



PHASE I MONITORING YEAR 0 ANNUAL REPORT

June, 2022

MILLSTONE CREEK MITIGATION SITE

Randolph County, NC
Cape Fear River Basin
HUC 03030003

DMS Project No. # 204
NCDEQ Contract No. 6741
USACE Action ID No. 2018-01788
DWR Project No. 16-1200
Data Collection Dates: August 2021 – January 2022

PREPARED FOR:



**NC Department of Environmental Quality
Division of Mitigation Services**
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EXECUTIVE SUMMARY

NC State University (NCSU) developed the design and mitigation plan and administered the construction for Phase I of a design-bid-build for the Millstone Creek Mitigation Site (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS). Phase I of the project restored a total of 1,489 linear feet and enhanced 1,462 feet of perennial streams in Randolph County, NC. The Site will generate 3,151.91 stream credits with an additional 31.62 potential stream credits pending validation of proposed water quality improvements. The work was completed in two phases in order to accommodate a paired watershed study to evaluate the effectiveness of Regenerative Stormwater Conveyance for removing nutrients and sediment in both storm flow and baseflow. The Site is located approximately 3 miles southeast of the Town of Ramseur off Highway 22 in the Cape Fear River Basin 8-Digit Hydrologic Unit Code (HUC) 03030003 in the Piedmont region. The Site is located on a family farm with cattle pasture that is sprayed with waste from a hog operation. The Site is located in the Cape Fear River Basin HUC 03030003020030 and NC Division of Water Resources (DWR) Subbasin 03-06-09. The project involves the restoration and enhancement of Millstone Creek and two unnamed tributaries to Millstone Creek. The downstream drainage area of the Site is 8.3 square miles. The 18.80 acre Site is protected with a permanent conservation easement.

The project goals established in the Mitigation Plan (NCSU 2020) were completed with careful consideration of the stream morphology, stability, macroinvertebrate and water quality data collected at the site. The project goals include:

- Enhance processing of nutrients from onsite sources.
- Improve stream channel stability.
- Improve instream habitat.
- Restore native riparian vegetation.
- Permanently protect site resources from local disturbance including livestock

Phase I of construction was completed in September of 2021, as-built surveys were completed in August - September 2021, and planting was completed in December 2021. Monitoring Year 0 (MY0) assessments and site visits were completed between September 2021 and January 2022. Monitoring stations were installed as proposed in the Mitigation Plan with minor modifications in location. All streams restored during Phase I are stable and functioning as designed. Hydrologic data will be collected and reported during MY1.

MILLSTONE CREEK MITIGATION SITE
Monitoring Year 0 Annual Report

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Section 1: PROJECT OVERVIEW

The Millstone Mitigation Site (Site) is located in Randolph County, approximately 3 miles southeast of the Town of Ramseur off Highway 22. The Site is on a livestock farm in the Piedmont region. The Site is within Hydrologic Unit Code (HUC) 03030003020030, Subbasin 03-06-09. The watershed area for the Site is 8.3 square miles and contains primarily agricultural and wooded land. The project is being implemented in two phases. Grading and site work for Phase I were completed in September of 2021. Phase II is slated to go to construction before the end of 2022. Phase II results will be provided later as an addendum to this report.

1.1 Project Quantities and Credits

The Site is located on two parcels and a conservation easement was recorded on 18.80 acres. Mitigation work proposed within the Site included restoration and enhancement I of 3,576 linear feet of perennial stream channels and hydrologic enhancement to an existing 1.323 acre jurisdictional wetland. Phase I has completed the restoration and enhancement of 2,951 linear feet of channel. When complete Phase II is expected to provide restoration of an additional 623 linear feet of perennial stream. The project is also expected to provide 3,151.91 stream credits plus an additional 31.62 potential credits (2%) for WQ uplift by closeout, including the future work to be completed for Phase II. (Note: The mitigation plan indicates an additional 26.22 for the WQ uplift credit. The discrepancy is due to a math error.) Table 1 below provides additional detail regarding the restoration types, quantities, credit ratios and total credits.

Table 1: Project Quantities and Credits

Project Segment	Mitigation Plan Footage	As-Built Footage Phase I	Mitigation Category	Restoration Level	Mitigation Ratio (X:1)	Credits	WQ Monitoring (4%) *	WQ Reduction Std. Achieved (2%) **	Comments
NT R1	326	326	Warm	R	1:1	326.00	13.04	6.52	Step-pool system with Regenerative Stormwater Conveyance
NT R2	103	103	Warm	R	1:1	103.00	4.12	2.06	Bank grading, in-stream structures, WQ treatment on NT R1
UTA R1	523	Phase II	Warm	R	1:1	523.00	20.92	10.46	Step-pool system with Regenerative Stormwater Conveyance
UTA R2	100	Phase II	Warm	R	1:1	100.00	4.00	2.00	Bank grading, in-stream structures, invasive removal
UTB	529	523	Warm	R	1:1	529.00	21.16	10.58	Bank grading, in-stream structures, WQ treatment on NT R1
MC R1	1462	1462	Warm	E1	1.5:1	974.67	0.00	0.00	Bank grading, in-stream structures, bank treatments, planting
MC R2	533	537	Warm	R	1:1	533.00	0.00	0.00	Priority 2 approach. Appropriate bankfull channel dimensions, minor floodplain grading, in-stream structures, bank treatments, planting
Totals	3576	2951			Phase I	2465.67	38.32	31.62***	
					Phase II	3088.67	63.24		
Phase I: Standard + WQ Sampling					2465.67+38.32 =			2503.99	
Phase II: Standard + WQ Sampling + Reduction Achieved					3088.67+63.24+31.62=			3183.53	
Wetland 1	E	N/A		Enhancement	1.323 AC	2:1		0.662	Hydrological enhancement through filling ditch; no planting per IRT guidance

*The 4% is available upon installation of monitoring equipment.

**The 2% Reduction is not available until after Phase II has been completed and data has been collected and analyzed.

***Note the water quality credit differs from the 26.22 reported in the mitigation plan due to a math error.

Table 1 Continued

Restoration Level	Stream		
	Warm	Cool	Cold
Restoration Completed (Phase I)	1,529.32		
Restoration Proposed (Phase 2)	679.54		
Restoration Total	2,208.86		
Enhancement I (Phase I Completed)	974.67		
Total Stream Credit	3,183.53		

1.2 Project Goals and Objectives

The project is intended to provide numerous ecological benefits. Table 2 below describes expected outcomes to water quality and ecological processes and provides project goals and objectives.

Table 2: Goals, Performance Criteria, and Functional Improvements

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Enhance processing of nutrients from onsite sources.	Construct stream and wetland systems designed to process nitrogen and phosphorus.	Reduction in sediment and nutrient inputs and treatment. Improved water quality and aquatic habitat.	*20% decrease in TN concentrations on NT and UT A. 8% wetland hydrology standard applied	Supplemental water quality monitoring of discharge and TN concentrations downstream of NT R2 and UTA R2. Two groundwater gauges installed in wetland to document enhanced wetland hydrology.	To be reported in M1, M2 & MY3.
Improve stream channel stability.	Grade streambanks, Construct stream channels with appropriate bankfull channel dimensions, planform geometry and profile such that channel maintenance and adjustments are representative of other natural systems.	Decrease sediment inputs from channel and bank erosion. Efficiently transport sediment loads and stream flow.	Stable channels with BHR less than 1.2.	Monitoring & visual assessment of 8 cross sections.	No deviations from design. 8 cross sections have been installed and baseline survey completed
Improve instream habitat.	Install habitat features and structures, add LWD, increase bedform diversity, improve instream water quality.	Increase in available habitat for macroinvertebrates and fish leading to an increase in biodiversity.	There is no required performance standard for this metric.	Visual assessment and macroinvertebrate surveys conducted via Supplemental Monitoring.	Reported in MY3, MY5 & MY7.

Table 2 Continued

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Restore native riparian vegetation.	Plant native tree, understory and grass species in riparian zones, streambank and wetland areas.	Reduce sediment inputs from bank erosion. Increase nutrient processing, uptake and storage within the floodplain. Create riparian habitats. Add a source of LWD and organic material to stream.	In planted open areas, the survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7. Trees in each plot must average 7 feet in height by MY5 and 10 feet by MY7.	10 permanent and 4 mobile 100-square meter vegetation plots placed on 2% of the planted area of the Site and monitored annually. Shaded areas will be visually assessed.	10 permanent veg plots have been installed and surveyed. 4 mobile veg transects were also surveyed.
Permanently protect site resources from local disturbance including livestock	A conservation easement has been secured and recorded for the Site. A livestock exclusion fence and watering system has been installed with NC DMS funding.	Protection of the Site from encroachment into the conservation easement and direct impact to streams. Supports all functions including Hydrology (reach-scale), Hydraulic, Geomorphology, Physicochemical, and Biology.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.	No easement encroachments.

*This metric is assigned to 2% supplemental water quality credits only. Not meeting this metric will result in these credits not being realized; no credit loss will be assessed.

1.3 Project Attributes

The Site includes all reaches of an unnamed tributary of Millstone Creek located on the Cox Family Farm and 2,015 (existing) feet of Millstone Creek. The entire project easement is contained on two farm properties owned by 1) Joe Dean Cox and Billie White Cox, and 2) Victor Craig Staley, Anthony Todd Stout and Co-Trustees of the Magalene Staley Family Trust. The tributary reaches and their watershed are contained within the Cox property. The property is used for cattle grazing and application of spray waste from a confined hog operation. Prior to construction, land adjacent to the Site and within the established conservation easement have been heavily impacted by cattle grazing and the application of swine waste. Table 3 below and Table 8 in Appendix C present additional information on pre-restoration conditions.

Table 3: Project Attributes

PROJECT INFORMATION				
Project Name	Millstone Creek Mitigation Site	County	Randolph County	
Project Area (acres)	18.80	Project Coordinates	N35°41'48.06" W79°37'26.24"	
PROJECT WATERSHED SUMMARY INFORMATION				
Physiographic Province	Piedmont	River Basin	Cape Fear	
USGS HUC 8-digit	03030003	USGS HUC 14-digit	03040101070010	
DWR Sub-basin	03-06-09	Land Use Classification	48% pasture, 35% forested, 5% shrub, 7% grassland, 4% developed	
Project Drainage Area (sq. mi)	8.3	Percentage of Impervious Area	<1%	
RESTORATION TRIBUTARY SUMMARY INFORMATION				
Parameters	Millstone	NT	UTA	UTB
Pre-project length (feet)	1,995	429	623	529
Post-project (feet)	1,999	429	Phase II	523
Valley confinement	Unconfined	Confined	Confined	Confined
Drainage area (acres)	5312	25	26	56
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
DWR Water Quality Classification	C			
Dominant Stream Classification (existing)	E5 / C5	G5 / F5	F5	G5 / E5
Dominant Stream Classification (proposed)	C5	B5	B5	E5
Dominant Evolutionary class (Simon) if applicable	Stage IV	Stage III	Stage III	Stage III
REGULATORY CONSIDERATIONS				
Parameters	Applicable?	Resolved?	Supporting Documentation	
Water of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No. 27 and DWQ 401 Water Quality Certification No. 16-1200	
Water of the United States - Section 401	Yes	Yes		
Endangered Species Act	Yes	Yes	Categorical Exclusion in Mitigation Plan (NCSU, 2020)	
Historic Preservation Act	Yes	Yes		
Coastal Zone Management Act (CZMA or CAMA)	N/A	N/A	N/A	
Essential Fisheries Habitat	N/A	N/A	N/A	

Section 2: As-Built Condition (Baseline)

The Phase I Site construction and as-built surveys were completed in September of 2021, respectively. The survey included developing an as-built topographic surface; as well as, surveying the as-built channel centerlines, top of banks, structures, and cross-sections. Vegetation monitoring was conducted in January of 2022 because the planting of the Site was not completed until December of 2021.

The As-Built Plans show that streams were constructed as designed with only minor deviations. The difference between the design alignment length and the surveyed stream lengths are negligible as noted in the project quantities and credits table. The existing fence along the southern boundary of the easement was removed and replaced with new fencing to better secure the site from cattle access. In addition, several areas of existing healthy native vegetation were preserved. This vegetation became established following the installation of the conservation easement fencing and associated cattle exclusion in 2015. These areas were not planted, however, the quantities of planted trees and stems specified in the mitigation plan and construction documents were installed within the conversation easement for the Site.

2.1 As-Built/Record Drawings

A sealed half-size set of record drawings are in Appendix E which includes the post-construction survey, alignments, structures, and monitoring features. These include redlines for any significant field adjustments made during construction that differ from the design plans. Where needed, adjustments were made during construction based on field evaluations and are listed below.

2.1.1 Millstone Reach 1 (MCR1)

- Station 3+75 to 4+80 - The toe of slope was moved to match the bottom front edge of the Brush Toe;
- Entire Reach - All pool depths a 2 feet below (rather than 4 feet) the thalweg for the upstream point of curvature due to the presence of running sand; and
- Station 3+00 to 4+25 - The floodplain above the right bank is approximately 1 foot higher than the pre-construction existing condition. The difference could be the result of sediment deposition from overbank flooding that has occurred since the existing condition survey was collected.

2.1.2 Millstone Reach 2 (MCR2)

- Entire Reach - All pool depths a 2 feet below (rather than 4 feet) the thalweg for the upstream point of curvature due to the presence of running sand;
- Station 15+00 and 18+00 - Floodplain grading on the left bank was reduced to minimize removal of excess material being stockpiled outside of the easement area;
- Station 18+50 to 20+20 - Floodplain grading reduced to better transition flow at the end of the bankfull bench into the existing channel; and
- Station 12+00 - The floodplain above the right bank is approximately 1 foot higher than the pre-construction existing condition. The difference could be the result of sediment deposition from overbank flooding that has occurred since the existing condition survey was collected.

2.1.3 North Tributary Reach 1 (NTR1)

- Station 0+20 to 0+80 - The channel is shifted slightly to the east and the bankfull bench was eliminated on the right bank in order to avoid grading of the steep bank on the west side of the

channel. The floodplain bench was extended on the left bank to compensate for the loss of floodplain bench width on the right bank.

- Stations 0+95, 1+20, 1+43 and 2+50 - Boulder Step Structures are two feet south of their design location.
- Entire Reach - Boulders installed are larger than the specifications, and
- Stations 2+50 to 3+25 - The media extends 0.5 feet deeper than designed to compensate for 11.5 cubic yards of media not installed under the larger boulders.

2.1.4 North Tributary Reach 2 (NTR2)

- No deviations from design were noted.

2.1.5 Unnamed Tributary of Millstone Creek Reach A (UTA)

- This reach will be constructed as part of Phase II

2.1.6 Unnamed Tributary of Millstone Creek Reach B (UTB)

- Station 0+00 to 0+20 - Grading of the channel banks was eliminated because the existing banks were stable and the stream was not incised at this location.
- Station 3+75 to 5+00 - Channel grading was shifted 5 to 8 feet to the north to reduce grading into the steep slope.

2.1.7 Wetland

- A rock and log step structure was added to the outlet channel of the existing wetland to ensure that the transition between the graded areas and tie in on existing ditch off easement was stable and to protect the wetland from a future head cut that could migrate upstream from the ditch below.

Section 3: Monitoring Year 0 Data Assessment

Monitoring and site visits were conducted following construction in order to assess the condition of the project for the MY0 period of Phase I. The vegetation and stream success criteria for the Site follow the approved success criteria presented in the Mitigation Plan (NCSU, 2020). Performance criteria for vegetation, stream, and hydrologic assessment are located in Section 1.2 Table 3: Goals, Performance Criteria, and Functional Improvements.

3.1 Vegetative Assessment

The MY0 vegetative survey was completed in January 2022. Ten permanent plots and four mobile transects were assessed. Vegetation monitoring resulted in a stem density range of 486 to 769 planted stems per acre for 8 of the 10 permanent plots, which is well above the interim requirement of 320 stems per acre required at MY3. However, two of the permanent vegetation plots, plot 3 and 7, did not meet the criteria. Plot 7 is located in an existing jurisdictional wetland where no plants were installed per IRT instructions, so performance criteria are not relevant to this plot. Plot 7 is therefore intended to document natural recruitment. Vegetation Plot 3, is located on the boundary between the Millstone Creek Reach 1 enhancement work and the existing wooded area. Streambanks were graded in this section of the project and minimal disturbance occurred in this location. However, it does not appear that any woody plants were installed in this particular location. We propose that this vegetation plot be moved due to the current shaded location not being optimal for planting. The remaining vegetation plots met the interim success criteria and are on track to meet the final success criteria required for MY7. Refer to Appendix A for Vegetation Plot Photographs and the Vegetation Condition Assessment Table and Appendix B for Vegetation Plot Data.

3.2 Vegetation Areas of Concern

There are no vegetation cover concerns identified during the MY0 monitoring with the exception of a lack of grass cover on the floodplain for MCR2 beyond the right bank due to heavy storms that have dumped substantial fine sediment onto the floodplain. However, it is anticipated that this area will recover; DMS is observing this area for a period of one year.

3.3 Stream Assessment

Morphological surveys for MY0 were conducted in August and September of 2021. All streams within the Site are stable and functioning as designed. Bank height ratios are all equal to 1. Substrate measurements were not collected as per approval by the US ACE. This change was made due to the lack of native gravel and cobble in the streambed. Millstone Creek substrate is primarily sand, the NT RSC channel bed is quarry boulder steps and sand/mulch media and the UTB channel bed is predominantly logs and quarry rock riffles. Large Woody Debris counts were collected and compared to the pre-existing condition. Refer to Appendix A for the Visual Stream Morphology Stability Assessment Table and Stream Photographs. Refer to Appendix C for Stream Geomorphology Data.

3.4 Stream Areas of Concern

No stream areas of concern were identified during MY0.

3.5 Hydrology Assessment

Hydrologic data will be collected and reported during MY1.

3.6 Wetland Assessment

Wetland water levels will be monitored for seven years. No performance standard or reverification of the wetland extent are required.

3.7 Adaptive Management Plan

No adaptive management plans are needed at this time.

3.8 Monitoring Year 0 Summary

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

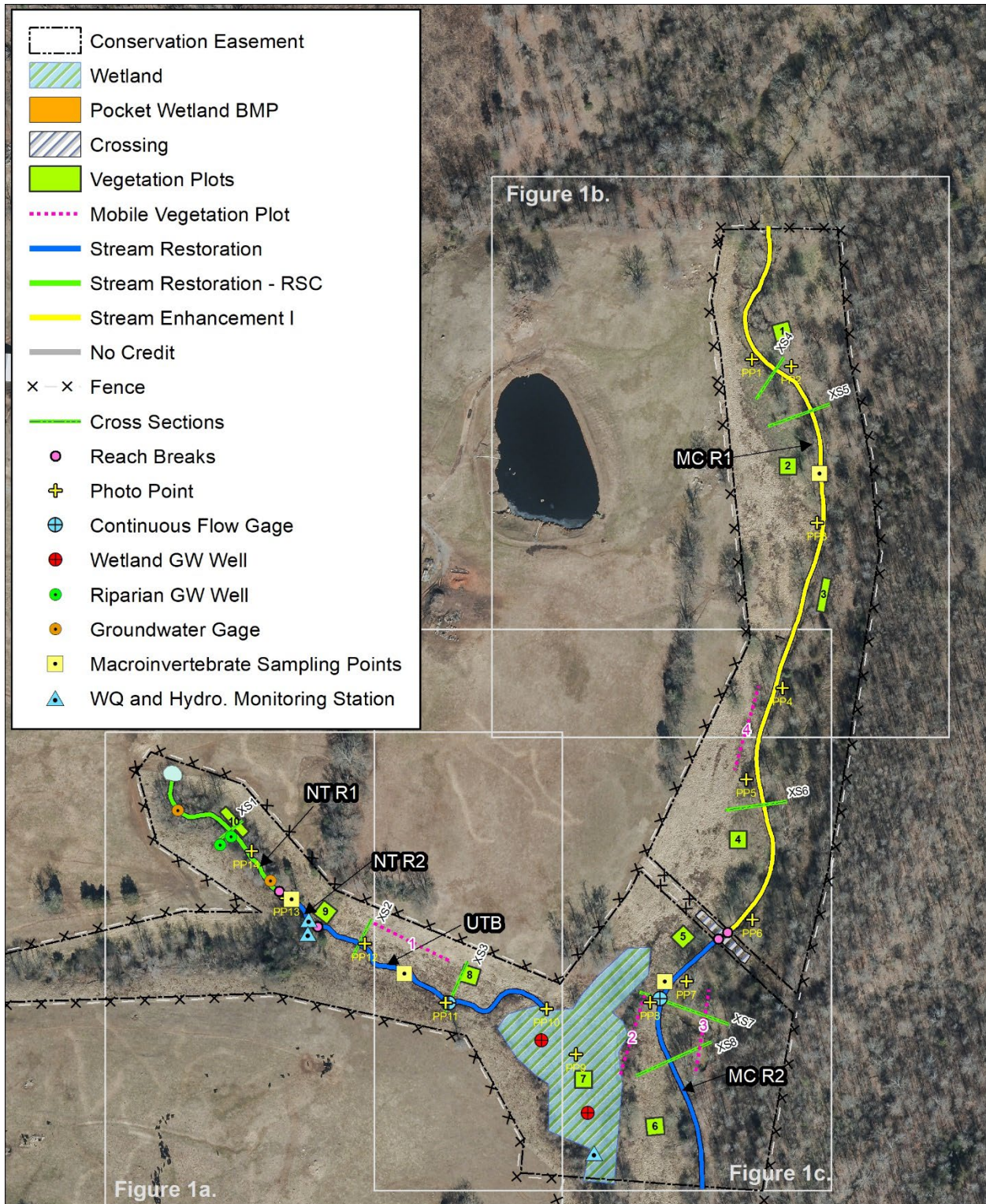
Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

Section 4: METHODOLOGY

Geomorphic data was collected following the standards outlined in *The Stream Channel Reference Site: An Illustrated Guide to Field Techniques* (Harrelson et al., 1994) and in *Stream Restoration: A Natural Channel Design Handbook* (Doll et al., 2003). All as-built field data was recorded from existing construction control using a Spectra Precision Focus 35 total station or with a Spectra Precision SP85 RTK/VRS sub-centimeter GPS unit operating on the NCGS VRS system. Field data was collected using TDS software platforms and was processed and drafted using Carlson Civil Suite 2020. Groundwater wells with water level loggers were installed in the streambed of NT R1 and NT R2 and a gauge with a pressure transducer was installed in both UTB and MC R2. Two sensor groundwater gauges were installed in the wetland. Monitoring was initiated on all installed equipment. Hydrologic monitoring instrument installation and monitoring methods are in accordance with the United States Army Corps of Engineers standards (USACE, 2003). Three continuous flow and water quality sampling stations for supplemental monitoring are established at the downstream end of NT R2 and UTA R2 and downstream of the wetland using a staff gage, integrated flowmeter, trapezoidal flume and an automated ISCO sampler. Stage discharge relationships were developed for all three flumes from field measurements of velocity using a Doppler-based probe. In addition, wells with pressure transducers were installed and monitoring initiated in the riparian areas of NT R1 and UTA R1 to record groundwater levels and measure water quality for the supplemental water quality monitoring. Vegetation monitoring protocols followed the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008). Large woody debris counts were conducted in accordance with protocols outlined by the U.S. Forest Service (USFS) General Technical Report *Monitoring Wilderness Stream Ecosystems* (Davis et al., 2001).

Section 5: REFERENCES

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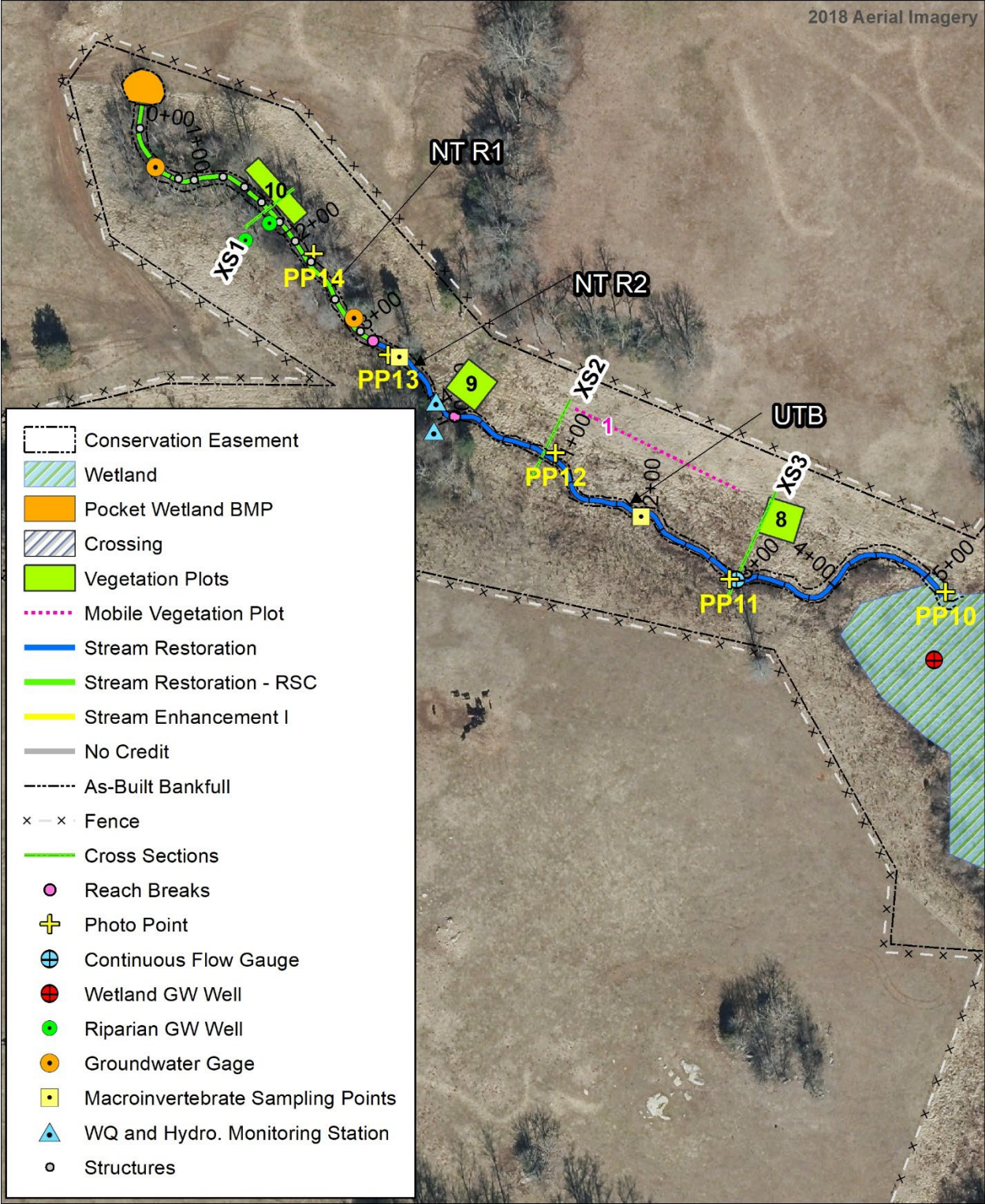


Figure 1a. Current Condition Plan View
Millstone Creek Mitigation Site
Cape Fear Basin 03030003
Monitoring Year 0 - 2021

Randolph County

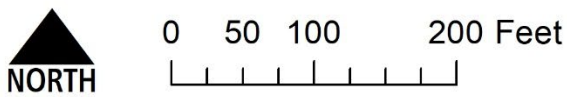
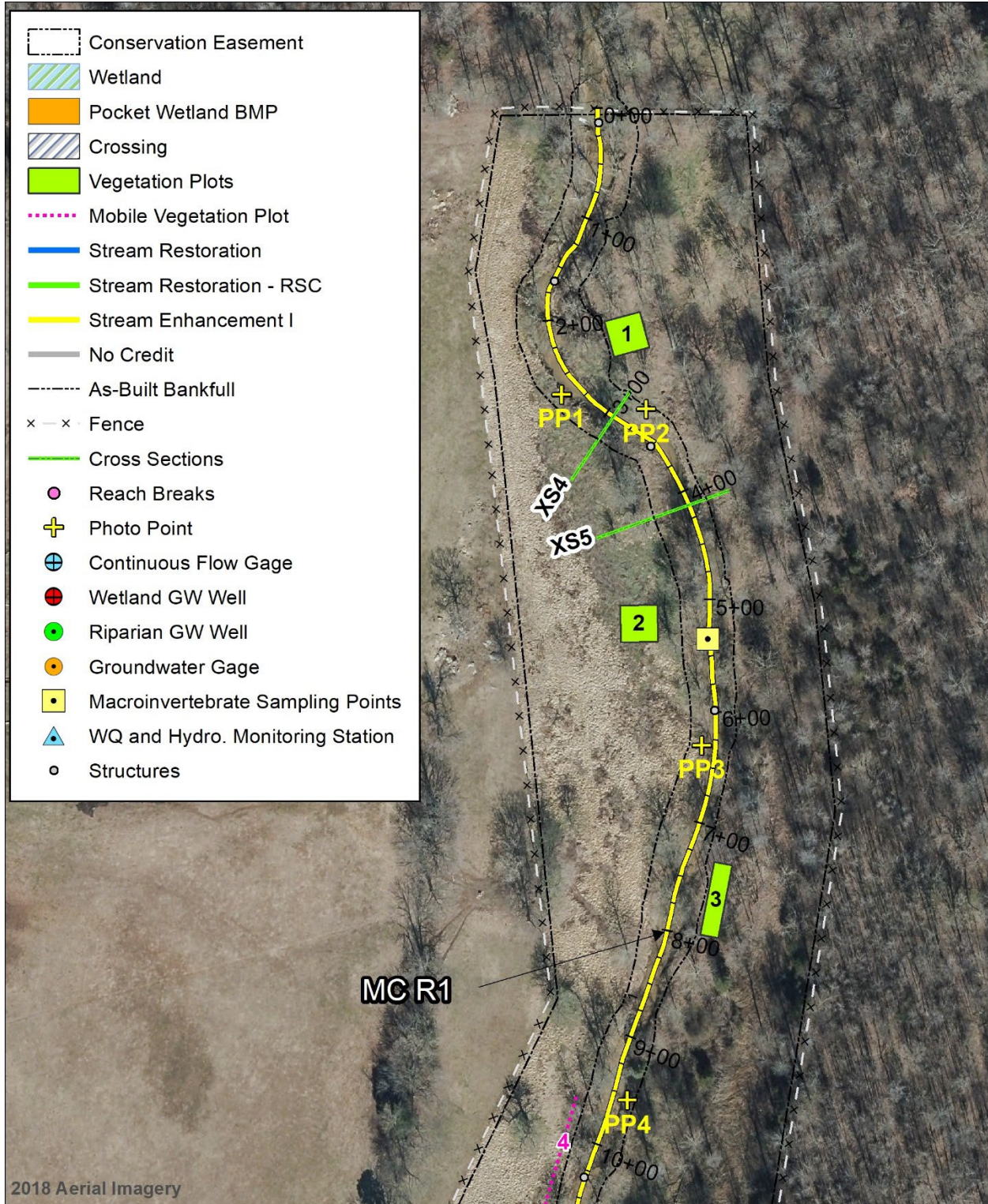


Figure 1b. Current Condition Plan View
 Millstone Creek Mitigation Site
 Cape Fear Basin 03030003
 Monitoring Year 0 - 2021

Randolph County

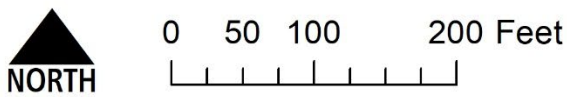
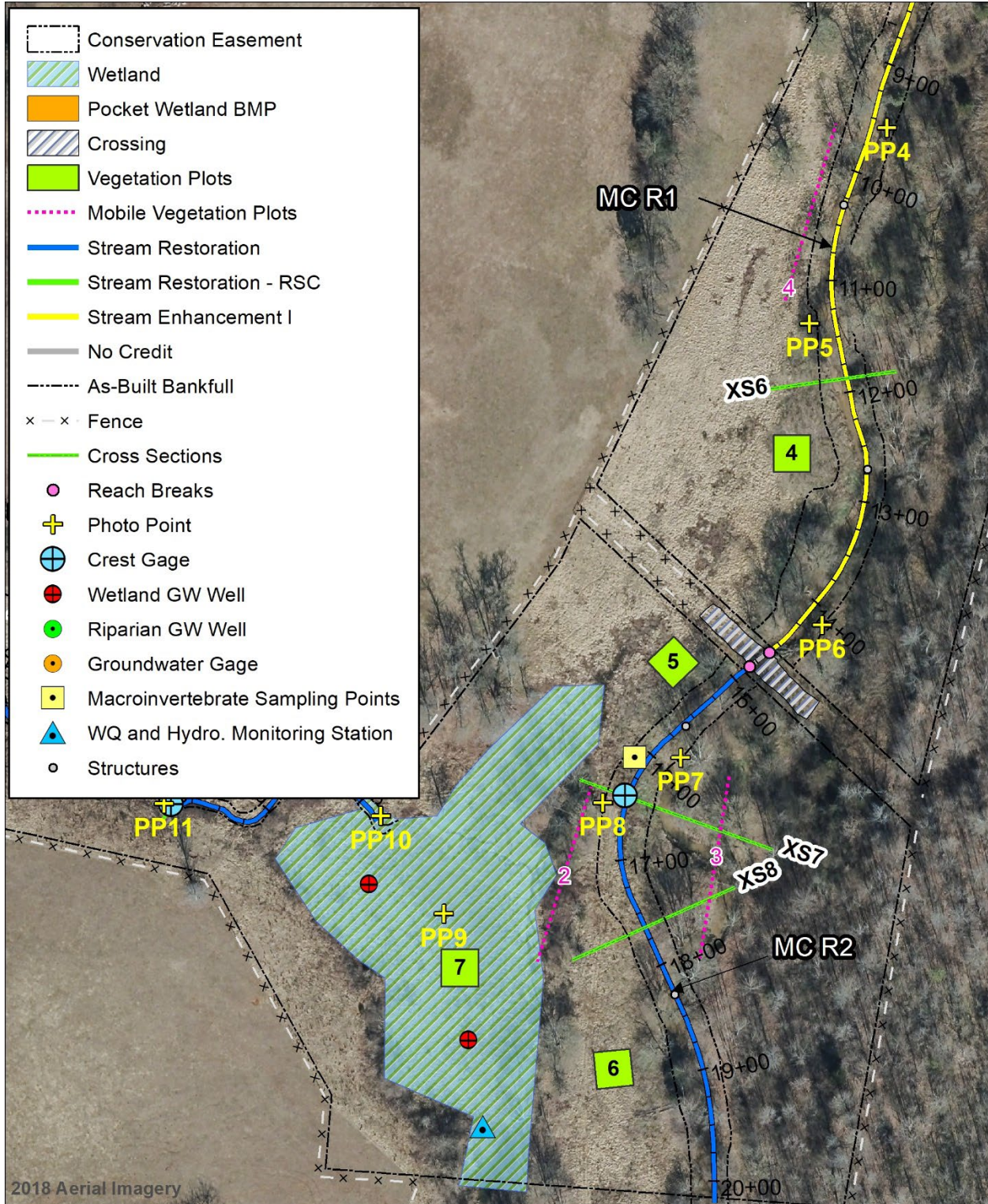


Figure 1c. Current Condition Plan View
 Millstone Creek Mitigation Site
 Cape Fear Basin 03030003
 Monitoring Year 0 - 2021

Randolph County

APPENDIX A - Visual Assessment Data

Table 4. Visual Stream Morphology Stability Assessment Table

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 – 2021

North Tributary Reach 1 (NTR1)

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Assessed Stream Length						326
Assessed Bank Length						652
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	14	14		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	14	14		100%

North Tributary Reach 2 (NTR2)

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Assessed Stream Length						103
Assessed Bank Length						206
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	4	4		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	4	4		100%

Table 4. Visual Stream Morphology Stability Assessment Table

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 – 2021

Un-Named Tributary B (UTB)

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	529
					Assessed Bank Length	1058
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	16	16		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	16	16		100%

Millstone Creek Reach 1 (MCR1)

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	1462
					Assessed Bank Length	2924
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			10	99.7%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
					10	99.7%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	32	32		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	32	32		100%

Table 4. Visual Stream Morphology Stability Assessment Table

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 – 2021

Millstone Creek Reach 2 (MCR2)

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	533
					Assessed Bank Length	1066
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	10	10		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	10	10		100%

Table 5. Visual Stream Morphology Stability Assessment Table

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 –

Planted Acreage		11.5 (Phase I only)		
Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10 acres	0.00	0.0%
Total			0.00	0.0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.00	0.0%
Cumulative Total			0.00	0.0%
Easement Acreage		17.96		
Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasive plants may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage- Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.10 acres	0.00	0.0%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, and vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	none	0 Encroachments Noted/ 0 acres	

Stream Photos



PHOTO POINT 1 MCR1 – upstream (9-2-2021)



PHOTO POINT 2 MCR1 –downstream (9-2-2021)



PHOTO POINT 3 MCR1 – upstream (9-2-2021)



PHOTO POINT 4 MCR1 – upstream (9-2-2021)



PHOTO POINT 5 MCR1 – upstream (9-2-2021)



PHOTO POINT 6 MCR1/MCR2 – downstream (9-2-2021)



PHOTO POINT 7 MCR2 – upstream (9-2-2021)



PHOTO POINT 8 MCR2 –downstream (9-2-2021)



PHOTO POINT 8 MCR2 – upstream (9-2-2021)



PHOTO POINT 9 WETLAND – upstream/NW (9-2-2021)



PHOTO POINT 9 WETLAND – downstream/SE (9-2-2021)



PHOTO POINT 10 UTB- upstream (9-2-2021)



PHOTO POINT 11 UTB – downstream (9-2-2021)



PHOTO POINT 12 MCR1 –downstream (9-2-2021)



PHOTO POINT 13 NTR2 – upstream (9-2-2021)



PHOTO POINT 14 NTR1 – upstream (9-2-2021)

Vegetation Plot Photographs



VEGETATION PLOT 1 (1-5-2022)



VEGETATION PLOT 2 (1-5-2022)



VEGETATION PLOT 3 (1-5-2022)



VEGETATION PLOT 4 (1-5-2022)



VEGETATION PLOT 5 (1-5-2022)



VEGETATION PLOT 6 (1-5-2022)



VEGETATION PLOT 7 (1-5-2022)



VEGETATION PLOT 8 (1-5-2022)



VEGETATION PLOT 9 (1-5-2022)



VEGETATION PLOT 10 (1-5-2022)



MOBILE TRANSECTION 1 (1-11-2022)



MOBILE TRANSECTION 2 (1-11-2022)



MOBILE TRANSECTION 3 (1-11-2022)



MOBILE TRANSECTION 4 (1-11-2022)

APPENDIX B – Vegetation Plot Data

Table 6. Vegetation Plot Data

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 - 2021

Planted Acreage	11.6
Date of Initial Plant	2021-12-01
Date of Current Survey	2022-01-05
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Alnus serrulata	hazel alder	Tree	OBL							1	1	2	2
	Betula nigra	river birch	Tree	FACW	3	3					2	2	3	3
	Cercis canadensis	eastern redbud	Tree	FACU	4	4	1	1						
	Juglans nigra	black walnut	Tree	FACU			2	2						
	Liriodendron tulipifera				1	1								
	Liriodendron tulipifera	tuliptree	Tree	FACU	3	3	2	2			6	6	3	3
	Nyssa sylvatica	blackgum	Tree	FAC	1	1	1	1			3	3	2	2
	Other						1	1						
	Other												1	1
	Platanus occidentalis	American sycamore	Tree	FACW	2	2					1	1	2	2
	Quercus alba	white oak	Tree	FACU										
	Quercus phellos	willow oak	Tree	FAC			4	4			3	3		
	Quercus prinoides	dwarf chinquapin oak	Shrub	UPL	1	1								
Quercus sp.										1	1	2	2	
Viburnum nudum	possumhaw	Shrub	OBL	2	2	4	4							
Sum	Performance Standard				17	17	15	15			17	17	15	15
Mitigation Plan Performance Standard	Current Year Stem Count					17		15		0		17		15
	Stems/Acre					688		607		0		688		607
	Species Count					8		7		0		7		7
	Dominant Species Composition (%)					24		27		0		35		20
	Average Plot Height (ft.)					217		215				231		230
	% Invasives					0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					17		15		0		17		15
	Stems/Acre					688		607		0		688		607
	Species Count					8		7		0		7		7
	Dominant Species Composition (%)					24		27		0		35		20
	Average Plot Height (ft.)					217		215				231		230
	% Invasives					0		0		0		0		0

Table 6. Vegetation Plot Data

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 - 2021

Planted Acreage	11.6
Date of Initial Plant	2021-12-01
Date of Current Survey	2022-01-05
Plot size (ACRES)	0.0247

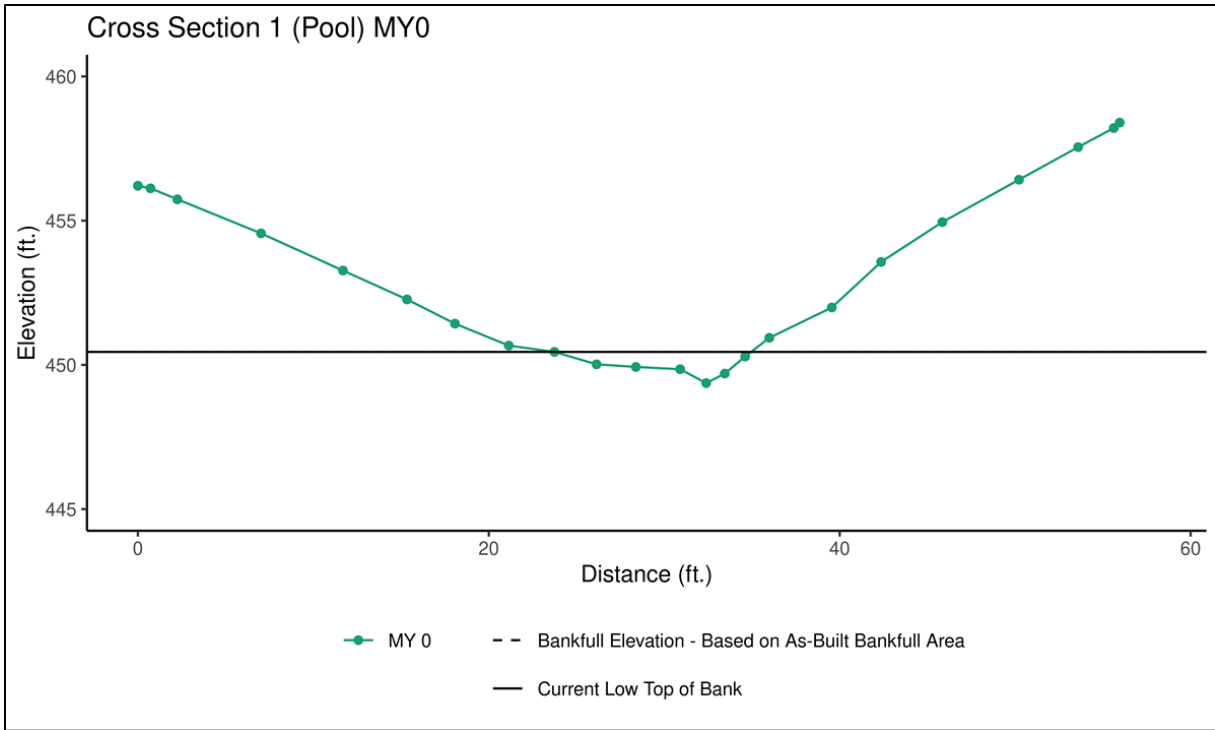
	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F		Veg Plot 10 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Alnus serrulata	hazel alder	Tree	OBL	4	4			1	1	1	1	1	1
	Betula nigra	river birch	Tree	FACW					1	1				
	Cercis canadensis	eastern redbud	Tree	FACU					2	2				
	Diospyros virginiana	common persimmon	Tree	FAC							1	1		
	Ilex glabra	inkberry	Shrub	FAC									2	2
	Juglans nigra	black walnut	Tree	FACU							2	2	1	1
	Liriodendron tulipifera	tuliptree	Tree	FACU	7	7			2	2				
	Nyssa sylvatica	blackgum	Tree	FAC	1	1								
	Other												2	2
	Other					1	1					3	3	
	Platanus occidentalis	American sycamore	Tree	FACW	2	2			5	5				
	Quercus alba	white oak	Tree	FACU					2	2	1	1		
	Quercus phellos	willow oak	Tree	FAC					1	1	1	1		
	Quercus sp.				2	2			3	3	4	4	6	6
Sambucus canadensis	Amer. black elderberry	Tree		1	1									
Viburnum nudum	possumhaw	Shrub	OBL	1	1									
Sum	Performance Standard							19	19			17	17	13
Mitigation Plan Per- formance Standard	Current Year Stem Count					19		0		17		13		12
	Stems/Acre					769		0		688		526		486
	Species Count					8		0		8		7		5
	Dominant Species Composition (%)					37		0		29		31		50
	Average Plot Height (ft.)					220				235		217		190
	% Invasives					0		0		0		0		0
Post Mitigation Plan Per- formance Standard	Current Year Stem Count					19		0		17		13		12
	Stems/Acre					769		0		688		526		486
	Species Count					8		0		8		7		5
	Dominant Species Composition (%)					37		0		29		31		50
	Average Plot Height (ft.)					217		215				231		230
	% Invasives					0		0		0		0		0

Table 7. Vegetation Performance Standards Summary Table

	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	688		8	0	607		7	0	0		0	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	688		7	0	607		7	0	769		8	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	0		0	0	688		8	0	526		7	0
	Veg Plot 10 F											
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives								
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	486		5	0								

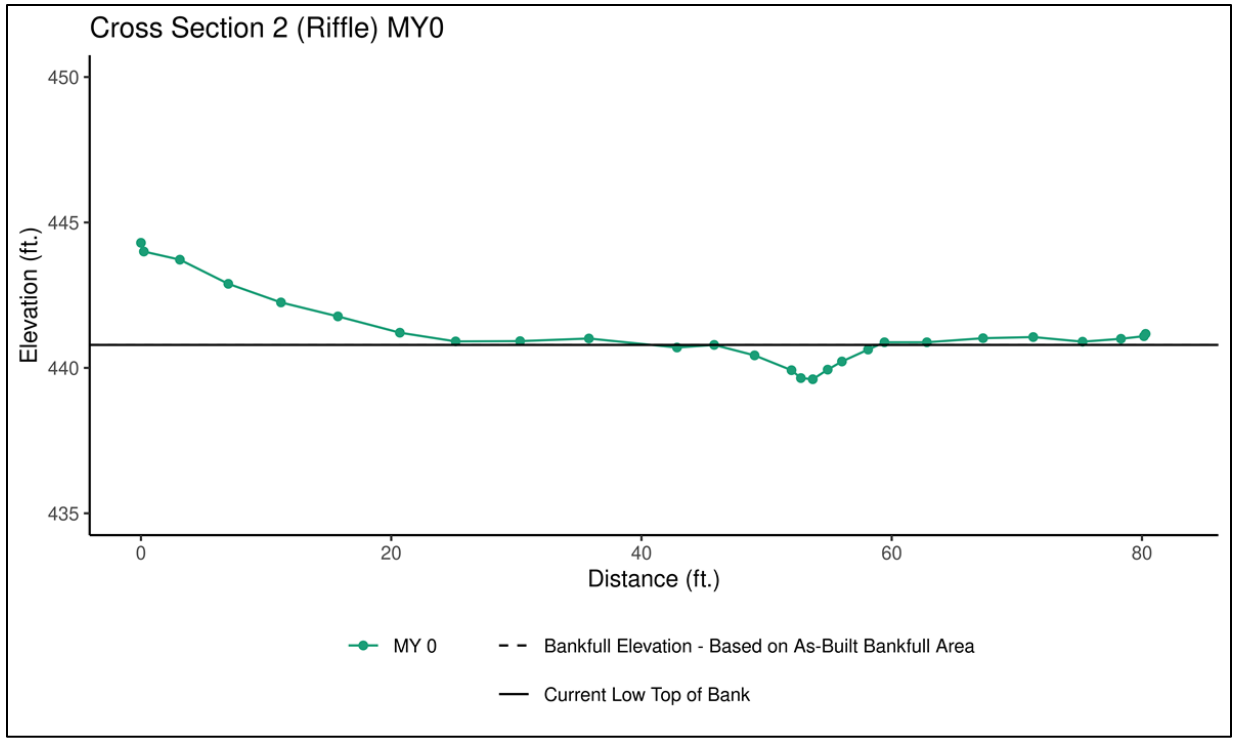
APPENDIX C. Stream Geomorphology Data

Cross-Section Plots



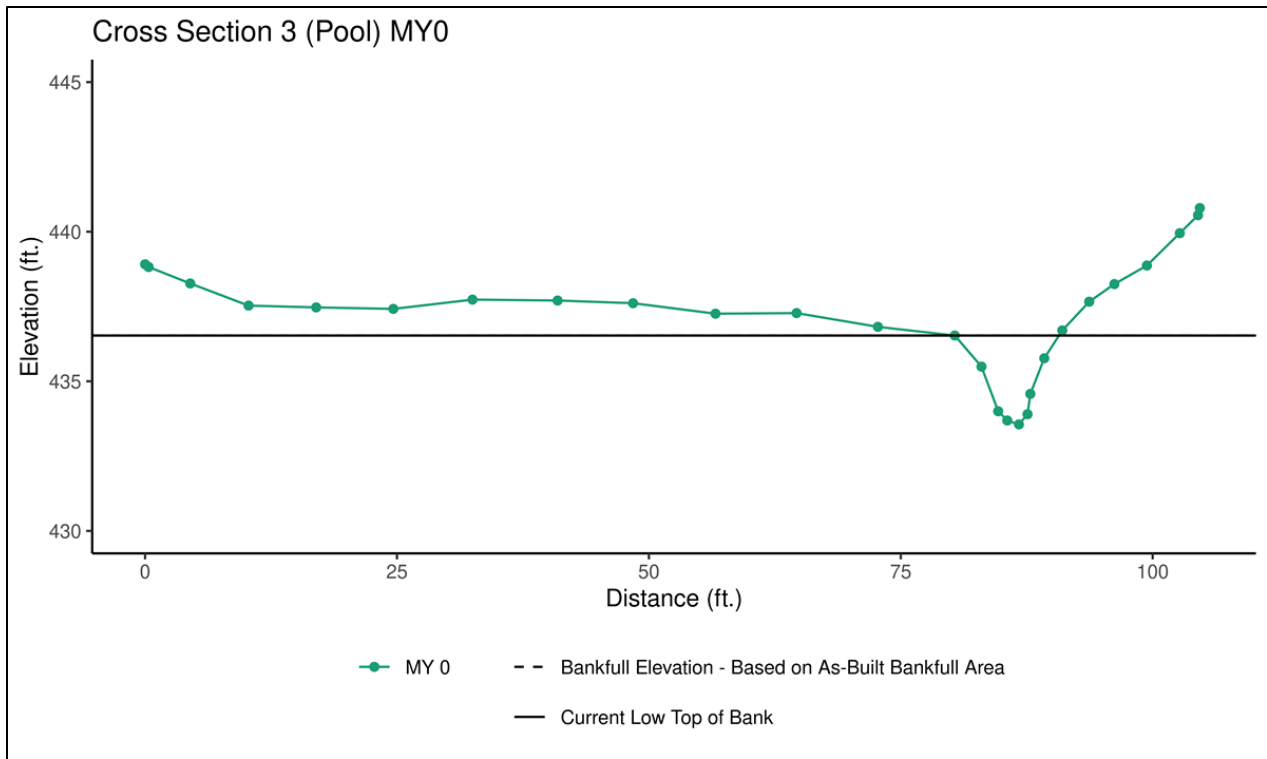
NTR1 – Cross Section 1 (Pool)	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	450.45					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00					
Thalweg Elevation	449.37					
LTOB Elevation	450.45					
LTOB Max Depth	1.08					
LTOB Cross Sectional Area	5.76					





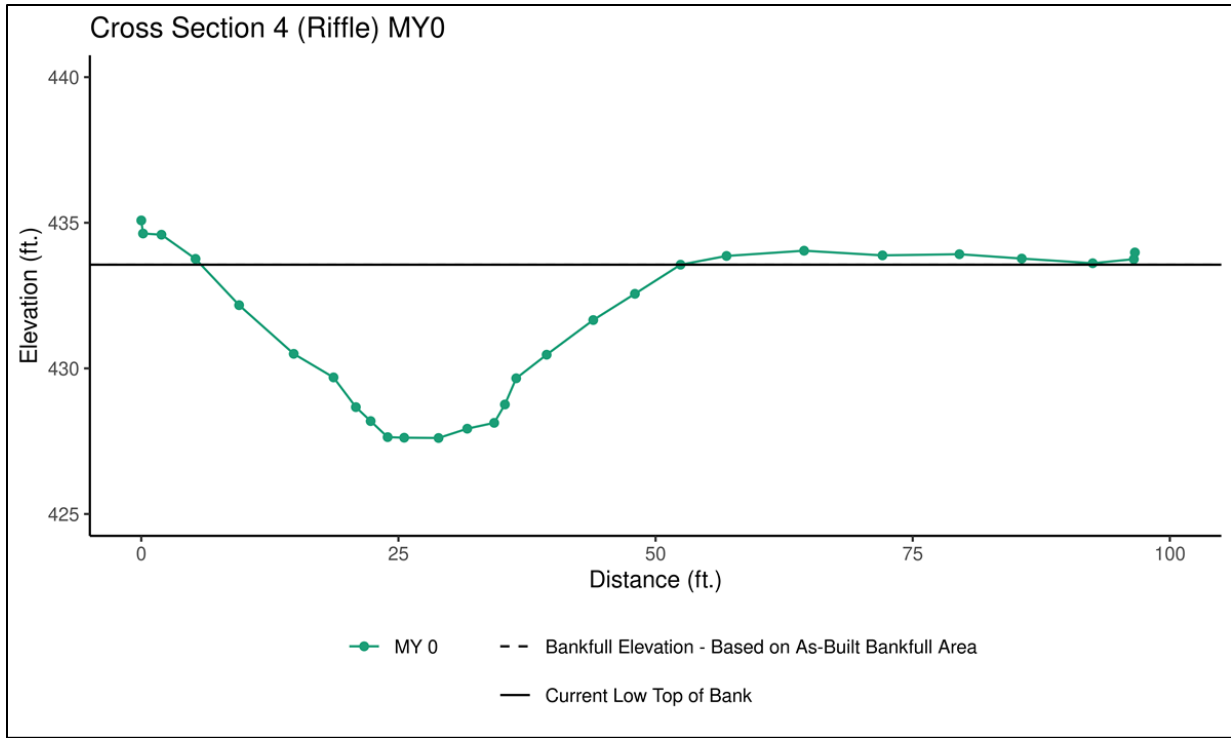
UTB – Cross Section 2 (Riffle)	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	440.79					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00					
Thalweg Elevation	439.61					
LTOB Elevation	440.79					
LTOB Max Depth	1.18					
LTOB Cross Sectional Area	7.10					





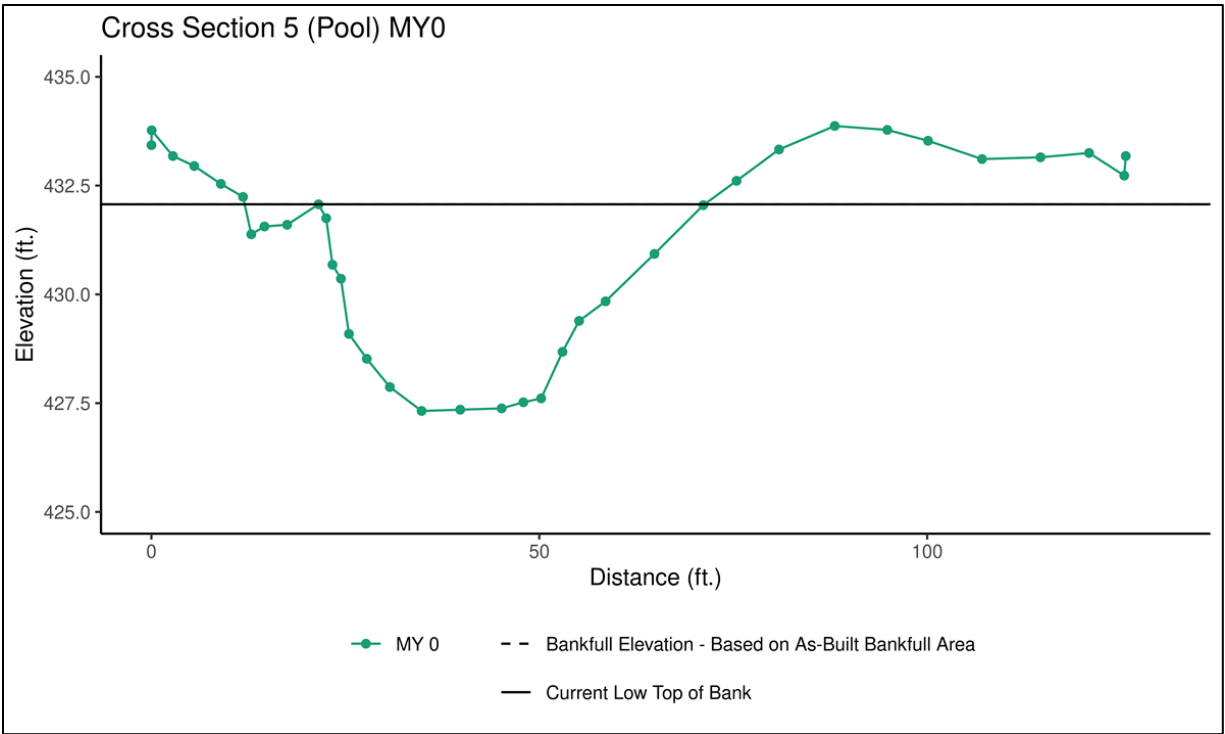
UTB – Cross Section 3 (Pool)	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	436.53					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00					
Thalweg Elevation	433.56					
LTOB Elevation	436.53					
LTOB Max Depth	2.97					
LTOB Cross Sectional Area	15.57					





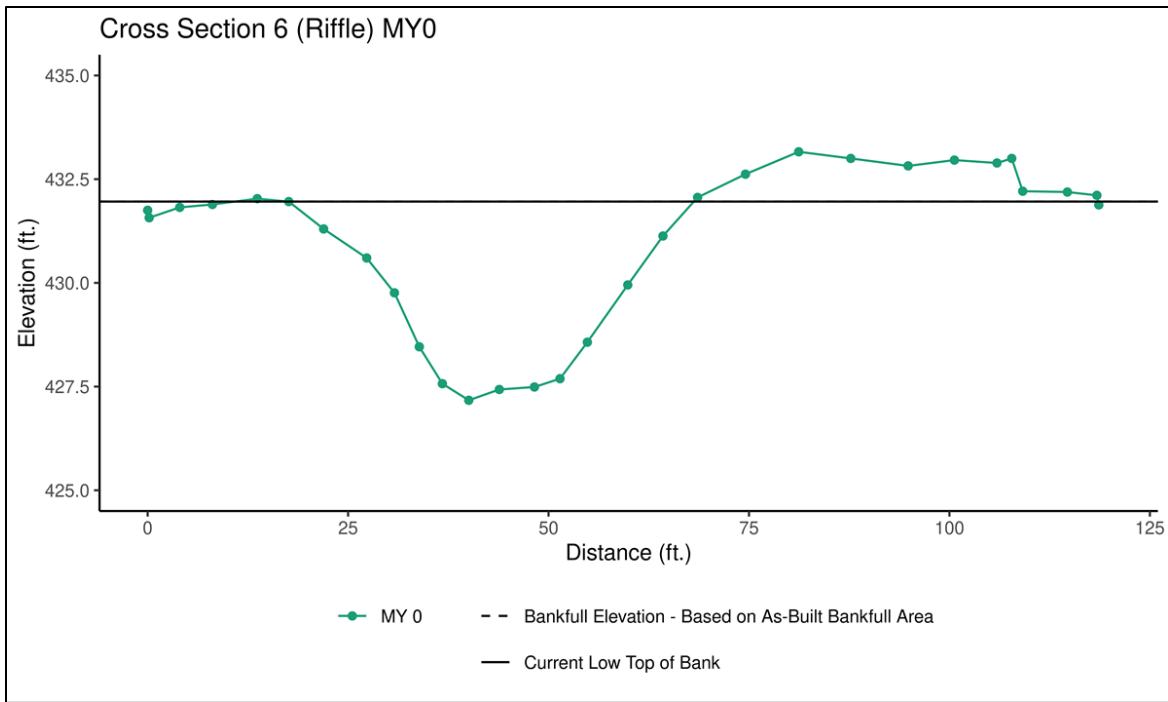
MCR1 – Cross Section 4 (Riffle)	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	433.56					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00					
Thalweg Elevation	427.61					
LTOB Elevation	433.56					
LTOB Max Depth	5.95					
LTOB Cross Sectional Area	153.88					





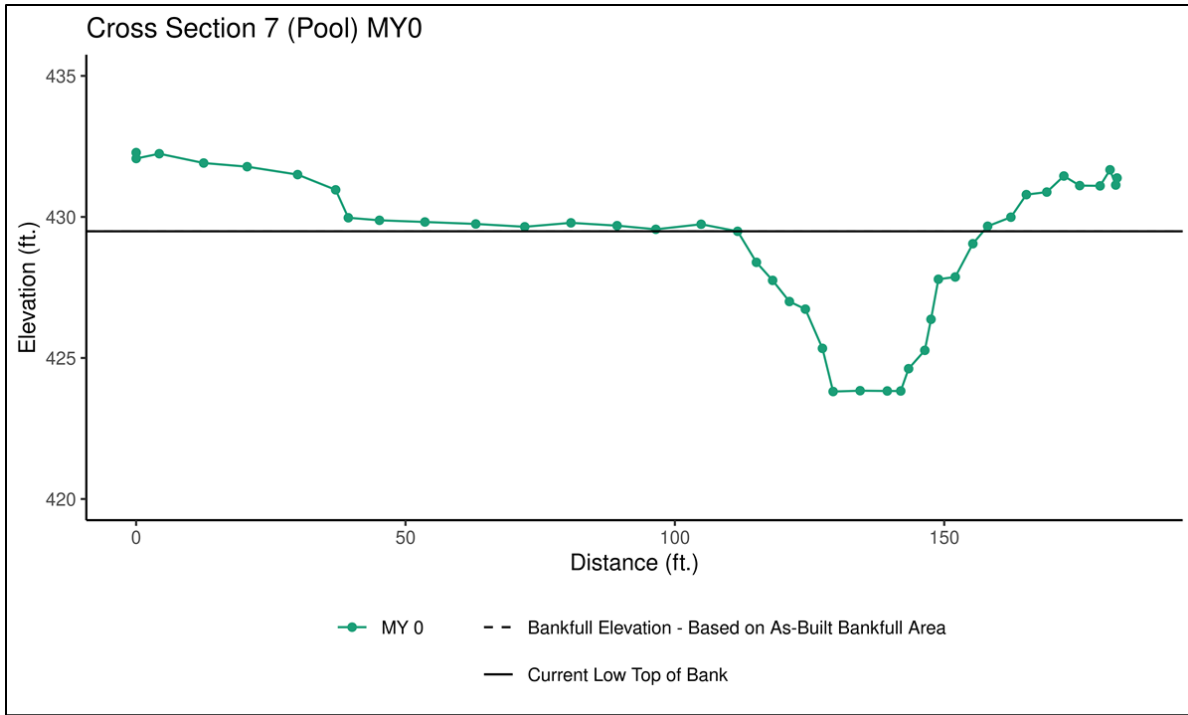
MCR1 – Cross Section 5 (Pool)	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	432.07					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00					
Thalweg Elevation	427.32					
LTOB Elevation	432.07					
LTOB Max Depth	4.75					
LTOB Cross Sectional Area	154.17					





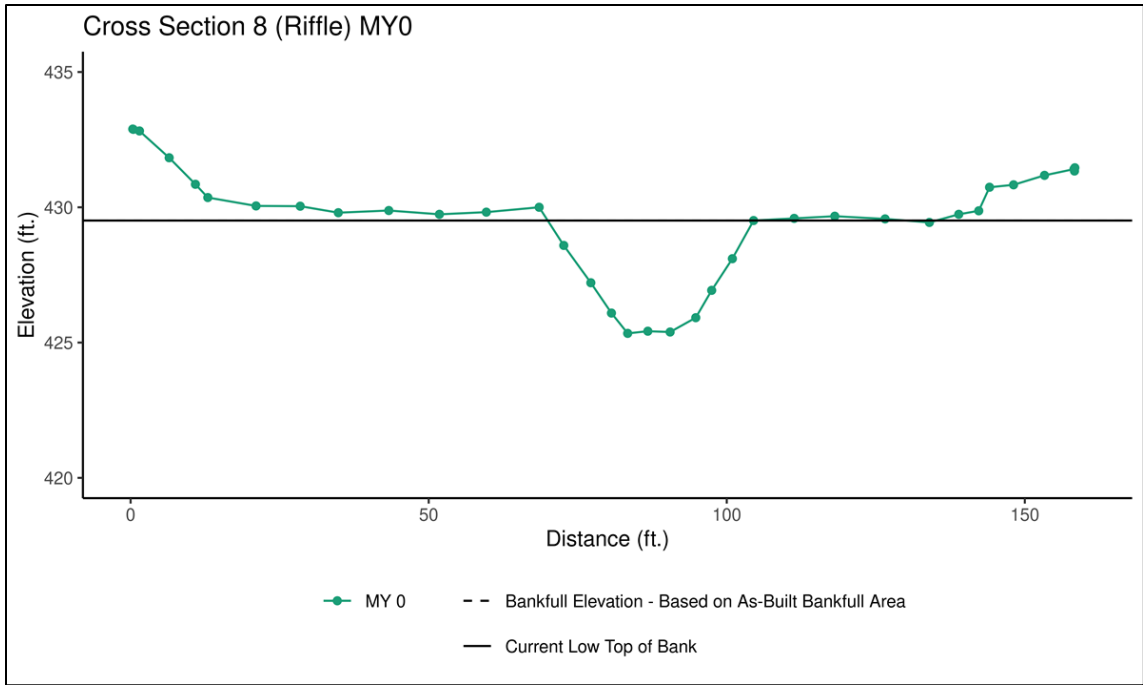
MCR1 – Cross Section 6 (Riffle)	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	431.96					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00					
Thalweg Elevation	427.43					
LTOB Elevation	431.96					
LTOB Max Depth	4.53					
LTOB Cross Sectional Area	133.02					





MCR2 – Cross Section 7 (Pool)	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	429.49					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00					
Thalweg Elevation	423.83					
LTOB Elevation	429.49					
LTOB Max Depth	5.66					
LTOB Cross Sectional Area	146.27					





MCR2 – Cross Section 8 (Riffle)	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	429.51					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00					
Thalweg Elevation	425.42					
LTOB Elevation	429.51					
LTOB Max Depth	4.09					
LTOB Cross Sectional Area	89.89					



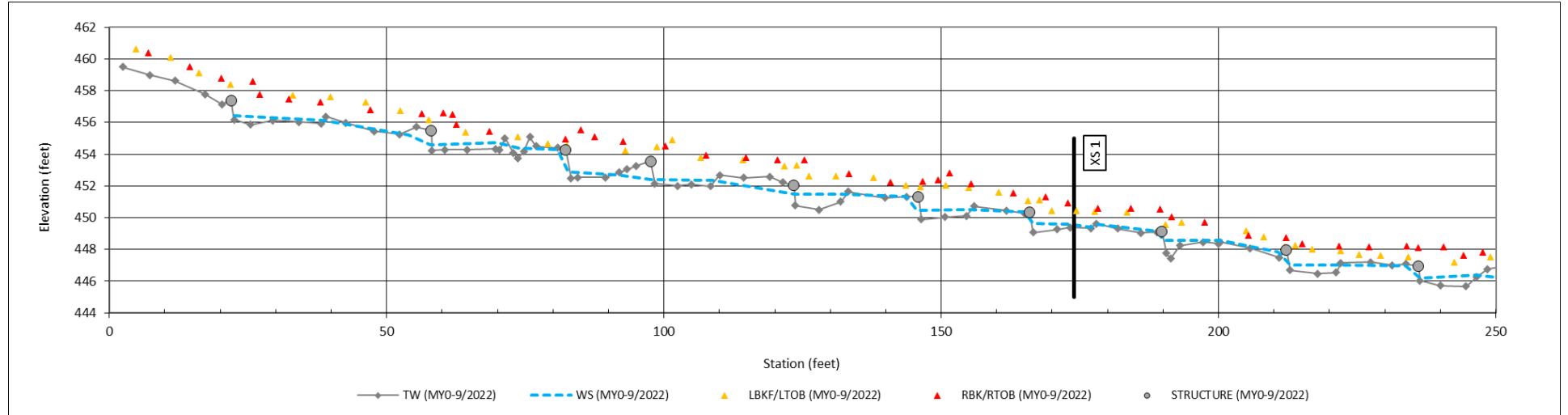
Longitudinal Profile Plots

Millstone Creek Mitigation Site

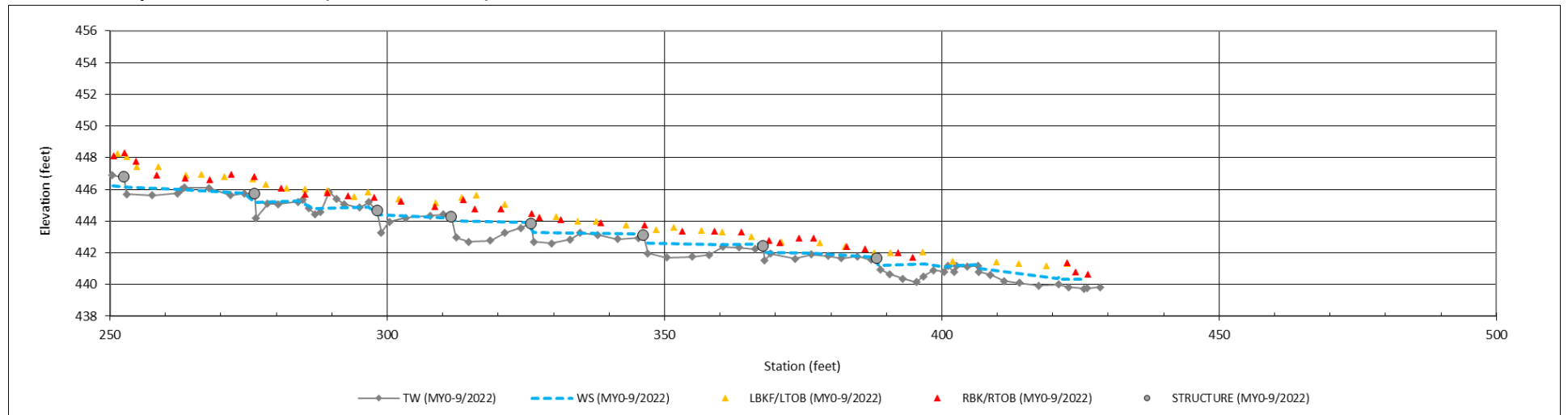
DMS Project No. IMS# 204

Monitoring Year 0 – 2021

North Tributary Reach 1 (STA 0+00 to 2+50)



North Tributary Reach 1 & Reach 2 (STA 2+50 to 4+29)



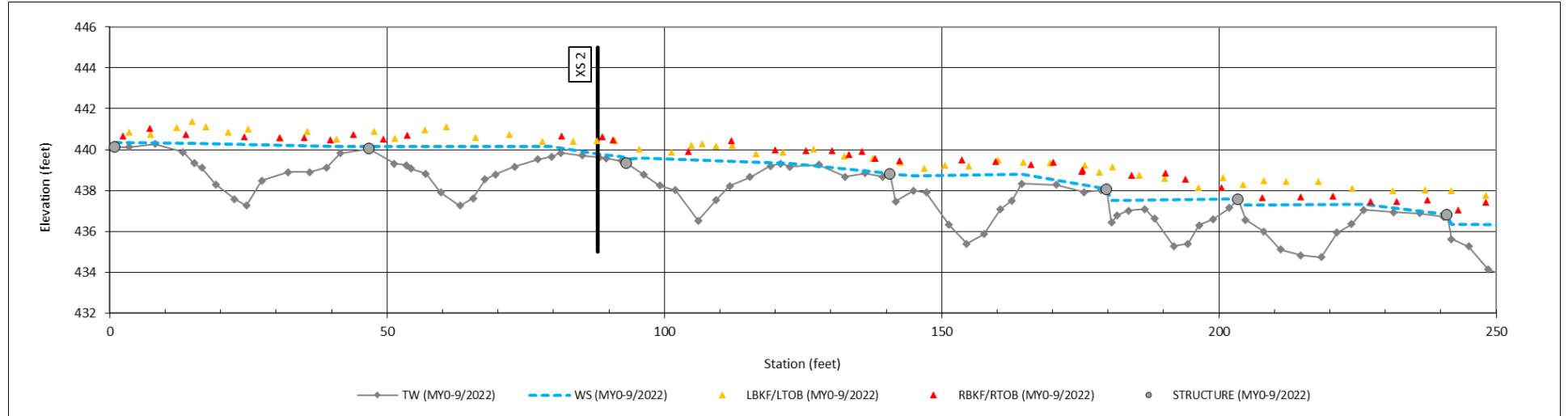
Longitudinal Profile Plots

Millstone Creek Mitigation Site

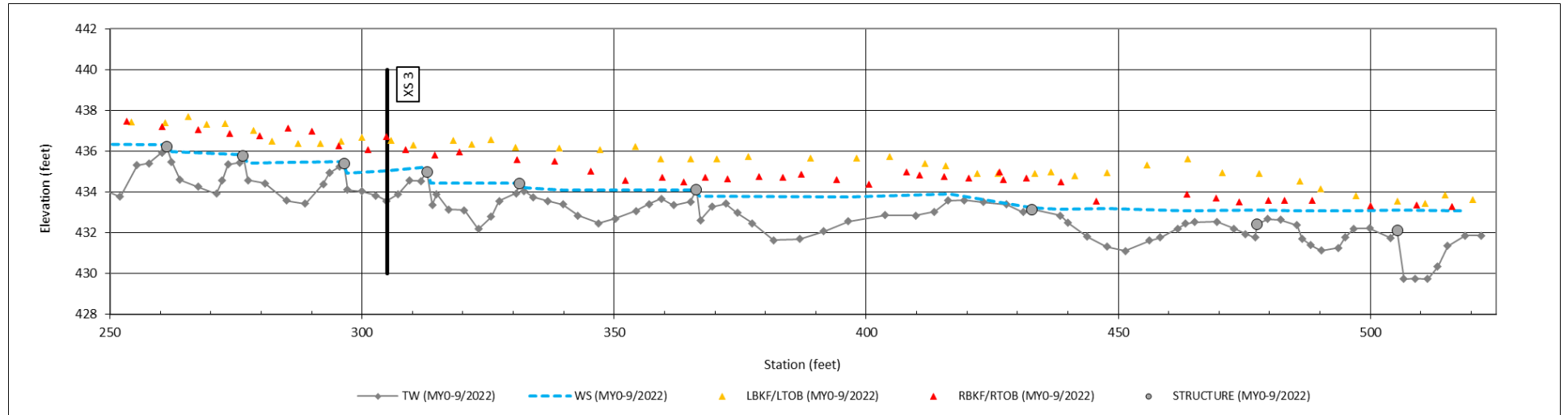
DMS Project No. IMS# 204

Monitoring Year 0 – 2021

Un-Named Tributary B (STA 0+00 to 2+50)



Un-Named Tributary B (STA 2+50 to 5+23)



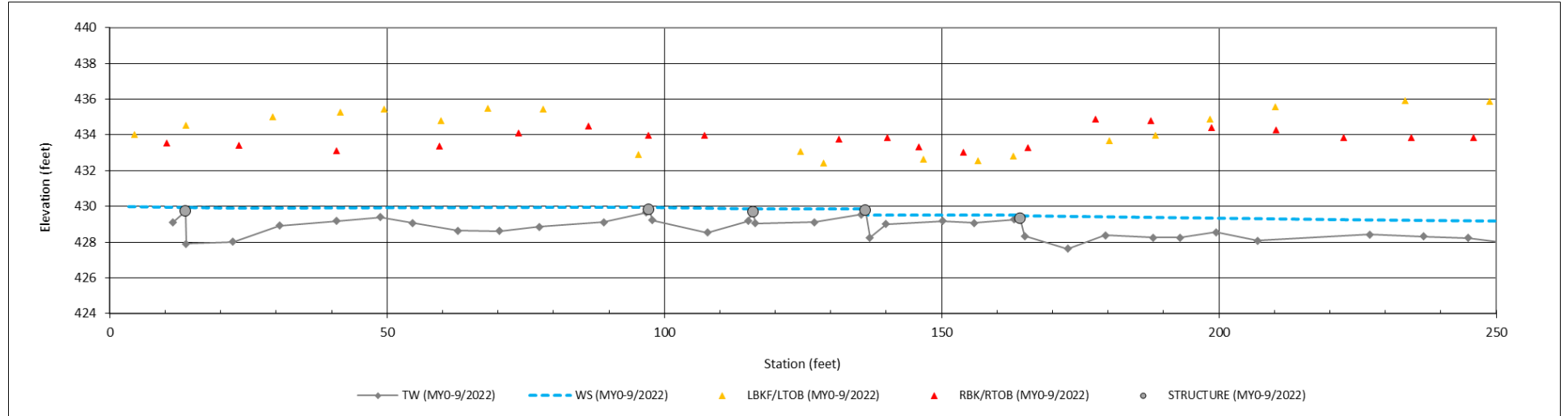
Longitudinal Profile Plots

Millstone Creek Mitigation Site

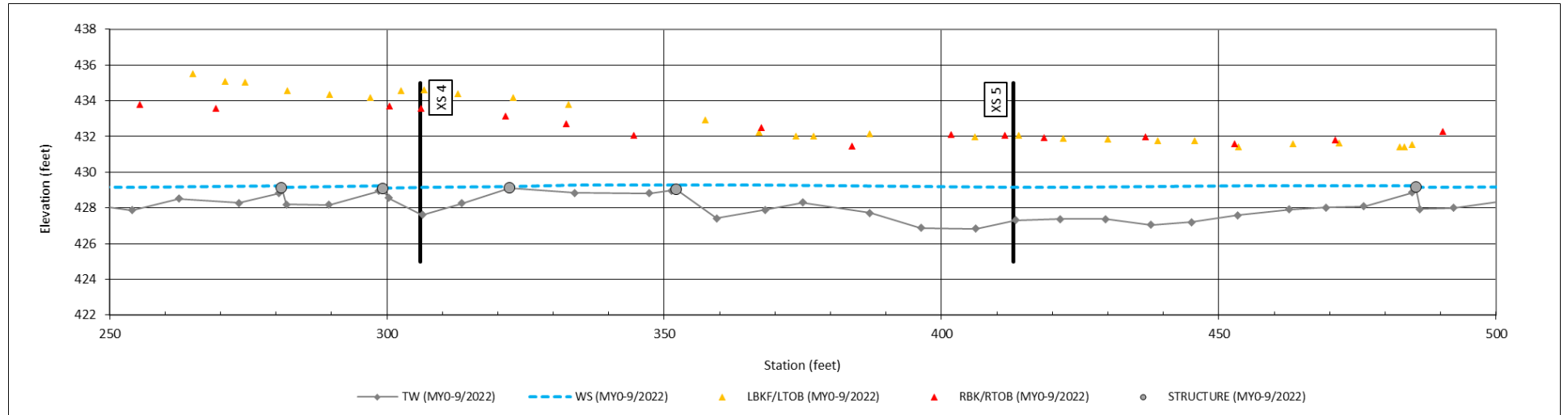
DMS Project No. IMS# 204

Monitoring Year 0 – 2021

Millstone Creek Reach 1 (STA 0+00 to 2+50)



Millstone Creek Reach 1 (STA 2+50 to 5+00)



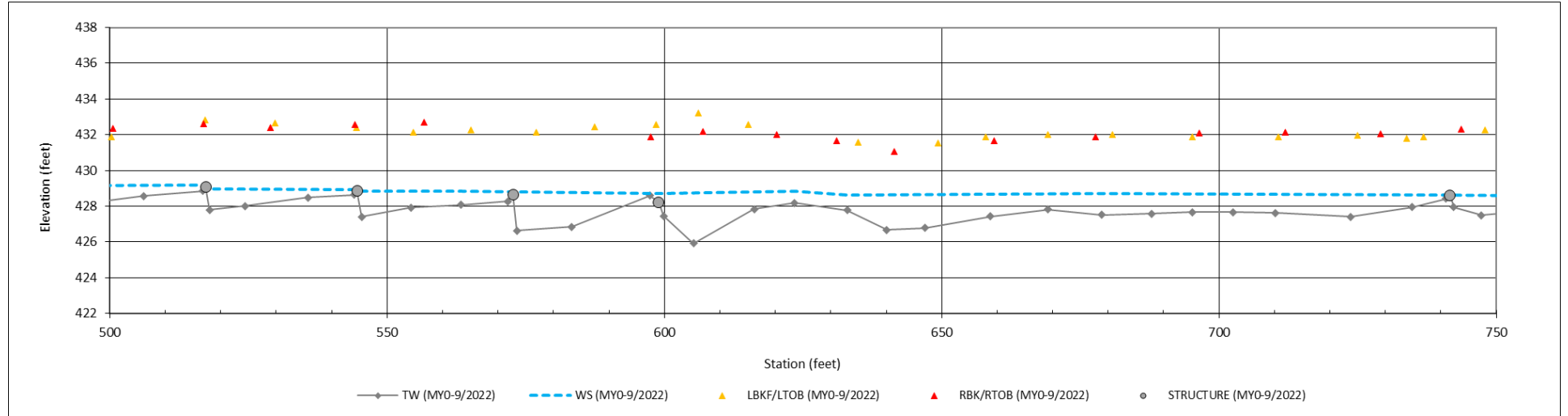
Longitudinal Profile Plots

Millstone Creek Mitigation Site

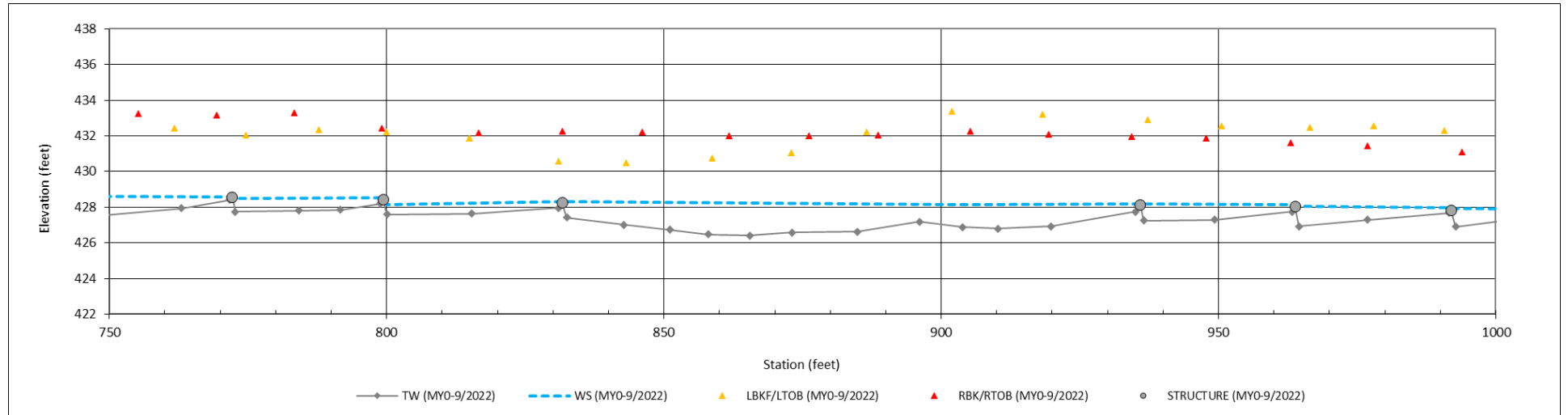
DMS Project No. IMS# 204

Monitoring Year 0 – 2021

Millstone Creek Reach 1 (STA 5+00 to 7+50)



Millstone Creek Reach 1 (STA 7+50 to 10+00)



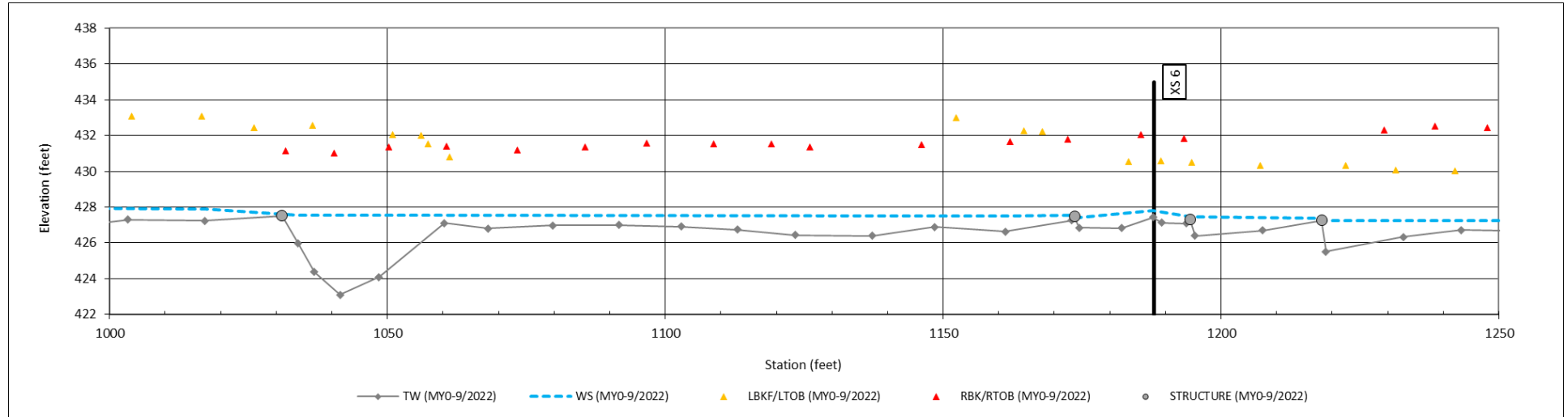
Longitudinal Profile Plots

Millstone Creek Mitigation Site

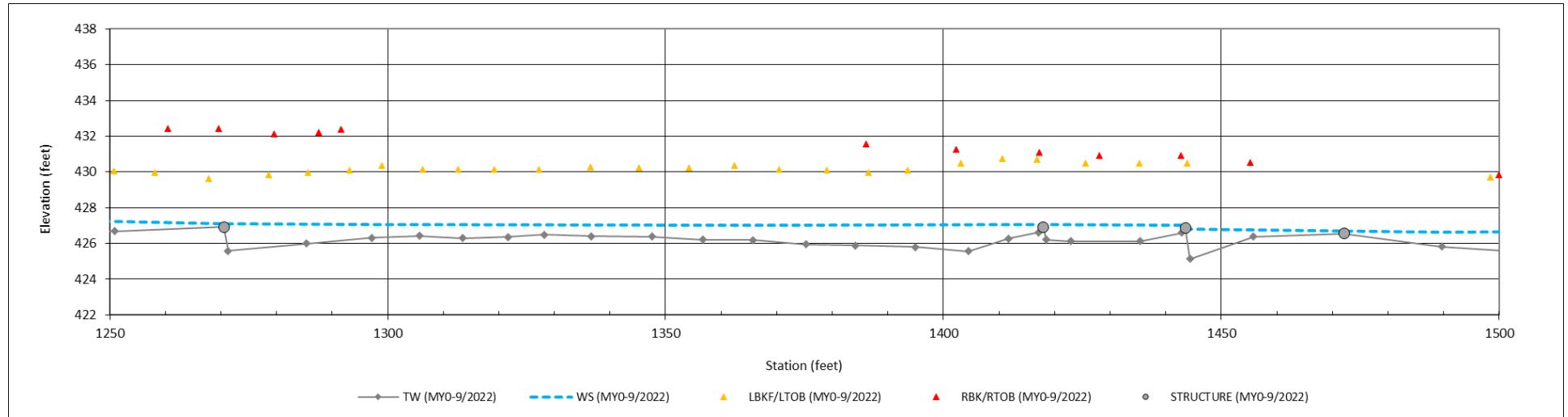
DMS Project No. IMS# 204

Monitoring Year 0 – 2021

Millstone Creek Reach 1 (STA 10+00 to 12+50)



Millstone Creek Reach 1 & Reach 2 (STA 12+50 to 15+00)



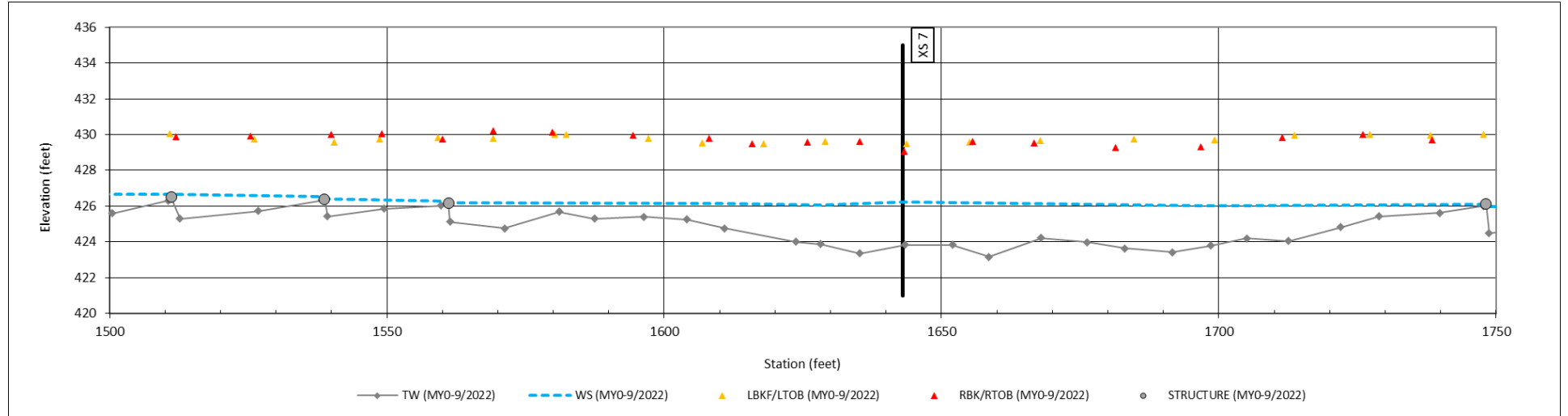
Longitudinal Profile Plots

Millstone Creek Mitigation Site

DMS Project No. IMS# 204

Monitoring Year 0 – 2021

Millstone Creek Reach 2 (STA 15+00 to 17+50)



Millstone Creek Reach 2 (STA 17+50 to 20+20)

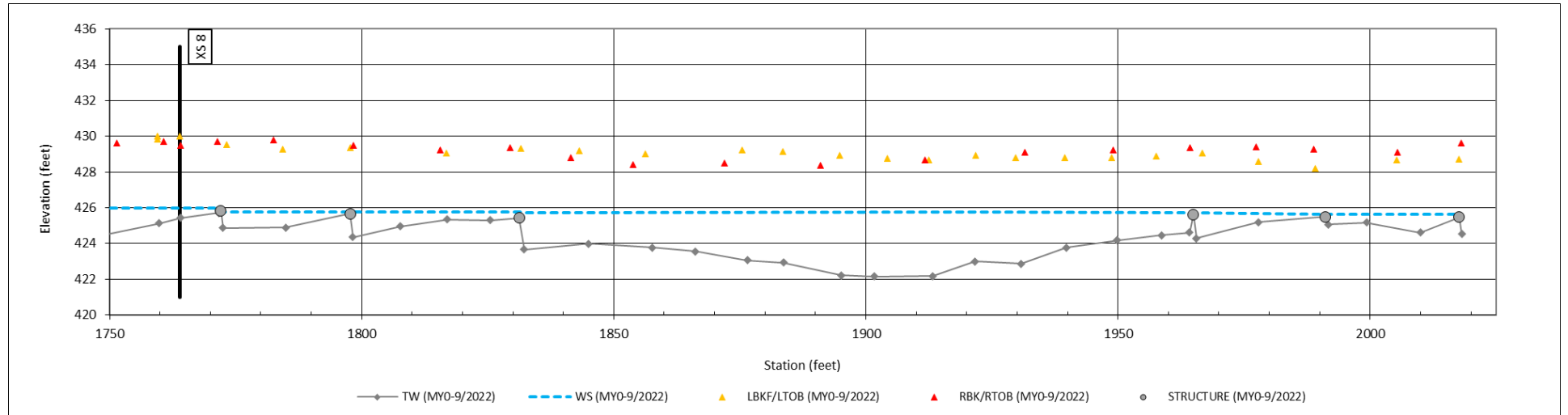


Table 8: Baseline Stream Data Summary

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 – 2021

Parameter	Pre-Existing Condition					Design		Monitoring Baseline (MY0)		
North Tributary Reach 1 (NTR1)						* As-Built Condition				
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	5.8	5.85	5.85	5.9	2	8		8.2		1
Floodprone Width (ft)	8.3	8.5	8.5	8.7	2	14.3		16.5		1
Bankfull Mean Depth (ft)	0.4	0.5	0.5	0.6	2	0.4		0.41		1
Bankfull Max Depth (ft)	0.6	0.75	0.75	0.9	2	0.5		0.65		1
Bankfull Cross Sectional Area (ft ²)	2.3	3	3	3.7	2	3.5		3.4		1
Width/Depth Ratio	9.4	11.95	11.95	14.5	2	18.3		19.8		1
Entrenchment Ratio	1.4	1.45	1.45	1.5	2	1.8		2.0		1
Bank Height Ratio	3	3.1	3.1	3.2	2	1		1		1
Max part size (mm) mobilized at bankfull	48-108					93-172		86-164		
Rosgen Classification	G5/F5					B5		B5		
Bankfull Discharge (cfs)	9.7					15.4		14.3		
Sinuosity (ft)	1.03					1.1		1.1		
Water Surface Slope (Channel) (ft/ft)	0.023					0.048		0.047		
Other										
North Tributary Reach 2 (NTR2)						* As-Built Condition				
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)		4.9			1	4.9		9.7		1
Floodprone Width (ft)		9.8			1	8.3		21		1
Bankfull Mean Depth (ft)		0.5			1	0.5		0.5		1
Bankfull Max Depth (ft)		0.6			1	0.6		1.7		1
Bankfull Cross Sectional Area (ft ²)		2.3			1	2.3		4.6		1
Width/Depth Ratio		10.2			1	10.2		20.5		1
Entrenchment Ratio		2.0			1	1.7		2.2		1
Bank Height Ratio		1			1	1		1		1
Max part size (mm) mobilized at bankfull	70-141					70-141		60-127		
Rosgen Classification	B5					B5		B5		
Bankfull Discharge (cfs)	8.8					8.8		14.0		
Sinuosity (ft)	1.05					1.05		1.05		
Water Surface Slope (Channel) (ft/ft)	0.037					0.037		0.029		
Other										
UTB										
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	4.4	4.8	4.4	5.6	3	10	15	13.1		1
Floodprone Width (ft)	6.16	34.7	10.1	88	3	65.0		65		1
Bankfull Mean Depth (ft)	0.5	0.6	0.7	0.7	3	0.7	0.9	0.5		1
Bankfull Max Depth (ft)	0.9	0.9	0.9	0.9	3	0.9	1.5	1.2		1
Bankfull Cross Sectional Area (ft ²)	2.1	2.9	3.0	3.7	3	7.0	13.0	7.10		1
Width/Depth Ratio	6.6	8.1	8.4	9.3	3	14.3	21.4	24.3		1
Entrenchment Ratio	1.4	7.7	1.8	20.0	3	6.5	4.3	4.9		1
Bank Height Ratio	1	1.65	1.65	2.3	3	1		1		1
Max part size (mm) mobilized at bankfull	33-82					52-114		29-76		
Rosgen Classification	G5/E5					C5		C5		
Bankfull Discharge (cfs)	8.1					26.0		19.6		
Sinuosity (ft)	1.08					1.08		1.12		
Water Surface Slope (Channel) (ft/ft)	0.0144					0.0140		0.0140		
Other										

* Baseline morphology data for NTR1 and NTR2 are based on the general topographic survey of the as-built condition. The data is not based on a permanent cross section as there are no permanent riffle cross sections located in either of these two reaches.

Table 8: Baseline Stream Data Summary

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 – 2021

Parameter	Pre-Existing Condition					Design		Monitoring Baseline (MY0)		
Millstone Creek Reach 1 (MCR1)										
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	28.9	37.8	37.8	46.6	3	28.9	46.6	67.5	46.6	2
Floodprone Width (ft)	217	274	274	331	3	217	331	65.0	65.0	2
Bankfull Mean Depth (ft)	2.6	2.65	2.65	2.7	3	2.6	3.3	2.0	3.3	2
Bankfull Max Depth (ft)	3.3	3.7	3.7	4.1	3	3.4	4.8	4.8	5.9	2
Bankfull Cross Sectional Area (ft ²)	75.3	99.5	99.5	123.6	3	75.3	123.6	136.0	153.9	2
Width/Depth Ratio	11.1	14.4	14.4	17.6	3	11.1	17.6	33.5	14.1	2
Entrenchment Ratio	7.1	7.3	7.3	7.5	3	7.1	7.5	1.0	1.4	2
Bank Height Ratio	1.0	1.1	1.1	1.1	3	1.0	1.1	1	1	2
Max part size (mm) mobilized at bankfull	167-260					67-85		19-57		
Rosgen Classification	G5/E5					C5		C5		
Bankfull Discharge (cfs)	9.7					243-295		363		
Sinuosity (ft)	1.08					1.06		1.1		
Water Surface Slope (Channel) (ft/ft)	0.0144					0.002		0.0022		
Other										
Millstone Creek Reach 2 (MCR2)										
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)		30.9			1	36.0		34.5		1
Floodprone Width (ft)	219	226	226	232	1	217	331	225.0		1
Bankfull Mean Depth (ft)		3.4			1	2.6		2.7		1
Bankfull Max Depth (ft)		4.3			1	3.6		4.2		1
Bankfull Cross Sectional Area (ft ²)		105.8			1	85.0		94.3		1
Width/Depth Ratio		9.0			1	13.8		12.7		1
Entrenchment Ratio	7.1	7.3	7.3	7.5	1	6.0	9.2	6.5		1
Bank Height Ratio		1.2			1	1.0	1.0	1		1
Max part size (mm) mobilized at bankfull	27-73					24-72		21-60		
Rosgen Classification	E5					C5		C5		
Bankfull Discharge (cfs)	358.4					305.0		270		
Sinuosity (ft)	1.13					1.09		1.08		

Table 9: Cross-Section Morphology Monitoring Summary

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 – 2021

	North Tributary Reach 1							UTB														
	Cross Section 1 (Pool - Reach 1)							Cross Section 2 (Riffle)						Cross Section 3 (Pool)								
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	450.45							440.79							436.53							
Bank Height Ratio_Based on AB Bankfull ¹ Area	1.00							1.00							1.00							
Thalweg Elevation	449.37							439.61							433.56							
LTOB ² Elevation	450.45							440.79							436.53							
LTOB ² Max Depth (ft)	1.08							1.18							2.97							
LTOB ² Cross Sectional Area (ft ²)	5.76							7.10							15.57							
	Millstone Creek																					
	Cross Section 4 (Riffle - Reach 1)							Cross Section 5 (Pool - Reach 1)						Cross Section 6 (Riffle - Reach 1)								
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	433.56							432.07							431.96							
Bank Height Ratio_Based on AB Bankfull ¹ Area	1.00							1.00							1.00							
Thalweg Elevation	427.61							427.32							427.43							
LTOB ² Elevation	433.56							432.07							431.96							
LTOB ² Max Depth (ft)	5.95							4.75							4.53							
LTOB ² Cross Sectional Area (ft ²)	153.88							154.17							133.02							
	Millstone Creek																					
	Cross Section 7 (Pool - Reach 2)							Cross Section 8 (Riffle - Reach 2)						Cross Section								
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	429.49							429.51														
Bank Height Ratio_Based on AB Bankfull ¹ Area	1.00							1.00														
Thalweg Elevation	423.83							425.42														
LTOB ² Elevation	429.49							429.51														
LTOB ² Max Depth (ft)	5.66							4.09														
LTOB ² Cross Sectional Area (ft ²)	146.27							89.89														

¹Bank Height Ratio (BHR) takes the As-built bankfull area as the basis for adjusting each subsequent year’s bankfull elevation

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

Table 10: Large Woody Debris Assessment Table

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 – 2021

	Pre-Existing Condition							After Restoration							Difference
	Date: 5-6-16		Length Assessed (ft)			2040	Date: 11-2-21		Length Assessed (ft)			2020			
	Score							Score							
Pieces	1	2	3	4	5	Count	Total Score	1	2	3	4	5	Count	Total Score	
<i>Length/Bankfull Width</i>	20	9	3	3	3	38	74	2	11	27			40	105	
<i>Diameter</i>	10	9	7	6	6	38	103	2		1	36	1	40	154	
<i>Location</i>			4	17	17	38	165				6	34	40	194	
<i>Type</i>	1		16	13	8	38	141	1		9	26	4	40	152	
<i>Structure</i>	24	4	6		4	38	70	7	33				40	73	
<i>Stability</i>	1	3	7	3	24	38	160	1				39	40	196	
<i>Orientation</i>	13	6	8	4	7	38	100	2	7		10	21	40	161	
Total	69	31	51	46	69		813	15	51	37	78	99		1035	222
Average/Linear Foot							0.4							0.5	0.1
Average/300 Feet							120							154	33
Debris Dams															
<i>Length</i>	3		1			4	6	7	1				8	9	
<i>Height</i>	2		2			4	8		6	2			8	18	
<i>Structure</i>			3		1	4	14			2	4	2	8	32	
<i>Location</i>		1	1		2	4	15				6	2	8	34	
<i>Stability</i>	2		2			4	8					8	8	40	
Total	7	1	9	0	82		51	7	7	4	10	12		133	82
							0.03							0.066	0.04
							7.5							19.8	12.3
Grand Total							864							1168	304

APPENDIX D. Project Timeline and Contact Information

Table 11: Project Activity and Reporting History

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 – 2021

Activity or Deliverable		Data Collection Complete	Task Completion or Deliverable Submission
Project Instituted		NA	May 22, 2006
Mitigation Plan Approved		May 1, 2020	July 16, 2020
Construction (Grading) Completed		September, 2021	October, 2021
Planting Completed		December 2021	December 28, 2021
As-built Survey Completed		September, 2021	January, 2022
MY-0 Baseline Report	Stream Survey	April, 2022	April, 2022
	Vegetation Survey		
MY1 Monitoring	Stream Survey		
	Vegetation Survey		
MY2 Monitoring	Stream Survey		
	Vegetation Survey		
MY3 Monitoring	Stream Survey		
	Vegetation Survey		
MY4 Monitoring			
MY5 Monitoring	Stream Survey		
	Vegetation Survey		
MY6 Monitoring			

Table 12: Project Contact Table

Millstone Creek Mitigation Site
 DMS Project No. IMS# 204
 Monitoring Year 0 – 2021

Project Name/Number	
Provider	NC Division of Mitigation Services
Mitigation Provider POC	Melonie Allen, NC Division of Mitigation Services
Designer	Barbara A. Doll & Jonathan Page, Biological & Agricultural Engineering Dept., NC State University, Box 7625, Raleigh NC 27695
Primary project design POC	Barbara A. Doll, 919-515-5287
Construction Contractor	Backwater Environmental, PO Box 1107, 515 S. Kennedy St., Eden, NC 27289

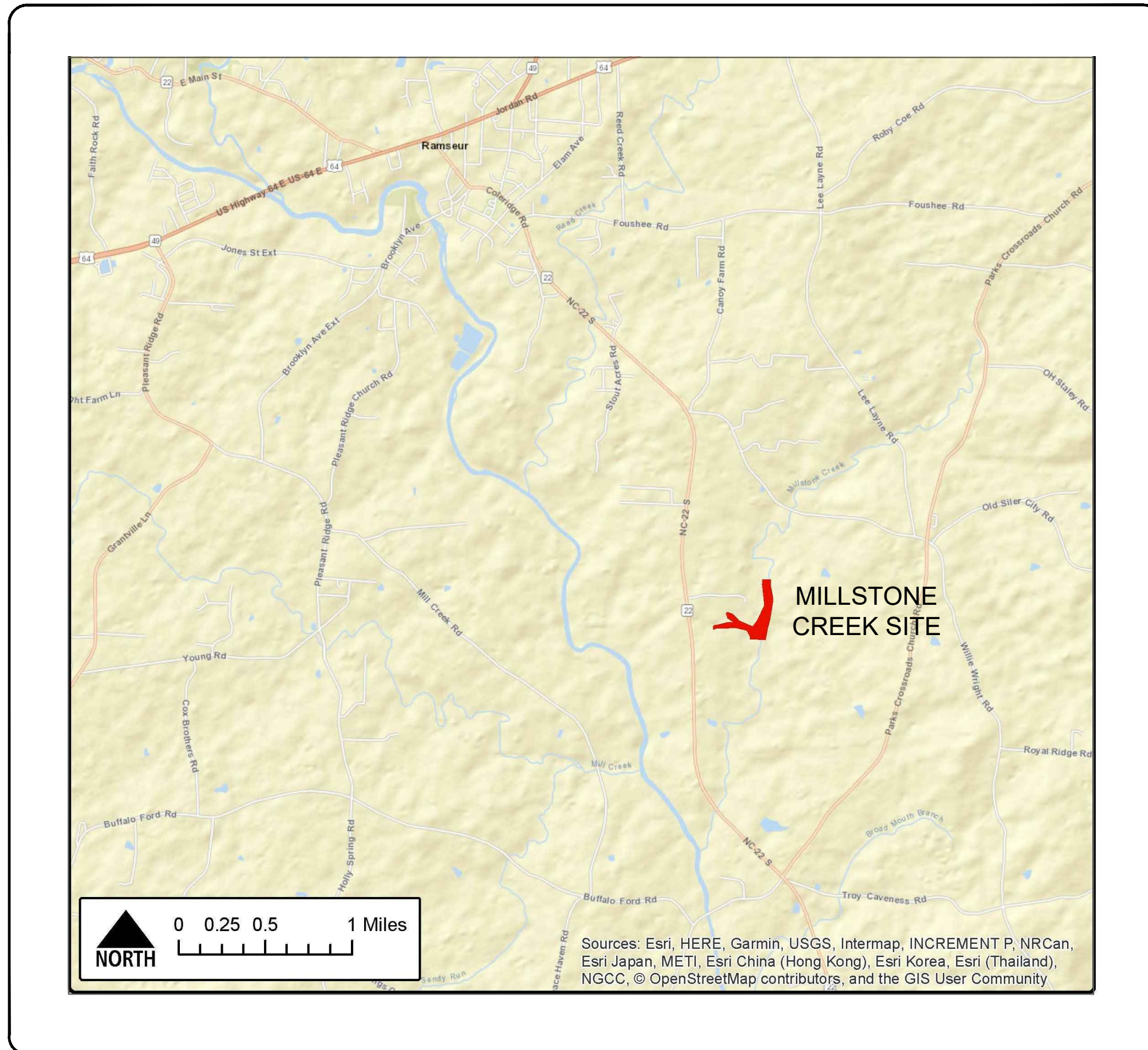
APPENDIX E. Record Drawings

NC DEPARTMENT OF ENVIRONMENTAL QUALITY - DIVISION OF MITIGATION SERVICES

MILLSTONE CREEK MITIGATION SITE - PHASE 1

RECORD DRAWINGS

RANDOLPH COUNTY, NORTH CAROLINA
SCO ID # 20-22021-01A; NCDMS IMS# 204; USACE AID: SAW-2019-01363
LAT: 35.696683 LONG: -79.623956



PROJECT DIRECTORY	
OWNER:	NORTH CAROLINA DIVISION OF MITIGATION SERVICES
	MELONIE ALLEN 217 WEST JONES STREET RALEIGH, NC 27603 919.707.8540 melonie.allen@ncdenr.gov
ENGINEER:	NORTH CAROLINA STATE UNIVERSITY
	BARBARA A. DOLL, PHD, PE CAMPUS BOX 7625 RALEIGH, NC 27695 919.515.5287 bdoll@ncsu.edu
	JONATHAN L. PAGE, PE CAMPUS BOX 7625 RALEIGH, NC 27695 919.515.8595 jlp@ncsu.edu
SURVEYOR:	TURNER LAND SURVEYING
	DAVID S. TURNER, PLS PO BOX 148 SWANNANOVA, NC 26778 919.827.0745
SHEET INDEX	
TITLE SHEET	1.1
PROJECT OVERVIEW	2.1
PLAN AND PROFILE SHEETS	4.1
RE-VEGETATION PLAN	5.1

I, DAVID S. TURNER, AS A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF NORTH CAROLINA, HEREBY CERTIFY THAT THE SURVEY DATA SHOWN ON THIS DRAWING, WAS OBTAINED UNDER MY SUPERVISION, IS AN ACCURATE AND COMPLETE REPRESENTATION OF WHAT WAS CONSTRUCTED IN THE FIELD, AND THAT THE PHYSICAL DIMENSIONS OR ELEVATIONS SHOWN THIS ARE AS-BUILT CONDITIONS EXCEPT WHERE OTHERWISE NOTED HEREON. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 2nd DAY OF FEBRUARY, 2022.

David S. Turner
 DAVID S. TURNER, P.L.S. #L-4551

I, DAVID S. TURNER, CERTIFY THAT THE AS-BUILT TOPOGRAPHIC SURVEY FOR THIS PROJECT WAS COMPLETED UNDER MY DIRECT AND RESPONSIBLE CHARGE AND TAKEN FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION; THAT THIS AS-BUILT TOPOGRAPHIC SURVEY WAS PERFORMED AT THE 95 PERCENT CONFIDENCE LEVEL TO MEET FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS; THAT THIS SURVEY WAS PERFORMED TO MEET THE REQUIREMENTS FOR A TOPOGRAPHIC SURVEY TO THE HORIZONTAL ACCURACY OF CLASS A AND THE VERTICAL ACCURACY WHEN APPLICABLE TO CLASS C STANDARD, AND THAT THE ORIGINAL DATA WAS OBTAINED IN AUG-OCT 2021; THAT THE SURVEY WAS COMPLETED ON 8 OCTOBER 2021; AND ALL COORDINATES ARE BASED ON NAD83 (2011) AND ALL ELEVATIONS ARE BASED ON NAVD83. WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 2nd DAY OF FEBRUARY, 2022.

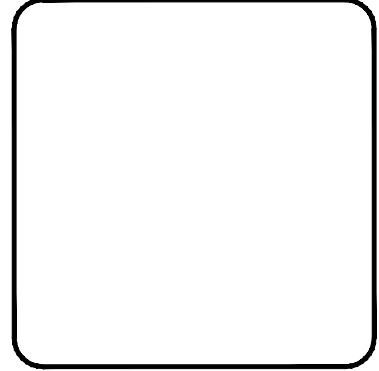
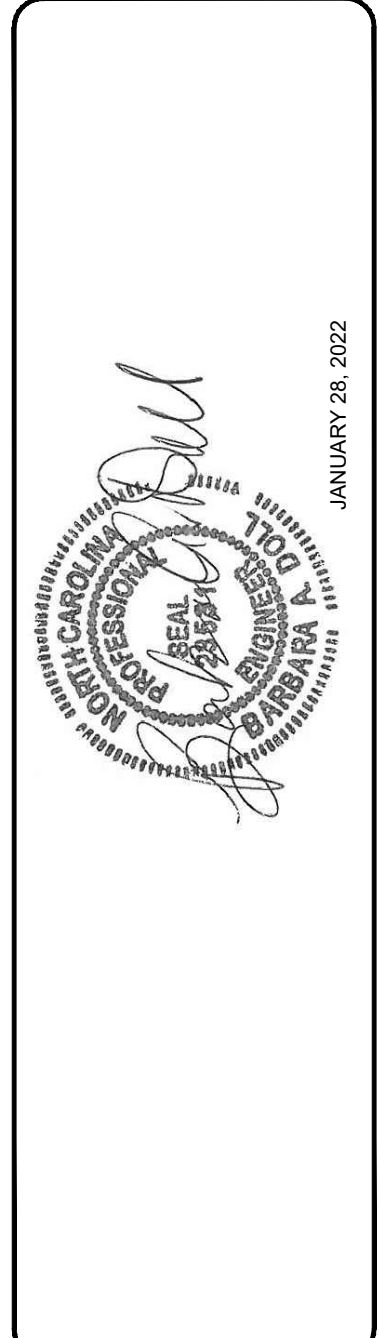
David S. Turner
 DAVID S. TURNER, P.L.S. #L-4551

**AS-BUILT & RECORD
 DRAWINGS
 JANUARY 28, 2022**

MILLSTONE CREEK
 NC DMS MITIGATION SITE
 RANDOLPH COUNTY, NC
 PHASE 1

TITLE

1.1



NC STATE

DRAWN: JLP, JLF
 DESIGN: BAD, JLP
 CHECK: BAD
 APPROVED: BAD

PROJECT NAME: MILLSTONE CREEK MITIGATION SITE
 SCALE: AS NOTED
 DATE: JANUARY 28, 2022

SCO ID # 20-22021-01A
 PHASE # 1

STANDARD LINES AND SYMBOLS

PRECONSTRUCTION FEATURES

- EXISTING TOB
- EXISTING CONSERVATION EASEMENT
- EXISTING PROPERTY LINE
- EXISTING EASEMENT FENCING
- EXISTING WETLANDS
- EXISTING BUILDING FOOTPRINT
- EXISTING GATE

DESIGN FEATURES

- DESIGN REGENERATIVE STORMWATER CONVEYANCE
- DESIGN ENHANCEMENT 1
- DESIGN RESTORATION
- DESIGN WETLAND ENHANCEMENT
- DESIGN CHANNEL CENTERLINE
- DESIGN BANKFULL
- DESIGN LOG SILL
- DESIGN BRUSH TOE WITH SOIL GEOLIFT
- DESIGN LOG VANE WITH BOULDER J-HOOK
- DESIGN REGENERATIVE STORMWATER CONVEYANCE CHANNEL
- DESIGN LOG RIFFLE
- DESIGN CONSTRUCTED RIFFLE

AS-BUILT FEATURES

- AS-BUILT THALWEG
- AS-BUILT TOP OF BANK
- AS-BUILT SURVEY LIMIT
- AS-BUILT FENCE
- AS-BUILT GATE
- AS-BUILT CONTOURS
- TREELINE
- TREE
- AS-BUILT LOG SILL
- AS-BUILT BRUSH TOE WITH SOIL GEOLIFT
- AS-BUILT LOG VANE WITH BOULDER J-HOOK
- AS-BUILT FLOOD GATE

- AS-BUILT LOG RIFFLE
- AS-BUILT CONSTRUCTED RIFFLE
- AS-BUILT RIPRAP/STONE
- MONITORING CROSS SECTION
- VEG PLOT
- PHOTO POINT
- MONITORING WELL/ GROUNDWATER GAUGE
- CONTROL POINT

CONTROL POINTS

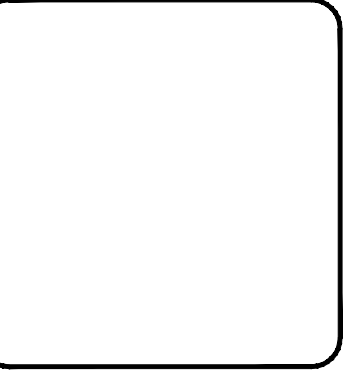
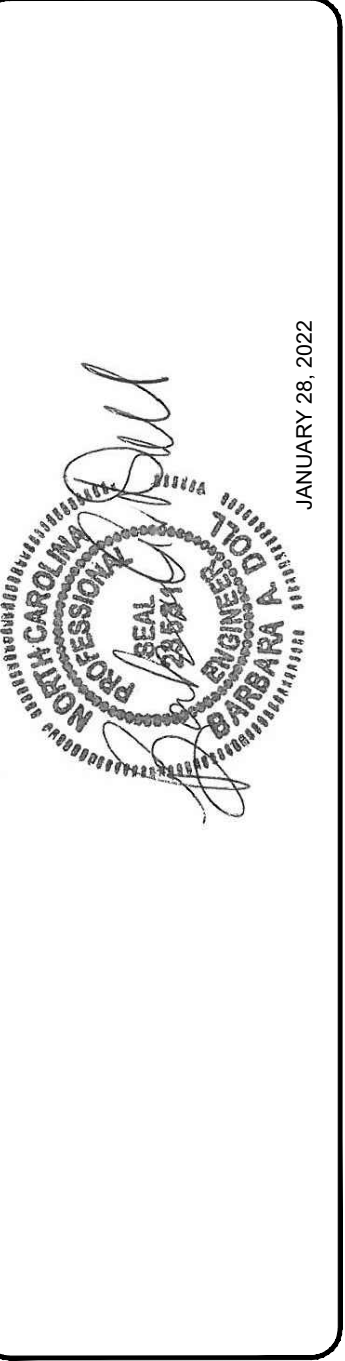
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2	709005.28	1814573.92	462.591	TLS#2NL
3	709098.44	1814902.49	443.691	TLS#3NL
4	708694.19	1815046.77	438.284	TLS#4NL
5	708593.88	1815321.16	431.151	TLS#5NL
6	709193.14	1815191.97	437.679	TLS#6NL
7	709060.41	1815494.85	442.400	TLS#7NL
9	709762.36	1815629.26	447.277	TLS#9NL
10	710108.00	1815387.34	439.149	TLS#10NL

NOTE: AS-BUILT SURVEY COMPLETED AUG-OCT 2021

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED

MILLSTONE CREEK
NC DMS MITIGATION SITE
RANDOLPH COUNTY, NC
PHASE 1

PROJECT OVERVIEW 2.1

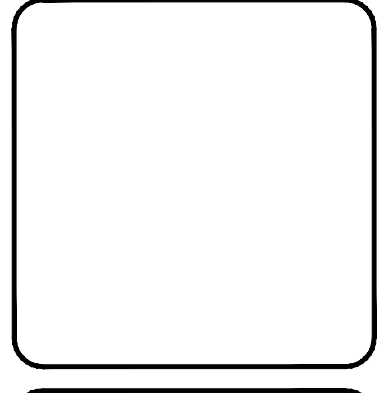
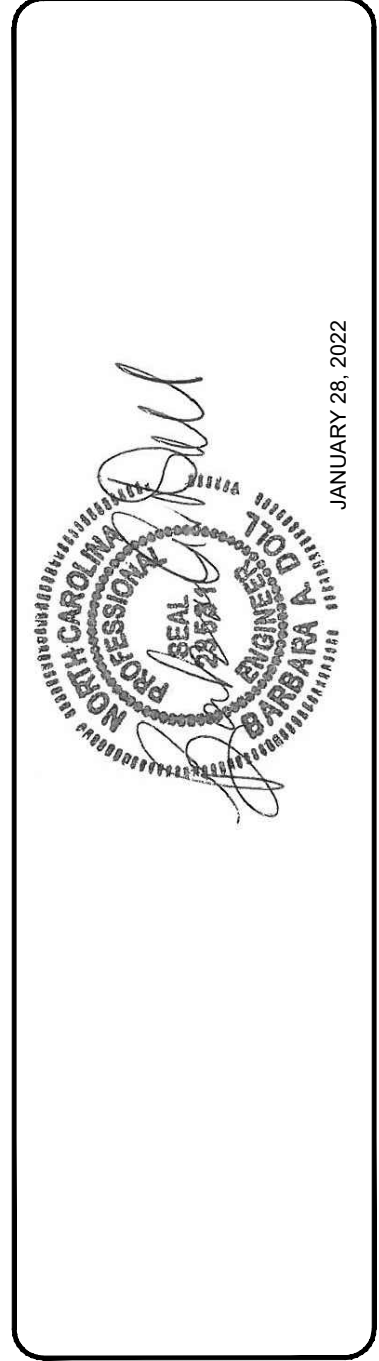


NC STATE

DRAWN: JLP, JLF	PROJECT: MILLSTONE CREEK
DESIGN: BAD, JLP	NAME: MITIGATION SITE
CHECK: BAD	SCALE: AS NOTED
APPROVED: BAD	DATE: JANUARY 28, 2022
SCO ID # 20-22021-01A	PHASE # 1

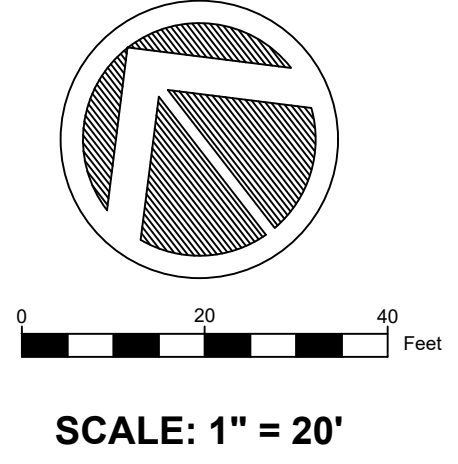
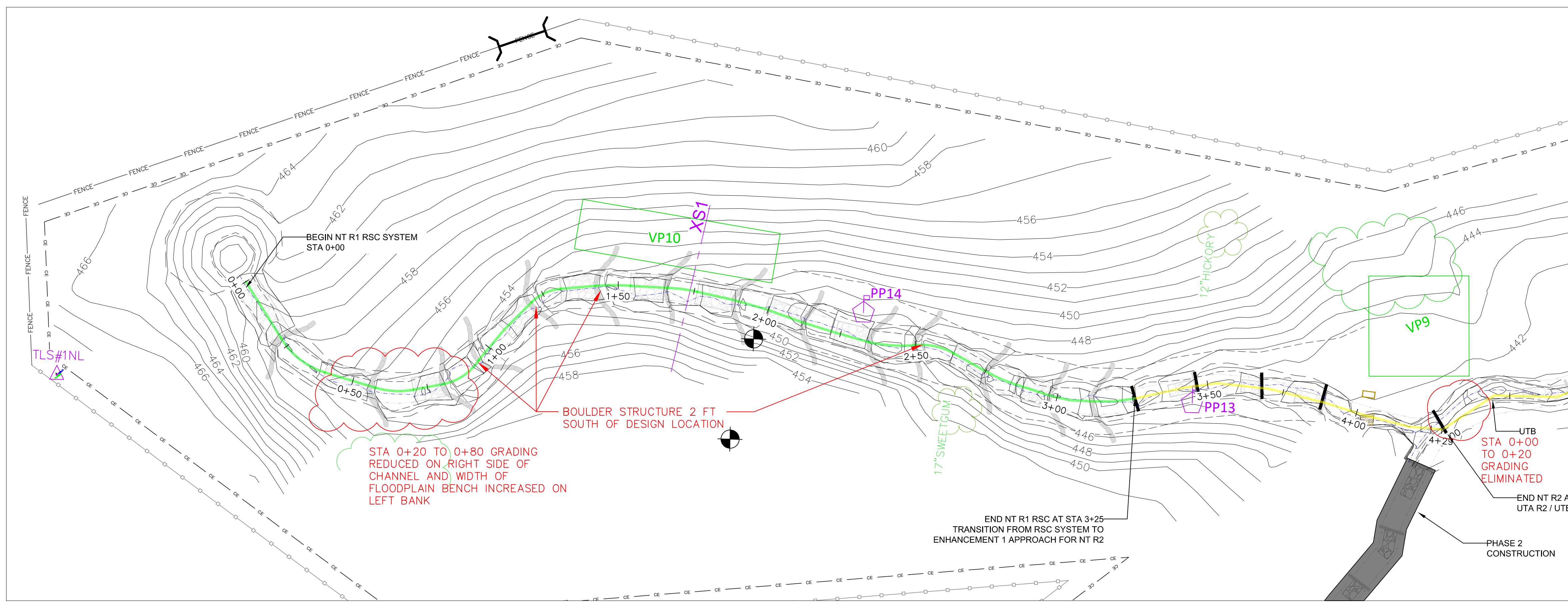


NOTES:
 1. DEVIATIONS FROM THE DESIGN
 WILL BE SHOWN IN RED



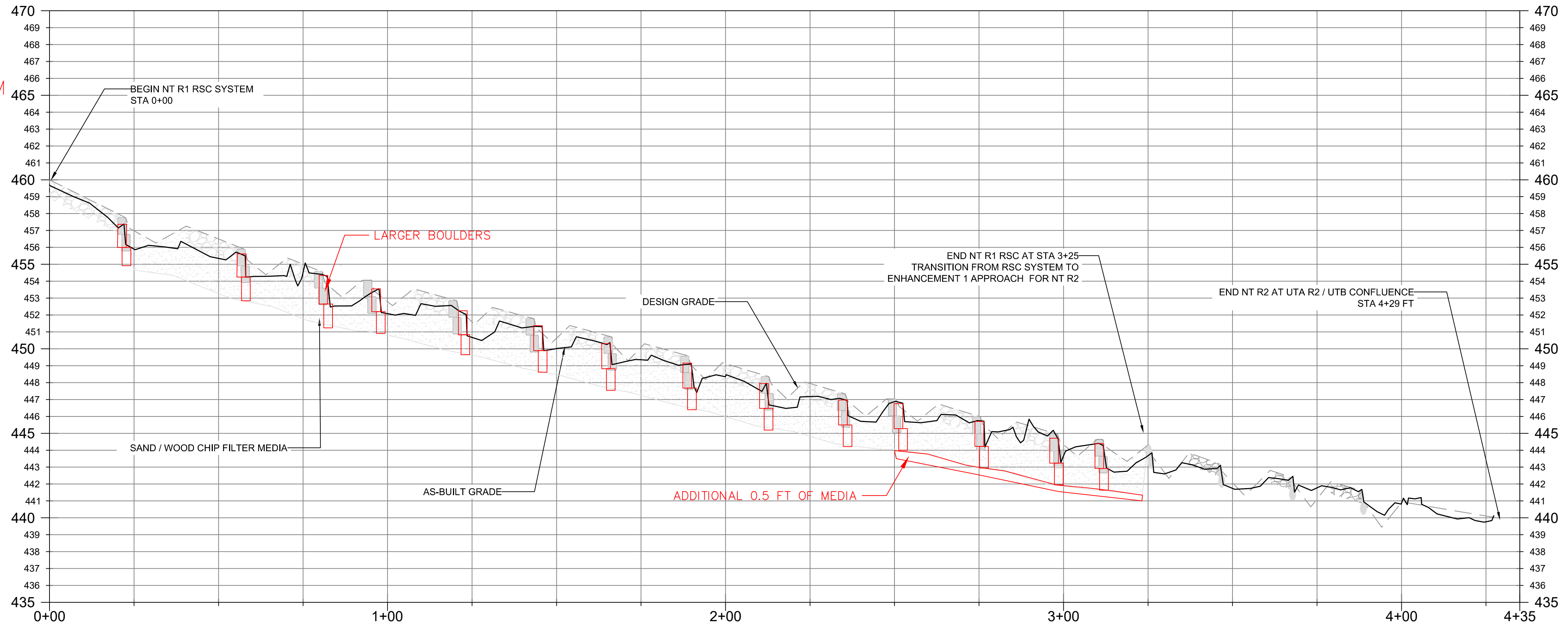
NC STATE

PROJECT NAME:	MILLSTONE CREEK
SCALE:	AS NOTED
DATE:	JANUARY 28, 2022
DRAWN:	JLP, JLF
DESIGN:	BAD, JLP
CHECK:	BAD
APPROVED:	BAD
SCO ID #	20-22021-01A
PHASE #	1



Professional Engineer Seal for **DAVID A. BRADY**, License No. 10004, State of North Carolina. The seal is dated **JANUARY 28, 2022**.

- NOTES:**
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED
 2. BOULDERS ARE LARGER THAN SPECIFIED AND EXTEND TO THE BOTTOM OF THE MEDIA TRENCH. AN ADDITIONAL 0.5 FT OF MEDIA WAS ADDED FROM STA 2+50 TO STA 3+25 TO COMPENSATE FOR THE LOSS IN MEDIA VOLUME DUE TO THE LARGER BOULDERS

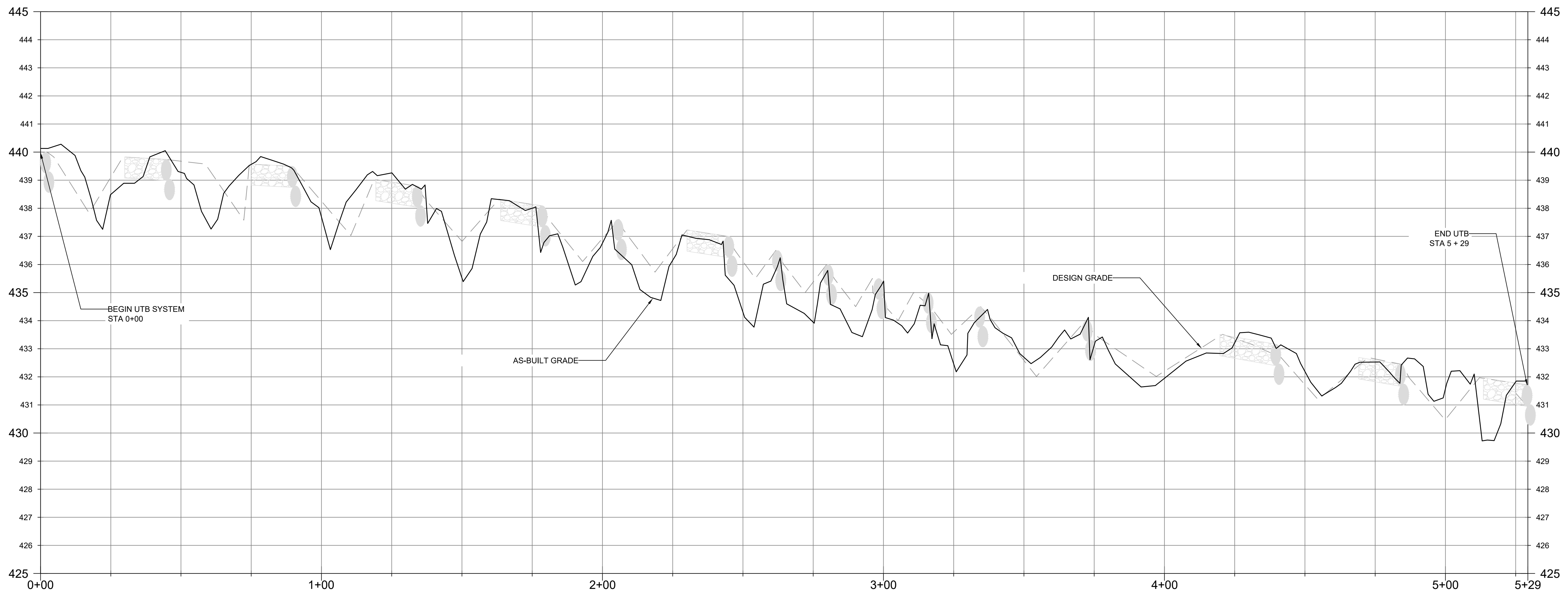
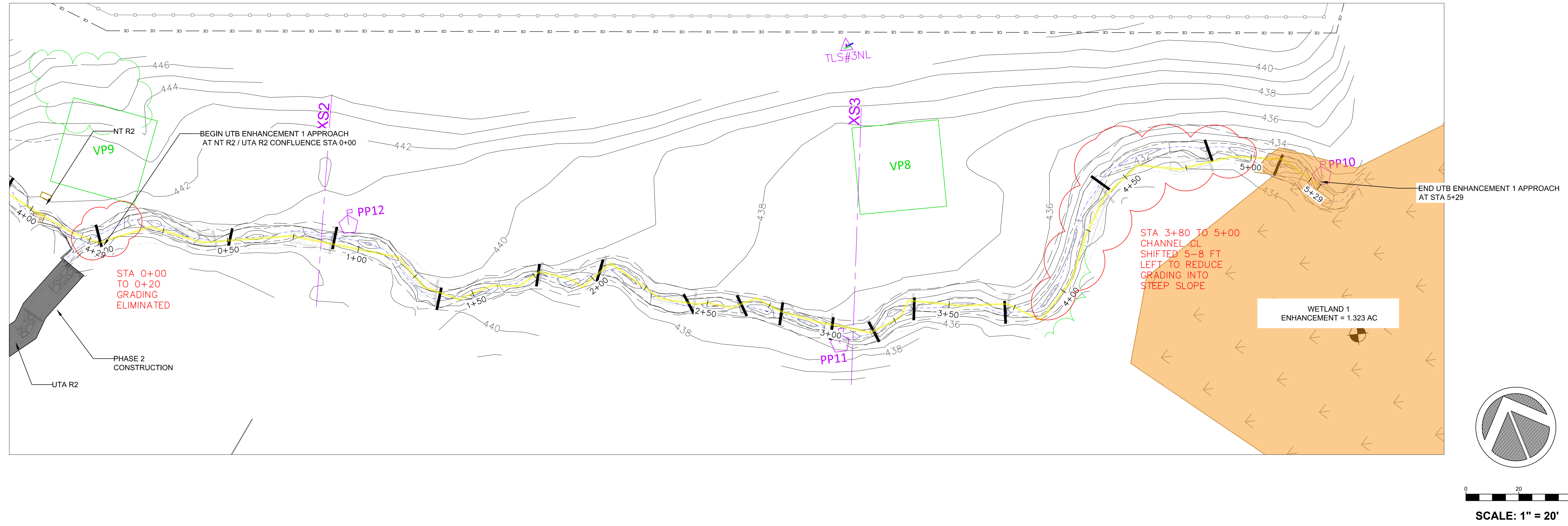


NC STATE

PROJECT:	MILLSTONE CREEK
NAME:	MITIGATION SITE
SCALE:	AS NOTED
DATE:	JANUARY 28, 2022
SCO ID #	20-22021-01A
PHASE #	1

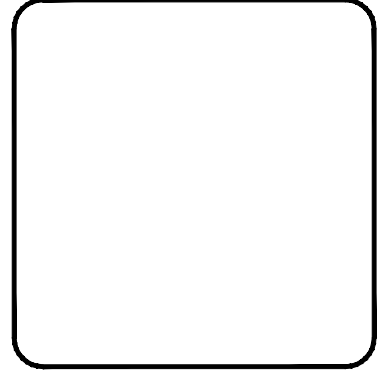
NOTES:

- 1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED



MILLSTONE CREEK
NC DMS MITIGATION SITE
RANDOLPH COUNTY, NC
PHASE 1

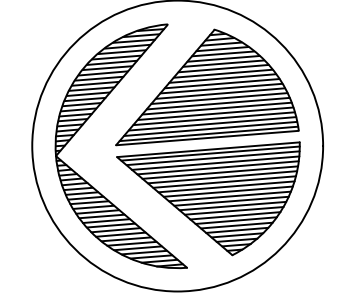
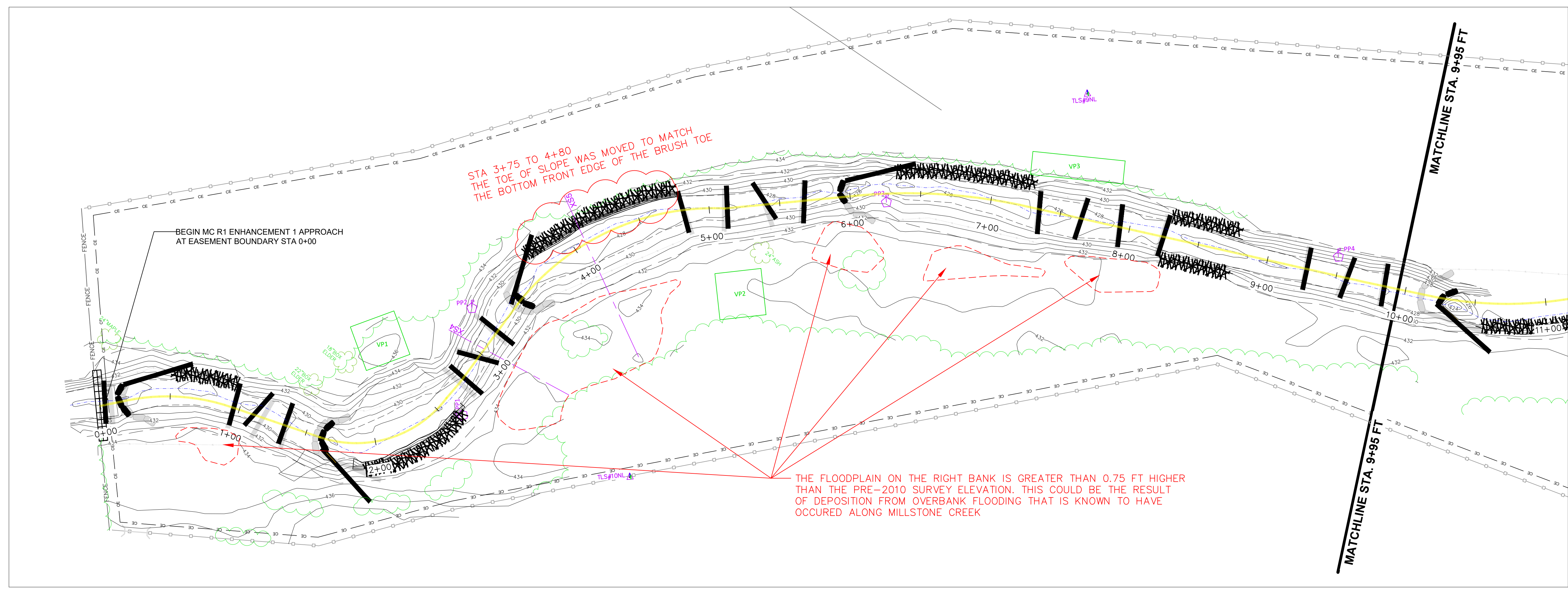
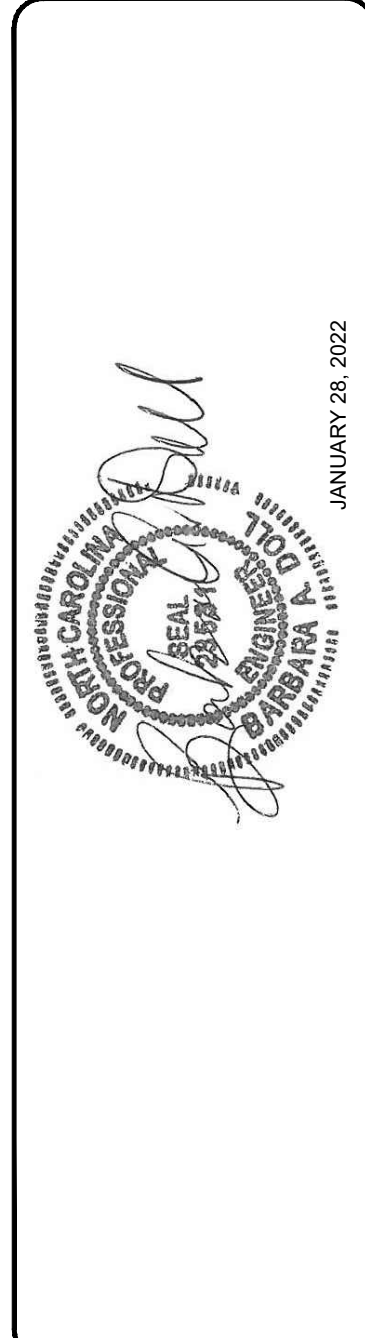
UTB: PLAN - PROFILE 4.2



NC STATE

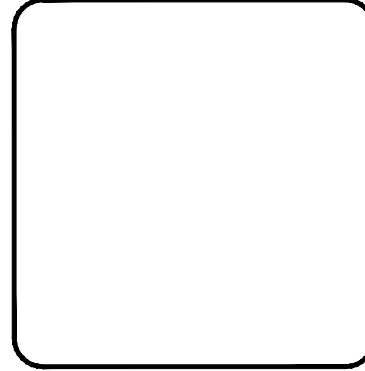
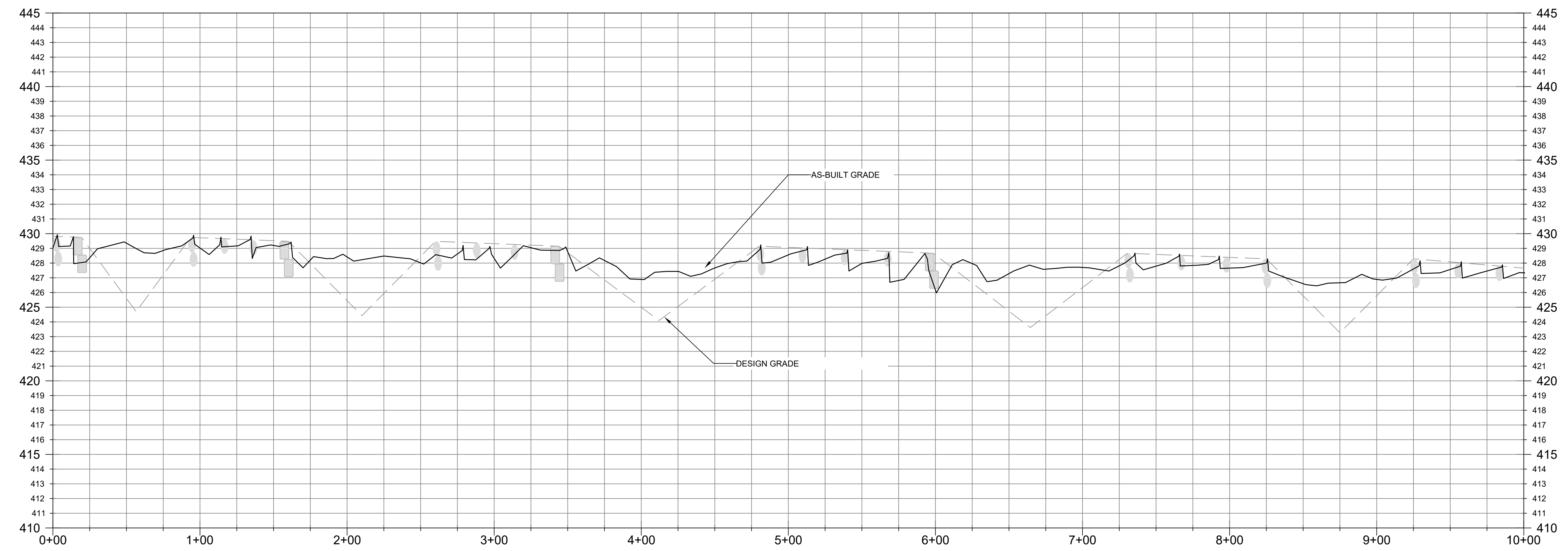
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DESIGN: BAD, JLP	NAME: MITIGATION SITE
CHECK: BAD	SCALE: AS NOTED
APPROVED: BAD	DATE: JANUARY 28, 2022

SCO ID # 20-22021-01A
PHASE # 1



0 40 80 Feet
 SCALE: 1" = 40'

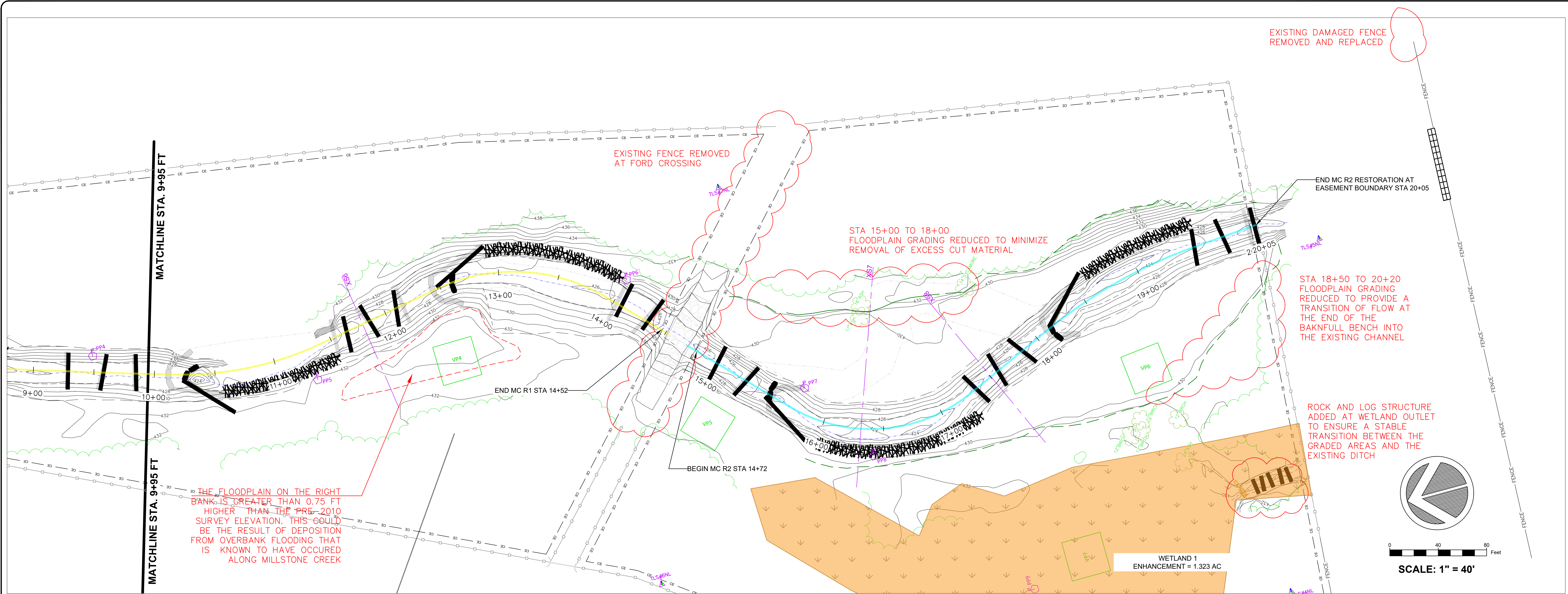
- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED
 2. ALL J-HOOKS WERE LOCATED AND ORIENTED ACCORDING TO THE DESIGN DETAIL NOT THE PLAN VIEW LOCATION
 3. ALL POOL DEPTHS WERE MODIFIED TO BE TWO (2) FT BELOW THE THALWEG FOR THE UPSTREAM PC DUE TO THE PRESENCE OF RUNNING SAND



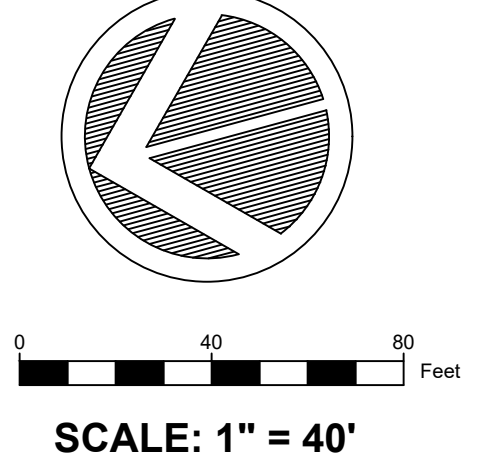
NC STATE

DRAWN: JLP, JLP	PROJECT: MILLSTONE CREEK
DESIGN: BAD, JLP	NAME: MITIGATION SITE
CHECK: BAD	SCALE: AS NOTED
APPROVED: BAD	DATE: JANUARY 28, 2022

SCO ID # 20-22021-01A
 PHASE # 1

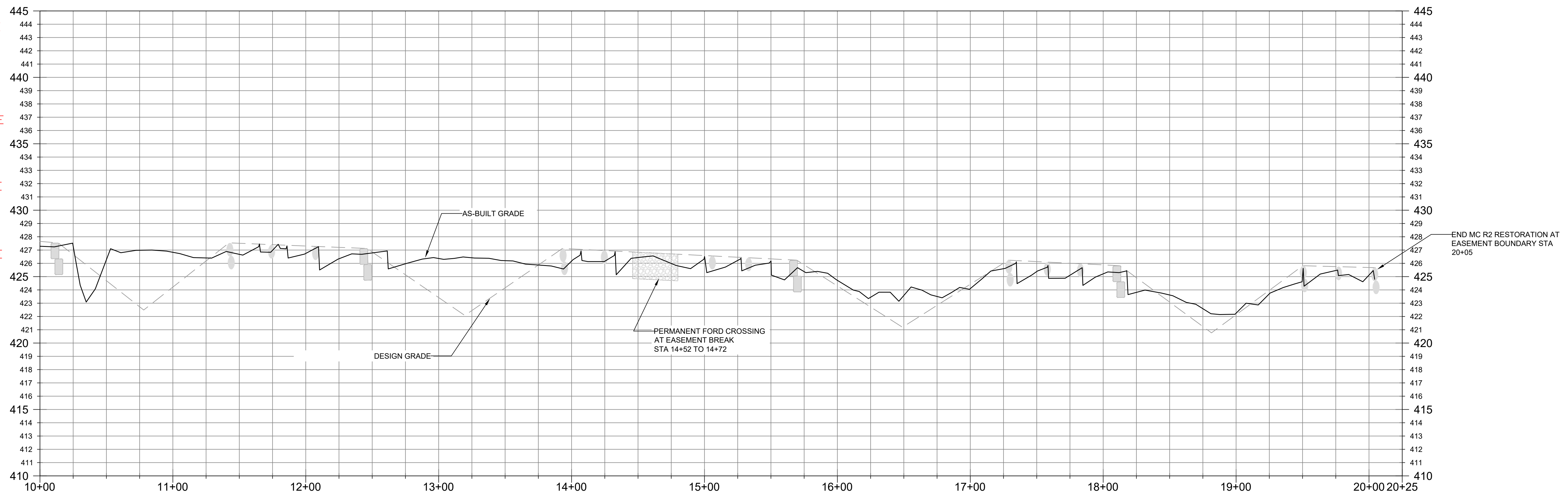


THE FLOODPLAIN ON THE RIGHT BANK IS GREATER THAN 0.75 FT HIGHER THAN THE PRE-2010 SURVEY ELEVATION. THIS COULD BE THE RESULT OF DEPOSITION FROM OVBANK FLOODING THAT IS KNOWN TO HAVE OCCURED ALONG MILLSTONE CREEK

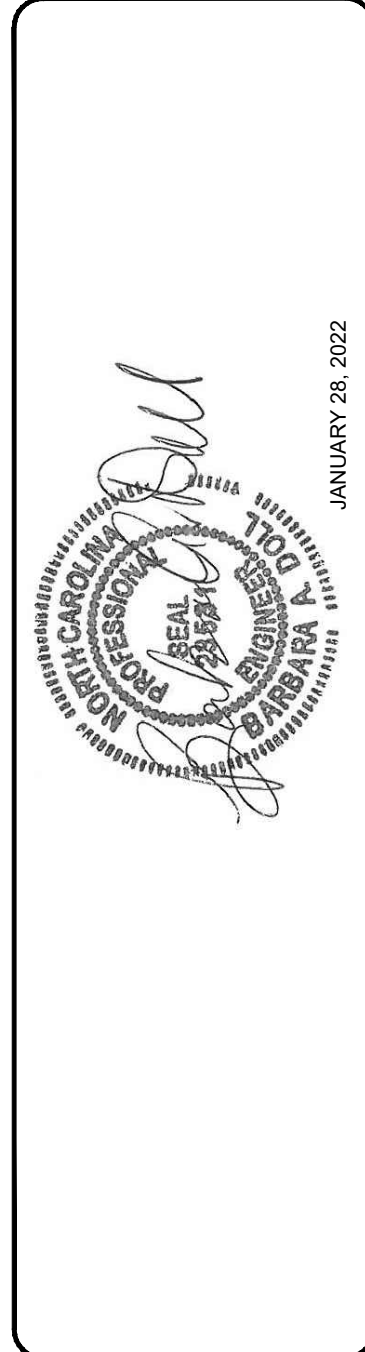


NOTES:

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2. ALL J-HOOKS WERE LOCATED AND ORIENTED ACCORDING TO THE DESIGN DETAIL NOT THE PLAN VIEW LOCATION
3. ALL POOL DEPTHS WERE MODIFIED TO BE TWO (2) FT BELOW THE THALWEG FOR THE UPSTREAM PC DUE TO THE PRESENCE OF RUNNING SAND



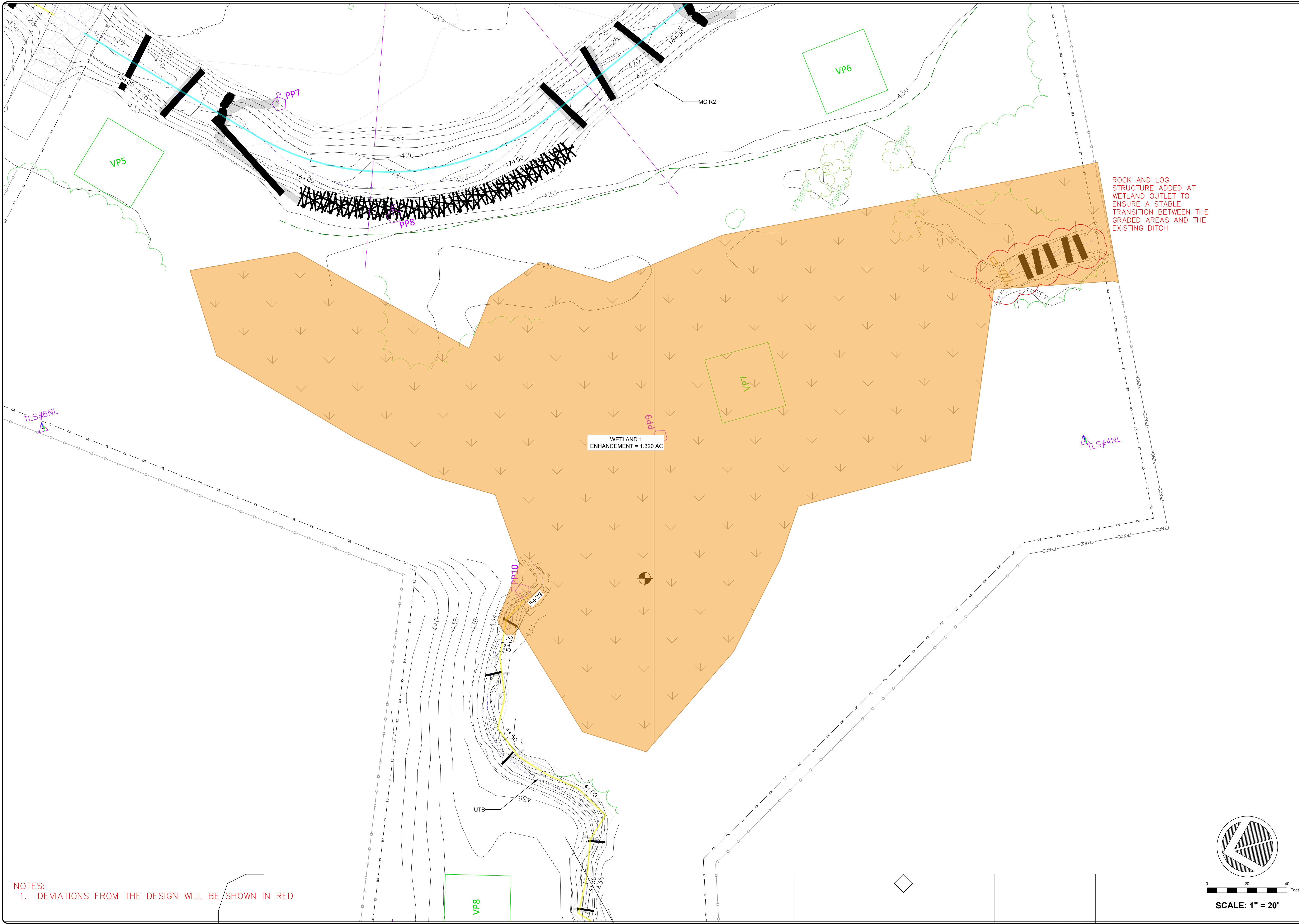
MILLSTONE CREEK
NC DMS MITIGATION SITE
RANDOLPH COUNTY, NC
PHASE 1



NC STATE

DRAWN: JLP, JLP	PROJECT: MILLSTONE CREEK
DESIGN: BAD, JLP	NAME: MITIGATION SITE
CHECK: BAD	SCALE: AS NOTED
APPROVED: BAD	DATE: JANUARY 28, 2022

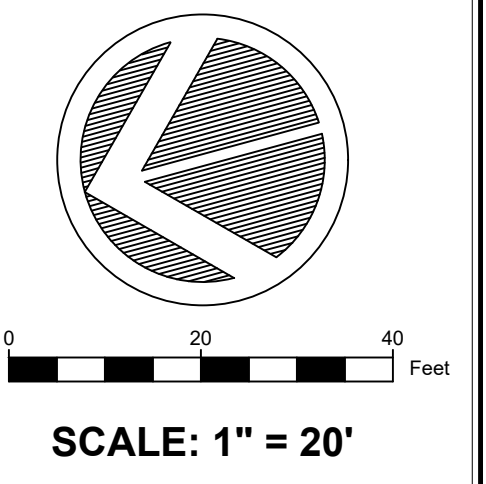
SCO ID # 20-22021-01A
PHASE # 1



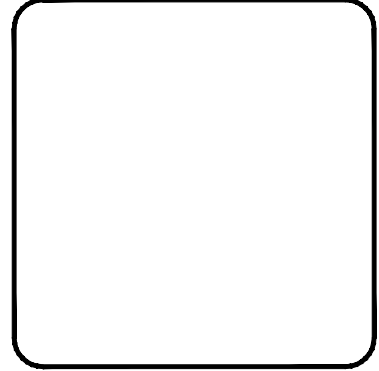
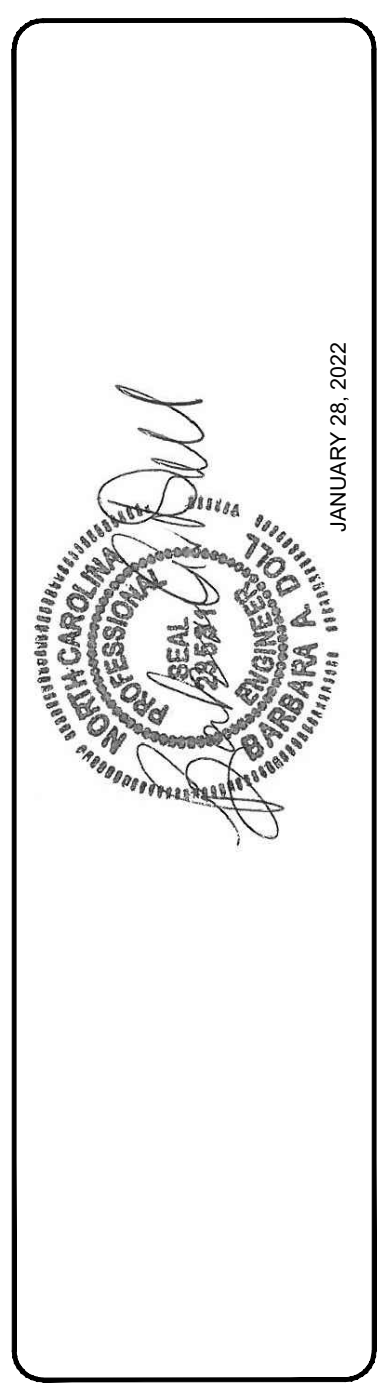
ROCK AND LOG
STRUCTURE ADDED AT
WETLAND OUTLET TO
ENSURE A STABLE
TRANSITION BETWEEN THE
GRADED AREAS AND THE
EXISTING DITCH

WETLAND 1
ENHANCEMENT = 1.320 AC

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED



MILLSTONE CREEK
NC DMS MITIGATION SITE
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DRAWN:	JLP, JLF
DESIGN:	BAD, JLP
CHECK:	BAD
APPROVED:	BAD
SCO ID #	20-22021-01A
PHASE #	1

WETLAND PLAN 4.5

JANUARY 28, 2022

Temporary Seeding Schedule and Rates		
Date	Type	Application Rate (lbs/acre)
Jan 1 – May 1	Rye Grain	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	750
	Straw Mulch	4,000
May 1 – Aug 15	German Millet	40
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	750
	Straw Mulch	4,000
Aug 15 – Dec 30	Rye Grain	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	750
	Straw Mulch	4,000

Permanent Seeding Rates		
Wetland Seed Mix – 20 lbs per acre		
Species	Common Name	Percent
<i>Bidens aristosa</i>	Showy tickseed	7
<i>Carex vulpinoidea</i>	Fox sedge	12
<i>Dichanthelium clandestinum</i>	Deertongue	8
<i>Elymus virginicus</i>	Virginia wildrye	20
<i>Juncus effusus</i>	Soft rush	4
<i>Panicum dichotomiflorum</i>	Smooth panicgrass	14
<i>Panicum rigidulum</i>	Redtop panicgrass	8
<i>Panicum virgatum</i>	Switchgrass	23
<i>Polygonum pensylvanicum</i>	Pennsylvania smartweed	2
<i>Sparganium americanum</i>	Eastern bur reed	2
		100

Streambank and Floodplain Seed Mix – 20 lbs per acre		
Species	Common Name	Percent
<i>Agrostis perennans</i>	Autumn bentgrass	15
<i>Andropogon gerardii</i>	Big bluestem	10
<i>Coreopsis lanceolata</i>	Lanceleaf coreopsis	10
<i>Elymus virginicus</i>	Virginia wildrye	20
<i>Juncus effusus</i>	Soft rush	5
<i>Panicum virgatum</i>	Switchgrass	15
<i>Rudbeckia hirta</i>	Blackeyed susan	10
<i>Schizachyrium scoparium</i>	Little bluestem	5
<i>Sorghastrum nutans</i>	Indian grass	5
<i>Tripsacum dactyloides</i>	Eastern gamagrass	5
		100

Upland Hardwood Forest – 20 lbs per acre		
Species	Common Name	Percent
<i>Achillea millefolium</i>	Common yarrow	10
<i>Agrostis perennans</i>	Autumn bentgrass	6
<i>Asclepias tuberosa</i>	Butterfly weed	1
<i>Bidens aristosa</i>	Showy tickseed sunflower	11
<i>Chamaecrista fasciculata</i>	Partridge pea	10
<i>Coreopsis lanceolata</i>	Lance-leaf coreopsis	10
<i>Echinacea purpurea</i>	Purple coneflower	4
<i>Elymus virginicus</i>	Virginia wildrye	6
<i>Gaillardia pulchella</i>	Indian blanket	8
<i>Helianthus angustifolius</i>	Swamp sunflower	2
<i>Helianthus maximiliani</i>	Maximilian's sunflower	2
<i>Monarda punctata</i>	Spotted beebalm	2
<i>Rudbeckia hirta</i>	Blackeyed susan	6
<i>Schizachyrium scoparium</i>	Little bluestem	4
<i>Sorghastrum nutans</i>	Indian grass	6
<i>Symphotrichum pilosum</i>	Heath aster	1
<i>Tridens flavus</i>	Purpletop	4
<i>Tripsacum dactyloides</i>	Eastern gamagrass	6
<i>Verbena hastata</i>	Blue vervain	1
		100

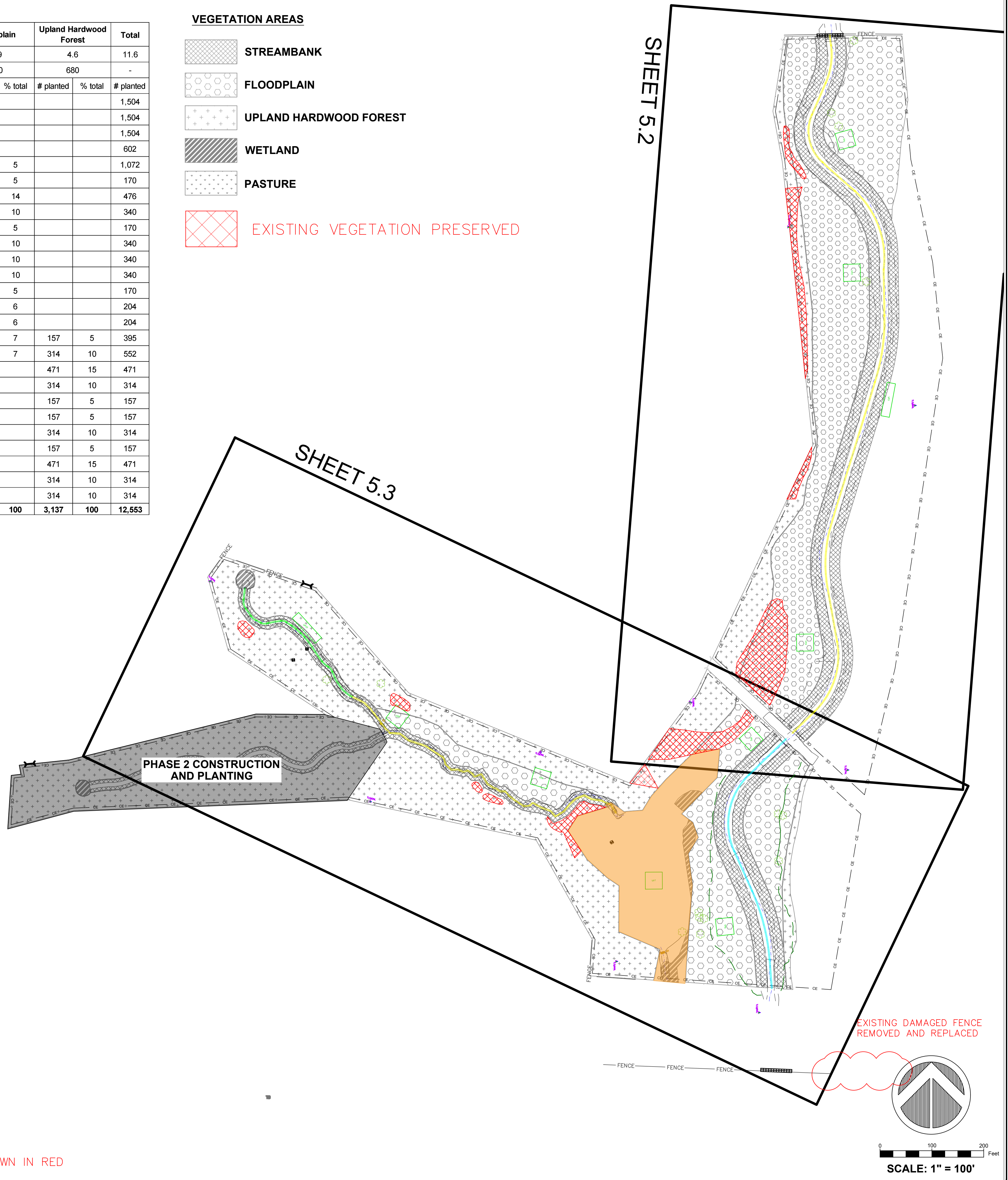
Pasture Seed Mix – 60 lbs per acre		
Species	Common Name	Percent
<i>Dactylis glomerata</i>	Orchard Grass	50
<i>Schedonorus phoenix</i>	KY 31 Tall Fescue	50
		100

Vegetation Area	Streambank	Floodplain	Upland Hardwood Forest	Total			
Area (acres)	2.1	4.9	4.6	11.6			
Density	2,800	680	680	-			
Species	# planted	% total	# planted	% total			
*Silky dogwood (<i>Cornus amomum</i>)	1,504	25		1,504			
*Silky willow (<i>Salix sericea</i>)	1,504	25		1,504			
*Elderberry (<i>Sambucus canadensis</i>)	1,504	25		1,504			
Yellowroot (<i>Xanthorhiza simplicissima</i>)	602	10		602			
**Buttonbush (<i>Cephalanthus occidentalis</i>)	902	15	170	5	1,072		
Tag alder (<i>Alnus serrulata</i>)		170	5	170			
River Birch (<i>Betula nigra</i>)		476	14	476			
Ironwood (<i>Carpinus caroliniana</i>)		340	10	340			
Water oak (<i>Quercus nigra</i>)		170	5	170			
Inkberry (<i>Ilex glabra</i>)		340	10	340			
Tulip poplar (<i>Liriodendron tulipifera</i>)		340	10	340			
Sycamore (<i>Plantanus occidentalis</i>)		340	10	340			
Black gum (<i>Nyssa sylvatica</i>)		170	5	170			
Swamp Chestnut Oak (<i>Quercus michauxii</i>)		204	6	204			
Possumhaw (<i>Viburnum nudum</i>)		204	6	204			
Willow oak (<i>Quercus phellos</i>)		238	7	157	5	395	
Black Walnut (<i>Juglans nigra</i>)		238	7	314	10	552	
White oak (<i>Quercus alba</i>)			471	15	471		
Black Cherry (<i>Prunus serotina</i>)			314	10	314		
Red Bud (<i>Cercis canadensis</i>)			157	5	157		
Persimmon (<i>Diospyros virginiana</i>)			157	5	157		
Overcup Oak (<i>Quercus lyrata</i>)			314	10	314		
Sassafras (<i>Sassafras albidum</i>)			157	5	157		
Red Oak (<i>Quercus rubra</i>)			471	15	471		
Chestnut Oak (<i>Quercus prinus</i>)			314	10	314		
American Beech (<i>Fagus grandifolia</i>)			314	10	314		
Total	6,016	100	3,400	100	3,137	100	12,553

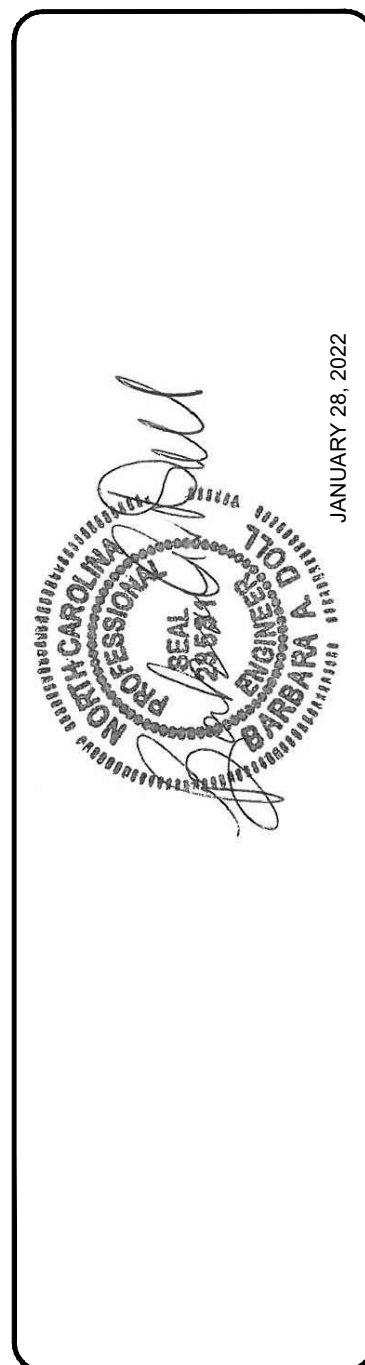
*Provide as live stakes
 **Provide as live stakes on streambanks and bareroot in floodplain zone

VEGETATION AREAS

-  **STREAMBANK**
-  **FLOODPLAIN**
-  **UPLAND HARDWOOD FOREST**
-  **WETLAND**
-  **PASTURE**
-  **EXISTING VEGETATION PRESERVED**

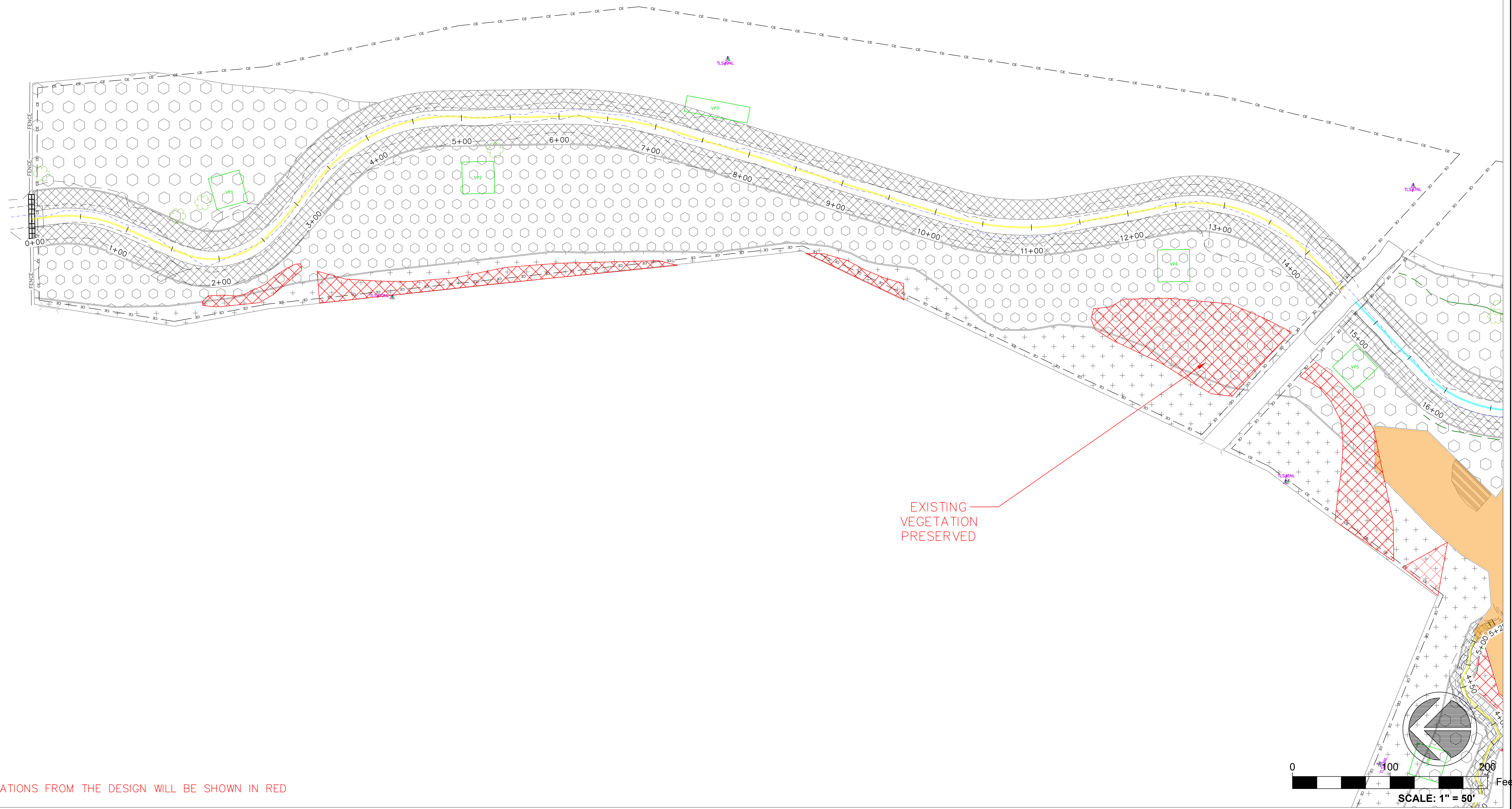


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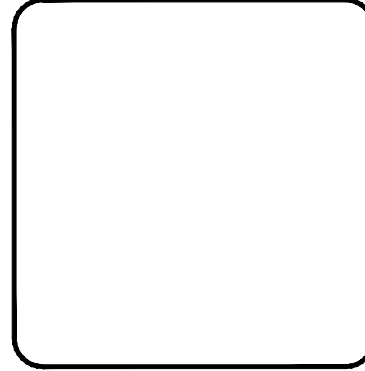
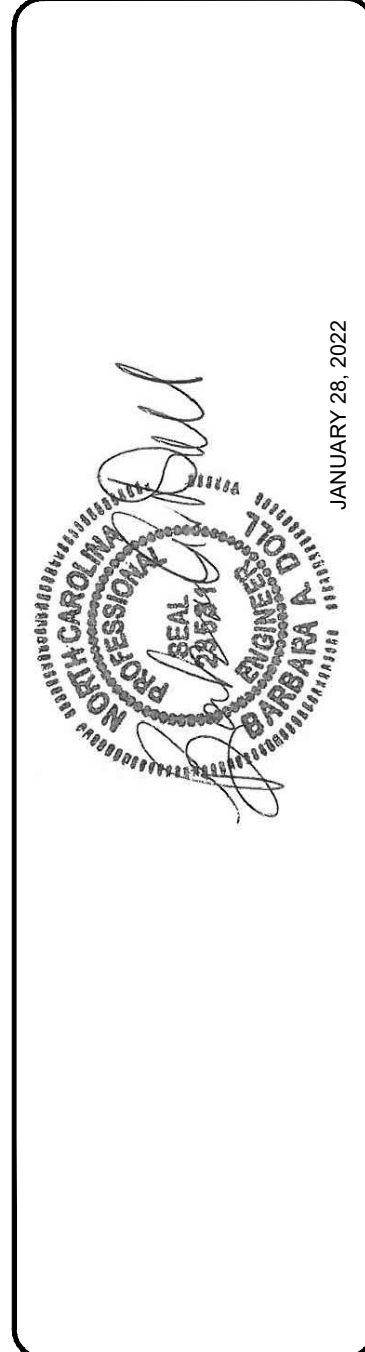


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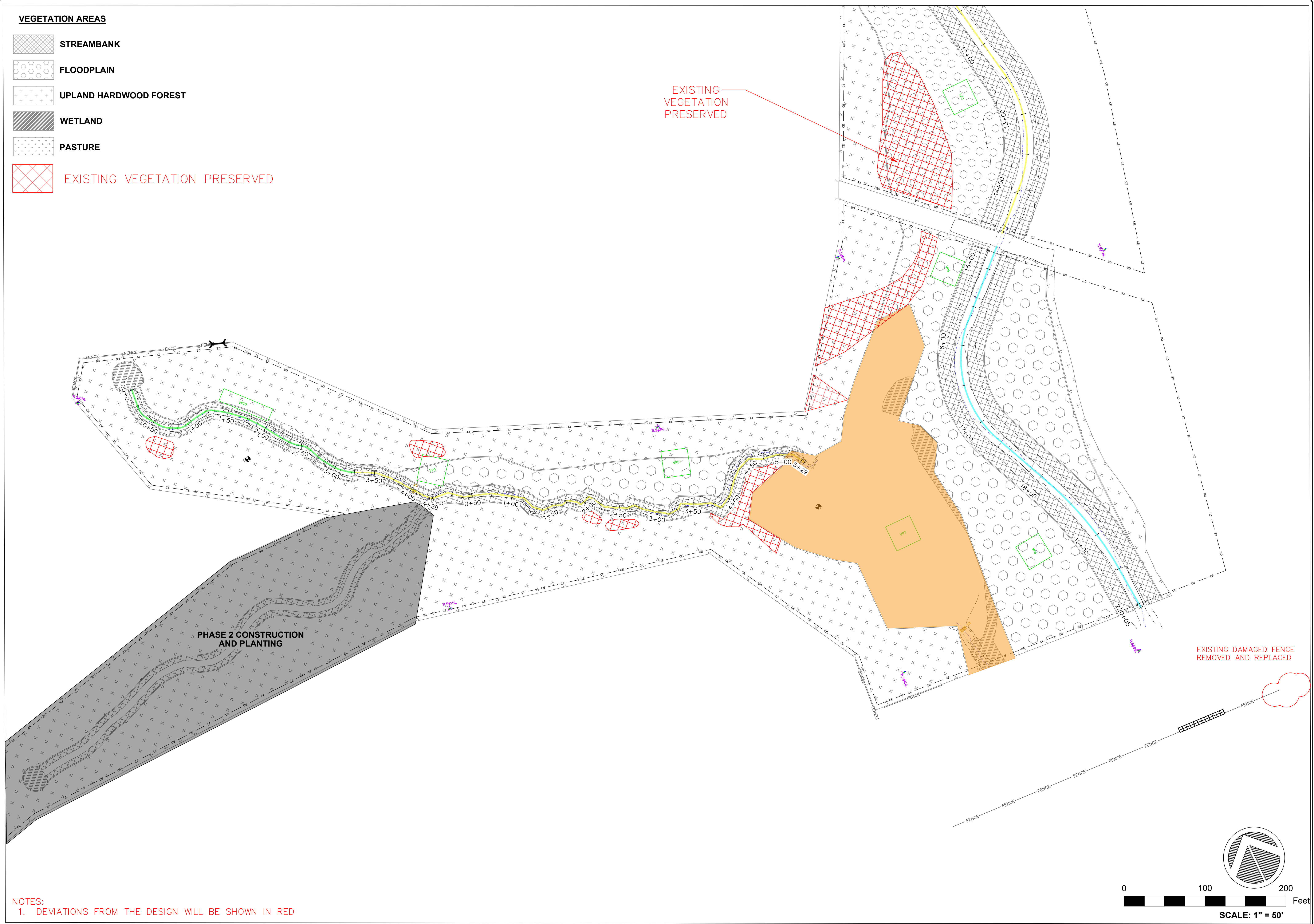


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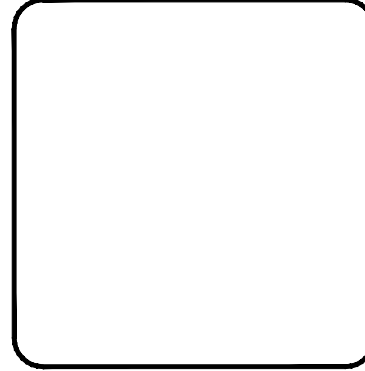
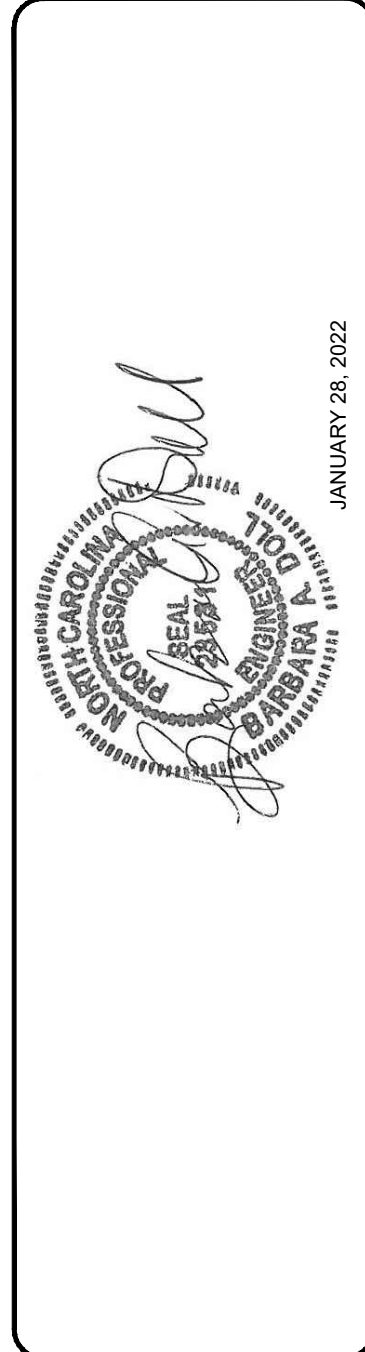
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-  **FLOODPLAIN**
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