FINAL
AS-BUILT BASELINE
MONITORING REPORT (MY0)

ALLIANCE HEADWATERS MITIGATION SITE

Johnston County, North Carolina

NCDEQ Contract No. 6832
DWR ID No. 20160405
DMS ID No. 97086
USACE Action ID No. SAW-2016-00882
RFP No. 16-006477

Neuse River Basin
HUC 03020201

Data Collection: January 2020
Submission: March 2020

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NORTH CAROLINA 27699-1652

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

March 23, 2020

Lindsay Crocker
NC DEQ – Division of Mitigation Services
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Subject: Alliance Headwaters Stream & Riparian Riverine Wetland Mitigation Site
DMS Contract #: 6832; DMS Project ID: 95017; RFP # 16-006477
Response to DMS Comments on the Draft Baseline Monitoring Document & As-built Survey

Lindsay - Below are responses from Restoration Systems to all comments received on Alliance Headwaters' draft Baseline Monitoring Document & As-built Survey. DMS comments are in black, and RS responses are in blue. Please do not hesitate to reach out if you would like to discuss.

Sincerely,

Raymond Holz
Restoration Systems

Comments Received & Responses

1. Credits and areas for wetlands should go out 3 significant digits. Stream areas should be rounded to the whole foot, but credit should go out three significant digits (6029.384 SMU and 39.354 WMU). Please utilize 5/2019 DMS updated template for reporting areas and credits.
   Table 1 was updated to reflect the 5/2019 DMS template. Acreages and credits were taken to 3 decimal points.

2. Table 7. Temp plots. Add the labels for the bottom rows (number of stems and Stems/acre)
   Table 7 was revised to include labels for the bottom 2 rows.

3. It appears there are some substitutions from the vegetation in the Mitigation Plan. Make note of the substitutions in the report.
   The following footnote was added to Table 5: "Some species planted onsite were not included in the mitigation plan, including Morella cerifera, Morus rubra, Quercus bicolor, and Quercus shumardii. These were determined to be viable substitutions that were made based on bare-root stem availability at the time of site planting."

4. Include information on permanent and/or temporary seed mix and any soil amendments if utilized.
   Seed mix info was added to section 1.3 under "Additional activities that occurred at the Site," and a species list was included in Appendix C.

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And

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Raleigh, North Carolina 27603
Contact: Grant Lewis
919-215-1693 (phone)

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APPENDICES

1.0 PROJECT SUMMARY

Restoration Systems, LLC has established the North Carolina Division of Mitigation Services (NCDMS) Alliance Headwaters Mitigation Site (Site).

1.1 Project Goals & Objectives

Project goals and associated objectives are summarized below:

Summary of Goals and Objectives for the Alliance Headwaters Mitigation Project

Goals	Objectives	Pre-construction Functional Status	Post-construction Functional Status
Goals Specific to the Neuse River and Hannah Creek Watershed Discussed in the RBRP (NCDMS 2010 and 2015) and *Neuse River Basinwide Plan* (NCDWQ 2009)			
Remove Direct Nutrient Inputs from Agricultural Lands	• Restoration and enhancement of minimum 50-foot riparian buffers along all project reaches. • Protection of riparian buffers with a perpetual conservation easement. • Reducing the amount of land in active row crop agriculture. • Decreasing drainage to restore wetlands, promoting higher water table conditions, and denitrification.	Not Functioning	Functioning
Remove Direct Sediment Inputs from Agricultural Lands	• Restoration of stabilized headwater stream systems. • Restoration of wetlands and riparian buffers to filter runoff. • Increase distance between active farming operations and receiving waters. • Stabilization of gullies and ditches.	Not Functioning	Functioning
Additional Benefits to Hannah Creek Significant Natural Heritage Area			
Improved Aquatic Habitats	• Restoration of appropriate bed form diversity, headwater stream/wetland form, and in-stream structures to provide appropriate habitat. • Restoration of self-sustaining stream/wetland headwaters. • Restoration of riparian buffer vegetation to provide organic matter and shade.	Not Functioning	Functioning
Improved Connectivity	• Restore connectivity to historic remnant channel features. • Improved aquatic connectivity to Hannah Creek.	Not Functioning	Functioning

1.2 Project Background

The Alliance Headwaters Mitigation Site (Site) is in Johnston County, approximately six miles southeast of Four Oaks and one mile east of US 701 (Figure 1, Appendix A). The project is located within NC Division of Mitigation Services (DMS) targeted watershed for the Neuse River Basin

Hydrologic Unit (HU) 03020201150020 and the NC Division of Water Resources (NCDWR) subbasin 03-04-04.

A review of historic aerials of the site and adjacent parcels taken in 1939, 1965, 1971, 1988 and 2005 revealed that while agriculture was prevalent in the area, much of the site was not converted to agricultural uses until after 1997/1998. Additional aerial photographs from Google Earth show that the prior to construction the project site had been manipulated for agricultural production numerous times. The channelization of perimeter ditches to carry stream flow served to undermine the hydrologic connection between the headwaters of UT3 and UT4 (located in the forested sections of the site) from their downstream channels. In addition, two small impoundments were excavated on the historical flow paths of UT1 and UT3 during this time. The Site existed in its preconstruction condition since approximately 2005.

Current land use near the Site is predominately agriculture (crop and livestock production) and silviculture. While the Site is near (< 6 miles) to two major interstates (I-95 and I-40), there are no foreseeable signs of impending land use changes or development pressure that would impact the Project's watershed. The conservation easement will eliminate the potential for future development and/or agricultural use in the floodplain areas of the restored streams.

1.3 Project Components and Structure

Proposed Site restoration activities generated 6029 Stream Mitigation Units (SMUs) and 39.4 riverine Wetland Mitigation Units (WMUs) within a 71.7-acre conservation easement as the result of the following.

- Restoration of 6,529 linear feet of stream channels that have been straightened and channelized for agricultural purposes
- Restoration of 32.6 acres of drained hydric soil to riparian riverine wetlands as the result of stream restoration activities and ditch plugging
- Areas of potential wetland riparian riverine restoration total approximately 7.0 acres of drained soils with hydric inclusions
- Enhancement of 0.38 acres of jurisdictional riparian headwater forest through stream realignment activities and supplemental wetland plantings
- Creation of 1.99 acres of riparian riverine wetlands in areas of drained hydric soil requiring bench excavation
- Preservation of 16.39 acres of jurisdictional riparian riverine wetlands located within forested headwater systems

Additional activities that occurred at the Site included the following.

- Planting 49.9 acres of the Site with 35,200 stems (planted species and densities by zone are included in Table 5 [Appendix C]).
- Application of permanent seed mix across 49.9 acres of the Site (permanent seed mix species list included in Table 9 [Appendix C]), as well as temporary seed mix consisting of grain rye, millet, clover, and turnip.

Due to the deep, fine textured nature of Site soils, lack of geologic contact in the vicinity, and agricultural setting relatively few deviations from the proposed construction plans occurred at the Site. Minor deviations included converting woody riffles to stone constructed riffles in the lower reaches of UT 1 (stations 29+50 and 29+80) as the channel approached culverts under Old Williams Road. In the downstream riffle (station 29+80) a log vane was not installed due to conflicts with the roadside ditch/right-of-way.

Downstream of Old Williams Road in UT 1 gravel inlet protection was added at a location where roadside ditches (from a decommissioned access road) channeled preferential flow across the floodplain.

No other deviations of significance occurred between construction plans and the as-built condition. In addition, no issues have arisen since construction occurred.

Site design was completed in October 2018. Construction started on May 13, 2019 and ended within a final walkthrough on July 31, 2019. The Site was planted on January 28, 2020. Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 1-4 (Appendix A).

1.4 Success Criteria

Performance criteria outlined in the *NCDMS Mitigation Plan Template* (ver. 10/2015), and *U.S. Army Corps of Engineers – Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District* (October 24, 2016), will be followed and are briefly outlined below. Monitoring data collected on the site will include reference photos, plant survival analyses, channel stability analyses, wetland hydrological analysis, and biological data if specifically required by permit conditions.

Monitoring will be conducted for a period of seven years, unless the USACE, in consultation with the Interagency Review Team (IRT), agrees that monitoring may be terminated early. Early closure will only be provided through written approval from the USACE in consultation with the IRT. Annual monitoring reports will be submitted to the NCDMS by RS no later than November 30 of each monitoring year.

Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Continuous surface flow must be documented each year for at least 30 consecutive days. • Bank height ratio (BHR) cannot exceed 1.2 for a majority of measured cross sections on a given reach. • Entrenchment ratio (ER) must be 2.2 or above for a majority of measured riffle cross-sections on a given reach. • BHR and ER should not change by more than 10% in any given year for a majority of a given reach. • Must document occurrence of at least 4 bankfull events in separate years during the monitoring period.
Wetland Hydrology
• Saturation or inundation within the upper 12 inches of the soil surface for, at a minimum, 10 percent of the growing season, during average climatic conditions. Note: Soil temperature for growing season establishment will be determined using a continuously logging soil probe installed at the rain gauge. Soil temperature will be measured from mid-February through the end of April (at a minimum).
Vegetation
• 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 7 feet in height at year 5, and 10 feet in height at year 7. • Planted and volunteer stems are counted, provided they are included in the approved planting list for the site. • Any single species can only account for 50% of the required stems per monitoring plot.

2.0 METHODS

Monitoring requirements and success criteria outlined in this plan follow the October 24, 2016 NC Interagency Review Team *Wilmington District Stream and Wetland Compensatory Mitigation Update*. 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 31 of each monitoring year data is collected. The monitoring schedule is summarized in the following table.

Monitoring Schedule

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

2.1 Monitoring

The monitoring parameters are summarized in the following table.

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 to 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.
Stream Hydrology	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through monitoring period	Total of 7 surface water gauges: One gauge on UT1 – R2, UT1 – R3, UT1A, UT2, UT3 – R1, UT3 – R2, and UT4	Surface water data for each monitoring period as depicted in Figures 2A-2B.
Bankfull Events	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through monitoring period	Total of 7 surface water gauges: One gauge on UT1 – R2, UT1 – R3, UT1A, UT2, UT3 – R1, UT3 – R2, and UT4	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through monitoring period	All restored stream channels	Visual evidence, photo documentation, and/or rain data.
Wetland Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Wetland Restoration	Groundwater gauges	As-built, Years 1, 2, 3, 4, 5, 6, and 7 throughout the year with the growing season defined as March 1-November 4	26 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 acre (100 square meters) in size; *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	32 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre
	Annual random vegetation plots, 0.0247 acre (100 square meters) in size	As-built, Years 1, 2, 3, 5, and 7	18 plots randomly selected each year	Species and height

3.0 REFERENCES

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Appendix A
Background Tables

Table 1. Project Components and Mitigation Units
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Attributes Table

Table 1. Project Components and Mitigation Credits
Alliance Headwaters Restoration Site

Reach ID	Stream Stationing/ Wetland Type	Existing Footage/ Acreage	Mitigation Plan Footage/ Acreage	Restoration Footage/ Acreage	Restoration Level	Restoration or Restoration Equivalent	Mitigation Ratio	Mitigation Credits	Comment
UT 1A	10+00 to 10+87	--	87	87	Restoration	87	1:1	87	
UT 1 Reach 1	10+00 to16+71	4761	671	671	Restoration	671	1:1	671	
UT 1 Reach 2	16+71 to 30+33		1362	1362	Restoration	1362-70= 1292	1:1	1292	70 feet is outside of the easement and is therefore non-credit generating.
UT 1 Reach 3	10+00 to 24+63		1463	1463	Restoration	1463-149= 1314	1.3:1	1011	149 feet is outside of the easement and is therefore non-credit generating.
UT 2	10+00 to 19+97	<1	997	997	Restoration	997-146= 851	1.3:1	655	146 feet either does not have proper buffer width or is outside of the easement and is therefore non-credit generating.
UT 3 Reach 1	10+00 to 16+39	3313	639	639	Restoration	639	1:1	639	
UT 3 Reach 2	16+39 to 29+15		1276	1276	Restoration	1276-132= 1144	1:1	1144	132 feet is outside of the easement and is therefore non-credit generating.
UT 4	10+00 to 15+31	1142	531	531	Restoration	531	1:1	531	
Wetland R1	Riparian Riverine	0	7.11	7.108	Restoration	7.108	1:1	7.108	Wetland Restoration
Wetland R2	Riparian Riverine	0	6.97	6.973	Restoration	6.973	1.3:1	5.364	Wetland Restoration
Wetland R3	Riparian Riverine	0	18.47	18.473	Restoration	18.473	1:1	18.473	Wetland Restoration
Wetland R4	Riparian Riverine	0	0.29	0.285	Restoration	0.285	1:1	0.285	Wetland Restoration
Wetland R5	Riparian Riverine	0	0.95	0.950	Restoration	0.950	1:1	0.950	Wetland Restoration
Wetland R6	Riparian Riverine	0	0.90	0.896	Restoration	0.896	1:1	0.896	Wetland Restoration
Wetland R7	Riparian Riverine	0	0.28	0.284	Restoration	0.284	1:1	0.284	Wetland Restoration

Table 1. Project Components and Mitigation Credits (continued)
Alliance Headwaters Restoration Site

Reach ID	Stream Stationing/ Wetland Type	Existing Footage/ Acreage	Mitigation Plan Footage/ Acreage	Restoration Footage/ Acreage	Restoration Level	Restoration or Restoration Equivalent	Mitigation Ratio	Mitigation Credits	Comment
Wetland R8	Riparian Riverine	0	1.47	1.472	Restoration	1.472	1.3:1	1.132	Wetland Restoration
Wetland R9	Riparian Riverine	0	0.87	0.867	Restoration	0.867	1.3:1	0.667	Wetland Restoration
Wetland R10	Riparian Riverine	0	1.11	1.105	Restoration	1.105	1:1	1.105	Wetland Restoration
Wetland R11	Riparian Riverine	0	0.97	0.970	Restoration	0.970	1:1	0.970	Wetland Restoration
Wetland R12	Riparian Riverine	0	0.17	0.170	Restoration	0.170	1:1	0.170	Wetland Restoration
Wetland E1	Riparian Riverine	0.38	0.38	0.384	Enhancement	0.384	3.25:1	0.118	Wetland Enhancement
Wetland C1	Riparian Riverine	0	0.54	0.540	Creation	0.540	10:1	0.054	Wetland Creation
Wetland C2	Riparian Riverine	0	0.55	0.546	Creation	0.546	13:1	0.042	Wetland Creation
Wetland C3	Riparian Riverine	0	0.90	0.901	Creation	0.901	10:1	0.090	Wetland Creation
Wetland P1	Riparian Riverine	16.39	16.39	16.392	Preservation	16.392	10:1	1.639	Wetland Preservation

Length & Area Summations by Mitigation Category		
Restoration Level	**Stream (linear footage)**	**Riparian Wetland (acreage)**
Restoration	6529*	39.553
Enhancement	--	0.384
Creation	--	1.987
Preservation	--	16.392

*An additional 497 linear feet of stream restoration is located outside of the conservation easement and is therefore not included in this total or in mitigation credit calculations.

Overall Assets Summary	
Asset Category	**Overall Credits**
Stream	**6029.384**
Riparian Riverine Wetland	**39.354**

Table 2. Project Activity and Reporting History
Alliance Headwaters Restoration Site

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal (RFP No. 16-006477)	October 15, 2015	October 28, 2015
Institution Date (NCDMS Contract No. 6832)	--	March 21, 2016
404 Permit	--	December 3, 2018
Mitigation Plan	--	October 12, 2018
Construction Plans	--	October 12, 2018
Site Construction	--	May 13, 2019-July 31, 2019
Planting	--	January 28, 2020
As-built Baseline Monitoring (MY0)	October 2019-January 2020	March 2020

Table 3. Project Contacts Table
Alliance Headwaters Mitigation Site

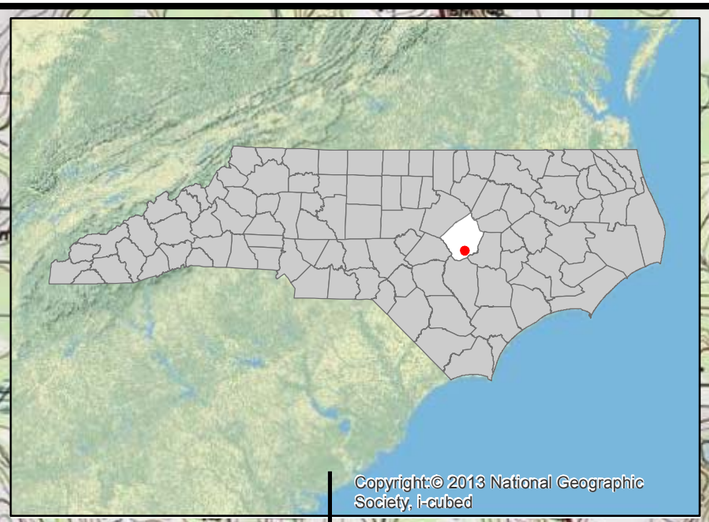
Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 Worth Creech 919-755-9490
Designer	Ecosystem Planning & Restoration 1150 SE Maynard Road, Suite 140 Cary, NC 27511 Kevin Tweedy, PE 919-999-0262

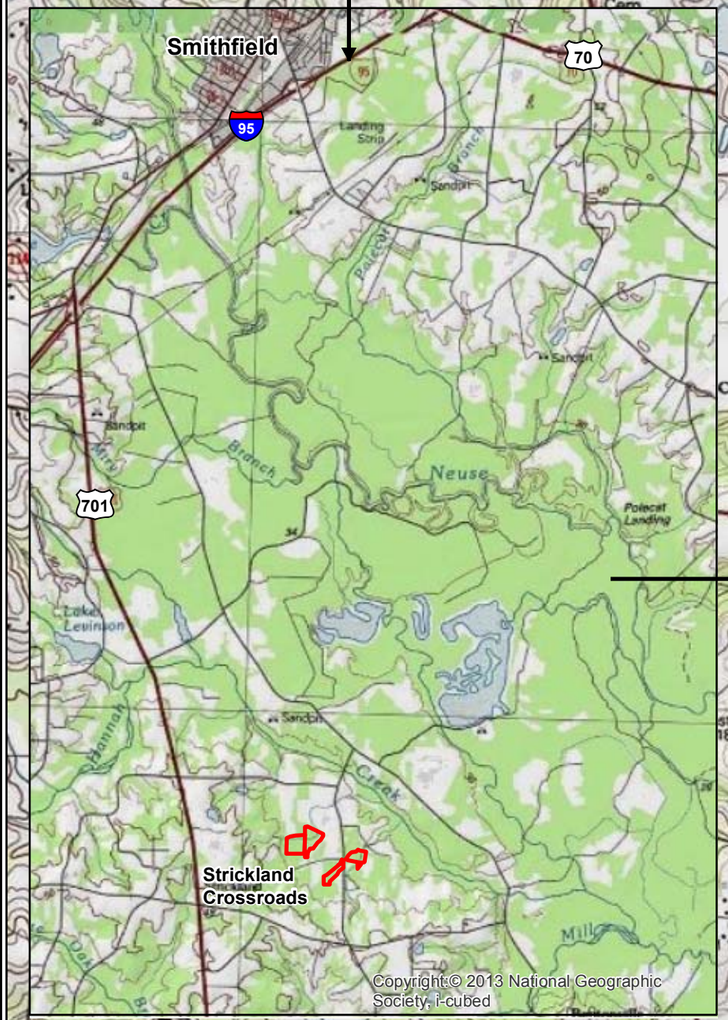
Table 4. Project Attribute Table
Alliance Headwaters Mitigation Site

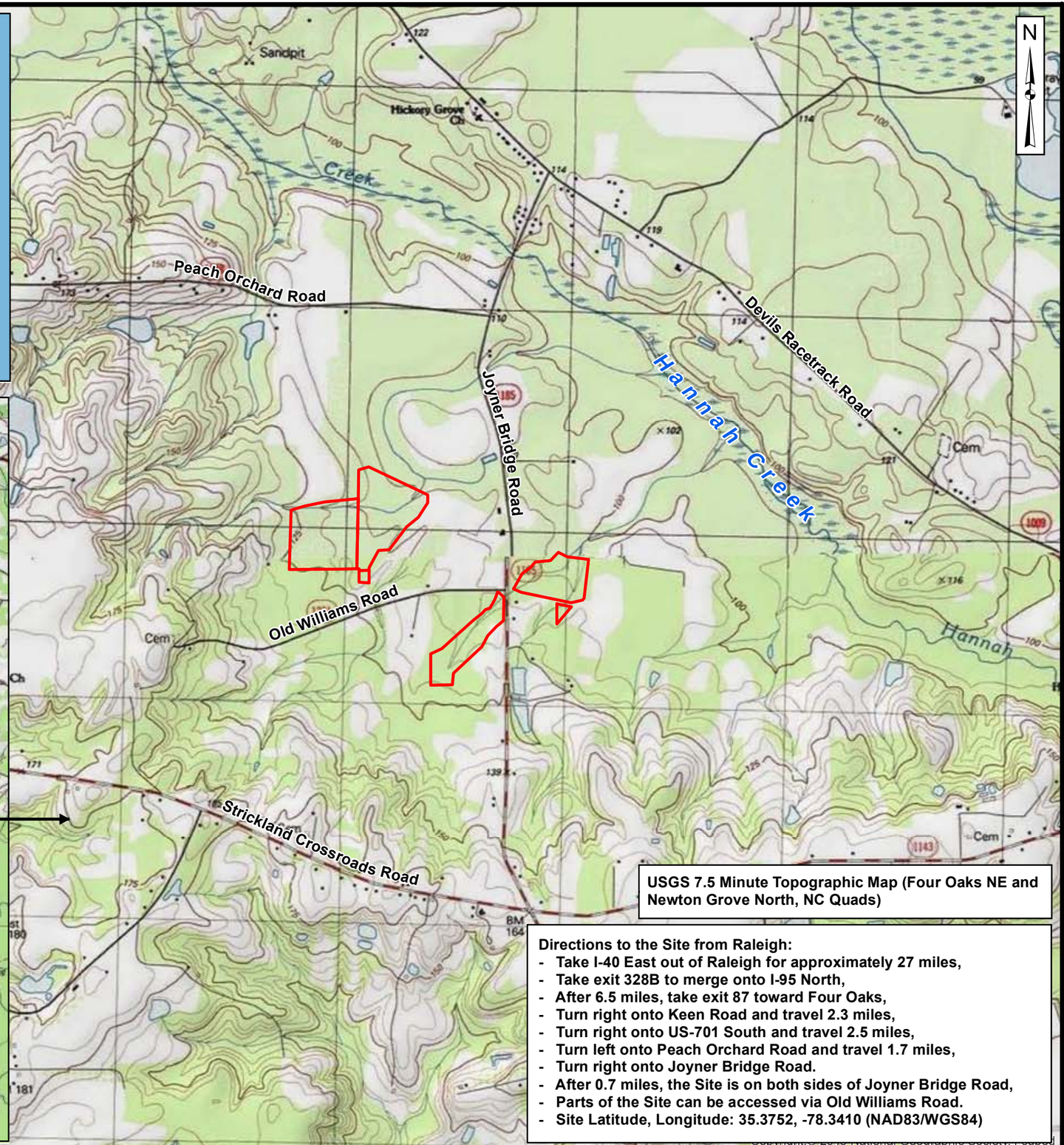
Project Information					
Project Name	Alliance Headwaters Mitigation Site				
Project County	Johnston County, North Carolina				
Project Area (acres)	71.7				
Project Coordinates (latitude & latitude)	35.372028ºN, 78.340514ºW				
Planted Area (acres)	49.9				
Project Watershed Summary Information					
Physiographic Province	Coastal Plain				
Project River Basin	Neuse				
USGS HUC for Project (14-digit)	03020201150020				
NCDWR Sub-basin for Project	03-04-04				
Project Drainage Area (acres)	132 to 546				
Percentage of Project Drainage Area that is Impervious	<2%				
CGIA Land Use Classification	Agriculture & Forested/Scrubland				
Reach Summary Information					
Parameters	**UT1**	**UT1A**	**UT2**	**UT 3**	**UT4**
Length of reach (linear feet)	3495	87	997	1915	531
Valley Classification & Confinement	Alluvial, unconfined				
Drainage Area (acres)	546	6.4	147	354	132
NCDWR Stream ID Score	Blue Line	NA	Blue Line	27.25	27.25
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Perennial	Perennial/ Intermittent	Perennial/ Intermittent
NCDWR Water Quality Classification	C, NSW				
Proposed Stream Classification (Rosgen 1996)	C5	C5	C5	C5	C5
Underlying Mapped Soils	Leaf silt loam				
Drainage Class	Poorly-drained				
Hydric Soil Status	Hydric				
FEMA Classification	NA				
Native Vegetation Community	Coastal Plain Small Stream Swamp				
Watershed Land Use/Land Cover (Site)	31% forest,67% agricultural land, <2% low density residential/impervious surface				
Percent Composition of Exotic Invasive Vegetation	<2%				

Appendix B
Visual Assessment Data

Figure 1. Project Location
Figures 2 & 2A-2B. Current Conditions Plan View
Vegetation Plot Photographs







USGS 7.5 Minute Topographic Map (Four Oaks NE and Newton Grove North, NC Quads)

Directions to the Site from Raleigh:
- **Take I-40 East out of Raleigh for approximately 27 miles,**
- **Take exit 328B to merge onto I-95 North,**
- **After 6.5 miles, take exit 87 toward Four Oaks,**
- **Turn right onto Keen Road and travel 2.3 miles,**
- **Turn right onto US-701 South and travel 2.5 miles,**
- **Turn left onto Peach Orchard Road and travel 1.7 miles,**
- **Turn right onto Joyner Bridge Road.**
- **After 0.7 miles, the Site is on both sides of Joyner Bridge Road,**
- **Parts of the Site can be accessed via Old Williams Road.**
- **Site Latitude, Longitude: 35.3752, -78.3410 (NAD83/WGS84)**

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

LEAF SWAMP WETLAND MITIGATION SITE

Johnston County, NC

Title:

SITE LOCATION

Drawn by: KRJ/CLF

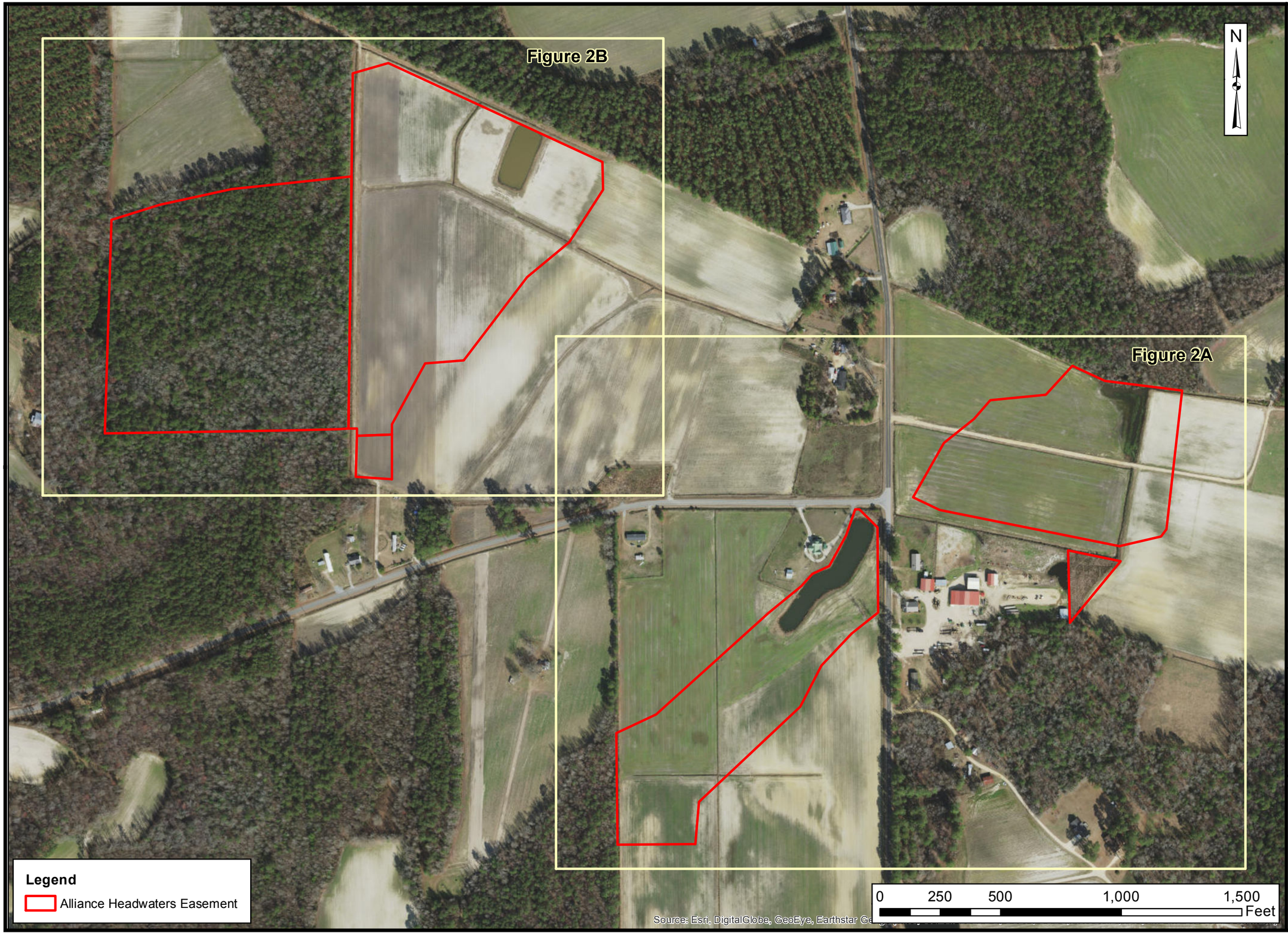
Date: AUG 2017

Scale: 1:20,000

Project No.: 17-002

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

ALLIANCE HEADWATERS STREAM AND WETLAND MITIGATION SITE

Wayne County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: KRJ

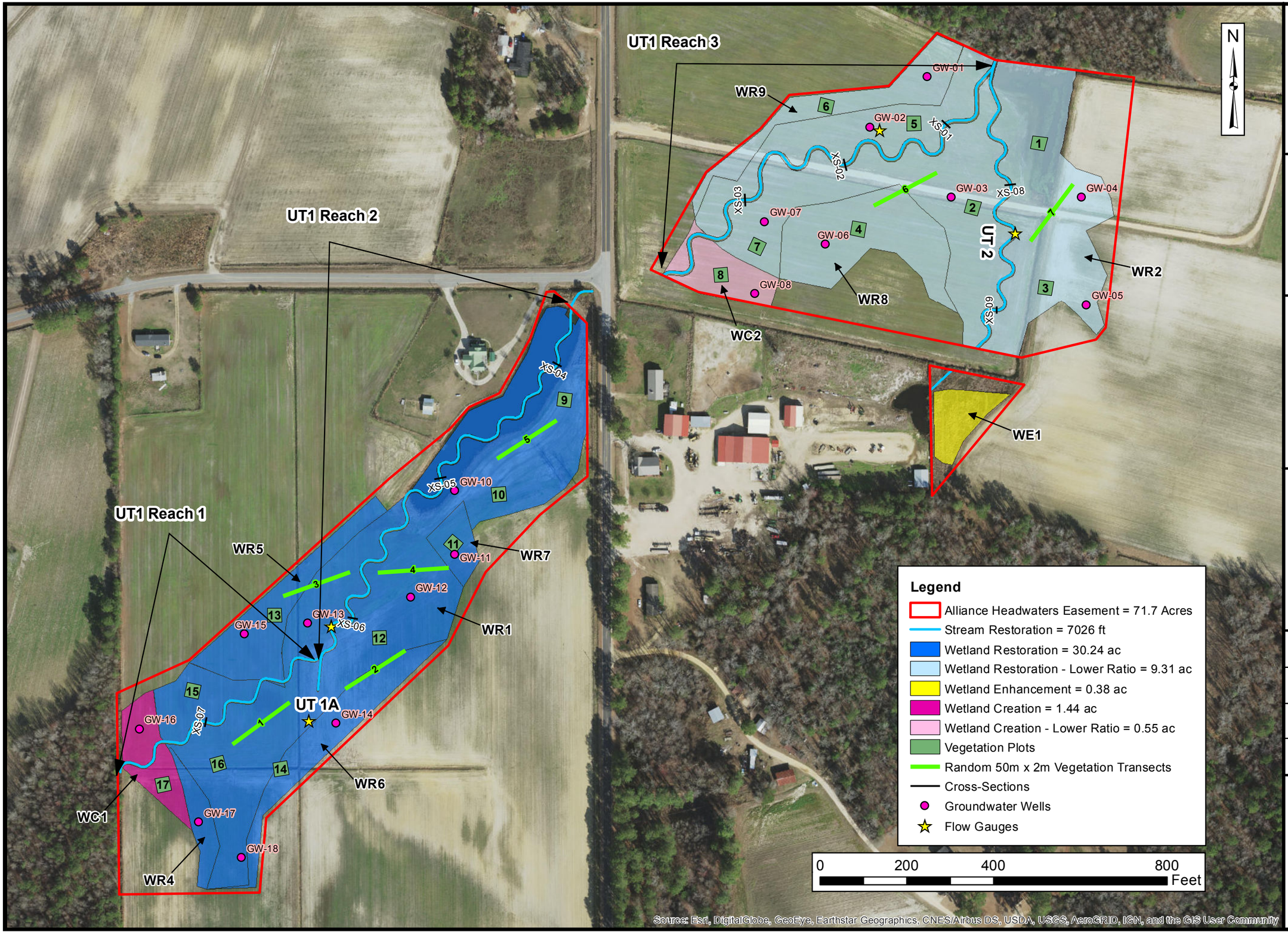
Date: FEB 2020

Scale: 1:4500

Project No.: 18-035

FIGURE

2



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

ALLIANCE HEADWATERS STREAM AND WETLAND MITIGATION SITE

Johnston County, NC

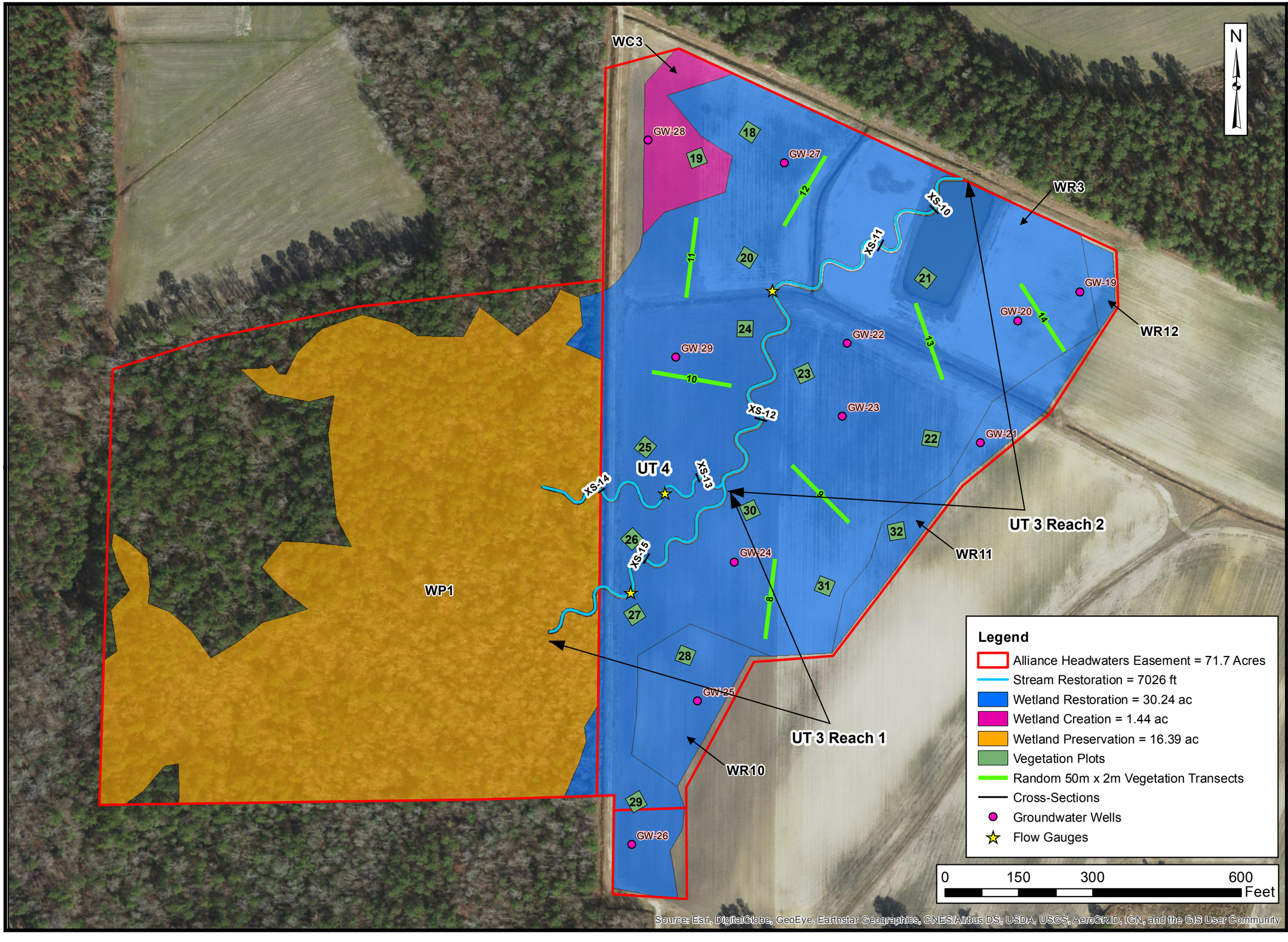
Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by:	AMR
Date:	JAN 2020
Scale:	1:2500
Project No.:	18-035

FIGURE

2A



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

ALLIANCE HEADWATERS STREAM AND WETLAND MITIGATION SITE

Johnston County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: AMR

Date: JAN 2020

Scale: 1:2200

Project No.: 18-035

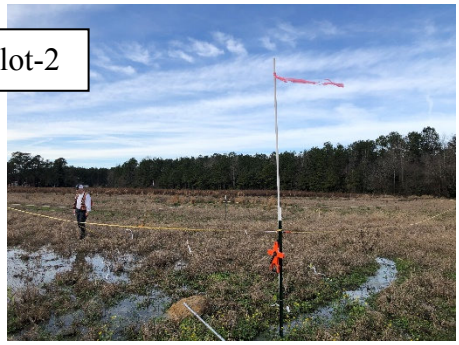
FIGURE

2B

Alliance Headwaters Asbuilt Vegetation Plots
Photos Taken January 17, 2020

Plot-1

Plot-2



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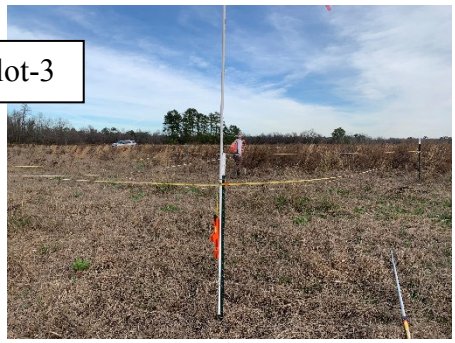

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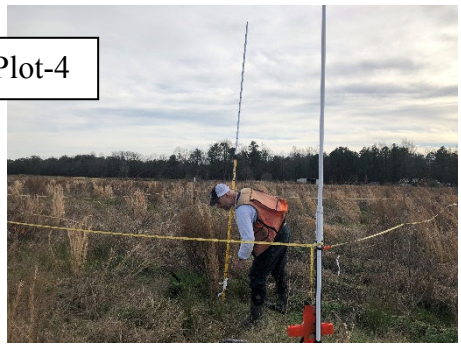


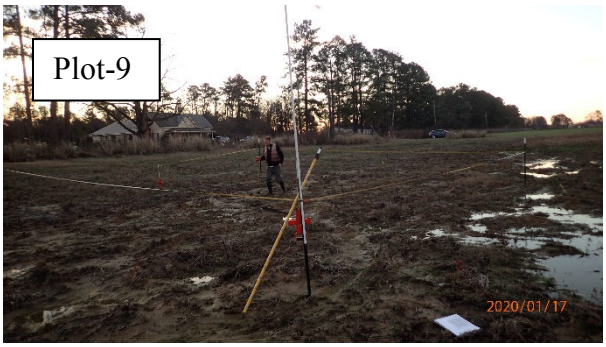
Plot-5

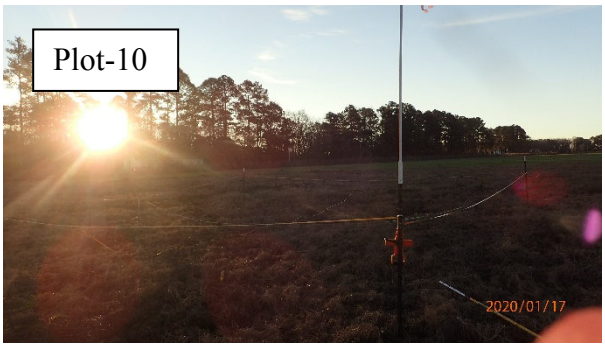
Plot-6

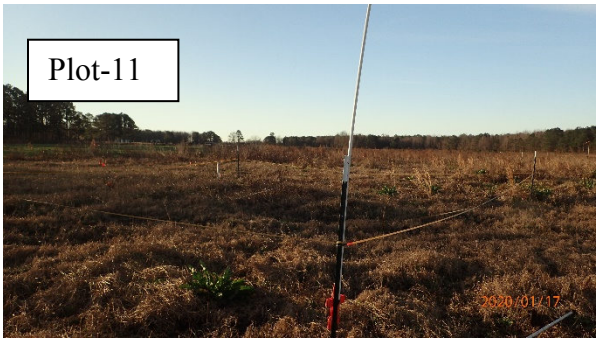
Plot-7

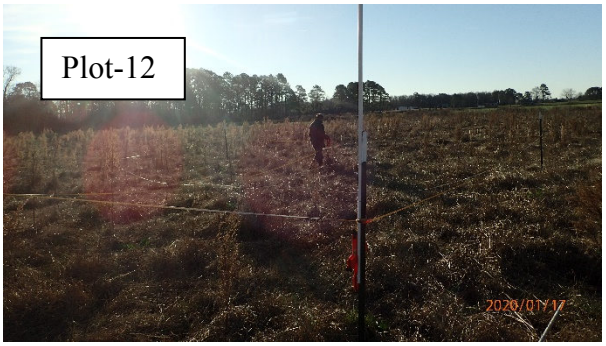
Plot-8

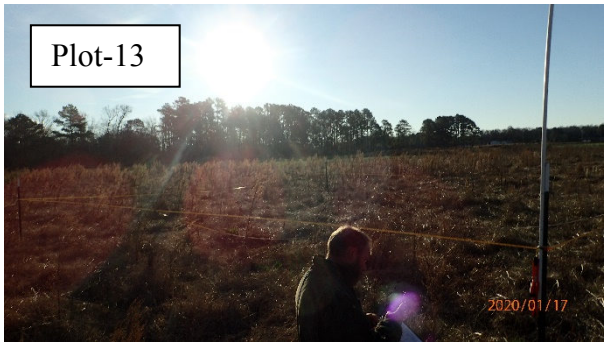
Alliance Headwaters Asbuilt Vegetation Plots
Photos Taken January 17, 2020
(continued)

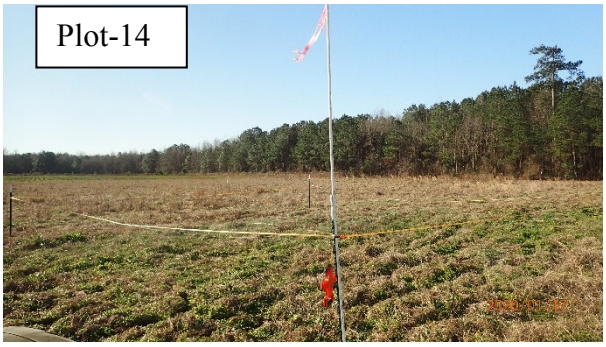






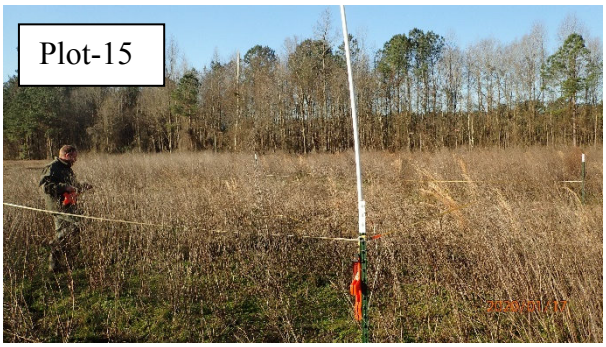




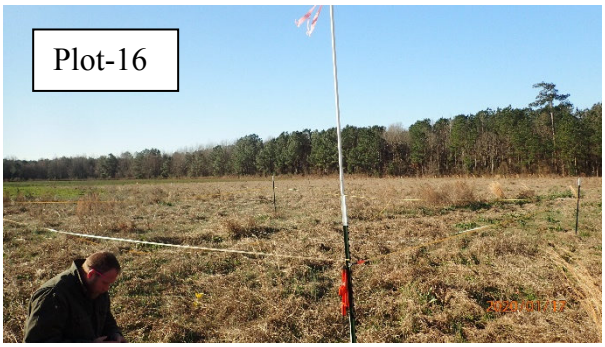


Alliance Headwaters Asbuilt Vegetation Plots
Photos Taken January 17, 2020
(continued)

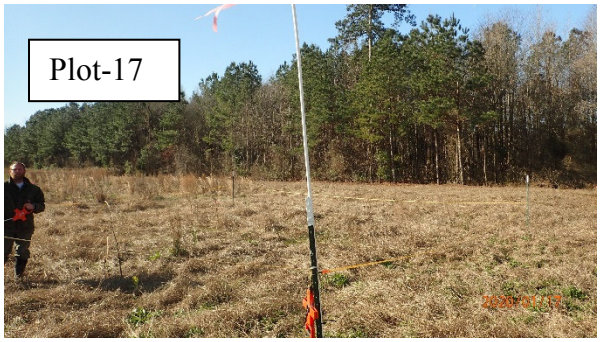
Plot-15



Plot-16

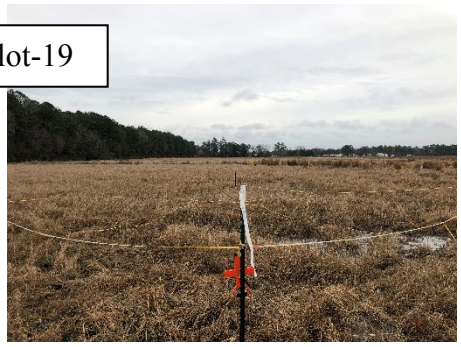


Plot-17

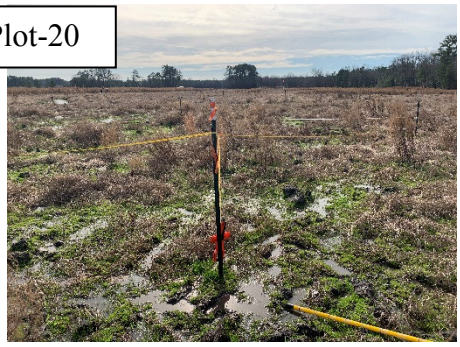


Plot-18

Plot-19



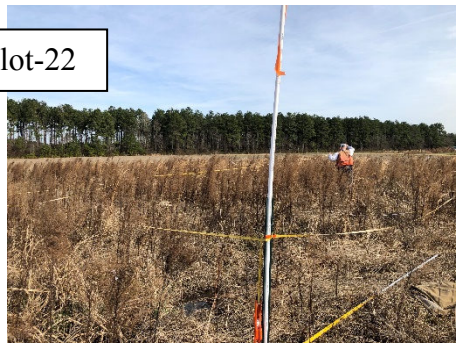
Plot-20



Alliance Headwaters Asbuilt Vegetation Plots
Photos Taken January 17, 2020
(continued)

Plot-21

Plot-22



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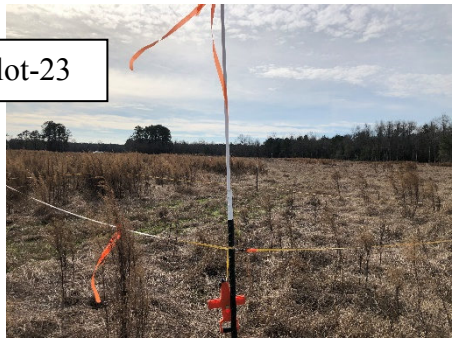

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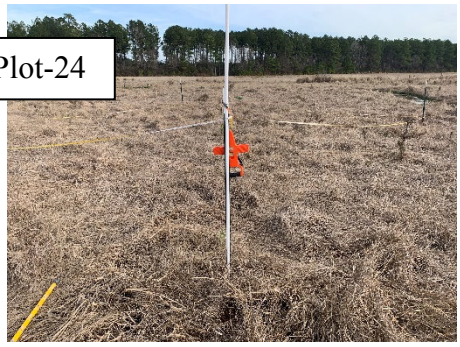

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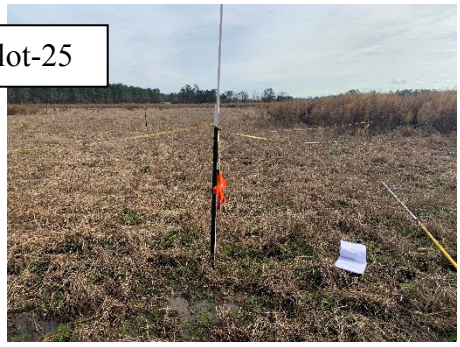
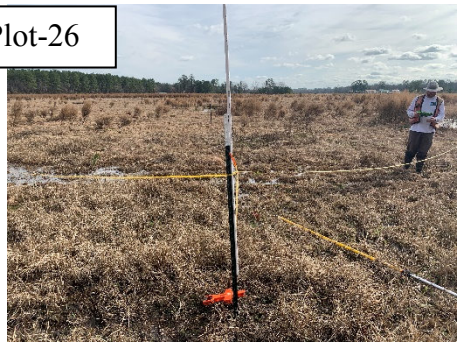


Plot-26



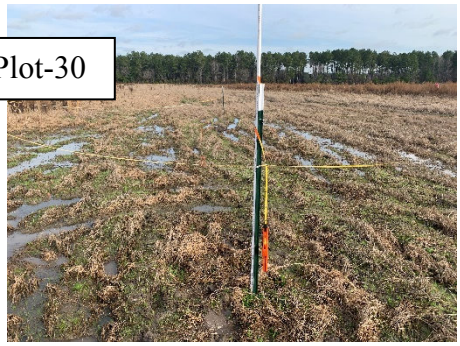
Alliance Headwaters Asbuilt Vegetation Plots
Photos Taken January 17, 2019
(continued)

Plot-27

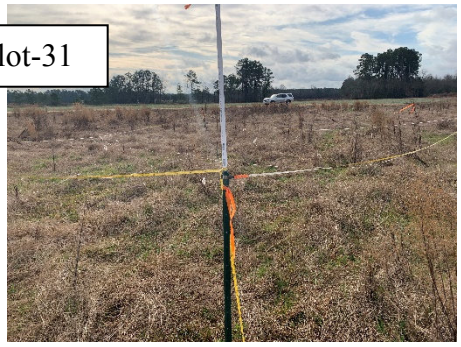
Plot-28

Plot-29

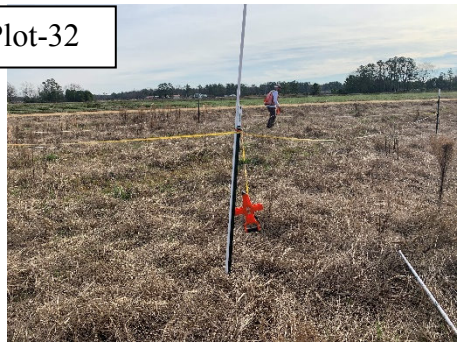
Plot-30



Plot-31



Plot-32



Appendix C
Vegetation Data

Table 5. Planted Bare Root Woody Vegetation
Table 6. Total Stems by Plot and Species
Table 7. Temporary Vegetation Plot Data
Table 8. Planted Vegetation Totals
Table 9. Permanent Seed Mix

Table 5. Planted Bare Root Woody Vegetation
Alliance Headwaters Mitigation Site

Species	Upland Planting	Riparian Planting	Total Stems
Betula Nigra	0	2,900	2,900
Morella cerifera	0	1,300	1,300
Carpinus caroliniana	300	0	300
Diospyros virginiana	100	0	100
Liriodendron tulipifera	500	2,800	3,300
Magnolia virginiana	0	1,600	1,600
Morus rubra	100	0	100
Nyssa sylvatica	700	300	1,000
Persea palustris	0	800	800
Prunus serotina	400	0	400
Quercus alba	800	0	800
Quercus bicolor	0	500	500
Quercus laurifolia	0	2,000	2,000
Quercus shumardii	0	200	200
Quercus lyrata	0	4,200	4,200
Quercus michauxii	800	3,900	4,700
Quercus pagoda	650	3,050	3,700
Taxodium distichum	0	4,500	4,500
Ulmus americana	0	2,800	2,800
	4,350	**30,850**	**35,200**

*Some species planted onsite were not included in the mitigation plan, including *Morella cerifera*, *Morus rubra*, *Quercus bicolor*, and *Quercus shumardii*. These were determined to be viable substitutions that were made based on bare-root stem availability at the time of site planting.

Table 6. Total Stems by Plot and Species
NCDMS Project Code 18035. Project Name: Alliance Headwaters

			Current Plot Data (MY0 2020)																						
			18035-01-0001			18035-01-0002			18035-01-0003			18035-01-0004			18035-01-0005			18035-01-0006			18035-01-0007			18035-01-0008		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Betula nigra	river birch	Tree	3	3	3	3	3	3	5	5	5										2	2	2			
Cornus amomum	silky dogwood	Shrub																								
Diospyros virginiana	common persimmon	Tree										1	1	1												
Liriodendron tulipifera	tuliptree	Tree							3	3	3															
Magnolia virginiana	sweetbay	Tree	5	5	5	4	4	4							1	1	1									
Morella cerifera	wax myrtle	shrub	1	1	1	2	2	2	3	3	3															
Nyssa	tupelo	Tree																						1	1	1
Nyssa sylvatica	blackgum	Tree																6	6	6						
Persea palustris	swamp bay	tree													1	1	1	2	2	2				1	1	1
Prunus serotina	black cherry	Tree													2	2	2	3	3	3						
Quercus	oak	Tree	2	2	2	5	5	5				7	7	7							8	8	8	8	8	8
Quercus alba	white oak	Tree																								
Quercus bicolor	swamp white oak	Tree																								
Quercus lyrata	overcup oak	Tree																								
Quercus michauxii	swamp chestnut oak	Tree	1	1	1				1	1	1							1	1	1						
Quercus nigra	water oak	Tree																								
Quercus pagoda	cherrybark oak	Tree							1	1	1				1	1	1							1	1	1
Taxodium distichum	bald cypress	Tree										4	4	4	8	8	8	4	4	4	2	2	2	1	1	1
Ulmus americana	American elm	Tree	5	5	5				9	9	9															
Unknown		Shrub or Tree																						1	1	1
		Stem count	17	17	17	14	14	14	22	22	22	12	12	12	13	13	13	16	16	16	12	12	12	13	13	13
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	6	6	6	4	4	4	6	6	6	3	3	3	5	5	5	5	5	5	3	3	3	6	6	6
		Stems per ACRE	688	688	688	566.6	566.6	566.6	890.3	890.3	890.3	485.6	485.6	485.6	526.1	526.1	526.1	647.5	647.5	647.5	485.6	485.6	485.6	526.1	526.1	526.1

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Table 6. Total Stems by Plot and Species (continued)
NCDMS Project Code 18035. Project Name: Alliance Headwaters

			Current Plot Data (MY0 2020)																						
			18035-01-0009			18035-01-0010			18035-01-0011			18035-01-0012			18035-01-0013			18035-01-0014			18035-01-0015			18035-01-0016		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Betula nigra	river birch	Tree													1	1	1	5	5	5	1	1	1	1	1	1
Cornus amomum	silky dogwood	Shrub																								
Diospyros virginiana	common persimmon	Tree													1	1	1									
Liriodendron tulipifera	tuliptree	Tree	3	3	3	1	1	1										2	2	2				1	1	1
Magnolia virginiana	sweetbay	Tree																			1	1	1			
Morella cerifera	wax myrtle	shrub	1	1	1	3	3	3										2	2	2						
Nyssa	tupelo	Tree																						2	2	2
Nyssa sylvatica	blackgum	Tree				1	1	1																		
Persea palustris	swamp bay	tree	2	2	2	1	1	1							1	1	1	2	2	2						
Prunus serotina	black cherry	Tree																								
Quercus	oak	Tree	1	1	1	4	4	4	7	7	7	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5
Quercus alba	white oak	Tree							1	1	1				1	1	1									
Quercus bicolor	swamp white oak	Tree																						2	2	2
Quercus lyrata	overcup oak	Tree	5	5	5																1	1	1			
Quercus michauxii	swamp chestnut oak	Tree							2	2	2							1	1	1						
Quercus nigra	water oak	Tree	4	4	4							1	1	1	2	2	2							2	2	2
Quercus pagoda	cherrybark oak	Tree	1	1	1							2	2	2	1	1	1									
Taxodium distichum	bald cypress	Tree				2	2	2	2	2	2	4	4	4				5	5	5						
Ulmus americana	American elm	Tree																								
Unknown		Shrub or Tree																								
		Stem count	17	17	17	12	12	12	12	12	12	10	10	10	10	10	10	20	20	20	6	6	6	13	13	13
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	7	7	7	6	6	6	4	4	4	4	4	4	7	7	7	7	7	7	4	4	4	6	6	6
		Stems per ACRE	688	688	688	485.6	485.6	485.6	485.6	485.6	485.6	404.7	404.7	404.7	404.7	404.7	404.7	809.4	809.4	809.4	242.8	242.8	242.8	526.1	526.1	526.1

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 6. Total Stems by Plot and Species (continued)
NCDMS Project Code 18035. Project Name: Alliance Headwaters

			Current Plot Data (MY0 2020)																						
			18035-01-0017			18035-01-0018			18035-01-0019			18035-01-0020			18035-01-0021			18035-01-0022			18035-01-0023			18035-01-0024		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Betula nigra	river birch	Tree				1	1	1				5	5	5				2	2	2						
Cornus amomum	silky dogwood	Shrub				2	2	2																		
Diospyros virginiana	common persimmon	Tree																								
Liriodendron tulipifera	tuliptree	Tree										4	4	4										1	1	1
Magnolia virginiana	sweetbay	Tree				1	1	1	1	1	1	2	2	2	3	3	3				1	1	1	3	3	3
Morella cerifera	wax myrtle	shrub	2	2	2	3	3	3	2	2	2							1	1	1						
Nyssa	tupelo	Tree																								
Nyssa sylvatica	blackgum	Tree																								
Persea palustris	swamp bay	tree	1	1	1																					
Prunus serotina	black cherry	Tree																								
Quercus	oak	Tree	3	3	3	4	4	4	4	4	4	1	1	1	8	8	8	4	4	4	5	5	5			
Quercus alba	white oak	Tree																								
Quercus bicolor	swamp white oak	Tree																								
Quercus lyrata	overcup oak	Tree	4	4	4																1	1	1			
Quercus michauxii	swamp chestnut oak	Tree				1	1	1	1	1	1													1	1	1
Quercus nigra	water oak	Tree																			1	1	1			
Quercus pagoda	cherrybark oak	Tree	3	3	3	1	1	1				1	1	1	1	1	1	4	4	4				3	3	3
Taxodium distichum	bald cypress	Tree							3	3	3				4	4	4	2	2	2	6	6	6	3	3	3
Ulmus americana	American elm	Tree																								
Unknown		Shrub or Tree				2	2	2													1	1	1			
		Stem count	13	13	13	15	15	15	11	11	11	13	13	13	16	16	16	13	13	13	15	15	15	11	11	11
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	5	8	8	8	5	5	5	5	5	5	4	4	4	5	5	5	6	6	6	5	5	5
		Stems per ACRE	526.1	526.1	526.1	607	607	607	445.2	445.2	445.2	526.1	526.1	526.1	647.5	647.5	647.5	526.1	526.1	526.1	607	607	607	445.2	445.2	445.2

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 6. Total Stems by Plot and Species (continued)
NCDMS Project Code 18035. Project Name: Alliance Headwaters

			Current Plot Data (MY0 2020)																							Annual Means		
			18035-01-0025			18035-01-0026			18035-01-0027			18035-01-0028			18035-01-0029			18035-01-0030			18035-01-0031			18035-01-0032			MY0 (2020)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	river birch	Tree																3	3	3	2	2	2	2	2	2	36	36	36
Cornus amomum	silky dogwood	Shrub																									2	2	2
Diospyros virginiana	common persimmon	Tree																									2	2	2
Liriodendron tulipifera	tuliptree	Tree	4	4	4				1	1	1	3	3	3	3	3	3										26	26	26
Magnolia virginiana	sweetbay	Tree	1	1	1				1	1	1	2	2	2	1	1	1	1	1	1							28	28	28
Morella cerifera	wax myrtle	shrub	1	1	1	4	4	4				1	1	1	2	2	2	1	1	1							29	29	29
Nyssa	tupelo	Tree																									3	3	3
Nyssa sylvatica	blackgum	Tree																						5	5	5	12	12	12
Persea palustris	swamp bay	tree																			1	1	1				12	12	12
Prunus serotina	black cherry	Tree																									5	5	5
Quercus	oak	Tree	3	3	3				2	2	2	2	2	2	2	2	2	3	3	3				1	1	1	101	101	101
Quercus alba	white oak	Tree																									2	2	2
Quercus bicolor	swamp white oak	Tree																									2	2	2
Quercus lyrata	overcup oak	Tree																2	2	2							13	13	13
Quercus michauxii	swamp chestnut oak	Tree													1	1	1										10	10	10
Quercus nigra	water oak	Tree				1	1	1	1	1	1										6	6	6				18	18	18
Quercus pagoda	cherrybark oak	Tree	1	1	1	6	6	6	2	2	2	2	2	2	2	2	2	1	1	1							34	34	34
Taxodium distichum	bald cypress	Tree	2	2	2				2	2	2	4	4	4	2	2	2										60	60	60
Ulmus americana	American elm	Tree							5	5	5							2	2	2							21	21	21
Unknown		Shrub or Tree																									4	4	4
		Stem count	12	12	12	11	11	11	14	14	14	14	14	14	13	13	13	13	13	13	9	9	9	8	8	8	420	420	420
		size (ares)	1			1			1			1			1			1			1			1			32		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.79		
		Species count	6	6	6	3	3	3	7	7	7	6	6	6	7	7	7	7	7	7	3	3	3	3	3	3	20	20	20
		Stems per ACRE	485.6	485.6	485.6	445.2	445.2	445.2	566.6	566.6	566.6	566.6	566.6	566.6	526.1	526.1	526.1	526.1	526.1	526.1	364.2	364.2	364.2	323.7	323.7	323.7	531.1499	531.1499	531.1499

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 7. Temporary Vegetation Plot Data
Alliance Headwaters Restoration Site

Species	T-1 (222°)	T-2 (230°)	T-3 (244°)	T-4 (90°)	T-5 (44°)	T-6 (82°)	T-7 (39°)
Betula nigra	4	2	4	2	3	6	2
Liriodendron tulipifera	2		4	3	1	1	
Magnolia virginiana		1		2			4
Morella cerifera	1	2			4	4	4
Nyssa Spp.					5		
Persea palustris	2	1		3		2	
Quercus spp.	13	4	1	4	2	1	3
Quercus lyrata	3	3	2			2	
Quercus michauxii		4					
Quercus nigra		1		4		1	4
Quercus pagoda	9	2		3			1
Taxodium distichum		2			3		
Total Number of Stems	**34**	**22**	**11**	**21**	**18**	**17**	**18**
Stems/Acre	**1376**	**890**	**445**	**850**	**728**	**688**	**728**

Table 7. Temporary Vegetation Plot Data (continued)
Alliance Headwaters Restoration Site

Species	T-8 (193°)	T-9 (297°)	T-10 (282°)	T-11 (14°)	T-12 (36°)	T-13 (340°)	T-14 (130°)
Betula nigra	9	1		9	2	2	1
Liriodendron tulipifera				4	1	3	
Magnolia virginiana	2	2	1			5	1
Morella cerifera	4	2			1		1
Nyssa Spp.							2
Persea palustris	1					1	
Quercus spp.	2	3	5	3	6	5	3
Quercus lyrata		1					1
Quercus michauxii	1						
Quercus nigra	1				1		1
Quercus pagoda		3	1		3		1
Taxodium distichum			1	6	1	4	1
Total Number of Stems	**20**	**12**	**8**	**22**	**15**	**20**	**12**
Stems/Acre	**809**	**486**	**324**	**890**	**607**	**809**	**486**

Table 8. Planted Vegetation Totals
Alliance Headwaters Mitigation Site

Plot #	Planted Stems/Acre	Success Criteria Met?
1	688	Yes
2	567	Yes
3	890	Yes
4	486	Yes
5	526	Yes
6	648	Yes
7	486	Yes
8	526	Yes
9	688	Yes
10	486	Yes
11	486	Yes
12	405	Yes
13	405	Yes
14	809	Yes
15	243	No
16	526	Yes
17	526	Yes
18	607	Yes
19	445	Yes
20	526	Yes
21	647	Yes
22	526	Yes
23	607	Yes
24	445	Yes
25	486	Yes
26	445	Yes
27	567	Yes
28	567	Yes
29	526	Yes
30	526	Yes
31	364	Yes
32	324	Yes
Average Planted Stems/Acre	**531**	**Yes**

Table 8. Planted Vegetation Totals
Alliance Headwaters Mitigation Site (continued)

Transect#	Planted Stems/Acre	Success Criteria Met?
T-1	1376	Yes
T-2	890	Yes
T-3	445	Yes
T-4	850	Yes
T-5	728	Yes
T-6	688	Yes
T-7	728	Yes
T-8	809	Yes
T-9	486	Yes
T-10	324	Yes
T-11	890	Yes
T-12	607	Yes
T-13	809	Yes
T-14	486	Yes
Average Planted Stems/Acre	**723**	**Yes**

Table 9. Permanent Seed Mix
Alliance Headwaters Mitigation Site

Species	Percentage
Agrostis alba	20%
Tridens flavus	20%
Agrostis hyemalis	5%
Agrostis stolonifera	5%
Chrysanthemum leucanthemum	5%
Coreopsis lanceolata	5%
Coreopsis tinctoria	5%
Elymus virginicus	5%
Panicum clandestinum	5%
Rudbeckia hirta	5%
Echinacea purpurea	3%
Lespedeza stipulacea	3%
Chamaecrista fasciculata	2%
Chamaecrista nictitans	1%
Cosmos bipinnatus	1%
Desmodium canadense	1%
Helianthus angustifolius	2%
Heliopsis helianthoides	1%
Hibiscus moscheutos	1%
Lespedeza capitata	1%
Lespedeza virginica	1%
Liatris spicata	1%
Verbena hastata	1%
Eupatorium perfoliatum	0.5%
Monarda fistulosa	0.3%
Pycnanthemum tenuifolium	0.3%
Total	**100%**

Appendix D
Stream Geomorphology Data

Tables 10A-10E. Baseline Stream Data Summary
Tables 11A-11E. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Tables 12A-12D. Monitoring Data-Dimensional Morphology Summary (Dimensional Parameters-Cross-sections)
Tables 13A-13E. Monitoring Data-Stream Reach Data Summary

Table 10a. Baseline Stream Data Summary
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT1/Reach 1&2 (2033 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Johanna Creek Ref			Still Creek Ref			Cole Property Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					8.4	13.3		24				9.7			7.4			6.5			6.5 - 7.5		7.1		7.9	8.6		2
Floodprone Width (ft)					100	100		100													100		100		100	100		2
Bankfull Mean Depth (ft)					1.43	1.68		2.25				0.8			0.82			0.6			0.50 - 0.70		0.5		0.5	0.5		2
[1]Bankfull Max Depth (ft)												0.75 - 1.00			0.75 - 1.00			0.75 - 1.00			0.60 - 0.71		0.9		1	1.1		2
Bankfull Cross Sectional Area (ft^2)					12.9	22.2		42				8			6.1			3.8			3.0 - 4.0		3.6		4	4.4		2
Width/Depth Ratio												12			9			10			14		14		15.6	17.2		2
Entrenchment Ratio					1.3	1.65		2				> 3.0			> 3.0			> 3.0			6.9 - 10.2		11.6		12.9	14.1		2
																							0.9		1	1.1		2
[1]Bank Height Ratio					2.7	3.0		3.3				1.0 - 1.2			1.0 - 1.2			1.0 - 1.2			1.0		1.0		1.0	1.0		2
Profile																												
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																7.0 - 30.0		9	28.6	28.45	49.5	10.7	35
Riffle Slope (ft/ft)																							0.000	0.010	0.009	0.021	0.007	13
Pool Length (ft)																							4.3	10.9	9.14	39.8	7.5	27
Pool Max depth (ft)																							1.7		1.8	2		3
Pool Spacing (ft)																							25.3	49.8	50.71	89.2	14.7	35
Pattern																												
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																							
Radius of Curvature (ft)												1.5 - 2.8			2.9 - 6.4			1.2 - 2.3										
Rc:Bankfull width (ft/ft)																												
Meander Wavelength (ft)																												
Meander Width Ratio												1.4 - 2.1			2.1 - 6.6			5.4 - 8.2										
Transport parameters																												
Reach Shear Stress (competency) lb/f^2																												
Max part size (mm) mobilized at bankfull																												
Stream Power (transport capacity) W/m^2																												
Additional Reach Parameters																												
Rosgen Classification					Incised B5c						C5/E5			E5			E5/C5			C5			C5					
Bankfull Velocity (fps)																				1.4 -2.1			1.4 -2.1					
Bankfull Discharge (cfs)																				4.2 -8.4								
Valley length (ft)																												
Channel Thalweg length (ft)																				2033			2033					
Sinuosity (ft)					1						1.22 - 1.59			1.22 - 1.59			1.22 - 1.59			1.26 -1.29			1.26 -1.29					
Water Surface Slope (Channel) (ft/ft)					0.007						0.0027 - 0.0088			0.0027 - 0.0088			0.0027 - 0.0088			0.0026 - 0.0049			0.0049					
BF slope (ft/ft)																												
[3]Bankfull Floodplain Area (acres)																												
[4]% of Reach with Eroding Banks																												
Channel Stability or Habitat Metric																												
Biological or Other																												

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b. Baseline Stream Data Summary

Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT1/Reach 3 (1463 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Johanna Creek Ref			Still Creek Ref			Cole Property Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Med	Max	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)					5	6		7				9.7			7.4			6.5			9.9		10.4		10.4	10.4		1
Floodprone Width (ft)					100	100		100													100		100		100	100		1
Bankfull Mean Depth (ft)												0.8			0.82			0.6			0.5 - 0.7		0.8		0.8	0.8		1
[1]Bankfull Max Depth (ft)					0.6	0.7		0.8				0.75 - 1.00			0.75 - 1.00			0.75 - 1.00			0.93		1.4		1.4	1.4		1
Bankfull Cross Sectional Area (ft^2)					1	1.75		2.5				8			6.1			3.8			7.0		8.4		8.4	8.4		1
Width/Depth Ratio					6.6	8.6		10.6				12			9			10			14		13		13	13		1
Entrenchment Ratio					1.3	1.65		2				> 3.0			> 3.0			> 3.0			6.7		9.6		9.6	9.6		1
																							1.4		1.4	1.4		1
[1]Bank Height Ratio					2.7	3.0		3.3				1.0 - 1.2			1.0 - 1.2			1.0 - 1.2			1.0		1.0		1.0	1.0		1
Profile																												
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																14.0 - 25.0		12.2	39.6	38.7	63.2	12.7	23
Riffle Slope (ft/ft)																							0.001	0.006	0.003	0.029	0.009	10
Pool Length (ft)																							4.7	13	11.75	32	6.4	22
Pool Max depth (ft)																							1.9	2.1	2.1	2.3		2
Pool Spacing (ft)																							37.3	68	73.78	87.5	13.9	22
Pattern																												
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																							
Radius of Curvature (ft)												1.5 - 2.8			2.9 - 6.4			1.2 - 2.3										
Rc:Bankfull width (ft/ft)																												
Meander Wavelength (ft)																												
Meander Width Ratio												1.4 - 2.1			2.1 - 6.6			5.4 - 8.2										
Transport parameters																												
Reach Shear Stress (competency) lb/f^2																												
Max part size (mm) mobilized at bankfull																												
Stream Power (transport capacity) W/m^2																												
Additional Reach Parameters																												
Rosgen Classification					Incised B5c						C5/E5			E5			E5/C5			C5			C5					
Bankfull Velocity (fps)																					1.5		1.5					
Bankfull Discharge (cfs)																					10.7							
Valley length (ft)																												
Channel Thalweg length (ft)																					1463		1463					
Sinuosity (ft)					1						1.22 - 1.59			1.22 - 1.59			1.22 - 1.59			1.35		1.35					
Water Surface Slope (Channel) (ft/ft)					0.026						0.0027 - 0.0088			0.0027 - 0.0088			0.0027 - 0.0088			0.0018		0.0028					
BF slope (ft/ft)																												
[3]Bankfull Floodplain Area (acres)																												
[4]% of Reach with Eroding Banks																												
Channel Stability or Habitat Metric																												
Biological or Other																												

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10c. Baseline Stream Data Summary
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT2 (996.7 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Johanna Creek Ref			Still Creek Ref			Cole Property Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					5	6		7				9.7			7.4			6.5			7.5		9.9		9.9	9.9		1
Floodprone Width (ft)					100	100		100													100		100		100	100		1
Bankfull Mean Depth (ft)												0.8			0.82			0.6			0.6		0.6		0.6	0.6		1
[1]Bankfull Max Depth (ft)					0.6	0.7		0.8				0.75 - 1.00			0.75 - 1.00			0.75 - 1.00			0.7		1.3		1.3	1.3		1
Bankfull Cross Sectional Area (ft^2)					1	1.75		2.5				8			6.1			3.8			4.0		6.1		6.1	6.1		1
Width/Depth Ratio					6.6	8.6		10.6				12			9			10			14		16.1		16.1	16.1		1
Entrenchment Ratio					1.3	1.65		2				> 3.0			> 3.0			> 3.0			5.6		10.1		10.1	10.1		1
																							1.3		1.3	1.3		1
[1]Bank Height Ratio					2.7	3.0		3.3				1.0 - 1.2			1.0 - 1.2			1.0 - 1.2			1.0		1.0		1.0	1.0		1
Profile																												
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																14.0 - 50.0		15.7	29.9	28.44	52.3	10.8	11
Riffle Slope (ft/ft)																							0.000	0.014	0.004	0.014	0.005	8
Pool Length (ft)																							2.4	14.2	12.38	28.4	7.4	17
Pool Max depth (ft)																							1.6	1.6	1.6	1.6		1
Pool Spacing (ft)																							34.5	55.6	54.92	73.1	10.7	16
Pattern																												
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																							
Radius of Curvature (ft)												1.5 - 2.8			2.9 - 6.4			1.2 - 2.3										
Rc:Bankfull width (ft/ft)																												
Meander Wavelength (ft)																												
Meander Width Ratio												1.4 - 2.1			2.1 - 6.6			5.4 - 8.2										
Transport parameters																												
Reach Shear Stress (competency) lb/f^2																												
Max part size (mm) mobilized at bankfull																												
Stream Power (transport capacity) W/m^2																												
Additional Reach Parameters																												
Rosgen Classification					G5						C5/E5			E5			E5/C5			C5			C5					
Bankfull Velocity (fps)																				2.1			2.1					
Bankfull Discharge (cfs)																				8.4								
Valley length (ft)																												
Channel Thalweg length (ft)																				997			997					
Sinuosity (ft)					1						1.22 - 1.59			1.22 - 1.59			1.22 - 1.59			1.22			1.22					
Water Surface Slope (Channel) (ft/ft)					0.004						0.0027 - 0.0088			0.0027 - 0.0088			0.0027 - 0.0088			0.0049			0.0031					
BF slope (ft/ft)																												
[3]Bankfull Floodplain Area (acres)																												
[4]% of Reach with Eroding Banks																												
Channel Stability or Habitat Metric																												
Biological or Other																												

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10d. Baseline Stream Data Summary
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT3 (1914.8 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Johanna Creek Ref			Still Creek Ref			Cole Property Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					5	6		7				9.7			7.4			6.5			7.5 - 9.2		7.3		8.1	8.9		2
Floodprone Width (ft)					100	100		100													100		100		100	100		2
Bankfull Mean Depth (ft)												0.8			0.82			0.6			0.6 - 0.7		0.6		0.6	0.6		2
[1]Bankfull Max Depth (ft)					0.6	0.7		0.8				0.75 - 1.00			0.75 - 1.00			0.75 - 1.00			0.7 - 0.86		1		1	1		2
Bankfull Cross Sectional Area (ft^2)					1	1.75		2.5				8			6.1			3.8			4.0 - 6.0		4.3		4.9	5.4		2
Width/Depth Ratio					6.6	8.6		10.6				12			9			10			14		12.4		13.5	14.7		2
Entrenchment Ratio					1.3	1.65		2				> 3.0			> 3.0			> 3.0			4.3 - 5.3		11.2		12.5	13.7		2
																							1.0		1.0	1.0		2
[1]Bank Height Ratio					2.7	3.0		3.3				1.0 - 1.2			1.0 - 1.2			1.0 - 1.2			1.0		1.0		1.0	1.0		2
Profile																												
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																8.0 - 29.8		22.1	39	35.67	60.9	10	29
Riffle Slope (ft/ft)																							0.001	0.005	0.005	0.010	0.003	14
Pool Length (ft)																							7	10.7	10.06	16.8	2.5	28
Pool Max depth (ft)																							1.6	1.65	1.65	1.7		2
Pool Spacing (ft)																							45.6	63	60.35	91.7	11.3	28
Pattern																												
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																							
Radius of Curvature (ft)												1.5 - 2.8			2.9 - 6.4			1.2 - 2.3										
Rc:Bankfull width (ft/ft)																												
Meander Wavelength (ft)																												
Meander Width Ratio												1.4 - 2.1			2.1 - 6.6			5.4 - 8.2										
Transport parameters																												
Reach Shear Stress (competency) lb/f^2																												
Max part size (mm) mobilized at bankfull																												
Stream Power (transport capacity) W/m^2																												
Additional Reach Parameters																												
Rosgen Classification					Incised B5c						C5/E5			E5			E5/C5			C5			C5					
Bankfull Velocity (fps)																					1.9 - 2.6		1.9 - 2.6					
Bankfull Discharge (cfs)																					7.5 - 15.4							
Valley length (ft)																												
Channel Thalweg length (ft)																					1915		1915					
Sinuosity (ft)					1						1.22 - 1.59			1.22 - 1.59			1.22 - 1.59			1.21 - 1.38			1.21 - 1.38					
Water Surface Slope (Channel) (ft/ft)					0.003						0.0027 - 0.0088			0.0027 - 0.0088			0.0027 - 0.0088			0.0038 - 0.0040			0.0033					
BF slope (ft/ft)																												
[3]Bankfull Floodplain Area (acres)																												
[4]% of Reach with Eroding Banks																												
Channel Stability or Habitat Metric																												
Biological or Other																												

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10e. Baseline Stream Data Summary
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT4 (530.9 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Johanna Creek Ref			Still Creek Ref			Cole Property Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					5	6		7				9.7			7.4			6.5			6.5		7.5		7.5	7.5		1
Floodprone Width (ft)					100	100		100													100		100		100	100		1
Bankfull Mean Depth (ft)												0.8			0.82			0.6			0.5		0.5		0.5	0.5		1
[1]Bankfull Max Depth (ft)					0.6	0.7		0.8				0.75 - 1.00			0.75 - 1.00			0.75 - 1.00			0.61		0.9		0.9	0.9		1
Bankfull Cross Sectional Area (ft^2)					1	1.75		2.5				8			6.1			3.8			3.0		3.8		3.8	3.8		1
Width/Depth Ratio					6.6	8.6		10.6				12			9			10			14		14.8		14.8	14.8		1
Entrenchment Ratio					1.3	1.65		2				> 3.0			> 3.0			> 3.0			6.2		13.3		13.3	13.3		1
																							0.9		0.9	0.9		1
[1]Bank Height Ratio					2.7	3.0		3.3				1.0 - 1.2			1.0 - 1.2			1.0 - 1.2			1.0		1.0		1.0	1.0		1
Profile																												
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																10.0 -11.0		17.4	36.6	31.69	74.4	16.6	9
Riffle Slope (ft/ft)																							0.006	0.008	0.008	0.015	0.003	9
Pool Length (ft)																							5.2	9.5	9.34	12.3	2.3	9
Pool Max depth (ft)																							1.4	1.4	1.4	1.4		1
Pool Spacing (ft)																							21.2	49.6	46.5	75.4	15.6	9
Pattern																												
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.																							
Radius of Curvature (ft)												1.5 - 2.8			2.9 - 6.4			1.2 - 2.3										
Rc:Bankfull width (ft/ft)																												
Meander Wavelength (ft)																												
Meander Width Ratio												1.4 - 2.1			2.1 - 6.6			5.4 - 8.2										
Transport parameters																												
Reach Shear Stress (competency) lb/f^2																												
Max part size (mm) mobilized at bankfull																												
Stream Power (transport capacity) W/m^2																												
Additional Reach Parameters																												
Rosgen Classification												C5/E5			E5			E5/C5			C5				C5			
Bankfull Velocity (fps)																					2.1				2.1			
Bankfull Discharge (cfs)																					6.2							
Valley length (ft)																												
Channel Thalweg length (ft)																					531				531			
Sinuosity (ft)												1.22 - 1.59			1.22 - 1.59			1.22 - 1.59			1.36				1.36			
Water Surface Slope (Channel) (ft/ft)												0.0027 - 0.0088			0.0027 - 0.0088			0.0027 - 0.0088			0.0057				0.0051			
BF slope (ft/ft)																												
[3]Bankfull Floodplain Area (acres)																												
[4]% of Reach with Eroding Banks																												
Channel Stability or Habitat Metric																												
Biological or Other																												

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 11a. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT1/Reach 1&2 (2033 feet)

Parameter	Pre-Existing Condition							Johanna Creek Reference Reach Data							Still Creek Reference Reach Data							Cole Propery Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																																		58	10	23	9			
[1]SC% / Sa% / G% / C% / B% / Be%		100							100							100							100																		
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)																																									
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																																									
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																																									

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtction distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 11b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT1/Reach 3 (1463 feet)

Parameter	Pre-Existing Condition							Johanna Creek Reference Reach Data							Still Creek Reference Reach Data							Cole Propery Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																																		59	11	19	11			
[1]SC% / Sa% / G% / C% / B% / Be%		100							100							100							100																		
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)																																									
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																																									
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																																									

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtction distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 11c. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT2 (996.7 feet)

Parameter	Pre-Existing Condition							Johanna Creek Reference Reach Data							Still Creek Reference Reach Data							Cole Propery Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																																		53	10	25	12			
[1]SC% / Sa% / G% / C% / B% / Be%		100							100							100							100																		
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)																																									
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																																									
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																																									

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtction distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 11d. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT3 (1914.8 feet)

Parameter	Pre-Existing Condition							Johanna Creek Reference Reach Data							Still Creek Reference Reach Data							Cole Propery Reference Reach Data							Design							As-built/Baseline						
[1]Rif% / Ru% / P% / G% / S%																																		63	10	17	10			
[1]SC% / Sa% / G% / C% / B% / Be%		100							100							100							100																		
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)																																									
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																																									
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																																									

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 11e. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT4 (530.9 feet)

Parameter	Pre-Existing Condition							Johanna Creek Reference Reach Data							Still Creek Reference Reach Data							Cole Propery Reference Reach Data							Design							As-built/Baseline						
[1]Rif% / Ru% / P% / G% / S%																																		63	11	16	10			
[1]SC% / Sa% / G% / C% / B% / Be%		100							100							100							100																		
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)																																									
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																																									
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																																									

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 12a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT1/Reach 1,2,3 (3496 feet)

	Cross Section 1 (Pool)							Cross Section 2 (Pool)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																																				
Bankfull Width (ft)	15.4							16.4							10.4							10.2							8.6						
Floodprone Width (ft)	NA							NA							100							NA							100						
Bankfull Mean Depth (ft)	0.9							1.1							0.8							0.9							0.5						
Bankfull Max Depth (ft)	1.9							2.3							1.4							1.7							1.1						
Bankfull Cross Sectional Area (ft^2)	14.5							18.5							8.4							9.0							4.4						
Bankfull Width/Depth Ratio	NA							NA							12.9							NA							16.8						
Bankfull Entrenchment Ratio	NA							NA							9.6							NA							11.6						
Low Bank Height (ft)	1.9							2.3							1.4							1.7							1.1						
Bankfull Bank Height Ratio	1.00							1.00							1.00							1.00							1.00						
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				

	Cross Section 6 (Pool)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)																			
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+																
Record elevation (datum) used																																				
Bankfull Width (ft)	10.4							8.0							7.1																					
Floodprone Width (ft)	NA							NA							100																					
Bankfull Mean Depth (ft)	0.6							0.9							0.5																					
Bankfull Max Depth (ft)	2.0							1.8							0.9																					
Bankfull Cross Sectional Area (ft^2)	6.1							6.8							3.6																					
Bankfull Width/Depth Ratio	NA							NA							14.0																					
Bankfull Entrenchment Ratio	NA							NA							14.1																					
Low Bank Height (ft)	2.0							1.8							0.9																					
Bankfull Bank Height Ratio	1.0							1.0							1.0																					
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 12b. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT2 (996.7 feet)

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)																												
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+																						
Record elevation (datum) used																																				
Bankfull Width (ft)	11.8							9.9																												
Floodprone Width (ft)	NA							100																												
Bankfull Mean Depth (ft)	0.7							0.6																												
Bankfull Max Depth (ft)	1.6							1.3																												
Bankfull Cross Sectional Area (ft^2)	8.8							6.1																												
Bankfull Width/Depth Ratio	NA							16.1																												
Bankfull Entrenchment Ratio	NA							10.1																												
Low Bank Height (ft)	1.6							1.3																												
Bankfull Bank Height Ratio	1.00							1.00																												
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				
Based on fixed baseline bankfull elevation[1]																																				
Record elevation (datum) used																																				
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft^2)																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Low Bank Height (ft)																																				
Bankfull Bank Height Ratio																																				
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 12c. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT3 (1914.8 feet)

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							Cross Section 4 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																												
Bankfull Width (ft)	11.0							8.9							13.6							7.3						
Floodprone Width (ft)	NA							100							NA							100						
Bankfull Mean Depth (ft)	0.9							0.6							0.9							0.6						
Bankfull Max Depth (ft)	1.6							1.0							1.7							1.0						
Bankfull Cross Sectional Area (ft^2)	10.2							5.4							12.7							4.3						
Bankfull Width/Depth Ratio	NA							14.7							NA							12.4						
Bankfull Entrenchment Ratio	NA							11.2							NA							13.7						
Low Bank Height (ft)	1.6							1.0							1.7							1.0						
Bankfull Bank Height Ratio	1.00							1.00							1.00							1.00						
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												
Based on fixed baseline bankfull elevation[1]																												
Record elevation (datum) used																												
Bankfull Width (ft)																												
Floodprone Width (ft)																												
Bankfull Mean Depth (ft)																												
Bankfull Max Depth (ft)																												
Bankfull Cross Sectional Area (ft^2)																												
Bankfull Width/Depth Ratio																												
Bankfull Entrenchment Ratio																												
Low Bank Height (ft)																												
Bankfull Bank Height Ratio																												
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 12d. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT4 (530.9 feet)

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used														
Bankfull Width (ft)	10.9							7.5						
Floodprone Width (ft)	NA							100						
Bankfull Mean Depth (ft)	0.7							0.5						
Bankfull Max Depth (ft)	1.4							0.9						
Bankfull Cross Sectional Area (ft^2)	7.9							3.8						
Bankfull Width/Depth Ratio	NA							14.8						
Bankfull Entrenchment Ratio	NA							13.3						
Low Bank Height (ft)	1.4							0.9						
Bankfull Bank Height Ratio	1.00							1.00						
Cross Sectional Area between end pins (ft^2)														
d50 (mm)														
Based on fixed baseline bankfull elevation[1]														
Record elevation (datum) used														
Bankfull Width (ft)														
Floodprone Width (ft)														
Bankfull Mean Depth (ft)														
Bankfull Max Depth (ft)														
Bankfull Cross Sectional Area (ft^2)														
Bankfull Width/Depth Ratio														
Bankfull Entrenchment Ratio														
Low Bank Height (ft)														
Bankfull Bank Height Ratio														
Cross Sectional Area between end pins (ft^2)														
d50 (mm)														

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Exhibit Table 13a. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT1/Reach 1&2 (2033 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	7.1		7.9	8.6		2																														
Floodprone Width (ft)	100		100	100		2																														
Bankfull Mean Depth (ft)	0.5		0.5	0.5		2																														
[1]Bankfull Max Depth (ft)	0.9		1	1.1		2																														
Bankfull Cross Sectional Area (ft^2)	3.6		4	4.4		2																														
Width/Depth Ratio	14		15.6	17.2		2																														
Entrenchment Ratio	11.6		12.9	14.1		2																														
Low Bank Height (ft)	0.9		1.0	1.1		2																														
[1]Bank Height Ratio	1.0		1.0	1.0		2																														
Profile																																				
Riffle Length (ft)	9	28.6	28.5	49.5	10.7	35																														
Riffle Slope (ft/ft)	0	0.01	0.01	0.02	0.01	13																														
Pool Length (ft)	4.3	10.9	9.14	39.8	7.5	27																														
Pool Max depth (ft)	1.7		1.8	2		3																														
Pool Spacing (ft)	25.3	49.8	50.7	89.2	14.7	35																														
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C5																																			
Channel Thalweg length (ft)	2033																																			
Sinuosity (ft)	1.26 -1.29																																			
Water Surface Slope (Channel) (ft/ft)	0.0049																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	0																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 13b. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT1/Reach 3 (1463 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	10.4		10.4	10.4		1																														
Floodprone Width (ft)	100		100	100		1																														
Bankfull Mean Depth (ft)	0.8		0.8	0.8		1																														
[1]Bankfull Max Depth (ft)	1.4		1.4	1.4		1																														
Bankfull Cross Sectional Area (ft^2)	8.4		8.4	8.4		1																														
Width/Depth Ratio	13		13	13		1																														
Entrenchment Ratio	9.6		9.6	9.6		1																														
Low Bank Height (ft)	1.4		1.4	1.4		1																														
[1]Bank Height Ratio	1.0		1.0	1.0		1																														
Profile																																				
Riffle Length (ft)	12.2	39.6	38.7	63.2	12.7	23																														
Riffle Slope (ft/ft)	0	0.01	0	0.03	0.01	10																														
Pool Length (ft)	4.7	13	11.8	32	6.4	22																														
Pool Max depth (ft)	1.9	2.1	2.1	2.3		2																														
Pool Spacing (ft)	37.3	68	73.8	87.5	13.9	22																														
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C5																																			
Channel Thalweg length (ft)	1463																																			
Sinuosity (ft)	1.35																																			
Water Surface Slope (Channel) (ft/ft)	0.0028																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	0																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 13c. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT2 (996.7 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	9.9		9.9	9.9		1																														
Floodprone Width (ft)	100		100	100		1																														
Bankfull Mean Depth (ft)	0.6		0.6	0.6		1																														
[1]Bankfull Max Depth (ft)	1.3		1.3	1.3		1																														
Bankfull Cross Sectional Area (ft^2)	6.1		6.1	6.1		1																														
Width/Depth Ratio	16.1		16.1	16.1		1																														
Entrenchment Ratio	10.1		10.1	10.1		1																														
Low Bank Height (ft)	1.3		1.3	1.3		1																														
[1]Bank Height Ratio	1.0		1.0	1.0		1																														
Profile																																				
Riffle Length (ft)	15.7	29.9	28.4	52.3	10.8	11																														
Riffle Slope (ft/ft)	0.00	0.01	0.00	0.01	0.00	8																														
Pool Length (ft)	2.4	14.2	12.4	28.4	7.4	17																														
Pool Max depth (ft)	1.6	1.6	1.6	1.6		1																														
Pool Spacing (ft)	34.5	55.6	54.9	73.1	10.7	16																														
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C5																																			
Channel Thalweg length (ft)	996.7																																			
Sinuosity (ft)	1.22																																			
Water Surface Slope (Channel) (ft/ft)	0.0031																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	0																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 13d. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT3 (1914.8 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	7.3		8.1	8.9		2																														
Floodprone Width (ft)	100		100	100		2																														
Bankfull Mean Depth (ft)	0.6		0.6	0.6		2																														
[1]Bankfull Max Depth (ft)	1		1	1		2																														
Bankfull Cross Sectional Area (ft[2])	4.3		4.9	5.4		2																														
Width/Depth Ratio	12.4		13.5	14.7		2																														
Entrenchment Ratio	11.2		12.5	13.7		2																														
Low Bank Height (ft)	1.0		1.0	1.0		2																														
[1]Bank Height Ratio	1.0		1.0	1.0		2																														
Profile																																				
Riffle Length (ft)	22.1	39	35.7	60.9	10	29																														
Riffle Slope (ft/ft)	0	0.01	0	0.01	0	14																														
Pool Length (ft)	7	10.7	10.1	16.8	2.5	28																														
Pool Max depth (ft)	1.6	1.65	1.65	1.7		2																														
Pool Spacing (ft)	45.6	63	60.4	91.7	11.3	28																														
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C5																																			
Channel Thalweg length (ft)	1914.8																																			
Sinuosity (ft)	1.21 - 1.38																																			
Water Surface Slope (Channel) (ft/ft)	0.0033																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 13e. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Alliance Headwaters/97086) - Segment/Reach: UT4 (530.9 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	7.5		7.5	7.5		1																														
Floodprone Width (ft)	100		100	100		1																														
Bankfull Mean Depth (ft)	0.5		0.5	0.5		1																														
[1]Bankfull Max Depth (ft)	0.9		0.9	0.9		1																														
Bankfull Cross Sectional Area (ft^2)	3.8		3.8	3.8		1																														
Width/Depth Ratio	14.8		14.8	14.8		1																														
Entrenchment Ratio	13.3		13.3	13.3		1																														
Low Bank Height (ft)	0.9		0.9	0.9		1																														
[1]Bank Height Ratio	1.0		1.0	1.0		1																														
Profile																																				
Riffle Length (ft)	17.4	36.6	31.7	74.4	16.6	9																														
Riffle Slope (ft/ft)	0.01	0.01	0.01	0.01	0	9																														
Pool Length (ft)	5.2	9.5	9.34	12.3	2.3	9																														
Pool Max depth (ft)	1.4	1.4	1.4	1.4		1																														
Pool Spacing (ft)	21.2	49.6	46.5	75.4	15.6	9																														
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C5																																			
Channel Thalweg length (ft)	530.9																																			
Sinuosity (ft)	1.36																																			
Water Surface Slope (Channel) (ft/ft)	0.0051																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Appendix E
Groundwater Gauge Soil Profiles

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

SOIL BORING LOG

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 1**

Investigator: W. Grant Lewis

Soil Series: Lynchburg

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-14	10 YR 3/1	85	10 YR 6/6	15	clay loam
14-20	10 YR 4/2	95	10 YR 4/6	5	clay loam
20-30	10 YR 6/2	80	10YR 6/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 2**

Investigator: W. Grant Lewis

Soil Series: Lynchburg

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10 YR 3/1	100			loam
10-17	10 YR 5/2	85	10 YR 5/8	15	clay loam
17-30	10 YR 5/2	60	10 YR 5/8	40	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 3**

Investigator: W. Grant Lewis

Soil Series: Goldsboro Sandy Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10 YR 4/2	100			loam
6-12	10 YR 3/1	85	10 YR 6/6	15	clay loam
12-20	10 YR 4/2	95	10 YR 4/6	5	sandy clay loam
20-30	10 YR 6/2	80	10YR 6/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 4**

Investigator: W. Grant Lewis

Soil Series: Dorian Fine Sandy Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 5/2	85	10 YR 5/6	15	sandy loam
7-10	10 YR 5/6	100			clay loam
10-17	10 YR 4/1	100			clay loam
17-30	10 YR 7/1	80	10YR 6/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 5**

Investigator: W. Grant Lewis

Soil Series: Goldsboro Sandy Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/1	100			loam
7-14	10 YR 4/1	85	10 YR 6/6	15	clay loam
14-30	10 YR 6/1	60	10 YR 6/8	40	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 6**

Investigator: W. Grant Lewis

Soil Series: Lynchburg Sandy Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10 YR 4/2	100			loam
10-20	10 YR 3/1	90	10 YR 4/6	10	clay loam
20-30	10 YR 5/1	95	10 YR 4/6	5	clay loam
20-30	10 YR 6/2	80	10YR 4/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 7**

Investigator: W. Grant Lewis

Soil Series: Lynchburg Sandy Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10 YR 4/2	100			loam
10-20	10 YR 3/1	90	10 YR 4/6	10	clay loam
20-30	10 YR 3/1	95	10 YR 4/6	5	clay loam
20-30	10 YR 6/2	80	10YR 4/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 8**

Investigator: W. Grant Lewis

Soil Series: Lynchburg sandy loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10 YR 3/2	100			loam
10-20	10 YR 6/2	90	10 YR 6/6	15	clay loam
20-30	10 YR 2/1	100			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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 9**

Investigator: W. Grant Lewis

Soil Series: Goldsboro Sandy Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-8	10 YR 2/1	100			mucky
8-12	10 YR 3/1	80	10 YR 6/6	20	clay loam
12-20	10 YR 6/1	70	10 YR 5/8	30	clay loam
20-30	10 YR 6/1	50	10YR 5/8	50	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 10**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10 YR 4/1	90	10 YR 4/6	10	clay loam
10-17	10 YR 4/1	85	10 YR 4/6	15	clay loam
17-30	10 YR 4/2	100	10 YR 4/6		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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 11**

Investigator: W. Grant Lewis

Soil Series: Goldsboro Sandy Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-14	10 YR 3/1	85	10 YR 6/6	15	clay loam
14-20	10 YR 4/2	95	10 YR 4/6	5	clay loam
20-30	10 YR 6/2	80	10YR 6/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 12**

Investigator: W. Grant Lewis

Soil Series: Goldsboro Sandy Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-8	10 YR 4/2	100			loam
8-14	10 YR 3/1	85	10 YR 6/6	15	clay loam
14-20	10 YR 5/2	95	10 YR 4/6	5	sandy clay loam
20-30	7.5 YR 6/1	80	7.5 YR 5/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 13**

Investigator: W. Grant Lewis

Soil Series: Lynchburg sandy loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-9	10 YR 4/2	100			loam
9-18	10 YR 3/1	85	10 YR 6/6	15	clay loam
18-25	10 YR 4/2	95	10 YR 4/6	5	clay loam
25-35	10 YR 6/1	80	10YR 5/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 14**

Investigator: W. Grant Lewis

Soil Series: Lynchburg sandy loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-14	10 YR 3/1	85	10 YR 6/6	15	clay loam
14-20	10 YR 4/2	95	10 YR 4/6	5	clay loam
20-30	10 YR 6/2	80	10YR 6/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 15 ()**

Investigator: W. Grant Lewis

Soil Series: Lynchburg sandy loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-8	10 YR 4/2	100			loam
8-15	10 YR 3/1	85	10 YR 6/6	15	sandy clay loam
15-25	10 YR 5/2	95	10 YR 4/6	5	clay loam
25-35	10 YR 6/1	80	10YR 5/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 16**

Investigator: W. Grant Lewis

Soil Series: Lynchburg sandy loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/3	100			loam
7-14	10 YR 4/2	85	10 YR 5/6	15	clay loam
14-20	10 YR 4/2	95	10 YR 4/6	5	clay loam
20-30	10 YR 6/2	80	10YR 6/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 17**

Investigator: W. Grant Lewis

Soil Series: Lynchburg sandy loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-14	10 YR 3/1	85	10 YR 6/6	15	clay loam
14-20	10 YR 4/2	95	10 YR 4/6	5	clay loam
20-30	10 YR 6/2	80	10YR 6/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 18**

Investigator: W. Grant Lewis

Soil Series: Lynchburg sandy loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-14	10 YR 3/1	85	10 YR 6/6	15	clay loam
14-20	10 YR 4/2	95	10 YR 4/6	5	clay loam
20-30	10 YR 6/2	80	10YR 6/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 19**

Investigator: W. Grant Lewis

Soil Series: Goldsboro sandy loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-30	10 YR 5/1	70	10yr 5/6	30	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 20**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-14	10 YR 3/1	85	10 YR 6/6	15	clay loam
14-30	10 YR 4/2	95	10 YR 4/6	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 21**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-20	10 YR 3/1	80	10 YR 6/6	20	clay loam
20-30	10 YR 4/2	90	10 YR 4/6	10	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 22**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10 YR 2/2	100			loam
10-20	10 YR 5/1	80	10 YR 5/8	20	clay loam
20-30	10 YR 5/1	50	10 YR 5/8	50	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 23**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-14	10 YR 3/1	85	10 YR 6/6	15	clay loam
14-20	10 YR 4/2	95	10 YR 4/6	5	sandy clay
20-30	10 YR 6/2	80	10YR 6/6	20	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 24**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-20	10 YR 3/1	85	10 YR 6/6	15	clay loam
20-30	10 YR 4/2	95	10 YR 4/6	5	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 25**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-25	10 YR 5/1	85	10 YR 6/6	15	clay loam
25-30	10 YR 6/1	95	10 YR 4/6	5	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 26**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	10 YR 4/2	100			loam
7-20	10 YR 6-2	85	10 YR 5/6	15	sandy clay loam
20-35	10 YR 6/2	70	10 YR 4/6	30	sany 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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 27**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10 YR 4/1	100			loam
10-30	10 YR 5/1	85	10 YR 5/8	15	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/ Coordinates: **Soil Profile @ Gauge 28**

Investigator: W. Grant Lewis

Soil Series: Leaf Silt Loam

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10 YR 4/2	100			loam
10-30	10 YR 3/1	85	10 YR 6/6	15	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

Date: 8/7/2019

Project/Site: Alliance Headwaters

County, State: Johnston County, NC

Sampling Point/
Coordinates: **Soil Profile @ Gauge 29**

Investigator: W. Grant Lewis

Soil Series: Lynchburg

Notes: Location is shown on Figure 2A and 2B.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10 YR 4/1	100			loam
10-30	10 YR 5/1	70	10 YR 5/8	30	clay loam

North Carolina Licensed Soil Scientist

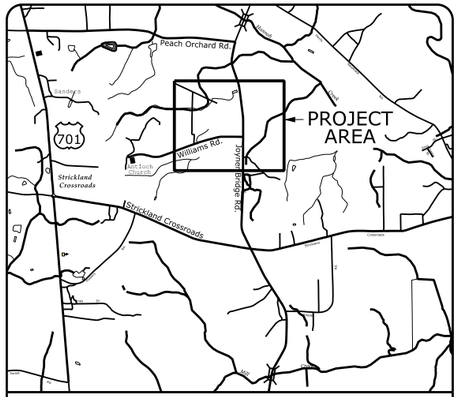
Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

Appendix F
As-built Plan Sheets

PROJECT: ALLIANCE HEADWATERS



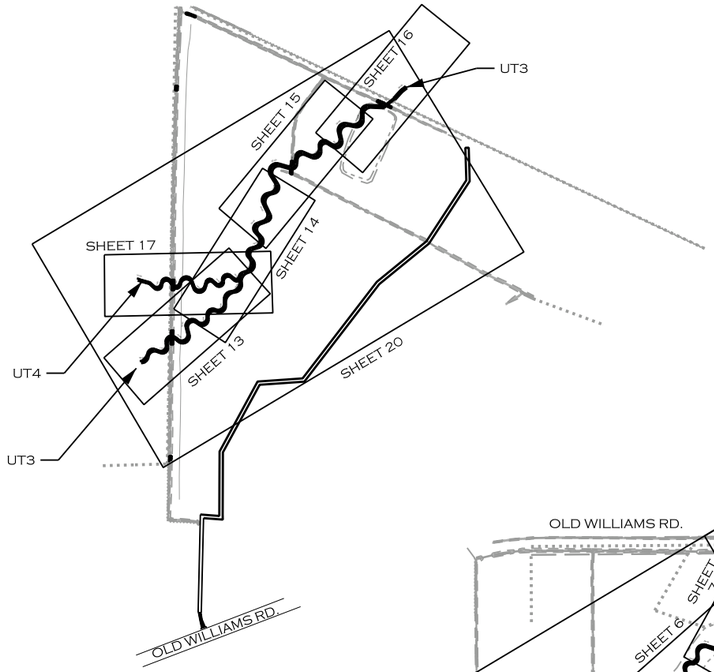
VICINITY MAP

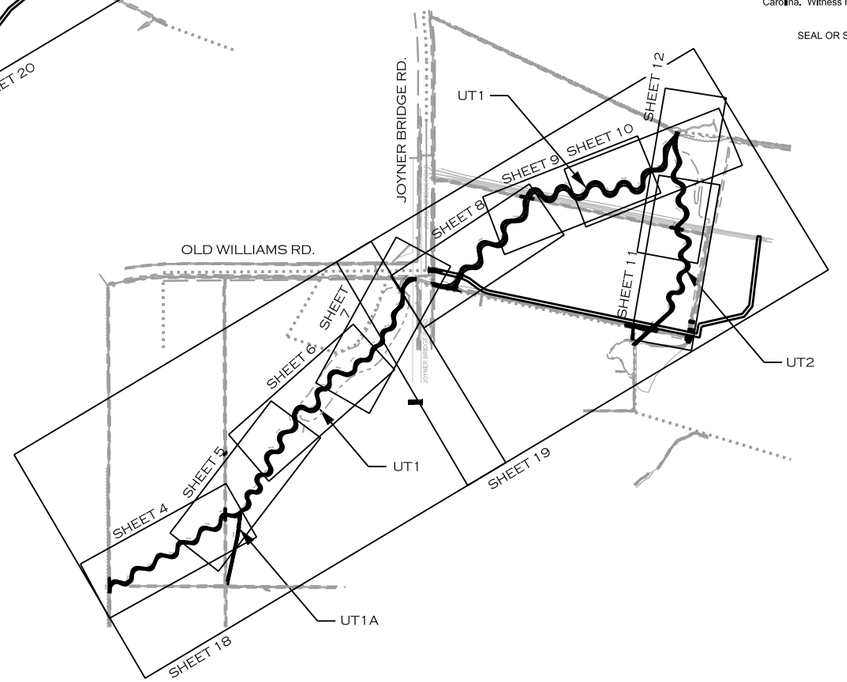
RESTORATION SYSTEMS, LLC

JOHNSTON COUNTY

LOCATION: JOHNSTON COUNTY, NC

TYPE OF WORK: AS-BUILT PLANS





STATE: NC | PROJECT REFERENCE NO.: 074 | SHEET NO.: 1 | TOTAL SHEETS: 19

INDEX OF SHEETS

SURVEYORS CERTIFICATION(S)

Surveyor's disclaimer: No attempt was made to locate any cemeteries, wetlands, hazardous material sites, underground utilities or any other features above, or below ground other than those shown. However, no visible evidence of cemeteries or utilities, aboveground or otherwise, was observed by the undersigned (other than those shown).

I certify that the survey is of an existing parcel or parcels of land or one or more existing easements and does not create a new street or change an existing street.

I JOHN A. RUDOLPH , certify that this plat was prepared under my supervision from an actual field survey made under my supervision, of as-built conditions.

That the boundaries not surveyed are clearly indicated as such and were plotted from information as referenced hereon; That the ratio of precision as calculated was 1:7,500+ and that the global navigational satellite system (GNSS) was used to perform this survey and the following information was used:

Class of Survey: CLASS B (HORIZONTAL) CLASS B (VERTICAL)
Positional Accuracy: 0.12 feet (HORIZONTAL)
Type of GPS field procedure: RTK
Dates of survey: February 2019
Datum/Epoch: NAD 1983(2011)
Published/Fixed Control Use: OPUS
Geoid Model: 2012B CONUS
Combined Grid Factor: 0.99990680 GROUND TO GRID
Units: US SURVEY FEET

That this plat meets the requirements of the standards of practice for land surveying in North Carolina. Witness my hand and seal this XX day of XXXX , 2019

SEAL OR STAMP

"PRELIMINARY PLAT"
NOT FOR RECORDATION,
CONVEYANCES OR SALES

L-4194
Professional Land Surveyor — License Number

ALLIANCE HEADWATERS STREAM AND WETALND MITIGATION SITE

SAW - 2016-00882
NC DMS Project # 97086
NC DMS Contract # 6832

Sponsor: Restoration Systems, LLC
POC: Raymond Holz
1101 Haynes St. Suite 211
Raleigh, NC 27604

NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

GRAPHIC SCALES

20 10 0 20 40
PLANS

20 10 0 20 40
PROFILE (HORIZONTAL)

5 2.5 0 5 10
PROFILE (VERTICAL)

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:

RESTORATION SYSTEMS | LLC
1101 HAYNES ST.
RALEIGH, NC 27604
(919) 755-9490

RAYMOND HOLZ
PROJECT MANAGER

PREPARED IN THE OFFICE OF:

ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD
SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

JANUARY 2020
COMPLETION DATE:

EMMETT PERDUE, PE
PROJECT ENGINEER

PROJECT ENGINEER

SIGNATURE: P.E.

PROJECT # 074 | SHEET NO. 1A

SYMBOLOGY / NOTES

STREAM CONVENTIONAL SYMBOLS

- ROCK J-HOOK (JH)
- ROCK VANE (RV)
- OFFSET ROCK CROSS VANE (OV)
- ROCK CROSS VANE (XV)
- TEMPORARY SILT CHECK
- ROOT WAD (RW)
- GRADE CONTROL LOG J-HOOK (LJH)
- LOG VANE (LV)
- LOG STEP (LS)
- ROCK STEP (RS)
- LOG CROSS VANE (XV)
- CONSTRUCTED CASCADE (CC)
- CONSTRUCTED RIFFLE (CR)
- BOULDER CLUSTER
- LOG ROLLER (LR)
- GRADE CONTROL WOODY RIFFLE (WR)
- TOEWOOD WITH GEOLIFT (TW)
- SOD MATS (SM)
- DEBRIS JAM (DJ-T#)
- SINGLE WING DEFLECTOR (SW)
- DOUBLE WING DEFLECTOR (DW)

- — SF — SAFETY FENCE
- — TP — TAPE FENCE
- — ||| — SILT FENCE
- — CE — CONSERVATION EASEMENT
- — 20 — EXISTING MAJOR CONTOUR
- — 21 — EXISTING MINOR CONTOUR
- LIMITS OF DISTURBANCE
- BANKFULL BENCH (GRADE)
- PROPERTY LINE
- ACCESS ROAD
- 10+00 STREAM THALWEG
- STREAM TOP OF BANKS
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- PERMANENT FORD STREAM CROSSING (PFC)
- TRANSPLANTED VEGETATION
- TREE REMOVAL
- TREE PROTECTION
- DITCH PLUG
- CHANNEL FILL
- GRADE BANK 2:1 OR FLATTER
- EXISTING WETLANDS
- CONSTRUCTION ENTRANCE
- MW - # MONITORING WELL
- SG - # STREAM GAUGE
- VP - # VEGETATION PLOT
- CROSS SECTION

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

2/11/2020
R:\PROJECTS\RDU0074_RS\ALLIANCEHEADWATERS\CADD\PLANS\AS_BUILT\AHW_ASB_PSH_1A.DGN
MKOEN

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

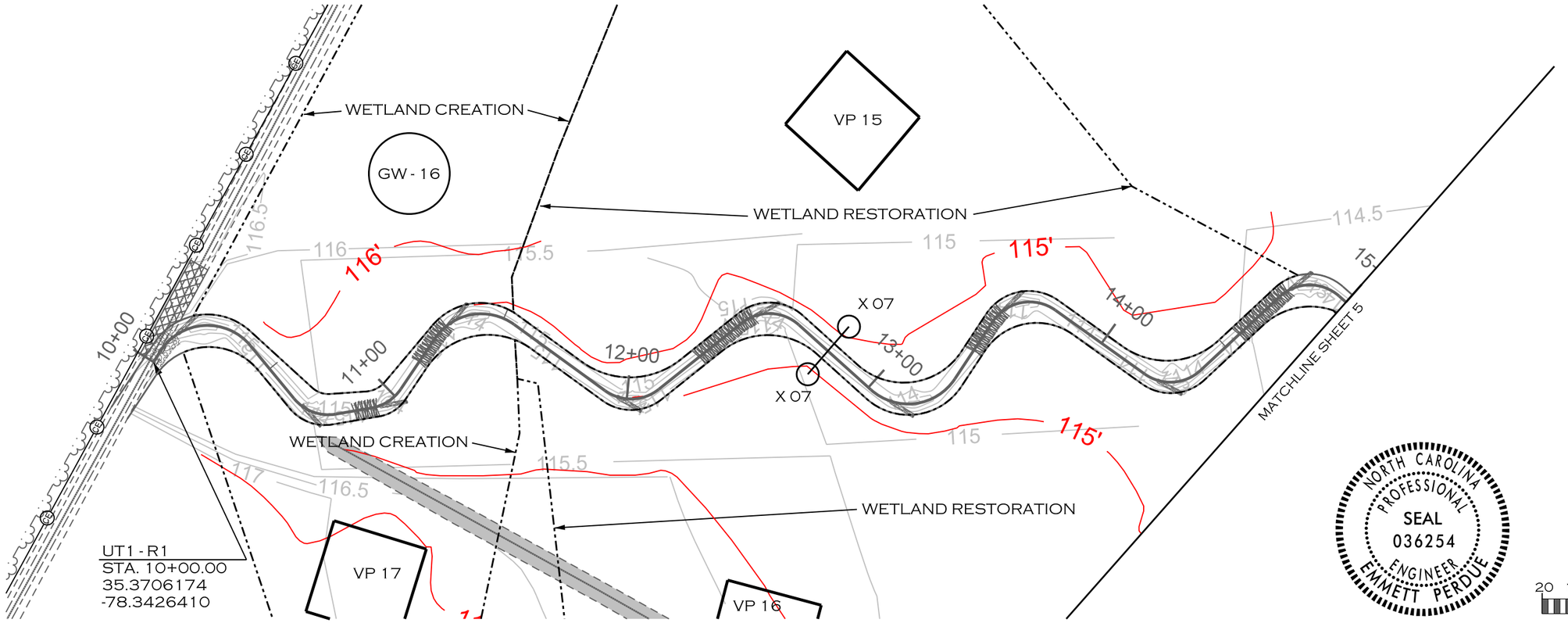
ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN ROAD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

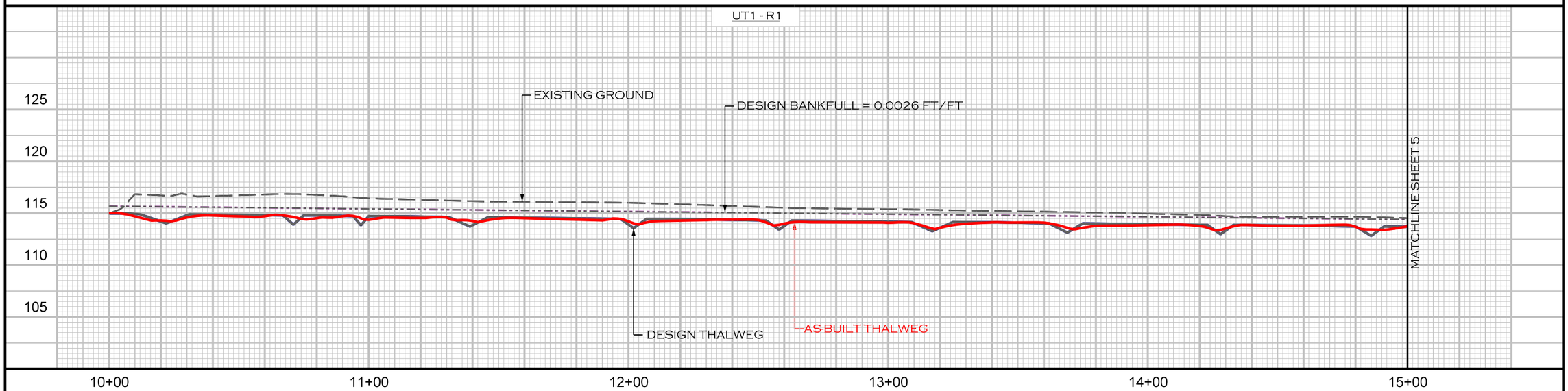
PROJECT ENGINEER

PROJECT # 074 | SHEET NO. 4

PLAN / PROFILE



NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE



REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

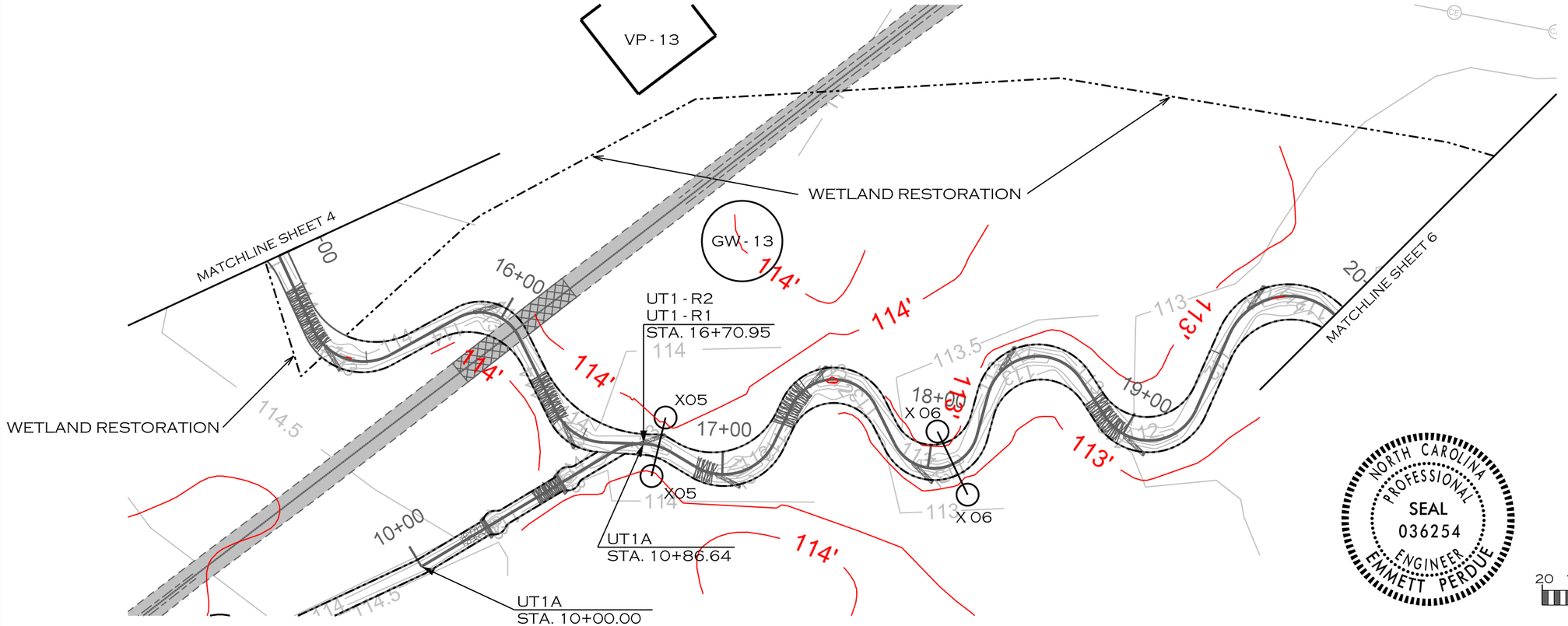
PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

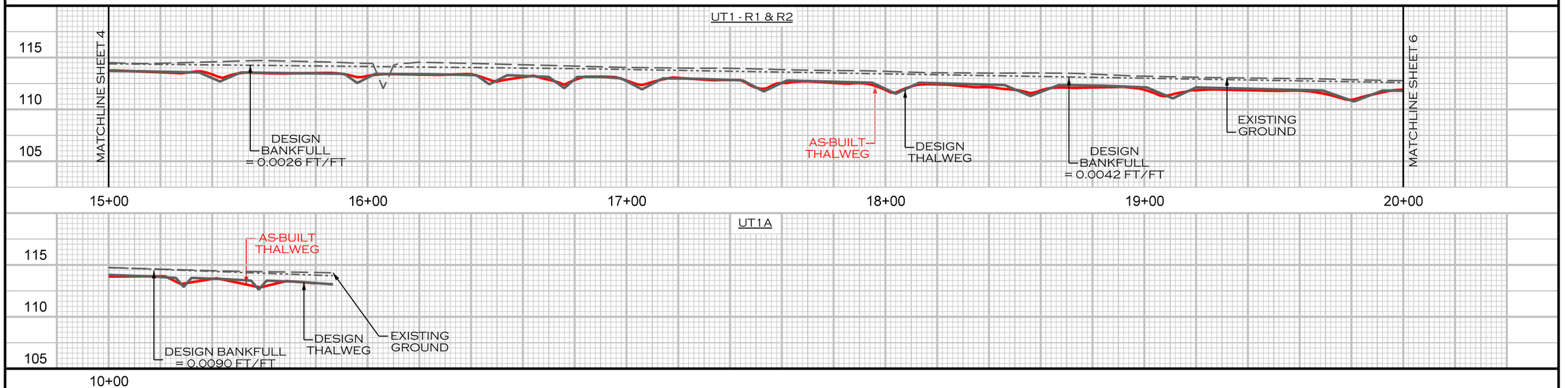
PROJECT ENGINEER

2/11/2020
R:\PROJECTS\RDU0074_RS-ALLIANCEHEADWATERS\CADD\PLANS\AS_BUILT\AHW_ASB_PSH_04.DGN
JKROON

PROJECT # 074 | SHEET NO. 5

PLAN / PROFILE





NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

NAD 83

20 10 0 20 40
SCALE (FT)

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

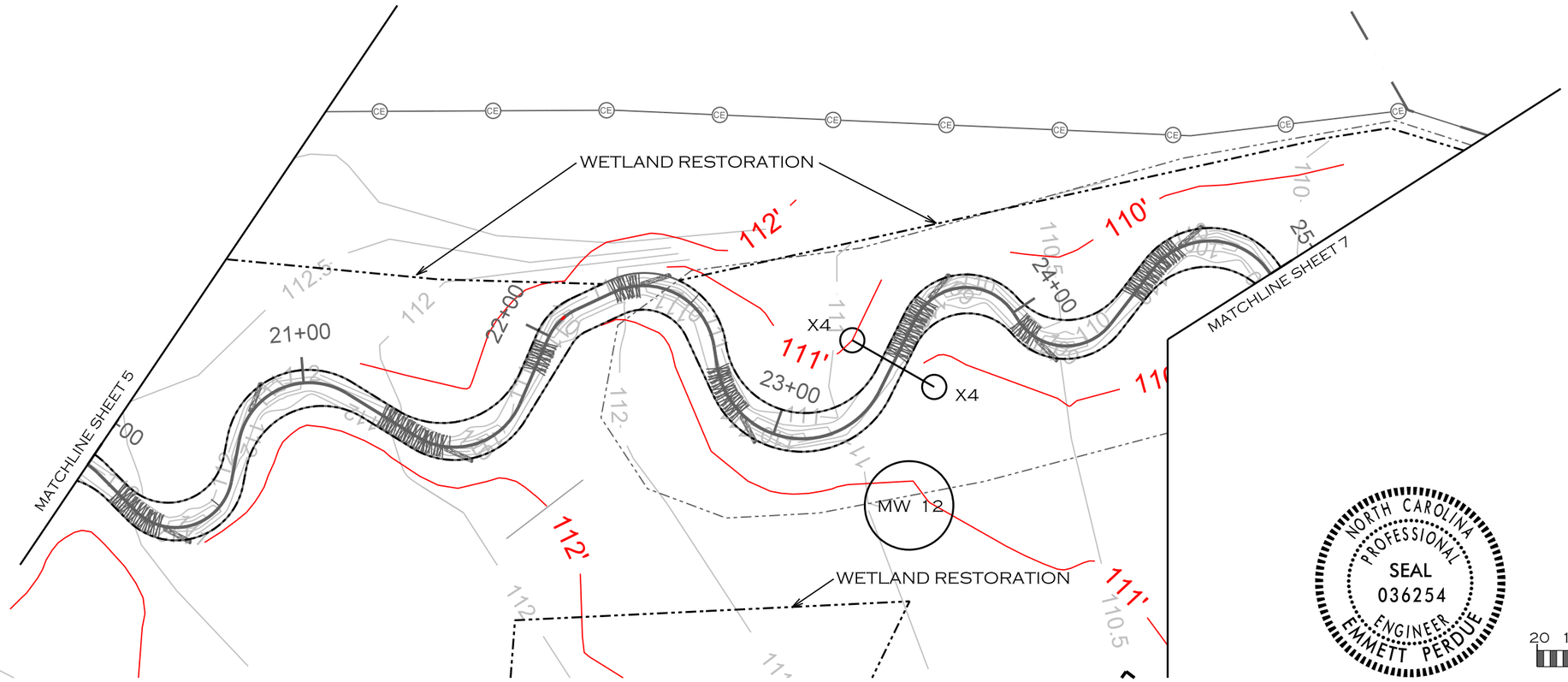
PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD. SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER

2/11/2020
R:\Projects\RDU0074_RS-AllianceHeadwaters\CADD\Plans\As_Built\AHW_ASB_PSH_05.dgn
MKOPKIN

PROJECT # 074 | SHEET NO. 6

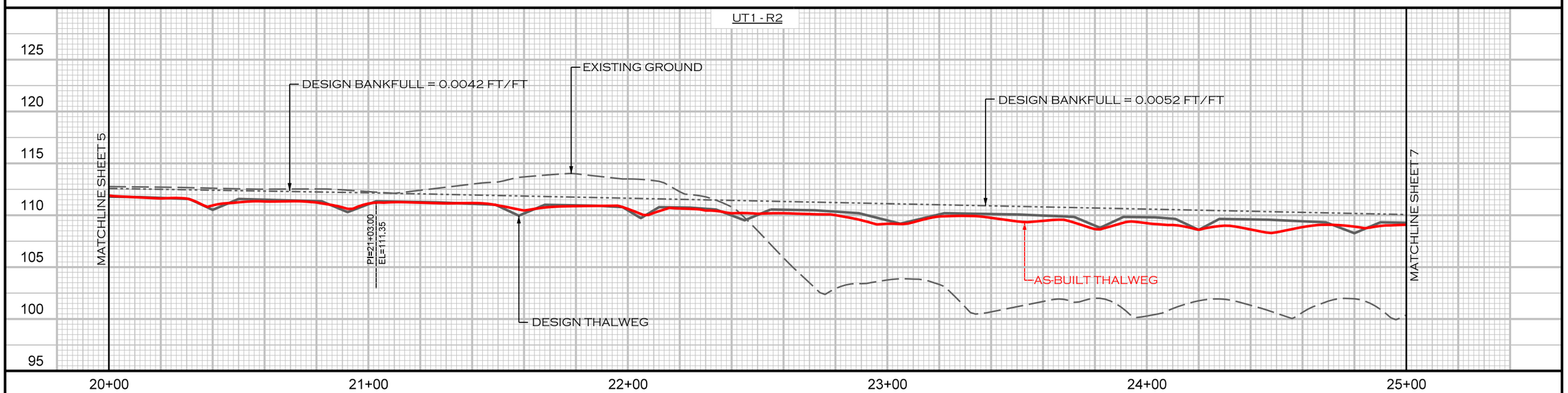
PLAN / PROFILE



NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

NAD 83

20 10 0 20 40
SCALE (FT)



REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

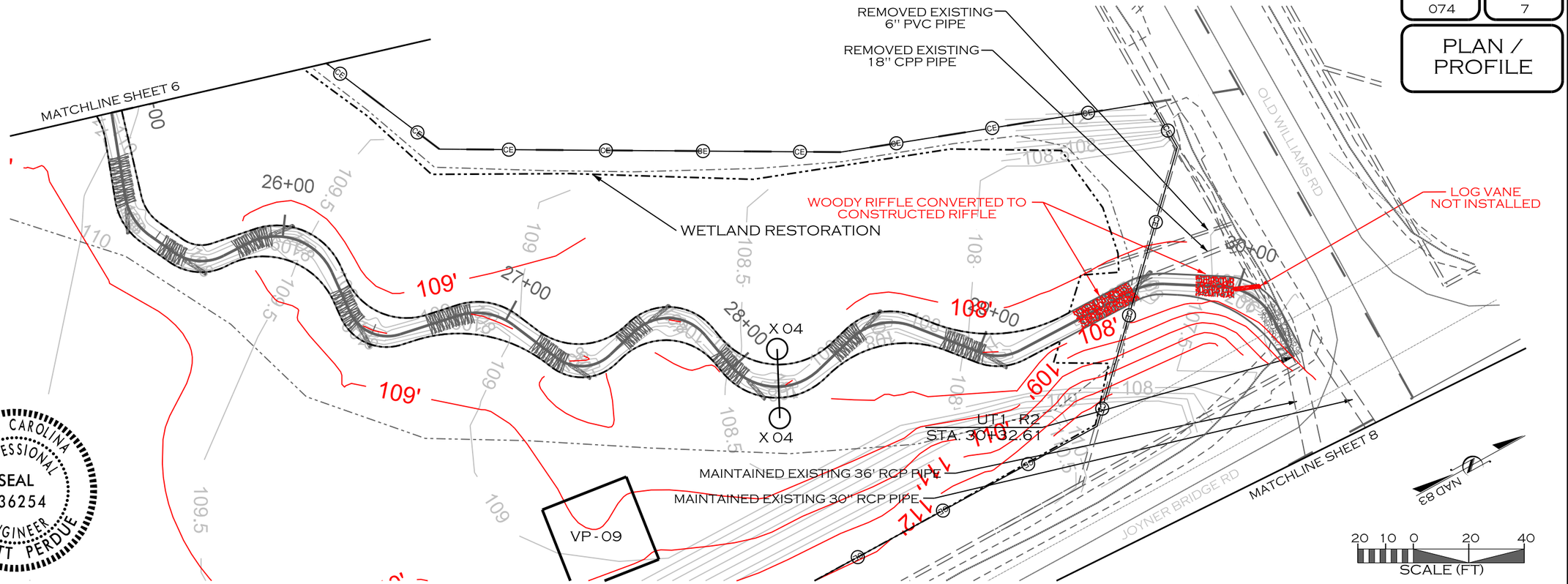
PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

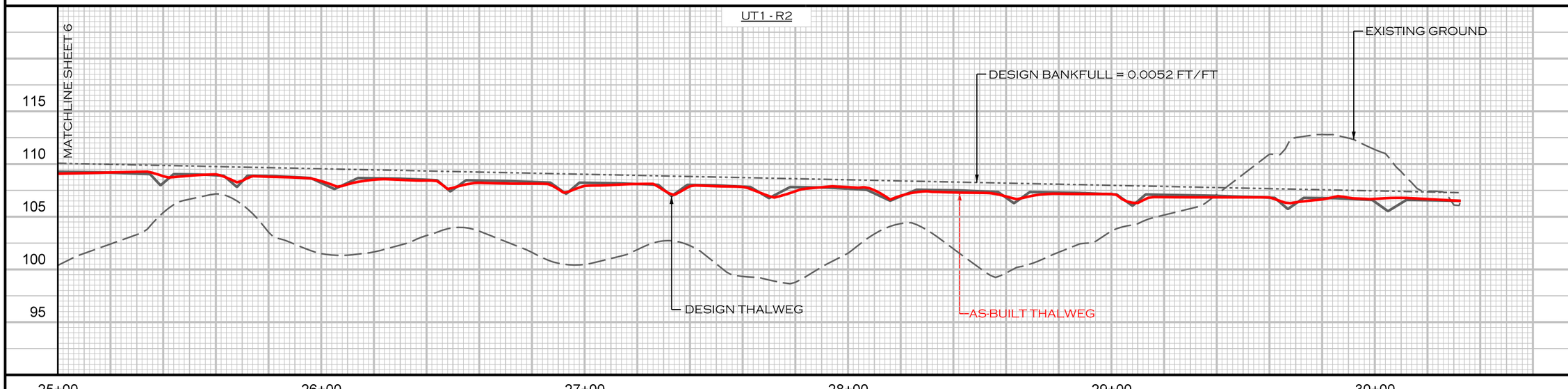
PROJECT ENGINEER

2/11/2020
R:\PROJECTS\RDU0074_RS-ALLIANCEHEADWATERS\CADD\PLANS\AS_BUILT\AHW_ASB_PSH_06.DGN
JBROOKS

PROJECT # 074 | SHEET NO. 7

PLAN / PROFILE





NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER

2/11/2020
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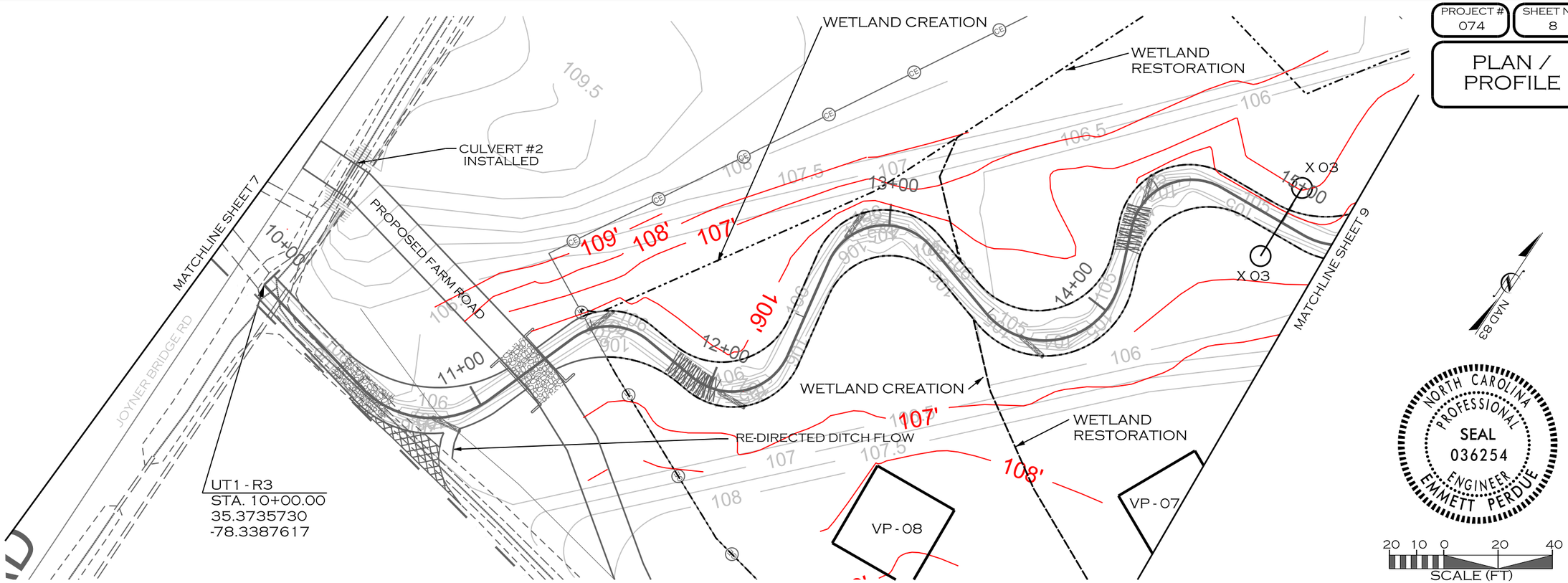
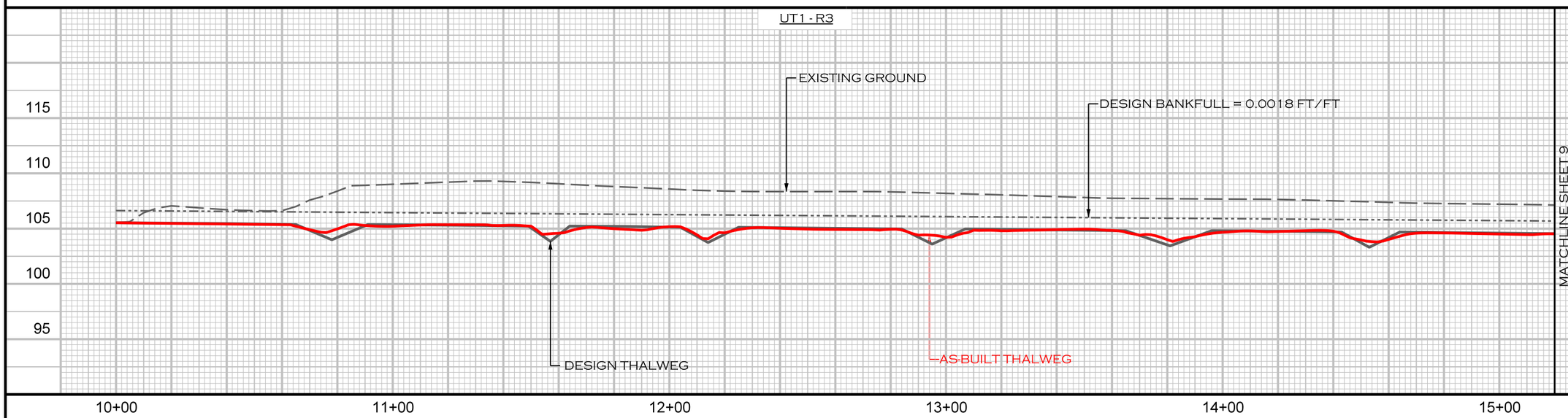
MKCOX

PROJECT # 074 | SHEET NO. 8

PLAN / PROFILE





REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

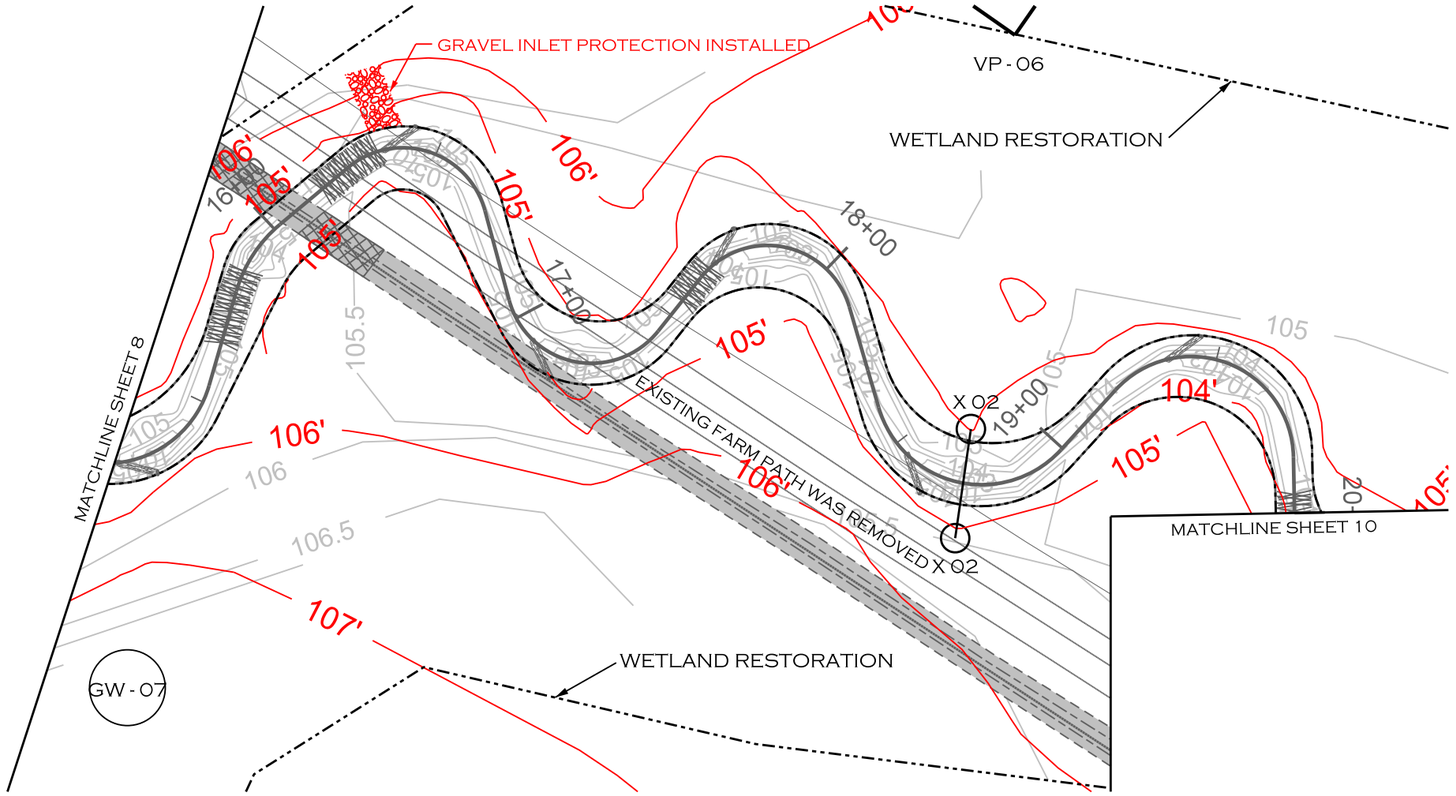
PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER

2/11/2020
R:\PROJECTS\RDU0074_RS-ALLIANCEHEADWATERS\CADD\PLANS\AS_BUILT\AHW_ASB_PSH_08.DGN

PROJECT # 074 | SHEET NO. 9

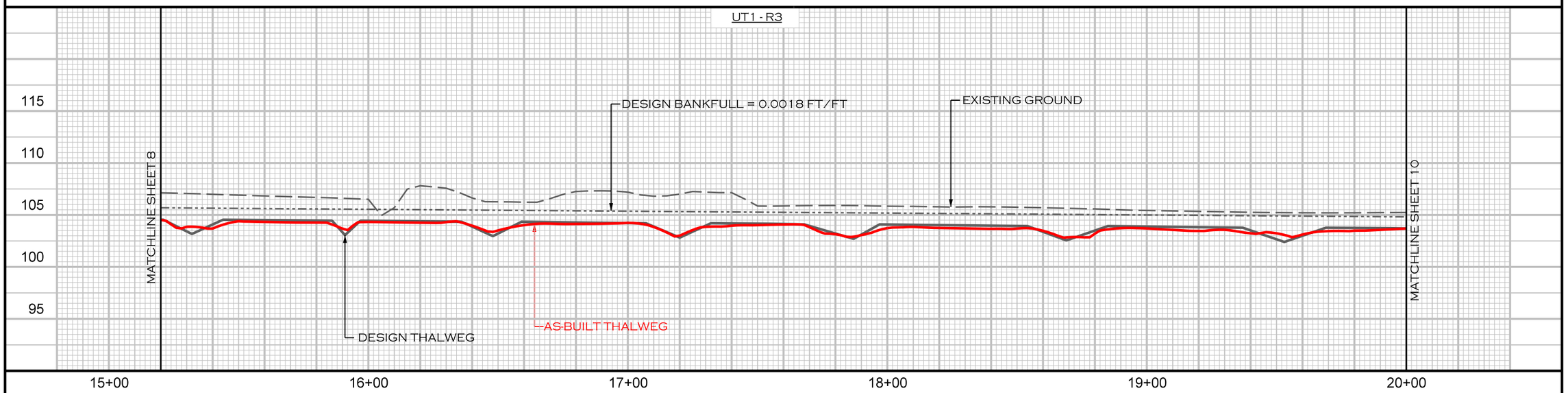
PLAN / PROFILE



NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

NAD 83

20 10 0 20 40
SCALE (FT)



REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

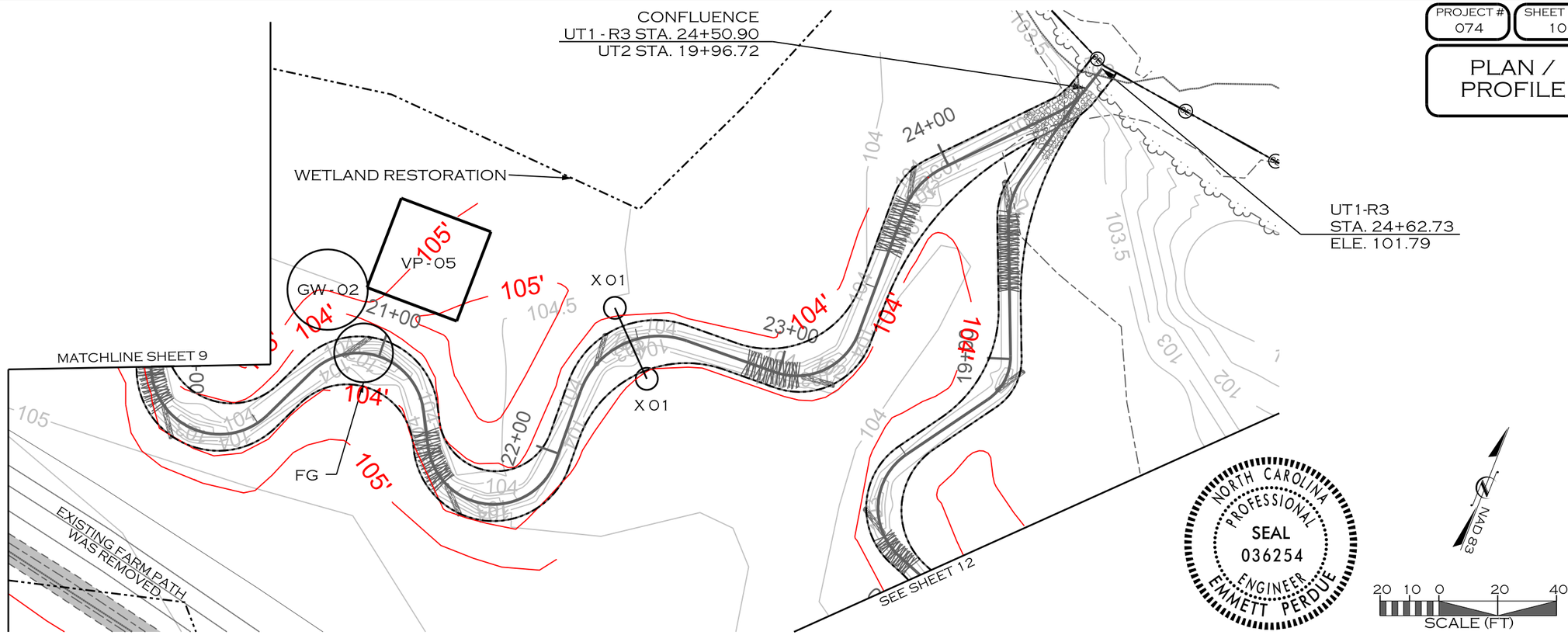
PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

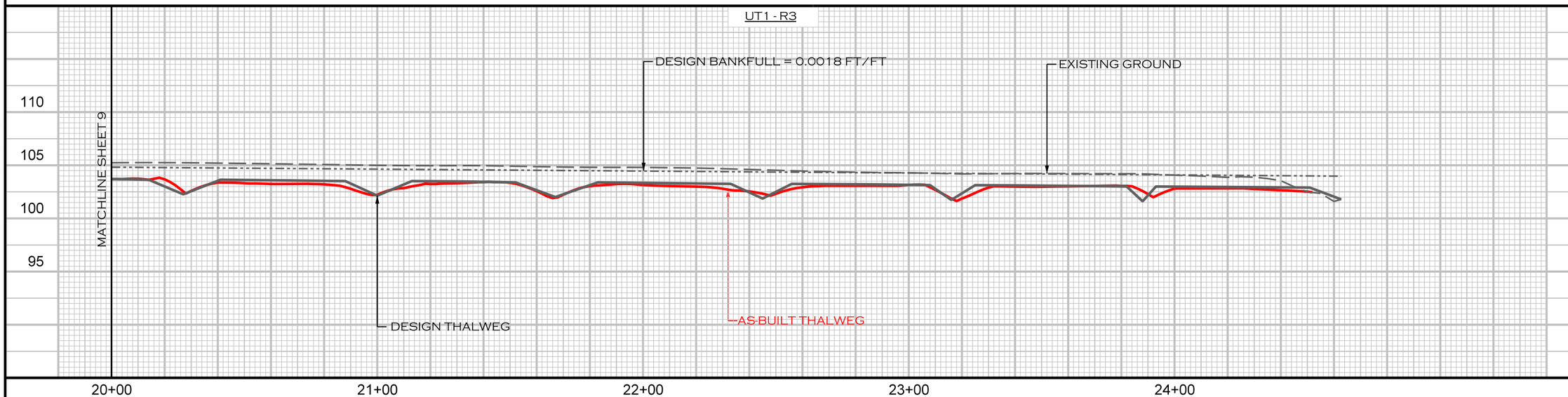
PROJECT ENGINEER

2/11/2020
R:\PROJECTS\RDU0074_RS-ALLIANCEHEADWATERS\CADD\PLANS\AS_BUILT\AHW_ASB_PSH_09.DGN
AKOON

PROJECT # 074 | SHEET NO. 10

PLAN / PROFILE





REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

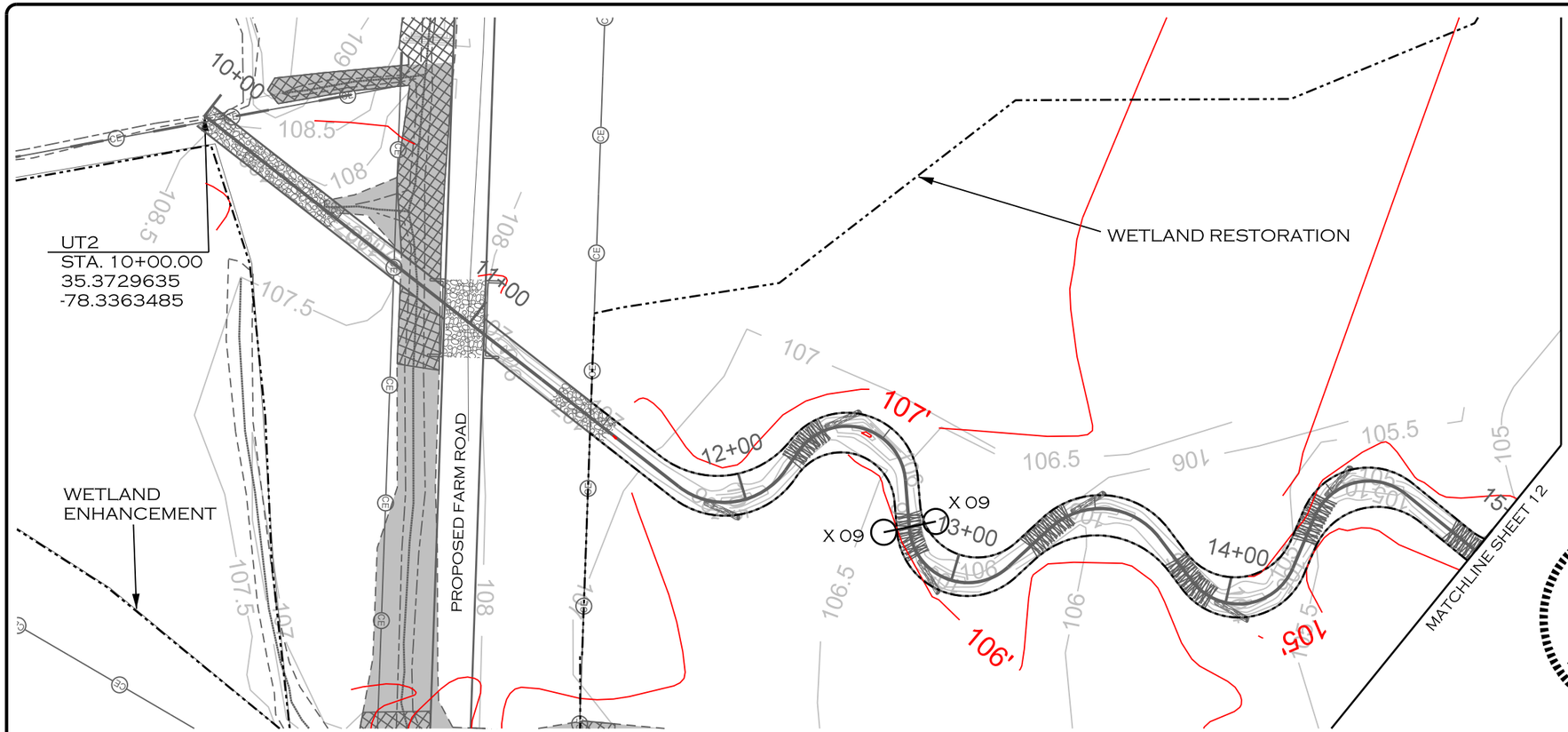
PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

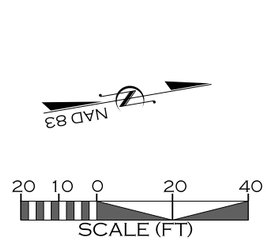
PROJECT ENGINEER

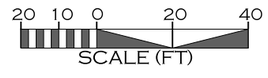
2/11/2020
R:\PROJECTS\RDU0074_RS-ALLIANCEHEADWATERS\CADD\PLANS\AS_BUILT\AHW_ASB_PSH_10.DGN
MKOEN

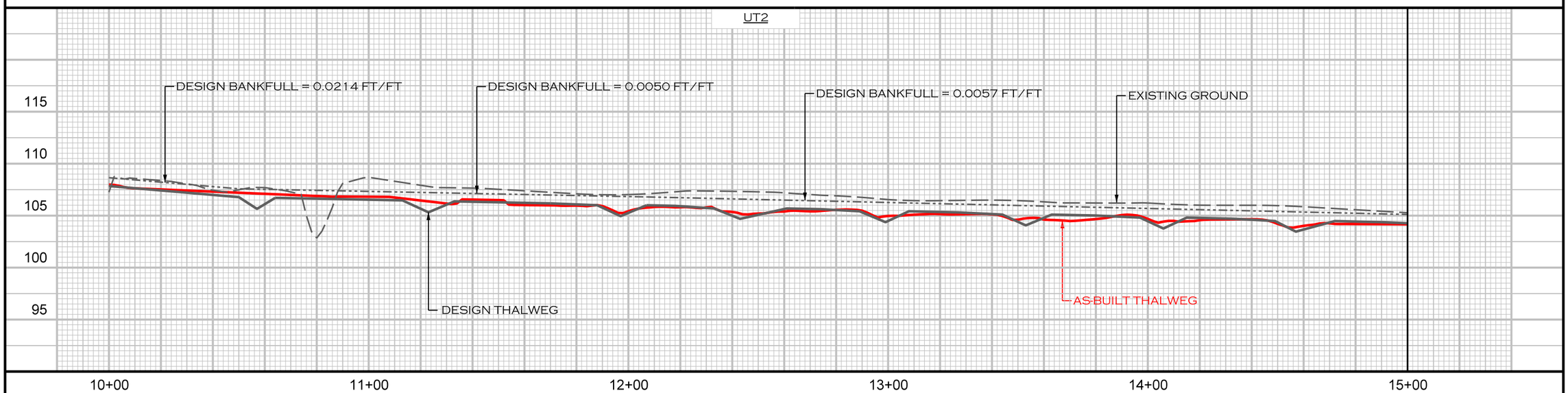
PROJECT # 074 | SHEET NO. 11

PLAN / PROFILE









REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

2/11/2020
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MKOPAN

SEE SHEET 10

PROJECT # 074 | SHEET NO. 12

PLAN / PROFILE

WETLAND RESTORATION

VP - 02

EXISTING FARM PATH WAS REMOVED

MATCHLINE SHEET 11

FG

X 08

X 08

WETLAND RESTORATION

VP - 01

EXISTING FARM PATH WAS REMOVED

104'

105'

16+00

17+00

18+00

19+00

24+00

104.5

104

103.5

103

102

101

NAD 83

UT2
STA. 19+96.72
ELE. 102.90

NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

20 10 0 20 40
SCALE (FT)

UT2

DESIGN BANKFULL = 0.0057 FT/FT

DESIGN BANKFULL = 0.0012 FT/FT

EXISTING GROUND

MATCHLINE SHEET 11

DESIGN THALWEG

AS-BUILT THALWEG

115
110
105
100
95

15+00 16+00 17+00 18+00 19+00 20+00

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

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ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

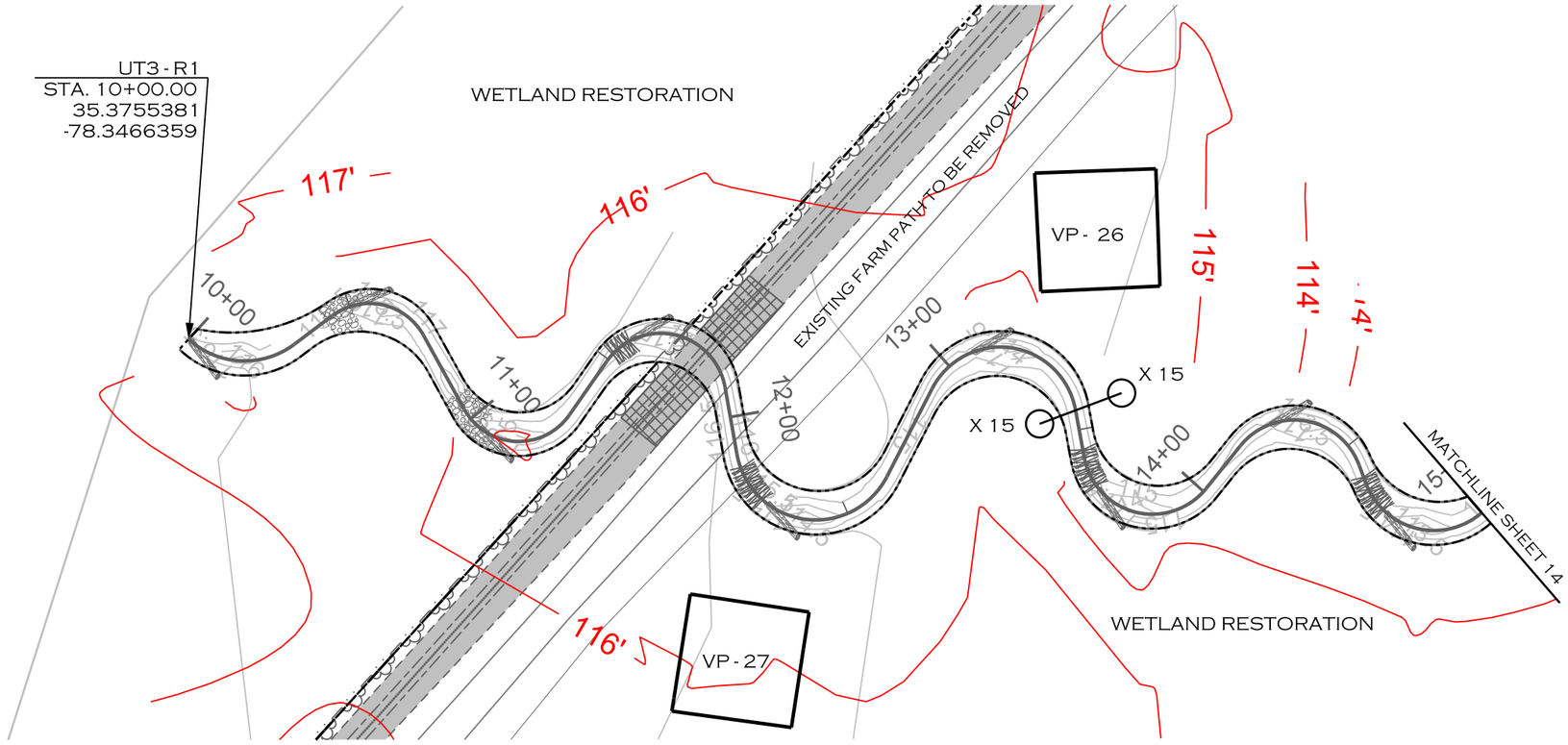
PROJECT ENGINEER

2/11/2020
R:\PROJECTS\RDU0074_RS-ALLIANCEHEADWATERS\CADD\PLANS\AS_BUILT\AHW_ASB_PSH_12.DGN
BROWN

PROJECT # 074 | SHEET NO. 13

PLAN / PROFILE

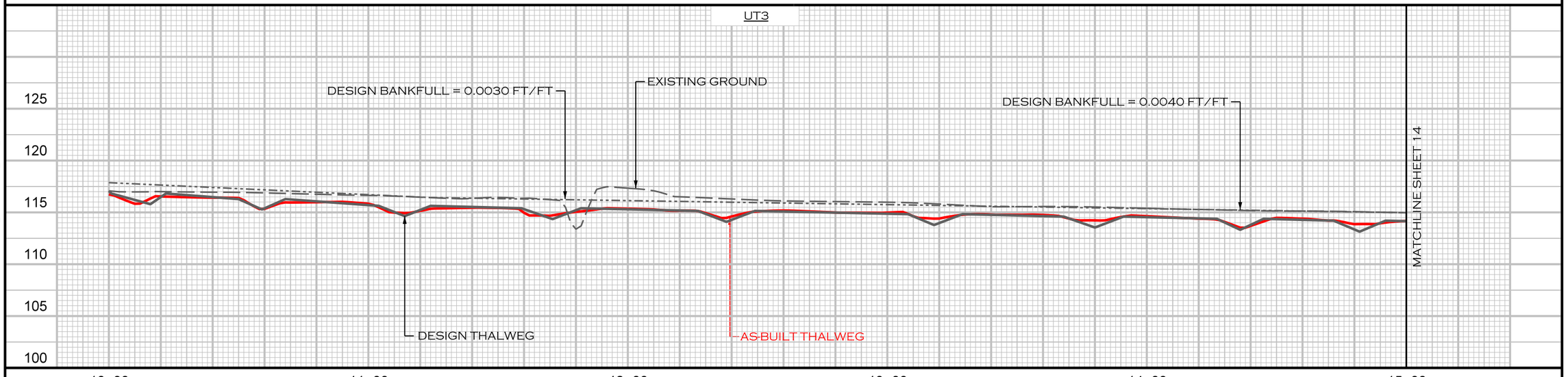
NOTE:
BEGINNING OF UT3 WILL TRANSITION FROM EXISTING CHANNELS INSIDE WOODLINE PER ENGINEERS DIRECTION. DISTURBANCE WITHIN WOODS WILL BE MINIMIZED.



NAD 83

NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

20 10 0 20 40
SCALE (FT)



REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER

2/11/2020
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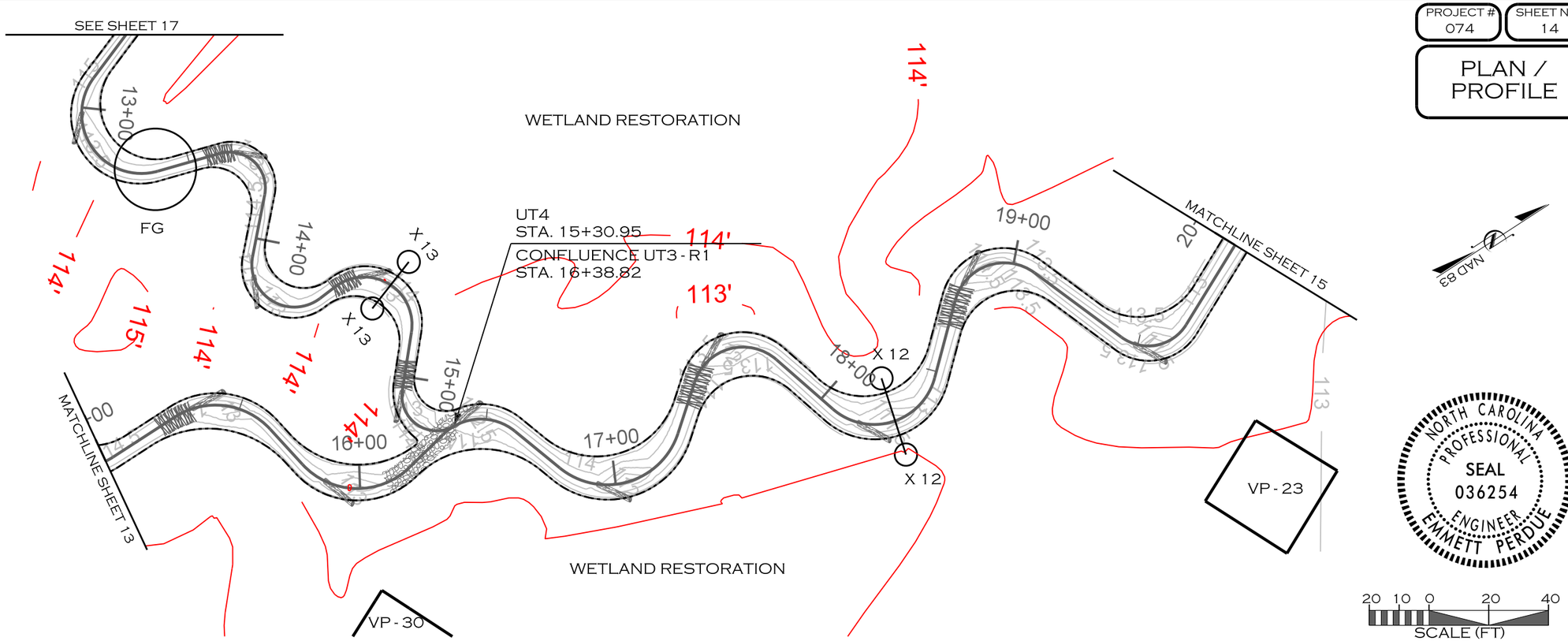
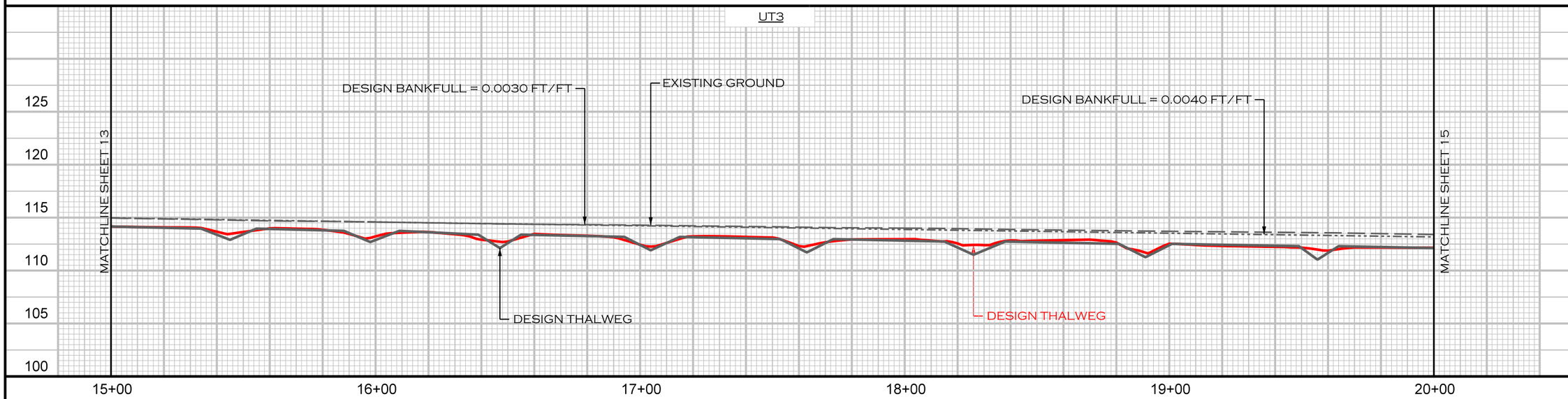
MKOCH

PROJECT # 074 | SHEET NO. 14

PLAN / PROFILE





NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

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ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER

2/11/2020
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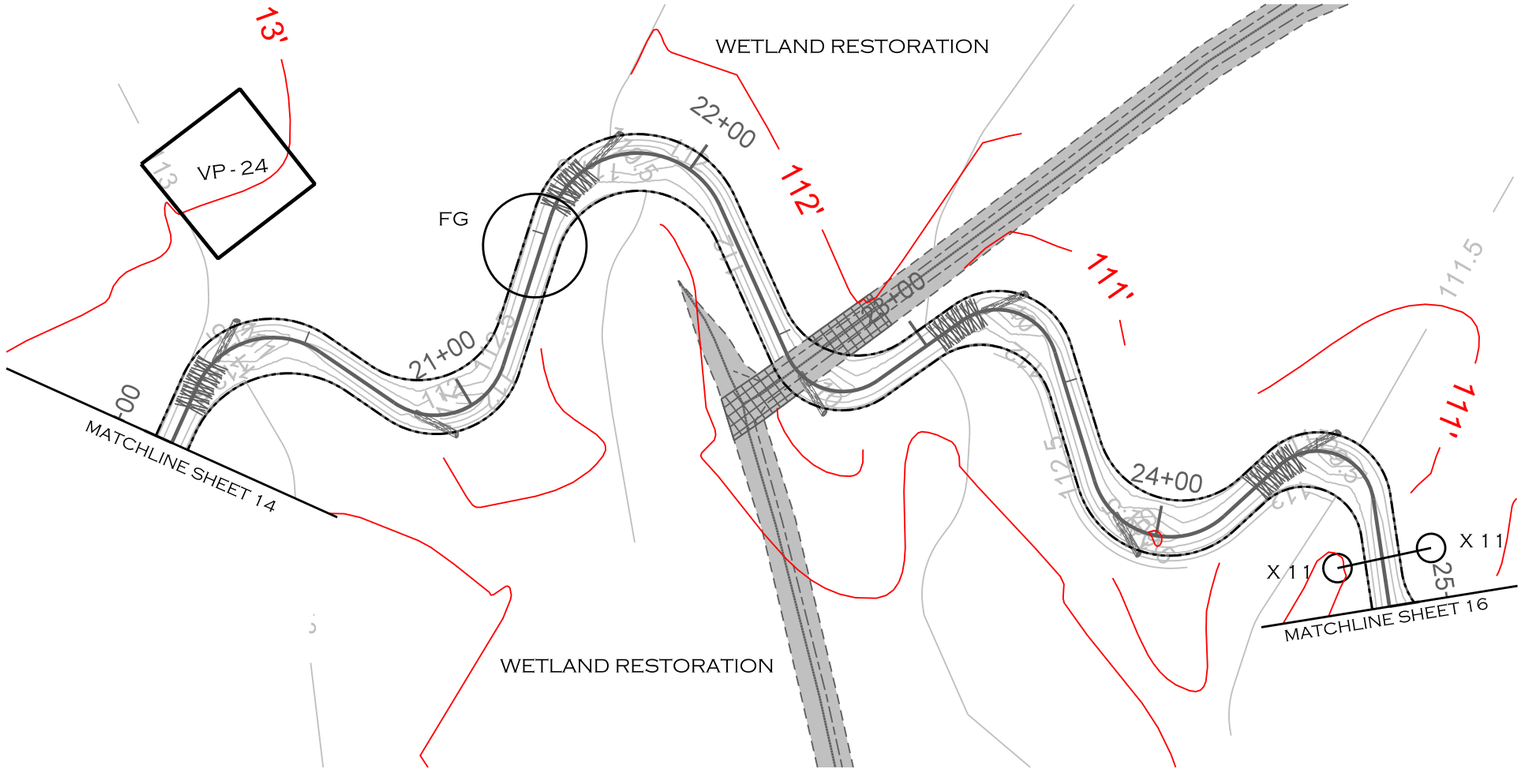
AKOON

PROJECT # 074 | SHEET NO. 15

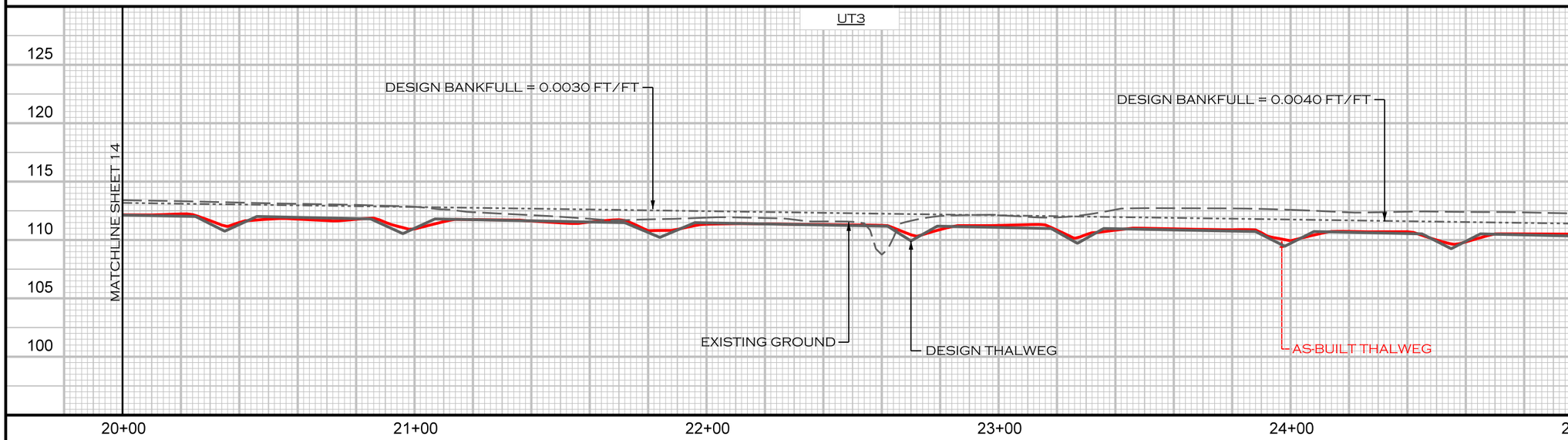
PLAN / PROFILE



NAD 83

NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

20 10 0 20 40
SCALE (FT)



REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER

2/11/2020
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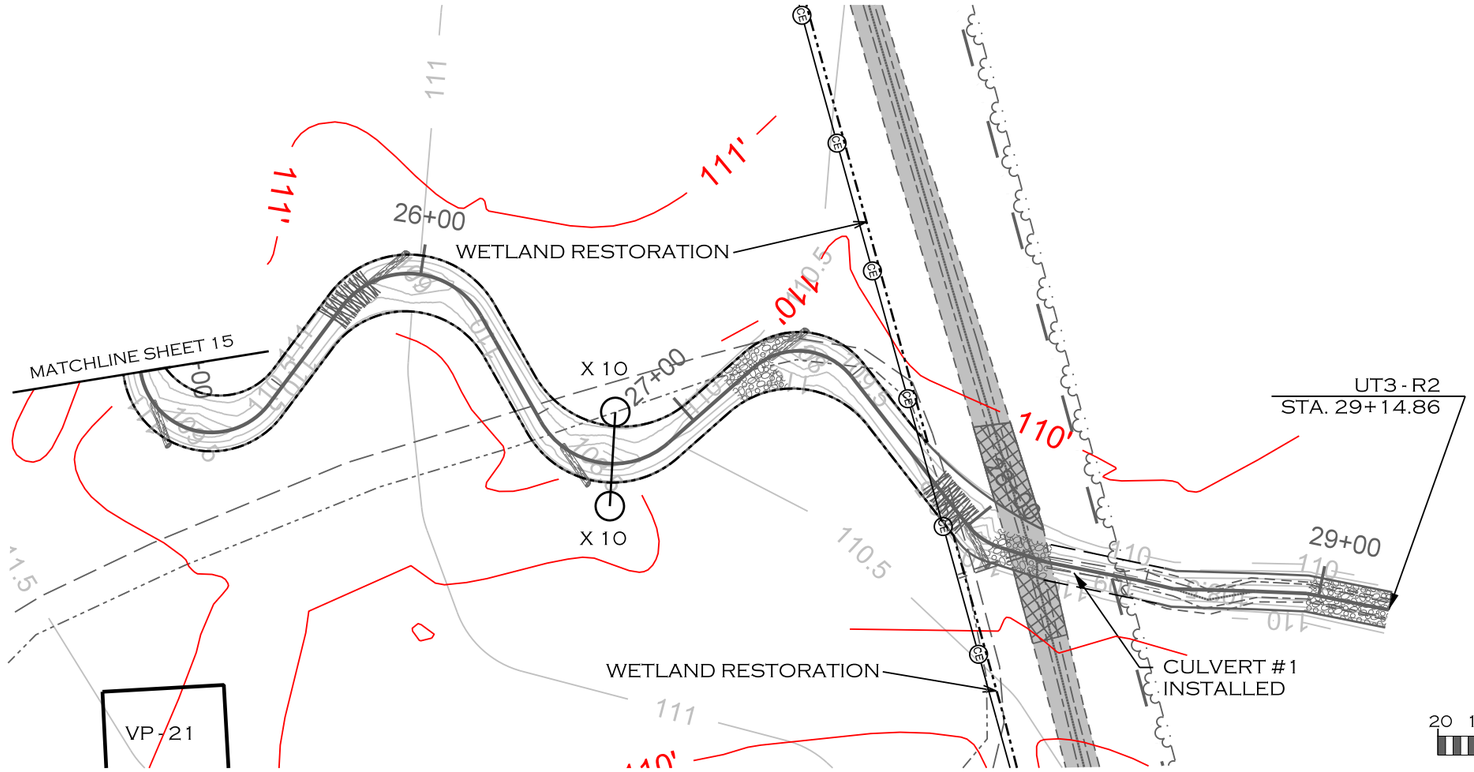
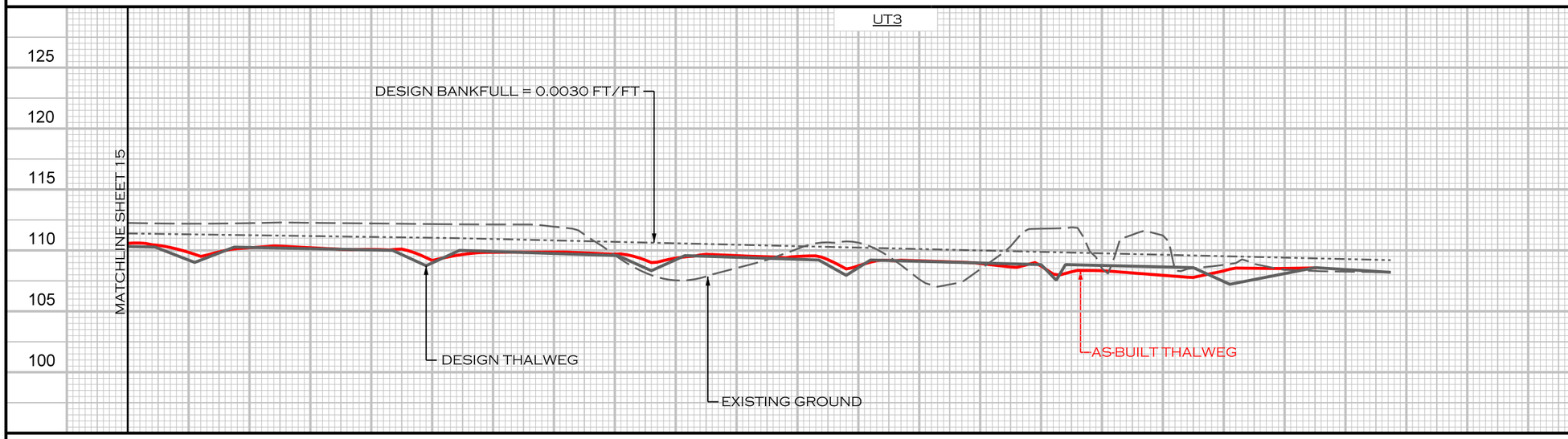
PROJECT # 074 | SHEET NO. 16

PLAN / PROFILE





NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

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RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

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ECOSYSTEM PLANNING & RESTORATION
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RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER

2/11/2020
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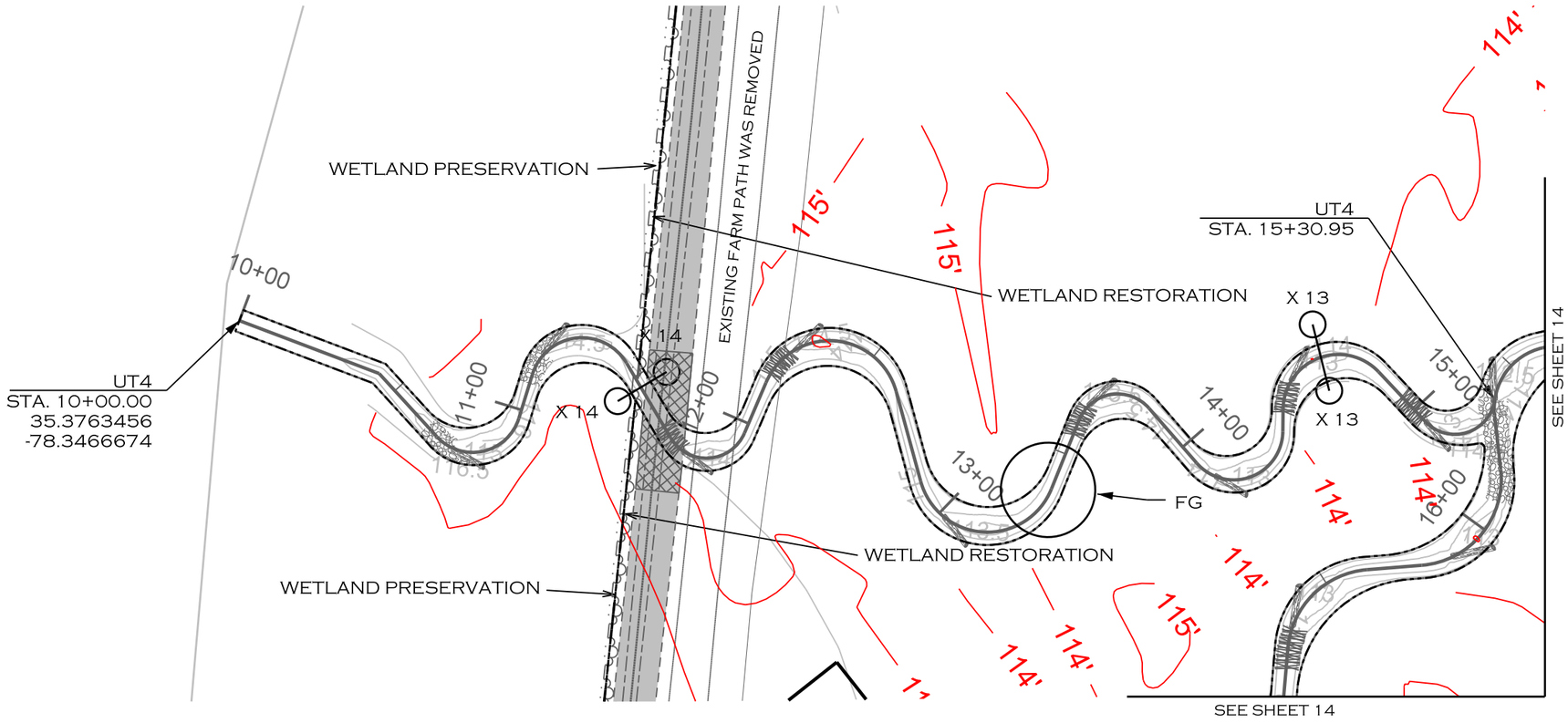
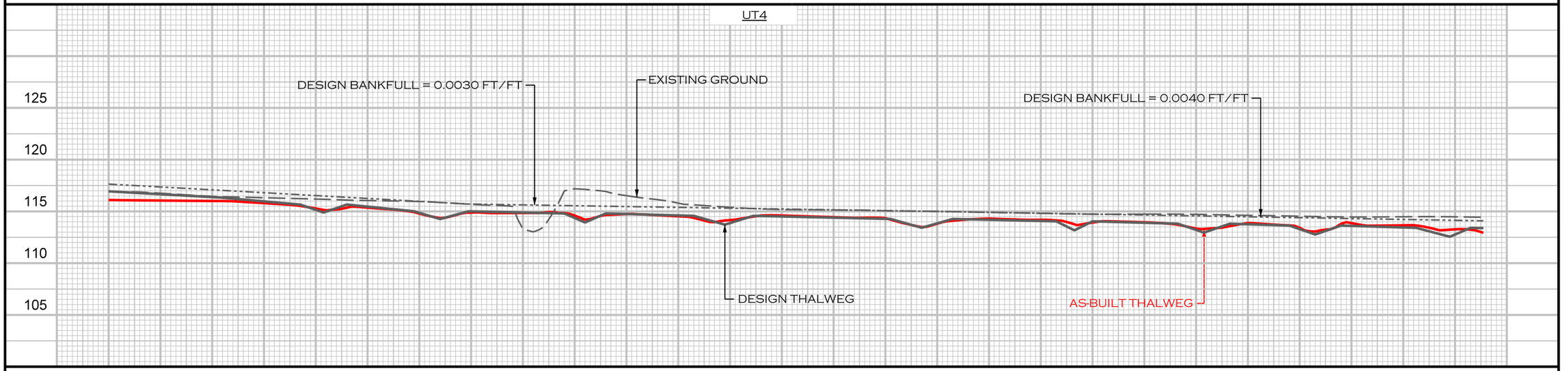
JBROOKS

PROJECT # 074 | SHEET NO. 17

PLAN / PROFILE

NOTE:
BEGINNING OF UT4 WILL TRANSITION FROM EXISTING CHANNELS INSIDE WOODLINE PER ENGINEERS DIRECTION. DISTURBANCE WITHIN WOODS WILL BE MINIMIZED.





REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

2/11/2020
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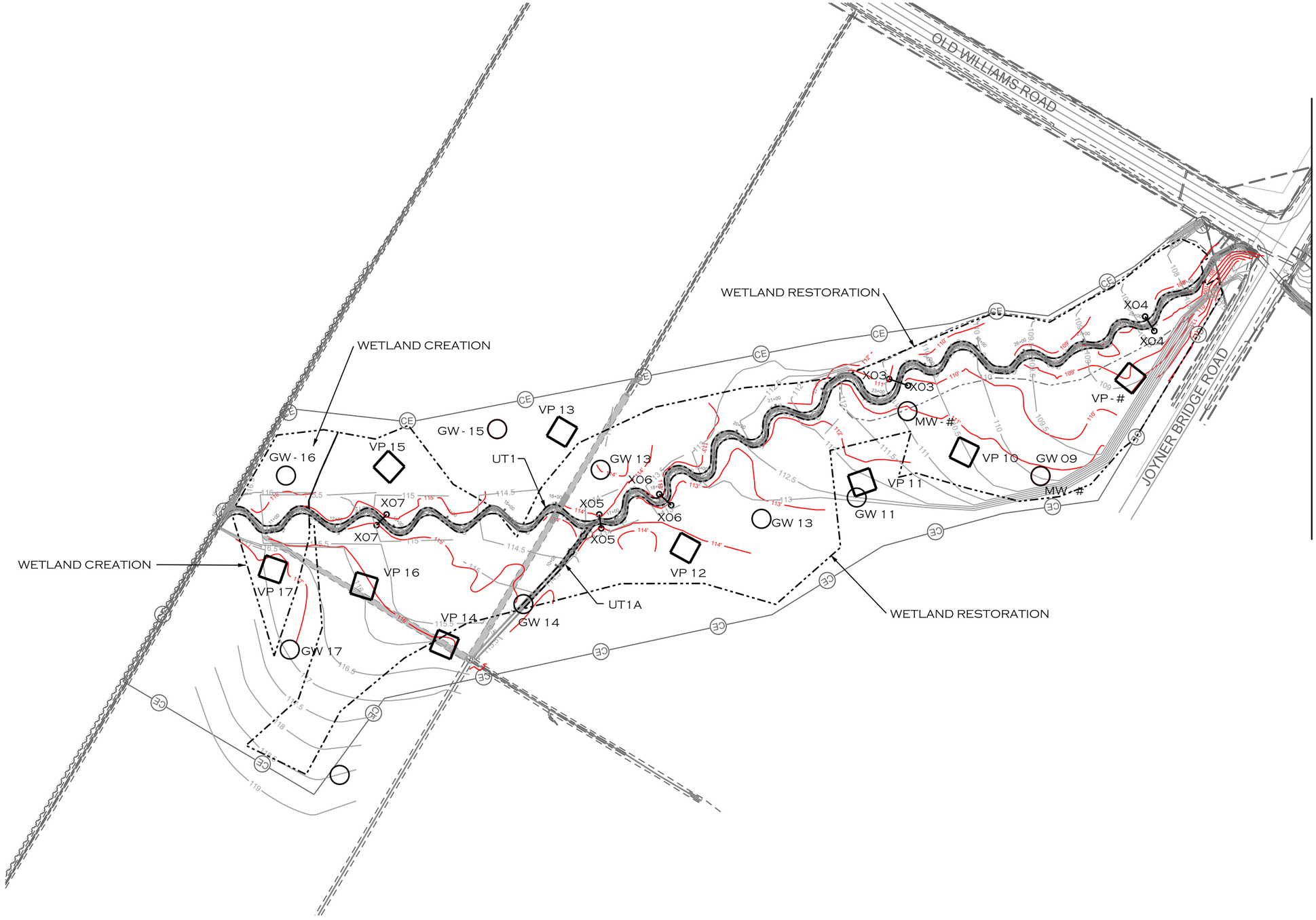
AKOON

PROJECT # 074 | SHEET NO. 18

MONITORING FEATURES



NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

75 0 75 150
SCALE (FT)

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

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ECOSYSTEM PLANNING & RESTORATION
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RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

2/11/2020
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MKOEN

PROJECT # 074 | SHEET NO. 19

MONITORING FEATURES

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

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RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

2/11/2020
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JKOCON

PROJECT # 074 | SHEET NO. 20

MONITORING FEATURES

WETLAND PRESERVATION
UT4
WETLAND RESTORATION
WETLAND RESTORATION
UT3
GW 28
VP 19
VP 18
GW 29
VP 20
VP 24
FG
X14
X14
FG
VP 26
X15
X15
X13
X13
X12
X12
VP 23
GW 22
X11
X11
X10
X10
VP 21
VP 27
VP 30
GW 24
VP 28
GW 25
VP 29
GW 26
VP 31
VP 32
VP 22
GW 21
GW 20
GW 19
NAD 83
75 0 75 150
SCALE (FT)

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	AS-BUILT PLANS	KLT	EMP	2/11/20

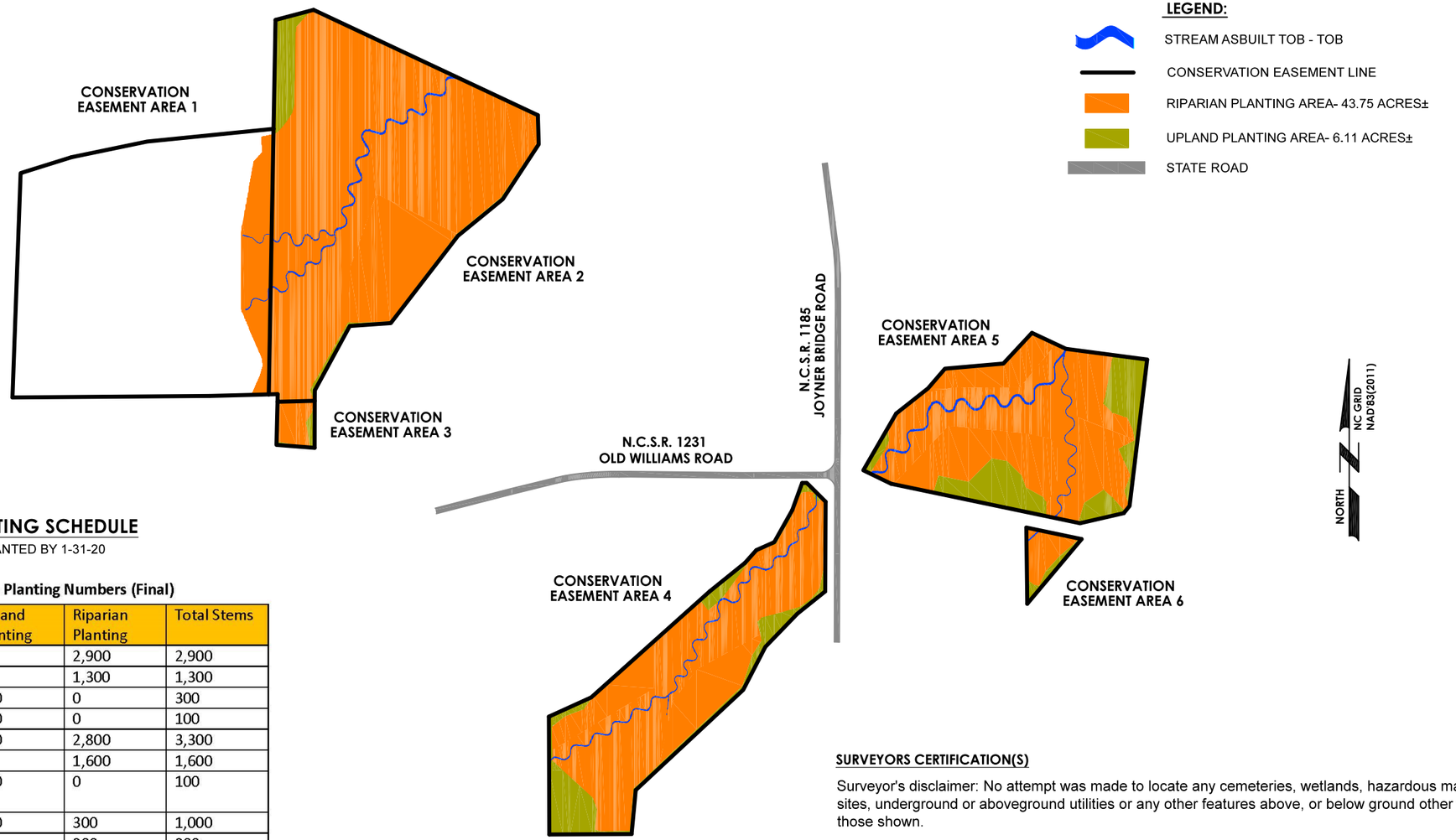
PREPARED FOR:
RESTORATION SYSTEMS | LLC
1101 HAYNES ST
RALEIGH, NC 27604

ALLIANCE HEADWATERS
JOHNSTON COUNTY, NC
DMS PROJECT NO.: 97086

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
559 JONES FRANKLIN RD, SUITE 150
RALEIGH, NC 27606
LICENSE # P-1182

PROJECT ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 036254 ENGINEER EMMETT PERDUE

2/11/2020
R:\PROJECTS\RDU0074_RS\ALLIANCEHEADWATERS\CADD\PLANS\As_Built\AHW_ASB_PSH_20.dgn
BROWN



PLANTING SCHEDULE

PLANTED BY 1-31-20

Alliance Planting Numbers (Final)

Species:	Upland Planting	Riparian Planting	Total Stems
River Birch	0	2,900	2,900
Wax Myrtle	0	1,300	1,300
Musclewood	300	0	300
Persimmon	100	0	100
Tulip Poplar	500	2,800	3,300
Sweet Bay	0	1,600	1,600
Mulberry (NFN)	100	0	100
Black Gum	700	300	1,000
Red Bay	0	800	800
Black Cherry	400	0	400
White Oak	800	0	800
Swamp White Oak	0	500	500
Swamp Laurel Oak	0	2,000	2,000
Shumard Oak	0	200	200
Overcup oak (50 extra trees)	0	4,200	4,200
Swamp Chestnut Oak	800	3,900	4,700
Cherrybark Oak	650	3,050	3,700
Bald Cypress	0	4,500	4,500
American Elm	0	2,800	2,800
	4,350	**30,850**	**35,200**

(PROVIDED BY RESTORATION SYSTEMS, LLC)

SHEET 1 OF 1
PLANTING PLAN

0 250 500 1000

1" = 500'

SURVEYORS CERTIFICATION(S)

Surveyor's disclaimer: No attempt was made to locate any cemeteries, wetlands, hazardous material sites, underground or aboveground utilities or any other features above, or below ground other than those shown.

I certify that the survey is of another category (planting plan), such as the recombination of existing parcels, a court-ordered survey, or other exception to the definition of subdivision.

I certify that this plat does not meet G.S. 47-30 as amended.

I, John A. Rudolph, certify that this map was drawn under my direct supervision from an actual survey made under my supervision. That the ratio of precision is 1:10,000±, that this map was prepared in accordance with the standards of practice for land surveyors in North Carolina, witness my hand and seal, this 6th day of February, 2020.

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN ASHLEY RUDOLPH

L-4194
Professional Land Surveyor — License Number

5688 U.S. Hwy. 70 East
Goldsboro, NC 27534
919.751.0075
www.k2designgroup.com
Firm license no.: C-2111

k2 design group

Client: RESTORATION SYSTEMS, LLC
1101 HAYNES STREET
SUITE 211
RALEIGH, NC 27604

Project: Alliance Headwaters Stream & Wetland Mitigation Site
Bentonville Township, Johnston County, North Carolina

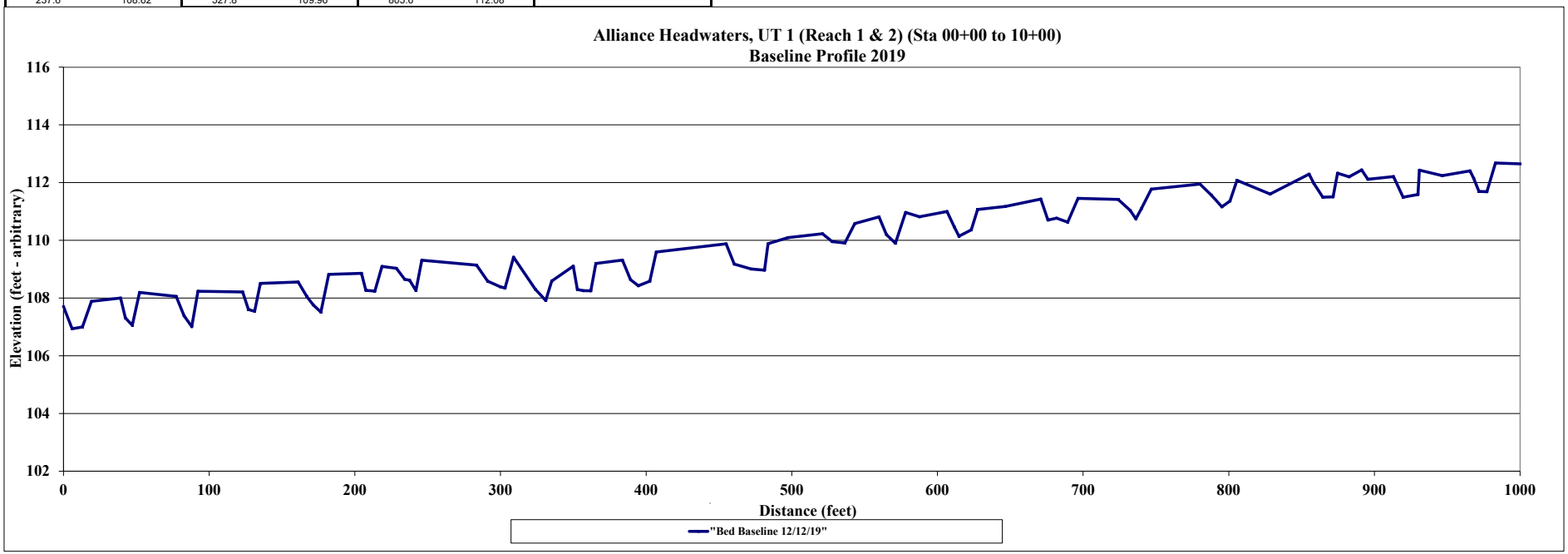
Title: PLANTING PLAN
FOR THE PURPOSE OF MONITORING

DRAWN BY: FGR
DATE: 02/06/20
SURVEYED BY: J.A.R.
DWG. NO. RSS429AB - PLANTING
SHEET 1 OF 1

Project Name	Alliance Headwaters - Baseline (2019) Profile
Reach	UT 1 (Reach 1 & 2) (Sta 00+00 to 10+00)
Feature	Profile
Date	12/12/19
Crew	Perkinson, Radecki

2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey	
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**
0.0	107.71	242.0	108.26	536.4	109.91	828.4	111.60
5.9	106.94	245.9	109.31	543.2	110.58	855.1	112.29
13.0	107.00	283.6	109.14	559.9	110.81	858.3	111.98
19.2	107.88	291.2	108.58	565.0	110.20	864.6	111.50
39.2	108.00	299.9	108.39	571.1	109.90	871.6	111.51
42.5	107.31	303.1	108.34	578.1	110.96	874.7	112.32
47.2	107.06	309.0	109.42	587.7	110.82	882.6	112.20
52.2	108.19	323.9	108.31	606.6	111.00	891.3	112.44
77.4	108.06	331.0	107.91	611.6	110.46	895.5	112.11
82.8	107.39	335.2	108.59	614.8	110.14	913.1	112.21
88.0	107.01	349.9	109.10	623.2	110.36	919.7	111.49
92.3	108.23	352.8	108.30	627.5	111.07	929.9	111.59
123.0	108.21	356.8	108.26	646.6	111.17	930.8	112.43
126.9	107.60	362.0	108.25	670.9	111.43	946.6	112.24
131.2	107.54	365.5	109.20	675.9	110.70	965.7	112.41
135.1	108.51	383.7	109.31	681.8	110.77	968.1	112.15
161.1	108.55	389.3	108.63	689.4	110.63	971.8	111.69
167.1	108.05	394.6	108.43	696.5	111.45	977.2	111.68
171.4	107.76	402.5	108.58	724.1	111.42	983.1	112.68
176.7	107.51	406.9	109.60	732.4	111.03		
182.1	108.82	455.0	109.88	736.2	110.74		
204.6	108.86	460.4	109.17	740.1	111.11		
207.6	108.27	472.1	109.01	746.8	111.77		
213.8	108.24	481.3	108.97	780.3	111.95		
218.7	109.10	483.7	109.88	788.1	111.57		
228.5	109.03	497.4	110.09	795.3	111.16		
234.3	108.65	521.0	110.23	800.8	111.36		
237.6	108.62	527.8	109.96	805.6	112.08		

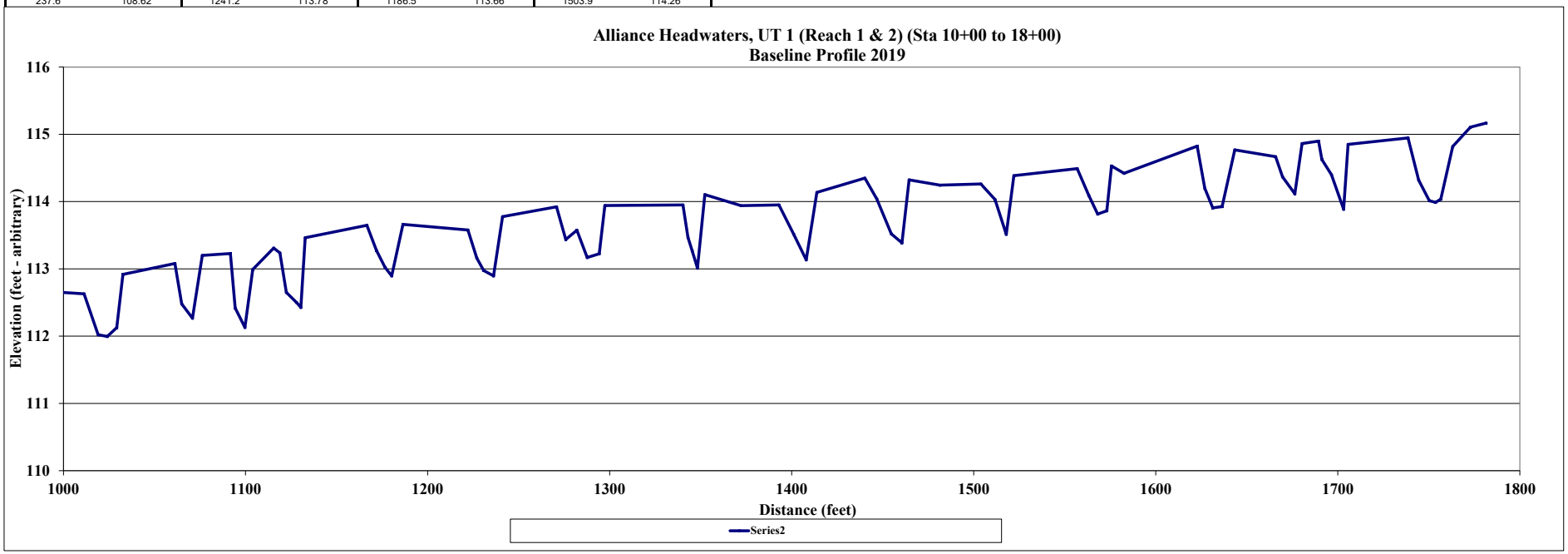
	Baseline	As needed		
Avg. Water Surface Slope	0.0049			
Riffle Length	29			
Avg. Riffle Slope	0.0101			
Pool Length	11			



Project Name	Alliance Headwaters - Baseline (2019) Profile
Reach	UT 1 (Reach 1 & 2) (Sta 10+00 to 18+00)
Feature	Profile
Date	12/12/19
Crew	Perkinson, Radecki

2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey	
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**
0.0	107.71	1011.3	112.63	1270.8	113.92	1222.1	113.58	1511.7	114.03	1676.4	114.11
5.9	106.94	1019.0	112.02	1275.9	113.44	1227.1	113.16	1517.9	113.51	1680.4	114.86
13.0	107.00	1024.1	111.99	1282.0	113.57	1230.8	112.97	1522.1	114.38	1689.4	114.90
19.2	107.88	1029.2	112.13	1287.7	113.17	1236.2	112.90	1556.8	114.49	1691.3	114.63
39.2	108.00	1032.7	112.92	1294.3	113.22	1241.2	113.78	1563.2	114.09	1696.5	114.40
42.5	107.31	1061.2	113.08	1011.3	112.63	1270.8	113.92	1568.1	113.81	1703.2	113.89
47.2	107.06	1064.9	112.48	1019.0	112.02	1275.9	113.44	1573.1	113.86	1705.6	114.85
52.2	108.19	1070.9	112.27	1024.1	111.99	1282.0	113.57	1575.7	114.53	1738.6	114.95
77.4	108.06	1076.3	113.20	1029.2	112.13	1287.7	113.17	1582.6	114.42	1744.4	114.32
82.8	107.39	1091.7	113.23	1032.7	112.92	1294.3	113.22	1622.8	114.82	1750.3	114.01
88.0	107.01	1094.3	112.42	1061.2	113.08	1297.4	113.94	1626.9	114.20	1753.7	113.99
92.3	108.23	1104.0	112.99	1064.9	112.48	1340.3	113.95	1631.3	113.91	1756.6	114.03
123.0	108.21	1115.5	113.31	1070.9	112.27	1343.0	113.47	1636.4	113.93	1763.1	114.82
126.9	107.60	1118.9	113.24	1076.3	113.20	1345.4	113.27	1643.4	114.77	1772.8	115.11
131.2	107.54	1122.4	112.65	1091.7	113.23	1348.2	113.01	1665.8	114.67	1781.5	115.17
135.1	108.51	1128.0	112.50	1094.3	112.42	1352.3	114.10	1669.7	114.37		
161.1	108.55	1130.4	112.43	1104.0	112.99	1372.2	113.94				
167.1	108.05	1132.8	113.46	1115.5	113.31	1393.0	113.95				
171.4	107.76	1166.7	113.65	1118.9	113.24	1401.1	113.51				
176.7	107.51	1171.9	113.27	1122.4	112.65	1408.0	113.13				
182.1	108.82	1176.6	113.02	1128.0	112.50	1413.8	114.14				
204.6	108.86	1180.3	112.90	1130.4	112.43	1440.2	114.35				
207.6	108.27	1186.5	113.66	1132.8	113.46	1446.8	114.04				
213.8	108.24	1222.1	113.58	1166.7	113.65	1454.7	113.52				
218.7	109.10	1227.1	113.16	1171.9	113.27	1460.6	113.39				
228.5	109.03	1230.8	112.97	1176.6	113.02	1464.5	114.32				
234.3	108.65	1236.2	112.90	1180.3	112.90	1481.4	114.24				
237.6	108.62	1241.2	113.78	1186.5	113.66	1503.9	114.26				

	Baseline	As needed		
Avg. Water Surface Slope	0.0049			
Riffle Length	29			
Avg. Riffle Slope	0.0101			
Pool Length	11			

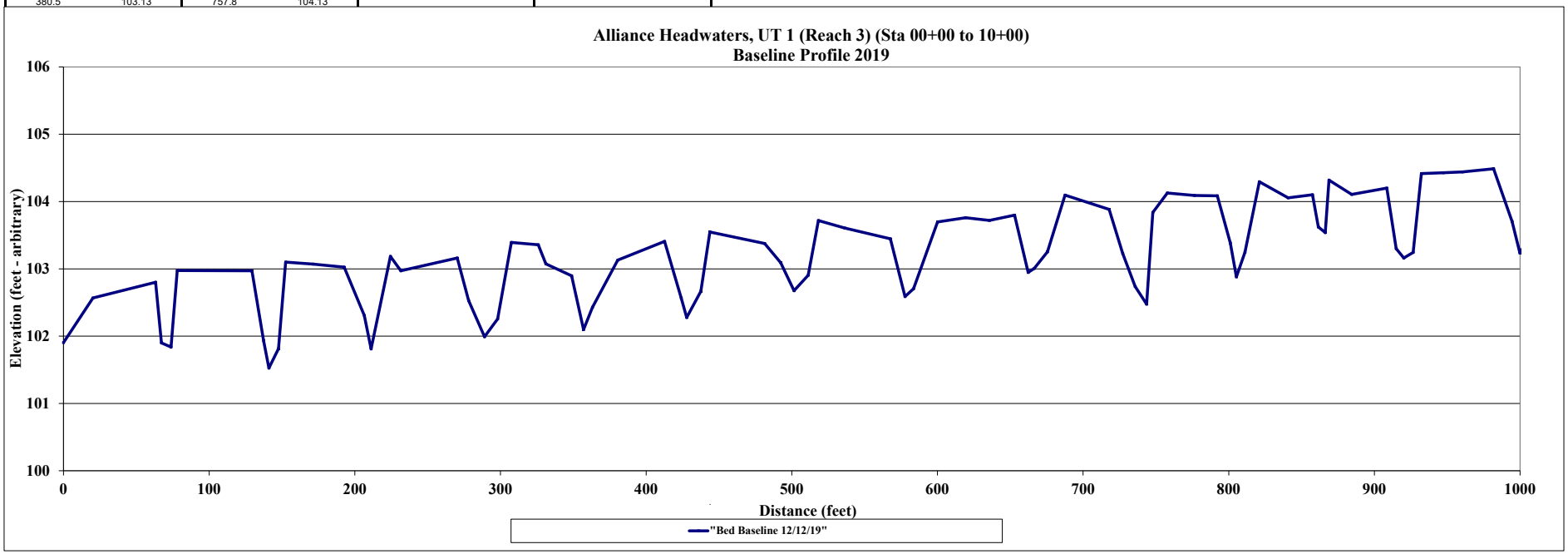


Project Name	Alliance Headwaters - Baseline (2019) Profile
Reach	UT 1 (Reach 3) (Sta 00+00 to 10+00)
Feature	Profile
Date	12/12/19
Crew	Perkinson, Radecki

2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		As needed	
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**
0.0	101.90	412.6	103.41	776.4	104.09		
20.2	102.57	424.1	102.57	792.1	104.09		
63.2	102.80	427.9	102.28	801.1	103.38		
67.2	101.90	437.6	102.67	805.3	102.88		
73.8	101.84	443.7	103.55	811.1	103.25		
78.1	102.98	481.4	103.38	821.0	104.29		
129.3	102.97	492.4	103.09	840.8	104.06		
137.4	101.93	501.5	102.68	857.5	104.10		
141.0	101.53	511.3	102.90	861.5	103.62		
147.6	101.81	518.3	103.72	866.2	103.54		
152.5	103.10	536.4	103.61	868.8	104.32		
171.3	103.07	567.7	103.45	884.4	104.11		
192.7	103.03	577.8	102.59	908.5	104.20		
206.5	102.31	583.6	102.71	914.9	103.30		
211.1	101.81	600.1	103.70	920.2	103.16		
224.4	103.19	619.3	103.76	926.6	103.24		
231.6	102.97	635.7	103.72	932.2	104.42		
270.3	103.16	652.9	103.80	947.4	104.43		
278.1	102.53	662.3	102.95	960.4	104.44		
289.1	101.99	666.5	103.01	981.8	104.49		
298.1	102.26	675.5	103.25	994.5	103.70		
307.4	103.39	687.6	104.10	999.9	103.23		
326.0	103.36	717.9	103.88				
331.2	103.07	727.2	103.23				
348.9	102.90	735.8	102.74				
357.0	102.10	743.6	102.47				
363.2	102.43	747.8	103.84				
380.5	103.13	757.8	104.13				

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN ASHLEY RUDOLPH

	Baseline	As needed		
Avg. Water Surface Slope	0.0028			
Riffle Length	30			
Avg. Riffle Slope	0.0062			
Pool Length	13			

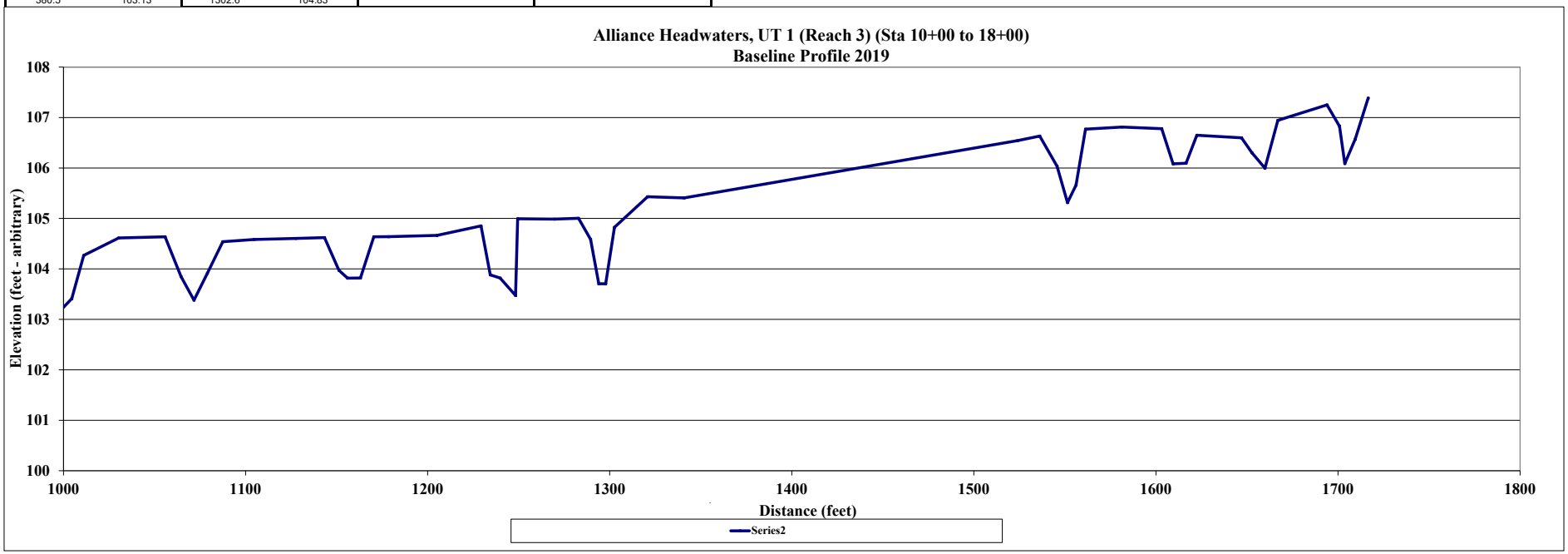


Project Name	Alliance Headwaters - Baseline (2019) Profile
Reach	UT 1 (Reach 3) (Sta 10+00 to 18+00)
Feature	Profile
Date	12/12/19
Crew	Perkinson, Radecki

2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		As needed	
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**
0.0	101.90	1004.5	103.41	1320.8	105.43		
20.2	102.57	1011.1	104.27	1340.9	105.41		
63.2	102.80	1030.3	104.61	1524.0	106.54		
67.2	101.90	1055.8	104.64	1536.2	106.63		
73.8	101.84	1064.6	103.85	1545.7	106.03		
78.1	102.98	1071.7	103.38	1551.4	105.32		
129.3	102.97	1079.0	103.91	1556.1	105.66		
137.4	101.93	1087.5	104.54	1561.3	106.77		
141.0	101.53	1104.7	104.58	1581.4	106.81		
147.6	101.81	1127.7	104.61	1603.1	106.78		
152.5	103.10	1143.4	104.62	1609.4	106.08		
171.3	103.07	1151.2	103.97	1616.5	106.09		
192.7	103.03	1156.0	103.82	1622.5	106.65		
206.5	102.31	1163.1	103.82	1647.0	106.60		
211.1	101.81	1170.4	104.64	1652.7	106.30		
224.4	103.19	1178.6	104.64	1659.9	106.00		
231.6	102.97	1205.2	104.66	1667.0	106.94		
270.3	103.16	1229.3	104.85	1694.0	107.25		
278.1	102.53	1234.4	103.88	1700.8	106.83		
289.1	101.99	1239.8	103.82	1703.8	106.09		
298.1	102.26	1248.3	103.47	1709.4	106.57		
307.4	103.39	1249.5	104.99	1716.6	107.38		
326.0	103.36	1269.6	104.99				
331.2	103.07	1282.9	105.00				
348.9	102.90	1289.5	104.59				
357.0	102.10	1294.0	103.71				
363.2	102.43	1297.8	103.71				
380.5	103.13	1302.6	104.83				

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN ASHLEY RUDOLPH

	Baseline	As needed		
Avg. Water Surface Slope	0.0028			
Riffle Length	30			
Avg. Riffle Slope	0.0062			
Pool Length	13			

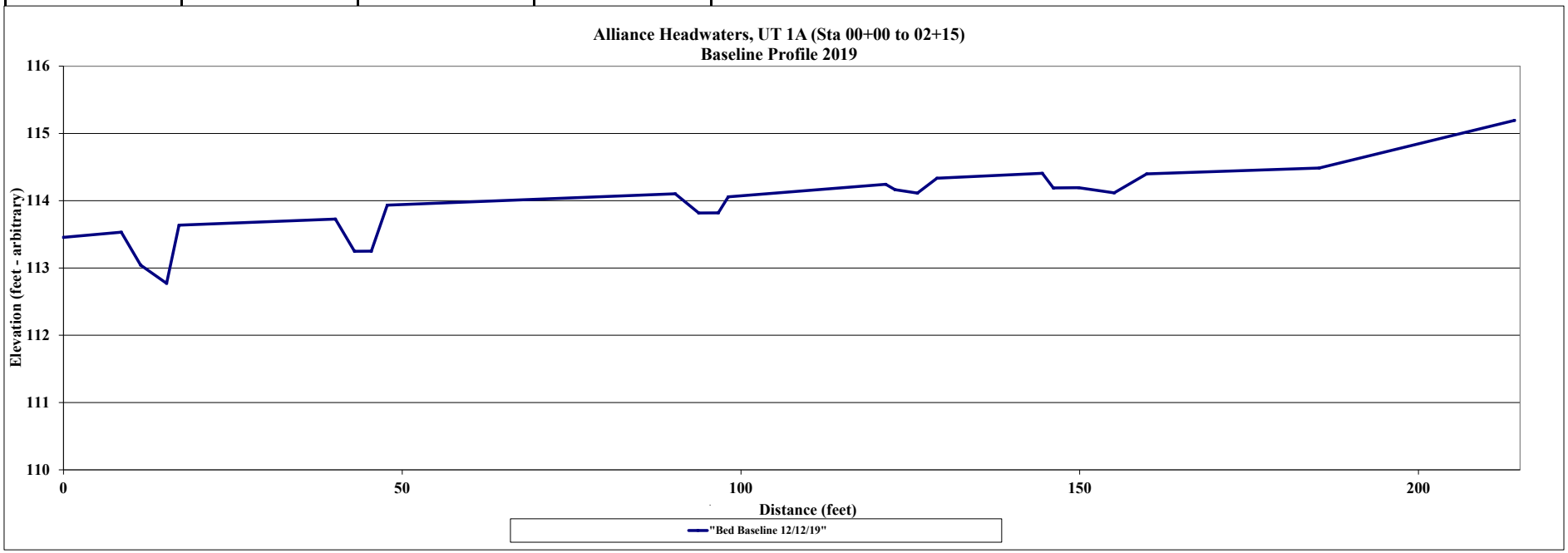


Project Name	Alliance Headwaters - Baseline (2019) Profile
Reach	UT 1A (Sta 00+00 to 02+15)
Feature	Profile
Date	12/12/19
Crew	Perkinson, Radecki

2019 Baseline Survey		As needed		As needed		As needed	
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**
0.0	113.46						
8.5	113.53						
11.4	113.04						
15.2	112.77						
17.0	113.64						
40.1	113.73						
43.0	113.25						
45.4	113.25						
47.8	113.93						
90.3	114.10						
93.8	113.82						
96.6	113.82						
98.1	114.06						
121.4	114.24						
122.7	114.16						
126.0	114.11						
128.9	114.33						
144.5	114.41						
146.1	114.19						
149.8	114.19						
155.1	114.12						
159.9	114.40						
185.3	114.49						
214.2	115.19						

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN ASHLEY RUDOLPH

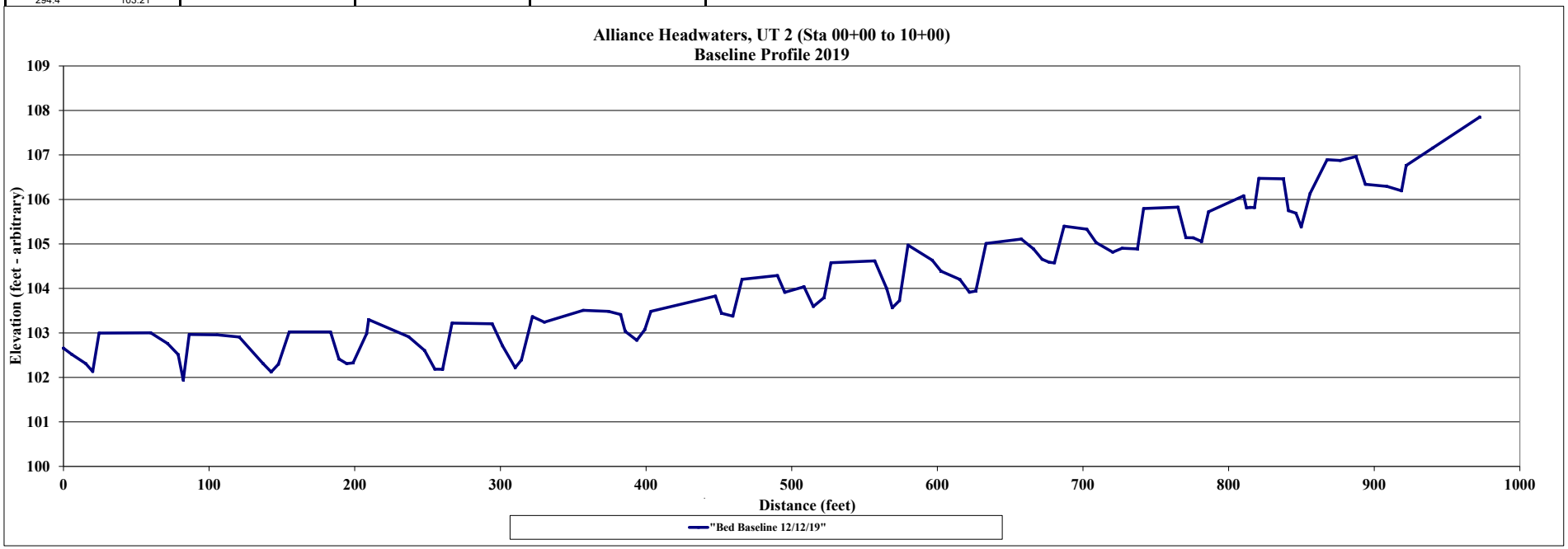
	Baseline	As needed		
Avg. Water Surface Slope	0.0056			
Riffle Length	28			
Avg. Riffle Slope	0.0080			
Pool Length	4			



Project Name	Alliance Headwaters - Baseline (2019) Profile
Reach	UT 2 (Sta 00+00 to 10+00)
Feature	Profile
Date	12/12/19
Crew	Perkinson, Radecki

2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey	
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**
0.0	102.66	301.5	102.71	569.1	103.57	781.5	105.05
5.6	102.52	310.2	102.22	574.0	103.73	786.2	105.72
15.3	102.31	314.5	102.39	579.9	104.97	810.4	106.08
20.1	102.13	322.0	103.37	596.5	104.63	812.3	105.81
24.5	103.00	330.2	103.24	602.6	104.39	841.1	105.75
60.0	103.00	356.9	103.51	615.5	104.20	846.3	105.69
71.5	102.76	374.3	103.48	622.1	103.91	849.9	105.38
78.8	102.51	382.5	103.41	626.4	103.94	855.9	106.13
82.3	101.94	385.7	103.04	633.4	105.01	867.7	106.89
86.3	102.97	393.7	102.84	657.7	105.11	876.7	106.88
105.5	102.96	399.2	103.08	666.1	104.89	887.5	106.96
120.7	102.91	403.3	103.48	671.9	104.66	893.9	106.34
137.1	102.31	447.6	103.83	676.8	104.59	908.7	106.29
142.7	102.12	451.8	103.44	680.4	104.58	918.8	106.19
147.6	102.30	459.6	103.38	687.0	105.40	921.9	106.76
155.0	103.02	465.9	104.20	702.7	105.33	940.2	107.16
183.4	103.02	490.2	104.29	709.0	105.03	972.4	107.85
189.1	102.41	495.2	103.91	720.5	104.81		
194.5	102.31	508.5	104.04	726.9	104.90		
198.9	102.33	514.9	103.59	737.4	104.89		
208.2	102.99	522.3	103.79	741.6	105.80		
209.5	103.30	527.0	104.58	765.3	105.83		
237.0	102.91	557.1	104.62	770.7	105.14		
248.0	102.60	565.2	104.00	775.7	105.14		
255.0	102.18						
260.3	102.18						
266.8	103.22						
294.4	103.21						

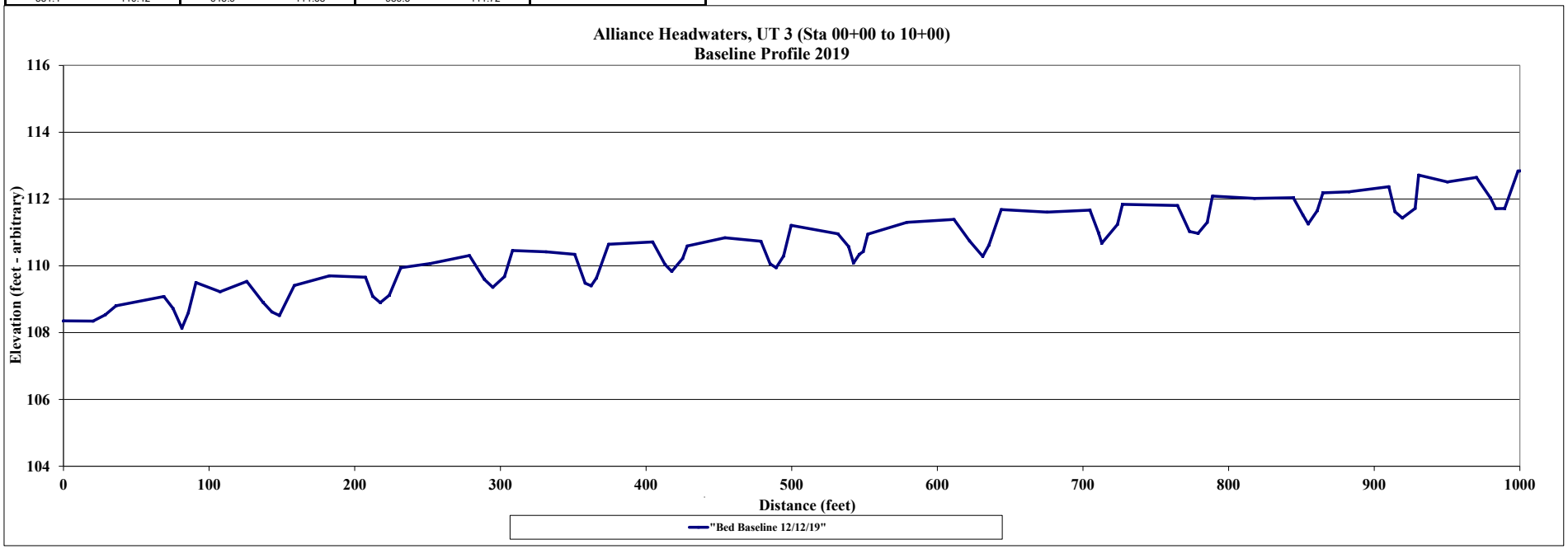
	Baseline	As needed		
Avg. Water Surface Slope	0.0031			
Riffle Length	30			
Avg. Riffle Slope	0.0043			
Pool Length	14			



Project Name	Alliance Headwaters - Baseline (2019) Profile
Reach	UT 3 (Sta 00+00 to 10+00)
Feature	Profile
Date	12/12/19
Crew	Perkinson, Radecki

2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey	
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**
0.0	108.35	351.1	110.34	675.4	111.61	998.7	112.84
20.3	108.34	358.2	109.48	704.8	111.67		
28.7	108.53	362.3	109.40	710.8	110.98		
36.1	108.80	366.0	109.64	713.0	110.68		
69.0	109.08	374.2	110.64	723.7	111.24		
75.3	108.72	404.6	110.71	727.1	111.84		
81.3	108.13	413.0	110.04	765.0	111.81		
85.7	108.59	417.7	109.83	773.2	111.03		
91.0	109.50	425.2	110.22	779.1	110.97		
107.6	109.22	428.3	110.59	785.3	111.30		
125.9	109.53	454.2	110.84	788.9	112.09		
137.0	108.91	478.9	110.74	817.8	112.02		
143.1	108.62	485.2	110.06	844.4	112.04		
148.3	108.51	489.3	109.94	851.0	111.53		
158.5	109.41	494.5	110.29	854.6	111.25		
182.6	109.70	499.6	111.21	860.9	111.65		
207.4	109.66	531.8	110.96	864.8	112.18		
212.3	109.09	539.1	110.58	882.7	112.22		
217.5	108.90	542.5	110.08	910.1	112.37		
223.7	109.12	546.4	110.34	914.2	111.62		
231.6	109.94	549.1	110.43	919.3	111.43		
252.0	110.07	552.2	110.95	928.1	111.72		
278.8	110.31	579.2	111.30	930.5	112.72		
288.9	109.60	611.5	111.39	950.2	112.51		
294.7	109.36	622.1	110.75	970.2	112.65		
302.8	109.68	631.2	110.28	979.9	112.03		
308.3	110.46	635.5	110.62	983.4	111.71		
331.4	110.42	643.9	111.68	989.5	111.72		

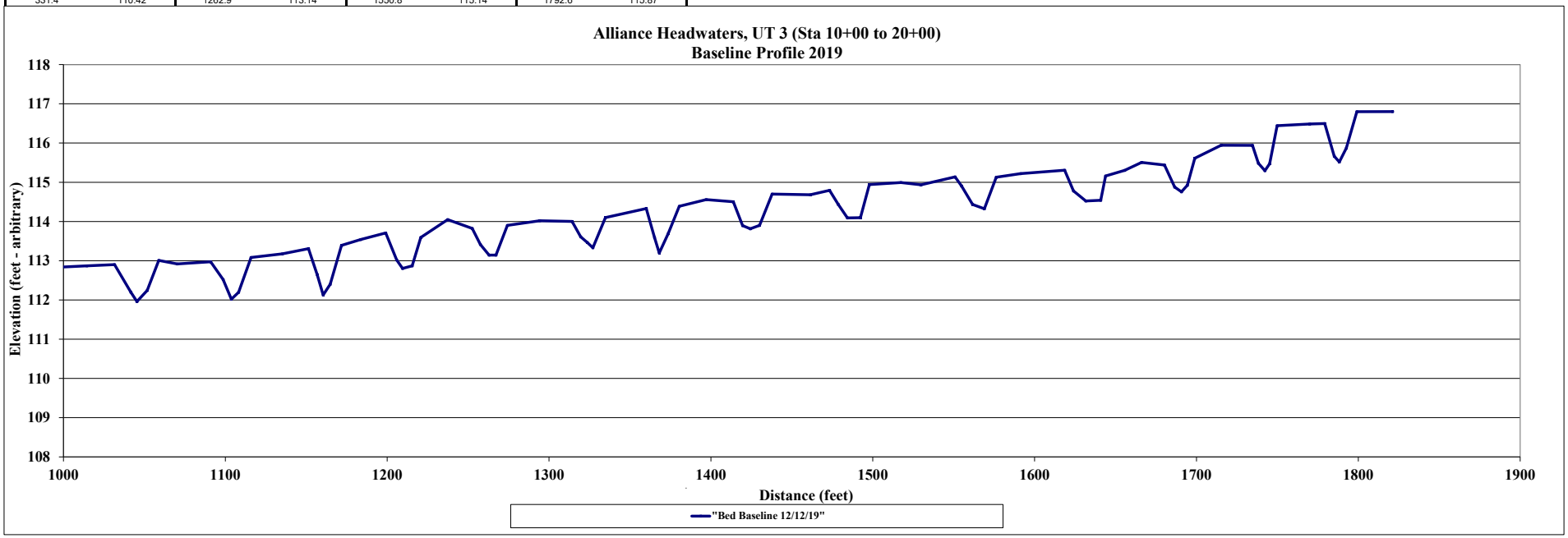
	Baseline	As needed		
Avg. Water Surface Slope	0.0033			
Riffle Length	39			
Avg. Riffle Slope	0.0049			
Pool Length	14			



Project Name	Alliance Headwaters - Baseline (2019) Profile
Reach	UT 3 (Sta 10+00 to 20+00)
Feature	Profile
Date	12/12/19
Crew	Perkinson, Radecki

2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey		2019 Baseline Survey	
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**
0.0	108.35	1014.4	112.87	1267.2	113.14	1554.9	114.91	1799.1	116.80
20.3	108.34	1031.6	112.90	1274.3	113.90	1561.7	114.43	1821.2	116.80
28.7	108.53	1041.6	112.20	1294.2	114.02	1568.9	114.33		
36.1	108.80	1045.4	111.96	1314.2	114.00	1576.3	115.13		
69.0	109.08	1051.7	112.25	1319.6	113.61	1591.4	115.22		
75.3	108.72	1058.8	113.01	1323.6	113.47	1618.6	115.31		
81.3	108.13	1070.2	112.92	1327.1	113.33	1624.0	114.78		
85.7	108.59	1090.9	112.97	1334.8	114.10	1631.7	114.52		
91.0	109.50	1098.7	112.52	1360.0	114.33	1640.8	114.54		
107.6	109.22	1103.7	112.02	1365.2	113.59	1643.8	115.16		
125.9	109.53	1108.2	112.20	1368.1	113.20	1655.7	115.30		
137.0	108.91	1115.9	113.08	1373.7	113.69	1666.1	115.51		
143.1	108.62	1135.1	113.17	1380.4	114.39	1680.3	115.44		
148.3	108.51	1151.4	113.31	1397.1	114.56	1686.5	114.88		
158.5	109.41	1156.7	112.65	1413.9	114.50	1690.7	114.76		
182.6	109.70	1160.5	112.13	1419.6	113.90	1694.4	114.92		
207.4	109.66	1164.8	112.40	1424.3	113.81	1699.0	115.61		
212.3	109.09	1171.8	113.39	1430.0	113.90	1715.3	115.94		
217.5	108.90	1183.7	113.54	1437.8	114.70	1734.6	115.94		
223.7	109.12	1199.1	113.71	1461.4	114.68	1738.2	115.48		
231.6	109.94	1205.9	113.02	1473.3	114.79	1742.3	115.29		
252.0	110.07	1209.5	112.80	1478.6	114.44	1745.3	115.47		
278.8	110.31	1215.4	112.87	1484.4	114.09	1749.8	116.44		
288.9	109.60	1220.7	113.59	1492.4	114.10	1770.0	116.48		
294.7	109.36	1237.4	114.05	1497.9	114.94	1779.3	116.50		
302.8	109.68	1252.5	113.82	1517.4	114.99	1785.1	115.66		
308.3	110.46	1257.6	113.41	1529.8	114.94	1788.3	115.52		
331.4	110.42	1262.9	113.14	1550.8	115.14	1792.6	115.87		

	Baseline	As needed		
Avg. Water Surface Slope	0.0033			
Riffle Length	39			
Avg. Riffle Slope	0.0049			
Pool Length	14			



Project Name	Alliance Headwaters - Baseline (2019) Profile
Reach	UT 3 (Sta 00+00 to 06+00)
Feature	Profile
Date	12/12/19
Crew	Perkinson, Radecki

2019 Baseline Survey		2019 Baseline Survey		As needed		As needed	
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**	**Station**	**Bed Elevation**
0.0	113.40	281.6	113.80				
3.4	112.98	290.9	113.96				
10.1	112.71	298.2	114.26				
15.0	112.92	328.5	114.67				
21.2	113.63	333.7	114.16				
47.3	113.47	338.9	113.95				
52.2	113.02	344.3	114.75				
58.5	113.00	383.2	114.76				
63.1	112.83	388.8	114.25				
72.1	113.57	398.1	114.31				
89.5	113.65	402.5	115.17				
95.2	112.97	428.9	115.40				
99.4	112.95	432.8	115.07				
106.0	113.28	437.0	114.97				
111.5	113.66	441.9	114.91				
127.3	113.87	446.3	115.64				
143.2	113.89	474.3	115.71				
148.0	113.38	503.8	116.01				
151.1	113.35	520.7	115.86				
154.7	113.39						
158.0	113.96						
176.1	114.14						
195.1	114.19						
200.7	113.89						
208.0	113.33						
213.0	113.50						
222.8	114.12						
270.0	114.67						

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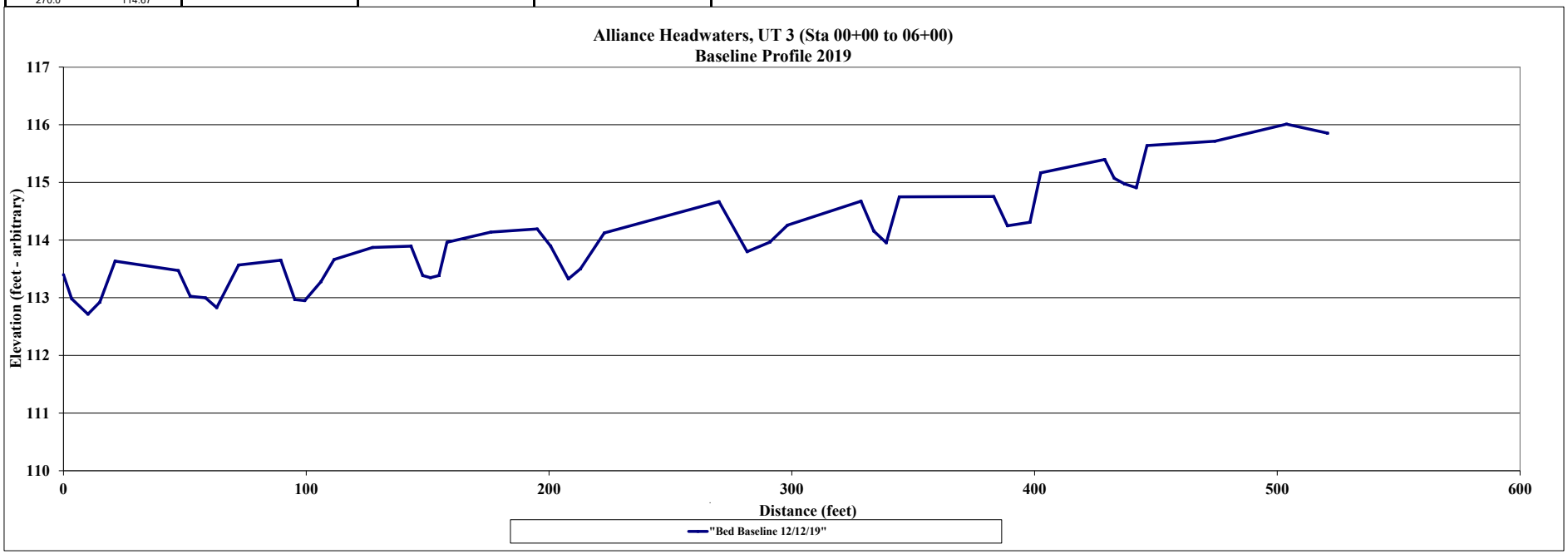
	Baseline	As needed		
Avg. Water Surface Slope	0.0051			
Riffle Length	37			
Avg. Riffle Slope	0.0084			
Pool Length	10			

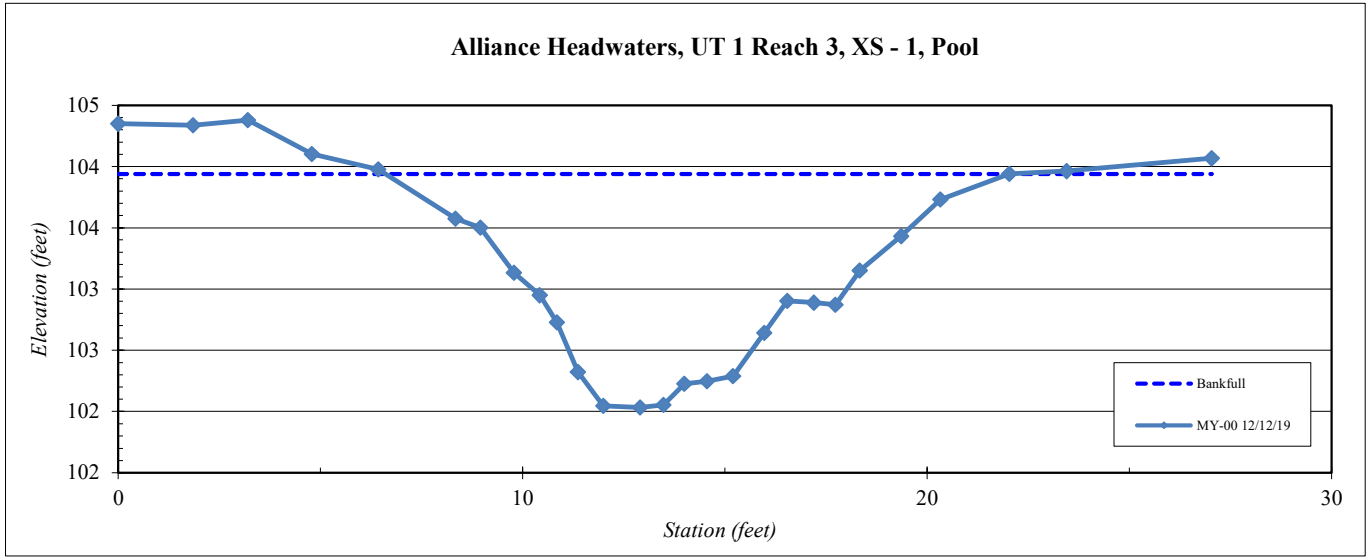


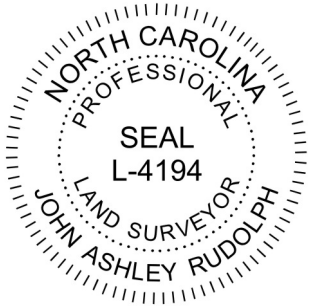
Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 1 Reach 3, XS - 1
Feature	Pool
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	104.35
1.9	104.34
3.2	104.38
4.8	104.10
6.4	103.98
8.3	103.57
9.0	103.50
9.8	103.13
10.4	102.95
10.8	102.73
11.4	102.32
12.0	102.05
12.9	102.03
13.5	102.06
14.0	102.23
14.6	102.25
15.2	102.29
16.0	102.64
16.5	102.90
17.2	102.89
17.7	102.87
18.3	103.15
19.4	103.43
20.3	103.73
22.0	103.94
23.4	103.96
27.0	104.07

SUMMARY DATA	
Bankfull Elevation:	103.9
Bankfull Cross-Sectional Area:	14.5
Bankfull Width:	15.4
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.9
Low Bank Height:	1.9
Mean Depth at Bankfull:	0.9
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	C5



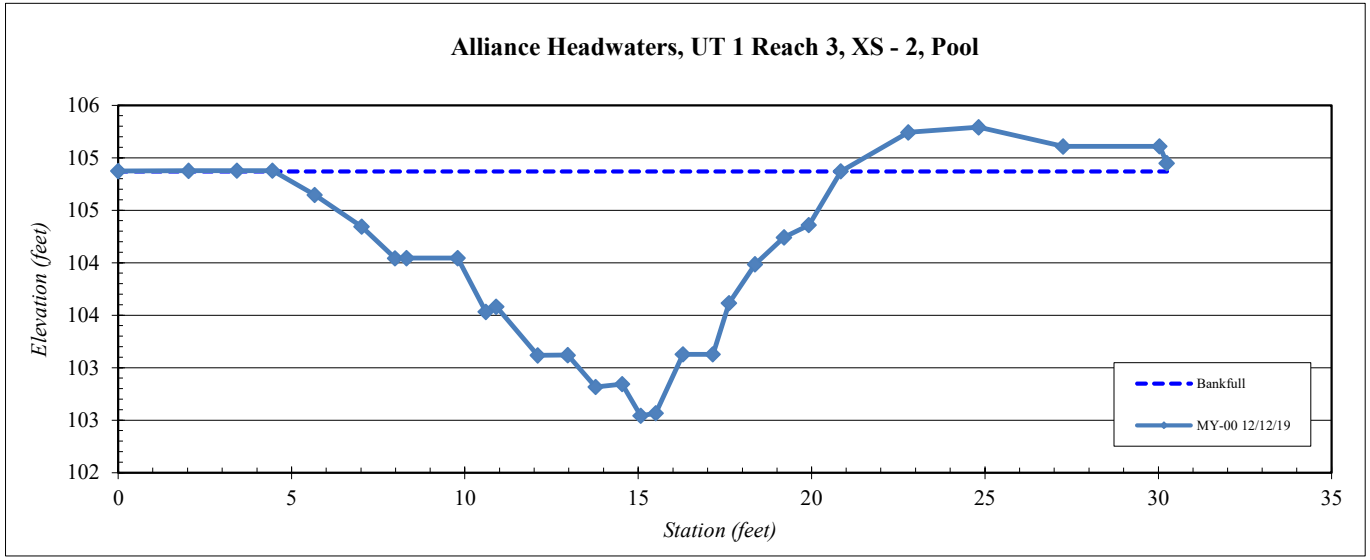


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 1 Reach 3, XS - 2
Feature	Pool
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	104.87
2.0	104.88
3.4	104.88
4.5	104.88
5.7	104.65
7.0	104.35
8.0	104.04
8.3	104.04
9.8	104.05
10.6	103.53
10.9	103.58
12.1	103.12
13.0	103.12
13.8	102.82
14.5	102.84
15.1	102.54
15.5	102.57
16.3	103.13
17.2	103.13
17.6	103.61
18.4	103.99
19.2	104.24
19.9	104.36
20.8	104.87
22.8	105.24
24.8	105.29
27.3	105.11
30.0	105.11
30.2	104.95

SUMMARY DATA	
Bankfull Elevation:	104.9
Bankfull Cross-Sectional Area:	18.5
Bankfull Width:	16.4
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.3
Low Bank Height:	2.3
Mean Depth at Bankfull:	1.1
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	C5

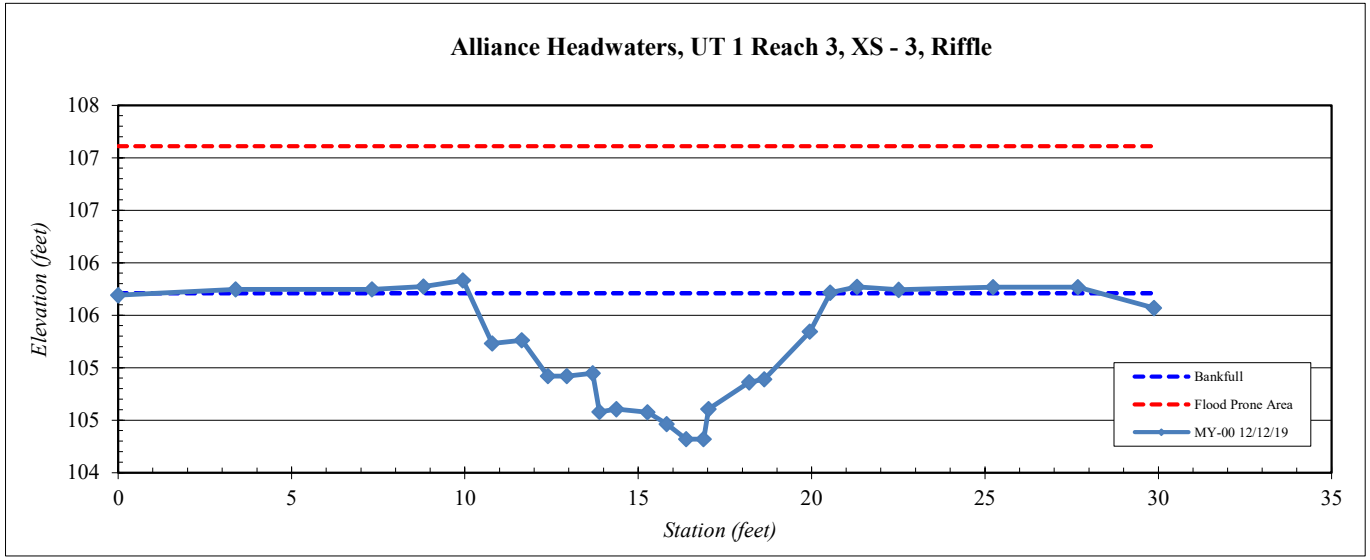


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 1 Reach 3, XS - 3
Feature	Riffle
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	105.69
3.4	105.75
7.3	105.75
8.8	105.77
9.9	105.83
10.8	105.23
11.6	105.26
12.4	104.92
12.9	104.92
13.7	104.95
13.9	104.58
14.4	104.61
15.3	104.58
15.8	104.46
16.4	104.32
16.9	104.32
17.0	104.61
18.2	104.86
18.6	104.89
20.0	105.35
20.5	105.71
21.3	105.8
22.5	105.7
25.2	105.8
27.7	105.8
29.9	105.6

SUMMARY DATA	
Bankfull Elevation:	105.7
Bankfull Cross-Sectional Area:	8.4
Bankfull Width:	10.4
Flood Prone Area Elevation:	107.1
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.4
Low Bank Height:	1.4
Mean Depth at Bankfull:	0.8
W / D Ratio:	12.9
Entrenchment Ratio:	9.6
Bank Height Ratio:	1.0

Stream Type	C5

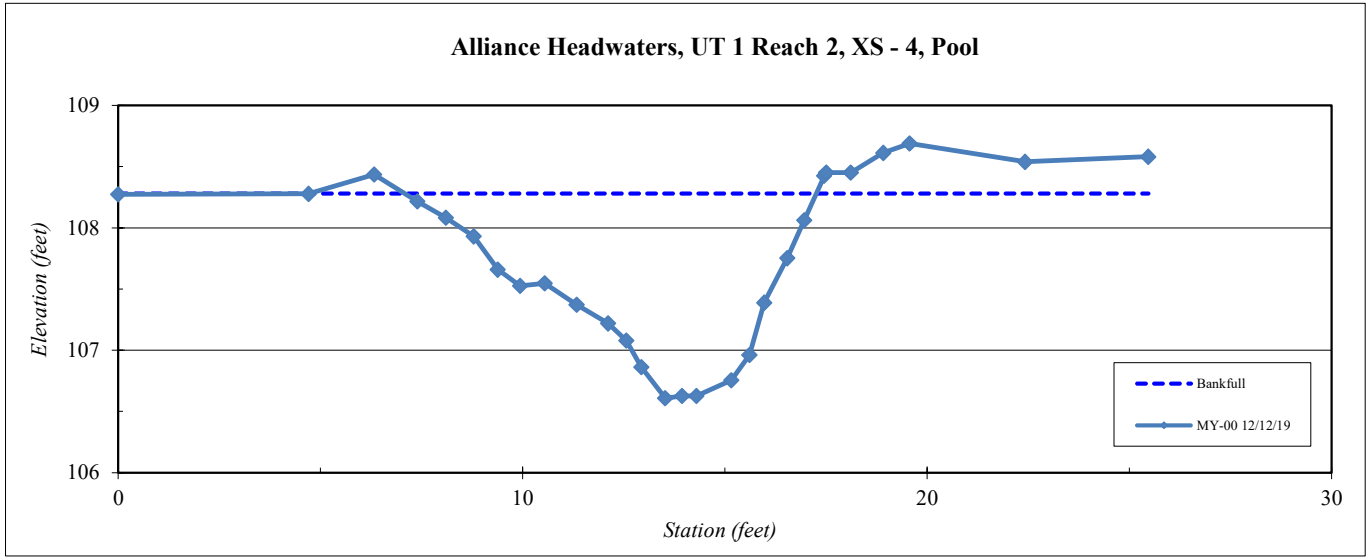


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 1 Reach 2, XS - 4
Feature	Pool
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	108.27
4.7	108.28
6.3	108.44
7.4	108.22
8.1	108.08
8.8	107.93
9.4	107.66
9.9	107.53
10.5	107.55
11.3	107.37
12.1	107.22
12.6	107.08
12.9	106.86
13.5	106.61
13.9	106.63
14.3	106.63
15.2	106.75
15.6	106.96
16.0	107.39
16.5	107.75
17.0	108.06
17.5	108.4
17.5	108.4
18.1	108.4
18.9	108.6
19.6	108.7
22.4	108.5
25.5	108.6

SUMMARY DATA	
Bankfull Elevation:	108.3
Bankfull Cross-Sectional Area:	9.0
Bankfull Width:	10.2
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.7
Low Bank Height:	1.7
Mean Depth at Bankfull:	0.9
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	C5

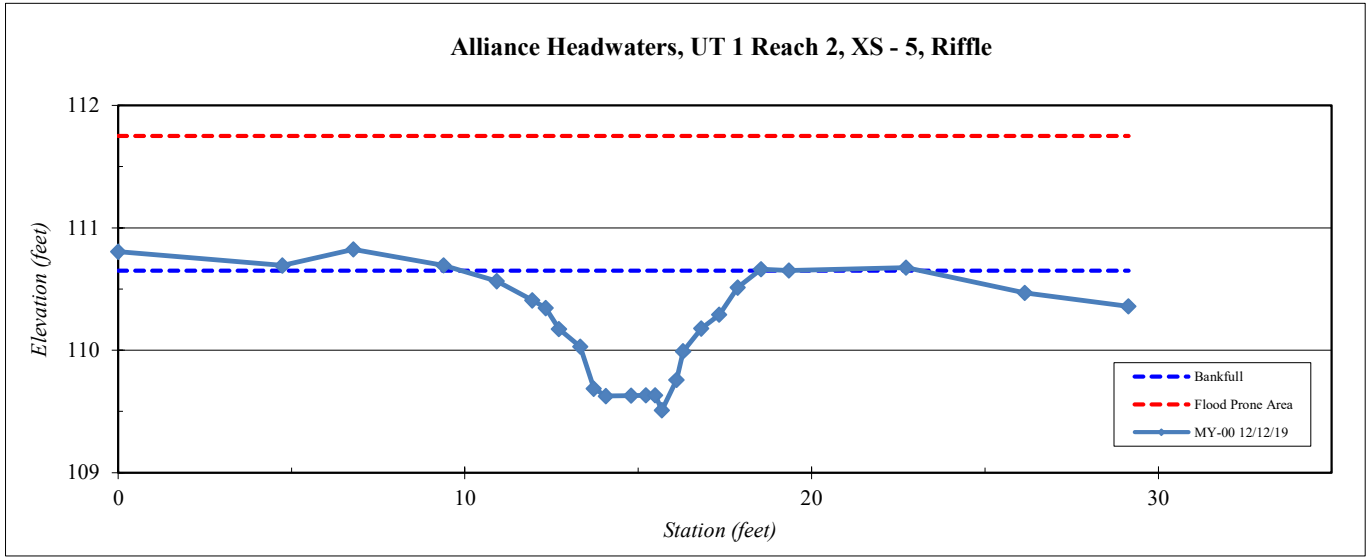


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 1 Reach 2, XS - 5
Feature	Riffle
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	110.80
4.7	110.69
6.8	110.82
9.4	110.69
10.9	110.56
12.0	110.41
12.3	110.35
12.7	110.17
13.3	110.03
13.7	109.69
14.1	109.63
14.8	109.63
15.2	109.63
15.5	109.63
15.7	109.51
16.1	109.76
16.3	109.99
16.8	110.18
17.3	110.29
17.9	110.51
18.5	110.66
19.4	110.7
22.7	110.7
26.2	110.5
29.1	110.4

SUMMARY DATA	
Bankfull Elevation:	110.7
Bankfull Cross-Sectional Area:	4.4
Bankfull Width:	8.6
Flood Prone Area Elevation:	111.8
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.1
Low Bank Height:	1.1
Mean Depth at Bankfull:	0.5
W / D Ratio:	16.8
Entrenchment Ratio:	11.6
Bank Height Ratio:	1.0

Stream Type	C5



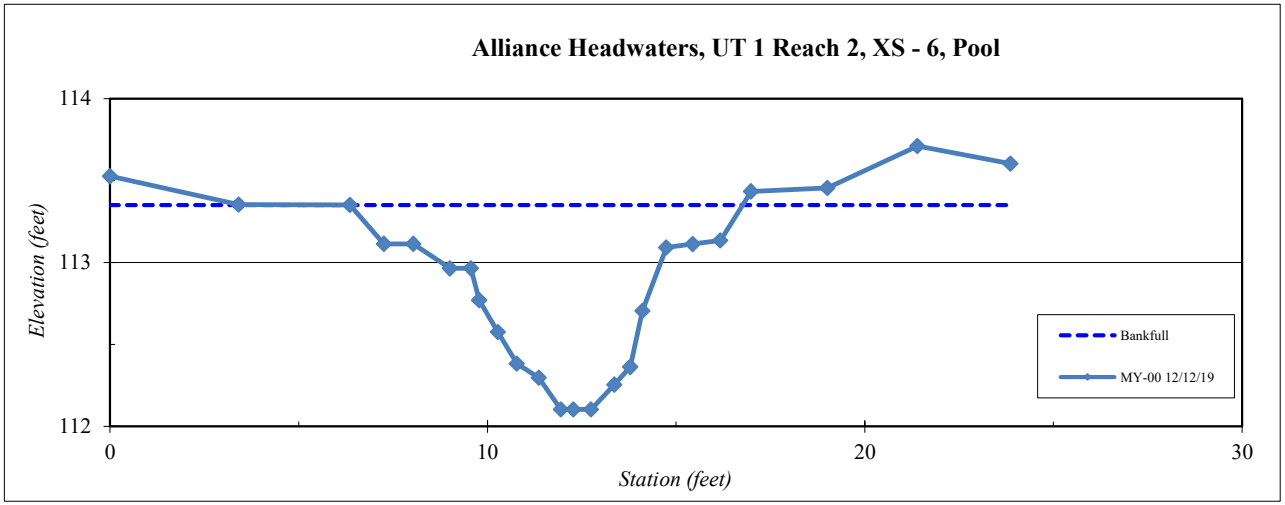
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN ASHLEY RUDOLPH

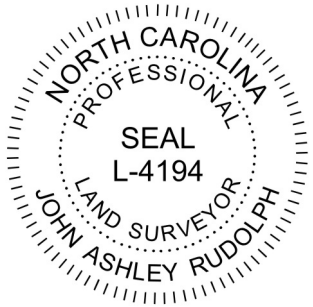
Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 1 Reach 2, XS - 6
Feature	Pool
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	113.5
3.4	113.4
6.4	113.4
7.3	113.1
8.0	113.1
9.0	113.0
9.6	113.0
9.8	112.8
10.3	112.6
10.8	112.4
11.4	112.3
11.9	112.1
12.3	112.1
12.7	112.1
13.4	112.3
13.8	112.4
14.1	112.7
14.7	113.1
15.4	113.1
16.2	113.1
17.0	113.4
19.0	113.5
21.4	113.7
23.9	113.6

SUMMARY DATA	
Bankfull Elevation:	113.4
Bankfull Cross-Sectional Area:	6.1
Bankfull Width:	10.4
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.0
Low Bank Height:	2.0
Mean Depth at Bankfull:	0.6
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	C5



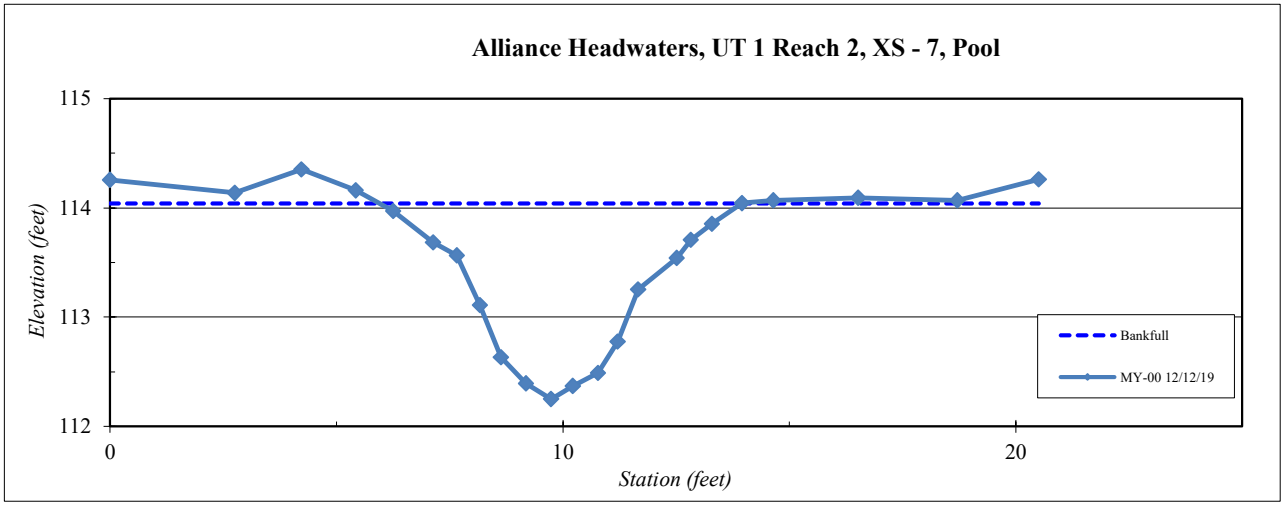


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 1 Reach 2, XS - 7
Feature	Pool
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	114.3
2.8	114.1
4.2	114.4
5.4	114.2
6.3	114.0
7.1	113.7
7.7	113.6
8.2	113.1
8.6	112.6
9.2	112.4
9.7	112.2
10.2	112.4
10.8	112.5
11.2	112.8
11.7	113.3
12.5	113.5
12.8	113.7
13.3	113.9
14.0	114.0
14.7	114.1
16.5	114.1
18.7	114.1
20.5	114.3

SUMMARY DATA	
Bankfull Elevation:	114.0
Bankfull Cross-Sectional Area:	6.8
Bankfull Width:	8.0
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.8
Low Bank Height:	1.8
Mean Depth at Bankfull:	0.9
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	C5

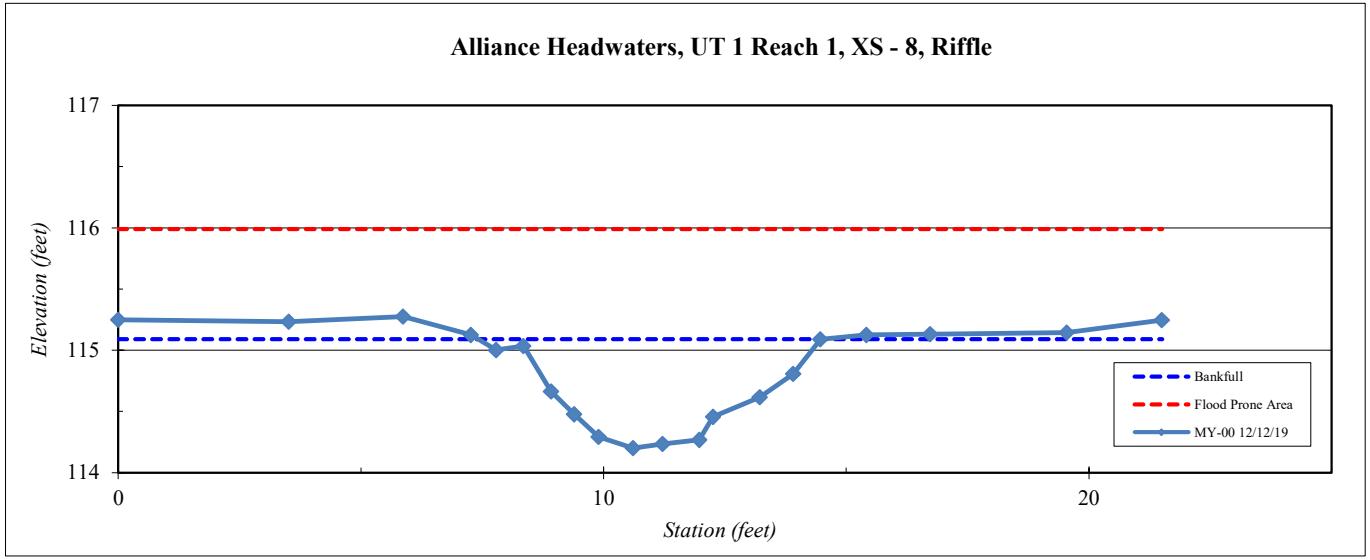


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 1 Reach 1, XS - 8
Feature	Riffle
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	115.25
3.5	115.23
5.9	115.28
7.3	115.12
7.8	115.00
8.3	115.04
8.9	114.66
9.4	114.48
9.9	114.29
10.6	114.20
11.2	114.23
12.0	114.27
12.3	114.46
13.2	114.62
13.9	114.81
14.5	115.09
15.4	115.13
16.7	115.13
19.5	115.14
21.5	115.25

SUMMARY DATA	
Bankfull Elevation:	115.1
Bankfull Cross-Sectional Area:	3.6
Bankfull Width:	7.1
Flood Prone Area Elevation:	116.0
Flood Prone Width:	100.0
Max Depth at Bankfull:	0.9
Low Bank Height:	0.9
Mean Depth at Bankfull:	0.5
W / D Ratio:	14.0
Entrenchment Ratio:	14.1
Bank Height Ratio:	1.0

Stream Type	C5

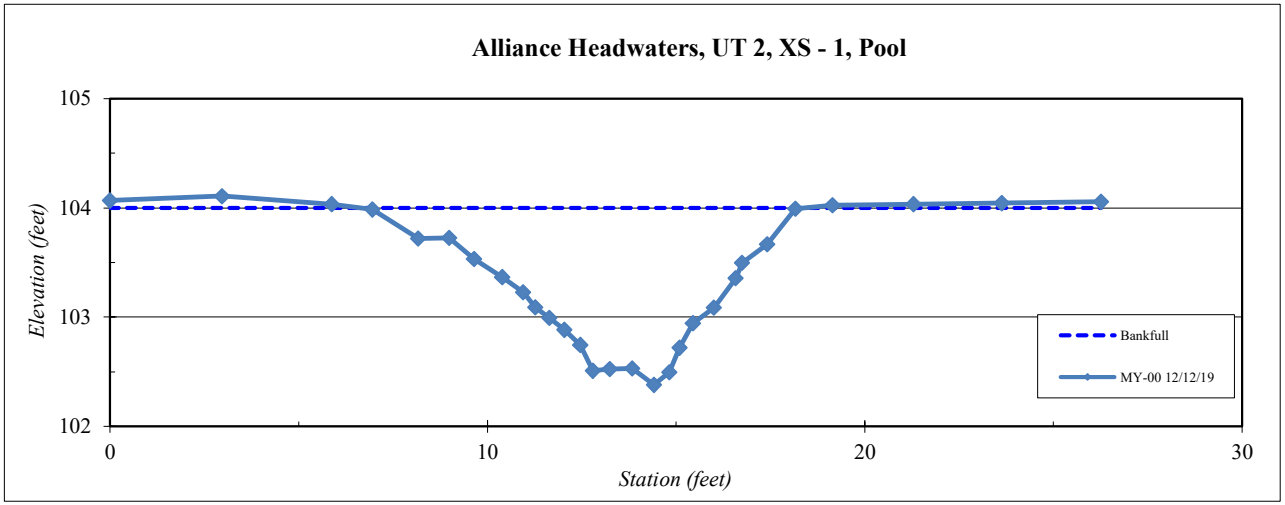


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 2, XS - 1
Feature	Pool
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	104.1
3.0	104.1
5.9	104.0
7.0	104.0
8.2	103.7
9.0	103.7
9.6	103.5
10.4	103.4
11.0	103.2
11.3	103.1
11.6	103.0
12.0	102.9
12.5	102.7
12.8	102.5
13.2	102.5
13.8	102.5
14.4	102.4
14.8	102.5
15.1	102.7
15.4	102.9
16.0	103.1
16.6	103.4
16.8	103.5
17.4	103.7
18.2	104.0
19.1	104.0
21.3	104.0
23.6	104.0
26.3	104.1

SUMMARY DATA	
Bankfull Elevation:	104.0
Bankfull Cross-Sectional Area:	8.8
Bankfull Width:	11.8
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.6
Low Bank Height:	1.6
Mean Depth at Bankfull:	0.7
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	C5

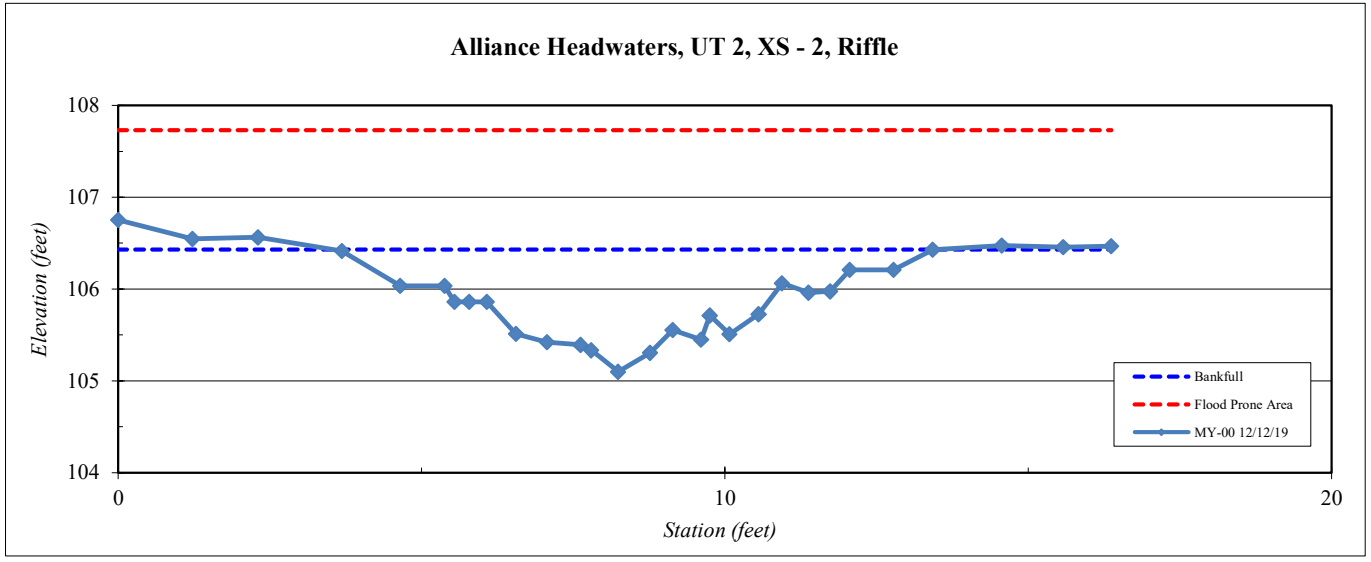


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 2, XS - 1
Feature	Riffle
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	106.8
1.2	106.5
2.3	106.6
3.7	106.4
4.7	106.0
5.4	106.0
5.5	105.9
5.8	105.9
6.1	105.9
6.6	105.5
7.1	105.4
7.6	105.4
7.8	105.3
8.2	105.1
8.8	105.3
9.1	105.6
9.6	105.5
9.8	105.7
10.1	105.5
10.6	105.7
10.9	106.1
11.4	106.0
11.7	106.0
12.1	106.2
12.8	106.2
13.4	106.4
14.6	106.5
15.6	106.5
16.4	106.5

SUMMARY DATA	
Bankfull Elevation:	106.4
Bankfull Cross-Sectional Area:	6.1
Bankfull Width:	9.9
Flood Prone Area Elevation:	107.7
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.3
Low Bank Height:	1.3
Mean Depth at Bankfull:	0.6
W / D Ratio:	16.1
Entrenchment Ratio:	10.1
Bank Height Ratio:	1.0

Stream Type	C5

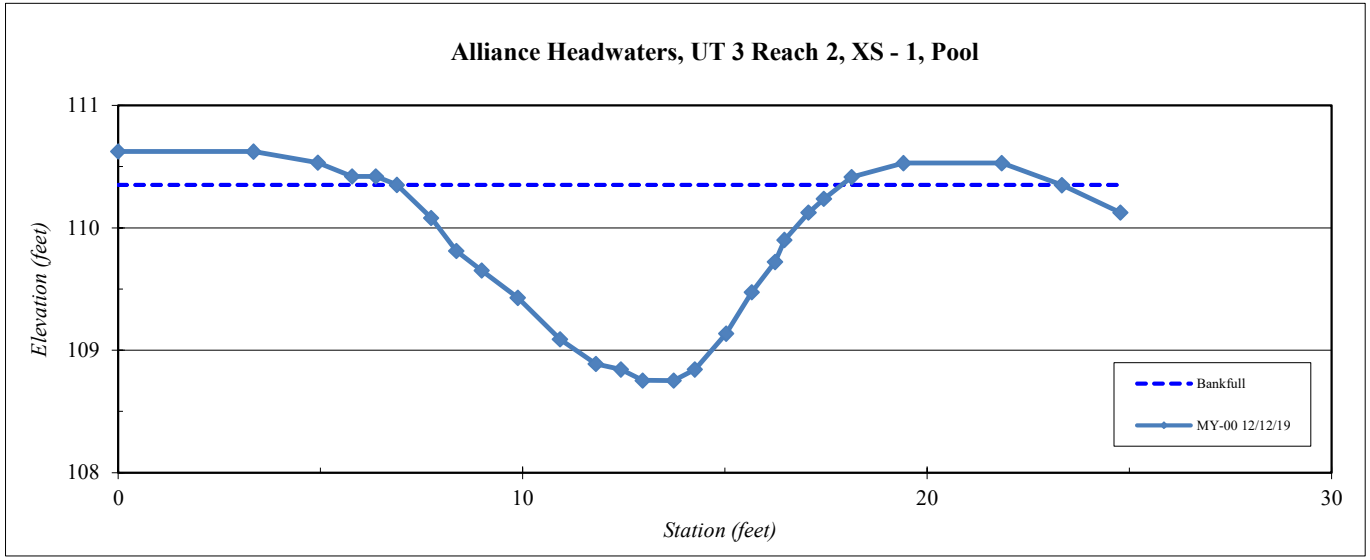


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 3 Reach 2, XS - 1
Feature	Pool
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	110.6
3.4	110.6
4.9	110.5
5.8	110.4
6.4	110.4
6.9	110.4
7.7	110.1
8.4	109.8
9.0	109.7
9.9	109.4
10.9	109.1
11.8	108.9
12.4	108.8
13.0	108.8
13.7	108.8
14.3	108.8
15.0	109.1
15.7	109.5
16.2	109.7
16.5	109.9
17.1	110.1
17.4	110.2
18.1	110.4
19.4	110.5
21.8	110.5
23.3	110.3
24.8	110.1

SUMMARY DATA	
Bankfull Elevation:	110.4
Bankfull Cross-Sectional Area:	10.2
Bankfull Width:	11.0
Flood Prone Area Elevation:	112.0
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.6
Low Bank Height:	1.6
Mean Depth at Bankfull:	0.9
W / D Ratio:	11.9
Entrenchment Ratio:	9.1
Bank Height Ratio:	1.0

Stream Type	C5

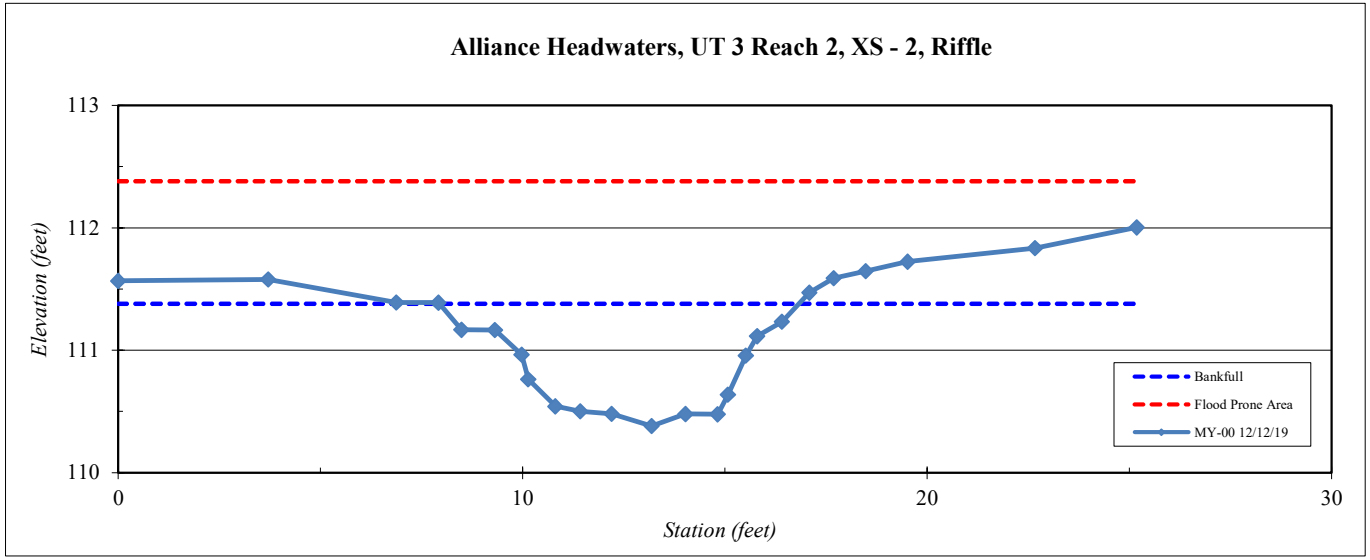


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 3 Reach 2, XS - 2
Feature	Riffle
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	111.6
3.7	111.6
6.9	111.4
7.9	111.4
8.5	111.2
9.3	111.2
10.0	111.0
10.1	110.8
10.8	110.5
11.4	110.5
12.2	110.5
13.2	110.4
14.0	110.5
14.8	110.5
15.1	110.6
15.5	111.0
15.8	111.1
16.4	111.2
17.1	111.5
17.7	111.6
18.5	111.6
19.5	111.7
22.7	111.8
25.2	112.0

SUMMARY DATA	
Bankfull Elevation:	111.4
Bankfull Cross-Sectional Area:	5.4
Bankfull Width:	8.9
Flood Prone Area Elevation:	112.4
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.0
Low Bank Height:	1.0
Mean Depth at Bankfull:	0.6
W / D Ratio:	14.7
Entrenchment Ratio:	11.2
Bank Height Ratio:	1.0

Stream Type	C5

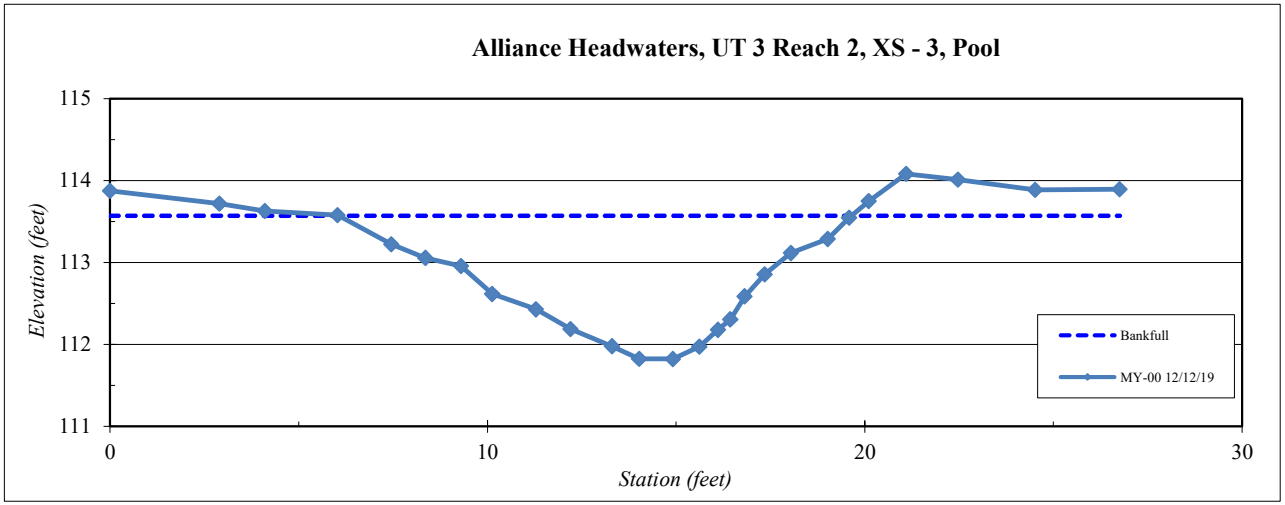


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 3 Reach 2, XS - 3
Feature	Pool
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	113.9
2.9	113.7
4.1	113.6
6.0	113.6
7.5	113.2
8.4	113.1
9.3	113.0
10.1	112.6
11.3	112.4
12.2	112.2
13.3	112.0
14.0	111.8
14.9	111.8
15.6	112.0
16.1	112.2
16.4	112.3
16.8	112.6
17.3	112.9
18.0	113.1
19.0	113.3
19.6	113.5
20.1	113.7
21.1	114.1
22.5	114.0
24.5	113.9
26.8	113.9

SUMMARY DATA	
Bankfull Elevation:	113.6
Bankfull Cross-Sectional Area:	12.7
Bankfull Width:	13.6
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.7
Low Bank Height:	1.7
Mean Depth at Bankfull:	0.9
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	C5

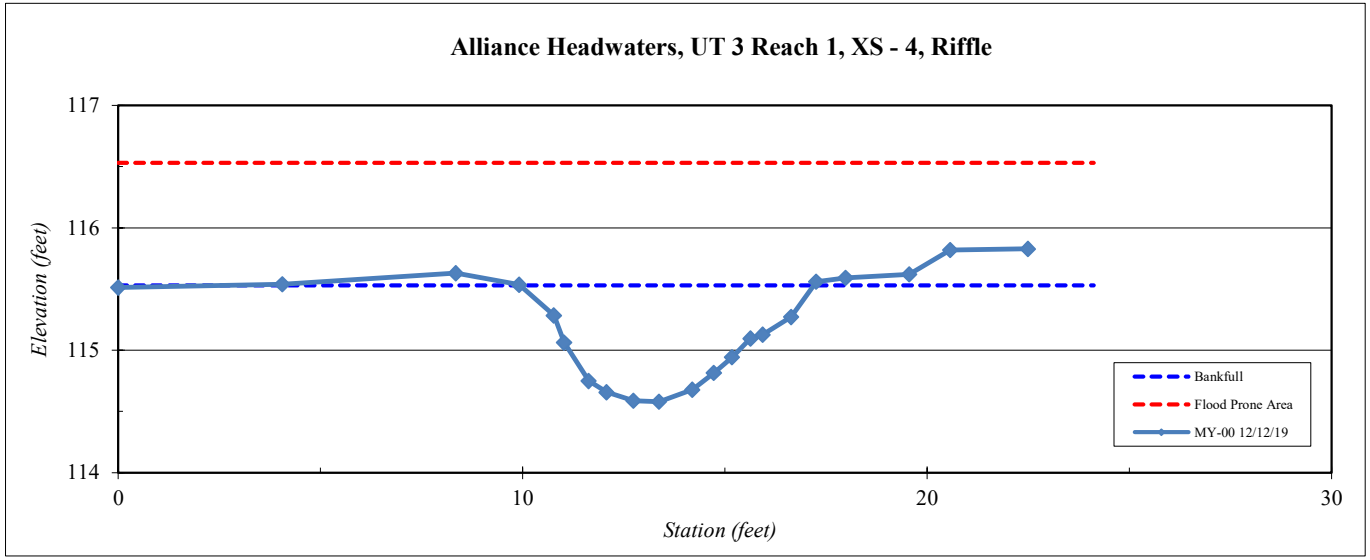


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 3 Reach 1, XS - 4
Feature	Riffle
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	115.5
4.1	115.5
8.3	115.6
9.9	115.5
10.8	115.3
11.0	115.1
11.6	114.7
12.1	114.7
12.7	114.6
13.4	114.6
14.2	114.7
14.7	114.8
15.2	114.9
15.6	115.1
15.9	115.1
16.6	115.3
17.3	115.6
18.0	115.6
19.6	115.6
20.6	115.8
22.5	115.8
24.1	115.8

SUMMARY DATA	
Bankfull Elevation:	115.5
Bankfull Cross-Sectional Area:	4.3
Bankfull Width:	7.3
Flood Prone Area Elevation:	116.5
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.0
Low Bank Height:	1.0
Mean Depth at Bankfull:	0.6
W / D Ratio:	12.4
Entrenchment Ratio:	13.7
Bank Height Ratio:	1.0

Stream Type	C5

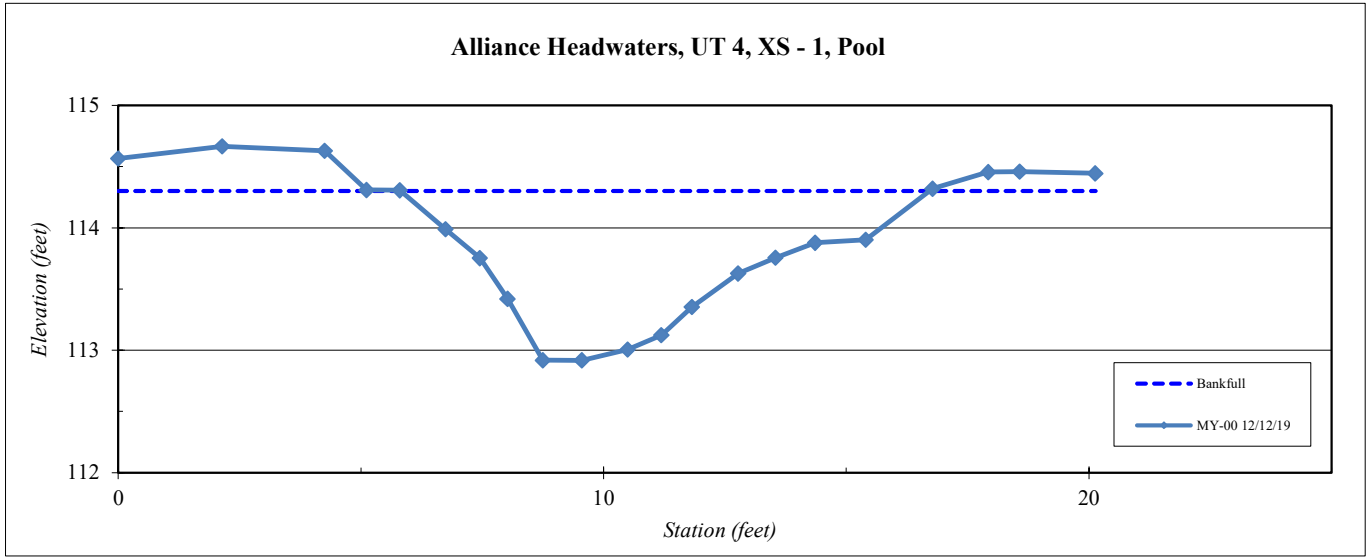


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 4, XS - 1
Feature	Pool
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	114.57
2.1	114.67
4.3	114.63
5.1	114.31
5.8	114.31
6.7	113.99
7.5	113.75
8.0	113.42
8.7	112.92
9.6	112.92
10.5	113.01
11.2	113.12
11.8	113.35
12.8	113.63
13.5	113.76
14.4	113.88
15.4	113.90
16.8	114.32
17.9	114.45
18.6	114.46
20.1	114.44

SUMMARY DATA	
Bankfull Elevation:	114.3
Bankfull Cross-Sectional Area:	7.9
Bankfull Width:	10.9
Flood Prone Area Elevation:	115.7
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.4
Low Bank Height:	1.4
Mean Depth at Bankfull:	0.7
W / D Ratio:	15.0
Entrenchment Ratio:	9.2
Bank Height Ratio:	1.0

Stream Type	C5

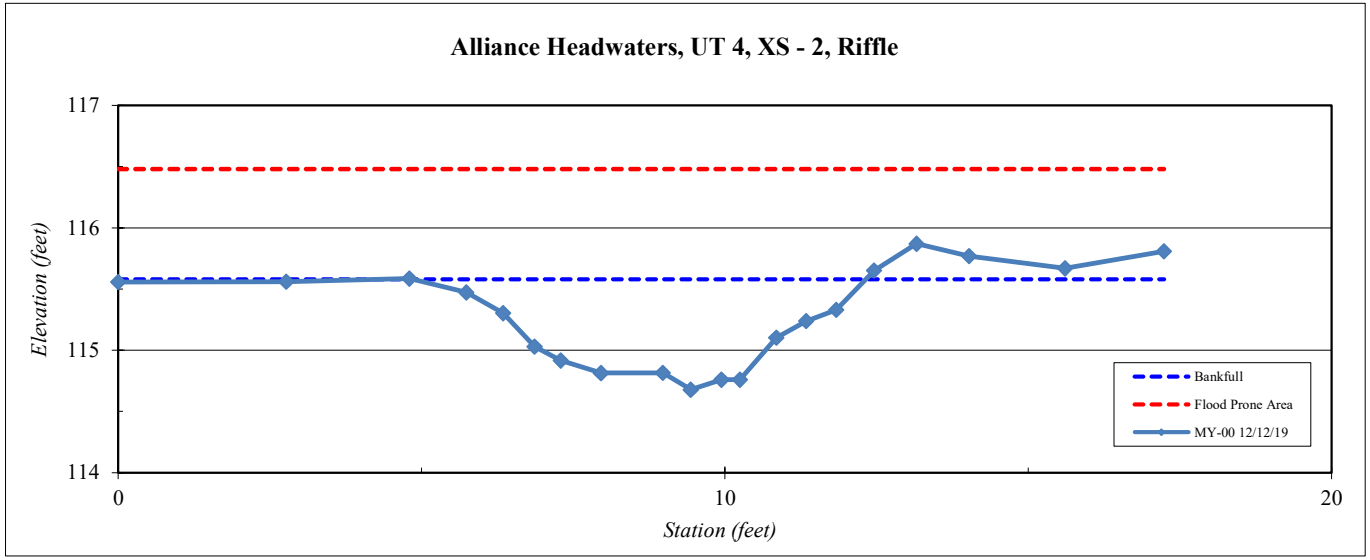


Site	Alliance Headwaters
Watershed:	Neuse River, 03020201
XS ID	UT 3, XS - 2
Feature	Riffle
Date:	12/12/2019
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	115.56
2.8	115.56
4.8	115.59
5.7	115.47
6.3	115.30
6.9	115.03
7.3	114.92
8.0	114.81
9.0	114.82
9.4	114.68
9.9	114.76
10.3	114.76
10.9	115.10
11.3	115.24
11.8	115.33
12.5	115.65
13.2	115.87
14.0	115.77
15.6	115.67
17.2	115.81

SUMMARY DATA	
Bankfull Elevation:	115.6
Bankfull Cross-Sectional Area:	3.8
Bankfull Width:	7.5
Flood Prone Area Elevation:	116.5
Flood Prone Width:	100.0
Max Depth at Bankfull:	0.9
Low Bank Height:	0.9
Mean Depth at Bankfull:	0.5
W / D Ratio:	14.8
Entrenchment Ratio:	13.3
Bank Height Ratio:	1.0

Stream Type	C5



Appendix G
Construction & Planting Photo Log

Alliance Headwaters Mitigation Site: Construction
DMS Contract #: 6832; DMS Project ID: 95017; RFP # 16-006477

Channel Construction - 05/16/2020

Eastern Easement, Pond draining and filling - 05/16/2020

Eastern Easement, post 1.5” summer rain - 06/10/2019

Eastern Easement, UT-4 near origin point, post 1.5” summer rain - 06/10/2019

Eastern Easement, UT-3/UT-4, 12/22/2019

Eastern Easement, UT-3/UT-4, near origin point, 12/22/2019

Eastern Easement, UT-3 origin point, 12/22/2019

Eastern Easement, UT-4 origin point, 12/22/2019

Eastern Easement, outfall, 12/22/2019

Eastern Easement, 12/22/2019

Bare-root planting - 01/15/2020

Bare-root planting - 01/15/2020

Bare-root planting - 01/15/2020

Bare-root planting - 01/15/2020

Bare-root planting - 01/15/2020

Bare-root planting - 01/15/2020 + flow gauge - UT3

Bare-root planting - 01/15/2020

Bare-root planting - 01/15/2020 + flow gauge - UT3

Bare-root planting - 01/15/2020

Live-stake planting - 01/28/202

Live-stake planting - 01/28/202

Live-stake planting - 01/28/202

Live-stake planting - 01/28/202

Live-stake planting - 01/28/202