FINAL
AS-BUILT BASELINE
MONITORING REPORT (MY0)

SLINGSHOT CREEK STREAM AND WETLAND MITIGATION SITE
Rockingham County, North Carolina

DMS Project ID No. 100058
Full Delivery Contract No. 7525
USACE Action ID No. SAW-2018-01170
RFP No. 16-007330

Cape Fear River Basin
Cataloging Unit 03030002

Data Collection: May 2020
Submission: August 2020

Prepared for:

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

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Prepared by:

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APPENDICES

1.0 PROJECT SUMMARY

Restoration Systems, LLC has established the North Carolina Division of Mitigation Services (NCDMS) Slingshot Creek Stream and Wetland Restoration Site (Site).

1.1 Project Goals & Objectives

Project goals were based on the *Cape Fear River Basin Restoration Priorities* (RBRP) report (NCEEP 2009) and on-site preconstruction data collection of channel morphology and function observed during field investigations. The Site is located within Targeted Local Watershed (TLW) 03030002010010. The RBRP report documents benthic ratings vary between "Fair" and "Good-Fair" possibly due to cattle, dairy, and poultry operations.

The project is located within the Troublesome Creek and Little Troublesome Creek Local Watershed Planning area (NCEEP 2004); project activities addressed priorities associated with the LWP as follows with Site specific information following the LWP goals in parenthesis.

1. Protect and improve water quality by restoring wetland, stream, and riparian area functions and values, which may have been, or may be, lost through historic, current, and future impacts (4115 linear feet of stream restored/enhanced/preserved, 1.71 acres of wetland restored/enhanced, and 11.6. acres of riparian buffer restored/enhanced).
2. Achieve a net increase in riparian zone buffers and wetlands acreage, functions, and values (11.6 acres of riparian buffer were restored/enhanced, and wetland acreage was increased by 1.02 acres).
3. Promote a comprehensive approach for the protection of natural resources (protected athe Site, streams, wetlands, and riparian buffer through a permanent conservation easement).

In addition to the defined Troublesome Creek LWP goals, additional goals for the area generally revolve around reduction of stressors to water quality. Stressors and how each were addressed by project activities is as follows.

1. Nutrient Inputs – (livestock were removed from streams resulting in a direct reduction of 474.7 pounds of nitrogen, 39.3 pounds of phosphorus per year, and 4.7×10^{11} colonies of fecal coliform; eliminated fertilizer applications; and installed marsh treatment areas).
2. Streambank Erosion – (reduction of 220 tons of sediment per year).
3. Stormwater – (reduced bank height ratios and installed marsh treatment area to reduce stormwater pulses).
4. Disturbed Riparian Buffer – (restored/enhanced 11.6 acres of riparian buffer along 4115 linear feet of stream).
5. Floodplain Alteration – (eliminated straightened, entrenched streams and removed spoil material deposited in the floodplain).

Site specific mitigation goals and objectives were developed through the use of North Carolina Stream Assessment Method (NC SAM) and North Carolina Wetland Assessment Method (NC WAM) analyses of preconstruction and reference stream systems at the Site (NC SFAT 2015 and NC WFAT 2010) (see table below).

Stream/Wetland Targeted Functions, Goals, and Objectivest

Targeted Functions	Goals	Objectives	Compatibility of Success Criteria
(1) HYDROLOGY			
(2) Flood Flow (Floodplain Access) (3) Streamside Area Attenuation (4) Floodplain Access (4) Wooded Riparian Buffer	• Attenuate flood flow across the Site. • Minimize downstream flooding to the maximum extent possible. • Connect streams to functioning wetland systems.	• Construct new channel at historic floodplain elevation to restore overbank flows and restore jurisdictional wetlands • Plant woody riparian buffer • Remove livestock • Deep rip floodplain soils to reduce compaction and increase soil surface roughness • Protect riparian buffers with a perpetual conservation easement	• Over the monitoring period BHR not to exceed 1.2 • Document four overbank events in separate monitoring years • Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded
(3) Stream Stability (4) Sediment Transport (4) Stream Geomorphology	• Increase stream stability within the Site so that channels are neither aggrading nor degrading.	• Construct channels with proper pattern, dimension, and longitudinal profile • Remove livestock • Construct stable channels with cobble/gravel substrate • Plant woody riparian buffer	• Cross-section measurements indicate a stable channel with cobble/gravel substrate • Visual documentation of stable channels and structures • Over the monitoring period BHR not to exceed 1.2 • < 10% change in BHR over the monitoring period • Livestock excluded from the easement • Attain Vegetation Success Criteria
(1) WATER QUALITY			
(2) Streamside Area Vegetation (3) Upland Pollutant Filtration (2) Indicators of Stressors Wetland Particulate Change	• Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	• Remove livestock and reduce agricultural land/inputs • Install marsh treatment areas, where necessary • Plant woody riparian buffer • Restore/enhance jurisdictional wetlands adjacent to Site streams	• Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria
(1) HABITAT			
(2) In-stream Habitat (3) Substrate (3) In-Stream Habitat (2) Stream-side Habitat (3) Stream-side Habitat (3) Thermoregulation Wetland Physical Structure Wetland Landscape Patch Structure Wetland Vegetation Composition	• Improve instream and stream-side habitat.	• Construct stable channels with cobble/gravel substrate • Add large woody debris in the form of log vane structures • Plant permanent seed mixtures along banks to add rooting material and leafy vegetation for macroinvertebrates • Plant woody riparian buffer to provide organic matter and shade • Protect riparian buffers with a perpetual conservation easement • Restore/enhance jurisdictional wetlands adjacent to Site streams	• Cross-section measurement indicate a stable channel with cobble/gravel substrate • Visual documentation of stable channels and in-stream structures. • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded

1.2 Project Background

The Slingshot Creek Stream & Wetland Mitigation Site (hereafter referred to as the "Site") encompasses 11.6 acres of disturbed forest and livestock pasture along warm water, unnamed tributaries to Lake Hunt. The Site is located approximately 2 miles west of Reidsville, just east of Lake Hunt, and north NC Highway 158 in Rockingham County (Figure 1, Appendix A).

Prior to construction, Site land use consisted of livestock pasture, hay fields, and disturbed forest. Livestock had unrestricted access to Site streams. A narrow riparian fringe had developed on the stream margins that was composed of opportunistic species, invasive species, and a few mature tree species. Approximately 55 percent of the stream channel was degraded contributing to sediment export from the Site resulting from mechanical processes from livestock hoof shear. In addition, streamside wetlands were cleared and drained by channel downcutting and land uses. Preconstruction Site conditions resulted in degraded water quality, a loss of aquatic habitat, reduced nutrient and sediment retention, and unstable channel characteristics (loss of horizontal flow vectors that maintain pools and an increase in erosive forces to channel bed and banks). Site restoration activities restored riffle-pool morphology, aided in energy dissipation, increased aquatic habitat, stabilized channel banks, and greatly reduced sediment loss from channel banks.

1.3 Project Components and Structure

Proposed Site restoration activities generated 3185 Stream Mitigation Units (SMUs) and 1.321 Riparian Wetland Mitigation Units (WMUs) as the result of the following.

- 2501 linear feet of Priority I stream restoration
- 587 linear feet of stream enhancement (Level I)
- 635 linear feet of stream enhancement (Level II)
- 391 linear feet of stream preservation
- 1.018 acre of riparian wetland restoration
- 0.606 acre of riparian wetland enhancement

Additional activities that occurred at the Site included the following.

- Planting 12.05 acres of the Site with 10,950 stems (planted species are included in Table 5 [Appendix C]).
- Site fencing has not yet been constructed. However, fencing the entire conservation easement by leaving some pre-existing fencing, removing fencing, and installing additional fencing will occur this year.

Deviations from the construction plans included removing the left vane arm from the structure at sta. 05+63 on Slingshot Creek and removing the three log cross-vanes between sta. 03+00 and 04+00 on UT1 due to bedrock presence. 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 November 2019. Construction started on March 13, 2020 and ended within a final walkthrough on April 30, 2020. The Site was also planted on April 30, 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

Project success criteria have been established per the October 24, 2016 NC Interagency Review Team *Wilmington District Stream and Wetland Compensatory Mitigation Update*. Monitoring and success criteria relate to project goals and objectives. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving success criteria. The following table summarizes Site success criteria.

Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section over the monitoring period. • BHR at any measured riffle cross-section should not change by more than 10% from baseline condition over monitoring period. • A minimum of 30-days continuous surface flow for intermittent streams. • The stream project shall remain stable and all other performance standards shall be met through four separate bankfull events, occurring in separate years, during the monitoring years 1-7.
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: Growing season length will be confirmed with a continuous recording temperature gauge that will measure from February to April each monitoring year.
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 in each plot. • Planted and volunteer stems are counted, provided they are included in the approved planting list for the site; natural recruits not on the planting list may be considered by the IRT on a case-by-case basis.

Note: BHR will be calculated using procedures outlined in the latest approved guidance from NCDMS.

2.0 METHODS

Monitoring will be conducted by Axiom Environmental, Inc. Annual monitoring reports of the data collected will be submitted to the NCDMS by Restoration Systems no later than December 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	■	■	■		■		■
Macroinvertebrates			■		■		■
Visual Assessment*	■	■	■	■	■	■	■
Report Submittal	■	■	■	■	■	■	■

*Visual Assessment will be complimented by permanent photographic points located at each permanent cross section and vegetation plot.

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 14 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern will be depicted on a plan view figure with a written assessment and photograph of the area included in the report.
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Stream Hydrology	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through monitoring period	Stream flow regime is not in question. However, surface water gauges and/or cameras will be used to document bankfull events.	NA
Bankfull Events	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through monitoring period	Surface water gauge on Slingshot Creek and UT 1	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.
Benthic Macroinvertebrates	"Qual 4" method described in *Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates, Version 5.0* (NCDWR 2016)	Pre-construction, Years 3, 5, and 7 during the "index period" referenced in *Small Streams Biocriteria Development* (NCDWQ 2009)	2 stations (one at the lower end of UT1 and one at the lower end of Slingshot Creek)	Results* will be presented on a site-by-site basis and will include a list of taxa collected, an enumeration of *Ephemeroptera, Plecoptera,* and *Tricopetera* taxa as well as Biotic Index values.
Wetland Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Wetland Restoration	Groundwater gauges	Years 1, 2, 3, 4, 5, 6, and 7 throughout the year with the growing season defined as March 1-October 26	11 gauges spread throughout restored/enhanced 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	10 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	2 plots randomly selected each year	Species and height

*Benthic Macroinvertebrate sampling data will not be tied to success criteria; however, the data may be used as a tool to observe positive gains to in-stream habitat

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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
Slingshot Creek Restoration Site

Project Segment	Stream Stationing/ Wetland Type	Existing Footage/ Acreage	Mitigation Plan Footage/ Acreage	Restoration Level	Mitigation Ratio		Restoration Footage/ Acreage	Comment
Slingshot Creek-Reach 1	00+00 to 03+05	305	305	Preservation	10:1		305	
Slingshot Creek-Reach 2	03+05 to 04+59	154	154	Enhancement (Level II)	2.5:1		154	
Slingshot Creek-Reach 3	04+59 to 05+78	156	119	Restoration (Priority I)	1:1		124	
Slingshot Creek-Reach 4	05+78 to 07+17	139	139	Enhancement (Level I)	1.5:1		143	
Slingshot Creek-Reach 5	07+17 to 27+77	2069	2060-50-51-25= 1934	Restoration (Priority I)	1:1		1970	126 lf of Slingshot Creek is located outside of the conservation easement and therefore is not generating credit
Slingshot Creek-Reach 6	27+77 to 28+74	97	97	Enhancement (Level II)	2.5:1		97	
UT 1A	00+00 to 01+95	195	195	Enhancement (Level II)	2.5:1		195	
UT 1B	01+95 to 06+95	500	500-52= 448	Enhancement (Level I)	1.5:1		475	52 lf of the UT1 is located outside of the conservation easement and therefore is not generating credit
UT 1C	06+95 to 09+70	273	275	Restoration (Priority I)	1:1		270	
UT 2	00+04 to 01+78	130	173	Restoration (Priority I)	1:1		169	
UT 3	00+00 to 01+89	189	189	Enhancement (Level II)	2.5:1		189	
UT 4	00+00 to 00+86	86	86	Preservation	10:1		86	
Wetland Restoration	--	--	1.018	Restoration	1:1		1.018	
Wetland Enhancement	--	0.69	0.606	Enhancement	2:1		0.606	

Table 1. Project Components and Mitigation Credits (continued)
Slingshot Creek Restoration Site

	Stream			Riparian Wetland		Non-Rip	Coastal
Restoration Level	Warm	Cool	Cold	Riverine	Non-Riv	Wetland	Marsh
Restoration	**2501.000***				**1.018**		
Re-establishment							
Rehabilitation							
Enhancement					**0.303**		
Enhancement I	**391.333****						
Enhancement II	**254.000**						
Creation							
Preservation	**39.100**						
TOTALS	**3185.433**				**1.321**		

*An additional 126 linear feet of stream restoration is proposed to occur outside of the conservation easement and is therefore not included in this total or in mitigation credit calculations.
**An additional 52 linear feet of stream enhancement (level I) is proposed to occur outside of the conservation easement and is therefore not included in this total or in mitigation credit calculations.

Table 2. Project Activity and Reporting History
Slingshot Creek Restoration Site

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal (RFP No. 16-007330)	February 2, 2018	February 8, 2018
Institution Date (NCDMS Contract No. 100058)	--	April 24, 2018
Mitigation Plan	September 2018	June 2019
Construction Plans	--	November 18, 2019
404 Permit	--	January 2, 2020
Site Construction Final Walkthrough	--	April 30, 2020
Planting	--	April 30, 2020
As-built Baseline Monitoring (MY0)	May 2020	August 2020

Table 3. Project Contacts Table
Slingshot Creek Restoration Site

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 Worth Creech 919-755-9490
Designer & Monitoring Provider	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Attribute Table
Slingshot Creek Restoration Site

Project Information	
Project Name	Slingshot Creek Restoration Site
Project County	Rockingham County, North Carolina
Project Area (acres)	11.6
Project Coordinates (latitude & latitude)	36.334687ºN, 79.711665ºW
Planted Area (acres)	9.3
Project Watershed Summary Information	
Physiographic Province	Piedmont
Project River Basin	Cape Fear
USGS HUC for Project (14-digit)	03030002010010
NCDWR Sub-basin for Project	03-06-01
Project Drainage Area (acres)	270
Percentage of Project Drainage Area that is Impervious	<5%
CGIA Land Use Classification	Managed Herbaceous Cover & Hardwood Swamps

Table 4. Project Attribute Table
Slingshot Creek Restoration Site (continued)

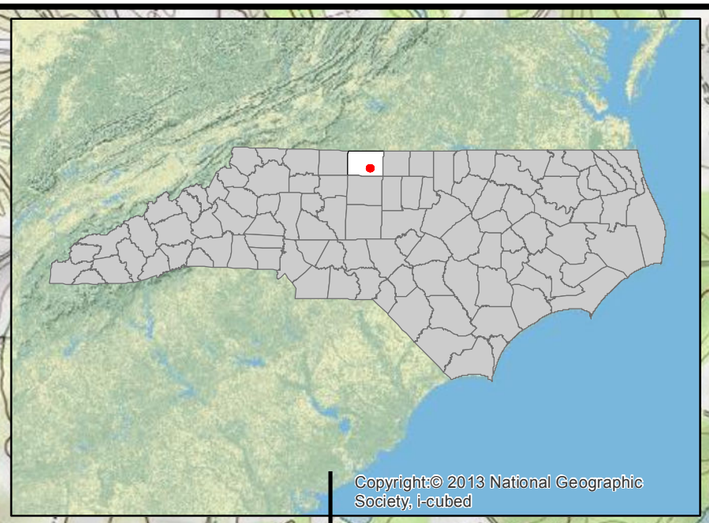
Reach Summary Information					
Parameters	**Slingshot Creek**	**UT 1**	**UT 2**	**UT 3**	**UT 4**
Length of reach (linear feet)	2920	968	130	189	86
Valley Classification & Confinement	Alluvial, confined				
Drainage Area (acres)	270	60	65	9	22
NCDWR Stream ID Score	---	---	---	---	---
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Intermittent	Perennial
NCDWR Water Quality Classification	WS-III, B, NSW				
Existing Morphological Description (Rosgen 1996)	G4/5	G5	G5	C5	Eg4
Proposed Stream Classification (Rosgen 1996)	C/E 4	C/E 4	C/E 4	C5	Eg4
Existing Evolutionary Stage (Simon and Hupp 1986)	III/IV	I/III/IV	III/IV	II/III	II/III
Underlying Mapped Soils	Clifford sandy clay loam, Codorus loam, Davie sandy loam, Fairview-Poplar complex, Nathalie sandy loam, Poplar Forest sandy clay loam				
Drainage Class	Well-drained, moderately well-drained, somewhat poorly-drained, well-drained, well-drained, well-drained, well-drained				
Hydric Soil Status	Nonhydric, nonhydric, nonhydric, nonhydric, nonhydric, nonhydric, nonhydric, respectively				
Valley Slope	0.0195	0.0315	0.0218	---	---
FEMA Classification	NA				
Native Vegetation Community	Piedmont Alluvial Forest/Dry-Mesic Oak-Hickory Forest				
Watershed Land Use/Land Cover (Site)	43% forest,55% agricultural land, <2% low density residential/impervious surface				
Watershed Land Use/Land Cover (Cedarock Reference Channel)	65% forest, 30% agricultural land, <5% low density residential/impervious surface				
Percent Composition of Exotic Invasive Vegetation	<5%				

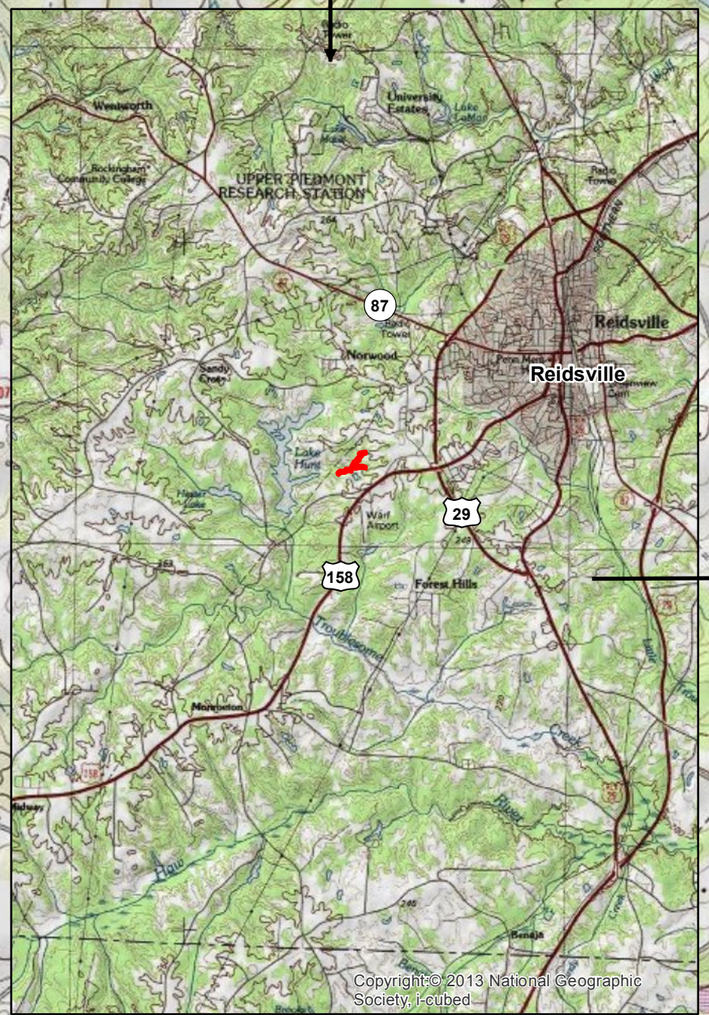
Table 4. Project Attribute Table
Slingshot Creek Restoration Site (continued)

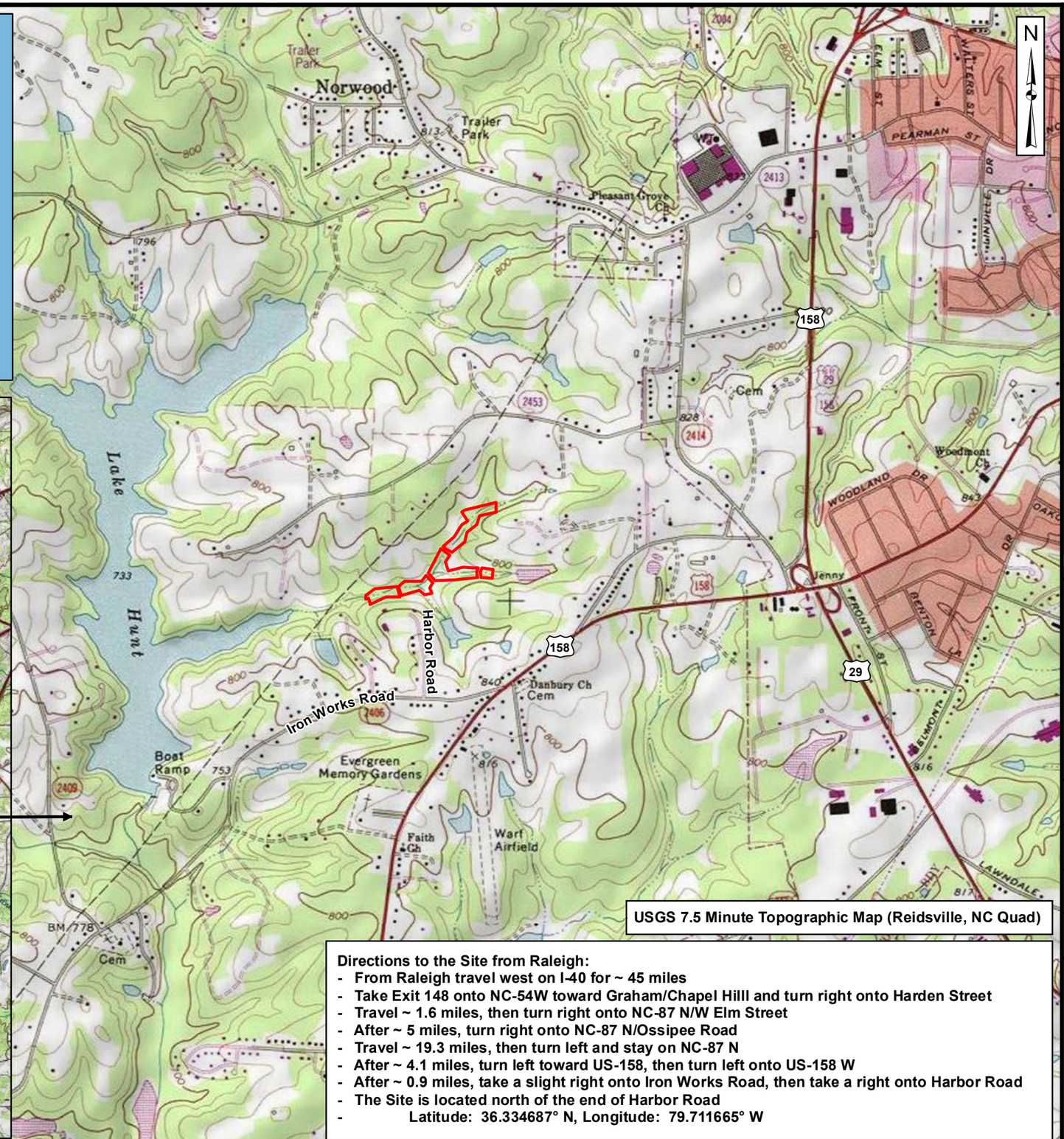
Wetland Summary Information			
Parameters	**Wetlands**		
Wetland acreage	1.02 acre drained & 0.69 acre degraded		
Wetland Type	Riparian riverine		
Mapped Soil Series	Worsham		
Drainage Class	Poorly drained		
Hydric Soil Status	Hydric		
Source of Hydrology	Groundwater, stream overbank		
Hydrologic Impairment	Incised streams, compacted soils, livestock		
Native Vegetation Community	Piedmont/Low Mountain Alluvial Forest		
% Composition of Exotic Invasive Vegetation	<5%		
Restoration Method	Hydrologic, vegetative, livestock		
Enhancement Method	Vegetative, livestock		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States-Section 401	Yes	Yes	JD Package (App D)
Waters of the United States-Section 404	Yes	Yes	JD Package (App D)
Endangered Species Act	Yes	Yes	CE Document (App E)
Historic Preservation Act	Yes	Yes	CE Document (App E)
Coastal Zone Management Act	No	--	NA
FEMA Floodplain Compliance	No	--	CE Document (App E)
Essential Fisheries Habitat	No	--	NA

Appendix B
Visual Assessment Data

Figure 1. Project Location
Figure 2. Current Conditions Plan View
Vegetation Plot Photographs







USGS 7.5 Minute Topographic Map (Reidsville, NC Quad)

Directions to the Site from Raleigh:

- From Raleigh travel west on I-40 for ~ 45 miles
- Take Exit 148 onto NC-54W toward Graham/Chapel Hilll and turn right onto Harden Street
- Travel ~ 1.6 miles, then turn right onto NC-87 N/W Elm Street
- After ~ 5 miles, turn right onto NC-87 N/Ossipee Road
- Travel ~ 19.3 miles, then turn left and stay on NC-87 N
- After ~ 4.1 miles, turn left toward US-158, then turn left onto US-158 W
- After ~ 0.9 miles, take a slight right onto Iron Works Road, then take a right onto Harbor Road
- The Site is located north of the end of Harbor Road
- Latitude: 36.334687° N, Longitude: 79.711665° W

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SLINGSHOT CREEK STREAM AND WETLAND MITIGATION SITE

Rockingham County, NC

Title:

SITE LOCATION

Drawn by: KRJ

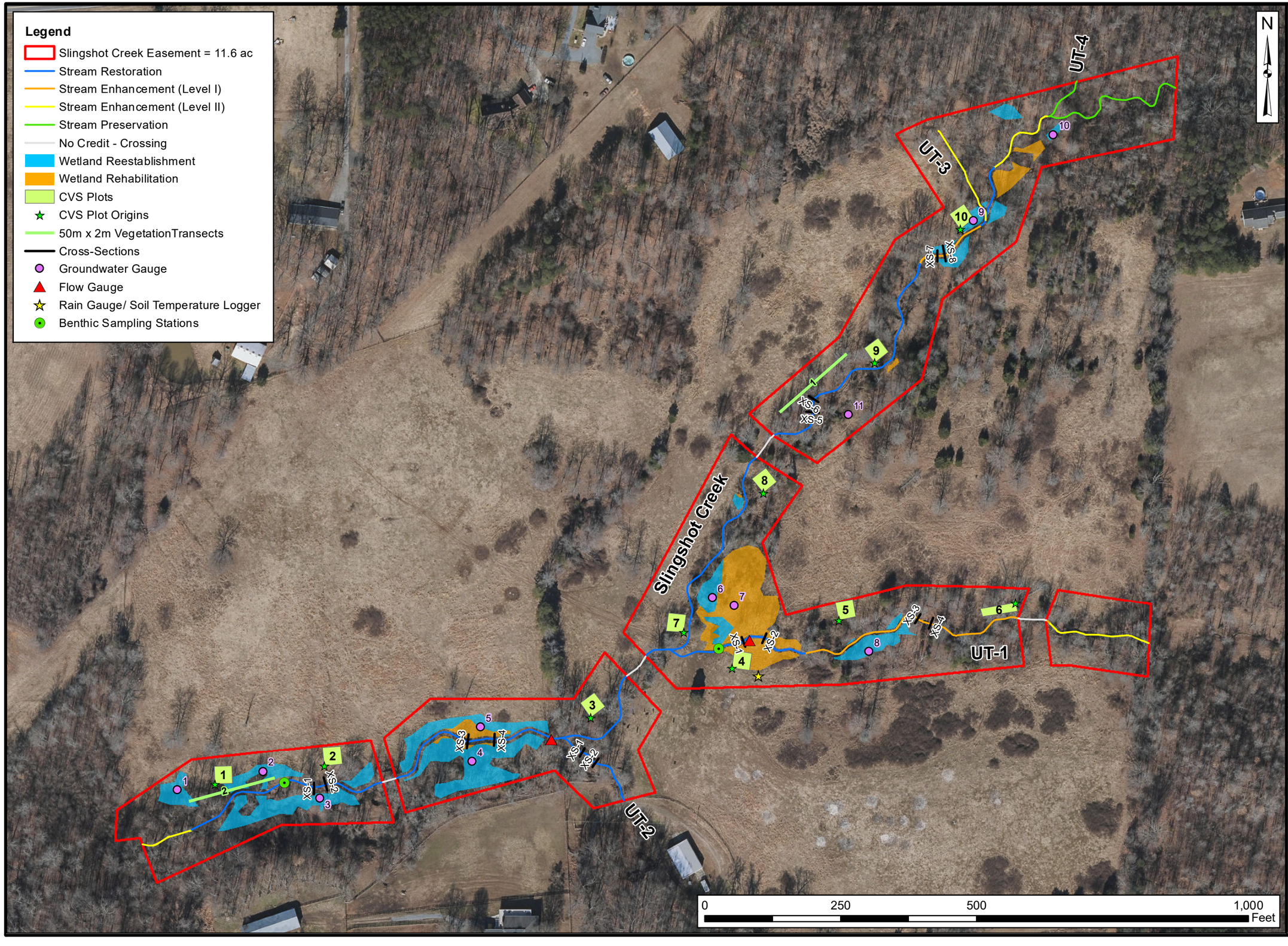
Date: DEC 2018

Scale: 1:20,000

Project No.: 18-013

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SLINGSHOT CREEK STREAM AND WETLAND MITIGATION SITE

Rockingham County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: KRJ

Date: AUG 2020

Scale: 1:2200

Project No.: 18-013

FIGURE

2

Slingshot Creek
MY0 (2020) Vegetation Monitoring Photographs (taken May 4, 2020)

Plot 1

Plot 2

Plot 3

Plot 4

Plot 5

Plot 6

Plot 7

Plot 8

Slingshot Creek
MY0 (2020) Vegetation Monitoring Photographs (taken May 4, 2020)

Plot 9

Plot 10

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 5. Planted Bare Root Woody Vegetation
Slingshot Creek Restoration Site

Species	Total*
Acres	**12.05**
Alnus serrulata	350
Betula nigra	700
Celtis occidentalis	300
Cercis canadensis	200
Cornus amomum	1700
Diospyros virginiana	200
Fraxinus pennsylvanica	400
Fraxinus caroliniana	100
Liriodendron tulipifera	500
Nyssa sylvatica	500
Platanus occidentalis	1500
Prunus serotina	300
Quercus alba	500
Quercus nigra	1500
Quercus phellos	1400
Quecus shumardii	500
Rhamnus caroliniana	300
TOTALS	**10,950**
Average Stems/Acre	**909**

*Approximately 2000 live stakes of willow (*Salix* spp.), elderberry (*Sambucus canadensis*), silky dogwood (*Cornus amomum*), and ninebark (*Physocarpus opulifolius*) were planted but are not included in this table.

Table 6. Total Stems by Plot and Species
Project Name: Slingshot Creek

			Current Plot Data (MY0 2020)																											Annual Means		
			18013-01-0001			18013-01-0002			18013-01-0003			18013-01-0004			18013-01-0005			18013-01-0006			18013-01-0007			18013-01-0008			18013-01-0009			18013-01-0010			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**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Alnus serrulata	hazel alder	Shrub																1	1	1												1	1	1
Betula nigra	river birch	Tree										5	5	5				3	3	3	2	2	2	1	1	1						11	11	11
Carpinus caroliniana	American hornbeam	Tree																		4														4
Celtis occidentalis	common hackberry	Tree				2	2	2							1	1	1															3	3	3
Cercis canadensis	eastern redbud	Tree				1	1	1																								1	1	1
Cornus amomum	silky dogwood	Shrub	1	1	1				2	2	2	9	9	9	7	7	7	3	3	3	8	8	8	6	6	6	5	5	5	17	17	17	58	58	58
Fraxinus pennsylvanica	green ash	Tree													3	3	3															3	3	3
Juniperus virginiana	eastern redcedar	Tree																		1														1
Liriodendron tulipifera	tuliptree	Tree	2	2	2										1	1	1							10	10	10	11	11	11	3	3	3	27	27	27
Nyssa sylvatica	blackgum	Tree	3	3	3	1	1	1	1	1	1				3	3	3																8	8	8
Platanus occidentalis	American sycamore	Tree										3	3	3				25	25	25	13	13	13	6	6	6	5	5	5	4	4	4	56	56	56
Prunus serotina	black cherry	Tree													3	3	3																3	3	3
Quercus	oak	Tree	6	6	6	5	5	5	5	5	5				1	1	1	5	5	5	2	2	2	2	2	2	1	1	1				27	27	27
Quercus alba	white oak	Tree	3	3	3	3	3	3	2	2	2				2	2	2				1	1	1										11	11	11
Quercus nigra	water oak	Tree	4	4	4	2	2	2	5	5	5	1	1	1	6	6	6				1	1	1	1	1	1				2	2	2	22	22	22
Quercus phellos	willow oak	Tree				2	2	2				2	2	2				1	1	1													5	5	5
		Stem count	19	19	19	16	16	16	15	15	15	20	20	20	27	27	27	38	38	43	27	27	27	26	26	26	22	22	22	26	26	26	236	236	241
		size (ares)	1			1			1			1			1			1			1			1			1			1			10		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.25		
		Species count	6	6	6	7	7	7	5	5	5	5	5	5	9	9	9	6	6	8	6	6	6	6	6	6	4	4	4	4	4	4	14	14	16
		Stems per ACRE	768.9	768.9	768.9	647.5	647.5	647.5	607	607	607	809.4	809.4	809.4	1093	1093	1093	1538	1538	1740	1093	1093	1093	1052	1052	1052	890.3	890.3	890.3	1052	1052	1052	955.1	955.1	975.3

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%

PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

Table 7. Temporary Vegetation Plot Data
Slingshot Creek Restoration Site

Species	T-1 (222°)	T-2 (230°)
Cornus amomum	5	7
Liriodendron tulipifera		1
Platanus occidentalis	6	5
Quercus alba	7	1
Quercus lyrata	3	
Quercus phellos		9
Quercus shumardii	2	
Total Number of Stems	**21**	**25**
Stems/Acre	**850**	**1012**

Table 8. Planted Vegetation Totals
Slingshot Creek Restoration Site

Plot #	Planted Stems/Acre	Success Criteria Met?
1	768	Yes
2	647	Yes
3	607	Yes
4	809	Yes
5	1093	Yes
6	1538	Yes
7	1093	Yes
8	1052	Yes
9	890	Yes
10	1052	Yes
T-1	850	Yes
T-2	1012	Yes
Average Planted Stems/Acre	**951**	**Yes**

Appendix D
Stream Geomorphology Data

Tables 9A-9D. Baseline Stream Data Summary
Tables 10A-10D. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Tables 11A-11D. Monitoring Data-Dimensional Morphology Summary (Dimensional Parameters-Cross-sections)
Tables 12A-12D. Monitoring Data-Stream Reach Data Summary

Table 9a. Baseline Stream Data Summary

Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: Slingshot Creek Downstream (1200 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Flint Rock Farm Reference Data						Caswell Gameland Reference Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					8.7	11.7		15.8			6.9	7.5		8.1			14.6	18.4		21.9			11.5	12.5	13.3	12.59	12.64	12.64	12.69		2
Floodprone Width (ft)					12	20		100			100	100		100			23	33.5		44			70	100	150	100	100	100	100		2
Bankfull Mean Depth (ft)					0.7	1		1.3			0.7	0.8		0.9			0.9	1		1			0.8	0.9	1	0.86	0.86	0.86	0.87		2
[1]Bankfull Max Depth (ft)					1.1	1.6		1.9			1.4	1.4		1.4			1.3	1.4		1.5			1.1	1.2	1.3	1.19	1.21	1.21	1.24		2
Bankfull Cross Sectional Area (ft^2)					11.1	11.1		11.1			6.1	6.1		6.1			17.6	17.6		17.6			11.1	11.1	11.1	10.80	10.89	10.89	10.99		2
Width/Depth Ratio					6.7	12.4		22.6			7.7	9.6		11.6			14.9	19.6		24.3			12	14	16	14.65	14.66	14.66	14.67		2
Entrenchment Ratio					1.1	1.6		10.5			12.3	13.4		14.5			1.5	1.8		2			5.6	8	12	7.88	7.91	7.91	7.95		2
[1]Bank Height Ratio					**1.3**	**3**		**4.5**			**1**	**1**		**1**			**1.4**	**1.8**		**2.2**			**1**	**1**	**1.2**	**1**	**1**	**1**	**1**		**2**
Profile																														
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to staightening activities																					18.37	26.49	26.21	36.17	4.90	21
Riffle Slope (ft/ft)											0	0.005		0.019			0	0.015		0.036			0.02	0.025	0.034	0.003	0.017	0.016	0.050	0.009	21.000
Pool Length (ft)																										3.33	11.96	14.28	18.64	4.92	22
Pool Max depth (ft)											1.6	2		2.3			2.3	2.3		2.3			1.2	1.7	1.9	0.34	1.00	0.96	1.72	0.22	15
Pool Spacing (ft)											8.9	17.8		32.7			31.6	58.2		101.8			37.4	49.9	99.7	31.81	47.71	46.26	68.03	7.49	21
Pattern																														
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to staightening activities						7.9	14.3		24.9			15	28.6		42.2			24.9	37.4	49.9	24.9	37.4		49.9		
Radius of Curvature (ft)											5.2	8.4		12.8			18.6	31.1		46.3			24.9	37.4	124.7	24.9	37.4		124.7		
Rc:Bankfull width (ft/ft)											**0.8**	**1.1**		**2.1**			**0.8**	**1.1**		**2.1**			**2**	**3**	**10**	**2**	**3**		**10**		
Meander Wavelength (ft)											13.4	29.4		47.2			61	104.6		154.7			74.8	106	149.6	74.8	106		149.6		
Meander Width Ratio											1.1	1.9		4.1			1	1.6		1.9			2	3	4	2	3		4		
Transport parameters																														
Reach Shear Stress (competency) lb/ft^2					4.7																		0.82								
Max part size (mm) mobilized at bankfull																														
Stream Power (transport capacity) W/m^2					47.38																		47.1								
Additional Reach Parameters																														
Rosgen Classification					G 4/5						E 5						Cg 3/4						E/C 3/4			E/C 3/4					
Bankfull Velocity (fps)					0.74																		4								
Bankfull Discharge (cfs)					44.4																										
Valley length (ft)					1200																										
Channel Thalweg length (ft)					1368																					1389					
Sinuosity (ft)					1.14						1.22						1.14						1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					0.0171						0.0049						0.01						0.017			0.013					
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 9b. Baseline Stream Data Summary

Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: Slingshot Creek Upstream (1609 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Flint Rock Farm Reference Data						Caswell Gameland Reference Data						Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Dimension and Substrate - Riffle Only																														
Bankfull Width (ft)					6	8.8		14.6			6.9	7.5		8.1			14.6	18.4		21.9			10	10.8	11.5	11.17	11.44	11.44	11.72		2
Floodprone Width (ft)					12	16		100			100	100		100			23	33.5		44			30	50	70	100	100	100	100		2
Bankfull Mean Depth (ft)					0.6	0.9		1.4			0.7	0.8		0.9			0.9	1		1			0.7	0.8	0.8	0.66	0.76	0.76	0.86		2
[1]Bankfull Max Depth (ft)					0.7	1.4		1.9			1.4	1.4		1.4			1.3	1.4		1.5			0.9	1.1	1.2	1.03	1.20	1.20	1.36		2
Bankfull Cross Sectional Area (ft^2)					8.3	8.3		8.3			6.1	6.1		6.1			17.6	17.6		17.6			8.3	8.3	8.3	7.42	8.78	8.78	10.13		2
Width/Depth Ratio					4.3	9.8		24.3			7.7	9.6		11.6			14.9	19.6		24.3			12	14	16	13.55	15.18	15.18	16.81		2
Entrenchment Ratio					1.2	1.5		11.4			12.3	13.4		14.5			1.5	1.8		2			2.8	4.6	6.5	8.53	8.74	8.74	8.95		2
[1]Bank Height Ratio					**1.4**	**2.2**		**3.6**			**1**	**1**		**1**			**1.4**	**1.8**		**2.2**			**1**	**1**	**1.2**	**1**	**1**	**1**	**1**		**2**
Profile																														
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to staightening activities																					6.63	23.23	21.07	65.30	11.04	31
Riffle Slope (ft/ft)											0	0.005		0.019			0	0.015		0.036			0.018	0.023	0.031	0.002	0.019	0.017	0.039	0.009	31
Pool Length (ft)																										3.20	11.09	10.42	30.30	6.05	34
Pool Max depth (ft)											1.6	2		2.3			2.3	2.3		2.3			1	1.5	1.6	0.64	1.01	0.97	1.36	0.20	13
Pool Spacing (ft)											8.9	17.8		32.7			31.6	58.2		101.8			32.3	43.1	86.2	21.08	41.48	38.75	79.89	13.91	31
Pattern																														
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to staightening activities						7.9	14.3		24.9			15	28.6		42.2			21.6	32.3	43.1	21.6	32.3		43.1		
Radius of Curvature (ft)											5.2	8.4		12.8			18.6	31.1		46.3			21.6	32.3	107.8	21.6	32.3		107.8		
Rc:Bankfull width (ft/ft)											**0.8**	**1.1**		**2.1**			**0.8**	**1.1**		**2.1**			**2**	**3**	**10**	**2**	**3**		**10**		
Meander Wavelength (ft)											13.4	29.4		47.2			61	104.6		154.7			64.7	91.6	129.4	64.7	91.6		129.4		
Meander Width Ratio											1.1	1.9		4.1			1	1.6		1.9			2	3	4	2	3		4		
Transport parameters																														
Reach Shear Stress (competency) lb/f^2					0.315																		0.64								
Max part size (mm) mobilized at bankfull																														
Stream Power (transport capacity) W/m^2					30.4																		32.22								
Additional Reach Parameters																														
Rosgen Classification					G 4/5						E 5						Cg 3/4						E/C 3/4			E/C 3/4					
Bankfull Velocity (fps)					0.91																		3.94								
Bankfull Discharge (cfs)					32.7																										
Valley length (ft)					1609																										
Channel Thalweg length (ft)					1898																					1042					
Sinuosity (ft)					1.18						1.22						1.14						1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					0.049						0.0049						0.01						0.0153			0.0127					
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 9c. Baseline Stream Data Summary

Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: UT 1 (968 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Flint Rock Farm Reference Data						Caswell Gameland Reference Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					4.4	7.2		14.5			6.9	7.5		8.1			14.6	18.4		21.9			7	7.6	8.1	7.97	11.68	11.68	15.39		2
Floodprone Width (ft)					9	12		100			100	100		100			23	33.5		44			30	50	90	100	100	100	100		2
Bankfull Mean Depth (ft)					0.3	0.6		0.9			0.7	0.8		0.9			0.9	1		1			0.5	0.5	0.6	0.41	0.74	0.74	1.07		2
[1]Bankfull Max Depth (ft)					0.6	1.1		1.4			1.4	1.4		1.4			1.3	1.4		1.5			0.6	0.8	0.8	0.70	1.29	1.29	1.88		2
Bankfull Cross Sectional Area (ft^2)					4	4		4			6.1	6.1		6.1			17.6	17.6		17.6			4.1	4.1	4.1	3.23	9.82	9.82	16.40		2
Width/Depth Ratio					4.9	12		48.3			7.7	9.6		11.6			14.9	19.6		24.3			12	14	16	14.45	17.06	17.06	19.67		2
Entrenchment Ratio					1.4	2		13.7			12.3	13.4		14.5			1.5	1.8		2			4	6.6	11.9	6.50	9.52	9.52	12.54		2
[1]Bank Height Ratio					**1.2**	**2.4**		**3.7**			**1**	**1**		**1**			**1.4**	**1.8**		**2.2**			**1**	**1**	**1.2**	**1**	**1**	**1**	**1**		**2**
Profile																														
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to staightening activities																					2.89	15.29	14.31	68.79	12.62	26
Riffle Slope (ft/ft)											0	0.005		0.019			0	0.015		0.036			0.032	0.039	0.053	0.005	0.024	0.020	0.078	0.018	26
Pool Length (ft)																										1.79	8.61	6.24	26.47	6.27	26
Pool Max depth (ft)											1.6	2		2.3			2.3	2.3		2.3			0.7	1	1.1	0.34	1.50	1.57	2.46	0.66	16
Pool Spacing (ft)											8.9	17.8		32.7			31.6	58.2		101.8			22.7	30..3	60.6	12.76	30.71	27.39	74.65	13.50	25
Pattern																														
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to staightening activities						7.9	14.3		24.9			15	28.6		42.2			15.2	22.7	30.3	15.2	22.7		30.3		
Radius of Curvature (ft)											5.2	8.4		12.8			18.6	31.1		46.3			15.2	22.7	75.8	15.2	22.7		75.8		
Rc:Bankfull width (ft/ft)											**0.8**	**1.1**		**2.1**			**0.8**	**1.1**		**2.1**			**2**	**3**	**10**	**2**	**3**		**10**		
Meander Wavelength (ft)											13.4	29.4		47.2			61	104.6		154.7			45.5	64.4	90.9	45.5	64.4		90.9		
Meander Width Ratio											1.1	1.9		4.1			1	1.6		1.9			2	3	4	2	3		4		
Transport parameters																														
Reach Shear Stress (competency) lb/f^2					7.09																		0.78								
Max part size (mm) mobilized at bankfull																														
Stream Power (transport capacity) W/m^2					24.99																		25.44								
Additional Reach Parameters																														
Rosgen Classification					G 5						E 5						Cg 3/4						E/C 3/4			E/C 3/4					
Bankfull Velocity (fps)					0.75																		3.78								
Bankfull Discharge (cfs)					15																										
Valley length (ft)					968																										
Channel Thalweg length (ft)					1142																					812					
Sinuosity (ft)					1.18						1.22						1.14						1.2			1.2					
Water Surface Slope (Channel) (ft/ft)					0.0267						0.0049						0.01						0.0263			0.0228					
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 9d. Baseline Stream Data Summary

Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: UT 2 (130 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Flint Rock Farm Reference Data						Caswell Gameland Reference Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)											6.9	7.5		8.1			14.6	18.4		21.9			7	7.6	8.1	11.17	11.44	11.44	11.72		2
Floodprone Width (ft)											100	100		100			23	33.5		44			30	50	90	100	100	100	100		2
Bankfull Mean Depth (ft)											0.7	0.8		0.9			0.9	1		1			0.5	0.5	0.6	0.6646	0.76	0.76	0.86		2
[1]Bankfull Max Depth (ft)											1.4	1.4		1.4			1.3	1.4		1.5			0.6	0.8	0.8	1.0274	1.20	1.20	1.36		2
Bankfull Cross Sectional Area (ft^2)											6.1	6.1		6.1			17.6	17.6		17.6			4.1	4.1	4.1	7.4237	8.78	8.78	10.13		2
Width/Depth Ratio											7.7	9.6		11.6			14.9	19.6		24.3			12	14	16	13.547	15.18	15.18	16.81		2
Entrenchment Ratio											12.3	13.4		14.5			1.5	1.8		2			4	6.6	11.9	8.5343	8.74	8.74	8.95		2
[1]Bank Height Ratio											**1**	**1**		**1**			**1.4**	**1.8**		**2.2**			**1**	**1**	**1.2**	**1**	**1**	**1**	**1**		**2**
Profile																														
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to staightening activities																					8.6245	12.51	10.24	24.34	5.92	6
Riffle Slope (ft/ft)											0	0.005		0.019			0	0.015		0.036			0.032	0.039	0.053	0.000	0.008	0.010	0.014	0.006	6
Pool Length (ft)																										3.0779	6.51	6.01	12.29	3.07	6
Pool Max depth (ft)											1.6	2		2.3			2.3	2.3		2.3			0.7	1	1.1	0.9208	1.02	1.00	1.14	0.11	3
Pool Spacing (ft)											8.9	17.8		32.7			31.6	58.2		101.8			22.7	30..3	60.6	18.476	22.24	22.19	28.87	4.19	5
Pattern																														
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to staightening activities						7.9	14.3		24.9			15	28.6		42.2			15.2	22.7	30.3	15.2	22.7		30.3		
Radius of Curvature (ft)											5.2	8.4		12.8			18.6	31.1		46.3			15.2	22.7	75.8	15.2	22.7		75.8		
Rc:Bankfull width (ft/ft)											**0.8**	**1.1**		**2.1**			**0.8**	**1.1**		**2.1**			**2**	**3**	**10**	**2**	**3**		**10**		
Meander Wavelength (ft)											13.4	29.4		47.2			61	104.6		154.7			45.5	64.4	90.9	45.5	64.4		90.9		
Meander Width Ratio											1.1	1.9		4.1			1	1.6		1.9			2	3	4	2	3		4		
Transport parameters																														
Reach Shear Stress (competency) lb/ft^2					14.79																		0.78								
Max part size (mm) mobilized at bankfull																														
Stream Power (transport capacity) W/m^2					18.45																		25.44								
Additional Reach Parameters																														
Rosgen Classification					G 5						E 5						Cg 3/4						E/C 3/4			E/C 3/4					
Bankfull Velocity (fps)					0.27																		3.78								
Bankfull Discharge (cfs)					15.9																										
Valley length (ft)					130																										
Channel Thalweg length (ft)					152																					166					
Sinuosity (ft)					1.17						1.22						1.14						1.2			1.2					
Water Surface Slope (Channel) (ft/ft)					0.0186						0.0049						0.01						0.0263			0.004					
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 10a. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: Slingshot Creek Downstream (1200 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						53	11	25	7			
[1]SC% / Sa% / G% / C% / B% / Be%																												
[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																												

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: Slingshot Creek Upstream (1609 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						52	7	27	7			
[1]SC% / Sa% / G% / C% / B% / Be%																												
[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 loosely 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 10c. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: UT 1 (968 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						49	11	28	10			
[1]SC% / Sa% / G% / C% / B% / Be%																												
[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																												

Table 10d. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: UT 2 (130 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						45	9	23	12			
[1]SC% / Sa% / G% / C% / B% / Be%																												
[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 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: Slingshot Creek Downstream (1200 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)	13.44							12.59							16.13							12.69						
Floodprone Width (ft)	NA							100							NA							100						
Bankfull Mean Depth (ft)	1.352							0.858							1.369							0.866						
Bankfull Max Depth (ft)	1.997							1.236							2.289							1.19						
Bankfull Cross Sectional Area (ft^2)	18.17							10.8							22.08							10.99						
Bankfull Width/Depth Ratio	NA							14.67							NA							14.65						
Bankfull Entrenchment Ratio	NA							7.945							NA							7.88						
Bankfull Bank Height Ratio	1							1							1							1						
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												

Table 11b. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: Slingshot Creek Upstream (1609 feet)

	Cross Section 5 (Riffle)							Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section 8 (Pool)						
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)	11.17							12.09							11.72							12.41						
Floodprone Width (ft)	100							NA							100							NA						
Bankfull Mean Depth (ft)	0.665							1.182							0.865							1.314						
Bankfull Max Depth (ft)	1.027							1.85							1.364							2.281						
Bankfull Cross Sectional Area (ft^2)	7.424							14.29							10.13							16.3						
Bankfull Width/Depth Ratio	16.81							NA							13.55							NA						
Bankfull Entrenchment Ratio	8.952							NA							8.534							NA						
Bankfull Bank Height Ratio	1							1							1							1						
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 11c. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: UT 1 (968 feet)

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)						
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)	7.972							11.04							15.39							12.8						
Floodprone Width (ft)	100							NA							100							NA						
Bankfull Mean Depth (ft)	0.405							1.035							1.065							1.412						
Bankfull Max Depth (ft)	0.704							2.028							1.876							2.435						
Bankfull Cross Sectional Area (ft^2)	3.231							11.43							16.4							18.08						
Bankfull Width/Depth Ratio	19.67							NA							14.45							NA						
Bankfull Entrenchment Ratio	12.54							NA							6.496							NA						
Bankfull Bank Height Ratio	1							1							1							1						
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												

Table 11d. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: UT 2 (130 feet)

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)																					
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)	9.453							7.796																					
Floodprone Width (ft)	100							NA																					
Bankfull Mean Depth (ft)	0.566							0.813																					
Bankfull Max Depth (ft)	0.927							1.34																					
Bankfull Cross Sectional Area (ft^2)	5.355							6.339																					
Bankfull Width/Depth Ratio	16.69							NA																					
Bankfull Entrenchment Ratio	10.58							NA																					
Bankfull Bank Height Ratio	1							1																					
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 12a. Monitoring Data - Stream Reach Data Summary

Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: Slingshot Creek Downstream (1200 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)	12.6	12.6	12.6	12.7		2																														
Floodprone Width (ft)	100	100	100	100		2																														
Bankfull Mean Depth (ft)	0.86	0.86	0.86	0.87		2																														
[1]Bankfull Max Depth (ft)	1.19	1.21	1.21	1.24		2																														
Bankfull Cross Sectional Area (ft^2)	10.8	10.9	10.9	11		2																														
Width/Depth Ratio	14.7	14.7	14.7	14.7		2																														
Entrenchment Ratio	7.88	7.91	7.91	7.95		2																														
[1]Bank Height Ratio	**1**	**1**	**1**	**1**		**2**																														
Profile																																				
Riffle Length (ft)	18.4	26.5	26.2	36.2	4.9	21																														
Riffle Slope (ft/ft)	0	0.02	0.02	0.05	0.01	21																														
Pool Length (ft)	3.33	12	14.3	18.6	4.92	22																														
Pool Max depth (ft)	0.34	1	0.96	1.72	0.22	15																														
Pool Spacing (ft)	31.8	47.7	46.3	68	7.49	21																														
Pattern																																				
Channel Beltwidth (ft)	24.9	37.4		49.9																																
Radius of Curvature (ft)	24.9	37.4		125																																
Rc:Bankfull width (ft/ft)	**2**	**3**		**10**																																
Meander Wavelength (ft)	74.8	106		150																																
Meander Width Ratio	2	3		4																																
Additional Reach Parameters																																				
Rosgen Classification	E/C 3/4																																			
Channel Thalweg length (ft)	1389																																			
Sinuosity (ft)	1.15																																			
Water Surface Slope (Channel) (ft/ft)	0.013																																			
BF slope (ft/ft)	--																																			
[3]Ri% / Ru% / P% / G% / S%	**53**	**11**	**25**	**7**																																
[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 12b. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: Slingshot Creek Upstream (1609 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)	11.2	11.4	11.4	11.7		2																														
Floodprone Width (ft)	100	100	100	100		2																														
Bankfull Mean Depth (ft)	0.66	0.76	0.76	0.86		2																														
[1]Bankfull Max Depth (ft)	1.03	1.2	1.2	1.36		2																														
Bankfull Cross Sectional Area (ft^2)	7.42	8.78	8.78	10.1		2																														
Width/Depth Ratio	13.5	15.2	15.2	16.8		2																														
Entrenchment Ratio	8.53	8.74	8.74	8.95		2																														
[1]Bank Height Ratio	**1**	**1**	**1**	**1**		**2**																														
Profile																																				
Riffle Length (ft)	8.62	12.5	10.2	24.3	5.92	6																														
Riffle Slope (ft/ft)	0	0.01	0.01	0.01	0.01	6																														
Pool Length (ft)	3.08	6.51	6.01	12.3	3.07	6																														
Pool Max depth (ft)	0.92	1.02	1	1.14	0.11	3																														
Pool Spacing (ft)	18.5	22.2	22.2	28.9	4.19	5																														
Pattern																																				
Channel Beltwidth (ft)	21.6	32.3		43.1																																
Radius of Curvature (ft)	21.6	32.3		108																																
Rc:Bankfull width (ft/ft)	**2**	**3**		**10**																																
Meander Wavelength (ft)	64.7	91.6		129																																
Meander Width Ratio	2	3		4																																
Additional Reach Parameters																																				
Rosgen Classification	E/C 3/4																																			
Channel Thalweg length (ft)	1042																																			
Sinuosity (ft)	1.15																																			
Water Surface Slope (Channel) (ft/ft)	0.0127																																			
BF slope (ft/ft)	--																																			
[3]Ri% / Ru% / P% / G% / S%	**52**	**7**	**27**	**7**																																
[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 12c. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: UT 1 (968 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)	7.97	11.7	11.7	15.4		2																														
Floodprone Width (ft)	100	100	100	100		2																														
Bankfull Mean Depth (ft)	0.41	0.74	0.74	1.07		2																														
[1]Bankfull Max Depth (ft)	0.7	1.29	1.29	1.88		2																														
Bankfull Cross Sectional Area (ft^2)	3.23	9.82	9.82	16.4		2																														
Width/Depth Ratio	14.4	17.1	17.1	19.7		2																														
Entrenchment Ratio	6.5	9.52	9.52	12.5		2																														
[1]Bank Height Ratio	**1**	**1**	**1**	**1**		**2**																														
Profile																																				
Riffle Length (ft)	2.89	15.3	14.3	68.8	12.6	26																														
Riffle Slope (ft/ft)	0.01	0.02	0.02	0.08	0.02	26																														
Pool Length (ft)	1.79	8.61	6.24	26.5	6.27	26																														
Pool Max depth (ft)	0.34	1.5	1.57	2.46	0.66	16																														
Pool Spacing (ft)	12.8	30.7	27.4	74.6	13.5	25																														
Pattern																																				
Channel Beltwidth (ft)	15.2	22.7		30.3																																
Radius of Curvature (ft)	15.2	22.7		75.8																																
Rc:Bankfull width (ft/ft)	**2**	**3**		**10**																																
Meander Wavelength (ft)	45.5	64.4		90.9																																
Meander Width Ratio	2	3		4																																
Additional Reach Parameters																																				
Rosgen Classification	E/C 3/4																																			
Channel Thalweg length (ft)	812																																			
Sinuosity (ft)	1.2																																			
Water Surface Slope (Channel) (ft/ft)	0.0228																																			
BF slope (ft/ft)	--																																			
[3]Ri% / Ru% / P% / G% / S%	**49**	**11**	**28**	**10**																																
[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 12d. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Slingshot Creek Stream and Wetland Mitigation Site/100058) - Segment/Reach: UT 2 (130 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)	9.45	9.45	9.45	9.45		1																														
Floodprone Width (ft)	100	100	100	100		1																														
Bankfull Mean Depth (ft)	0.57	0.57	0.57	0.57		1																														
[1]Bankfull Max Depth (ft)	0.93	0.93	0.93	0.93		1																														
Bankfull Cross Sectional Area (ft^2)	5.35	5.35	5.35	5.35		1																														
Width/Depth Ratio	16.7	16.7	16.7	16.7		1																														
Entrenchment Ratio	10.6	10.6	10.6	10.6		1																														
[1]Bank Height Ratio	**1**	**1**	**1**	**1**		**1**																														
Profile																																				
Riffle Length (ft)	18.4	26.5	26.2	36.2	4.9	21																														
Riffle Slope (ft/ft)	0	0.02	0.02	0.05	0.01	21																														
Pool Length (ft)	3.33	12	14.3	18.6	4.92	22																														
Pool Max depth (ft)	0.34	0.96	0.95	1.72	0.27	15																														
Pool Spacing (ft)	31.8	47.7	46.3	68	7.49	21																														
Pattern																																				
Channel Beltwidth (ft)	15.2	22.7		30.3																																
Radius of Curvature (ft)	15.2	22.7		75.8																																
Rc:Bankfull width (ft/ft)	**2**	**3**		**10**																																
Meander Wavelength (ft)	45.5	64.4		90.9																																
Meander Width Ratio	2	3		4																																

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

Additional Reach Parameters																																				
Rosgen Classification	E/C 3/4																																			
Channel Thalweg length (ft)	166																																			
Sinuosity (ft)	1.2																																			
Water Surface Slope (Channel) (ft/ft)	0.004																																			
BF slope (ft/ft)	--																																			
[3]Ri% / Ru% / P% / G% / S%	**45**	**9**	**23**	**12**																																
[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																																				

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

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/
Coordinates: GW1 / 36.33379, -79.715046

Investigator: Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10YR 3/3	100	-	-	Silty Clay Loam
5-10	10YR 3/3	90	10 YR 4/6	10	Silty Clay
10-26	10YR 3/2	80	10 YR 3/1	20	Clay Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/
Coordinates: GW2 / 36.333886, -79.714512

Investigator: Lewis

Notes: Little disturbance

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-5	10YR 3/1	100	-	-	Silt Loam
5-10	10YR 3/2	80	10YR 4/6	20	Silt Loam
10-24	10YR 3/3	60	10YR 3/1	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

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/ Coordinates: GW3 / 36.333751, -79.714155

Investigator: Lewis

Notes: Located in disturbed area, along old channel

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-15	10YR 6/4	100	-	-	Clay
15-20+	10YR 3/1	100	-	-	Silty Clay

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/ Coordinates: GW4 / 36.333944, -79.713206

Investigator: Lewis

Notes: Disturbed soil along old channel. Profile was saturated throughout.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-15	10YR 5/4	100	-	-	Clay
15-24	10yr 3/1	100	-	-	Silty Clay Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/ Coordinates: GW5 / 36.3334117, -79.713155

Investigator: Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10YR 4/3	100	-	-	silty clay loam
6-10	10YR 4/3	90	10 YR 4/6	10	silty clay loam
10-18	10YR 4/1	90	10YR 4/6	10	Clay loam
18+	10YR 4/1	95	10YR 5/6	5	Clay loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/ Coordinates: GW6 / 36.334779, -79.710099

Investigator: Lewis

Notes: Moved gauge outside of low area of standing water, gauge still inundated during installation

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-5	10YR 3/3	100	-	-	Silt Loam
5-10	10YR 3/2	90	10YR 5/6	10	Clay Loam
10-20	10YR 4/2	95	10YR 5/6	5	Silty Clay

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/ Coordinates: GW7 / 36.33474, -79.711577

Investigator: Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-5	10YR 4/2	100	-	-	Loam
5-10	10YR 4/2	90	10yr 5/6	10	Clay Loam
10-20	10YR 5/1	90	10YR 5/6	10	Clay Loam
20-30+	10YR 5/1	95	10YR 5/6	5	Clay Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/ Coordinates: GW8 / 36.334514, -79.710731

Investigator: Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-5	10YR 3/1	100	-	-	Loam
5-10	10YR 6/1	50	10YR 5/8	20	Clay Loam
10-24	10YR 6/2	90	10YR 5/6	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

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/ Coordinates: GW9 / 36.336692, -79.710099

Investigator: Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10YR 4/3	100	-	-	Loam
5-10	10YR 5/2	90	10YR 5/8	10	Clay Loam
10-20	10YR 6/2	90	10YR 5/6	10	Clay Loam
20-30	10YR 5/2	95	10YR 5/6	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

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/ Coordinates: GW10 / 36.337131, -79.709605

Investigator: Lewis

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10YR 3/2	100	-	-	Silty Clay Loam
10-18	10YR 4/1	90	10 YR 4/6	10	Sandy Silty Clay
18-35	10YR 4/1	80	10 YR 5/6	20	Clay Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Project/Site: Slingshot Stream & Wetland Mitigation Site

County, State: Rockingham, NC

Sampling Point/ Coordinates: GW11 / 36.335724, -79.710878

Investigator: Lewis

Notes: Gauge located in fill in old stream channel. Abundant surface hydrology and Fe- from springs along toe of slope upstream

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-10	10YR 5/6	90	10 YR 5/3	10	Silt Clay
10-22	10YR 5/6	100	-	-	Silt CLay
22+	10 YR 6/1	100	-	-	Clay Loam

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

Appendix F
Preconstruction Benthic Data

Preconstruction Benthic Results (available upon request once received)
Habitat Assessment Dataforms

3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ **TOTAL SCORE** 45

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

Stream Stinkfoot Creek Location/road: Reidsville (Road Name Harbor Rd.) County Rockingham

Date 5/20/20 **CC#** 03030002 Basin Cape Fear Subbasin 03-06-01

Observer(s) GL + AK Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 36.323831 Longitude -79.714378 Ecoregion: ☐ MT ☒ P ☐ Slate Belt ☐ Triassic Basin

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

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

Visible Land Use: _____%Forest _____%Residential 100 %Active Pasture _____% Active Crops
_____%Fallow Fields _____% Commercial _____%Industrial _____%Other - Describe: _____

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

Width: (meters) Stream 15' Channel (at top of bank) 20' **Stream Depth:** (m) Avg 3-4' Max 5'
☐ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 3 ft.

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

☒ Channelized Ditch
☒ Deeply incised-steep, straight banks ☐Both banks undercut at bend ☐Channel filled in with sediment
☐ Recent overbank deposits ☐Bar development ☒Buried structures ☐Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐Green tinge ☐ Sewage smell
Manmade Stabilization: ☒N ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
Flow conditions : ☐High ☐Normal ☐Low
Turbidity: ☐Clear ☒ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☐**YES** ☐**NO Details** _____
Channel Flow Status

Useful especially under abnormal or low flow conditions.

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

Weather Conditions: Cloudy - 75° **Photos:** ☐N ☐Y ☐ Digital ☐35mm

Remarks: _____

I. Channel Modification

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

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream (☑Banks of uniform shape/height Subtotal 2

Remarks _____

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

___Rocks ___Macrophytes ___Sticks and leafpacks ___Snags and logs ___Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

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

☐ No woody vegetation in riparian zone Remarks _____ Subtotal 0

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

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

Subtotal 1

Remarks _____

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

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

Subtotal 4

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

Remarks _____ Page Total 13

V. Riffle Habitats

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

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	(16)	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☐Typical for area ☒Steep=fast flow ☐Low=like a coastal stream Subtotal 10

VI. Bank Stability and Vegetation

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

Remarks _____

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

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

Remarks _____ Subtotal 7

VIII. Riparian Vegetative Zone Width

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

FACE UPSTREAM	Lft. Bank Score	Rt. Bank Score
Dominant vegetation: ☑Trees ☒Shrubs ☐Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)		
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	(2)	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0
		Total 7

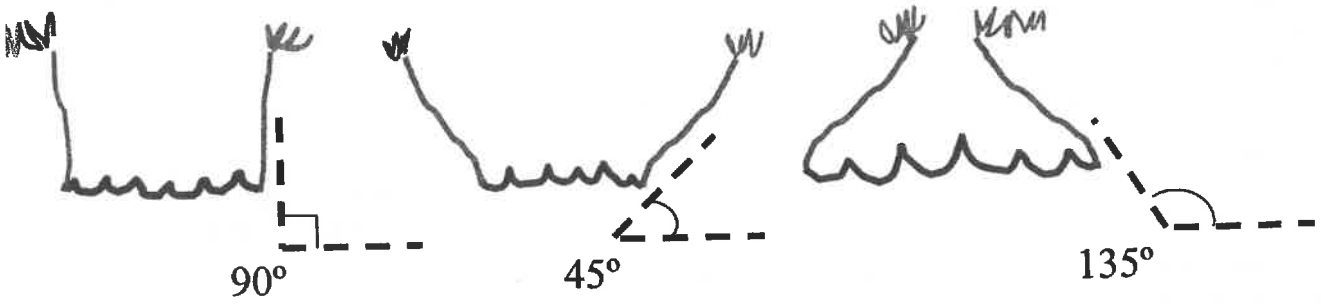
Remarks _____

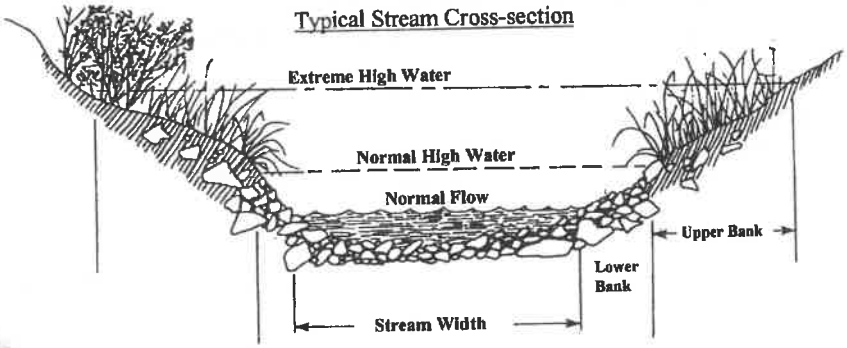
Page Total 32

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 45

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments:_____

_____

_____

_____

_____

3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ **TOTAL SCORE** 64

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

Stream Stumpshot UT-1 Location/road: Reidsville (Road Name Harbert Rd.) County Rockingham

Date 5/28/20 **CC#** 03030002 Basin Cape Fear Subbasin 03-06-01

Observer(s) GL/AK Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 36.33452 Longitude -79.71673 Ecoregion: ☐ MT ☒ P ☐ Slate Belt ☐ Triassic Basin

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

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

Visible Land Use: 20 %Forest _____%Residential 10% %Active Pasture _____% Active Crops
70 %Fallow Fields _____% Commercial _____%Industrial _____%Other - Describe: _____

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

Width: (meters) Stream 2-3 Channel (at top of bank) 5 **Stream Depth:** (m) Avg 4" Max 6"
☐ Width variable ☐ Large river >25m wide

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

Bank Angle: ∠ 45° ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☐ Channelized Ditch
☐Deeply incised-steep, straight banks ☐Both banks undercut at bend ☐Channel filled in with sediment
☐ Recent overbank deposits ☐Bar development ☐Buried structures ☐Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐Green tinge ☐ Sewage smell
Manmade Stabilization: ☐N ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
Flow conditions : ☐High ☐Normal ☐Low
Turbidity: ☐Clear ☒ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☒**YES** ☐**NO Details** _____
Channel Flow Status

Useful especially under abnormal or low flow conditions.

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

Weather Conditions: Windy ~75° **Photos:** ☐N ☐Y ☐ Digital ☐35mm

Remarks: _____

I. Channel Modification

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

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

Subtotal 3

Remarks _____

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

☒**Rocks** ____**Macrophytes** ☒**Sticks and leafpacks** ____**Snags and logs** ____**Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

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

☐ No woody vegetation in riparian zone Remarks _____

Subtotal 10

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

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

Remarks _____ Subtotal 8

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

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

Subtotal 4

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

Remarks _____

Page Total 25

V. Riffle Habitats

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

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	(7)
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☒Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 7

VI. Bank Stability and Vegetation

FACE UPSTREAM

	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	(6)	(6)
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
		Total 12

Remarks _____

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

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

Remarks _____ Subtotal 10

VIII. Riparian Vegetative Zone Width

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

FACE UPSTREAM

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

	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	(5)	(5)
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0
		Total 10

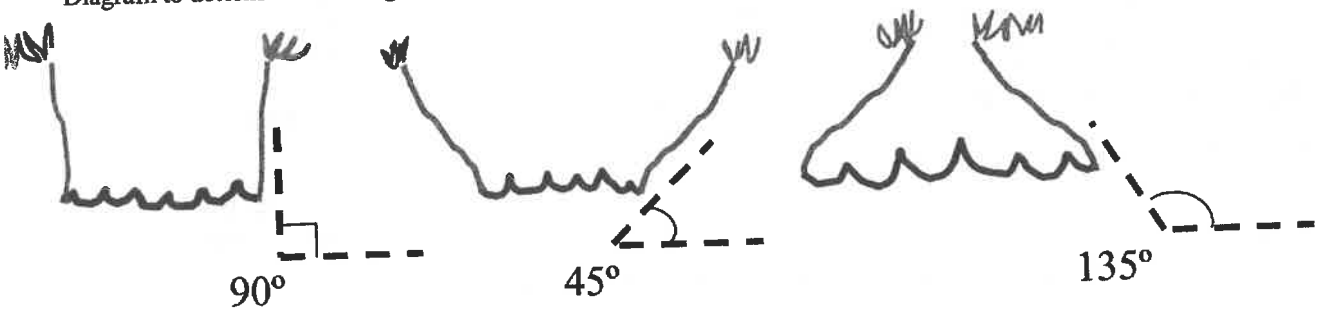
Remarks _____

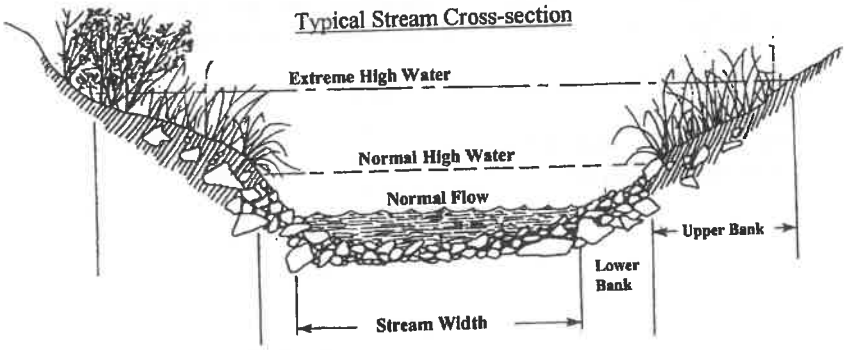
Page Total 39

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 64

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments:

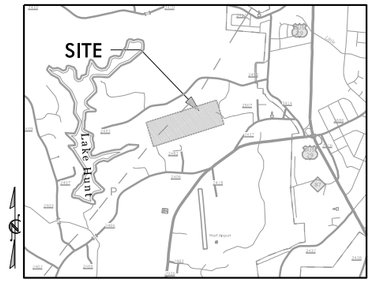
Appendix G
As-built Plan Sheets

NC DEPARTMENT OF ENVIRONMENTAL QUALITY, DIVISION OF MITIGATION SERVICES

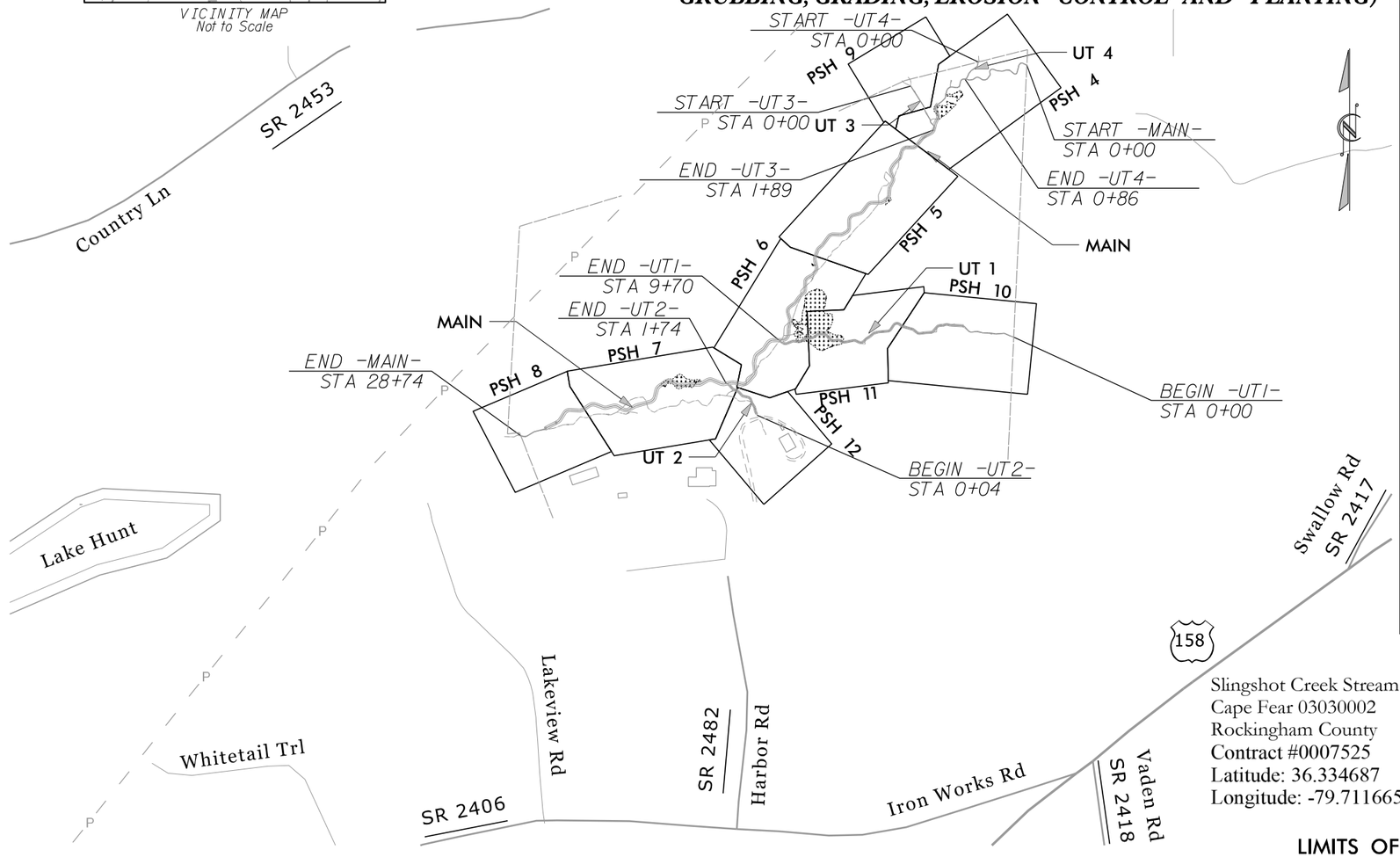
AS–BUILT PLANS
SLINGSHOT CREEK SITE

LOCATION: ROCKINGHAM COUNTY, NORTH CAROLINA

TYPE OF WORK: STREAM RESTORATION AND ENHANCEMENT (CLEARING, GRUBBING, GRADING, EROSION CONTROL AND PLANTING)



VICINITY MAP
Not to Scale



INDEX OF SHEETS

SHEET NUMBER	SHEET
01	Title Sheet
01A	Symbology
03A	As-Built Fencing
04 THRU 12	As-Built Structure Sheets
13	As-Built Planting

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: June 2020
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 , 2020

SEAL OR STAMP

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

8/25/2020

DocuSigned by:
John Rudolph
1C9D7386B9B645D...
Professional Land Surveyor

L-4194
License Number

Slingshot Creek Stream and Wetland Mitigation Site #100058
Cape Fear 03030002
Rockingham County
Contract #0007525
Latitude: 36.334687
Longitude: -79.711665

LIMITS OF DISTURBANCE: 6.85 AC

CONTRACT: SLINGSHOT CREEK SITE

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

10 5 0 10 5
PROFILE (VERTICAL)

PROPOSED LENGTH OF MAIN = 2874 LF	PROPOSED LENGTH OF UT3 = 189 LF
PROPOSED LENGTH OF UT1 = 970 LF	PROPOSED LENGTH OF UT4 = 86 LF
PROPOSED LENGTH OF UT2 = 170 LF	

TOTAL STREAM LENGTH = 4293 LF

RESTORATION LEVEL	STREAM (linear footage)	RIPARIAN WETLAND (acreage)	NONRIPARIAN WETLAND (acreage)
RESTORATION	2502	1.020	0.000
ENHANCEMENT	1212	0.690	0.000
PRESERVATION	391	0.000	0.000
TOTALS	4106	1.710	0.000
MITIGATION UNITS	3186 SMUs	1.370 RIPARIAN WMUs	NONRIPARIAN WMUs

Designed By:
Axiom Environmental
218 Snow Ave
Raleigh, NC 27603
GRANT LEWIS
PROJECT DESIGNER

Restoration Systems
1101 Haynes St.
Suite 211
Raleigh, NC 27604
WORTH CREECH
SITE CONSTRUCTION MANAGER

Prepared in the Office of:
SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890
JOSHUA G. DALTON, P.E.
PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

DocuSigned by:
Joshua G. Dalton
1089AD8C1499403...

8/25/2020
DATE:

8/24/2020
Slingshot_Crk_Rdy_AB_psh_01.dgn
jharvey

CONVENTIONAL PLAN SHEET SYMBOLS

Note: Not to Scale **S.U.E. = Subsurface Utility Engineering*

SHEET NAME	SHEET NUMBER
SYMBOLOGY	01A
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2020

Axiom Environmental, Inc.
SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin (EIP)
- Computed Property Corner
- Property Monument (ECM)
- Parcel/Sequence Number (123)
- Existing Fence Line
- Proposed Fence Gate
- Proposed Barbed Wire Fence
- Existing Wetland Boundary (WLB)
- Proposed Wetland Boundary (WLB)
- Existing Endangered Animal Boundary (EAB)
- Existing Endangered Plant Boundary (EPB)
- Existing Historic Property Boundary (HPB)

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign (S)
- Well (W)
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream (JS)
- Buffer Zone 1 (BZ 1)
- Buffer Zone 2 (BZ 2)
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch (FLOW)

RIGHT OF WAY & PROJECT CONTROL:

- Secondary Horiz and Vert Control Point
- Primary Horiz Control Point
- Primary Horiz and Vert Control Point

- Exist Permanent Easment Pin and Cap
- New Permanent Easement Pin and Cap
- Vertical Benchmark
- Existing Right of Way Marker
- Existing Right of Way Line
- New Right of Way Line (RW)
- New Right of Way Line with Pin and Cap (RW)
- New Right of Way Line with Concrete or Granite R/W Marker (RW)
- New Control of Access Line with Concrete C/A Marker (CA)
- Existing Control of Access (CA)
- New Control of Access (CA)
- Existing Easement Line (E)
- New Conservation Easement (E)
- New Temporary Drainage Easement (TDE)
- New Permanent Drainage Easement (PDE)
- New Permanent Drainage / Utility Easement (DUE)
- New Permanent Utility Easement (PUE)
- New Temporary Utility Easement (TUE)
- New Aerial Utility Easement (AUE)

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut (C)
- Proposed Slope Stakes Fill (F)
- Proposed Curb Ramp (CR)
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard (Vineyard)

EXISTING STRUCTURES:

MAJOR:
- Bridge, Tunnel or Box Culvert (CONC)
- Bridge Wing Wall, Head Wall and End Wall (CONC WW)

MINOR:
- Head and End Wall (CONC HW)
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB (CB)
- Paved Ditch Gutter
- Storm Sewer Manhole (S)
- Storm Sewer (S)

UTILITIES:

POWER:
- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole (P)
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole
- H-Frame Pole
- U/G Power Line LOS B (S.U.E.*) (P)
- U/G Power Line LOS C (S.U.E.*) (P)
- U/G Power Line LOS D (S.U.E.*) (P)

TELEPHONE:
- Existing Telephone Pole

WATER:
- Water Manhole (W)
- Water Meter
- Water Valve
- Water Hydrant
- U/G Water Line LOS B (S.U.E*) (W)
- U/G Water Line LOS C (S.U.E*) (W)
- U/G Water Line LOS D (S.U.E*) (W)
- Above Ground Water Line (A/G Water)

GAS:
- Gas Valve
- Gas Meter
- U/G Gas Line LOS B (S.U.E.*) (G)
- U/G Gas Line LOS C (S.U.E.*) (G)
- U/G Gas Line LOS D (S.U.E.*) (G)
- Above Ground Gas Line (A/G Gas)

SANITARY SEWER:
- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line (SS)
- Above Ground Sanitary Sewer (A/G Sanitary Sewer)
- SS Forced Main Line LOS B (S.U.E.*) (FSS)
- SS Forced Main Line LOS C (S.U.E.*) (FSS)
- SS Forced Main Line LOS D (S.U.E.*) (FSS)

MISCELLANEOUS:
- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box (S)
- Utility Unknown U/G Line LOS B (S.U.E.*) (?UTL)
- U/G Tank; Water, Gas, Oil
- Underground Storage Tank, Approx. Loc. (UST)
- A/G Tank; Water, Gas, Oil
- Geoenvironmental Boring
- U/G Test Hole LOS A (S.U.E.*)
- Abandoned According to Utility Records (AATUR)
- End of Information (E.O.I.)
- Riffle Rip Rap
- Log Vane
- Log Cross Vane
- Step Pool Structure (Begin / End)
- Stream Plug
- Floodplain Interceptor
- Proposed Fence
- Limits of Disturbance (LOD)

AS-BUILT:

- Stream Centerline
- Stream Top of Bank
- Stream Gauge
- Groundwater Gauge (#)
- Benthic & Water Quality Station (1)
- Origin Point on CVS Plots
- CVS Plots (#)
- Cross Section (XS-10R)
- Adjusted Stream Structure
- Not Constructed

8/24/2020
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jharvey

SHEET NAME	SHEET NUMBER
AS-BUILT FENCING	3A
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE	
COUNTY: ROCKINGHAM	DATE: 2020

Axiom Environmental, Inc.

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
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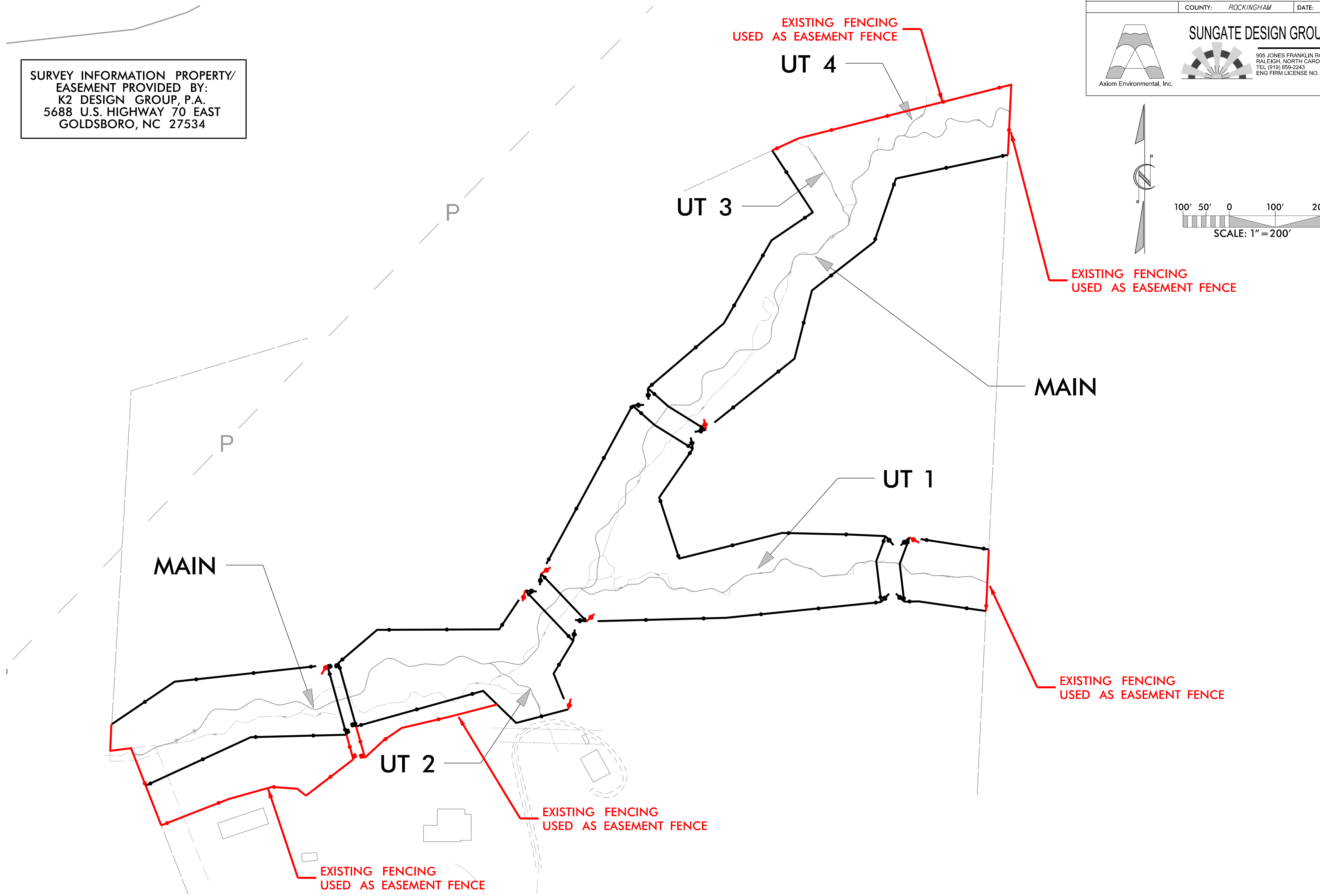

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jhervey

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	4
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE	
COUNTY: ROCKINGHAM	DATE: 2019

Axiom Environmental, Inc.

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

8/25/2020
DATE:

NAD 83

25' 12.5' 0 25' 50'
SCALE: 1" = 50'

START PRESERVATION
STA 0+00.00 -MAIN-

EXISTING FENCING USED AS EASEMENT FENCE

END PRESERVATION
START ENHANCEMENT II
STA 3+05.21 -MAIN-

END RESTORATION
START ENHANCEMENT I
STA 5+77.46 -MAIN-

EASEMENT FENCE LINE

PROPOSED BANKFULL

END ENHANCEMENT II
STA 1+89.21 -UT3-
STA 5+62.68 -MAIN-

WHELESS, JAN H. AND ROBERT L
BOOK I269, PG 0277

END ENHANCEMENT II
START RESTORATION
STA 4+58.93 -MAIN-

LEFT SIDE OF LOG CROSS VANE STRUCTURE NOT CONSTRUCTED DUE TO BEDROCK CONTACT

0+00 -MAIN-
1+00 -MAIN-
2+00 -MAIN-
3+00 -MAIN-
4+00 -MAIN-
5+00 -MAIN-
6+00 -MAIN-
0+00 -UT4-

MW-9
MW-10
10

LOG CROSS VANE

MATCHLINE STA 6+50 -MAIN- SEE SHEET 5

MATCHLINE STA 1+00 -UT3- SEE SHEET 9

EIP
EIS

MARSH, CHRISTOPHER C AND LAURA
BOOK I541, PG 2611

EASEMENT FENCE LINE

EXISTING FENCING USED AS EASEMENT FENCE

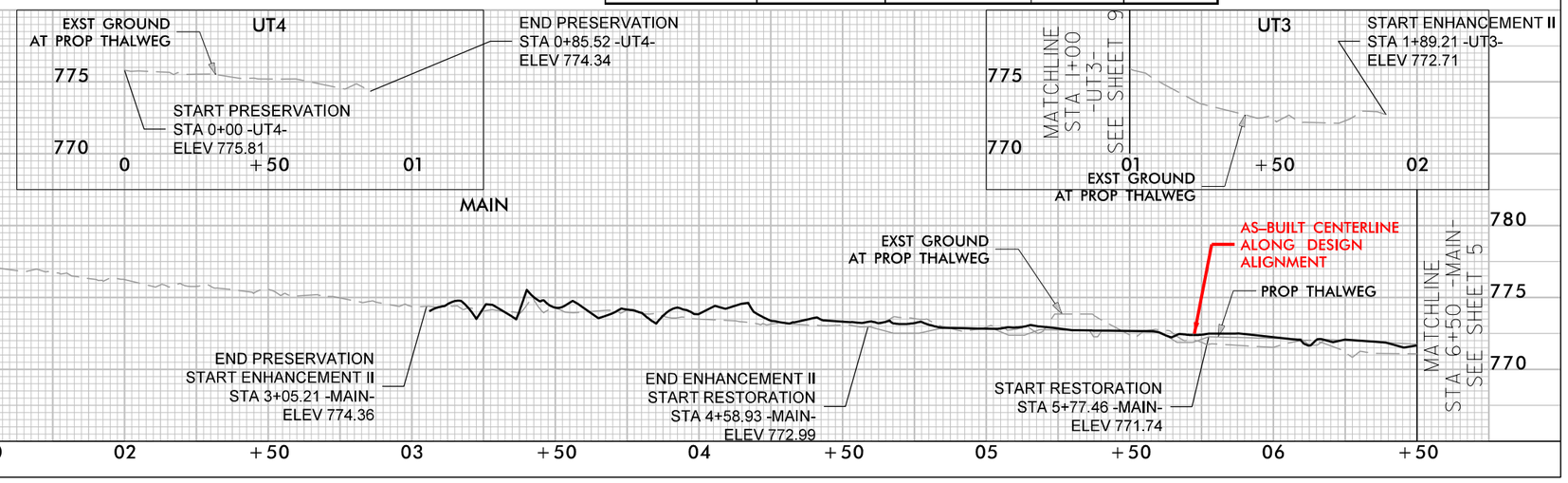
START PRESERVATION
STA 0+00.00 -UT4-

END PRESERVATION
STA 0+85.52 -UT4-
STA 3+01.50 -MAIN-

MANRING, KENNETH D AND VIRGINIA T
BOOK I265, PG 0869

As-Built -MAIN- STRUCTURE LOCATIONS				
STR. TYPE	NORTHING	EASTING	Design Channel Elevation	AB Survey Channel Elevation
LOG CROSS VANE	942,317.48	1,790,869.54	772.99	773.15
LOG CROSS VANE	942,251.98	1,790,862.93		772.70

TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR



8/24/2020
S:\Projects\Crk_Rdy_AB_psh_04.dgn
jhorsley

As-Built -MAIN- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Design Channel Elevation	AB Survey Channel Elevation
LOG CROSS VANE	942,162.63	1,790,789.81	771.75	771.70
LOG CROSS VANE	942,120.86	1,790,727.85	770.76	771.09
LOG CROSS VANE	942,079.12	1,790,695.28	769.79	769.99
LOG CROSS VANE	942,042.55	1,790,699.95	769.11	769.34
LOG CROSS VANE	942,006.12	1,790,689.08	768.61	767.82
LOG VANE	941,900.50	1,790,550.77	765.64	765.36
LOG CROSS VANE	941,855.50	1,790,535.73	765.07	765.4
LOG CROSS VANE	941,776.88	1,790,422.41	762.83	762.97

SHEET NAME		SHEET NUMBER
AS-BUILT STRUCTURES		5
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ROCKINGHAM	DATE: 2020

NAD 83

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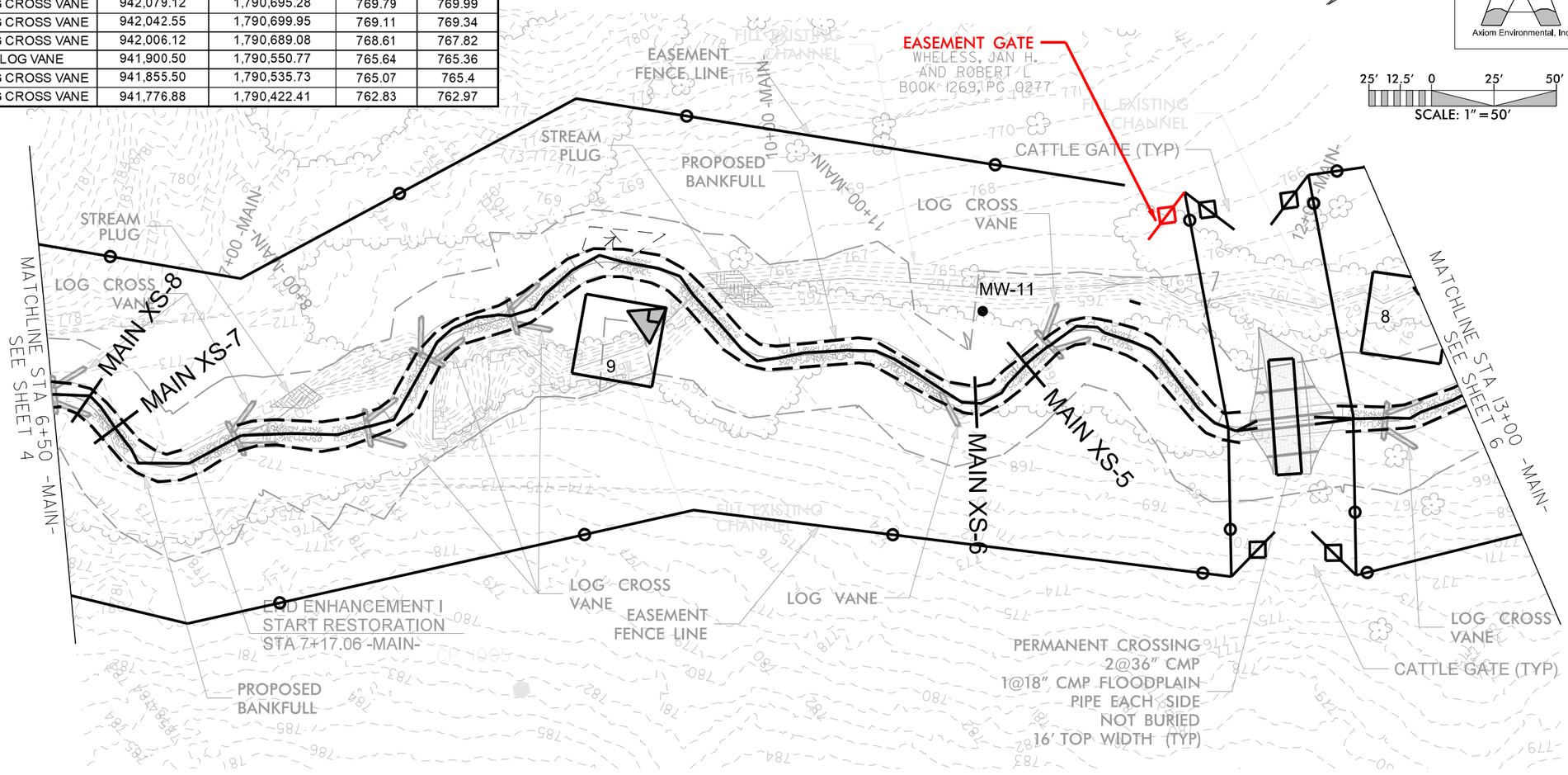
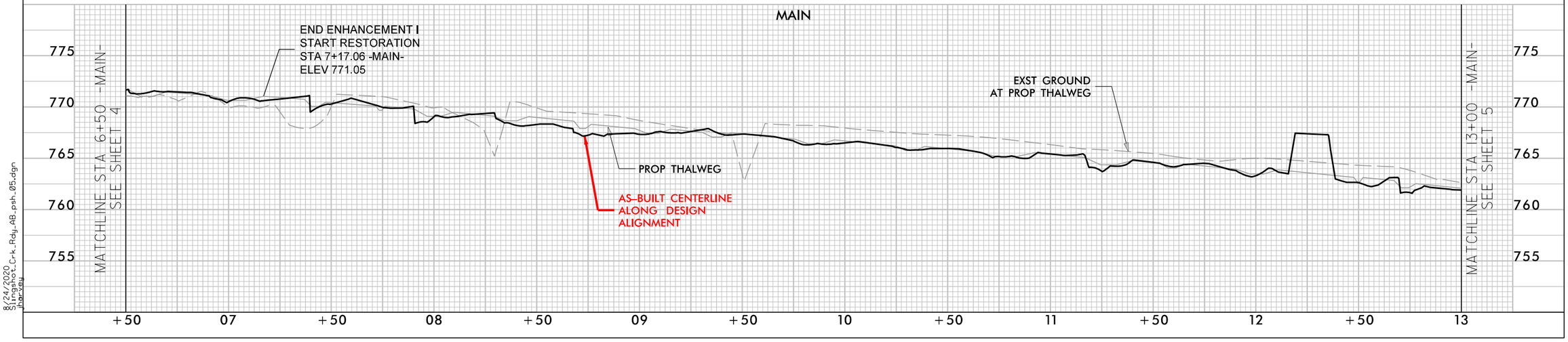
NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

8/25/2020
DATE:

25′ 12.5′ 0 25′ 50′
SCALE: 1″ = 50′



TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR



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jhartzell

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	6

PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE
COUNTY: ROCKINGHAM DATE: 2020

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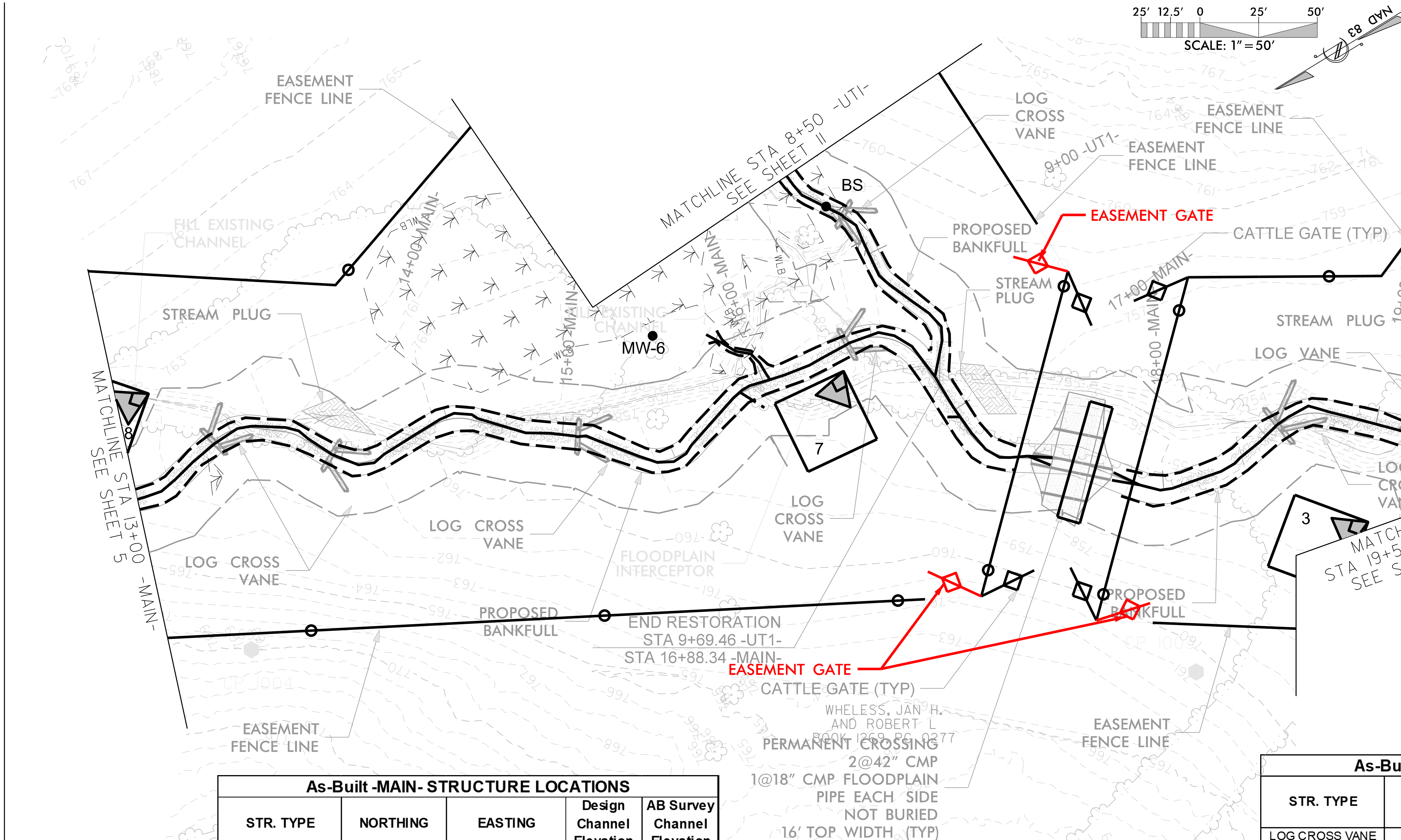
8/25/2020
DATE:

TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR



As-Built -MAIN- STRUCTURE LOCATIONS				
STR. TYPE	NORTHING	EASTING	Design Channel Elevation	AB Survey Channel Elevation
LOG CROSS VANE	941,706.80	1,790,413.02	761.33	761.50
LOG CROSS VANE	941,667.20	1,790,381.85	760.33	760.65
LOG CROSS VANE	941,573.50	1,790,334.03	758.37	758.55
LOG CROSS VANE	941,455.24	1,790,307.66	756.57	756.81
LOG CROSS VANE	941,316.77	1,790,182.24	754.56	754.13
LOG VANE	941,273.58	1,790,153.93	753.94	753.73

As-Built -UT1- STRUCTURE LOCATIONS				
STR. TYPE	NORTHING	EASTING	Design Channel Elevation	AB Survey Channel Elevation
LOG CROSS VANE	941,427.70	1,790,355.67	757.89	757.84

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As-Built -MAIN- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Design Channel Elevation	AB Survey Channel Elevation
LOG CROSS VANE	941,267.18	1,790,066.81	753.26	753.48
LOG CROSS VANE	941,267.94	1,789,981.30	752.04	752.26
LOG CROSS VANE	941,267.94	1,789,981.30	751.04	751.00

SHEET NAME: AS-BUILT STRUCTURES
SHEET NUMBER: 7
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE
COUNTY: ROCKINGHAM
DATE: 2020

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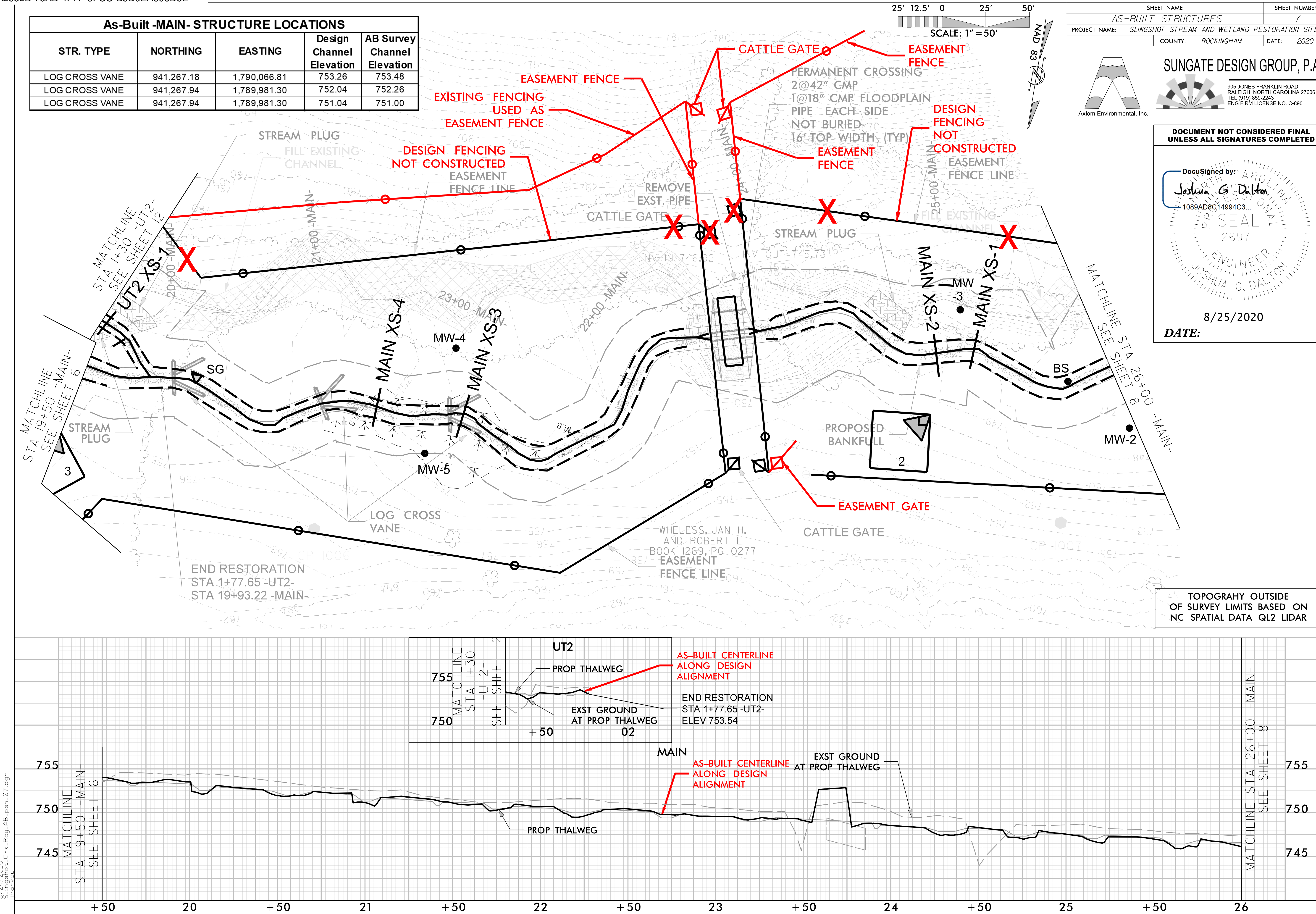
DATE: 8/25/2020



SCALE: 1" = 50'
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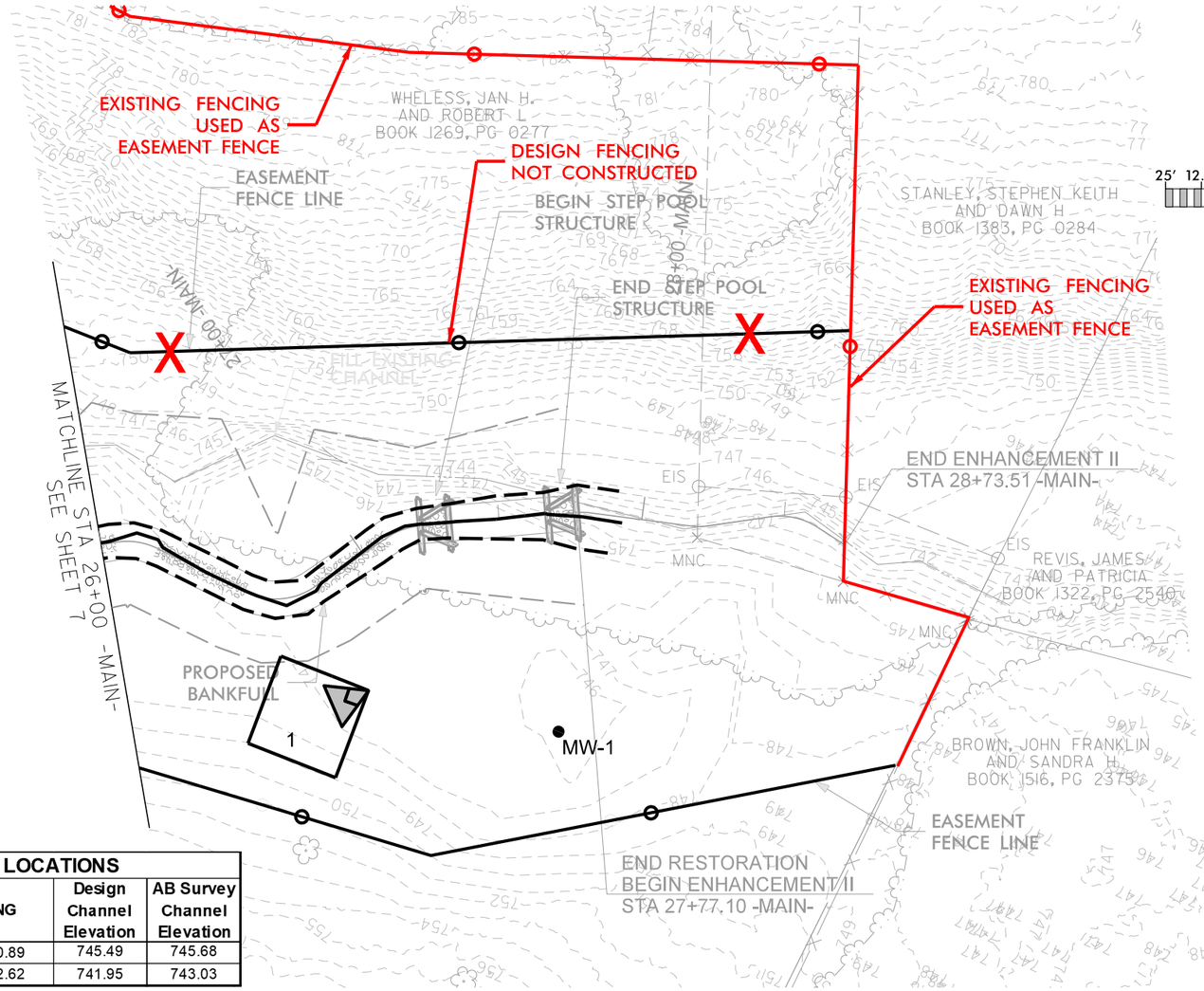
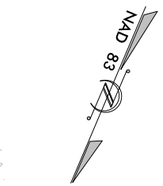
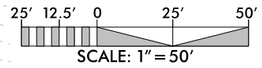
NAD 83
CATTLE GATE
EASEMENT FENCE
EASEMENT FENCE
PERMANENT CROSSING
2@42" CMP
1@18" CMP FLOODPLAIN PIPE EACH SIDE
NOT BURIED
16' TOP WIDTH (TYP)
EXISTING FENCING USED AS EASEMENT FENCE
DESIGN FENCING NOT CONSTRUCTED
EASEMENT FENCE LINE
EASEMENT FENCE
DESIGN FENCING NOT CONSTRUCTED
EASEMENT FENCE LINE
STREAM PLUG
FILL EXISTING CHANNEL
REMOVE EXST. PIPE
CATTLE GATE
STREAM PLUG
FILL EXISTING CHANNEL
INV IN=746.92
INV OUT=745.73
MATCHLINE STA 1+30 -UT2- SEE SHEET 12
UT2 XS-1
20+00 -MAIN-
21+00 -MAIN-
22+00 -MAIN-
23+00 -MAIN-
24+00 -MAIN-
25+00 -MAIN-
MAIN XS-4
MAIN XS-3
MAIN XS-2
MAIN XS-1
MW-4
MW-5
MW-3
MW-2
SG
BS
MATCHLINE STA 19+50 -MAIN- SEE SHEET 6
STREAM PLUG
3
LOG CROSS VANE
PROPOSED BANKFULL
2
EASEMENT GATE
CATTLE GATE
MATCHLINE STA 26+00 -MAIN- SEE SHEET 8
WHELESS, JAN H. AND ROBERT L.
BOOK 1269, PG 0277
EASEMENT FENCE LINE
END RESTORATION
STA 1+77.65 -UT2-
STA 19+93.22 -MAIN-
TOPOGRAPHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR
UT2
755
750
MATCHLINE STA 1+30 -UT2- SEE SHEET 12
PROP THALWEG
AS-BUILT CENTERLINE ALONG DESIGN ALIGNMENT
EXST GROUND AT PROP THALWEG
END RESTORATION
STA 1+77.65 -UT2-
ELEV 753.54
+50
02
MAIN
AS-BUILT CENTERLINE ALONG DESIGN ALIGNMENT
EXST GROUND AT PROP THALWEG
PROP THALWEG
MATCHLINE STA 19+50 -MAIN- SEE SHEET 6
MATCHLINE STA 26+00 -MAIN- SEE SHEET 8
755
750
745
+50
20
+50
21
+50
22
+50
23
+50
24
+50
25
+50
26







SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	8
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE	
COUNTY: ROCKINGHAM	DATE: 2020

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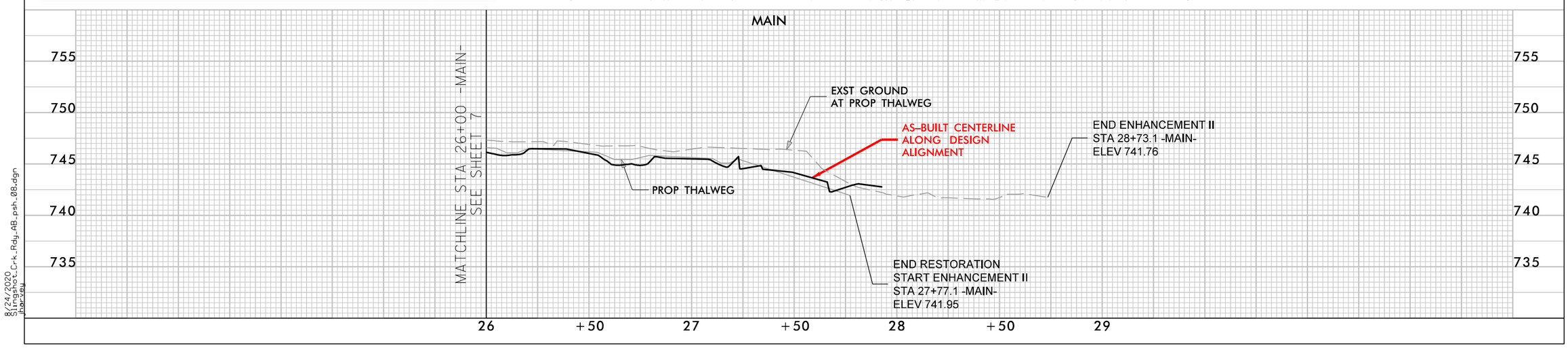
NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

8/25/2020
DATE:

As-Built -MAIN- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Design Channel Elevation	AB Survey Channel Elevation
Step Pool Structure	941,124.24	1,789,440.89	745.49	745.68
Step Pool Structure	941,098.75	1,789,392.62	741.95	743.03

TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR



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jhorsley

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	9

PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE

COUNTY: ROCKINGHAM DATE: 2020

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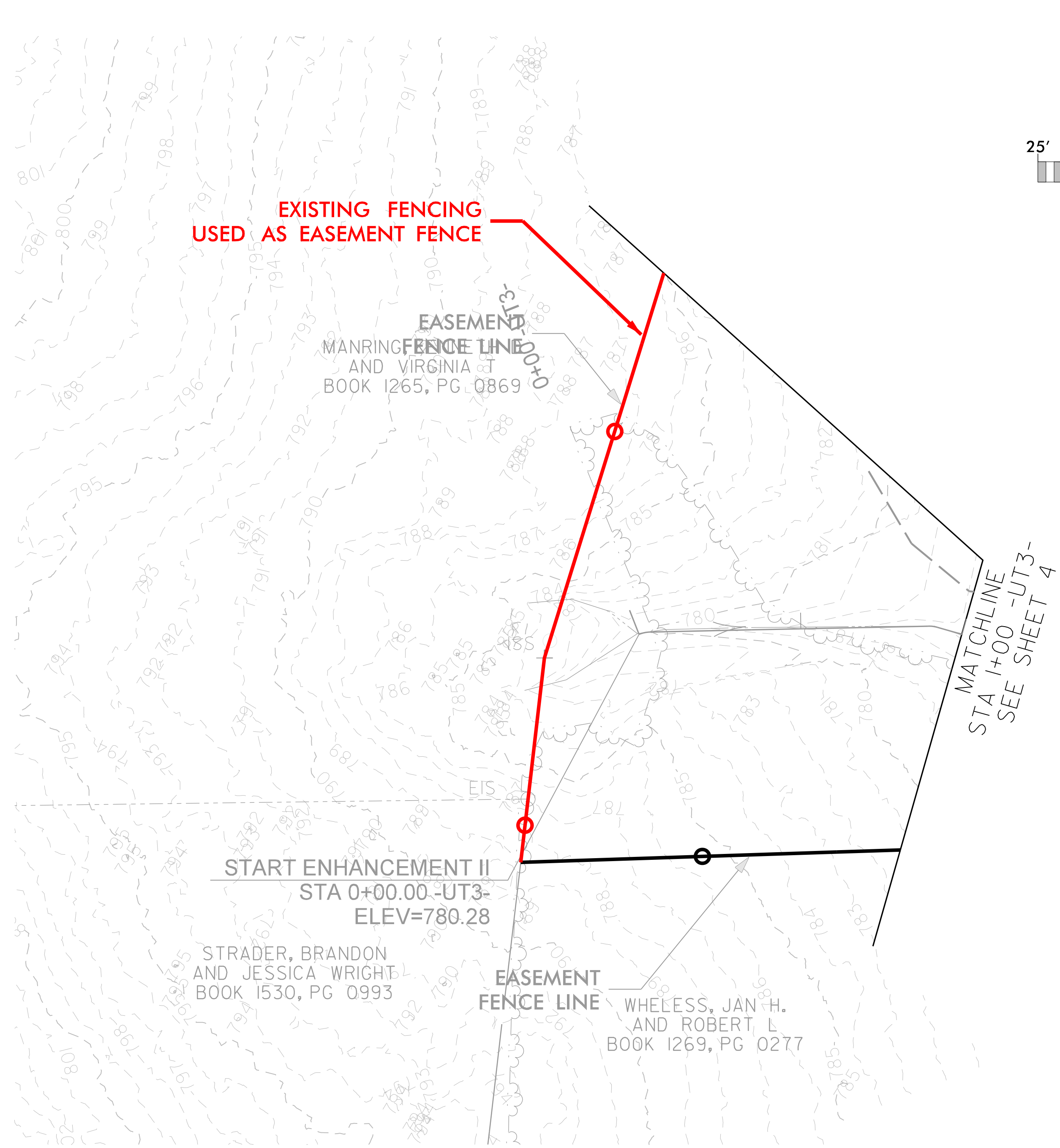
8/25/2020

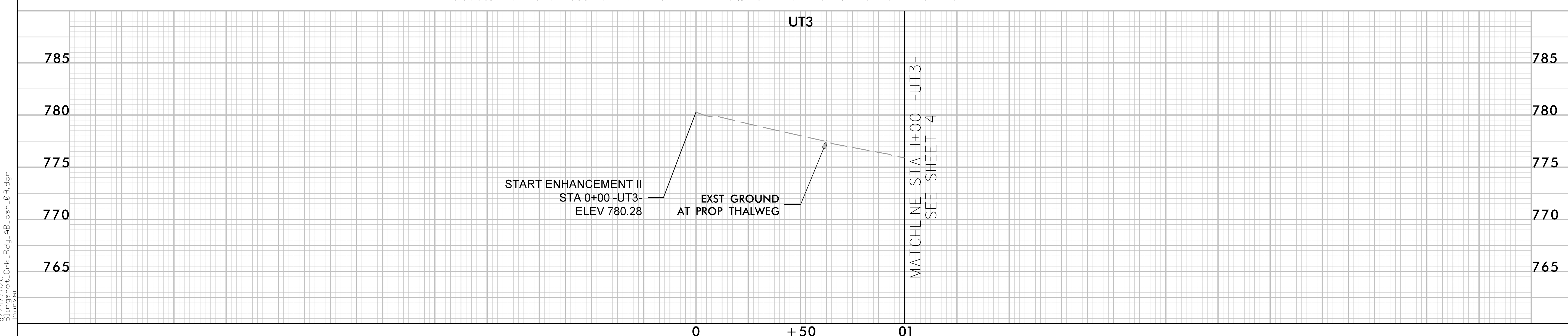
DATE:

NAD 83

25' 12.5' 0 25' 50'
SCALE: 1" = 50'



TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR



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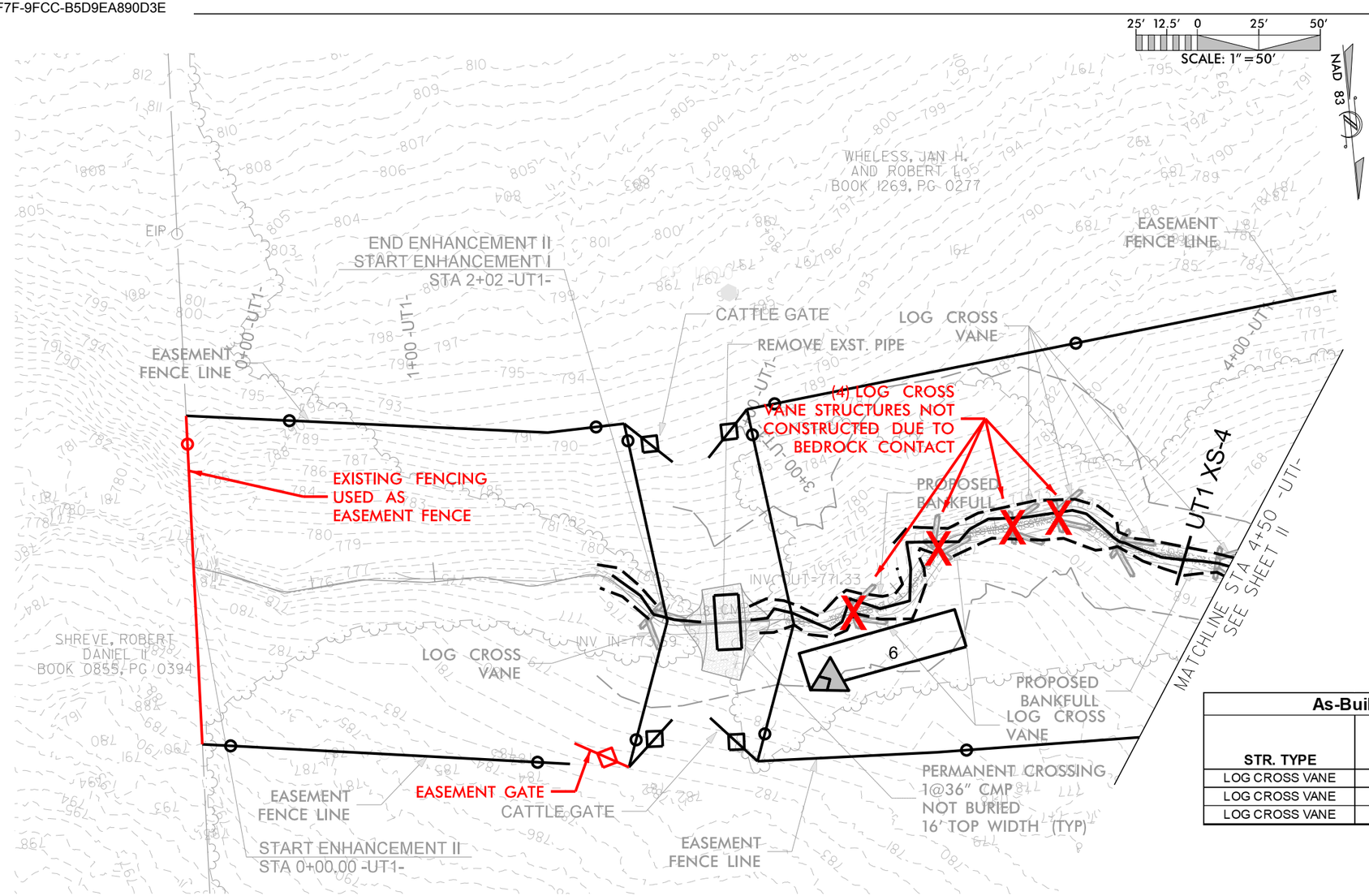
jharvey



SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	10
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE	
COUNTY: ROCKINGHAM	DATE: 2020

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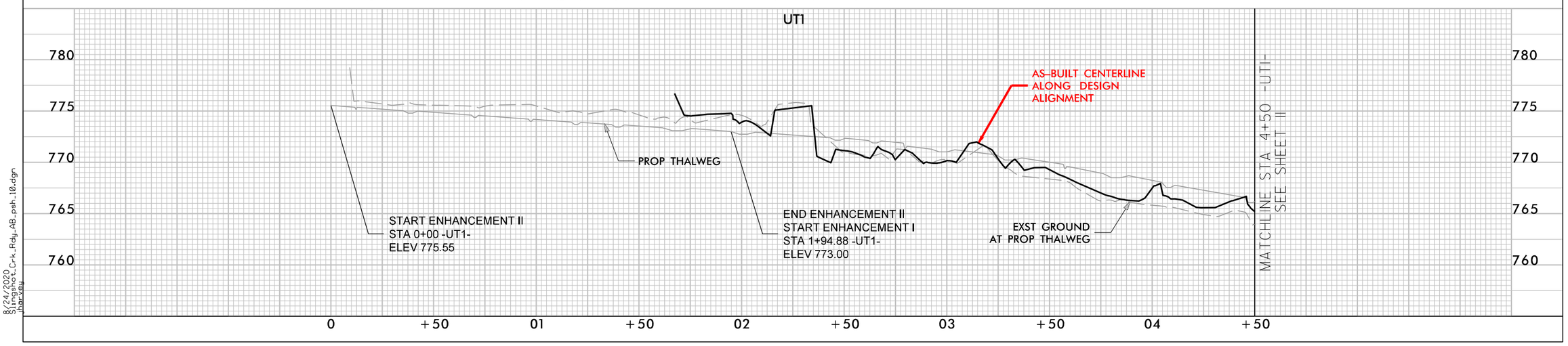
8/25/2020
DATE:

As-Built -UT1- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Design Channel Elevation	AB Survey Channel Elevation
LOG CROSS VANE	941,480.77	1,790,970.47	773.00	774.63
LOG CROSS VANE	941,470.16	1,790,777.79	768.06	767.93
LOG CROSS VANE	941,481.92	1,790,739.15	766.57	766.68

TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR



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jhorsley

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	11
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE	
COUNTY: ROCKINGHAM	DATE: 2020

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NAD 83

25' 12.5' 0 25' 50'
SCALE: 1" = 50'

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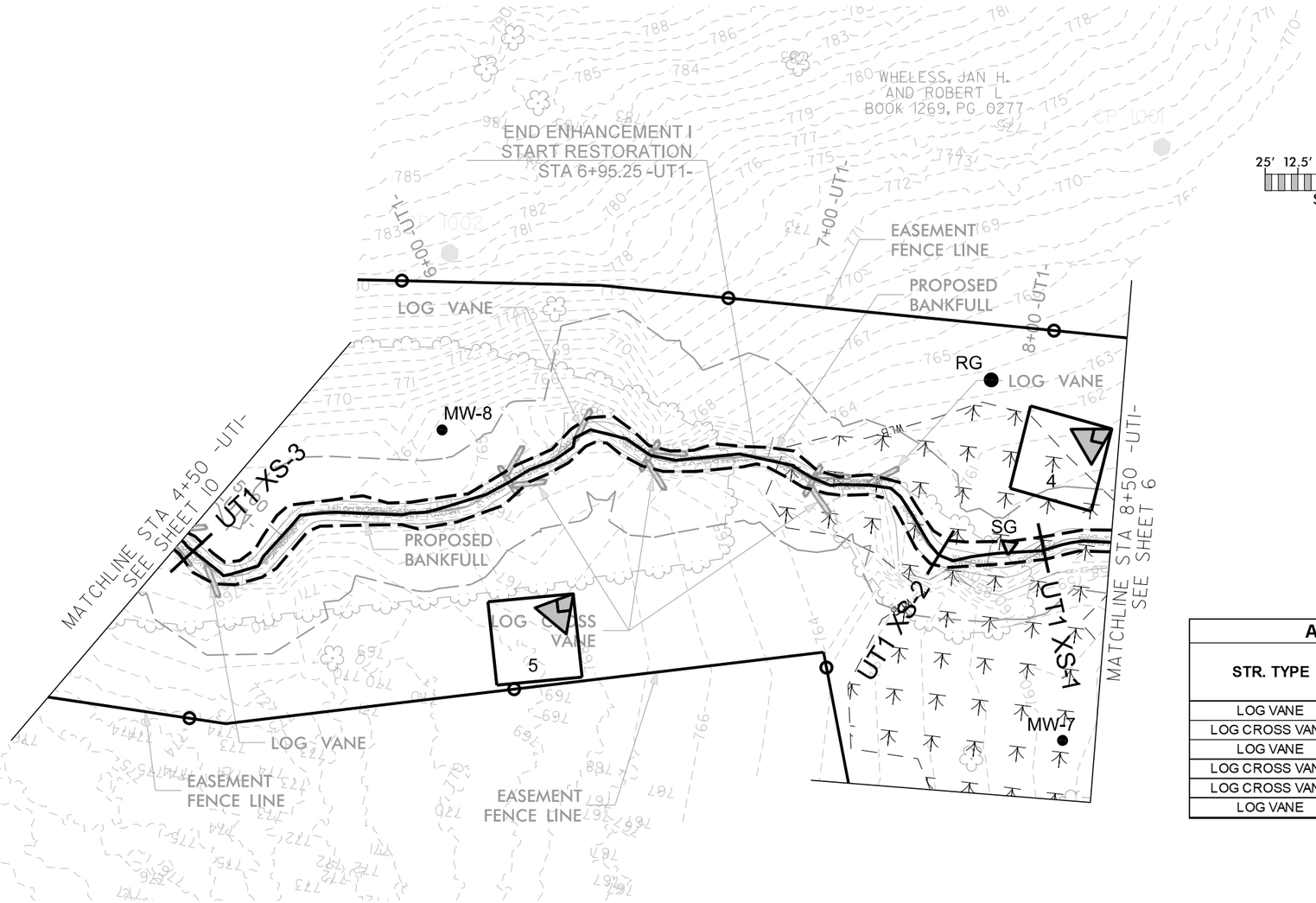
NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

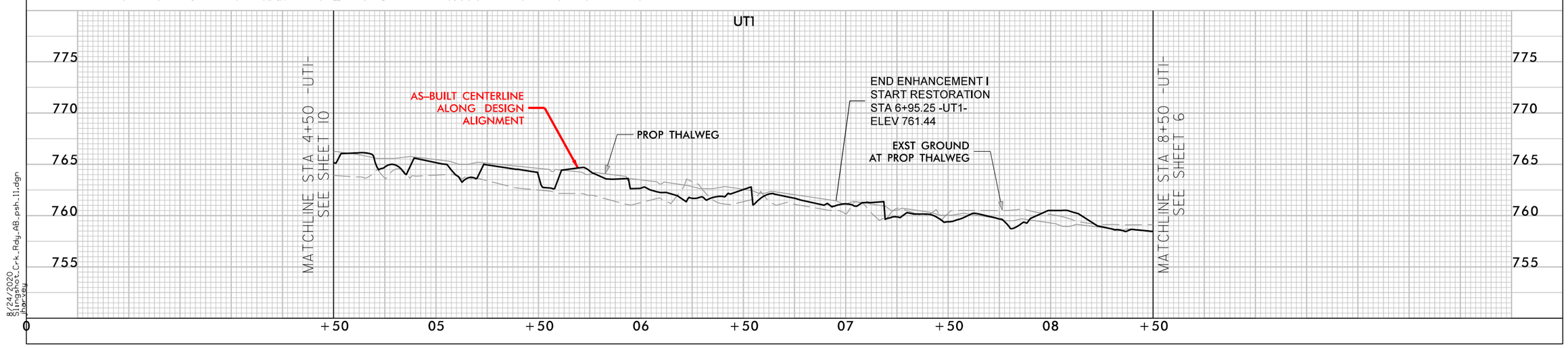
8/25/2020
DATE:



As-Built -UT1- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Design Channel Elevation	AB Survey Channel Elevation
LOG VANE	941,491.70	1,790,724.12	765.90	764.65
LOG CROSS VANE	941,445.27	1,790,613.43	763.82	763.56
LOG VANE	941,426.67	1,790,590.11	762.93	761.45
LOG CROSS VANE	941,429.07	1,790,561.19	762.43	762.75
LOG CROSS VANE	941,430.74	1,790,498.21	760.92	761.24
LOG VANE	941,429.37	1,790,477.07	760.33	759.98

TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR



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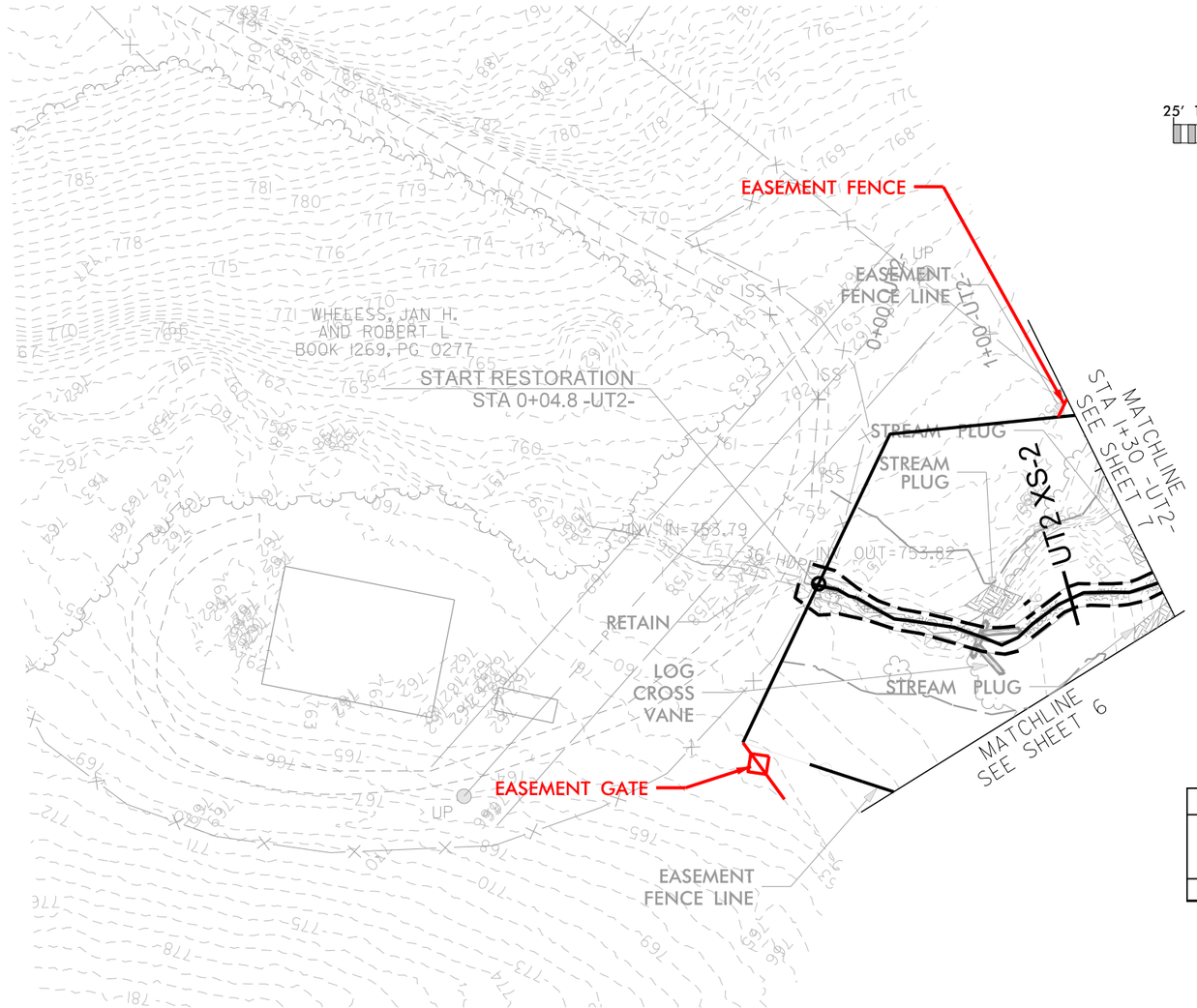
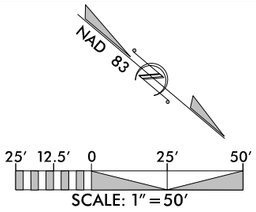
jhorsley





SHEET NAME		SHEET NUMBER
AS-BUILT STRUCTURES		12
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ROCKINGHAM	DATE: 2020

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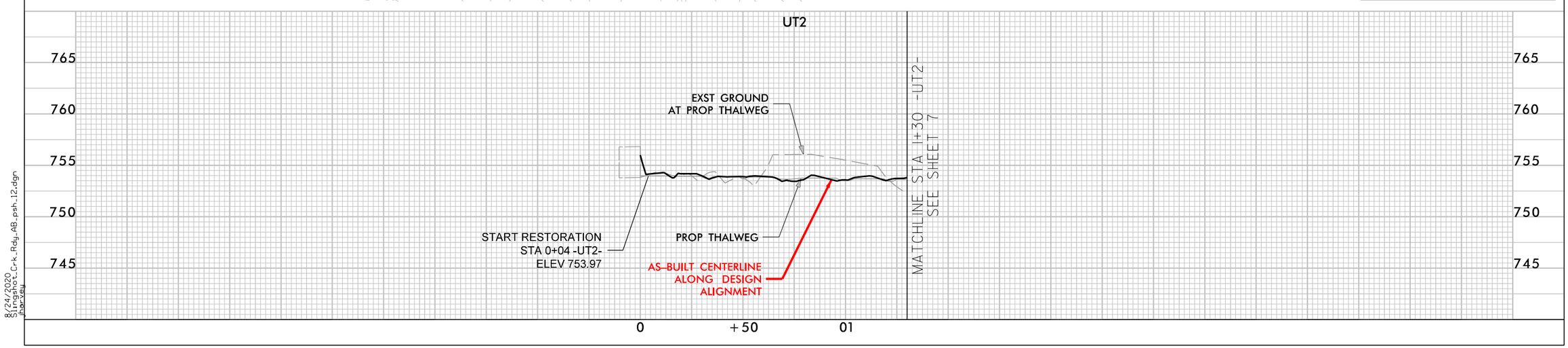
8/25/2020
DATE:

As-Built -UT2- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Design Channel Elevation	AB Survey Channel Elevation
LOG CROSS VANE	941,207.49	1,790,166.44	753.85	

TOPOGRAHY OUTSIDE OF SURVEY LIMITS BASED ON NC SPATIAL DATA QL2 LIDAR



8/24/2020
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jhardy

SHEET NAME	SHEET NUMBER
AS-BUILT PLANTING	13
PROJECT NAME: SLINGSHOT STREAM AND WETLAND RESTORATION SITE	
COUNTY: ROCKINGHAM	DATE: 2020

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1089AD8C1499403...

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8/25/2020
DATE:

Planted Bare Root Woody Vegetation

Species	Total*
Acres	**12.05**
Tag Alder *Alnus serrulate)*	350
River birch *Betula nigra*	700
Silky dogwood *Celtis occidentalis*	300
Red bud *Cercis canadensis*	200
Silky dogwood *Cornus amomum*	1700
Persimmon *Diospyros virginiana*	200
Green ash *Fraxinus pennsylvanica*	400
White ash *Fraxinus caroliniana*	100
Tulip poplar *Liriodendron tulipifera*	500
Black gum *Nyssa sylvatica*	500
Sycamore *Platanus occidentalis*	1500
Black cherry *Prunus serotina*	300
White oak *Quercus alba*	500
Water oak *Quercus nigra*	1500
Willow oak *Quercus phellos*	1400
Shumard oak *Quecus shumardii*	500
Carolina buckthorn *Rhamnus caroliniana*	300
TOTALS	**10,950**
Average Stems/Acre	**909**

*Approximately 2000 live stakes of willow (*Salix* spp.), elderberry (*Sambucus canadensis*), silky dogwood (*Cornus amomum*), and ninebark (*Physocarpus opulifolius*) were planted but are not included in this table.

8/24/2020
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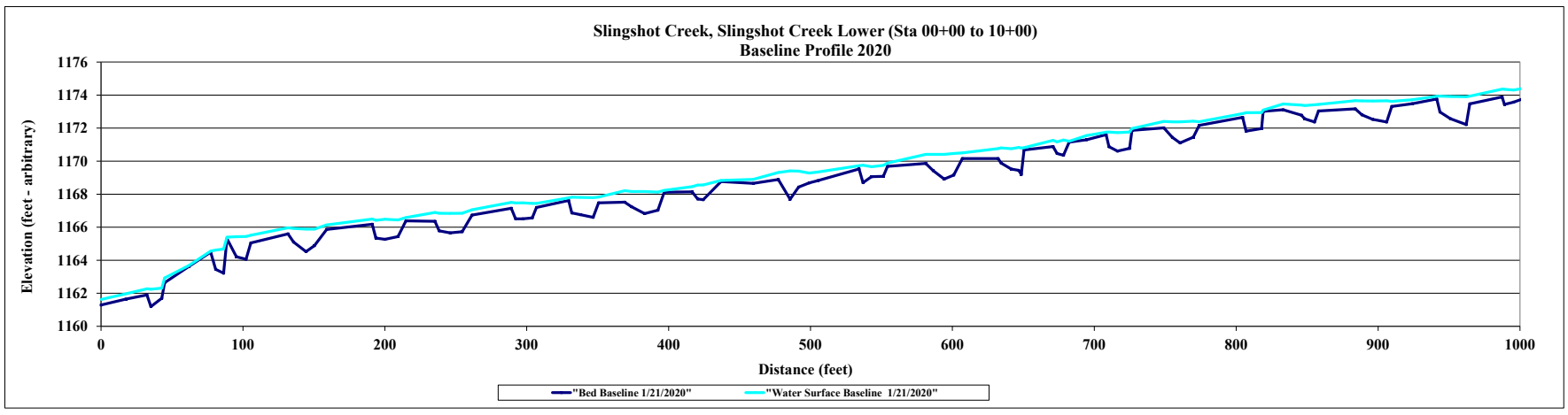
jhorsey

Project Name	Slinghshot Creek - Baseline (2020) Profile
Reach	SlingShot Creek Lower (Sta 00+00 to 10+00)
Feature	Profile
Date	1/21/20
Crew	Perkinson, Keith

2020 Baseline Survey			As needed			As needed			As needed		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	1161.29	1161.63									
17.5	1161.65	1161.97									
32.3	1161.90	1162.27									
35.1	1161.19	1162.25									
42.8	1161.70	1162.31									
44.8	1162.64	1162.93									
61.9	1163.62	1163.68									
77.2	1164.49	1164.55									
80.7	1163.45	1164.62									
86.3	1163.21	1164.68									
88.7	1165.30	1165.39									
95.4	1164.21	1165.42									
102.2	1164.06	1165.44									
105.5	1165.05	1165.51									
131.8	1165.59	1165.97									
135.6	1165.11	1165.93									
144.5	1164.52	1165.89									
150.4	1164.88	1165.88									
159.0	1165.87	1166.14									
191.1	1166.18	1166.50									
193.7	1165.34	1166.42									
200.1	1165.27	1166.48									
209.3	1165.43	1166.44									
214.9	1166.39	1166.58									
235.3	1166.36	1166.89									
238.3	1165.78	1166.85									
246.0	1165.66	1166.84									
254.5	1165.73	1166.85									
261.4	1166.73	1167.06									
289.1	1167.14	1167.50									
292.1	1166.51	1167.47									
297.3	1166.51	1167.48									
303.9	1166.56	1167.44									
306.9	1167.20	1167.44									
329.6	1167.62	1167.78									
331.8	1166.86	1167.82									
337.7	1166.76	1167.80									
346.8	1166.60	1167.79									
350.7	1167.48	1167.83									
369.0	1167.52	1168.21									
373.8	1167.24	1168.16									
383.1	1166.82	1168.16									
392.5	1167.03	1168.13									
396.9	1168.12	1168.23									
416.6	1168.14	1168.46									
420.5	1167.71	1168.55									
424.4	1167.67	1168.56									
436.9	1168.76	1168.84									
459.6	1168.66	1168.89									
477.3	1168.89	1169.32									
485.6	1167.69	1169.41									
491.6	1168.43	1169.40									
499.0	1168.68	1169.28									
505.1	1168.82	1169.34									
534.2	1169.53	1169.72									
537.0	1168.69	1169.75									
543.0	1169.06	1169.67									
551.3	1169.08	1169.74									
554.2	1169.69	1169.88									
581.2	1169.86	1170.41									
586.4	1169.42	1170.41									
594.2	1168.91	1170.41									
600.9	1169.16	1170.47									
607.0	1170.16	1170.50									
632.2	1170.16	1170.76									
634.3	1169.88	1170.81									
641.5	1169.52	1170.75									
646.7	1169.44	1170.83									
648.6	1169.19	1170.79									
650.5	1170.68	1170.82									
670.9	1170.89	1171.26									
673.7	1170.47	1171.17									
678.2	1170.36	1171.28									
682.3	1171.15	1171.21									
694.6	1171.30	1171.55									
708.4	1171.60	1171.75									
710.3	1170.88	1171.76									
716.4	1170.61	1171.73									
724.9	1170.78	1171.76									
726.6	1171.86	1171.98									
749.0	1172.02	1172.41									
755.0	1171.44	1172.38									
760.5	1171.10	1172.38									
769.8	1171.46	1172.42									
773.9	1172.17	1172.39									
804.5	1172.65	1172.88									
806.9	1171.81	1172.93									
817.9	1171.97	1172.94									
819.0	1173.02	1173.09									
833.1	1173.12	1173.46									
846.0	1172.78	1173.40									
848.2	1172.56	1173.37									
855.2	1172.37	1173.41									
858.0	1173.04	1173.43									
883.9	1173.17	1173.66									
888.6	1172.81	1173.65									
896.2	1172.53	1173.64									
906.0	1172.37	1173.66									
909.6	1173.31	1173.62									
924.0	1173.48	1173.72									
941.3	1173.76	1173.93									
943.6	1172.98	1173.94									
951.0	1172.57	1173.92									
962.1	1172.22	1173.90									
964.6	1173.47	1173.94									
987.4	1173.89	1174.36									
989.0	1173.43	1174.35									
995.6	1173.57	1174.31									
1032.6	1174.72	1174.86									
1041.5	1174.38	1175.17									

	Baseline	As needed		
Avg. Water Surface Slope	0.0130			
Riffle Length	26			
Avg. Riffle Slope	0.0167			
Pool Length	12			

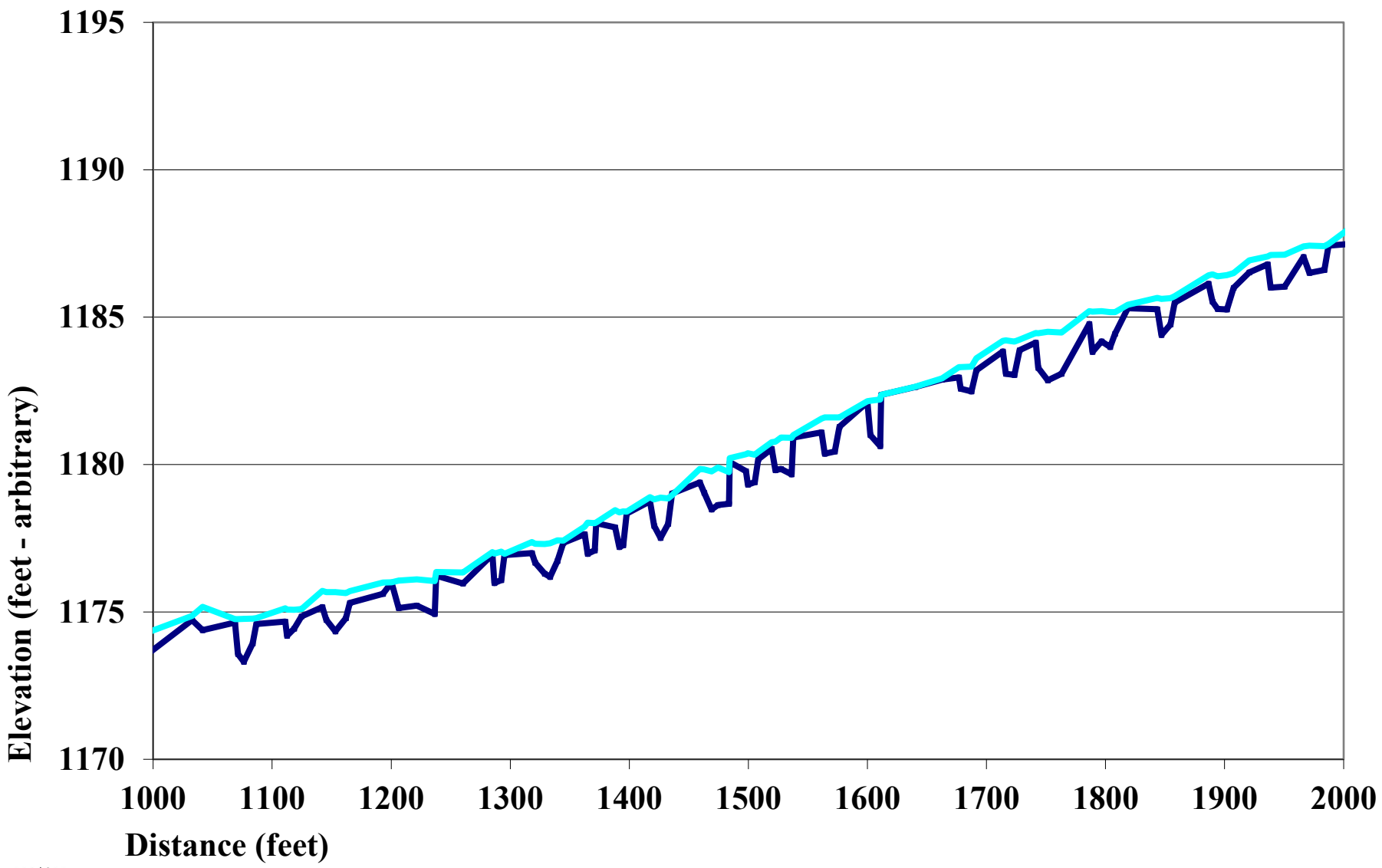


Project Name	Slingshot Creek - Baseline (2020) Profile
Reach	Slingshot Creek Upper (Sta 10+00 to 20+00)
Feature	Profile
Date	1/21/20
Crew	Perkinson, Keith

2020 Baseline Survey			As needed			As needed			As needed		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
995.6	1173.57	1174.31									
1032.6	1174.72	1174.86									
1041.5	1174.38	1175.17									
1068.8	1174.64	1174.75									
1071.3	1173.57	1174.76									
1076.2	1173.31	1174.76									
1083.6	1173.94	1174.77									
1086.8	1174.59	1174.79									
1110.9	1174.68	1175.12									
1112.4	1174.19	1175.08									
1118.5	1174.43	1175.07									
1124.7	1174.85	1175.10									
1142.2	1175.16	1175.72									
1145.5	1174.73	1175.67									
1153.1	1174.34	1175.67									
1161.9	1174.79	1175.64									
1165.2	1175.31	1175.70									
1193.2	1175.61	1176.00									
1200.4	1175.99	1176.01									
1206.2	1175.13	1176.06									
1221.6	1175.22	1176.10									
1236.5	1174.93	1176.05									
1237.9	1176.23	1176.35									
1260.3	1175.96	1176.33									
1285.1	1176.94	1177.03									
1286.6	1175.98	1176.98									
1292.5	1176.08	1177.05									
1295.2	1176.92	1176.97									
1318.3	1177.00	1177.37									
1320.9	1176.67	1177.31									
1328.8	1176.30	1177.30									
1333.5	1176.18	1177.32									
1339.7	1176.73	1177.43									
1344.7	1177.34	1177.42									
1362.6	1177.64	1177.89									
1365.0	1176.97	1178.02									
1371.0	1177.09	1178.01									
1372.2	1178.01	1178.03									
1388.1	1177.87	1178.45									
1391.6	1177.20	1178.38									
1394.8	1177.26	1178.41									
1397.8	1178.33	1178.40									
1417.3	1178.75	1178.90									
1420.9	1177.92	1178.82									
1426.3	1177.51	1178.87									
1432.6	1177.99	1178.85									
1435.9	1179.02	1178.96									
1459.1	1179.39	1179.85									
1462.9	1179.04	1179.83									
1469.0	1178.48	1179.77									
1474.4	1178.63	1179.90									
1483.6	1178.67	1179.74									
1484.4	1180.08	1180.21									
1497.9	1179.78	1180.35									
1499.7	1179.31	1180.39									
1505.3	1179.40	1180.33									
1508.2	1180.18	1180.42									
1519.5	1180.53	1180.76									
1522.6	1179.81	1180.78									
1527.4	1179.85	1180.91									
1536.3	1179.67	1180.91									
1537.6	1180.92	1181.00									
1561.5	1181.09	1181.56									
1564.2	1180.37	1181.60									
1572.6	1180.44	1181.60									
1576.4	1181.29	1181.60									
1600.0	1182.11	1182.15									
1602.4	1181.00	1182.16									
1610.8	1180.62	1182.20									
1611.6	1182.36	1182.37									
1640.1	1182.63	1182.64									
1662.6	1182.88	1182.92									
1676.9	1182.95	1183.30									
1678.4	1182.57	1183.30									
1687.3	1182.48	1183.32									
1691.5	1183.20	1183.61									
1713.8	1183.84	1184.20									
1716.2	1183.08	1184.21									
1723.4	1183.04	1184.17									
1727.8	1183.88	1184.23									
1741.5	1184.14	1184.46									
1743.4	1183.28	1184.46									
1751.6	1182.85	1184.50									
1763.0	1183.08	1184.48									
1786.3	1184.77	1185.20									
1789.0	1183.82	1185.18									
1796.5	1184.18	1185.20									
1803.8	1183.99	1185.17									
1808.0	1184.44	1185.17									
1818.7	1185.30	1185.42									
1843.5	1185.27	1185.65									
1847.0	1184.39	1185.62									
1854.6	1184.76	1185.64									
1858.1	1185.50	1185.71									
1886.4	1186.13	1186.42									
1889.8	1185.53	1186.45									
1894.1	1185.28	1186.38									
1902.0	1185.26	1186.43									
1907.4	1185.99	1186.49									
1920.8	1186.52	1186.92									
1936.2	1186.79	1187.06									
1938.8	1186.00	1187.11									
1950.5	1186.04	1187.11									
1966.3	1187.04	1187.40									
1971.2	1186.50	1187.42									
1983.7	1186.60	1187.41									
1987.2	1187.42	1187.49									
2004.7	1187.48	1188.00									
2007.3	1186.85	1188.01									
2012.1	1186.44	1187.97									
2014.3	1187.85	1188.00									
2035.4	1188.52	1188.72									
2038.9	1187.70	1188.62									
2044.6	1187.38	1188.63									
2050.8	1187.19	1188.64									
2053.0	1188.48	1188.66									
2072.1	1188.72	1189.10									
2074.8	1188.18	1189.09									
2081.0	1187.74	1189.01									
2093.5	1187.76	1189.01									
2094.2	1189.40	1189.45									
2107.0	1189.18	1189.62									
2108.3	1188.52	1189.64									
2113.4	1188.37	1189.61									
2115.2	1189.12	1189.73									
2135.4	1189.62	1190.13									
2137.0	1189.29	1190.09									
2144.3	1188.88	1190.10									
2145.2	1190.18	1190.29									
2168.9	1190.47	1190.54									
2171.5	1189.50	1190.56									
2176.3	1189.51	1190.57									
2182.2	1189.46	1190.54									
2189.8	1189.58	1190.57									
2196.7	1190.49	1190.87									
2216.1	1190.54	1191.08									
2221.3	1189.93	1191.03									
2226.9	1189.87	1191.08									
2234.0	1189.95	1191.04									
2235.4	1191.07	1191.31									
2265.7	1191.57	1191.75									
2271.6	1190.79	1191.77									
2275.7	1190.39	1191.77									
2277.8	1191.78	1191.78									
2297.0	1191.82	1192.02									
2310.5	1191.91	1192.16									
2314.2	1190.95	1192.16									
2324.0	1190.89	1192.18									
2326.9	1191.76	1192.16									
2345.8	1191.97	1192.44									
2347.907738	1191.239507	1192.523401									
2351.126851	1191.465067	1192.454528									
2353.894342	1192.056416	1192.451361									
2369.634914	1191.940244	1192.480186									
2372.130582	1191.528329	1192.415783									
2376.860877	1191.436474	1192.515164									
2383.57158	1191.748098	1192.520649									
2387.102222	1192.109137	1192.512202									
2407.45187	1192.325187	1192.759682									
2410.951552	1191.560184	1192.806627									
2414.305226	1191.612297	1192.723134									
2422.003461	1191.211516	1192.795122									
2424.185889	1192.491603	1192.800602									
2430.819184	1192.795357	1193.052366									

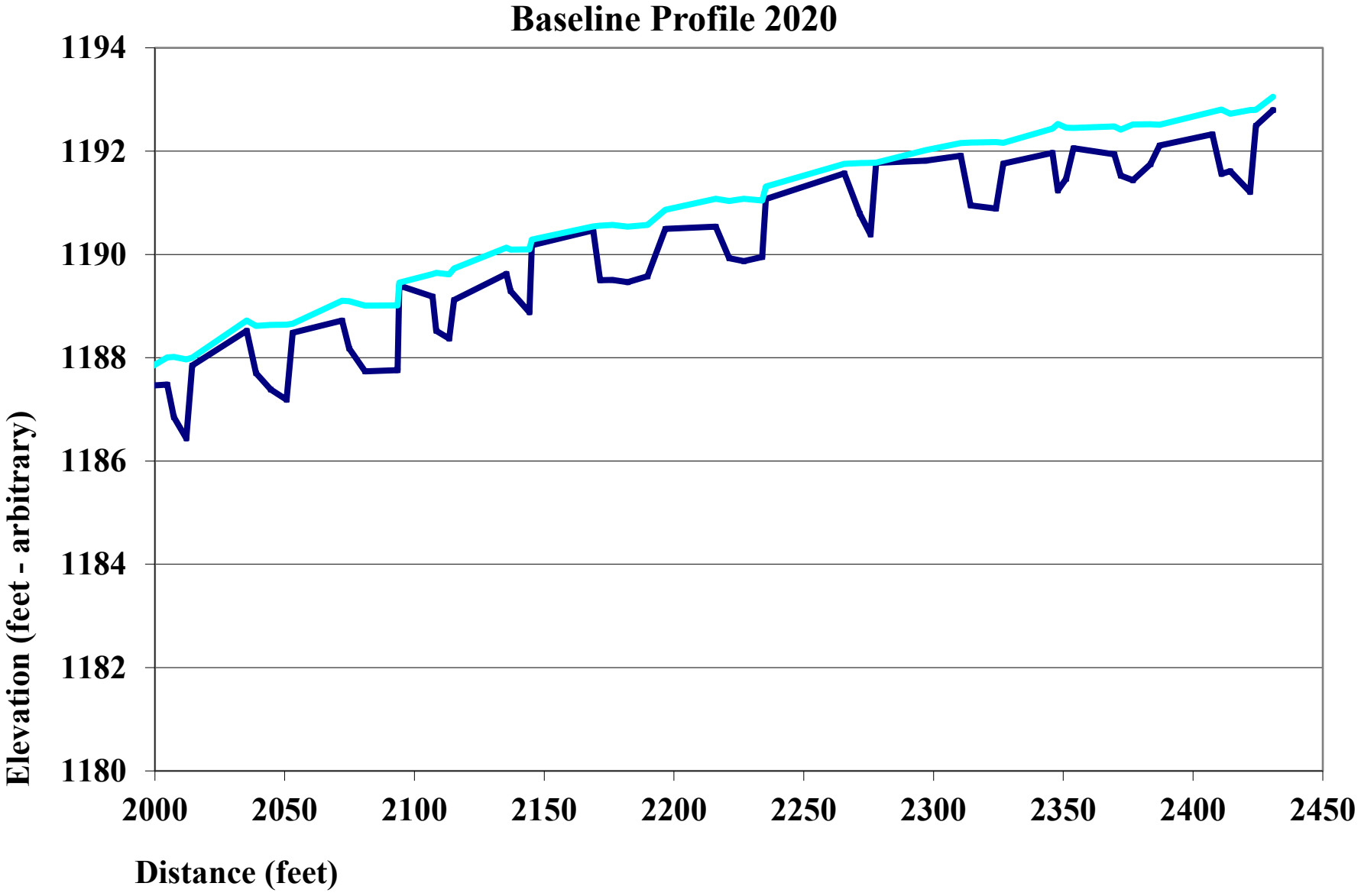
	Baseline	As needed		
Avg. Water Surface Slope	0.0127			
Riffle Length	23			
Avg. Riffle Slope	0.0194			
Pool Length	11			

Slingshot Creek, Slinghshot Creek Upper (Sta 10+00 to 20+00)
Baseline Profile 2020



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

Slingshot Creek, Slingshot Creek Upper (Sta 20+00 to 24+31)
Baseline Profile 2020

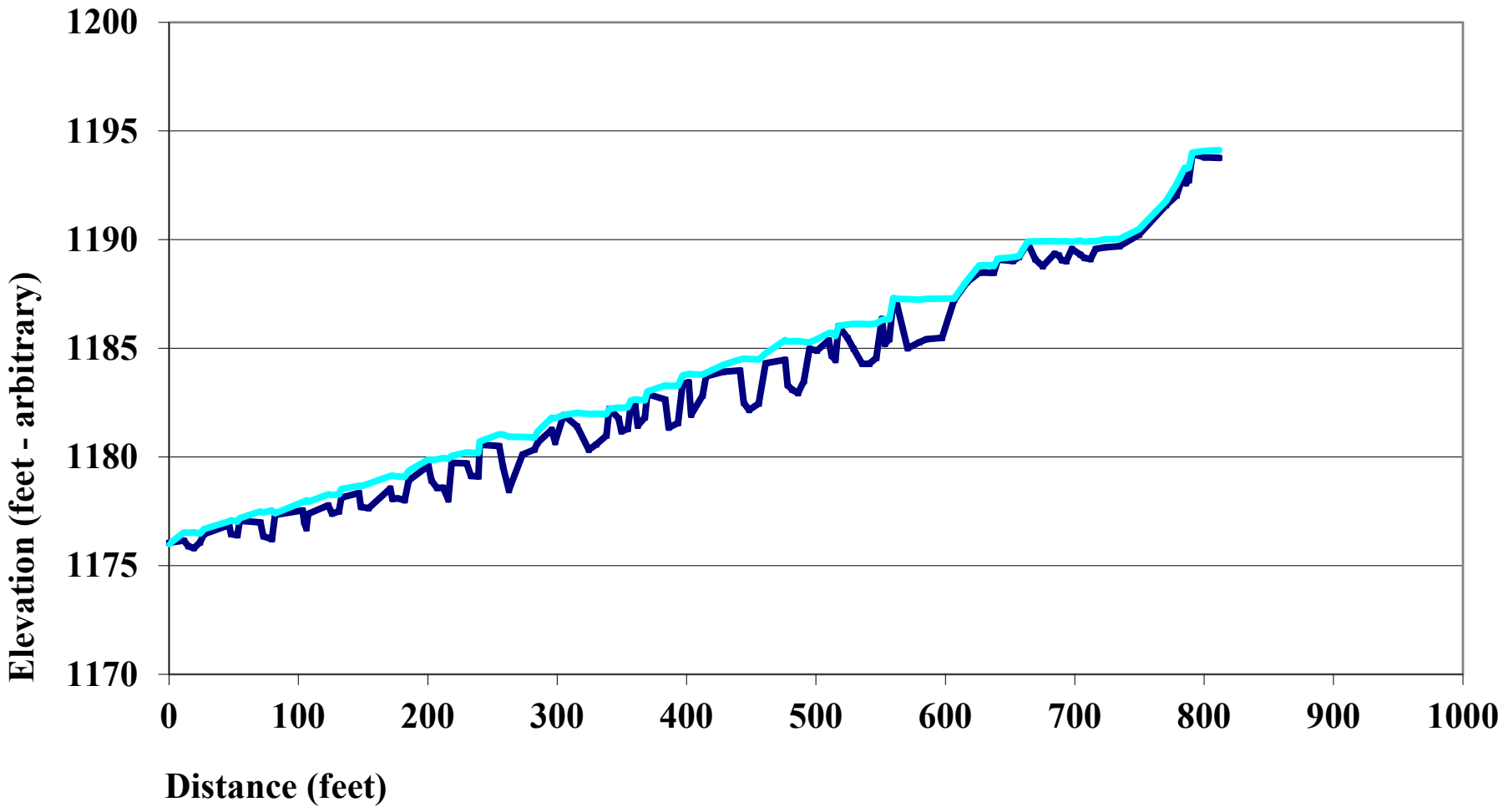


Project Name	Slingshot Creek - Baseline (2020) Profile
Reach	UT 1 (Sta 00+00 to 08+12)
Feature	Profile
Date	1/21/20
Crew	Perkinson, Keith

2020 Baseline Survey			As needed			As needed			As needed		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	1176.06	1176.00									
11.6	1176.16	1176.53									
14.8	1175.89	1176.51									
19.1	1175.81	1176.54									
23.9	1176.07	1176.47									
27.0	1176.45	1176.68									
46.3	1176.87	1177.04									
47.9	1176.45	1177.08									
52.8	1176.41	1177.03									
54.7	1177.06	1177.19									
70.5	1176.99	1177.50									
72.8	1176.35	1177.45									
79.4	1176.22	1177.54									
81.9	1177.34	1177.41									
103.2	1177.55	1177.92									
104.4	1177.00	1177.94									
106.2	1176.72	1178.01									
107.4	1177.38	1177.94									
123.1	1177.78	1178.28									
125.9	1177.39	1178.25									
131.2	1177.50	1178.28									
133.1	1178.13	1178.52									
146.7	1178.34	1178.68									
148.2	1177.70	1178.66									
154.2	1177.64	1178.77									
170.9	1178.55	1179.13									
172.6	1178.07	1179.14									
176.6	1178.10	1179.11									
182.0	1178.01	1179.08									
185.2	1178.92	1179.37									
200.4	1179.59	1179.89									
202.8	1178.92	1179.86									
207.2	1178.58	1179.89									
211.8	1178.58	1179.95									
215.8	1178.05	1179.92									
218.4	1179.74	1180.05									
230.1	1179.71	1180.21									
233.3	1179.13	1180.20									
239.0	1179.10	1180.19									
240.1	1180.57	1180.72									
255.1	1180.51	1181.05									
258.2	1179.55	1181.04									
262.7	1178.48	1180.94									
273.1	1180.11	1180.92									
282.4	1180.34	1180.90									
284.8	1180.65	1181.17									
295.7	1181.25	1181.80									
298.4	1180.69	1181.79									
305.1	1181.93	1181.93									
315.4	1181.42	1182.03									
324.5	1180.34	1181.98									
330.2	1180.58	1181.99									
338.1	1180.99	1181.98									
340.4	1182.22	1182.22									
347.6	1181.77	1182.28									
349.6	1181.19	1182.26									
354.5	1181.29	1182.29									
356.7	1182.34	1182.60									
360.4	1182.37	1182.65									
362.2	1181.44	1182.63									
367.7	1181.82	1182.61									
369.5	1182.91	1183.01									
383.3	1182.64	1183.30									
386.2	1181.35	1183.27									
393.3	1181.56	1183.29									
396.9	1183.36	1183.75									
401.6	1183.44	1183.82									
403.4	1181.94	1183.81									
412.3	1182.83	1183.78									
415.1	1183.71	1183.87									
428.5	1183.92	1184.24									
441.4	1183.99	1184.49									
444.1	1182.50	1184.52									
448.4	1182.17	1184.51									
455.6	1182.46	1184.49									
461.2	1184.32	1184.77									
476.2	1184.48	1185.39									
478.1	1183.31	1185.33									
481.6	1183.10	1185.33									
486.1	1182.93	1185.34									
490.6	1183.49	1185.29									
495.0	1184.98	1185.27									
500.8	1184.89	1185.42									
509.8	1185.37	1185.71									
512.2	1184.66	1185.71									
515.1	1184.46	1185.57									
517.6	1186.02	1186.04									
524.4	1185.47	1186.10									
529.0	1184.97	1186.12									
535.6	1184.29	1186.12									
541.2	1184.29	1186.11									
546.6	1184.56	1186.14									
551.0	1186.36	1186.30									
553.3	1185.20	1186.33									
556.8	1185.42	1186.34									
559.9	1187.28	1187.33									
562.8	1186.98	1187.28									
570.8	1185.01	1187.27									
579.6	1185.27	1187.24									
585.4	1185.43	1187.27									
597.3	1185.48	1187.29									
606.6	1187.22	1187.29									
616.6	1188.03	1188.12									
626.1	1188.48	1188.81									
630.1	1188.49	1188.83									
634.6	1188.49	1188.82									
637.5	1188.48	1188.79									
640.6	1189.09	1189.13									
652.2	1189.02	1189.19									
656.8	1189.21	1189.25									
663.7	1189.84	1189.92									
669.5	1189.09	1189.92									
675.2	1188.77	1189.93									
684.3	1189.36	1189.93									
687.5	1189.29	1189.92									
689.9	1189.06	1189.93									
693.4	1189.01	1189.93									
697.8	1189.58	1189.91									
704.1	1189.32	1189.95									
707.5	1189.15	1189.90									
712.2	1189.11	1189.93									
716.2	1189.57	1189.93									
723.4	1189.65	1190.02									
734.5	1189.70	1190.03									
749.6	1190.23	1190.48									
770.6	1191.59	1191.79									
778.7	1192.03	1192.56									
785.0	1193.14	1193.31									
786.0	1192.60	1193.27									
788.1	1192.74	1193.31									
790.8	1193.95	1194.01									
800.1	1193.79	1194.08									
811.6	1193.77	1194.12									

	Baseline	As needed		
Avg. Water Surface Slope	0.0228			
Riffle Length	15			
Avg. Riffle Slope	0.0245			
Pool Length	9			

Slingshot Creek, UT 1 (Sta 00+00 to 08+12)
Baseline Profile 2020

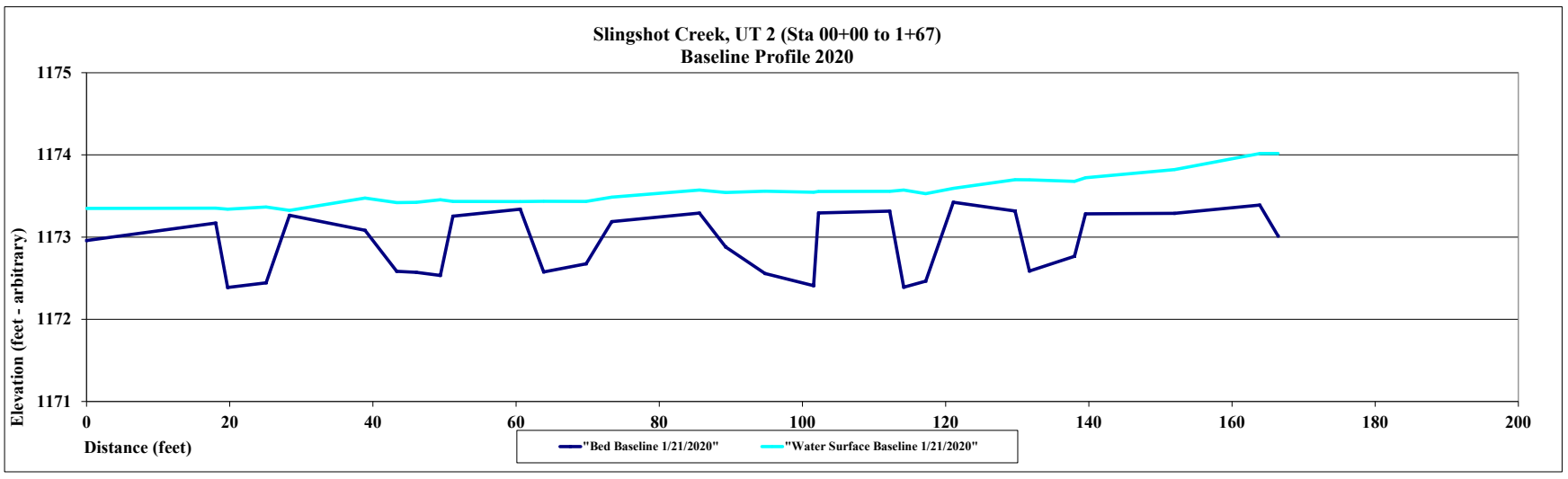


NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN ASHLEY RUDOLPH

Project Name	Slingshot Creek - Baseline (2020) Profile
Reach	UT 2 (Sta 00+00 to 01+67)
Feature	Profile
Date	1/21/20
Crew	Perkinson, Keith

Station	2020 Baseline Survey Bed Elevation	Water Elevation	Station	As needed Bed Elevation	Water Elevation	Station	As needed Bed Elevation	Water Elevation	Station	As needed Bed Elevation	Water Elevation
0.00	1172.96	1173.35									
18.05	1173.17	1173.35									
19.71	1172.39	1173.34									
25.08	1172.44	1173.37									
28.36	1173.27	1173.32									
38.89	1173.08	1173.47									
43.33	1172.58	1173.42									
46.08	1172.57	1173.42									
49.43	1172.53	1173.45									
51.17	1173.25	1173.43									
60.58	1173.34	1173.43									
63.85	1172.58	1173.44									
69.78	1172.68	1173.43									
73.36	1173.19	1173.49									
85.60	1173.29	1173.57									
89.27	1172.88	1173.54									
94.77	1172.56	1173.56									
101.57	1172.41	1173.55									
102.24	1173.29	1173.56									
112.19	1173.32	1173.56									
114.14	1172.39	1173.57									
117.22	1172.46	1173.53									
121.06	1173.42	1173.59									
129.69	1173.32	1173.70									
131.70	1172.59	1173.70									
137.99	1172.77	1173.68									
139.54	1173.28	1173.72									
151.97	1173.29	1173.82									
163.88	1173.39	1174.02									
166.44	1173.01	1174.02									

	Baseline	As needed		
Avg. Water Surface Slope	0.0040			
Riffle Length	13			
Avg. Riffle Slope	0.0076			
Pool Length	7			

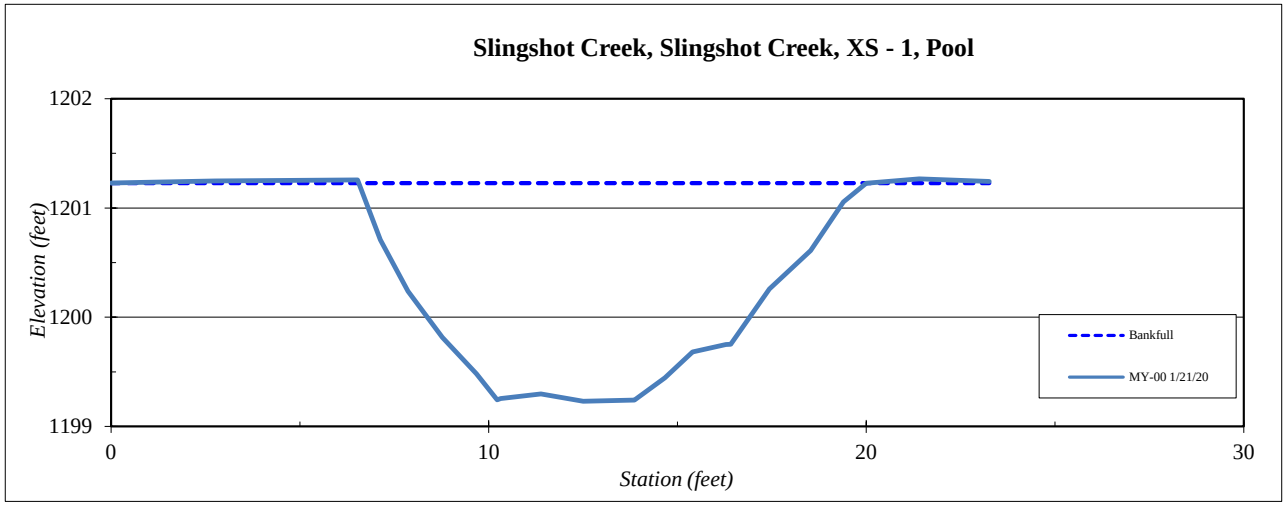


Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	Slingshot Creek, XS - 1, Pool
Feature	Pool
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1201.2
2.8	1201.2
6.5	1201.3
7.1	1200.7
7.9	1200.2
8.8	1199.8
9.7	1199.5
10.2	1199.2
10.3	1199.3
11.4	1199.3
12.5	1199.2
13.9	1199.2
14.7	1199.4
15.4	1199.7
16.3	1199.7
16.4	1199.8
17.4	1200.3
18.5	1200.6
19.4	1201.1
20.0	1201.2
21.4	1201.3
23.3	1201.2

SUMMARY DATA	
Bankfull Elevation:	1201.2
Bankfull Cross-Sectional Area:	18.2
Bankfull Width:	13.4
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.0
Low Bank Height:	2.0
Mean Depth at Bankfull:	1.4
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E/C 3/4

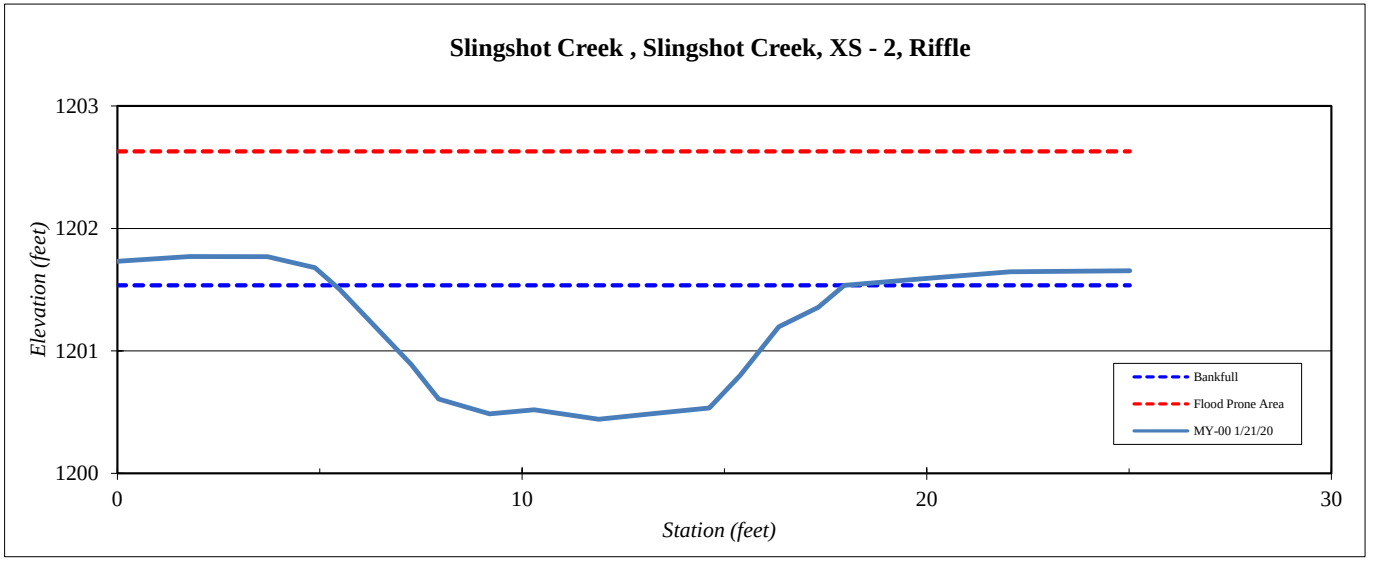


Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	Slingshot Creek, XS -2, Riffle
Feature	Riffle
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1201.5
1.8	1201.6
3.7	1201.6
4.9	1201.5
5.5	1201.3
7.3	1200.6
7.9	1200.2
9.2	1200.1
10.3	1200.2
11.9	1200.1
13.2	1200.1
14.6	1200.2
15.4	1200.5
16.3	1200.9
17.3	1201.1
18.0	1201.3
19.8	1201.4
22.1	1201.4
25.0	1201.4

SUMMARY DATA	
Bankfull Elevation:	1201.3
Bankfull Cross-Sectional Area:	10.8
Bankfull Width:	12.6
Flood Prone Area Elevation:	1202.5
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.2
Low Bank Height:	1.2
Mean Depth at Bankfull:	0.9
W / D Ratio:	14.7
Entrenchment Ratio:	7.9
Bank Height Ratio:	1.0

Stream Type	E/C 3/4

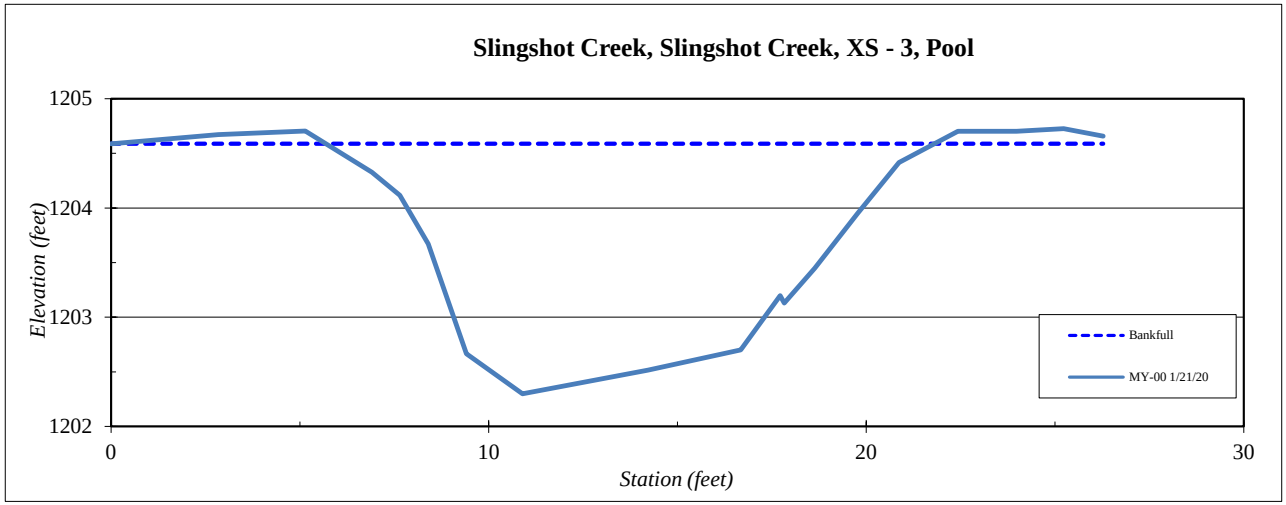


Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	Slingshot Creek, XS - 3, Pool
Feature	Pool
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1204.6
2.8	1204.7
5.1	1204.7
6.9	1204.3
7.6	1204.1
8.4	1203.7
9.4	1202.7
10.9	1202.3
14.2	1202.5
16.7	1202.7
17.7	1203.2
17.8	1203.1
18.6	1203.4
19.8	1204.0
20.9	1204.4
22.4	1204.7
24.0	1204.7
25.2	1204.7
26.3	1204.7

SUMMARY DATA	
Bankfull Elevation:	1204.6
Bankfull Cross-Sectional Area:	22.1
Bankfull Width:	16.1
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.3
Low Bank Height:	2.3
Mean Depth at Bankfull:	1.4
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E/C 3/4



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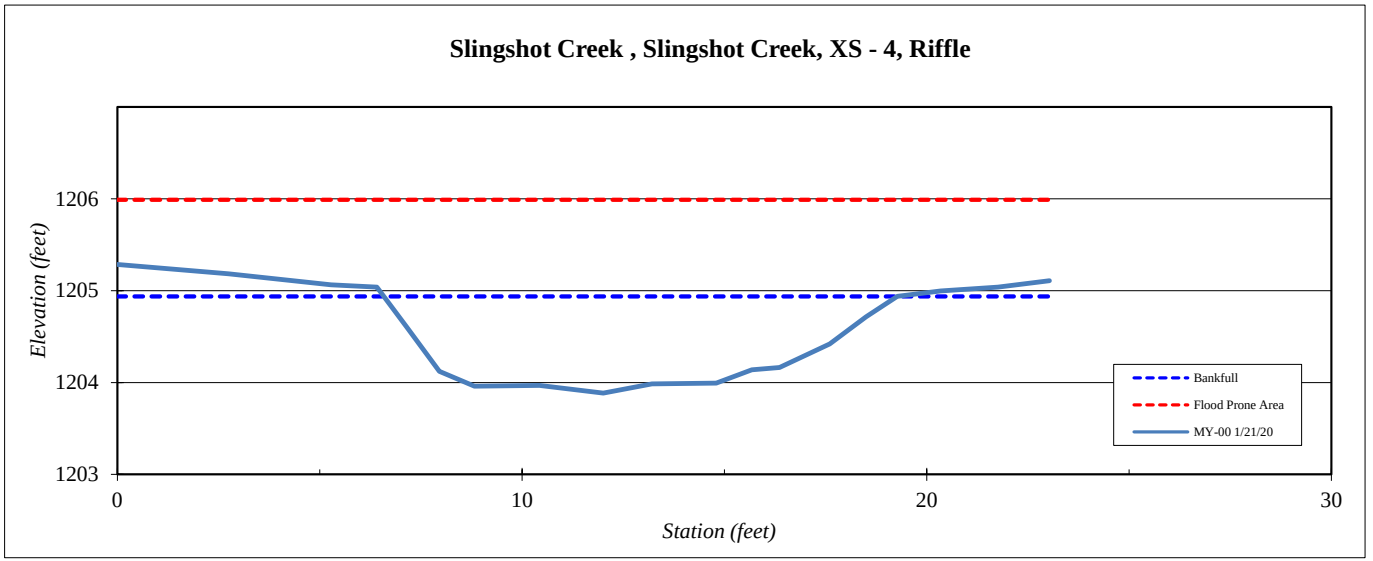
Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	Slingshot Creek, XS - 4, Riffle
Feature	Riffle
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1205.5
2.7	1205.4
5.3	1205.3
6.4	1205.3
7.2	1204.8
8.0	1204.2
8.8	1204.0
10.4	1204.1
12.0	1204.0
13.2	1204.1
14.8	1204.1
15.7	1204.2
16.4	1204.3
17.6	1204.6
18.5	1204.9
19.3	1205.1
20.3	1205.2
21.8	1205.3
23.0	1205.3

SUMMARY DATA	
Bankfull Elevation:	1205.1
Bankfull Cross-Sectional Area:	11.0
Bankfull Width:	12.7
Flood Prone Area Elevation:	1206.3
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.2
Low Bank Height:	1.2
Mean Depth at Bankfull:	0.9
W / D Ratio:	14.7
Entrenchment Ratio:	7.9
Bank Height Ratio:	1.0

Stream Type	E/C 3/4



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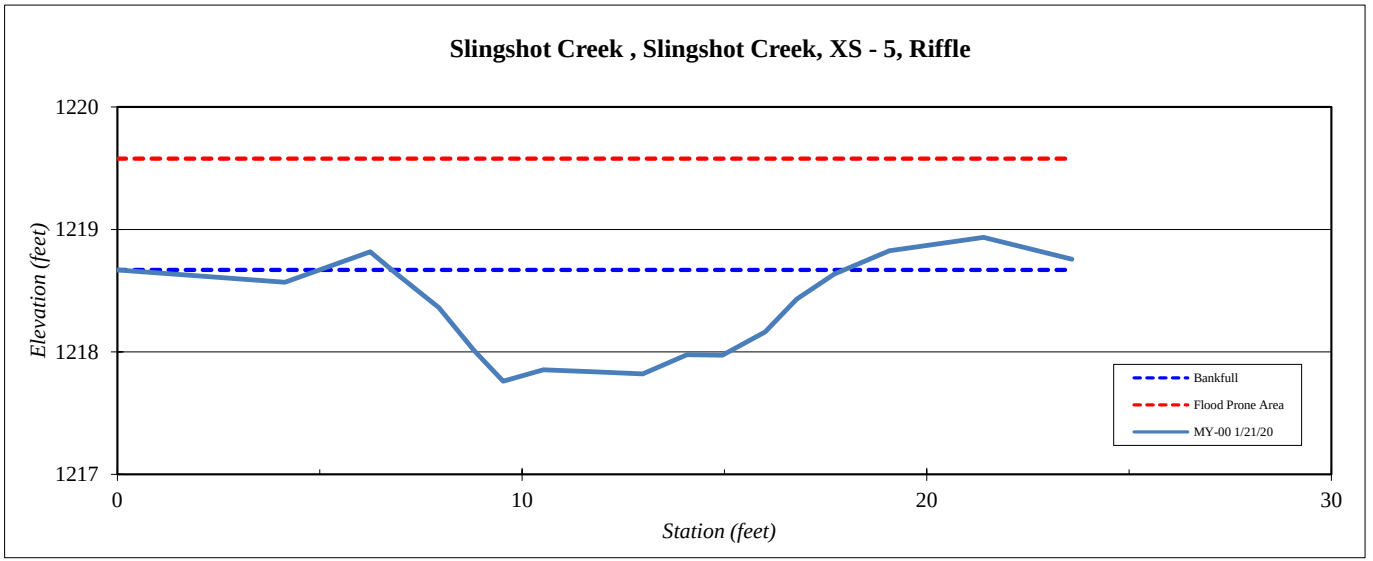
Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	Slingshot Creek, XS -5, Riffle
Feature	Riffle
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1218.4
4.1	1218.3
6.2	1218.6
6.9	1218.4
7.9	1218.1
8.8	1217.7
9.5	1217.4
10.5	1217.5
11.8	1217.5
13.0	1217.5
14.1	1217.6
15.0	1217.6
16.0	1217.8
16.8	1218.1
17.7	1218.4
19.1	1218.6
21.4	1218.7
23.6	1218.5

SUMMARY DATA	
Bankfull Elevation:	1218.4
Bankfull Cross-Sectional Area:	7.4
Bankfull Width:	11.2
Flood Prone Area Elevation:	1219.4
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.0
Low Bank Height:	1.0
Mean Depth at Bankfull:	0.7
W / D Ratio:	16.8
Entrenchment Ratio:	9.0
Bank Height Ratio:	1.0

Stream Type	E/C 3/4

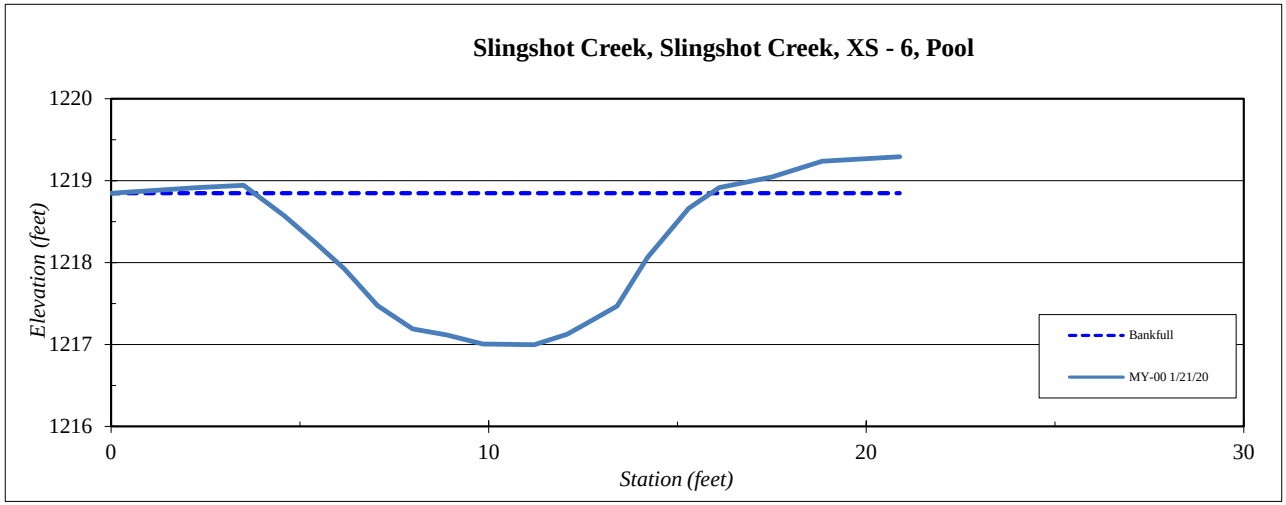


Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	Slingshot Creek, XS - 6, Pool
Feature	Pool
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1218.8
2.3	1218.9
3.5	1218.9
4.6	1218.6
5.4	1218.2
6.2	1217.9
7.1	1217.5
8.0	1217.2
8.9	1217.1
9.8	1217.0
11.2	1217.0
12.1	1217.1
12.6	1217.3
13.4	1217.5
14.2	1218.1
15.3	1218.7
16.1	1218.9
17.5	1219.0
18.8	1219.2
20.9	1219.3

SUMMARY DATA	
Bankfull Elevation:	1218.8
Bankfull Cross-Sectional Area:	14.3
Bankfull Width:	12.1
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.8
Low Bank Height:	1.8
Mean Depth at Bankfull:	1.2
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E/C 3/4

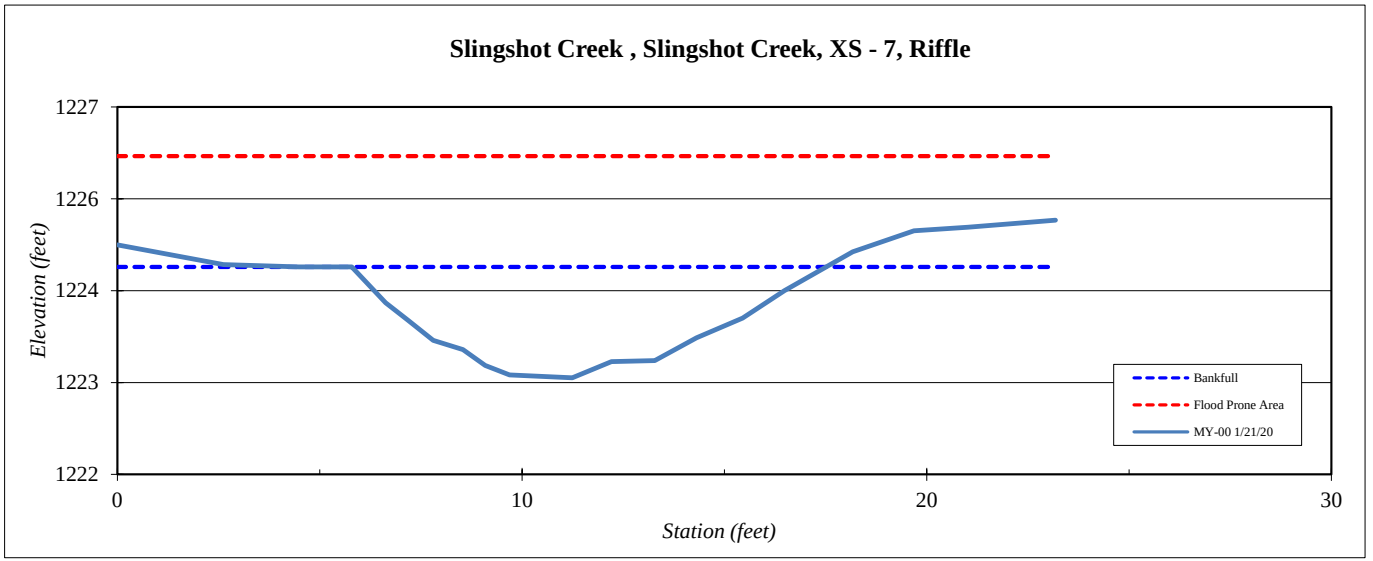


Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	Slingshot Creek, XS -7, Riffle
Feature	Riffle
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1225.0
2.6	1224.8
4.5	1224.7
5.8	1224.7
6.6	1224.3
7.2	1224.1
7.8	1223.8
8.5	1223.7
9.1	1223.5
9.7	1223.4
11.2	1223.4
12.2	1223.6
13.3	1223.6
14.3	1223.9
15.5	1224.1
16.5	1224.4
18.2	1224.9
19.7	1225.2
21.0	1225.2
23.2	1225.3

SUMMARY DATA	
Bankfull Elevation:	1224.7
Bankfull Cross-Sectional Area:	10.1
Bankfull Width:	11.7
Flood Prone Area Elevation:	1226.1
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.4
Low Bank Height:	1.4
Mean Depth at Bankfull:	0.9
W / D Ratio:	13.5
Entrenchment Ratio:	8.5
Bank Height Ratio:	1.0

Stream Type	E/C 3/4



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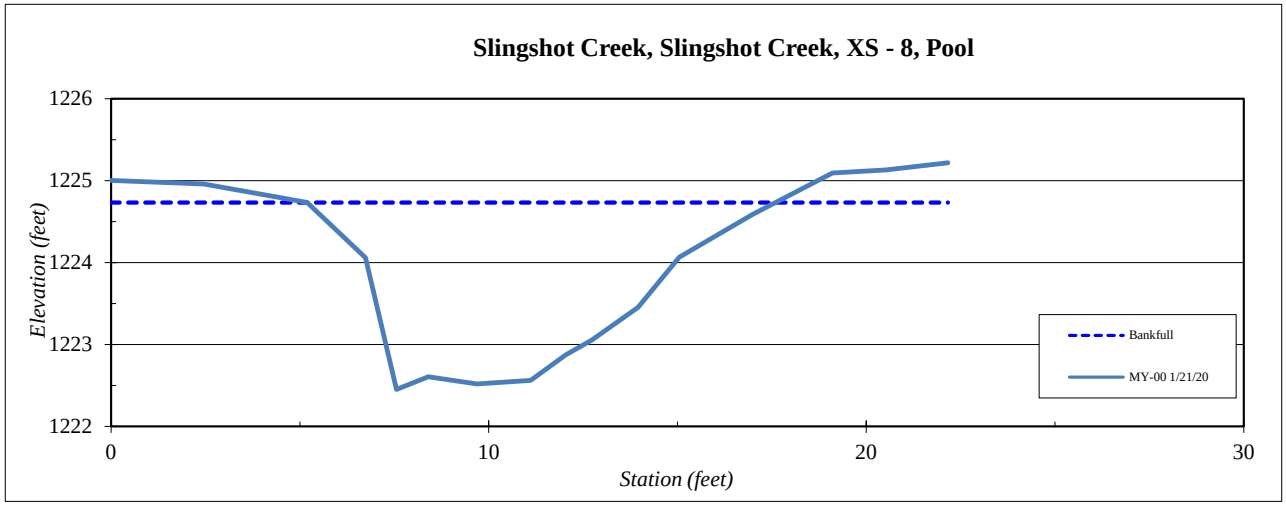
Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	Slingshot Creek, XS - 8, Pool
Feature	Pool
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1225.0
2.5	1225.0
5.2	1224.7
6.1	1224.3
6.7	1224.1
7.6	1222.5
8.4	1222.6
9.7	1222.5
11.1	1222.6
12.0	1222.9
12.7	1223.1
14.0	1223.5
15.0	1224.1
17.0	1224.6
19.1	1225.1
20.5	1225.1
22.2	1225.2

SUMMARY DATA	
Bankfull Elevation:	1224.7
Bankfull Cross-Sectional Area:	16.3
Bankfull Width:	12.4
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.3
Low Bank Height:	2.3
Mean Depth at Bankfull:	1.3
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E/C 3/4



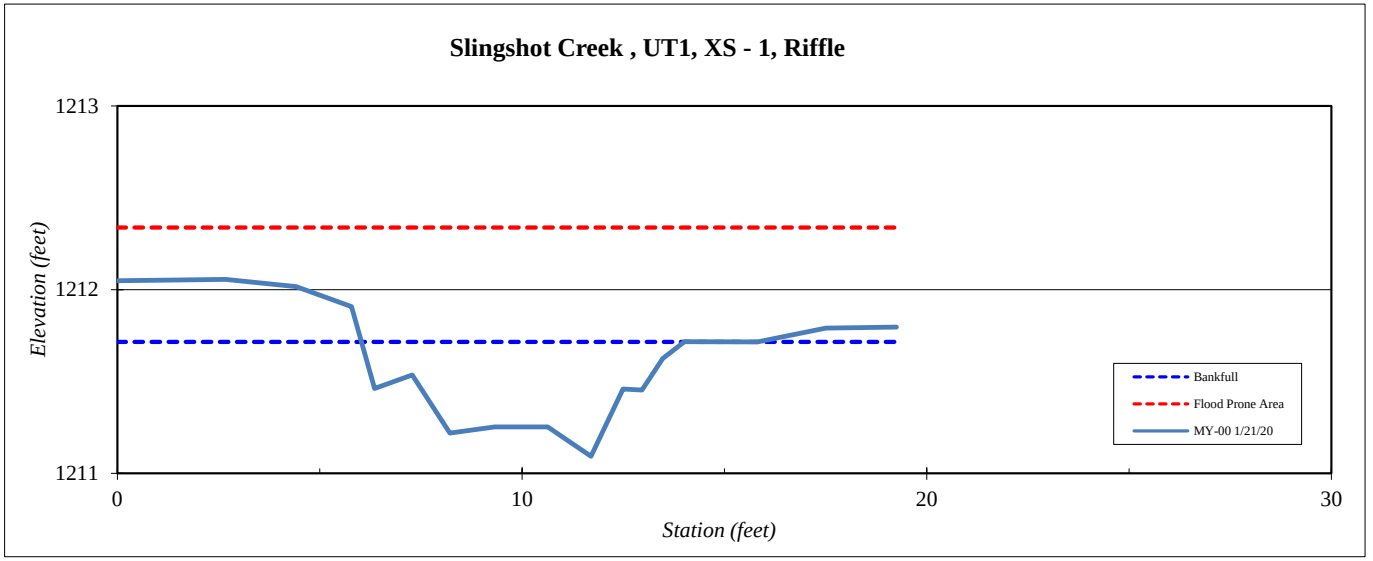
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN ASHLEY RUDOLPH

Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	UT1, XS -1, Riffle
Feature	Riffle
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1212.1
2.7	1212.1
4.4	1212.0
5.8	1211.9
6.4	1211.4
7.3	1211.5
8.2	1211.1
9.3	1211.2
10.6	1211.2
11.7	1211.0
12.5	1211.4
13.0	1211.4
13.5	1211.6
14.0	1211.7
15.8	1211.7
17.5	1211.8
19.3	1211.8

SUMMARY DATA	
Bankfull Elevation:	1211.7
Bankfull Cross-Sectional Area:	3.2
Bankfull Width:	8.0
Flood Prone Area Elevation:	1212.4
Flood Prone Width:	100.0
Max Depth at Bankfull:	0.7
Low Bank Height:	0.7
Mean Depth at Bankfull:	0.4
W / D Ratio:	19.7
Entrenchment Ratio:	12.5
Bank Height Ratio:	1.0

Stream Type	E/C 3/4



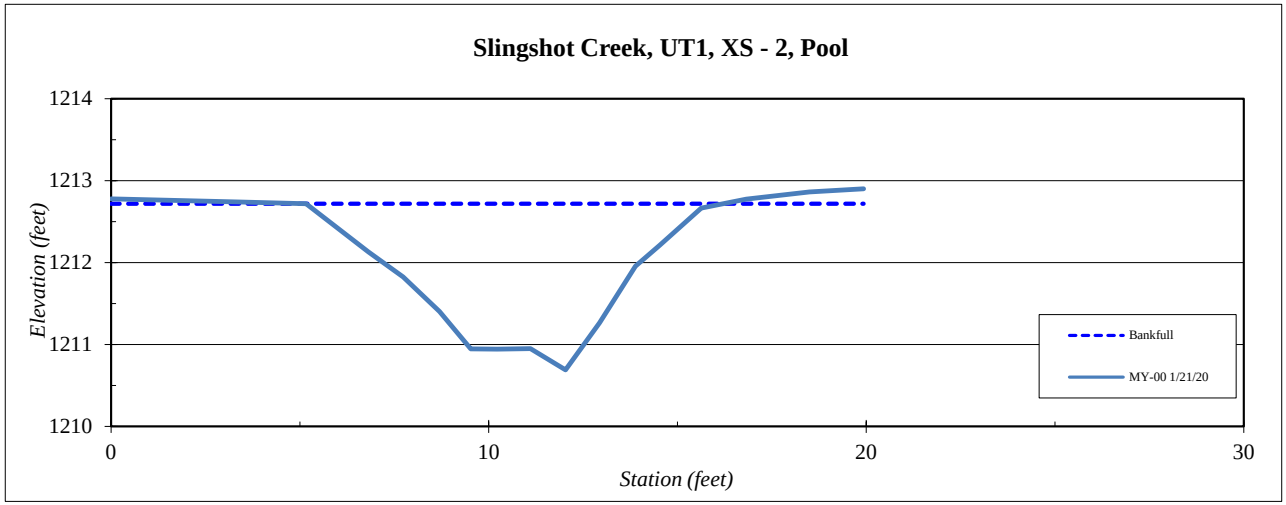
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN ASHLEY RUDOLPH

Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	UT1, XS - 2, Pool
Feature	Pool
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1212.8
3.3	1212.7
5.2	1212.7
6.8	1212.1
7.7	1211.8
8.7	1211.4
9.5	1210.9
10.2	1210.9
11.1	1211.0
12.0	1210.7
12.9	1211.3
13.9	1212.0
14.5	1212.2
15.6	1212.7
16.8	1212.8
18.5	1212.9
19.9	1212.9

SUMMARY DATA	
Bankfull Elevation:	1212.7
Bankfull Cross-Sectional Area:	11.4
Bankfull Width:	11.0
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.0
Low Bank Height:	2.0
Mean Depth at Bankfull:	1.0
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E/C 3/4

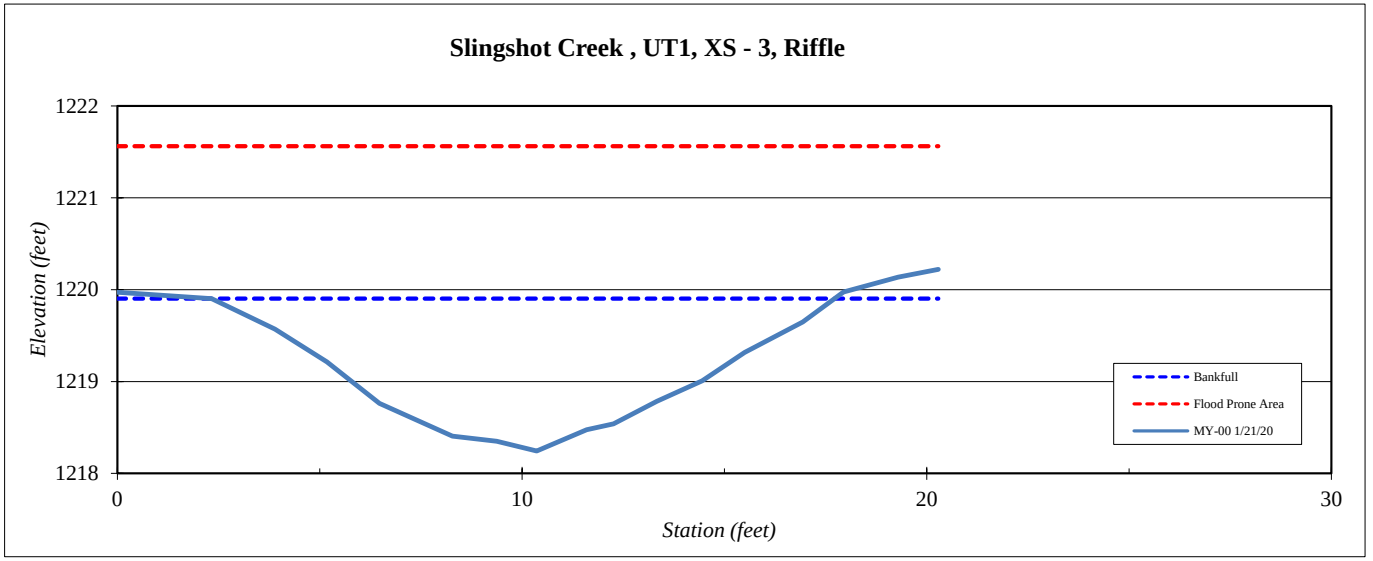


Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	UT1, XS -3, Riffle
Feature	Riffle
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1219.9
2.3	1219.8
3.9	1219.4
5.2	1219.0
6.5	1218.5
8.3	1218.1
9.4	1218.0
10.4	1217.9
11.6	1218.2
12.3	1218.3
13.3	1218.5
14.4	1218.8
15.5	1219.1
16.9	1219.5
17.9	1219.9
19.3	1220.1
20.3	1220.2

SUMMARY DATA	
Bankfull Elevation:	1219.8
Bankfull Cross-Sectional Area:	16.4
Bankfull Width:	15.4
Flood Prone Area Elevation:	1221.7
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.9
Low Bank Height:	1.9
Mean Depth at Bankfull:	1.1
W / D Ratio:	14.4
Entrenchment Ratio:	6.5
Bank Height Ratio:	1.0

Stream Type	E/C 3/4

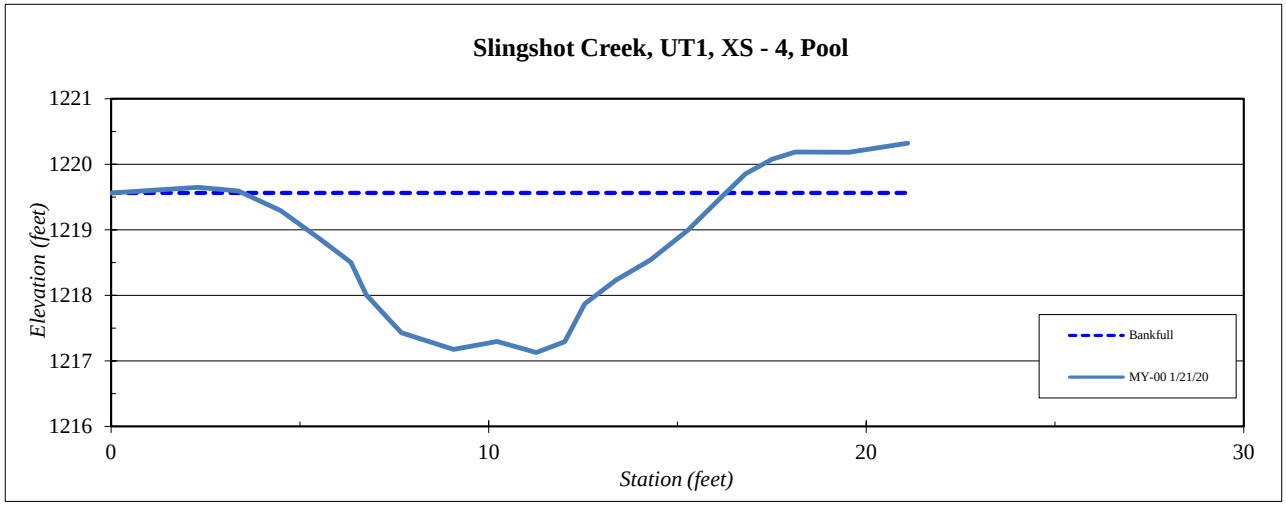


Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	UT1, XS - 4, Pool
Feature	Pool
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1219.6
2.3	1219.6
3.4	1219.6
4.5	1219.3
5.5	1218.9
6.3	1218.5
6.8	1218.0
7.7	1217.4
9.1	1217.2
10.2	1217.3
11.3	1217.1
12.0	1217.3
12.5	1217.9
13.4	1218.2
14.3	1218.5
15.3	1219.0
16.2	1219.5
16.8	1219.9
17.5	1220.1
18.1	1220.2
19.5	1220.2
21.1	1220.3

SUMMARY DATA	
Bankfull Elevation:	1219.6
Bankfull Cross-Sectional Area:	18.1
Bankfull Width:	12.8
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.4
Low Bank Height:	2.4
Mean Depth at Bankfull:	1.4
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E/C 3/4

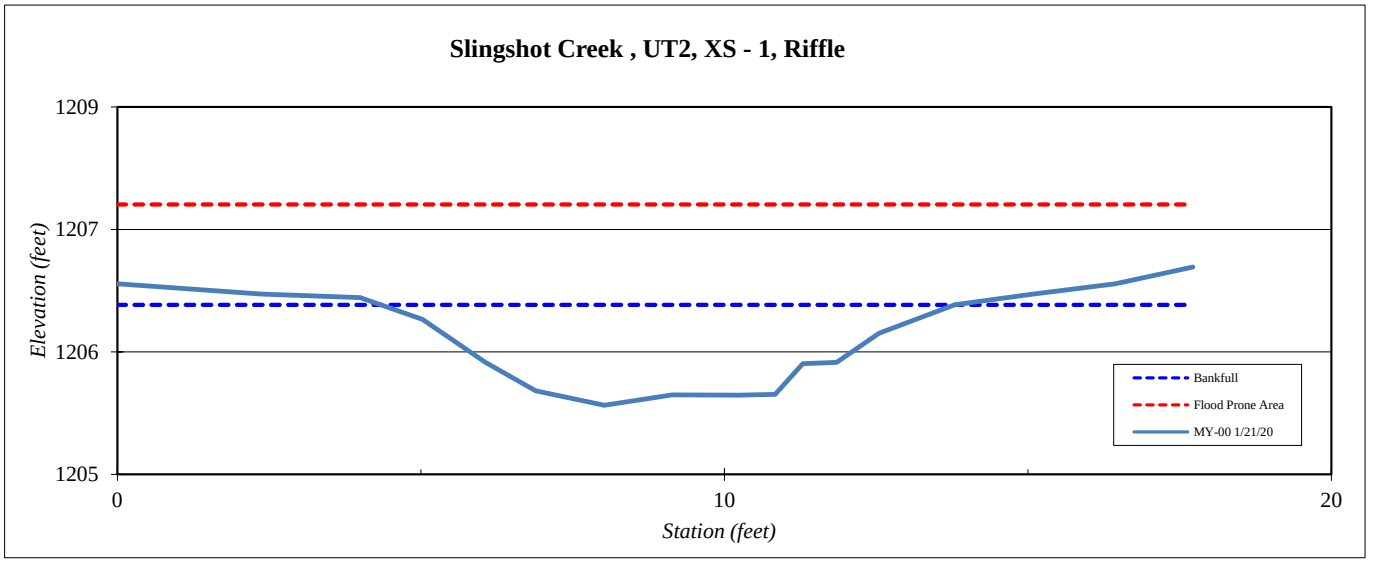


Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	UT2, XS -1, Riffle
Feature	Riffle
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1207.0
2.4	1206.9
4.0	1206.8
5.0	1206.6
6.1	1206.3
6.9	1206.0
8.0	1205.9
9.1	1206.0
10.2	1205.9
10.8	1206.0
11.3	1206.2
11.9	1206.3
12.5	1206.5
13.8	1206.8
15.1	1206.9
16.4	1207.0
17.7	1207.1

SUMMARY DATA	
Bankfull Elevation:	1206.8
Bankfull Cross-Sectional Area:	5.4
Bankfull Width:	9.5
Flood Prone Area Elevation:	1207.7
Flood Prone Width:	100.0
Max Depth at Bankfull:	0.9
Low Bank Height:	0.9
Mean Depth at Bankfull:	0.6
W / D Ratio:	16.7
Entrenchment Ratio:	10.6
Bank Height Ratio:	1.0

Stream Type	E/C 3/4



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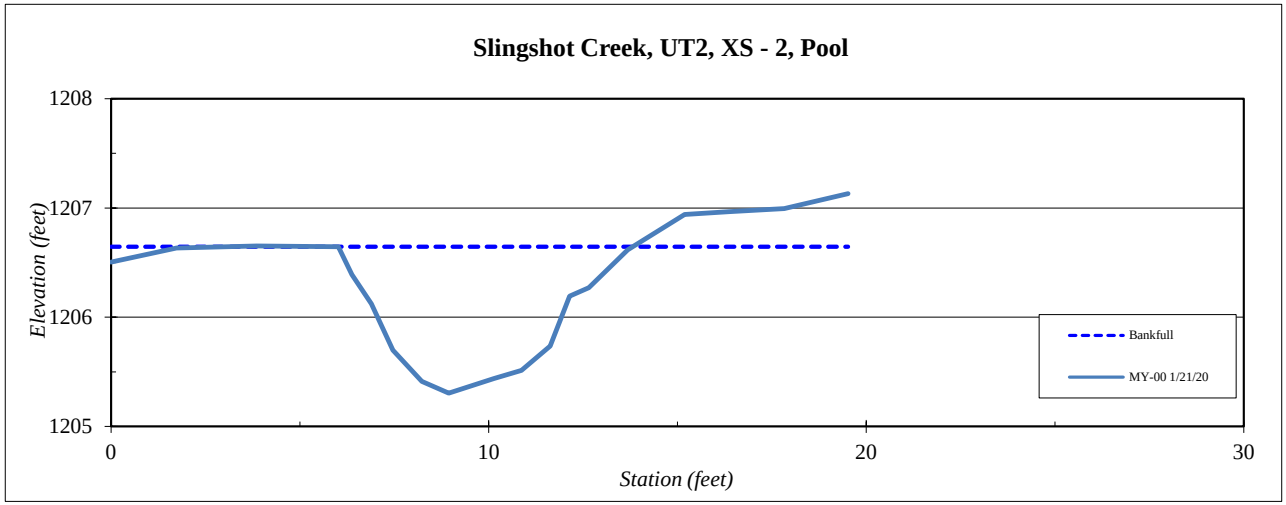
Site	Slingshot Creek
Watershed:	Cape Fear, 03030002
XS ID	UT2, XS - 2, Pool
Feature	Pool
Date:	4/28/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1206.5
1.7	1206.6
3.9	1206.7
6.0	1206.6
6.4	1206.4
6.9	1206.1
7.5	1205.7
8.2	1205.4
8.9	1205.3
10.1	1205.4
10.9	1205.5
11.6	1205.7
12.1	1206.2
12.7	1206.3
13.7	1206.6
15.2	1206.9
16.4	1207.0
17.8	1207.0
19.5	1207.1

SUMMARY DATA	
Bankfull Elevation:	1206.6
Bankfull Cross-Sectional Area:	6.3
Bankfull Width:	7.8
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.3
Low Bank Height:	1.3
Mean Depth at Bankfull:	0.8
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E/C 3/4



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