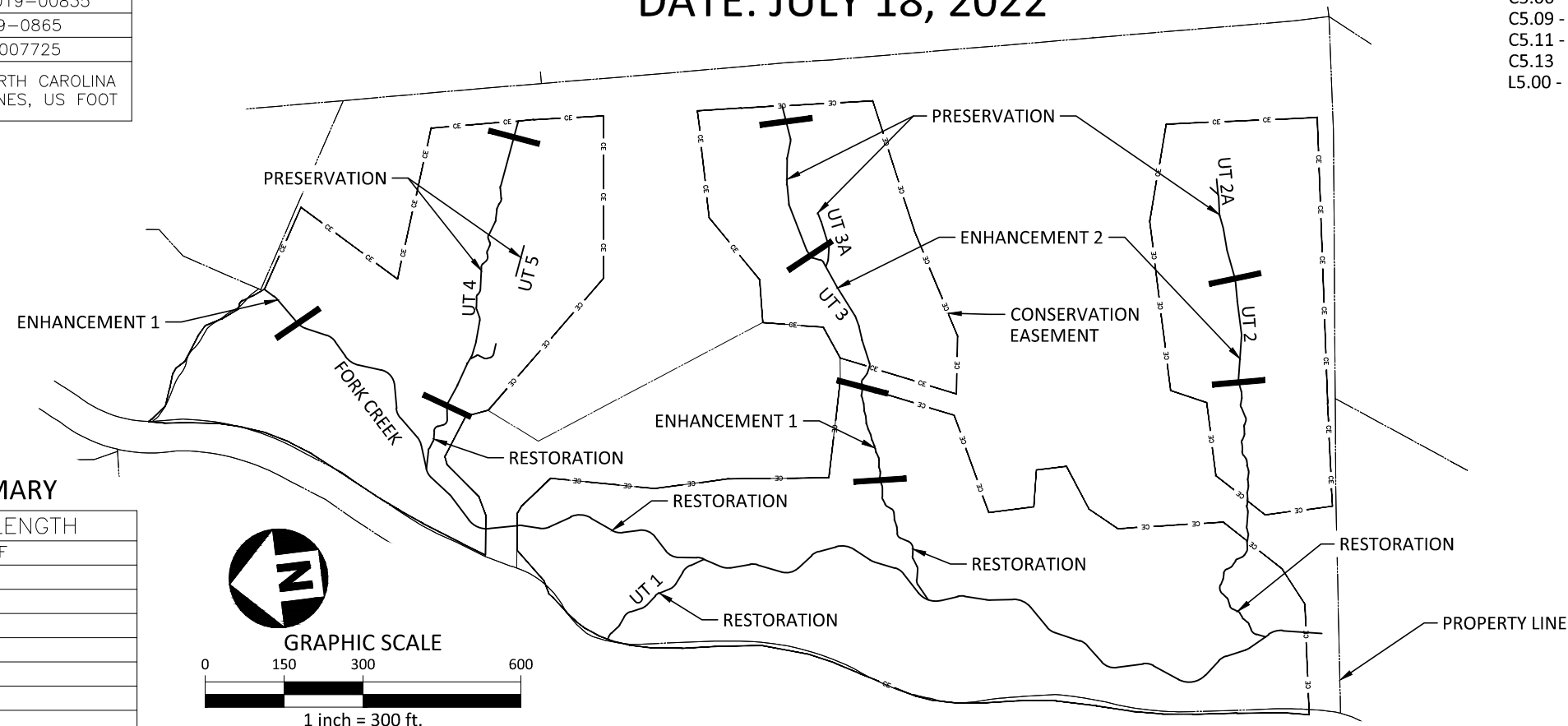
Appendix G: Record Drawings (As-Built Survey)

NC DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF MITIGATION SERVICES

AS-BUILT DRAWINGS LAUREL SPRINGS SITE AVERY COUNTY DATE: JULY 18, 2022

SITE DATA TABLE	
RIVER BASIN	FRENCH BROAD
8-DIGIT HUC	6010108
TOTAL DISTURBED AREA	27.53 AC
DMS PROJECT ID NO.	100122
FULL DELIVERY CONTRACT NO.	7890
USACE ACTION ID NO.	SAW-2019-00835
DWR PROJECT NO.	2019-0865
RFP NO.	16-007725
COORDINATE SYSTEM	NAD83 NORTH CAROLINA STATE PLANES, US FOOT

SHEET INDEX	
C1.00	EASEMENT AND CONTROL POINTS EXHIBIT
C1.01	INDEX OF SYMBOLS
C1.02	PROJECT OVERVIEW
C5.00 - C5.04	FORK CREEK PLAN AND PROFILE
C5.05	UT 1 PLAN AND PROFILE
C5.06 - C5.08	UT 2 PLAN AND PROFILE
C5.09 - C5.10	UT 3 PLAN AND PROFILE
C5.11 - C5.12	UT 4 PLAN AND PROFILE
C5.13	DRIVEWAY GRADING
L5.00 - L5.01	PLANTING PLAN



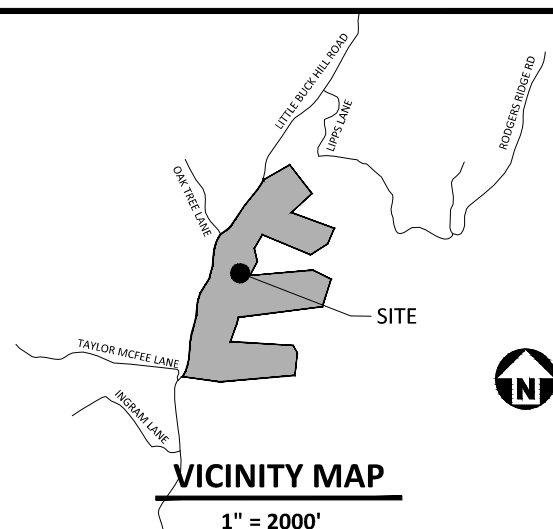
AS-BUILT MITIGATION SUMMARY

TRIBUTARY	AS-BUILT LENGTH
FORK CREEK	2,334 LF
UT1	235 LF
UT2	851 LF
UT2A	25 LF
UT3	921 LF
UT3A	103 LF
UT4	657 LF
UT5	127 LF

RESTORATION LEVEL	STREAM (LF)	RIPARIAN WETLAND (AC)	NON-RIPARIAN WETLAND (AC)
RESTORATION	3,286	—	—
ENHANCEMENT I	274	—	—
ENHANCEMENT II	449	—	—
PRESERVATION	1,244	0.198*	—
REESTABLISHMENT	—	7.656	—
REHABILITATION	—	1.845*	—
ENHANCEMENT	—	0.148*	—
TOTALS	5,253	9.847	—

*TOTAL STREAM MITIGATION UNITS INCLUDE UNITS FROM THE WIDER BUFFER TOOL

*WETLAND REHABILITATION, ENHANCEMENT, PRESERVATION, AND SOME RE-ESTABLISHMENT ARE NOT CREDIT GENERATING.

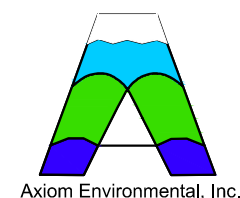


The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamscsco.com

AXIOM ENVIRONMENTAL, INC.
218 SNOW AVENUE
RALEIGH, NC 27603
CONTACT: GRANT LEWIS
PHONE: 919. 215. 1693



CLIENT

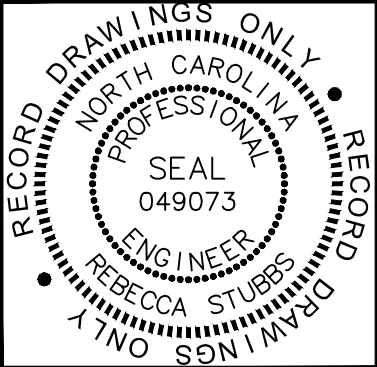
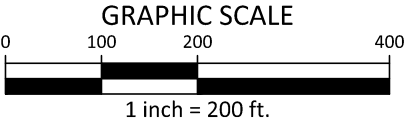
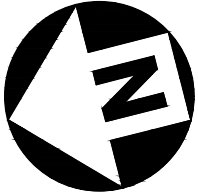
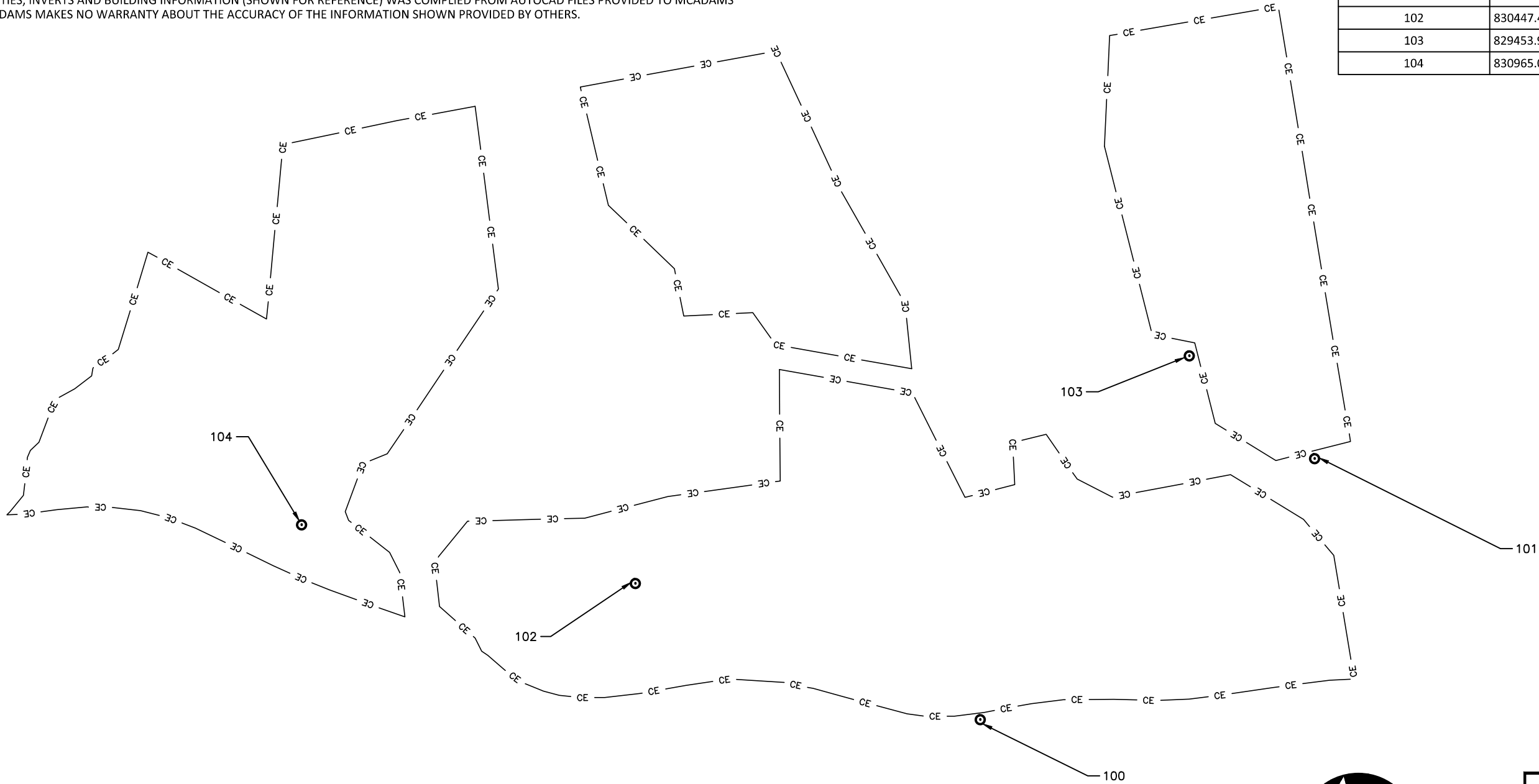
RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
CONTACT: WORTH CREECH
PHONE: 919. 389. 3888



GENERAL NOTES:

- 1. COORDINATE SYSTEM: NAD83 NORTH CAROLINA STATE PLANES, US FOOT
- 2. TOPOGRAPHY AND SPOT ELEVATIONS SHOWN ARE FROM AN ACTUAL FIELD SURVEY COMPLETED BY K2 DESIGN GROUP.
- 3. PLANIMETRICS, UTILITIES, INVERTS AND BUILDING INFORMATION (SHOWN FOR REFERENCE) WAS COMPILED FROM AUTOCAD FILES PROVIDED TO MCADAMS FROM OTHERS. MCADAMS MAKES NO WARRANTY ABOUT THE ACCURACY OF THE INFORMATION SHOWN PROVIDED BY OTHERS.

CONTROL POINT LOCATIONS			
CONTROL POINT	NORTHING	EASTING	ELEVATION
100	829943.8048	1117697.5263	2951.36
101	829292.7246	1117983.3841	2948.17
102	830447.4092	1118061.3990	2941.26
103	829453.9034	1118202.3079	2973.08
104	830965.0697	1118294.5656	2958.02

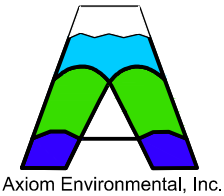


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phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

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LAUREL SPRINGS MITIGATION PLAN
AS-BUILT DRAWINGS
AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION
PROJECT NO. AXI-19000
FILENAME AXI19010-ESMT
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1" = 60'
DATE 07.18.2022

CONSERVATION EASEMENT
AND CONTROL POINTS EXHIBIT

C1.00

LEGEND AND SYMBOLS

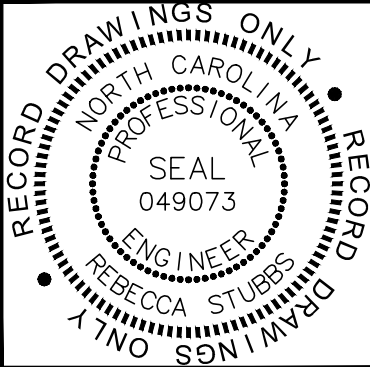
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	PROPOSED CONSERVATION EASEMENT
	EXISTING PROPERTY LINE
	EXISTING OVERHEAD UTILITY EASEMENT
	PROPOSED STREAM CENTERLINE
	PROPOSED TOP OF BANK

	PROPOSED LOG CROSS VANE
	PROPOSED LOG VANE
	PROPOSED STEP SILL
	PROPOSED STEP POOL
	PROPOSED DROP STRUCTURE

	WETLAND REHABILITATION AREA
	WETLAND RE-ESTABLISHMENT AREA
	WETLAND PRESERVATION AREA
	MARSH TREATMENT AREA

AS-BUILT LEGEND AND SYMBOLS

	MAJOR CONTOUR
	MINOR CONTOUR
	STREAM CENTERLINE
	TOP OF BANK
	LOG CROSS VANE
	LOG VANE
	ROCK SILL
	LOG J-HOOK
	STREAM CULVERT
	MONITORING – VEGETATION PLOT
	MONITORING – CROSS SECTION
	MONITORING – STREAM GAGUE
	MONITORING – GROUNDWATER WELL
	MONITORING – RAIN GAGUE

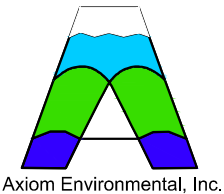


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phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

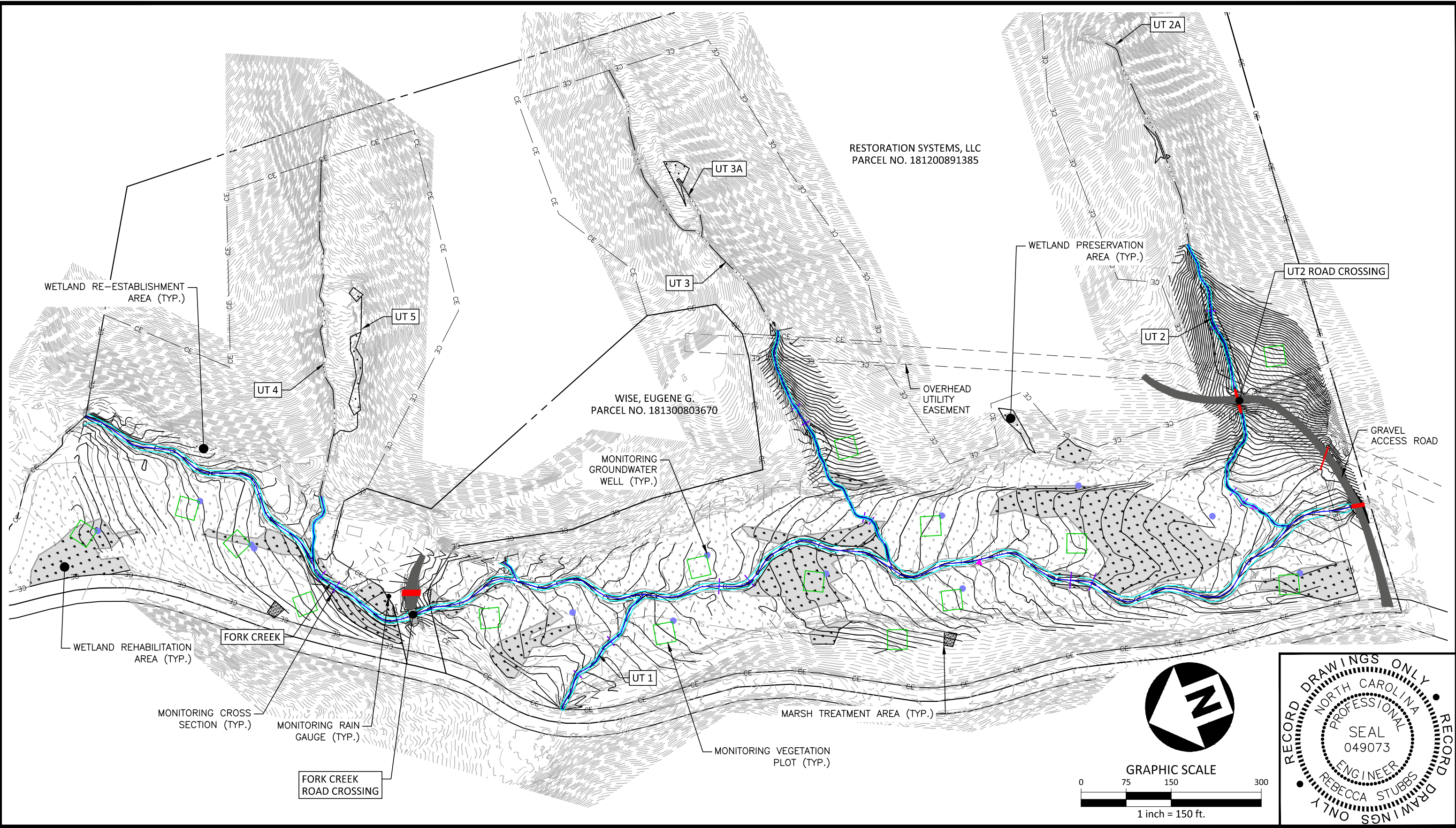
www.mcadamsco.com

LAUREL SPRINGS MITIGATION PLAN
AS-BUILT DRAWINGS
AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION	
PROJECT NO.	AXI-19000
FILENAME	AXI19000-P1
CHECKED BY	RAS
DRAWN BY	CHJ
SCALE	NTS
DATE	07.18.2022

LEGEND AND SYMBOLS
C1.01





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Durham, NC 27713

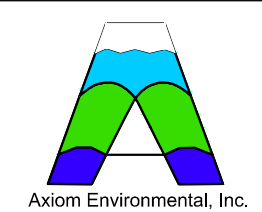
phone 919. 361. 5000
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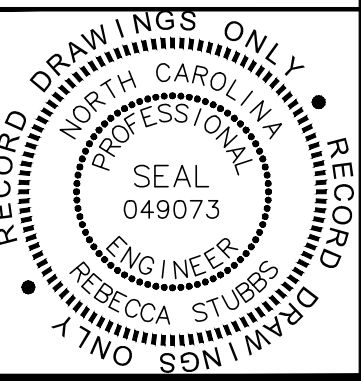
LAUREL SPRINGS MITIGATION PLAN

AS-BUILT DRAWINGS

AVERY COUNTY, NORTH CAROLINA

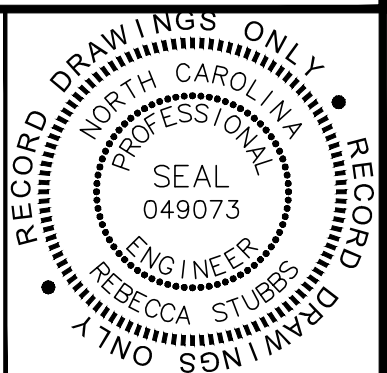
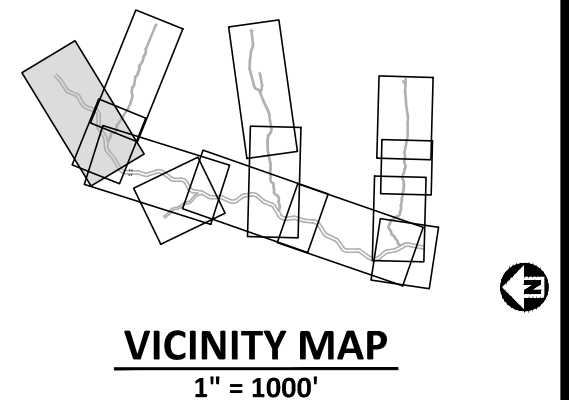
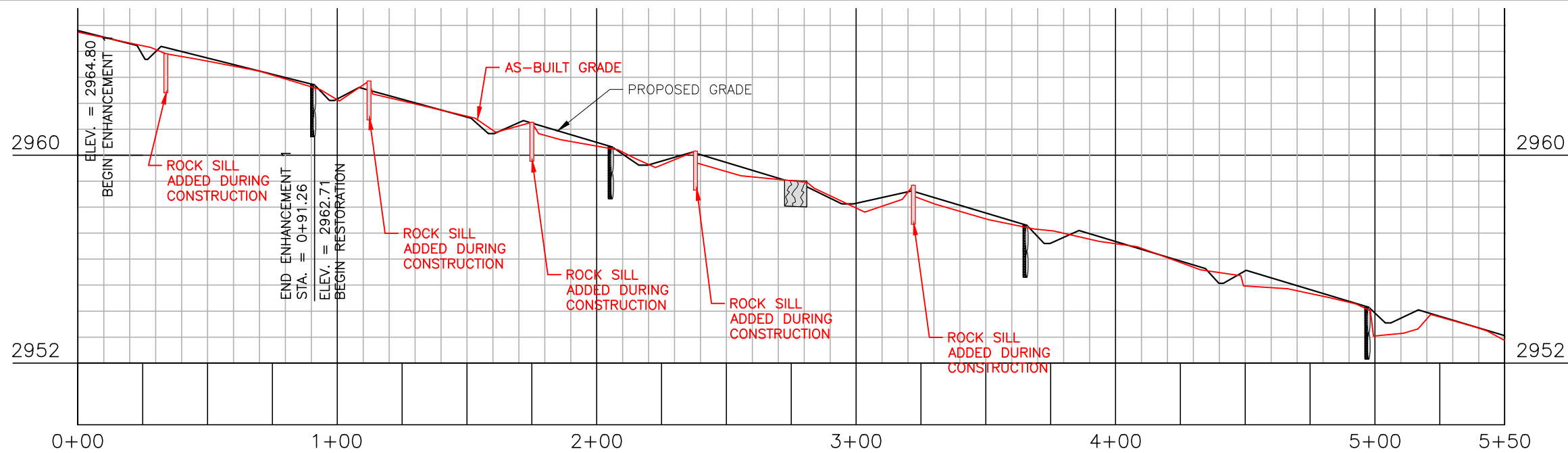
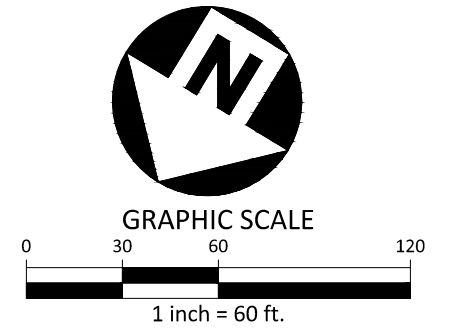
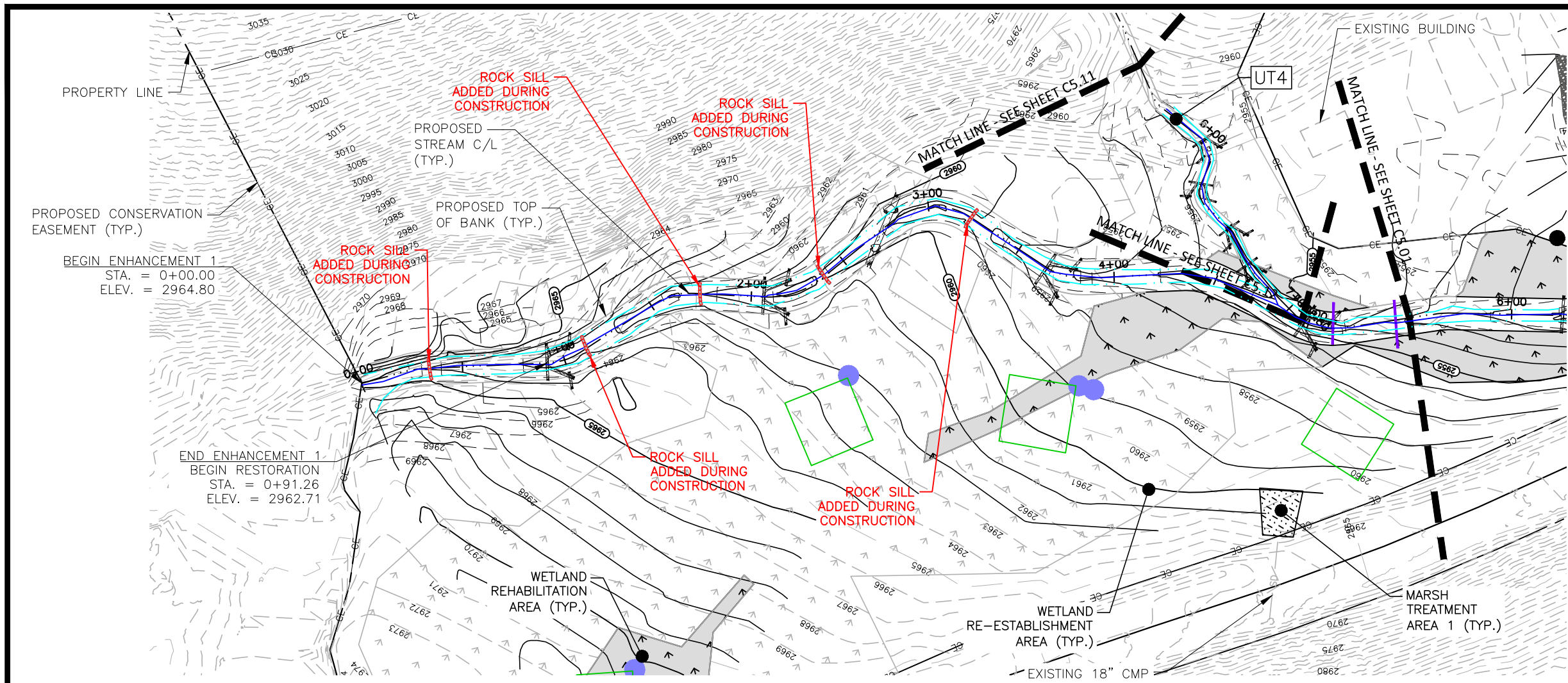


PLAN INFORMATION	
PROJECT NO.	AXI-19000
FILENAME	AXI19000-P1
CHECKED BY	RAS
DRAWN BY	CHJ
SCALE	1" = 150'
DATE	07.18.2022



PROJECT OVERVIEW

C1.02



The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

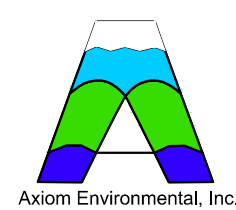
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

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LAUREL SPRINGS MITIGATION PLAN

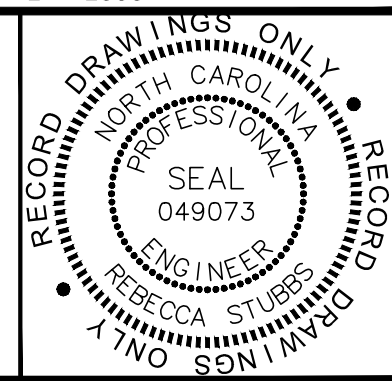
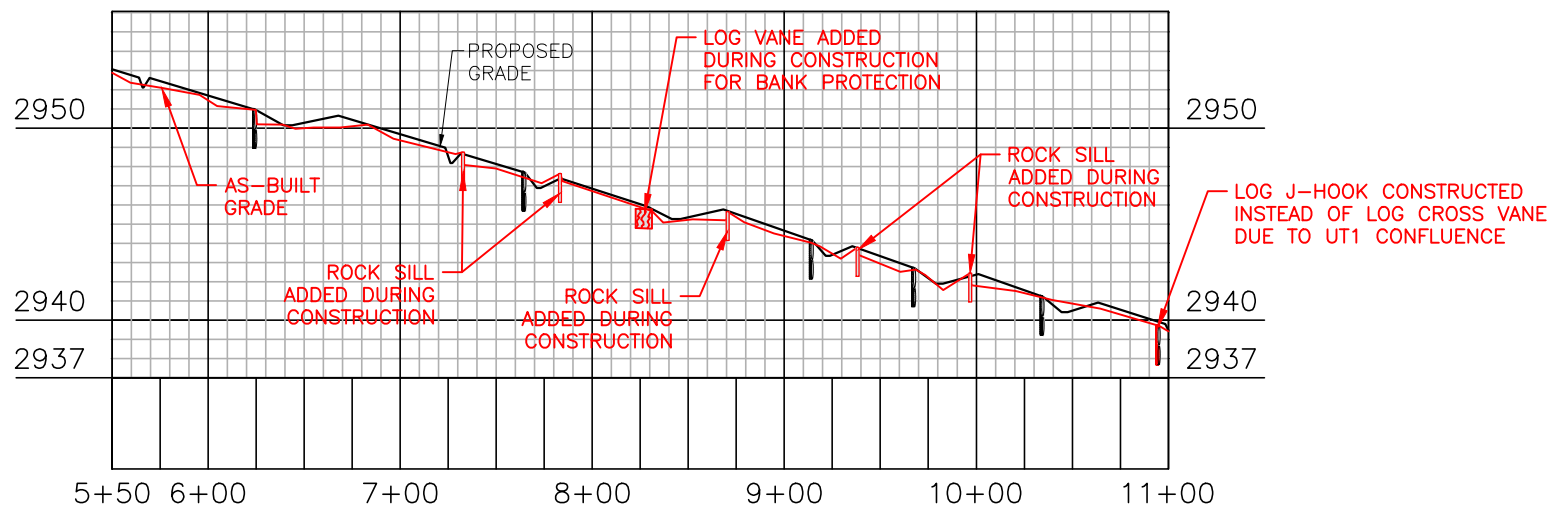
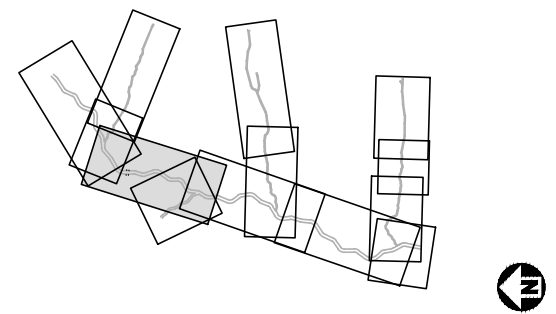
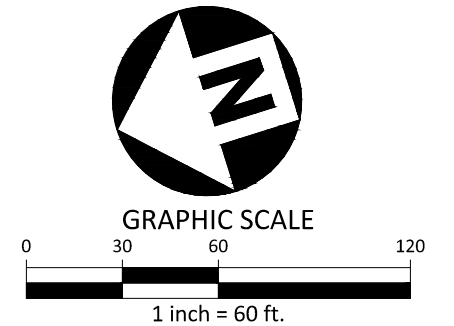
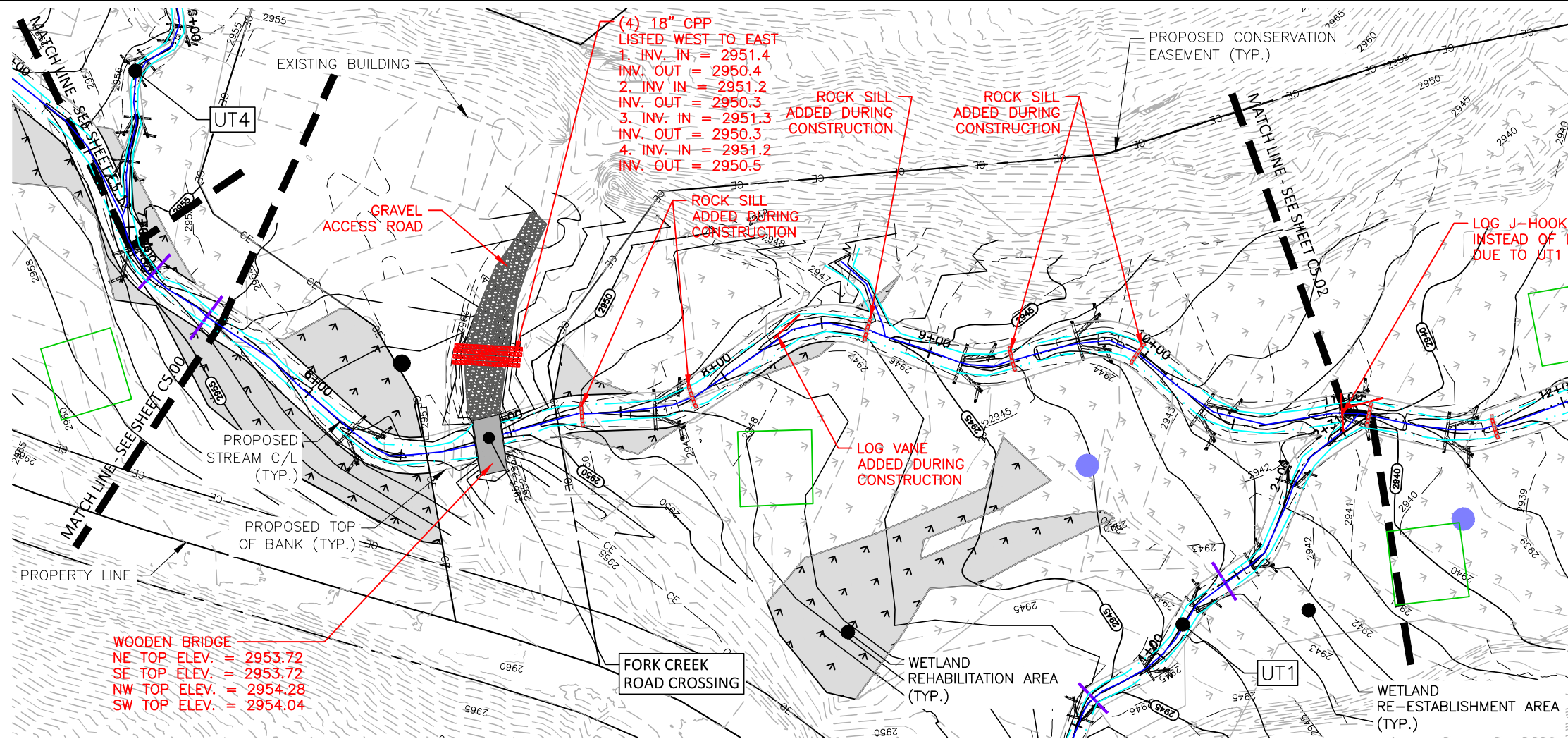
AS-BUILT DRAWINGS

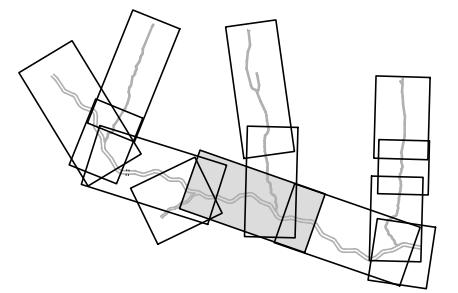
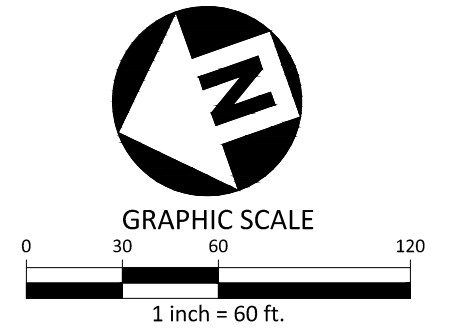
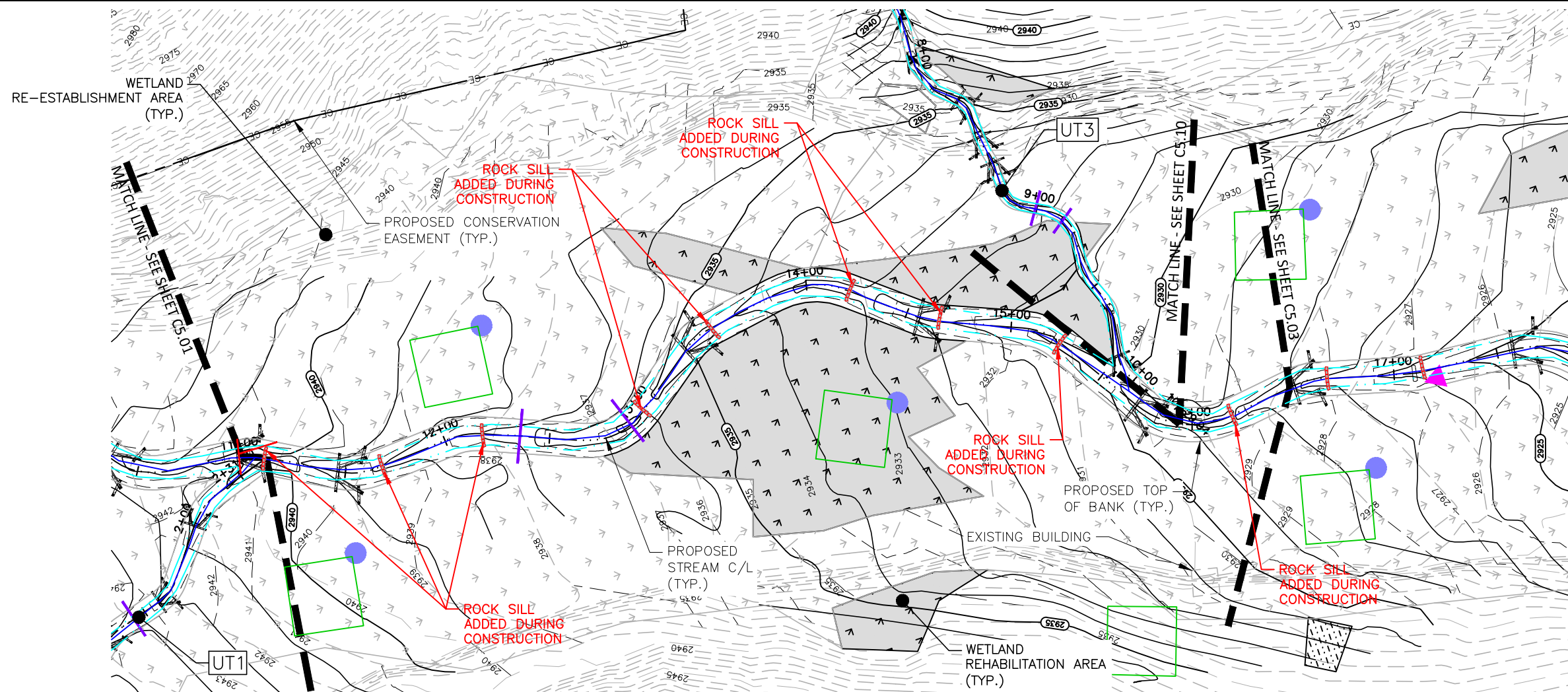
AVERY COUNTY, NORTH CAROLINA



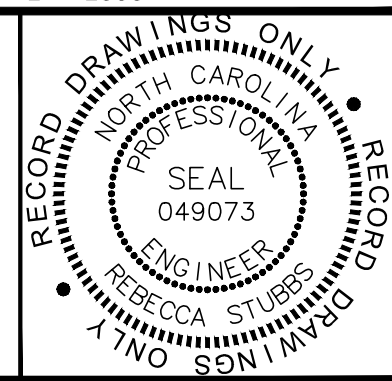
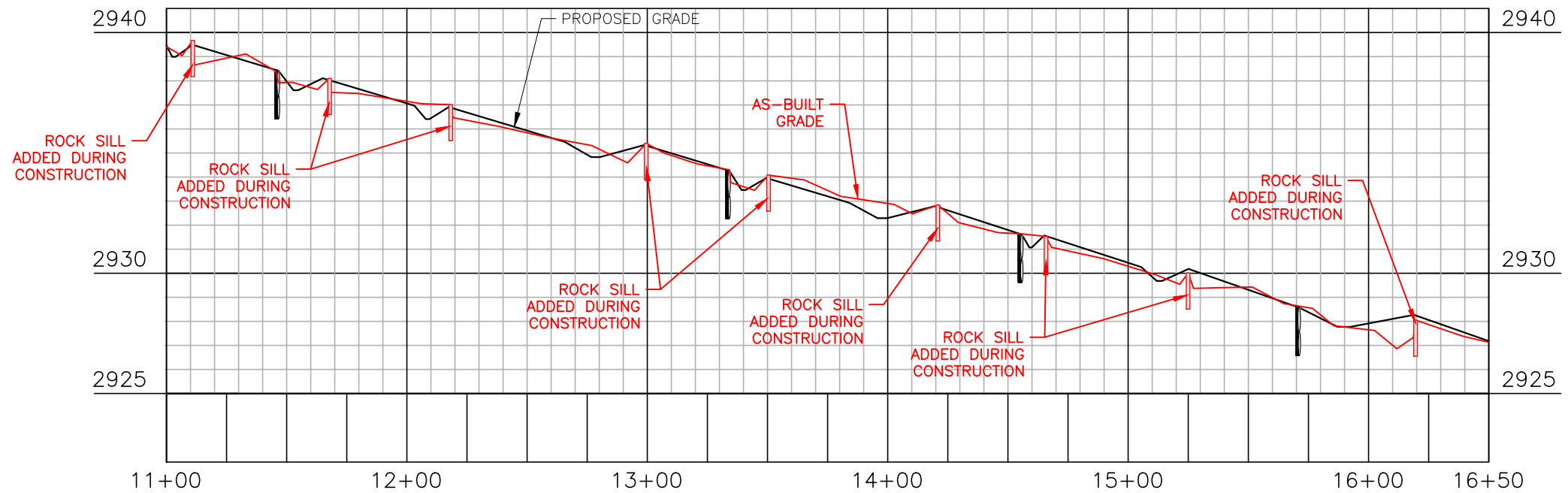
PLAN INFORMATION
PROJECT NO. AXI-19000
FILENAME AXI19000-P1
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1"=60' / 1"=50'
DATE 07.18.2022

PLAN AND PROFILE
FORK CREEK
STA. 00+00 THRU STA. 5+50
C5.00





VICINITY MAP
1" = 1000'



The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

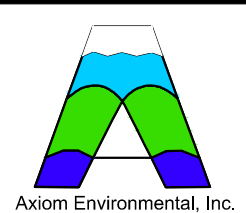
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

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LAUREL SPRINGS MITIGATION PLAN

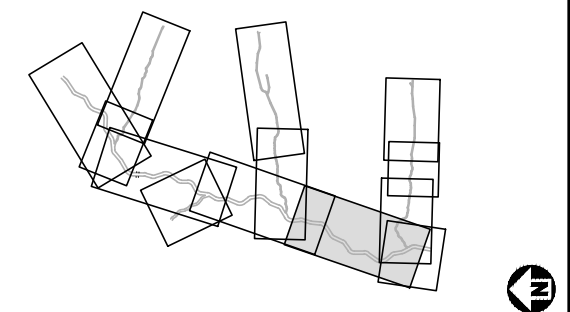
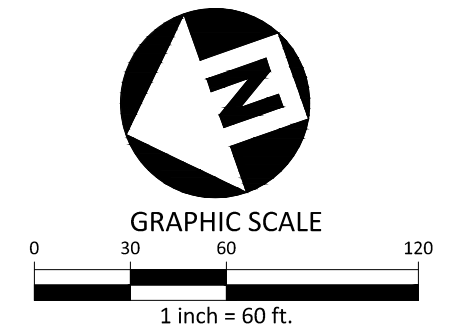
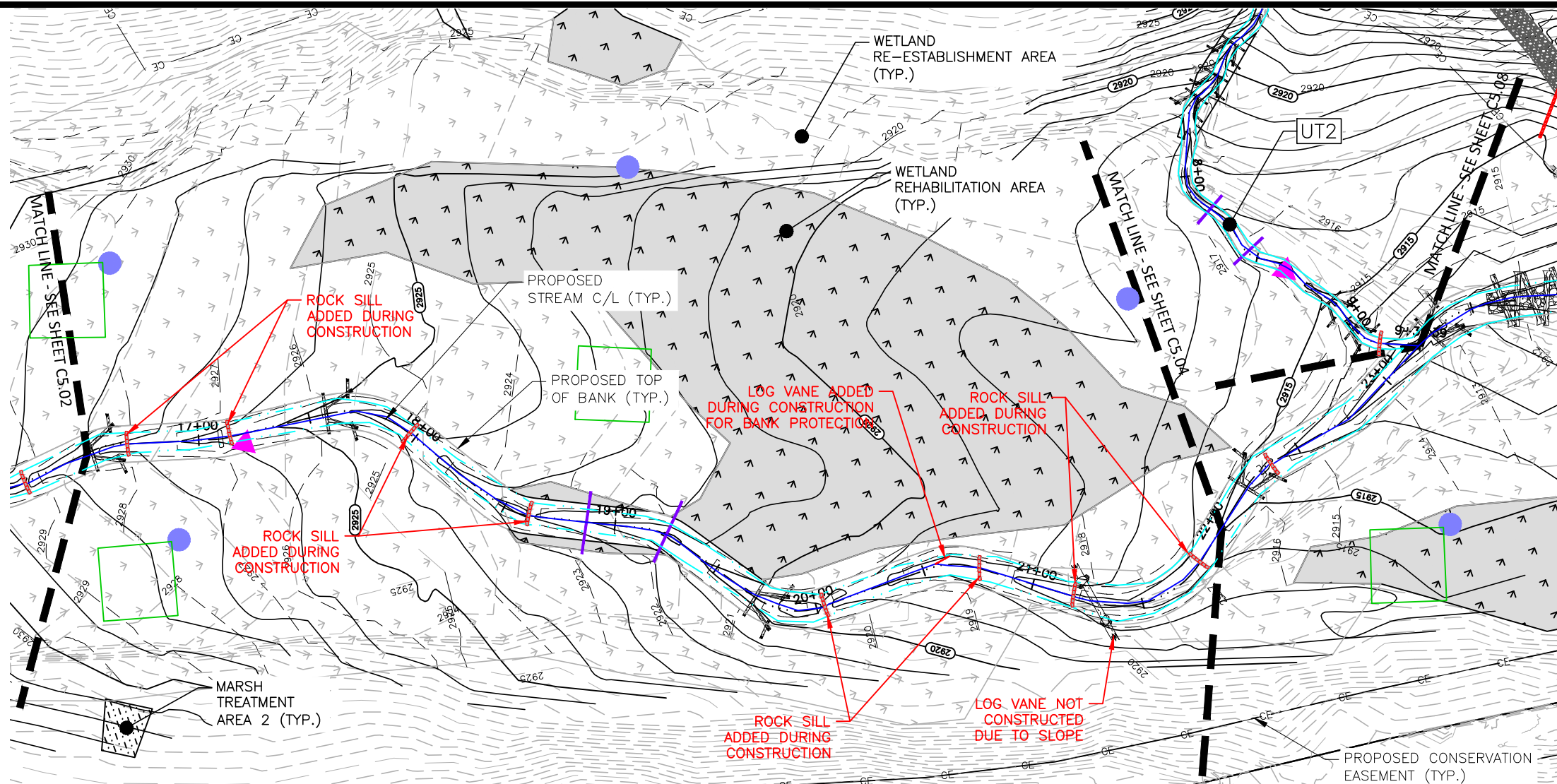
AS-BUILT DRAWINGS

AVERY COUNTY, NORTH CAROLINA

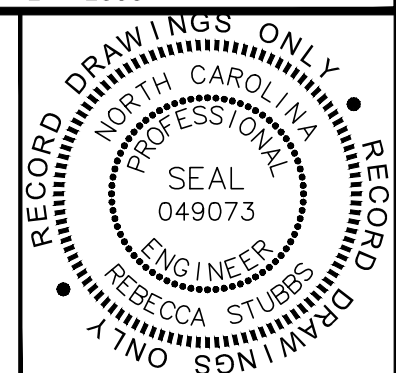
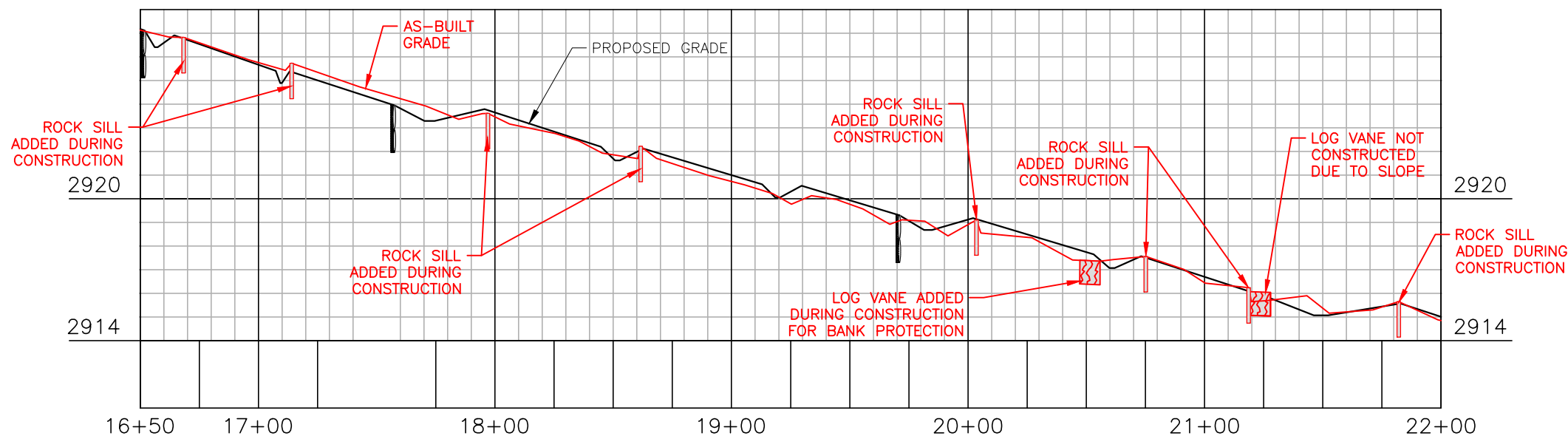


PLAN INFORMATION
PROJECT NO. AXI-19000
FILENAME AXI19000-P1
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1"=60' / 1"=60'
DATE 07.18.2022

PLAN AND PROFILE
FORK CREEK
STA. 11+00 THRU STA. 16+50
C5.02



VICINITY MAP
1" = 1000'



The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

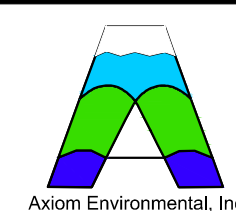
phone 919. 361. 5000
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LAUREL SPRINGS MITIGATION PLAN

AS-BUILT DRAWINGS

AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION

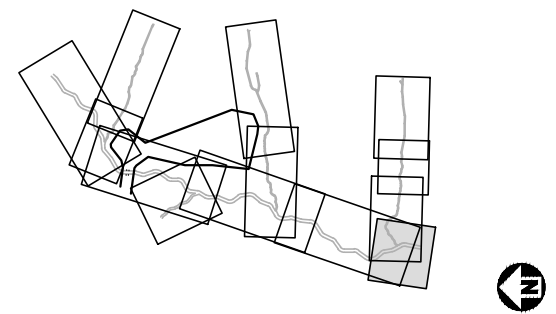
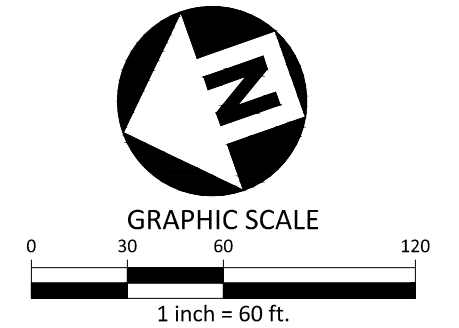
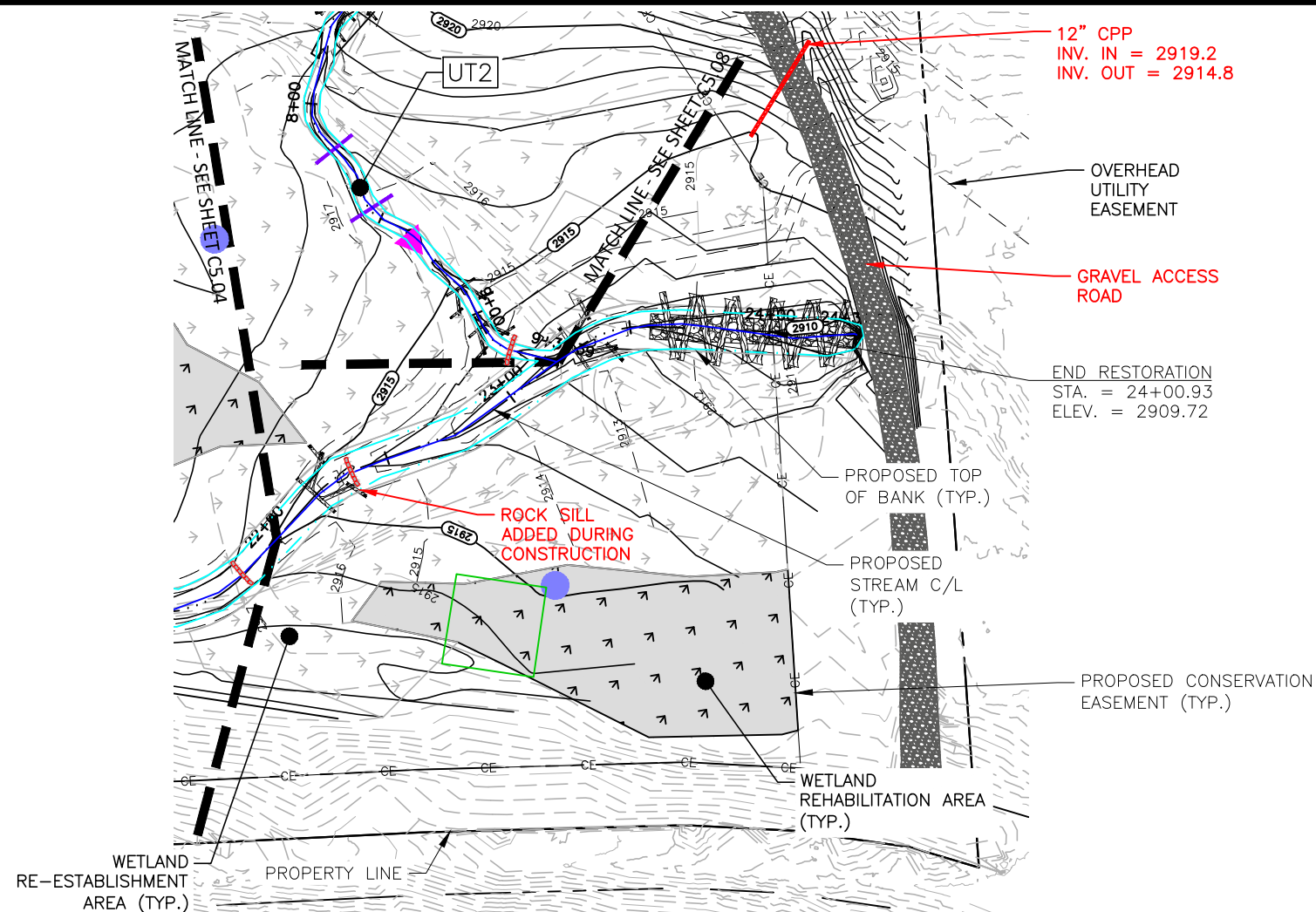
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PLAN AND PROFILE

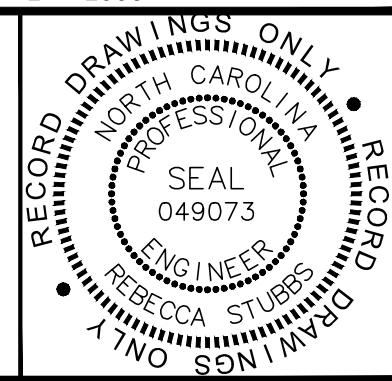
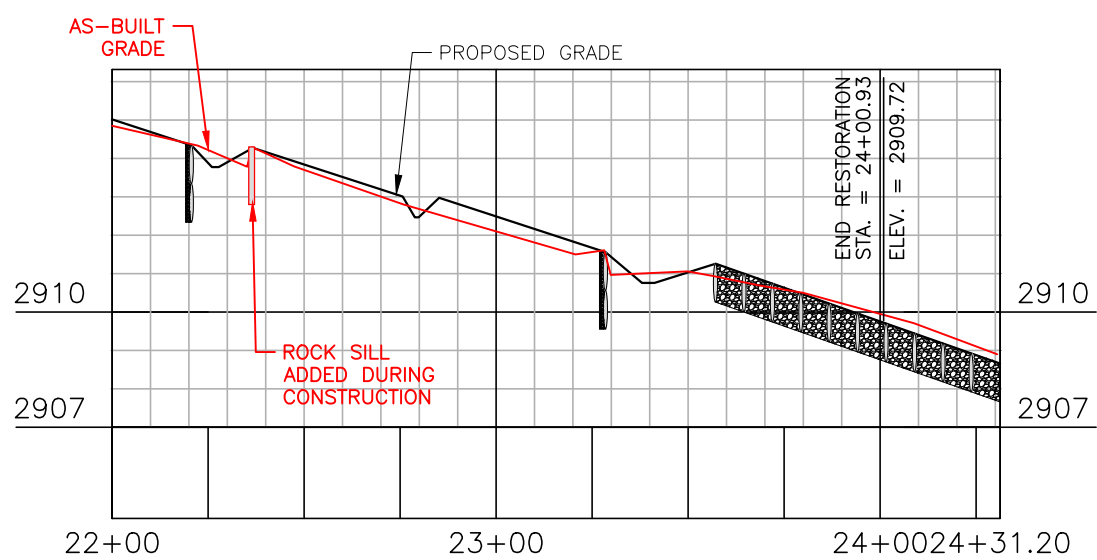
FORK CREEK

STA. 16+50 THRU STA. 22+00

C5.03



VICINITY MAP
1" = 1000'

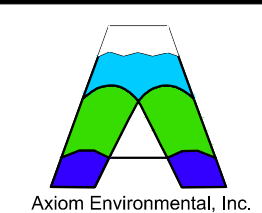


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LAUREL SPRINGS MITIGATION PLAN

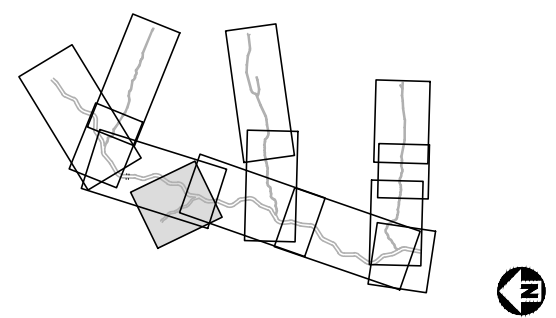
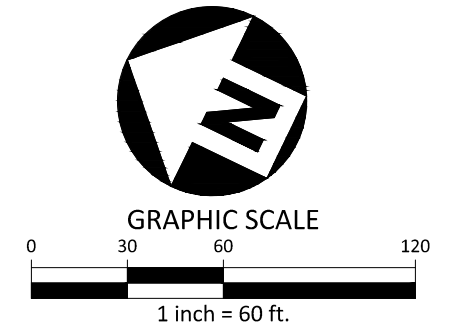
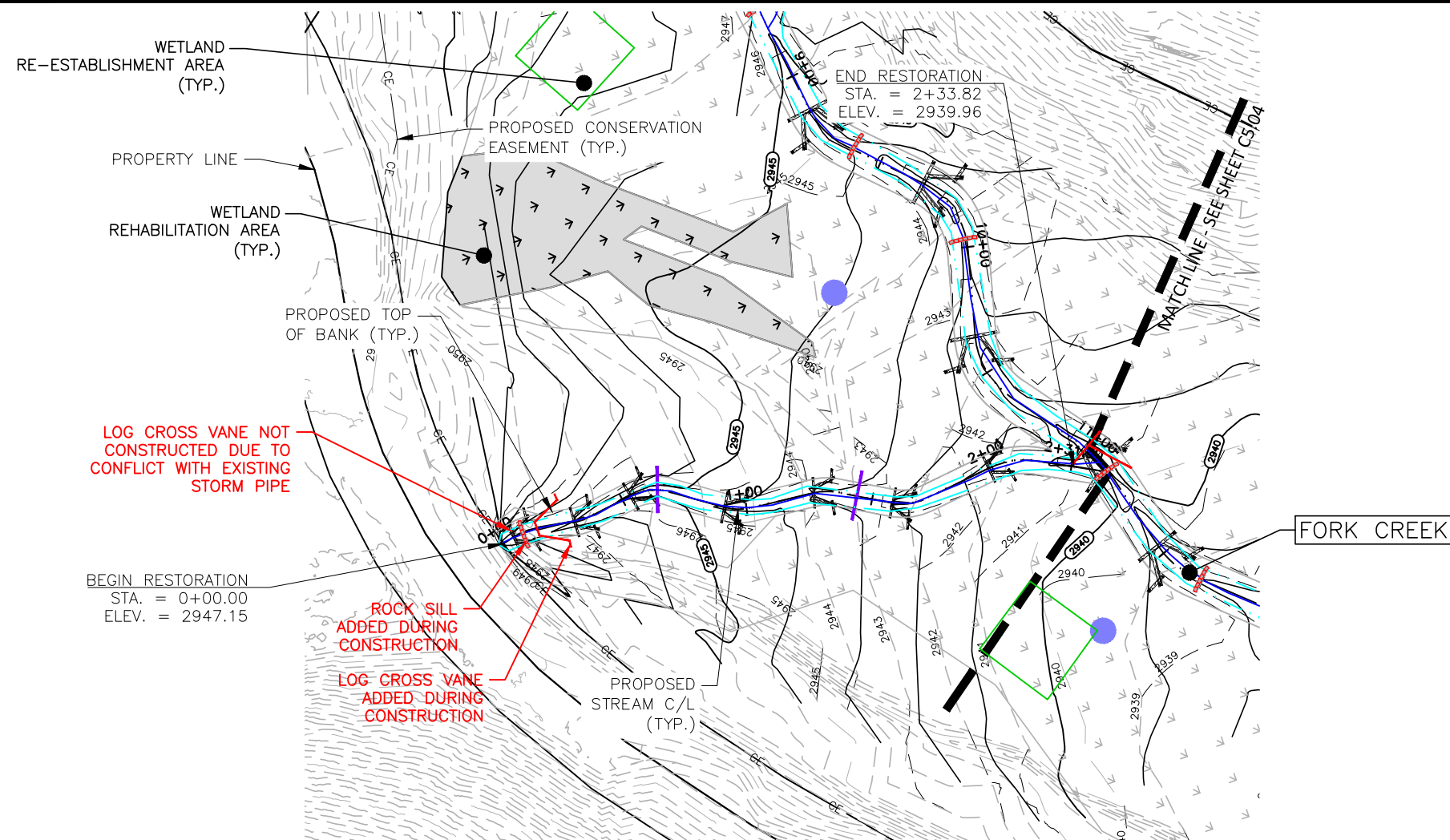
AS-BUILT DRAWINGS

AVERY COUNTY, NORTH CAROLINA

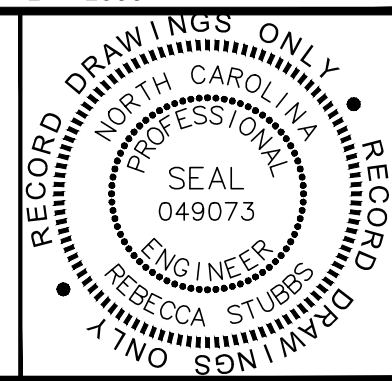
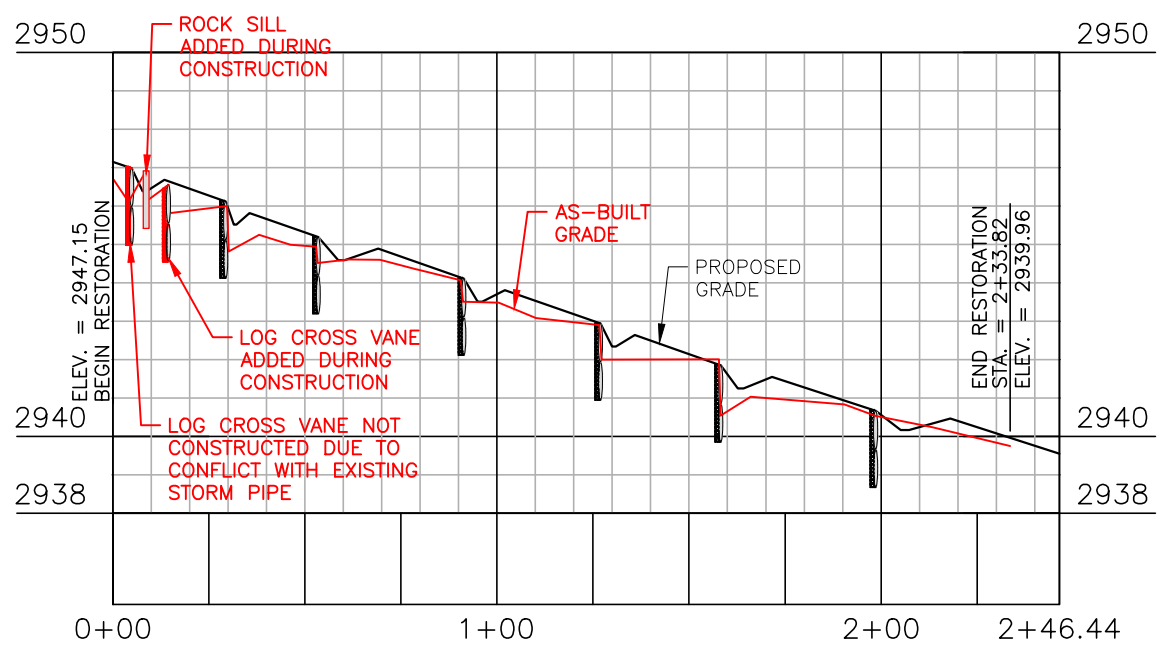


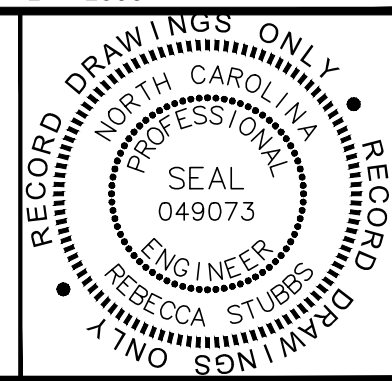
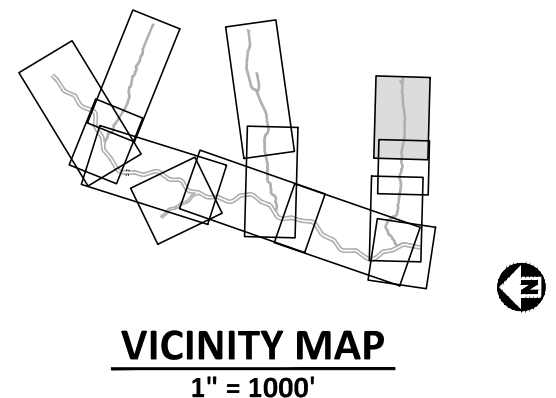
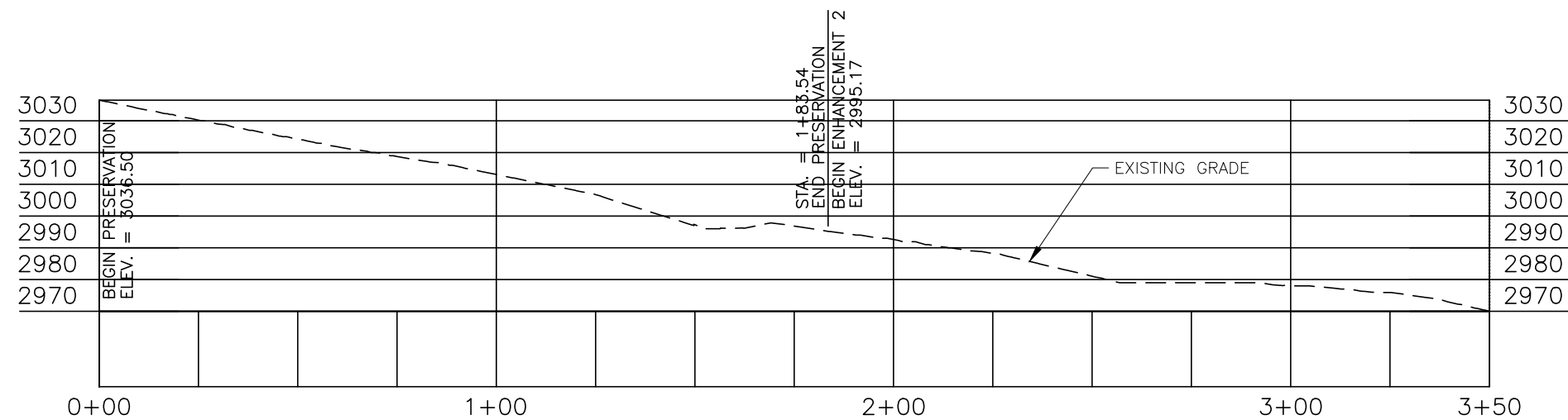
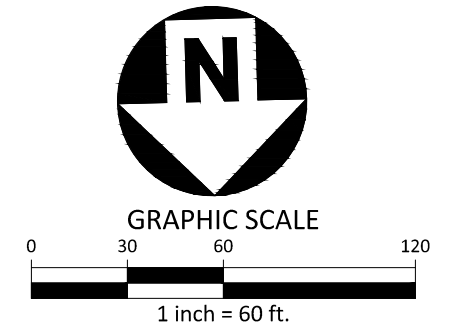
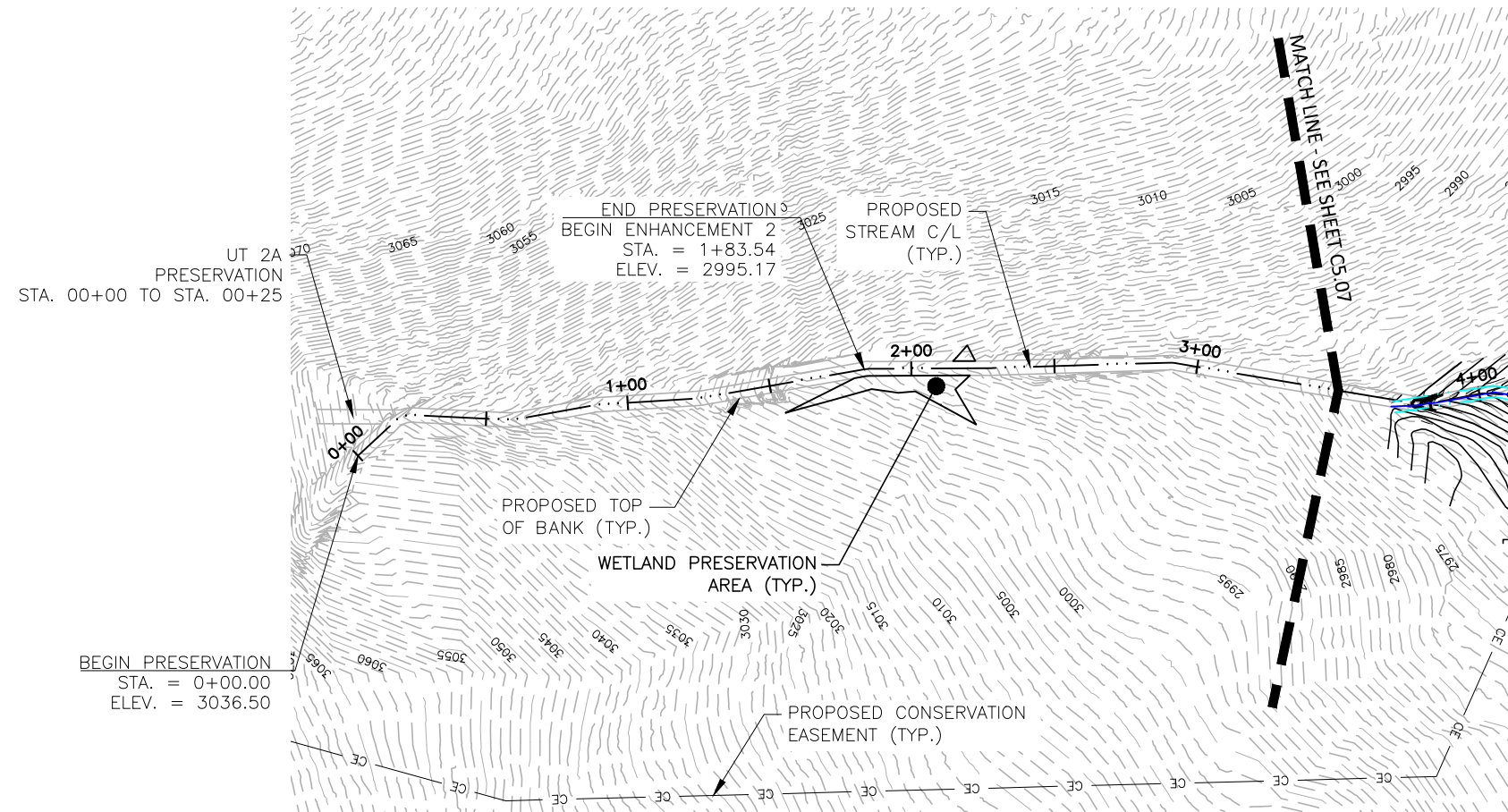
PLAN INFORMATION
PROJECT NO. AXI-19000
FILENAME AXI19000-P1
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1"=60' / 1"=50'
DATE 07.18.2022

PLAN AND PROFILE
FORK CREEK
STA. 22+00 THRU STA. 24+31.20
C5.04



VICINITY MAP
1" = 1000'





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Durham, NC 27713

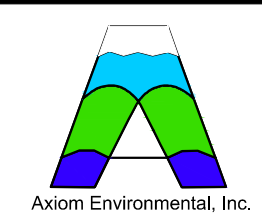
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

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LAUREL SPRINGS MITIGATION PLAN

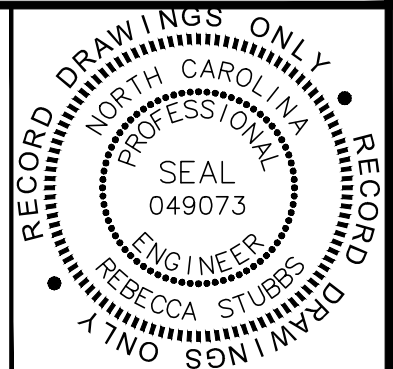
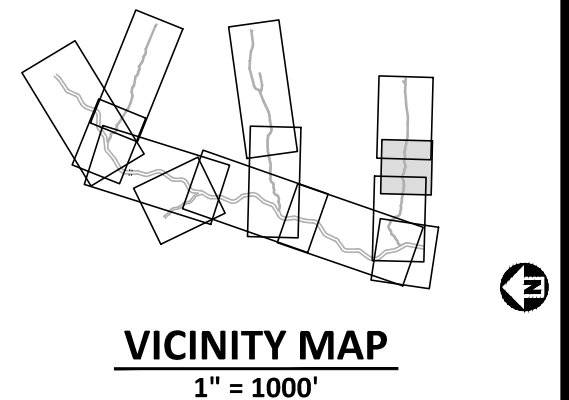
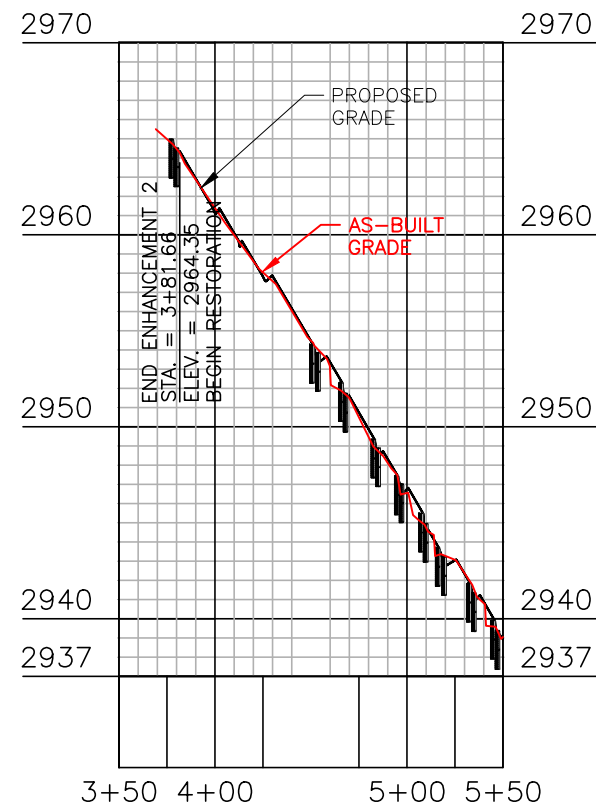
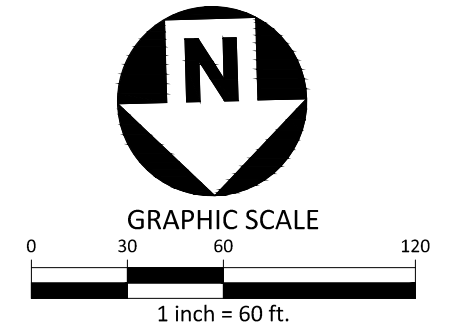
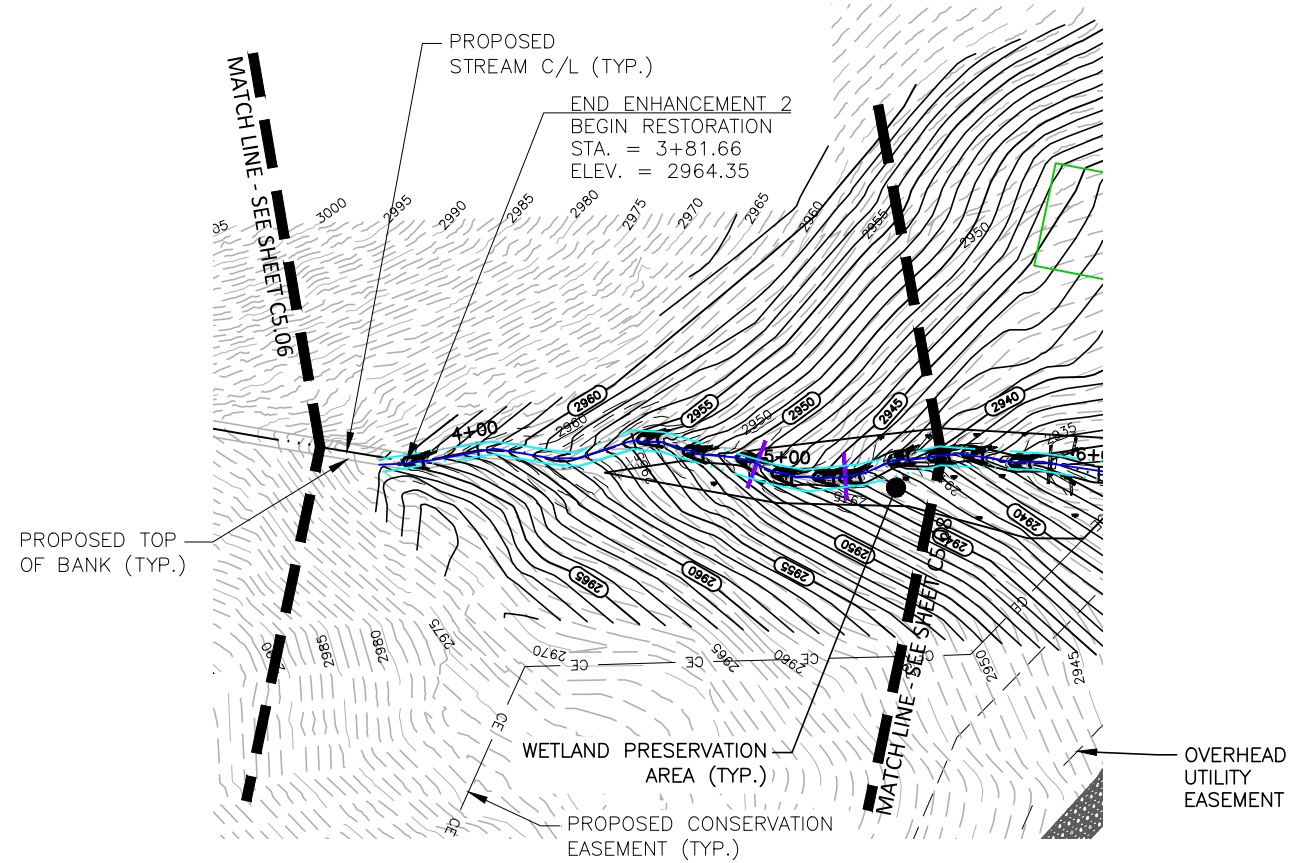
AS-BUILT DRAWINGS

AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION
PROJECT NO. AXI-19000
FILENAME AXI19000-P1
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1"=60' / 1"=40'
DATE 07.18.2022

PLAN AND PROFILE
UT2
STA. 00+00 THRU STA. 03+50
C5.06



The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

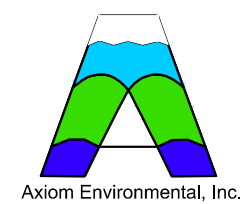
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

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LAUREL SPRINGS MITIGATION PLAN

AS-BUILT DRAWINGS

AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION

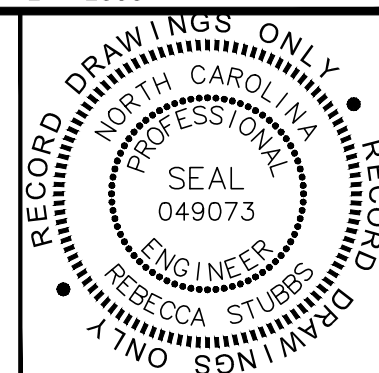
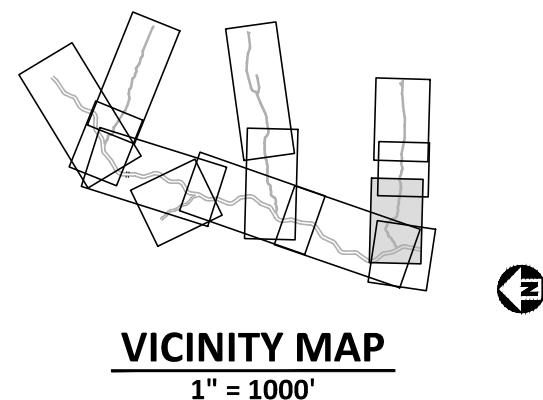
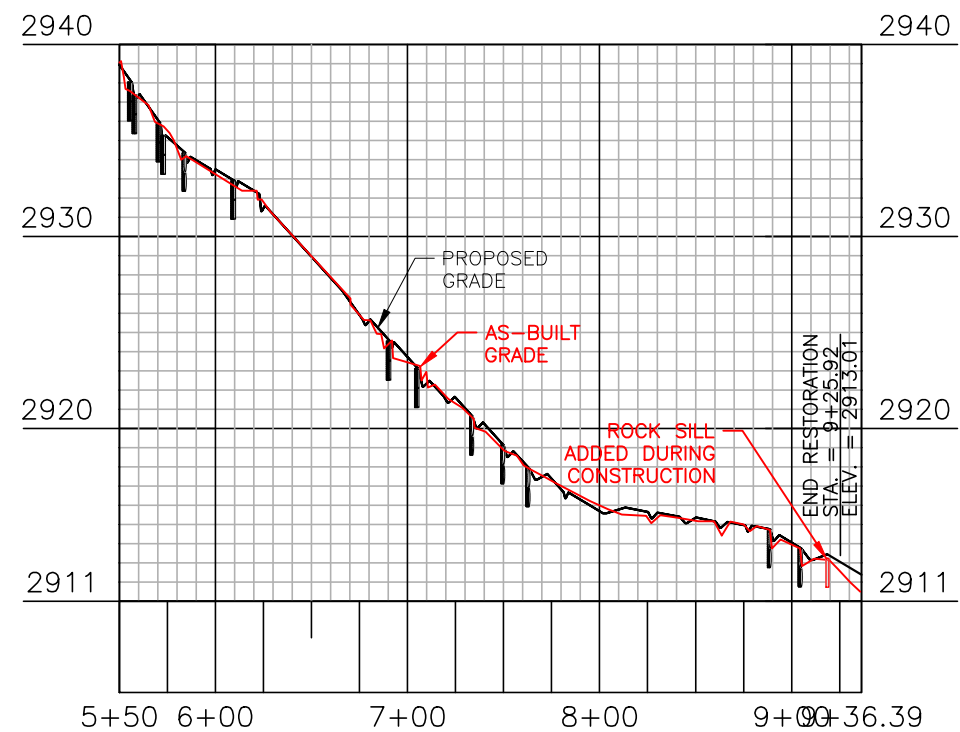
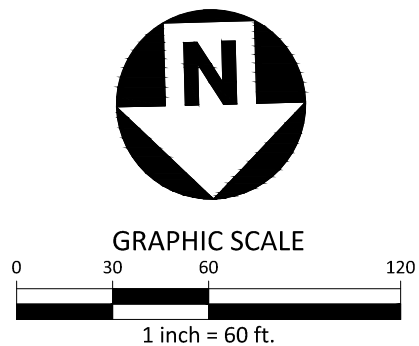
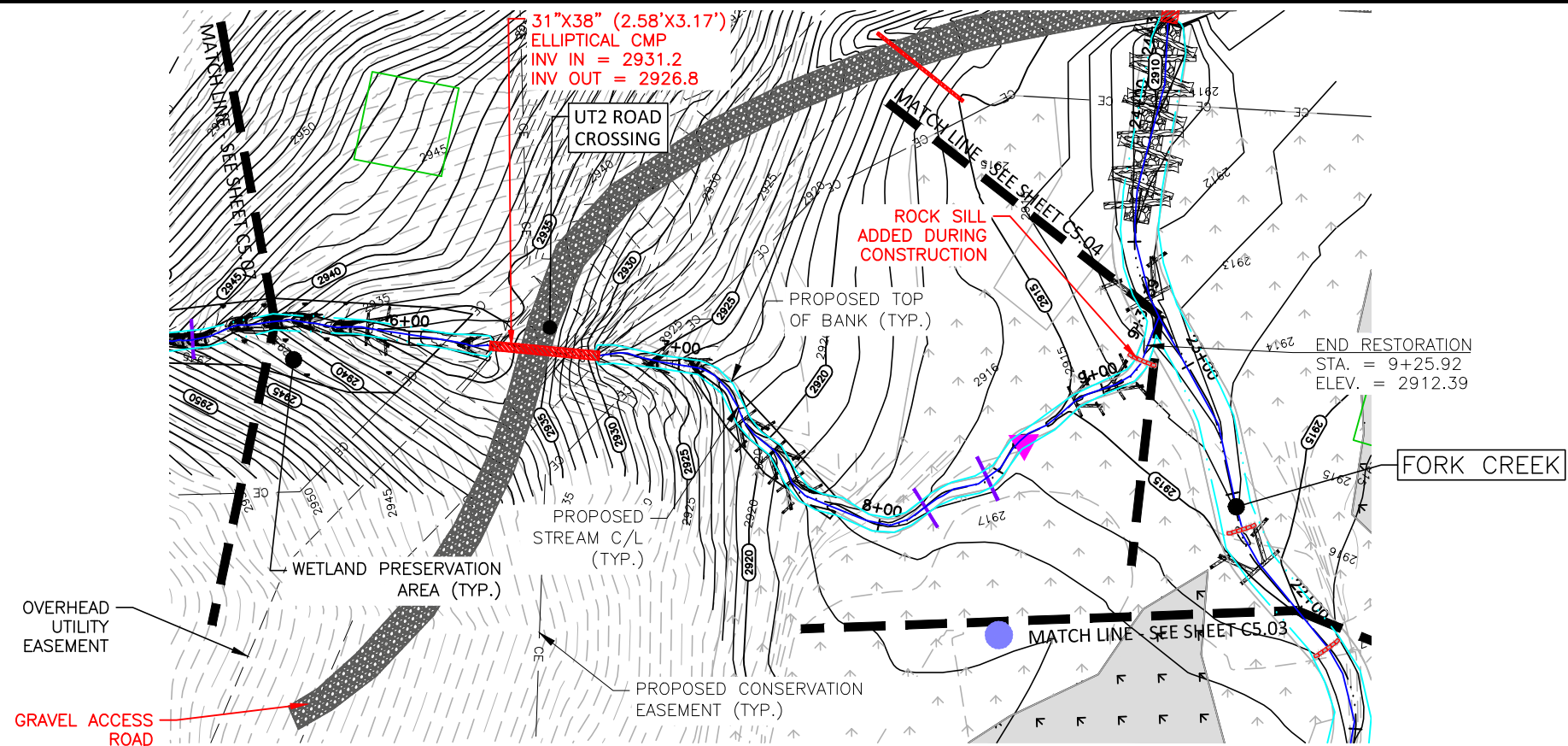
PROJECT NO. AXI-19000
FILENAME AXI19000-P1
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1"=60' / 1"=100'
DATE 07.18.2022

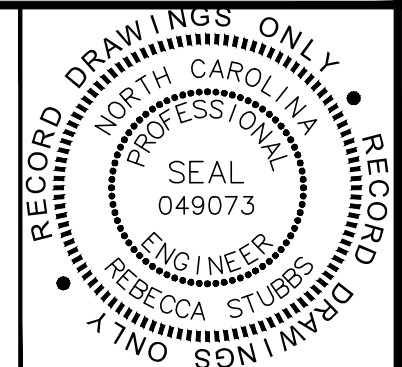
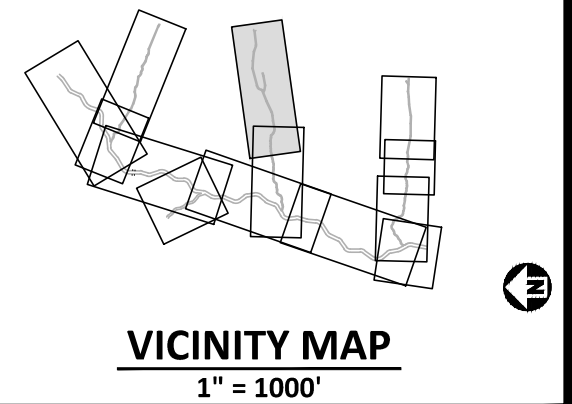
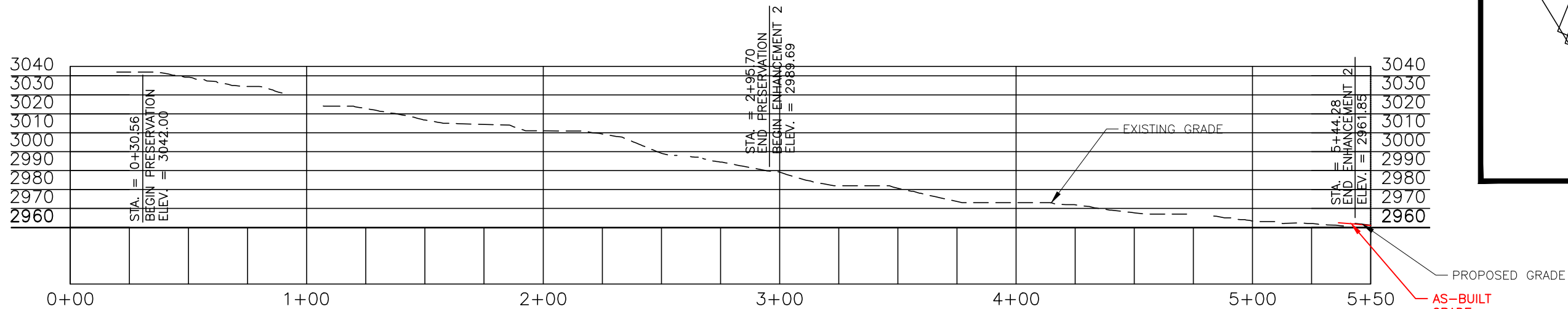
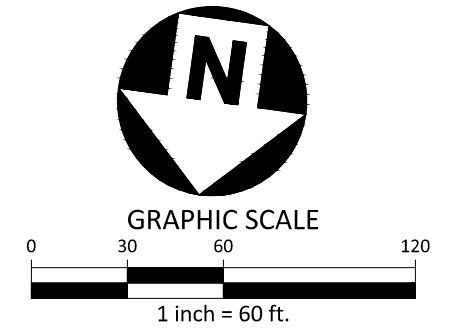
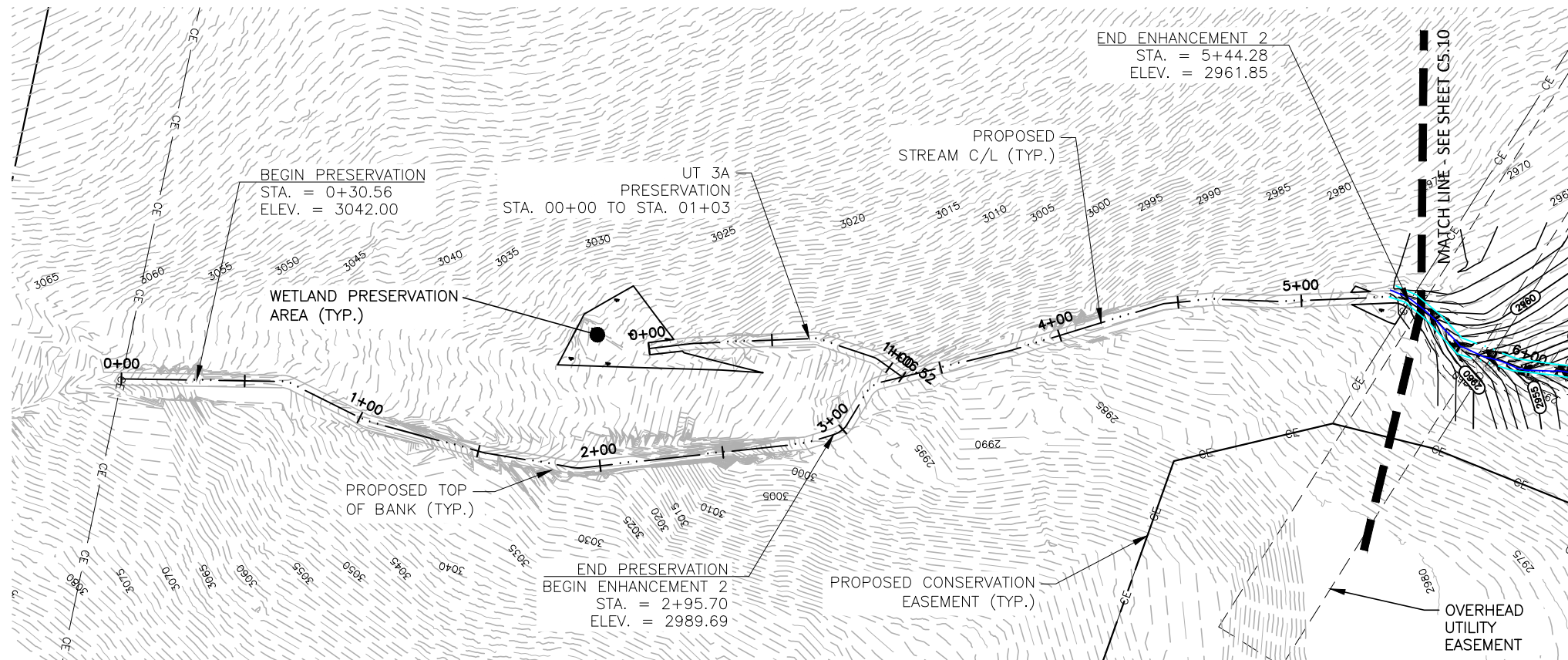
PLAN AND PROFILE

UT2

STA. 03+50 THRU STA. 05+50

C5.07





The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

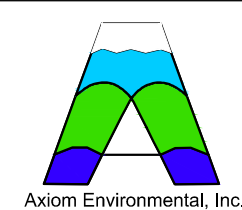
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

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LAUREL SPRINGS MITIGATION PLAN

AS-BUILT DRAWINGS

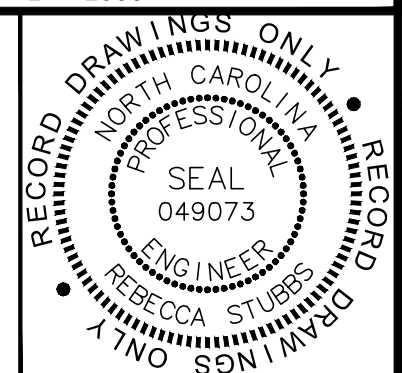
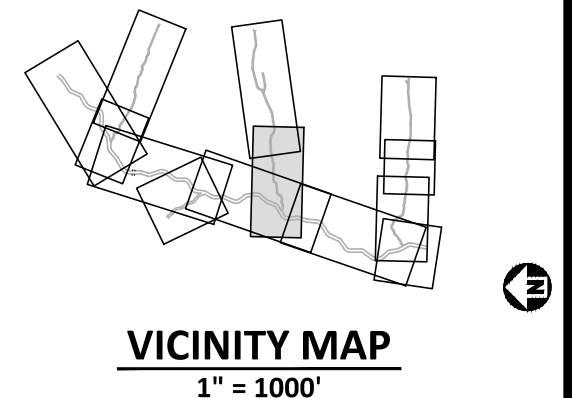
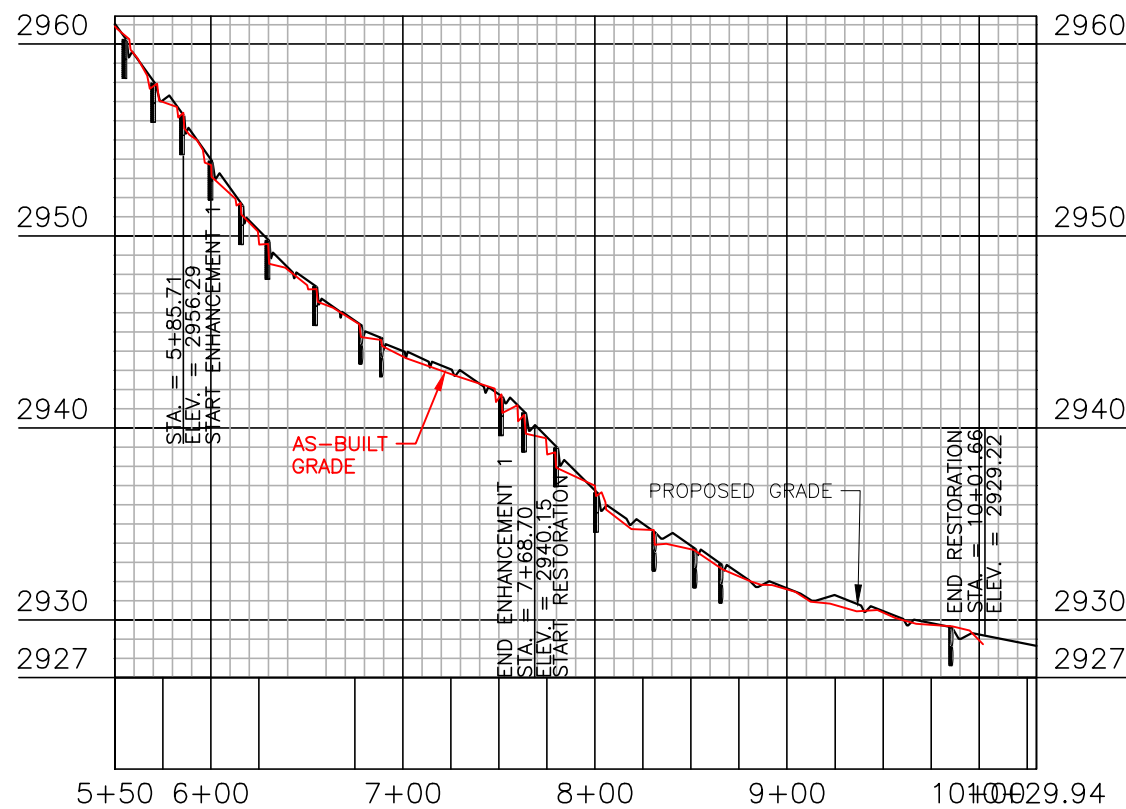
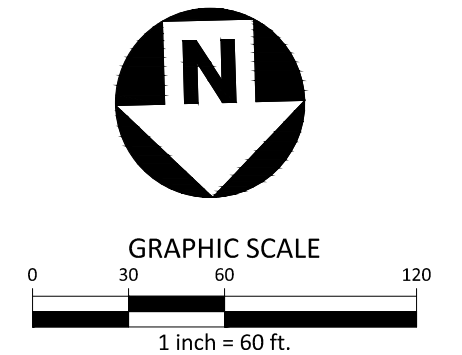
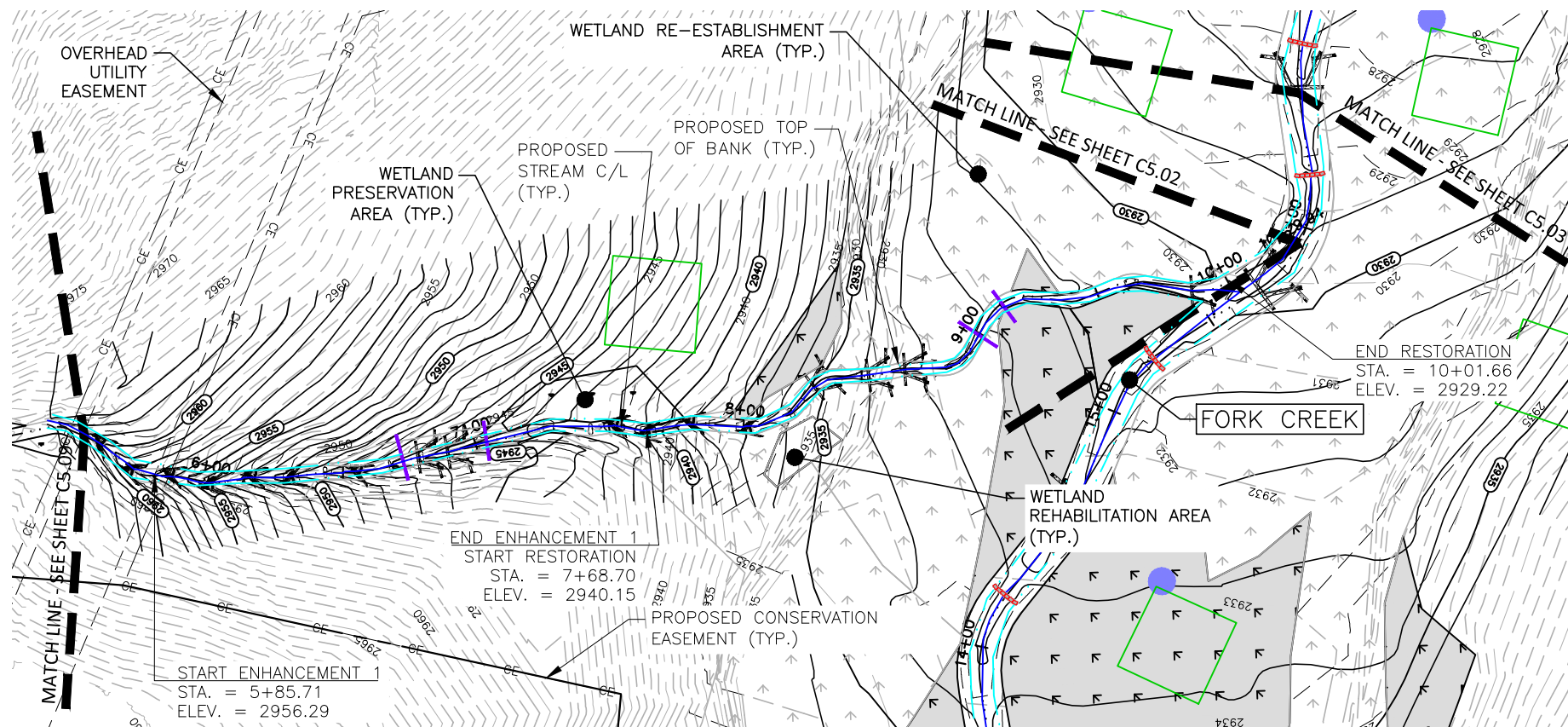
AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION

PROJECT NO. AXI-19000
FILENAME AXI19000-P1
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1"=60' / 1"=50'
DATE 07.18.2022

PLAN AND PROFILE
UT3
STA. 00+00 THRU STA. 05+50
C5.09



The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

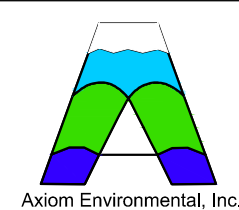
phone 919. 361. 5000
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license number: C-0293, C-187

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LAUREL SPRINGS MITIGATION PLAN

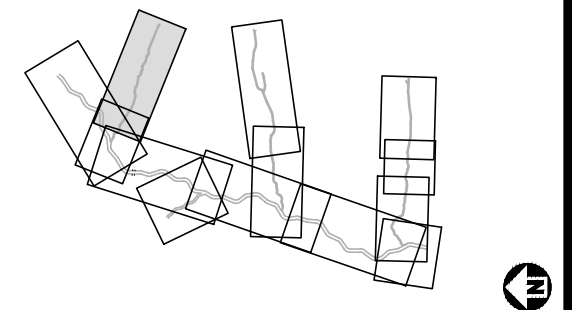
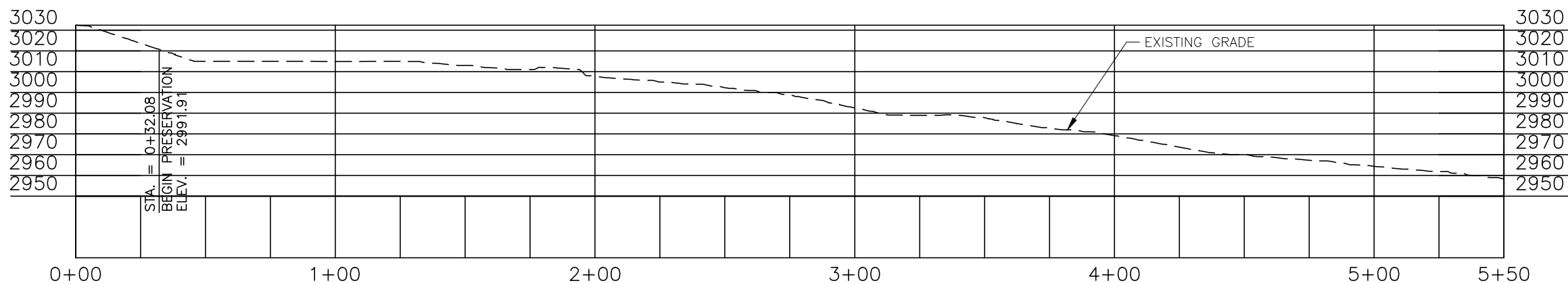
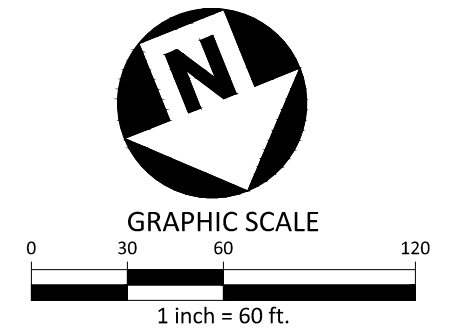
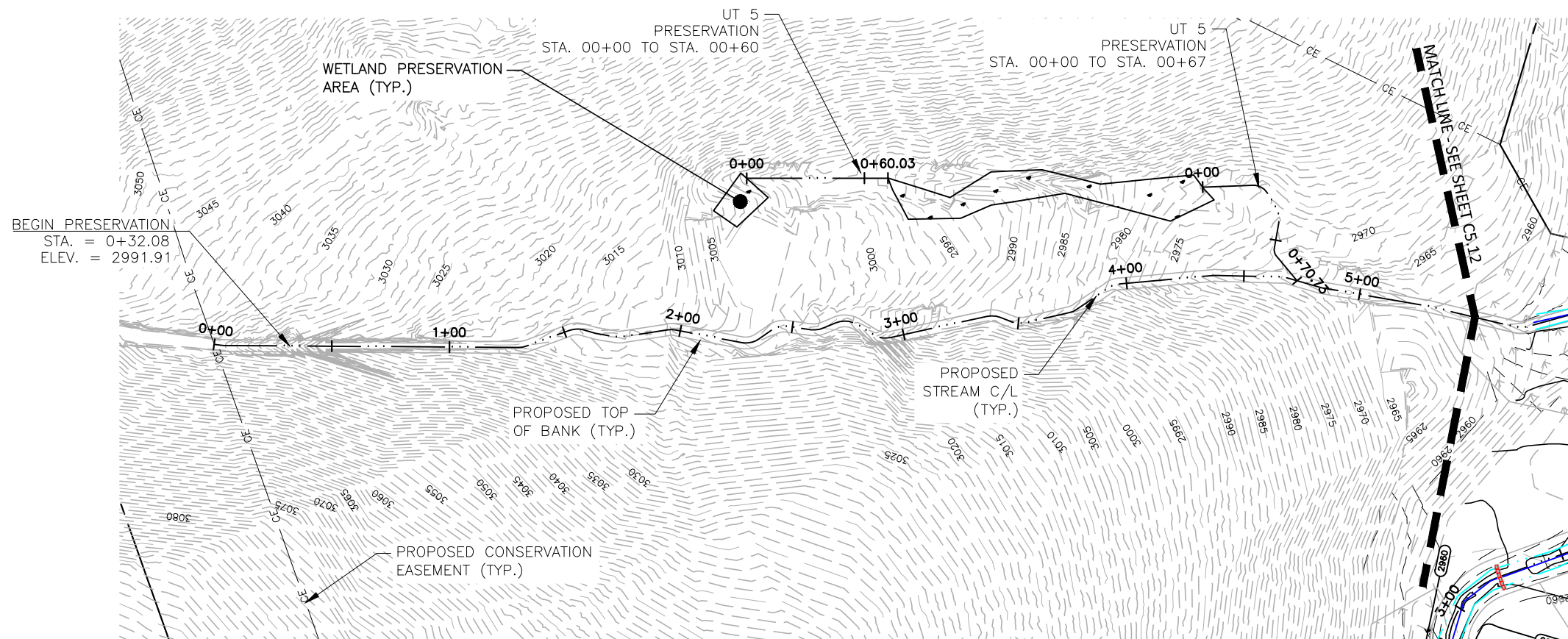
AS-BUILT DRAWINGS

AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION
PROJECT NO. AXI-19000
FILENAME AXI19000-P1
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1"=60' / 1"=100'
DATE 07.18.2022

PLAN AND PROFILE
UT3
STA. 05+50 THRU STA. 10+29.24
C5.10



VICINITY MAP
1" = 1000'



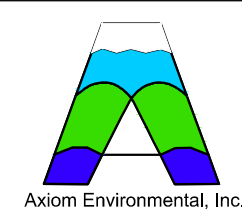
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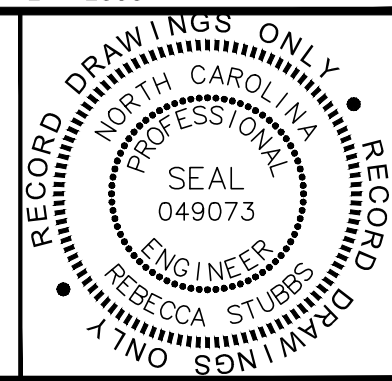
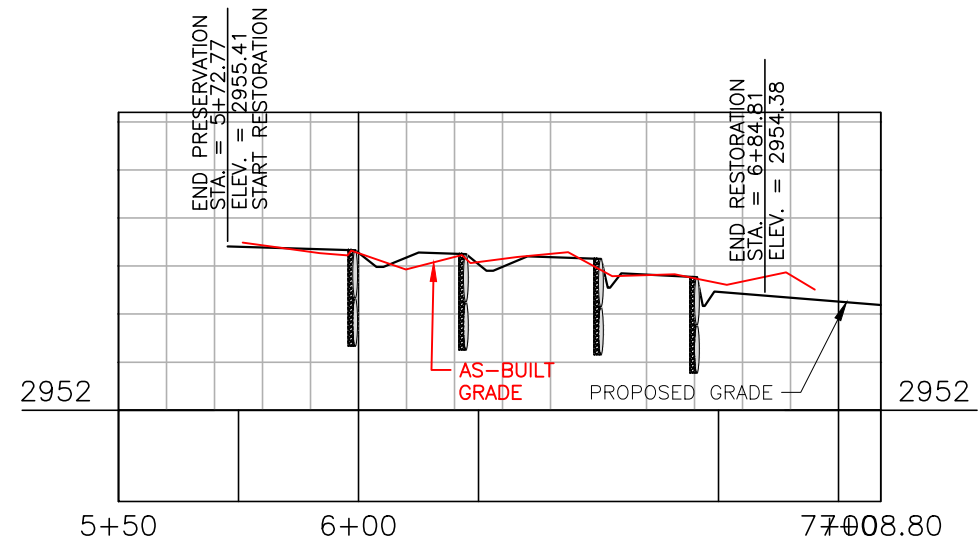
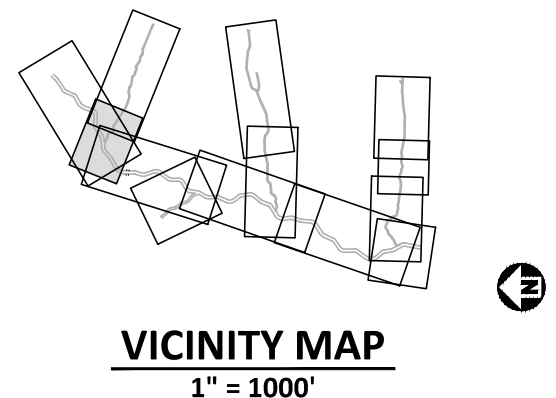
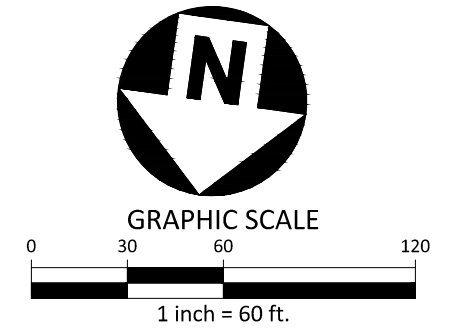
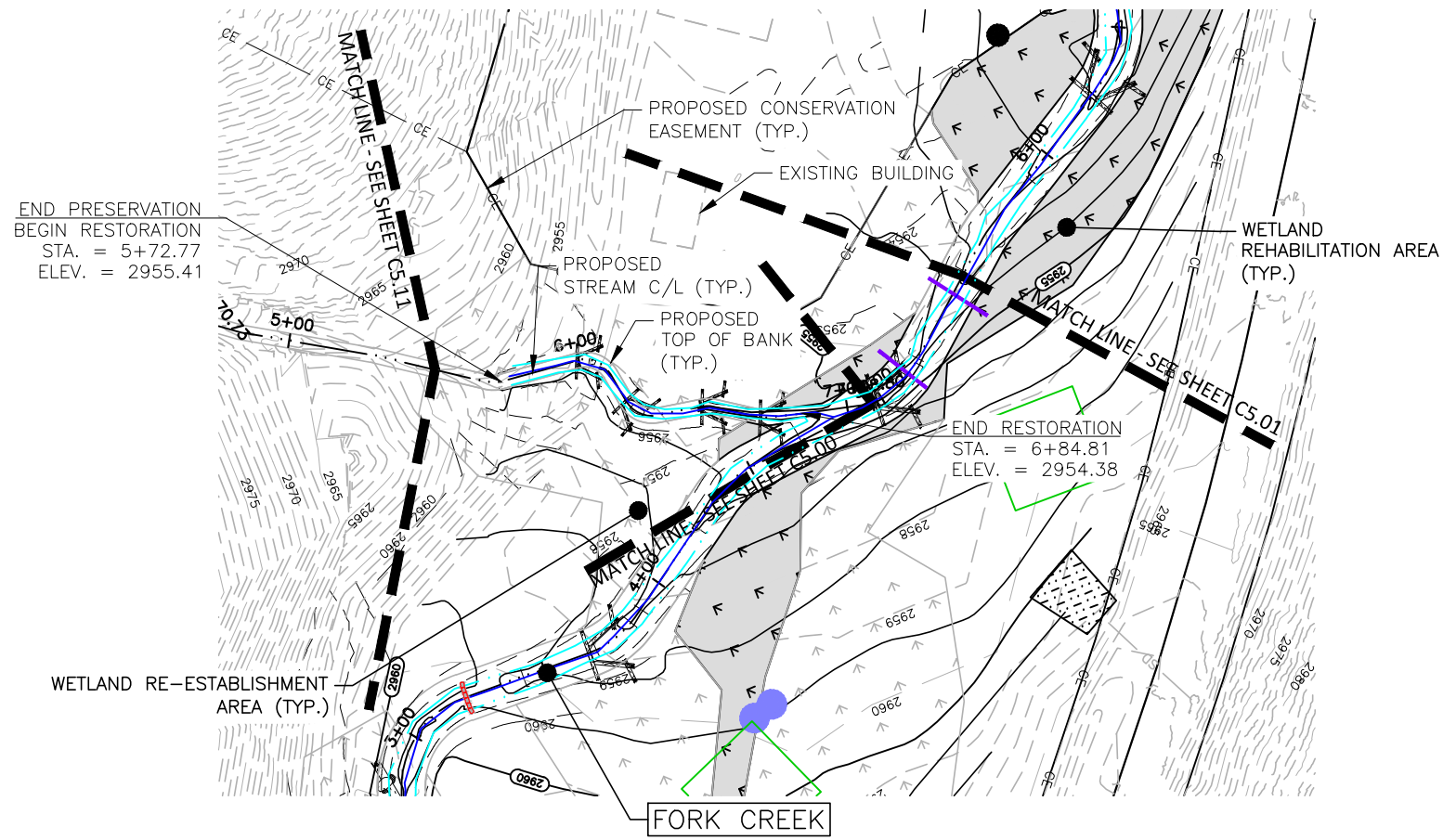
LAUREL SPRINGS MITIGATION PLAN

AS-BUILT DRAWINGS
AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION
PROJECT NO. AXI-19000
FILENAME AXI19000-P1
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1"=60' / 1"=50'
DATE 07.18.2022

PLAN AND PROFILE
UT4
STA. 00+00 THRU STA. 05+50
C5.11



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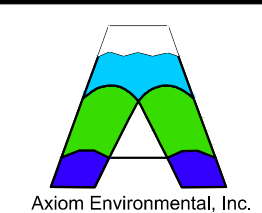
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LAUREL SPRINGS MITIGATION PLAN

AS-BUILT DRAWINGS

AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION

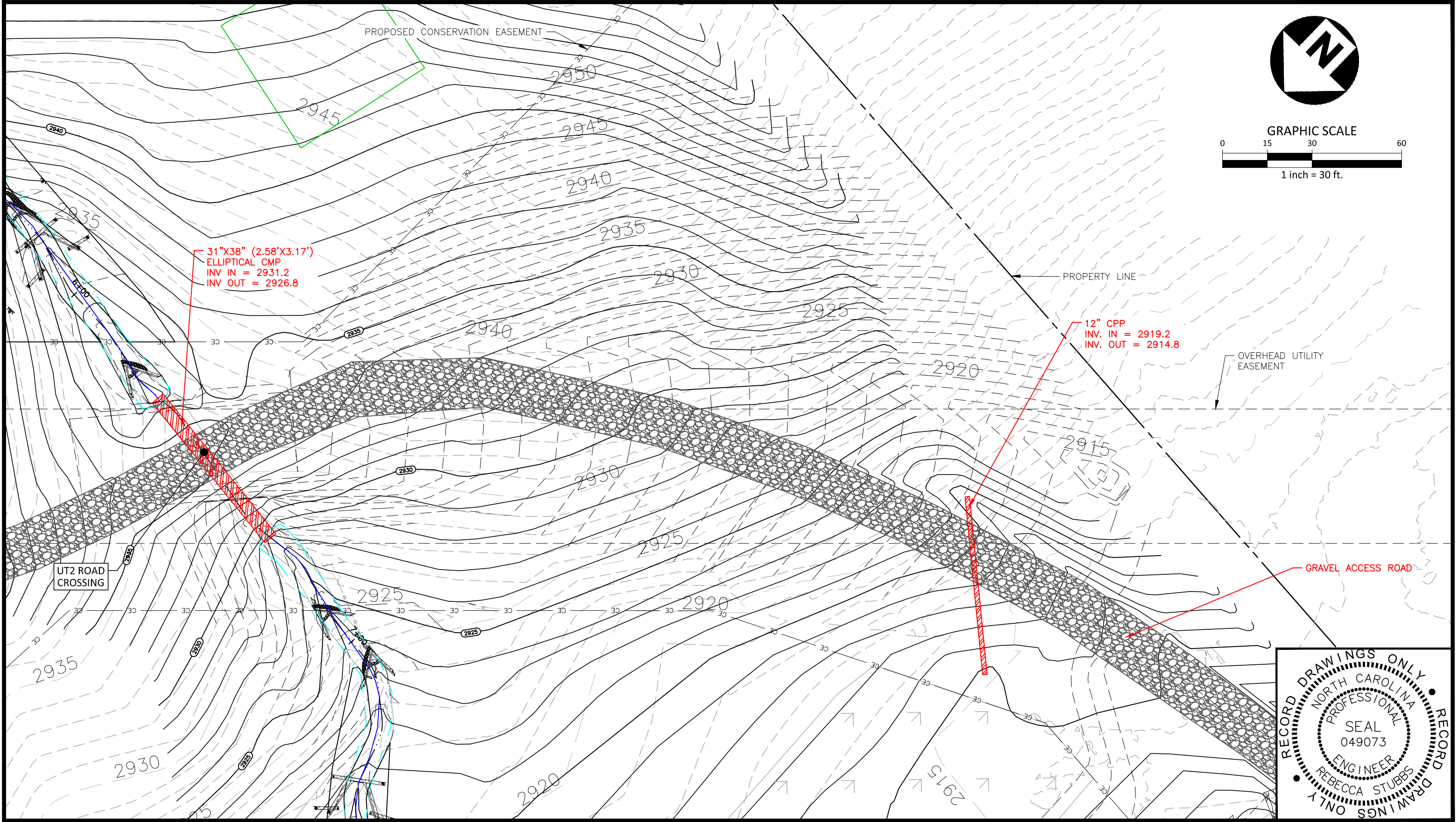
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FILENAME AXI19000-P1
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DRAWN BY CHJ
SCALE 1"=60' / 1"=40'
DATE 07.18.2022

PLAN AND PROFILE

UT4

STA. 05+50 THRU STA. 07+08.80

C5.12





The John R. McAdams Company, Inc.
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Durham, NC 27713

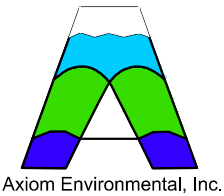
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LAUREL SPRINGS MITIGATION PLAN

AS-BUILT DRAWINGS

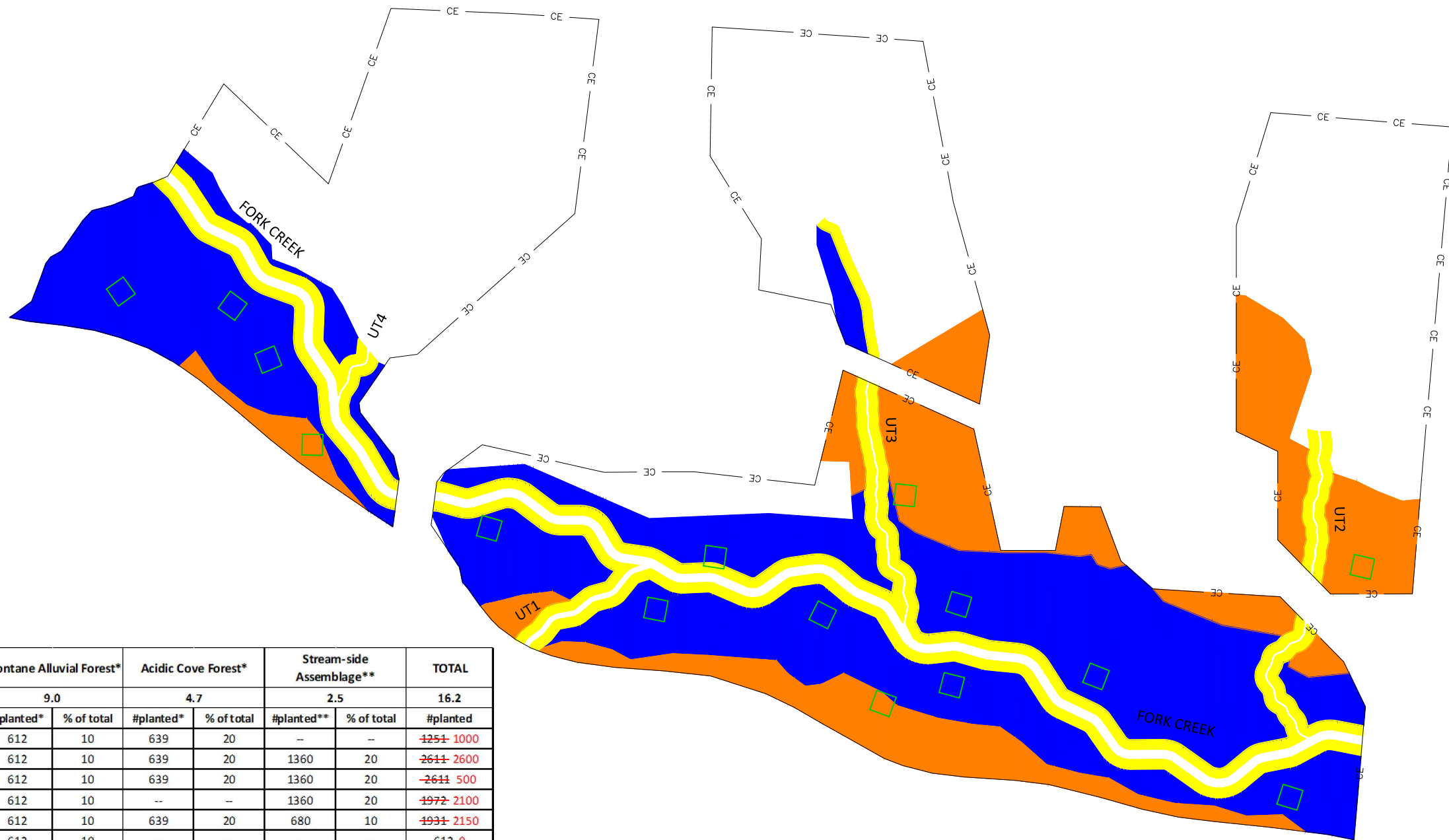
AVERY COUNTY, NORTH CAROLINA



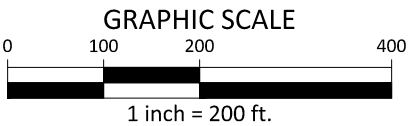
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PROJECT NO.	AXI-19000
FILENAME	AXI19000-P1
CHECKED BY	RAS
DRAWN BY	CHJ
SCALE	1"=60' / 1"=100'
DATE	07.18.2022

DRIVEWAY GRADING

C5.13

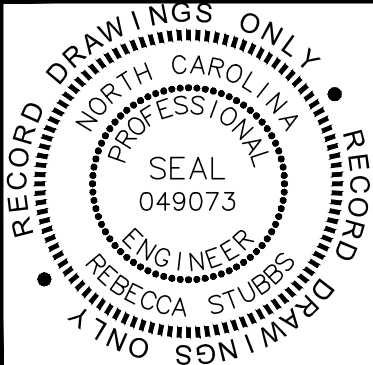


- STREAMSIDE ASSEMBLAGE
- MONTANE ALLUVIAL FOREST
- ACIDIC COVE FOREST
- VEGETATION MONITORING PLOT



Vegetation Association	Montane Alluvial Forest*		Acidic Cove Forest*		Stream-side Assemblage**		TOTAL
Area	9.0		4.7		2.5		16.2
Species	# planted*	% of total	#planted*	% of total	#planted**	% of total	#planted
Eastern hemlock (<i>Tsuga canadensis</i>)	612	10	639	20	--	--	1251 1000
Cherry birch (<i>Betula lenta</i>)	612	10	639	20	1360	20	2611 2600
Yellow birch (<i>Betula alleghaniensis</i>)	612	10	639	20	1360	20	2611 500
Sycamore (<i>Platanus occidentalis</i>)	612	10	--	--	1360	20	4972 2100
Tulip poplar (<i>Liriodendron tulipifera</i>)	612	10	639	20	680	10	4931 2150
Shadbush (<i>Amelanchier arborea</i>)	612	10	--	--	--	--	612 0
White oak (<i>Quercus alba</i>)	612	10	--	--	--	--	612 1100
River birch (<i>Betula nigra</i>)	612	10	--	--	680	10	1292 1450
White pine (<i>Pinus strobus</i>)	612	10	--	--	--	--	612 600
Red spruce (<i>Picea rubens</i>)	612	10	--	--	--	--	612 250
Red oak (<i>Quercus rubra</i>)	--	--	639	20	--	--	639 1100
Black willow (<i>Salix nigra</i>)	--	--	--	--	1360	20	1360 0
Scarlet oak (<i>Quercus coccinea</i>)							1100
Bitternut hickory (<i>Carya cordiformis</i>)							800
American hazelnut (<i>Corylus americana</i>)							600
Arrowwood (<i>Viburnum dentatum</i>)							1500
TOTAL	6120	100	3196	100	6800	100	16116 16850

* Planted at a density of 680 stems/acre
** Planted at a density of 2720 stems/acre

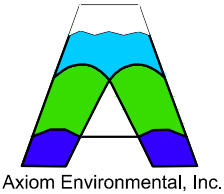


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LAUREL SPRINGS MITIGATION PLAN
AS-BUILT DRAWINGS
AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION
PROJECT NO. AXI-19000
FILENAME AXI19000-LS
CHECKED BY RAS
DRAWN BY CHJ
SCALE 1"=200'
DATE 07.18.2022

PLANTING PLAN

L5.00

TEMPORARY SEEDING SCHEDULE:

TEMPORARY SEEDING SHALL BE APPLIED AS NEEDED DURING CONSTRUCTION TO STABILIZE BARE OR DISTURBED AREAS OF SOIL AND AT THE COMPLETION OR ALL GRADING AND EARTHWORK ACTIVITIES WITHIN A PARTICULAR AREA OF THE SITE. PERMANENT SEED MAY BE DISTRIBUTED WITH TEMPORARY SEED UPON THE FINAL APPLICATION OF TEMPORARY SEED.

SEEDING DATE	SEEDING MIXTURE	APPLICATION RATE
AUG 15 - MAY 15	ANNUAL RYE (GRAIN)	30 LBS/AC
AUG 15 - MAY 15	WINTER WHEAT	30 LBS/AC
MAY 15 - AUG 15	GERMAN MILLET	10 LBS/AC
MAY 15 - AUG 15	BROWNTOP MILLET	10 LBS/AC

SEEDING METHODS

- EVENLY APPLY SEED USING A CYCLONE SEEDER, DRILL, CULTIPACKER SEEDER, OR HYDROSEEDER. THIS MUST BE DONE WITHIN 48 HOURS OF LAND DISTURBING ACTIVITIES.
- MULCH WITH CLEAN WHEAT STRAW.
- AFTER SEEDING, APPLY MULCH TO AREAS UNDER HARSH CONDITIONS SUCH AS AREAS THAT HAVE BEEN GRADED, OR THOSE WHICH WILL RECEIVE CONCENTRATED FLOWS. AREAS CONSIDERED TO BE UNDER HARSH CONDITIONS WILL BE CONSIDERED THE AREAS GRADED FOR THE WETLAND VALLEY.
- RESEED AND MULCH AREAS WHERE SEEDLING EMERGENCE IS LESS THAN 80% COVERAGE, OR WHERE EROSION OCCURS, AS SOON AS POSSIBLE. DO NOT MOW. PROTECT FROM TRAFFIC AS MUCH AS POSSIBLE.

NOTES

- TEMPORARY ANNUAL SEED SELECTION SHOULD BE BASED ON SEASON OF PROJECT INSTALLATION.
- A SINGLE SPECIES FOR TEMPORARY COVER IS ACCEPTABLE
- IN SOME CASES WHERE SEASONS OVERLAP, A MIXTURE OF TWO OR MORE SPECIES MAY BE NECESSARY. HOWEVER, APPLICATION RATES SHOULD NOT EXCEED THE TOTAL RECOMMENDED RATE PER ACRE.
- TEMPORARY SEED SHOULD BE MIXED AND APPLIED SIMULTANEOUSLY WITH THE PERMANENT SEED MIX IF OPTIMAL PLANTING DATES ALLOW.

PERMANENT SEEDING SCHEDULE:

PLANT MATERIAL SELECTION

- REFER TO THE TABLES ON THIS SHEET FOR APPROPRATE SELECTION OF NATIVE PERMANENET SEEDS.
- PERMANENT SEED MIXTURE SHOULD BE APPLIED USING AN APPLICATION RATE AND METHOD RECOMMENDED BY THE NURSERY.

SEEDBED PREPRATION

- DISTURBED SOILS WITHIN THE RIPARIAN AREAS MUST BE AMMMENDED TO PROVIDE AN OPTIMUM ENVORONMENT FR SEE GERMINATION AND SEEDNG GROWTH.
- THE pH OF THE SOIL MUST BE SUCH THAT IT IS NOT TOXIC AND NUTRIENTS ARE AVAILABLE.
- SOIL ANALYSIS SHOULD BE PERFORMED TO DETERMINE NUTRIENT AND LIME NEEDS OF EACH SITE.
- APROPRIATE pH LEVELS ARE BETWEEN 5.5 AND 7.0
- RIPARIAN BUFFERS REGULATED FOR NUTRIENT MANAGEMENT MAY BE LIMITED TO A SINGLE APPLICATION OF FERTILIZER.
- SUITABLE MECHANICAL MEANS SUCH AS DISKING, RAKING, AND HARROWING MUST BE EMPLOYED TO LOOSEN COMPACTED SOILS PRIOR TO SEEDING.

PLANTING

- APPLY SEED UNIFORMLY WITH A CYCLONE SEEDER, DROP-TYPE SPREADER, DRILL, OR HYDROSEEDER ON A FIRM, FRIABLE SEEDBED.
- IN FINE SOILS, SEEDS SHOULD BE DRILLED 0.25-0.5 INCHES. IN COURSE SAND SOILS, SEEDS SHOULD BE PLANTED NO MORE THAN 0.75 INCHES.

MULCH

- MULCH ALL PLANTING AREAS IMMEDIATELY AFTER SEEDING.
- IF PLANTING ON STREAMBANKS STEEPER THAN 10% OR OTHER AREAS SUBJEC TO FLOODING, A BIODEGRADEABLEL ROLLED EROSION CONTROL PRODUCT IS RECOMMENDED TO HOLD SEED AND SOIL IN PLACE.

MAINTENANCE

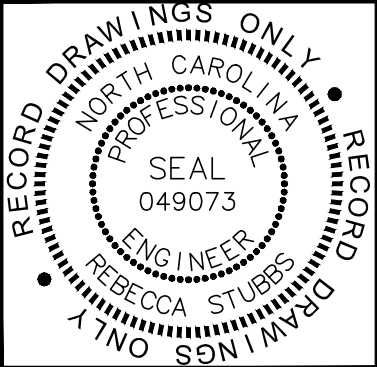
- THE RECOMMENED PERMANENT GRASS SPECIES MAY REQUIRE TWO YEARS FOR ESTABLISHMENT DEPENDIG ON SITE CONDITIONS.
- INSPECT SEEDED AREAS FOR FAILURE AND MAKE NECESSARY REPAIRS, SOIL AMENDMENTS, AND RE-SEEDINGS.
- IF WEEDY EXOTIC SPECIES HAVE TAKEN OVER AREAS AFTER THE FIRST GROING SEASON, THE INVASIVE SPECIES MUST BE ERADICATED TO ALLOW STAIVE SPECIES TO GROW.
- MONITORING THE SITE UNTIL LONG-TERM STABILITY HAS BEEN ESTABLISHED.

PERMANENT SEEDING MIXTURE (2 LB/ACRE)	
Name	Percent of Seed Mix
<i>Agrostis alba</i>	20
<i>Tridens flavus</i>	20
<i>Agrostis hyemalis</i>	5
<i>Agrostis stolonifera</i>	5
<i>Chrysanthemum leucanthemum</i>	5
<i>Coreopsis lanceolata</i>	5
<i>Coreopsis tinctoria</i>	5
<i>Elymus virginicus</i>	5
<i>Panicum clandestinum</i>	5
<i>Rudbeckia hirta</i>	5
<i>Echinacea purpurea</i>	3
<i>Eupatorium perfoliatum</i>	3
<i>Chamaecrista fasciculata</i>	2
<i>Chamaecrista nictitans</i>	1
<i>Cosmos bipinnatus</i>	1
<i>Desmodium canadense</i>	1
<i>Helianthus angustifolius</i>	1
<i>Heliopsis helianthoides</i>	1
<i>Hibiscus moscheutos</i>	1
<i>Lespedeza capitata</i>	1
<i>Lespedeza virginica</i>	1
<i>Liatris spicata</i>	1
<i>Silphium perfoliatum</i>	1
<i>Verbena hastata</i>	1
<i>Eupatorium coelestinum</i>	0.5
<i>Monarda fistulosa</i>	0.25
<i>Pycnanthemum tenuifolium</i>	0.25

*ERNST SEEDS "ERNMX-305, NC FACW MIX"

PERMANENT STREAM BANK SEEDING MIXTURE (4 LB/ACRE)	
Name	Percent of Seed Mix
<i>Panicum rigidulum</i>	35
<i>Panicum anceps</i>	23
<i>Elymus virginicus</i>	20
<i>Carex lurida</i>	12
<i>Juncus effusus</i>	3
<i>Helenium flexuosum</i>	2
<i>Hibiscus moscheutos</i>	2
<i>Scirpus cyperinus</i>	2
<i>Juncus tenuis</i>	1

Planted Permanent Seed Mix			
Species	Percentage	Species	Percentage
<i>Asclepias incarnata</i>	0.3	<i>Helianthus angustifolius</i>	0.8
<i>Agrostis gigantea</i>	16	<i>Heliopsis helianthoides</i>	1.2
<i>Agrostis hyemalis</i>	4	<i>Hibiscus moscheutos</i>	0.8
<i>Agrostis stolonifera</i>	4	<i>Juncus effusus</i>	0.6
<i>Carex lurida</i>	3.22	<i>Lespedeza capitata</i>	0.8
<i>Carex vulpinoidea</i>	10	<i>Lespedeza virginica</i>	0.8
<i>Chamaecrista fasciculata</i>	1.6	<i>Liatris spicata</i>	0.8
<i>Chamaecrista nictitans</i>	0.8	<i>Mimulus ringens</i>	0.06
<i>Chrysanthemum leucanthemum</i>	4	<i>Monarda fistulosa</i>	0.2
<i>Coreopsis lanceolata</i>	4	<i>Panicum virgatum</i>	4
<i>Coreopsis tinctoria</i>	4	<i>Pycnanthemum tenuifolium</i>	0.2
<i>Cosmos bipinnatus</i>	0.8	<i>Rhexia virginica</i>	0.06
<i>Desmodium canadense</i>	0.8	<i>Rudbeckia hirta</i>	4
<i>Echinacea purpurea</i>	2.4	<i>Scirpus cyperinus</i>	0.06
<i>Elymus virginicus</i>	8.6	<i>Silphium perfoliatum</i>	0.8
<i>Eupatorium coelestinum</i>	0.4	<i>Symphyotrichum puniceum</i>	0.1
<i>Eupatorium perfoliatum</i>	2.5	<i>Tridens flavus</i>	16
<i>Glyceria striata</i>	0.1	<i>Vernonia noveboracensis</i>	0.2
<i>Helenium autumnale</i>	0.2	<i>Verbena hastata</i>	0.8
		TOTAL	100

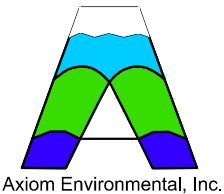


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PLANTING NOTES

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